

The
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How do Front Gardens Influence Health and Well-being?

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Except where otherwise indicated, this thesis is my own original work.

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Abstract

There is strong evidence for the benefits of gardens and other green spaces on human health and well-being. As front gardens (yards) are increasingly being paved over, this research evaluates how front garden landscapes can influence human health and well-being. Building on Attention Restoration Theory (Kaplan and Kaplan, 1989) and Stress Reduction Theory (Ulrich, 1983; Ulrich et al. 1991), the psycho-socio-cultural values of front gardens are examined across four distinct studies. The interdisciplinary approach uses a quasi-experimental design and mixed-methods including focus groups, questionnaires, semi-structured interviews, and sampling of salivary cortisol.

Results indicate that, alongside their well-documented ecological services, front gardens contribute to the health and well-being agenda by providing cultural ecosystem services. Front gardens are part of people's identity and self-expression. In addition, front gardens allow residents to contribute positively to their neighbourhood by building a sense of community, social cohesion, satisfaction, and well-being. A dose-response curve finds that people who garden daily have a higher well-being score and lower perceived stress score than those who garden less regularly. Front gardens have indirect influence on peoples' well-being and stress through their perception of the local area. Gardeners relate to their gardens in highly emotional ways that can be associated with specific garden features, plants, and activities.

Furthermore, introducing plants to front gardens that were initially paved over was associated with a statistically significant reduction in perceived stress levels compared to a pre-intervention baseline. This outcome was re-enforced by healthier salivary cortisol diurnal profiles (steeper diurnal declines, increased daily average concentration and total secretion from blunted levels pre-intervention). Qualitative data revealed the importance of motivation, pride in the home and area, relaxation, and uplifting emotions as mechanisms of change.

Conclusions drawn from the findings have implications for horticulture, landscape architecture, urban planning, and public health fields. Recommendations for policy-makers, decision-makers, and funding bodies are developed to integrate the value of front gardens in their work, particularly when dealing with front garden paving regulations, future housing developments, and streetscape greenery.

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List of Abbreviations

ADD	Attention Deficit Disorder
ANOVA	Analysis of Variance
ART	Attention Restoration Theory
AUCg	Area Under the Curve with respect to Ground of salivary cortisol
DAC	Daily Average Concentration of salivary cortisol
GDPR	General Data Protection Regulation
GGB	Greening Great Britain (formerly Greening Grey Britain)
HACT	Housing Associations' Charitable Trust
NHS	National Health Service
PSS	Perceived Stress Scale
RCT	Randomised Controlled Trial
RHS	Royal Horticultural Society
SRT	Stress Reduction Theory
SWEMWBS	Short Warwick-Edinburgh Mental Well-Being Scale
UK	United Kingdom
UREC	University Research Ethics Committee
USA	United States of America
WHO	World Health Organisation

Introduction

1.1 Background and context

In the dual context of the recognised impact of nature and green spaces on physical and mental health, and the growing trend in the United Kingdom (UK) to pave over front gardens for off-road parking, the aim of this research is to investigate how front garden landscapes influence health and well-being.

There is increasing evidence that access to green space and nature can provide a range of benefits including improvements in mental health, physical health and social cohesion. The vast majority of the evidence, however, has been limited to public green spaces rather than private gardens (Cameron et al., 2012).

Over five million front gardens in the UK now have no plants growing in them (one in three) and four and a half million front gardens (one in four) are completely paved over (Royal Horticultural Society, 2015). This is three times less plant cover in front gardens than ten years ago (RHS, 2015). In part, this is due to increasing fees and regulations for road parking, a desire for lower maintenance requirements, and a lack of time or skills to look after green space (Greater London Authority, 2005). In 2013, over one million homeowners paved over a portion of their garden (Horticultural Trade Association, 2015). Reasons cited were to create a driveway for off-road parking, and to minimise garden maintenance. Only 62% of residential garden space in Great Britain is estimated to be vegetated (Bonham, 2019). Domestic gardens currently have no protected status in planning law other than as part of private amenity space and are not classified as a land-use in their own right (Sayce et al., 2012). The

health consequences of land-use changes - such as paving over a front garden - are largely unknown.

If the loss of vegetated surface area in front gardens continues, significant ecological and environmental benefits will be lost. Environmental ecosystem services provided by garden plants and permeable surfaces include slowing run-off and minimising the risk of localised flash-flooding by reducing the pressure on urban drain systems (Kelly, 2016; Strohbach et al., 2019). For example, in Leeds (Yorkshire) over a 33-year period, there was a 13% increase in impervious surfaces, 75% of which was due to paving of residential front gardens (Perry and Nawaz, 2008). This was linked to higher frequency and magnitude of flooding in the area. It is a similar situation in Southampton (Hampshire), where impermeable cover in domestic front gardens increased by 22% between 1991 and 2011 and required a 26% increase in attenuation storage volumes (Warhurst et al., 2014). Furthermore, gardens can be a source of food and a habitat for wildlife. Plants can mitigate temperature extremes by cooling urban heat waves and providing shelter and insulation in winter (Cameron et al., 2012, 2014, 2015). This ecological role will potentially become even more important in the future as our climate changes (Webster et al., 2017).

There is now a strong body of evidence to indicate that access to green space, streetscape greenery, and nature can provide a range of benefits including improvements in mental health, physical health and social cohesion (de Vries et al., 2013; World Health Organization, 2016; van den Bosch and Bird, 2018). The ever-growing body of literature shows that a wide range of outdoor activities in green spaces have a positive effect on stress alleviation, including community gardening (Genter et al., 2015; Wood et al., 2016), walking in the countryside (Pretty et al., 2007), and bird watching (Ratcliffe et al., 2013; Cox and Gaston, 2015, 2016).

Positive effects include improved cognitive function (Wells, 2000; Bogerd et al., 2018), pain relief (Ulrich, 1983; Park and Mattson, 2009), improved relaxation (Whear et al., 2014; Oh et al., 2018; Kondo et al., 2018), coping with trauma (Roe and Aspinall, 2011a; Chan et al., 2015), and the alleviation of attention deficit disorder symptoms in children (Kuo and Faber Taylor, 2004; Faber Taylor and Kuo, 2011; Donovan et al., 2019). Swanwick et al. (2003) provided an overview of the sociocultural contributions of public urban green space to agendas of social inclusion, health, sustainability, and urban renewal. Conversely, a shortage of green space in local environments has been

linked to feelings of loneliness and lack of social support (Maas et al., 2009; Roe et al., 2013).

However, the vast majority of evidence backing these findings has been based on public green spaces rather than private gardens (Swanwick et al., 2003; Cameron et al., 2012; Haase et al., 2019). There are only few studies about the contribution private gardens add to the health and well-being agenda (Gehl, 1986; Buck, 2016; Ward Thompson et al., 2016; Soga et al., 2017). Moreover, in contrast to the increasing evidence for the ecological processes taking place in front garden landscapes, the physical, social, and cultural contributions of front gardens are less well evaluated.

1.2 Statement of purpose

The purpose of this research is to evaluate how front garden landscapes influence health and well-being using both quantitative and qualitative methods. The research findings will contribute to assessing the psycho-socio-cultural value of gardens. A better understanding of the health impacts of front gardens can provide a relatable argument to protect permeable surfaces and spaces for nature as well as to discourage the general public from paving over their front gardens. A case built on the need for basic habitability and well-being in the home rather than gardening in and of itself will be more compelling for urban planners, policy-makers, developers, homeowners, and housing associations.

1.3 Research questions

1. What relationships do gardeners have with their front gardens?
2. What are the health benefits of
 - (a) the presence of vegetated front gardens?
 - (b) gardening in front gardens?
3. How does a sense of community and social cohesion emerge from

- (a) the presence of vegetated front gardens?
 - (b) gardening in front gardens?
4. Do gardeners report higher levels of well-being than non-gardeners?
 5. Are certain garden features more conducive to positive emotions and higher well-being than others?
 6. Does introducing plants to front gardens that are currently paved over improve well-being and other cultural ecosystem services for residents?

1.4 Research approach

The World Health Organisation (WHO) (2016) has urgently called for robust evaluations of urban green space interventions to be conducted. While the health and social effects of greening vacant lots have been studied through randomised trials (Kondo et al., 2016; Branas et al., 2018; South et al., 2018), there have been no studies that have evaluated a front garden greening intervention at either household or street scale. Responding to this gap in knowledge, the conceptual frameworks developed in the thesis bring together existing literature and collected data. For example, one of the studies (chapter 7) evaluates an intervention based on its impacts on individuals and communities. The experimental studies presented in this thesis cover participatory approaches that focus on an understanding of adaptive and emergent interventions operating in complex and uncertain environments. Through personal accounts of change, the research determines if and how front gardens have contributed to observed outcomes.

This research straddles several fields including geography, environmental psychology, landscape studies, and public health. To a large extent, any research is framed by the researcher's professional (and sometimes personal) background. In this case, the researcher is a geographer seeing change through a spatio-temporal lens. Thus, the research is driven by an interest in social engagement with nature and, specifically, the socio-cultural value of urban nature. The interdisciplinary supervisory team is

formed of a horticultural scientist, a landscape horticulturalist, a geographer-turned-landscape architect, and an environmental psychologist with a background in landscape architecture and English literature. This is highlighted to explain the transdisciplinarity throughout this thesis, and to emphasise that this does not lead to the loss of any scientific rigour.

Finally, the researcher declares that she is not a gardener herself nor does she have access to a garden. While this should not impact the research at all, it does facilitate a context where there is less inadvertent bias, fewer preconceptions, and stronger objectivity in evaluating the subjectivities of people's relationships with their front gardens.

1.5 Significance and contribution

This thesis is a collaboration between the University of Sheffield, the University of Virginia, and the Royal Horticultural Society (RHS). This means that the scientific research benefits from RHS expertise on horticulture, an enthusiasm for greening urban areas, a pool of over half a million members keen to share their gardening experiences, and provides multiple avenues for the application of research into practice. For example, research findings are shared with the Ornamental Horticulture Roundtable Group and the All-Party Parliamentary Gardening and Horticulture Group.

In addition to working with the RHS, the project is funded by them as part of their work to curb the disappearance of front gardens through the Greening Great Britain campaign (GGB, previously called Greening Grey Britain) and to advance the art, science, and practice of horticulture. Therefore, the focus on front gardens can lead to findings that will support initiatives such as the GGB campaign, inform members, and potentially provide evidence to influence local authorities, housing associations, and government.

This research provides a basis to value front gardens in terms of their socio-cultural impacts, such as people's connection and engagement with nature or therapeutic benefits for mental health, stress, and well-being. As far as possible, the research treats the presence of plants in front gardens separately from the physical activity of gardening. This distinction is made to be able to isolate the impact of a passive

engagement with greenery and colourful plants. In 2011, 82.4% of the population of the English population lived in urban areas (Government Statistical Service, 2011) so there is potential to impact the health outcomes of many lives by improving the quality of urban green spaces.

Furthermore, this project links front gardens to a more refined understanding of the health promotion potential of private urban green spaces. According to biomedical or pathogenic approaches, health is merely the absence of disease. By contrast, a biopsychological approach offers a multidimensional concept of health which includes psychological and social well-being (Steg et al., 2012). Though often considered intangible and subjective, health is a positive and measurable variable, and it is possible to identify factors that promote health as well as factors that cause disease. Indeed, urban green infrastructure has a measurable role to play in addressing major public health issues related to non-communicable diseases such as mental illness, obesity, and cardiovascular diseases. These not only affect health and well-being but are also becoming increasing burdens on health care and workforce productivity (World Health Organization, 2016).

The following paper was written with direct connection to this thesis and has been published following peer-review:

Chalmin-Pui, L. S., Griffiths, A. Roe, J. J., and Cameron, R. W. F. (2019)
Bringing fronts back: a research agenda to investigate the health and
well-being impacts of front gardens, *Challenges*, 10(37).
<https://doi.org/10.3390/challe10020037>

1.6 Definition of key terminology

1.6.1 Front garden

The piece of land between the street and the front of a residential home. In most cases, this is private land belonging to the homeowner. Front gardens vary in size, shape, and aspect. There may be a hedge or fence delimiting the front garden from the pavement or public area. The front garden is typically visible from the street and

pavement, as well as from any windows at the front of the home. Residents and their visitors would need to cross the front garden to access the front door when leaving and arriving at the home.

For the purposes of this thesis, naming this area a garden does not imply that it is vegetated with a lawn or other plants. Indeed, the front garden may be completely paved over with concrete or gravel. There may be a driveway with space for one or more cars to park here. In contrast to the front garden, a house's back garden refers to the open area behind the house, which is usually not publicly visible from the street.

Front gardens are commonly called front yards in North America.

1.6.2 Gardening

The horticultural activity of tending to and cultivating plants in a garden. In the UK, gardening tends to be a leisure activity which can also provide fresh produce for the gardener's own family or community. In this thesis, gardening includes both ornamental and edible plants grown in private, residential spaces such as front gardens, back gardens, balconies, conservatories, or inside the home. Gardening encompasses a long list of more specific physical activities including sowing seeds, digging, planting, watering, propagating, trimming, deadheading, coppicing, weeding, mowing the lawn, pruning, harvesting, designing, pest control, fertilising, and composting. This list is not exhaustive and certainly not universal to all gardeners but tends to be the norm in the UK.

Gardening is distinct from farming or forestry mainly in terms of scale and intent: gardening is on a smaller scale and generally without the intention to sell produce.

1.6.3 Health

Health has been conceptualised in endless ways either as normality, as the absence of disease, as equilibrium, as functionality, as fitness, as resilience, as thriving, as a right, or as a resource. In 1948, the WHO adopted a definition of health as a 'state of complete physical, mental and social wellbeing and not merely the absence of

disease or infirmity'. In 1968, the WHO expanded their definition with the addition of a second sentence: 'to reach a state of complete physical, mental and social well-being, an individual or group must be able to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment. Health is, therefore, seen as a resource for everyday life, not the objective of living.' This has become one of the most widely used definitions of health as it alludes to three key (and inter-dependent) domains of health: physical, mental, and social.

This thesis uses the WHO definition of health, with an added caveat that 'complete' health is not only unrealistic to achieve but also inherently exclusionary of people with chronic conditions and disabilities (Huber et al., 2011; Bircher and Kuruvilla, 2014). Taking this into account, this thesis further understands health as a relative and complex system adaptive to social, emotional, and psychological circumstances of the life course.

1.6.4 Well-being

Like health, well-being is a complex term with many different conceptualisations. As quoted in the above WHO definition, health and well-being are interrelated and are components of each other. Well-being is interdependent on good mental, physical, and social health.

In this thesis, well-being is understood to be subjective and refers to people's own perceptions of what constitutes a good or improved quality of life (Diener et al., 2009a). Well-being is a positive state in terms of how people feel emotionally, how they judge their personal and social functions, and how they evaluate their lives as a whole in terms of life satisfaction or in comparison with the best possible life they can imagine.

Pertinent aspects of well-being commonly include: self-realisation, trust, confidence, life satisfaction, positive psychological functioning, good relationships with others, the capacity for self-development, viable aspirations, autonomy, self-acceptance, and purpose.

1.6.5 Stress

A state of physical, mental, and emotional strain resulting from adverse or demanding circumstances. Acute stress typically ensues following specific and seemingly uncontrollable life events, resulting in psychological adaptation and survival via physiological responses from the neural, cardiovascular, immune, and metabolic systems to maintain homeostasis (Währborg et al., 2018). Chronic stress is a response to stressors that persist over a prolonged period of time or to repeated acute stressors. Chronic stress can promote and exacerbate physiological pathologies and inflammatory diseases such as Type 2 diabetes, cardiovascular disease, obesity, inflammatory bowel diseases, and common mental disorders (Bird et al., 2018).

1.7 Thesis structure

As depicted in figure 1.1, the thesis is comprised of eight chapters from the present introduction to the final conclusion. After an initial review of the relevant literature, the identification of gaps in the knowledge and the formulation of hypotheses, the methodology chapter justifies the design and methods used to answer the research questions.

Each experimental chapter (chapters 4 to 7) reports on and discusses distinct studies undertaken as part of this PhD. These chapters form the main body of the thesis and are themselves structured around their own detailed aims, hypotheses, methods, results, analyses, and conclusions. The final concluding chapter provides a synthesis of the four studies and discusses the broader implications of the research findings.

Ensuring the structural cohesion of the thesis, the six research questions are addressed throughout. Each experimental chapter is designed to answer a selection of the research questions as summarised in table 1.1.

Figure 1.1: Overall thesis structure with chapter numbers

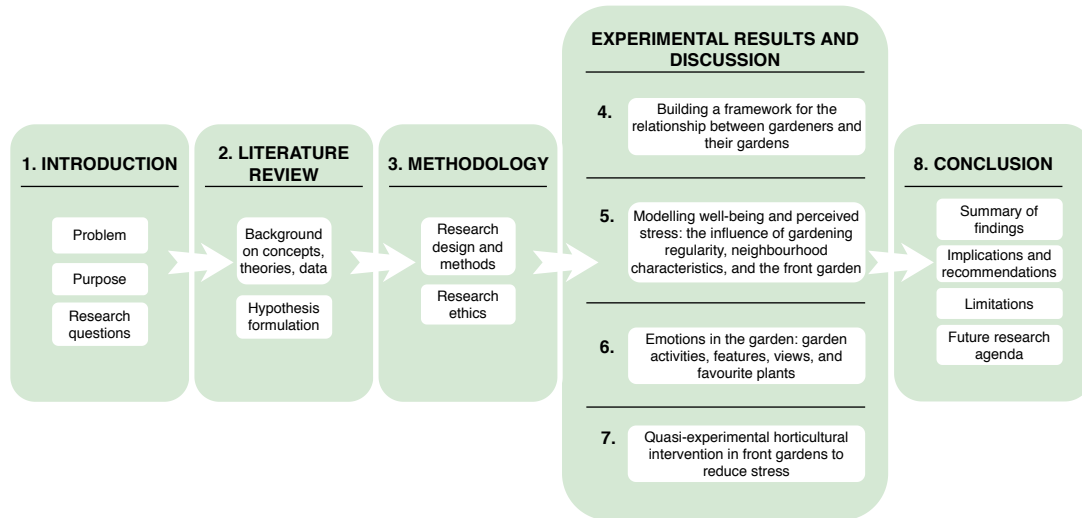


Table 1.1: Research questions of the four experimental chapters

Research question	Chapter(s)
1. What relationships do gardeners have with their front gardens?	4
2. What are the health benefits of the presence of (a) green front gardens? (b) gardening in front gardens?	4, 5, 7
3. How does a sense of community and social cohesion emerge from the presence of (a) green front gardens? (b) gardening in front gardens?	4, 7
4. Do gardeners report higher levels of well-being than non-gardeners?	5, 6
5. Are certain garden features more conducive to positive emotions and higher well-being than others?	6
6. Does introducing plants to front gardens that are currently paved over improve well-being and other cultural ecosystem services for residents?	7

Literature review and theoretical positioning of the research

Mental health is a growing public health concern. A recent index of 301 diseases found mental health problems to be leading causes of disease burden worldwide (Vos et al., 2015). In England, one in six adults has a common mental disorder such as chronic stress or depression (Adult Psychiatric Morbidity Survey 2016). The World Health Organisation (2003) has emphasised the negative impacts of stress in addressing the role of public policy in creating better health outcomes. Long-term stress, chronic anxiety, insecurity, low self-esteem, and social isolation all have detrimental effects on both mental and physical health. Furthermore, as these burdens accumulate over the life course, the risk of poorer quality of life, morbidity, and premature death increases.

Stress is a psychological, physiological, and behavioural reaction to a taxing or threatening situation (Cohen and Evans, 1987) that surpasses human response capabilities (Evans and Cohen, 2004). In moments of acute stress, the endocrine and nervous systems react to immediate threats by raising the heart rate, mobilising energy, diverting blood to muscles, and heightened alertness (Brunner et al., 2002). When this so-called 'fight or flight' response is sustained over long periods of time, these events hinder long-term health maintenance of the cardiovascular (Chida and Hamer, 2008) and immune systems (Seegerstrom and Miller, 2004). Brunner et al. (2002) link chronic stress to a wide range of conditions including infections, diabetes, high blood pressure, heart attacks, strokes, depression, and aggression. The WHO (2003) issued a key policy recommendation to improve the quality of the social environment people

live, study, and work in. In the same vein, Beute and De Kort (2018) explain that existing therapies for mental health issues should be complemented by everyday interventions such as exposure to restorative environments.

The purpose of this research is to evaluate how front garden landscapes might be understood as private therapeutic landscapes. This chapter provides a review of the relevant literature from landscape studies, geography, environmental psychology, public health, and horticultural therapy. This synthesis begins with an overview of the socio-environmental determinants of health and an examination of the interrelations between people and their environment. The next section delves into the causal mechanisms for nature's impact on health and well-being: key theories on the physiological and psychological pathways, as well as design considerations to optimise health benefits. The impacts of urban green space on health and well-being are discussed before turning to gardens and gardening. The following section details the cultural ecosystem services they promote. The literature on the emergence of social cohesion and a sense of community is explored in-depth. From the literature review, key research and knowledge gaps have been identified and consolidated to formulate hypotheses corresponding to each research question.

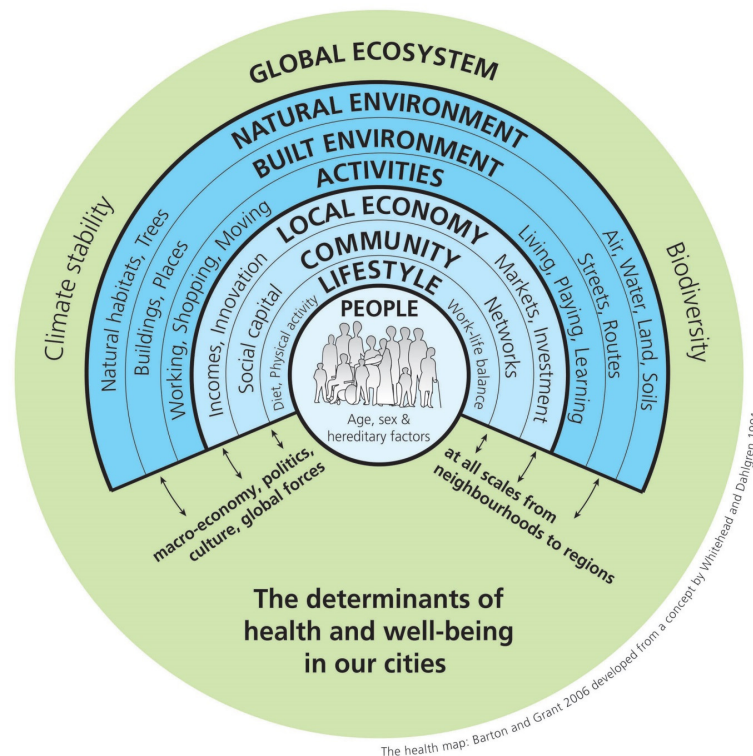
2.1 Socio-environmental determinants of health

Familiarity with the commonly-accepted determinants of human health is the best starting point to understand the extent to which front garden landscapes can play a role in determining health and well-being outcomes. At the most immediate level, an individual's health is determined by the physical cells, organs, genetics, and biochemical processes, alongside the availability of water, nutrition, oxygen, and shelter. Yet, health is not a purely physical function. Human health and well-being are also influenced by an individual's behaviours and lifestyle as well as broader socio-economic, political, cultural, and technological structures (Lovell, 2018).

Figure 2.1 is Barton and Grant's (2006) adaptation of Whitehead and Dahlgren's (1991) diagram conceptualising how individuals' health is embedded at all scales of built, social, and natural environments. The extent to which these different layers impact the individual is dependent on context and variable risk factors. Being the outermost

layer, the natural environment arguably has the most fundamental influence in that it underpins the provision of potable water, clean air, and food, as well as other environmental ecosystem services. The natural environment also engenders natural disasters and carries pathogens. Salutogenic landscapes promote good health, as opposed to being sources of pathogens. Examples of salutogenic places include restorative places, which promote restoration from stress and attentional fatigue, and therapeutic places, which are intended to heal specific illnesses (Townsend et al., 2018). This thesis on front gardens is concerned with the salutogenic impacts of nature on the scales of the city, street, and home environments.

Figure 2.1: Determinants of health and well-being in cities (Barton and Grant, 2006)



A recent report by the King’s Fund (2016) demonstrates how gardening interventions play an important role in the UK’s National Health Service (NHS) and the wider health system. The report places gardens within the national strategic health policy

context, particularly with regards to the integration of health services, social care and illness prevention. The report concludes that gardening interventions are an important mechanism for reaching national and local health policy goals.

2.2 Causal mechanisms for nature’s impact on health and well-being

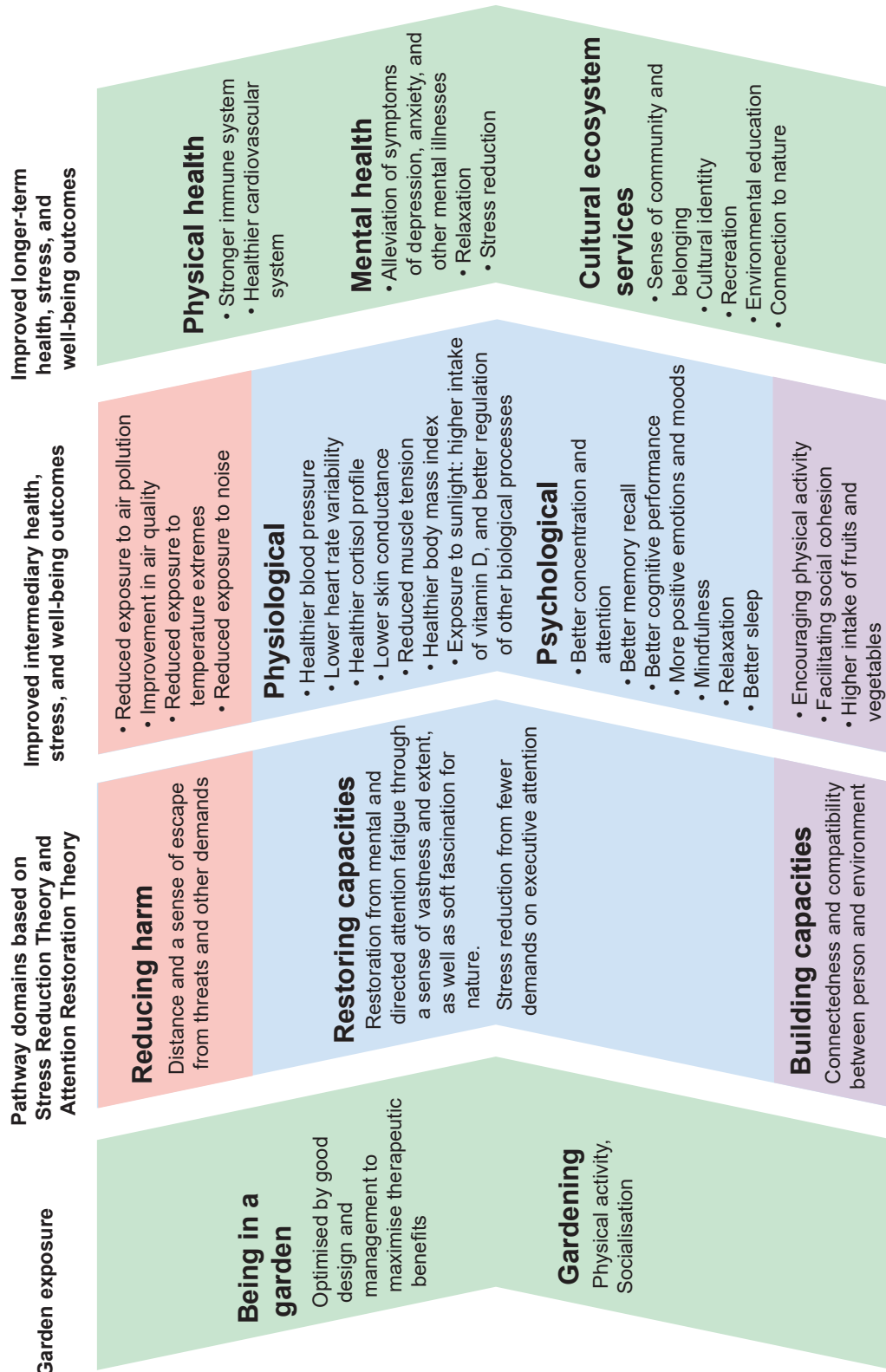
A therapeutic environment is one that can foster the maintenance of good health and the recovery from disease. In recent decades, both direct and indirect exposure to nature has been shown to generate positive cognitive, behavioural, affective, psychological, and physiological benefits, especially in urbanised societies. Our understanding of how the experience of nature might promote health has advanced through studies on environmental aesthetics, motivations for outdoor recreation, sources of residential satisfaction, and the affective and cognitive benefits of activities in gardens, parks, and wilderness areas (Hartig, 2008; Hartig et al., 2014). Indeed, there has been a growing body of literature focusing on the restorative potential of different settings and multi-sensory experiences of nature. Several key papers have dealt with the distinctive ability of natural environments to foster effective functioning and well-being as well as social cohesion (Kuo and Sullivan, 2001; Herzog et al., 2002; Nordh et al., 2011; Ratcliffe et al., 2013). Related to these findings, Louv (2005) popularised the concept of a nature deficit disorder - not a formal medical diagnosis, but used to designate the reduced contact with nature experienced by both adults and children.

2.2.1 Pathways to impact

Interaction with nature can be divided into two distinct experiences: those dealing with active contact such as gardening or activity in a natural setting; and those dealing with more passive interaction with nature such as the view from an office window (Brown and Grant, 2005). Systematic reviews (Hartig et al., 2014) agree that therapeutic effects from contact with nature do occur and that they are due to established mechanisms outlined in figure 2.2. These are directly linked to health related outcomes such as physical activity, social contacts, physiology, emotional states, and cognitive capacity rather than disease states and mortality.

The principal pathways through which nature contributes to health can be conceptualised in three domains: reducing harm, restoring capacities, and building capacities (Markevych et al., 2017). These domains operate individually as well as in complementarity with each other. Figure 2.2 is a conceptualisation of the intertwined pathways and mechanisms through which garden exposure leads to improved health, stress, and well-being outcomes.

Figure 2.2: Pathways to improved health and well-being from garden exposure



Explanations for this have been based primarily on two complementary theoretical frameworks from the field of environmental psychology: Attention Restoration Theory (ART) (Kaplan and Kaplan, 1989) and Stress Reduction Theory (SRT) (Ulrich, 1983; Ulrich et al., 1991). Both psycho-evolutionary theories are based on Wilson's (1984) biophilia hypothesis that humans have an innate affinity with the natural environment and that contact with nature is fundamental to psychological well-being and personal fulfillment (Kellert and Wilson, 1993). ART and SRT are equally linked through prospect refuge theory (Appleton, 1975), visual information processing theories (e.g. Hagerhall et al., 2004) and the circumplex model of emotion (Russell, 1988). All these mechanisms promote health through restoration - the psychological and physiological recovery from mental fatigue and stress (Steg et al., 2012).

Improved intermediary health, stress, and well-being outcomes are substantial and varied, including reduced exposure to noxious environments, physiological changes, psychological changes, and behavioural lifestyle impacts (de Vries, 2010; Hartig et al., 2014). There is a growing evidence base that green space promotes physical activity and encourages individuals to commit to more regular or prolonged exercise (de Vries, 2010). This has positive implications for physical fitness by minimising cardiovascular risks associated with a sedentary lifestyle (Cameron and Hitchmough, 2016). Longer term health, stress, and well-being is improved through beneficial impacts on physical health, mental health, and the provision of cultural ecosystem services (de Vries, 2010).

2.2.2 Attention Restoration Theory

ART was fully described for the first time in 1989 in the influential book 'The Experience of Nature' by psychologists Stephen and Rachel Kaplan. The core assumption of the theory is that people have a limited capacity to direct their attention to something. The cognitive mechanism necessary to inhibit or block out competing stimuli becomes depleted with prolonged or intensive use, which results in directed attentional fatigue. Restoration from mental fatigue caused by prolonged directed attention is characterised by a) being away from the source of fatigue/stress, b) a space with enough scope to allow someone to feel that they are in a different place and that can invite exploration of this place, c) fascination, d) compatibility between personal inclinations and environmental circumstances (Kaplan and Kaplan, 1989).

ART focuses on cognition, suggesting that exposure to natural environments restores the ability to concentrate on a task that requires effort and directed attention. This ability is finite and may become fatigued especially where there is a need to suppress distractions (Steg et al., 2012). Directed attention fatigue is associated with poorer decision making and lower levels of self-control, which in turn have been linked to a variety of health-related issues such as obesity through neural and behavioral pathways (Vohs et al., 2008; Hare et al., 2009; Fan and Jin, 2014). ART suggests that spending time in natural environments demands less cognitive resources and enables us to recover our attentional capacities by engaging us through soft fascination and providing opportunity for reflection (Ohly et al., 2016). Many studies have investigated the effects of nature for people with Attention Deficit Disorder (ADD). For example, children with ADD functioned better when participating in playful activities in green settings (Faber Taylor et al., 2002; Faber Taylor and Kuo, 2011).

Particularly useful for this thesis is the Kaplans' concept of nearby nature: the experience of nature in everyday living. This could be vegetation in the form of house plants, gardens, street trees, and the neighbourhood park. The interaction can be passive (window view) or active (exercising in the park). Nearby trees and grass visible from apartment buildings have been shown to enhance residents' effectiveness in facing their major life issues and to lessen intra-family aggression by reducing mental fatigue (Kuo and Sullivan, 2001).

2.2.3 Stress Reduction Theory

Based on seminal research of surgical patients, SRT proposes that natural environments create instantaneous affective responses. Studies have demonstrated physiological responses following exposure to actual green spaces or green views: reduced blood pressure (Ulrich et al., 1991; Hartig et al., 2003), more regular heart rate (Ottosson and Grahn, 2005), lower cortisol concentrations (van den Berg and van den Berg, 2011), lower skin conductance (Jiang et al., 2014), lower muscle tension (Ulrich et al., 1991; Tzoulas et al., 2007), improved hand dexterity (Park et al., 2009, 2016), and improved cognitive ability (Park et al., 2016; Cherrie et al., 2018). Responses to woodland environments included lower concentrations of cortisol, lower pulse rate, and lower blood pressure than in urban environments (Lee et al., 2011). Further, exposure

to green space was shown to reduce chronic stress in adults living in deprived urban neighbourhoods by observing diurnal patterns of salivary cortisol (Ward Thompson et al., 2012; Roe et al., 2013).

Despite the increasing number of studies providing empirical support for both ART and SRT, the majority of studies have been conducted in controlled laboratory conditions (Jiang et al., 2014) or using a strong and stereotyped binary distinction between natural and urban environments (Beil and Hanes, 2013). There is therefore a need for (quasi-) experimental studies in real urban green spaces and in real gardens.

2.2.4 How much nature do we need?

Assessing the size and duration of the effects of (residential) nature on health and well-being remains a difficulty (Hartig et al., 2014). Researchers conducting systematic reviews must synthesise results from studies that use a range of health outcome measures, study designs, nature typologies, and exposure durations. For example, the presence of a window with a nature scene allows frequent but short indirect exposure to nature (Cox et al., 2017).

Shanahan et al. (2015) identify three key components of exposure: intensity (the quality and quantity of nature elements), frequency (number of exposures, pattern of exposure), and duration (time exposed to natural element). The quality of nature elements can be calculated using several metrics such as safety, cleanliness, accessibility, maintenance, vegetation structure, species richness, number of different habitats, and birdsong (Banay et al., 2017). In all cases, preferences and perceptions will influence the extent to which these measures of nature are relevant or effective for different people (Hartig et al., 2014).

The dose-response curve of the health benefits of nature is largely unknown. Jiang et al. (2014) have described one such curve for a laboratory-based experiment on tree cover and stress recovery and Shanahan et al. (2015) have attempted to sketch dose-response curves to provide information on how small changes in the environment or exposure to nature could influence different health outcomes. More recently, White et al. (2019) showed that visiting natural environments for more than 120 minutes a week was associated with higher self-reported good health in England. There is no

existing dose-response curve concerning gardening in domestic gardens. This thesis will attempt to fill this knowledge gap. The potential presence of gardening intensity, frequency, or duration thresholds can be used to guide national or neighbourhood-scale public health guidelines.

2.2.5 Therapeutic design features in urban green spaces

There is a knowledge gap in the academic literature concerning the design aspects of a garden landscape or public park that make it therapeutic. From a relational perspective there can be no definite criteria for designing inherently healing places. For example, Milligan and Bingley (2007) and Jorgensen et al. (2007) found that woodlands can be both restorative and induce fear. The relationship between place and the people experiencing that place is not always straightforward and may not follow the same mechanisms. People who used woodlands as children were more likely to continue (or return to) using woodlands as adults (Milligan and Bingley, 2007). However, parental anxieties, myths, and media reporting adversely about woodlands could override earlier positive memories, thereby reducing peoples' use of woodlands.

Using Gibson's (1979) concept of affordances, this relational ontology means that opportunities (or constraints) that exist in an environment are relative to the characteristics of the person perceiving them. As illustrated by the woodlands example, people have different physical and psychological capacities, interests, and needs that, in turn, influence how they relate to the world around them (Lennon et al., 2017). This means that different aspects of the green space will not offer equal and universal opportunities for stress restoration, recreation, retreat, inspiration, or physical activity. Gardening, on the other hand, may be popular because it provides self-paced exercise, with little stigma attached to factors such as age, gender, cultural background, or level of physical fitness (Cameron and Hitchmough, 2016).

Nonetheless, there is a sufficient theoretical evidence-base to build on, supported by specific cases and design features, that have been shown to be effective. Theoretically, these garden features should be aligned with themes of a) sensory impressions, b) self-chosen places in the garden, and c) interactions between concrete and symbolic activities (Adevi and Lieberg, 2012). In line with ART, the following elements begin

to paint a picture of garden features that can improve the quality of life for people in either good or poor health (Kellert, 2018).

Size The size of the green space, including the quantity of grass, trees and bushes have been positively related to restoration and self-reported health (Brindley et al., 2018). While the size of a garden is difficult to change, the sense of extent can be optimised to appear larger through boundaries and colour to enhance restorative potential (Cervinka et al., 2016). This sense of extent can be set from specific view points such as seating locations (Nordh et al., 2011).

Demarcation A healing garden is designed to be experienced as a whole, marked off from its surroundings (Stigsdotter and Grahn, 2002). The Alnarp Rehabilitation Garden in Sweden has separate garden 'rooms' with different demands on activity, as well as groves and meadows (Adevi and Mårtensson, 2013). Garden rooms can be surrounded by fences, hedges, and rows of fruit trees. Plants can also be placed to create areas of confidentiality and privacy (Marcus and Sachs, 2013).

Simple pathways Hartig and Marcus (2006) find that simple looped pathways are commonly incorporated in healing gardens to aid patients with impaired way-finding abilities. They also recommend dark or tinted walking surfaces to reduce glare.

Water Water features, especially running water and natural looking water, usually get high rankings based on preference and restorative quality (Ulrich et al., 1991; Kellert, 2018).

Planting style Preferred garden style is not necessarily purely a matter of subjective aesthetic taste but is motivated by psychological needs that play a crucial role in human functioning. van den Berg and van Winsum-Westra (2010) found that a personal need for structure was associated with whether people had a romantic, manicured, or wild garden style. This need for structure will vary based on gender, age, life stage and extraneous stimuli.

Sounds In lab-based experiments, natural areas were perceived to be more restorative if the visual experience was alongside natural noises. This might be less modifiable in a garden than in a lab, but blocking anthropogenic noises such

as traffic, and encouraging bird song, the sound of running water or rustling leaves would enhance the restorative potential of the garden (Anderson et al., 1983; Stack and Shultis, 2013; Ratcliffe et al., 2013; Watts, 2017).

Multi-sensory A multi-sensory environment is a dedicated space or room where stimulation can be controlled, manipulated, intensified, reduced, presented in isolation or combination, packaged for active or passive interaction and temporally matched to fit the perceived motivation, interests, leisure, relaxation, therapeutic, and educational needs of the user (Hussein, 2012). Marcus and Sachs (2013) maintain that health benefits are derived from just being in the garden and that no staff (other than for garden maintenance) are necessary for a garden to be healing or restorative. Hartig and Marcus (2006) warn against toxic planting in case patients with various neurological diseases put things in their mouths and recommend flowers that may evoke early memories that are generally retained in patients with dementia.

2.3 Cultural ecosystem services

Using the broad framework of ecosystem services, cultural ecosystem services are the intangible contributions that ecosystems make in terms of framing identities, enabling experiences, and developing capabilities. Fish et al. (2016) conceptualise cultural ecosystem services as following three processes:

1. Biophysical spaces such as gardens, parks, green spaces are the contexts in which interactions between people and nature occur;
2. These interactions enable cultural practices such as exercising, creating, self-expression, producing, caring, and gathering;
3. These practices in turn shape the biophysical places.

Cultural ecosystem services might include spiritual enrichment, cognitive development, reflection, recreation, aesthetic and creative inspiration, creation and maintenance of cultural identities, environmental education, changing habits, encouragement of walking, a sense of belonging or rootedness, tranquility, discovery, dexterity,

judgement, and community cohesion (Daniel et al., 2012; Sander and Haight, 2012; Fish et al., 2016). Therefore, benefits from inter-relations between cultural spaces and practices and environmental spaces and practices are likely to contribute to well-being.

The concept of cultural ecosystem services has gained traction at the global scale through the Millennium Ecosystem Assessment (2003) and the Intergovernmental Platform on Biodiversity and Ecosystem Services (Díaz et al., 2015; IPBES, 2016). Shaped by biological and economic notions of stocks and flows (Winthrop, 2014), these services are used in this thesis to illuminate the full range of socio-ecological interactions in front gardens and while gardening. For example, as an indicator of the value accorded to residential green space, the presence and proximity of natural features adds an estimated £131 billion to the value of the UK's housing stock (Oxford Economics, 2018).

Vegetation in residential areas would thus provide a multitude of different ecosystem services to different people and at different scales, delivered through both active and passive pathways (Lin et al., 2017). With any level of stress and the need for restoration, access to gardens has a high potential value of providing this link (Keeler et al., 2019). Through a complex ecology of spatial reality, cognitive process, and physical work, the power of the garden lies in its simultaneous existence as providing a sense of control, an embodied experience, and a canvas for creativity (Francis and Hester, 1990; Gross, 2018).

2.4 Urban green space and health

In 2011, 82.4% of the population of the English population lived in urban areas (Government Statistical Service, 2011) so there is potential to impact the health outcomes of many lives by improving the quality of urban green spaces. Urban green infrastructure has a measurable role to play in addressing major public health issues related to mental illness, obesity, and cardiovascular diseases. These non-communicable diseases are becoming increasing burdens on health care and workforce productivity (WHO 2016).

There is a positive relationship between urban green space and self-reported health after controlling for socio-economic and demographic characteristics (de Vries et al.,

2013). Similarly, there is accumulating evidence that more time spent in green space is associated with improved mental health and vitality, independently of cultural and climatic context (van den Berg et al., 2016). In a review of studies on the impact of residential greenness on maternal health and pregnancy outcomes, (Banay et al., 2017) found positive associations between ‘greenness’ and birth weight as well as maternal peripartum depression, with stronger effects among mothers of lower socioeconomic status. An extensive collection of existing evidence on the links between urban green space and health is succinctly summarised by the WHO (2016), including the mechanisms through which therapeutic benefits occur and the differential health benefits of green spaces for specific population groups such as women, children, older adults, and marginalised groups.

2.5 Gardens and health

Although small in size, residential gardens make up a combined area of approximately 5,300 square kilometres in Great Britain, the equivalent of 30% of the total urban built-up area in the country (Office for National Statistics, 2018). In any one city, gardens can make up over 25% of urban land area (Gaston et al., 2005; Mathieu et al., 2007) and are the most readily accessible green spaces for residents. Davies et al. (2009) estimate that 87% of homes in the UK have access to a garden. Domestic gardens are therefore likely to also provide health benefits to residents. Whilst domestic gardens are perceived as a valuable component of green infrastructure and a wildlife habitat (Davies et al., 2009), their relative social contribution remains largely un-quantified (Cameron et al., 2012). More specifically, by virtue of being publicly visible from the street, front gardens can provide such benefits to the local area.

Gardening is a common pastime around the world. An estimated 49.2% of the adult population in England takes part in gardening activities (Department for Culture Media and Sport, 2017). If we assume a similar proportion of gardeners in Wales, Scotland, and Northern Ireland, there are approximately 27 million adult (16+) gardeners and 24 million domestic gardens in the UK (Office for National Statistics, 2015; Department for Culture Media and Sport, 2017).

Four main studies presented in table 2.1 have attempted to explain the motivations behind gardening as a leisure activity (Beard and Ragheb, 1983; Francis and Hester,

1990; Ashton-Shaeffer and Constant, 2006; Gross and Lane, 2007). These four studies involve gardeners from the United States of America (USA), Norway, and New Zealand - gardening cultures broadly comparable to the those in the UK. Table 4.1 highlights the key motivations for gardening in domestic gardens. These include seeking an intellectual challenge, the freedom of self-expression, an escape from negative stimuli, and facilitating social relationships.

Beyond these attempts at formal categorisation, academic literature focussing on gardeners' relationships with their gardens has been mostly ethnographic in nature. Analysing autobiographical narratives, Mark Bhatti and colleagues (Bhatti and Church, 2004; Bhatti et al., 2014; Bhatti, 2014) demonstrate that the domestic garden is an important part of everyday life for ordinary people. They consider the multiple roles and meanings of gardens and gardening to explore leisure in the domestic sphere and provide insight into contemporary meanings of the home. Using a more quantitative approach through a questionnaire with 126 respondents in the USA, Clayton (2007) found that gardening contributes to a sense of community belonging as well as to self-esteem. Still, Ashton-Shaeffer and Constant (2006) called for more research to further knowledge of the nuanced and emotive roles that gardens and gardening play in contributing to life satisfaction.

Despite the current enthusiasm for and recognition of the importance of this research area, studies into the distinct benefits of domestic green space towards health and well-being are currently lacking. For example, Mitchell et al. (2011) conclude that larger areas of green space were most salutogenic without taking into account the inherent smaller size of domestic gardens. Similarly, Stott et al. (2015) promote larger parks and reserves as being crucial for ecosystem service provision, without making a distinction between differential benefits from public and private landscapes and gardens. Addressing exactly this, a recent study ran a series of regression models to quantify the mitigation of local health deprivation by green space and domestic gardens, rather than relying on a simple measure of land cover (Dennis and James, 2017). Dennis and James (2017) found that domestic gardens provided the most convincing mitigating effect on health deprivation. Another exception, Brindley et al. (2018) looked exclusively at residential gardens and found that the largest residential gardens were associated with reduced socioeconomic health inequalities in England. This gives strong support to the idea that domestic gardens, through the provision of

Table 2.1: A review of existing meanings and motivations for gardening behaviour

Study citation	Topic	Geographic context	Emergent categories
Francis and Hester (1990)	Personal meanings of the domestic garden	California and Norway	<ol style="list-style-type: none"> 1. A place to be 2. A place to care for growing things 3. A place to control 4. A place to exert creativity 5. A place that reflects personality 6. A place of freedom 7. A place for productive work 8. A place to own 9. A place that develops over time 10. A place of retreat
Beard and Ragheb (1983)	Leisure behaviour motivations	USA	<ol style="list-style-type: none"> 1. Competence-mastery (to achieve, master, challenge, and compete) 2. Intellectual stimulation (learning, exploring, discovering, creating, or imagining) 3. Social interaction (friendship and interpersonal relationships) 4. Stimulus avoidance (escape from over-stimulating life situations)
Ashton-Shaeffer and Constant (2006)	Motivations for gardening as a leisure pursuit	USA	<ol style="list-style-type: none"> 1. Intellectual stimulation 2. Stimulus avoidance 3. Friendship building 4. Social interaction 5. Physical fitness 6. Skill-development 7. Creativity
Gross and Lane (2007)	Motivations to garden in back garden	New Zealand	<ol style="list-style-type: none"> 1. To escape the stresses of daily life 2. To express ownership and identity by creating places 3. Connectedness to nature 4. To forge social relationships 5. Caring for the environment 6. Physical and mental health

different socio-cultural opportunities, are at least just as important to human health as larger public green spaces.

Kaplan and Kaplan (1989) have considerably developed our understanding of the psychology of human-nature relations in ‘nearby nature’ (green spaces within walking distance of the home including domestic gardens) and identified four roles that these places play. These include 1) recovery from stress and anxiety that cannot be found elsewhere by providing a soft fascination for plants and flowers to restore directed attention, 2) a context for day dreaming and restfulness, 3) the feeling of being in a completely different world, and 4) the compatibility between nature and human beings. More recently, Hartig’s seminal work on the processes and mechanisms in restorative environments has further informed the health values of nature experiences (Hartig et al., 1997, 2003; Hartig and Staats, 2006; Hartig et al., 2014). Moreover, physical activity in nature settings has been shown to be more advantageous in terms of restoration, mood, and self-esteem when compared to physical activity in non-natural indoor and highly urban settings (Grahn and Stigsdotter, 2010). This is true for adults with both good and poor mental health.

The health and well-being benefits of gardening as a physical activity are well-documented. A meta-analysis assessing the consistency of the positive effects of gardening on health (while controlling for publication bias) shows that the reported health benefits are robust (Soga et al., 2017). The authors conclude that regular gardening can improve health. Previous research has focused on the restorative, rehabilitative, and nutritional aspects of gardening activities for many different groups, such as convalescing patients (Marcus and Sachs, 2013), children with ADD (Kuo and Faber Taylor, 2004), homeless women (Grabbe et al., 2013), older people (Sommerfeld et al., 2010; Scott et al., 2014), and adults with clinical depression (Gonzalez et al., 2010). Furthermore, gardening has been shown to be beneficial in a variety of settings: allotments (Hawkins et al., 2011; Audate et al., 2019), other communal gardening settings (Kingsley and Townsend, 2006; Kingsley et al., 2009, 2019; Kunpeuk et al., 2019), hospitals (Marcus and Sachs, 2013), nursing homes (Tse, 2010), and schools (Roe and Aspinall, 2011b; Block et al., 2012).

While the impacts of horticultural therapies and green social prescriptions run by professionals for patients with pre-determined health goals are beyond the scope of this thesis, they do have much in common with the impacts of gardening in residential gardens. Rehabilitation gardens play an increasing role in helping people

with stress-related illnesses, such as burn-out and fatigue, that are associated with physical as well as mental health problems (Adevi and Mårtensson, 2013). Treatment can require individualised rehabilitation and long recuperation times, facilitated with garden therapy through the patient's active use of the "place, process, and their intertwining" (Hartig and Marcus, 2006, pg. 36). Gardening activity is given meaning through various dimensions: the beauty of nature and seasonal changes which fascinate, relaxes, and gives perspective; the interdependence on nature and its cultivation; nurturing plants and attendance to their growth; sharing time and experiences with other people (Adevi and Mårtensson, 2013).

2.6 The significance of front gardens

The main difference between front and back gardens, is the role frontages play as unique buffer zones that connect the home to the outside world while simultaneously separating the private from the public realms (Riley Smith, 1991). Cultural geographers would classify front gardens as an ordinary urban landscape that reveals the everyday lives of ordinary people. The social and aesthetic function of front gardens has been explored to this effect (Uren et al., 2015; Ignatieva et al., 2017; Lebowitz and Trudeau, 2017). As well as gardening, front gardens are used to carry out mundane tasks such as arriving and departing the home, taking out the rubbish, or answering the door (Lin et al., 2017).

The front garden is a front-facing and exterior manifestation of the house. Via local ordinances and housing policies, front gardens have been used as a vehicle for social exclusion and discrimination in neighbourhood politics (Grampp, 2008). These places are our "unwitting autobiography, reflecting our tastes, values, aspirations and even our fears in tangible, visible form" (Lewis, 1979, pg. 1). Staats (2013) calls for research on restorative environments in specific spatial, behavioural, and temporal circumstances within the home. Filling this need, this thesis looks at the front garden, the first part of the home that one sees when arriving, and the most public-facing part of the home that provides public good.

The primary contribution of this research on the link between green space and nature is its focus on front gardens. There are few studies about these small, contained areas

(Haase et al., 2019), and certainly none that have evaluated a greening intervention at either household or street scale. de Vries et al. (2013) demonstrated an association between the quantity and quality of streetscape greenery and social cohesion (a sense of community, trust, belonging, shared norms and values, positive and friendly relationships) at the neighbourhood scale. Conversely, a shortage of green space in the environment has been linked to feelings of loneliness and lack of social support (Maas et al., 2009; Ward Thompson et al., 2012).

Regarding the motivation for people to garden in their front gardens, we encounter a key knowledge gap in the literature. All studies are either about back gardens - places that are hidden from public view and emotions associated with private lives - or confound between all types of domestic gardens so become dominated by answers about the back garden. One study does indicate that residents in Ohio, USA care for their front lawns as a sign of respect for their neighbourhood (Robbins et al., 2001). However, the socio-political context of American front lawns is imbued with rigid state laws and social pressure (Grampp, 2008) that are not comparable to those in the UK.

2.6.1 How do community and social cohesion emerge from gardening activities in front gardens?

Hassen and Kaufman (2016) define community engagement as “the ability of a group or network of people, bound either by interest or by geography, to interact with one another for support, to promote inclusivity and to organise social activities” (pg. 120). The body of literature on the community-building effects of gardening is large, though focussed on shared gardens. This includes gardens that are shared in numerous configurations - whether a collection of private plots such as allotments or a larger parcel everyone tends collectively, school gardens, rehabilitation gardens, etc. In these contexts, researchers have developed a strong understanding of how community gardens work to (re)build and nurture a sense of community. Such studies tend to look for evidence of bonding, high community engagement, and increased social capital (Firth et al., 2011). Gardeners reported higher ratings of neighbourhood aesthetics and more involvement in local social activities (Litt et al., 2015). In all types of community gardens, people socialise with each other and provide mutual

help (Veen et al., 2015). The learning processes, knowledge sharing, and engaging in intentional experimentation through gardening create opportunities to support social cohesion (Plummer and FitzGibbon, 2007; Armitage et al., 2008).

The history of urban communal gardens is equally well-documented and provides evidence of the social benefits of shared gardening spaces. This is especially true in the USA where citizens have often turned to community gardens as a coping mechanism in times of socio-economic hardship (Chan et al., 2015). In the same vein, with a focus on poverty in the UK, Milbourne (2012) explored the everyday and mundane forms of economic injustice in disadvantaged urban neighbourhoods to show that community gardens produce new spaces of justice within the city.

Nonetheless, front gardens are not community gardens. Though the mechanisms should not differ widely, there is no literature on the community benefits and social cohesion that may result from gardening activities in private front gardens. While on private land, front gardens are on public display and gardeners are themselves publicly visible from the street when gardening in front of their house so, in theory, there should also be opportunities for informal socialisation and mutual help.

Being in plain view to residents and passers-by, a stronger sense of community may also arise from greener streetscapes regardless of whether someone is a gardener or not. The perceived aesthetics and upkeep of a street do influence community engagement (Hassen and Kaufman, 2016). Kaplan and Kaplan (1989) found that neighbourhood satisfaction was correlated with the view of a garden, even if belonging to someone else. In an urban setting, the street is one of the most public of spaces (Hassen and Kaufman, 2016) so it follows that when there are more gardens visible from the street, neighbourhood satisfaction would potentially be higher. A survey of people walking along residential streets in Vancouver found that 89% felt that the front gardens and terraces contributed positively to the quality of the street (Macdonald, 2005).

Existing research links tighter community cohesion with health and well-being (Pantell et al., 2013; Yang et al., 2013). It is well-evidenced and reviewed by the OECD that housing and neighbourhood conditions are a significant factor in people's physical health, mental health, quality of life, and self-development (Balestra and Sultan, 2013). Residents' privacy, security, stability and control are vulnerable to threats that

are also likely to have a negative impact on their well-being. In addition to the built environment, the social environment of the neighbourhood also has both direct and indirect impacts on well-being. For example, it has been shown that the degree of trust and feelings of connectedness between neighbours has an impact on how they work together to achieve common goals (cleaner and safe public spaces), to exchange information, and to maintain informal social controls such as discouraging anti-social behaviour in the neighbourhood (Putnam, 1993).

2.7 Conclusion and formulation of hypotheses

In summary, there is a robust evidence base for the beneficial and therapeutic benefits of green spaces and domestic gardens. There is also a strong indication that front gardens will positively influence health and well-being outcomes, as well as provide additional cultural ecosystem services, though this has not yet been tested thoroughly. From this literature review, key issues that require more research and that will determine the agenda for ongoing and future studies in this area include further quantification of dose-response curves, and good design and management of residential front gardens to deliver maximal health benefits to residents.

To conclude this chapter, the formulation of hypotheses for each research question in table 2.2 synthesises the knowledge gaps identified in the review of the existing literature. In exploring these ideas, co-factors including gender, age, annual income, health problems, education, ethnicity, geographical location, and other leisure activities will also be taken into account.

Table 2.2: Hypotheses stemming from each research question

Research question	Hypotheses
1. What relationships do gardeners have with their front gardens?	Gardeners create and maintain relationships with their front gardens that are important to the gardeners' well-being and meaningful to the local neighbourhood.
2. What are the health benefits of the presence of (a) vegetated front gardens? (b) gardening in front gardens?	People with vegetated front gardens and active gardeners directly attribute specific health benefits to their interactions with front gardens. These health benefits include increased well-being, decreased stress, and a better overall health status. They may also gain health benefits they are not immediately aware of. Health benefits are associated with how much vegetation is in the front garden.
3. How does a sense of community and social cohesion emerge from the presence of (a) vegetated front gardens? (b) gardening in front gardens?	Gardening activities in front gardens and greener front gardens in the local neighbourhood encourages social interaction and fosters a sense of community among residents.
4. Do gardeners report higher levels of well-being than non-gardeners?	Gardeners report higher levels of well-being than non-gardeners. Well-being and stress levels are related to gardening activity and time spent in the garden.
5. Are certain garden features more conducive to positive emotions and higher well-being than others?	Green and colourful garden features are associated with stronger positive emotions and increased stress restoration than hard surfaces. Gardening activities are associated with positive emotional responses. Gardeners' favourite parts of their garden reflect their attachment to features more conducive to positive emotions.
6. Does introducing plants to front gardens that are currently paved over improve well-being and other cultural ecosystem services for residents?	Introducing plants to front gardens that are currently paved over improves resident well-being, lowers stress levels, and provides other cultural ecosystem services.

Methodology

This research aims to evaluate how front garden landscapes influence human health and well-being to contribute to assessing and providing new knowledge on the psychosocio-cultural value of front gardens. The aim of the present chapter is to provide an overview of the methodology and methods used in this thesis.

The combination of tools used to quantify and qualify human health and well-being are reported and justified in the first two sections. These decisions underpin all further premises of the research. The methods have been designed to answer the research questions and hypotheses in table 2.2.

The third section provides a rationale for the mixed-method approach taken and the theoretical implications of using both qualitative and quantitative methods in concert with each other. The fourth section addresses concerns about trustworthiness by demonstrating the validity and credibility of the methods used.

The fifth section provides background context for all of the methods used. The parameters of data collection and analysis in each of the four experimental chapters are outlined in the sixth section. The limitations of the research are acknowledged and addressed. Finally, a discussion surrounding research ethics and integrity concludes the chapter.

3.1 Health and well-being indicators

Monitoring and measuring human health and well-being is intangible and often subjective (OECD, 2013). There is an almost infinite number of ways to measure both

concepts, and several fields of scholarship dedicated to measuring and valuing human health. Any assessment of health is inherently related to how health is conceptualised and can vary markedly in medical practice and in different disciplines of health research. For example, key types of outcome measures for health include population morbidity, life expectancy, burden of disease in a population, quality of life, psychological or physiological functioning, physical fitness, lived experience of illness and its symptoms, lifestyle behaviours, genetic risk factors, and economic valuations of health and healthcare (Lovell, 2018).

This thesis uses a combination of indicators to measure health and well-being in a way that is most appropriate to the evaluation of front garden landscapes. The thesis seeks to measure personal well-being including positive and negative emotions, and psychological functioning (such as feeling competent and having a sense of purpose). The measures used are all designed to carry individual meaning, statistical relevance, and applicability to the medical, public policy, and business worlds. The health and well-being indicators used in this thesis are detailed below. The choice of tools was selected based on the merits of each individual measure, with respect to the added value that they provide when used in conjunction with each other, and a set of criteria set out in section 3.2.

3.1.1 Well-being: Short Warwick-Edinburgh Mental Well-Being Scale (SWEMWBS)

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This is a seven-item scale with five response categories and is a shortened version of the 14-item Warwick-Edinburgh Mental Well-Being Scale. All items are worded positively, covering feelings and the functional aspects of mental well-being. The SWEMWBS has been widely used by the health service sector to measure the mental well-being of the general population as well as to evaluate the impact of projects and programmes aiming to improve mental well-being. Scores range from 7 to 35, with 35 being the highest possible mental well-being and 7 being the lowest possible mental well-being. The main limitation of the SWEMWBS is that it relies on self-reporting.

The scale has been rigorously tested for internal consistency and sensitivity to changes in mental well-being (Stewart-Brown et al., 2009). It can be completed by the participant without any assistance in either paper or electronic formats. The questions use familiar vocabulary and concepts of well-being. The SWEMWBS can provide meaningful results when completed once and can be repeated at different stages of an intervention to assess changes in mental well-being. Change can be calculated per individual or as mean change calculated for groups of respondents (Maheswaran et al., 2012). Results at a project level can be compared with national survey data. Many studies of the impact of green spaces on well-being have included this measure (Roe et al., 2013; Ryan et al., 2017; Southon et al., 2018; Coldwell and Evans, 2018).

3.1.2 Stress: Perceived Stress Scale (PSS)

The PSS is also a well-validated measure of psychological well-being (Cohen et al., 1983). It measures the degree to which situations in the respondent's life are appraised as stressful by considering their own feelings of control and assessments of their coping resources. The PSS has been used in multiple studies about the impact of natural environments on stress and is sensitive to change. It is therefore also appropriate for use in intervention studies. Scores range from 0 to 40, with 40 being the highest possible perceived stress and 0 being the lowest possible perceived stress. The PSS also relies on self-reporting.

Just as with the SWEMWBS, the PSS can be completed by the participant without any assistance in either paper or electronic formats. The questions use familiar vocabulary and concepts of stress and well-being. It can provide meaningful results when completed once and can be repeated at different stages of an intervention to assess changes in perceived stress. Change can be calculated per individual or as mean change calculated for groups of respondents.

3.1.3 Stress: Diurnal decline of salivary cortisol

Commonly known as the 'stress hormone', cortisol concentration in saliva reflects changes in physiological state in response to the experience of stressful situations.

Cortisol is a hormone actively involved in many critical physiological processes including the regulation of blood pressure maintenance, anti-inflammatory function, and immune function (Sapolsky et al., 2000). The diurnal pattern of cortisol decline is used as a physiological outcome measure because it is sensitive to the effects of chronic stress and is a mechanism by which stress and health are linked (Kirschbaum and Hellhammer, 1994; Ryan et al., 2016).

Salivary cortisol is measured by taking saliva samples at regular points in the day to generate a cortisol profile for the day. In normal, healthy diurnal patterns, levels peak in the early morning shortly after awakening and drop to the lowest concentration at night. A lower, flatter cycle, with less change in cortisol concentration between morning and evening is indicative of exhaustion and dysfunctional regulation of the cortisol secretion system. This is associated with a lower level of well-being and long-term conditions such as post-traumatic stress disorder, chronic stress, repressive anxiety, and chronic fatigue (Adam et al., 2017). Diurnal profiles can also be used to investigate the impact of an intervention on cortisol stress response and recovery.

To provide a sample, participants chew on a cotton swab for 1 minute before placing it back into a Salivette[®] (a 90mm long test tube designed for collecting saliva). Samples are taken 4 times a day for 2 consecutive days both before and after the intervention. Participants must not smoke, eat, or drink anything other than water 30 minutes before providing a sample. Exclusion criteria include steroids and hormonal medication. Full protocol and instructions for providing samples are included in Appendix A.4. Cortisol samples were assayed by Dr Nina Smyth (University of Westminster). Salivette tubes and all associated packaging material were bought from Sarstedt Ltd. At the laboratory, samples were stored at -20°C until analysis. All samples were assayed at the University of Westminster using their standard laboratory protocols. Cortisol concentration was determined by Enzyme Linked Immunosorbent Assay (ELISA) developed by Salimetrics LLC (USA). Assay characteristics: standard range = 0.33-82.77 nmol/l, assay sensitivity = 0.19 nmol/l (lower limit of detection), correlation with serum cortisol = 0.91 ($p < 0.0001$, $n = 47$ samples). After centrifuging thawed samples at 3500 rpm for 10 min, duplicate analysis of samples was undertaken. The intra-assay coefficient of variation was for all $< 10\%$ samples.

3.1.4 Physical activity

“In the average week, on how many days do you do any physical activity (of sufficient exertion to raise breathing rate) for at least 30 minutes?” This single question is often used to evaluate physical activity behaviour in different interventions, including green space activities (Milton et al., 2011). Scores range from 0 = no days and 7 = being physically active on every day of the average week. This question relies on self-reporting and memory recall. Results can be compared to other larger populations.

3.1.5 Health and well-being state

Rich qualitative data on subjective well-being was collected by conducting in-depth semi-structured interviews (Murray and Chamberlain, 1999). Health and well-being information provides qualitative information on perceived stress, a self-assessment of the life course, social connection to others, and of general well-being (Bosma et al., 2005). Furthermore, it can elucidate potential health symptoms of specific conditions, effects on psychological and physical functioning, and the severity of these effects. Collecting this type of data is dependent upon a minimal level of trust between respondent and researcher, and a flexible schedule of pertinent interview questions tailored to each individual.

Qualitative data was analysed using interpretative phenomenological analysis, an idiographic approach to participants’ individual cognitive and perceptual accounts of their health. Following the examples set by Smith et al. (1999), phenomenological analysis searches not only for connections and shared themes but also for tensions and divergences. This approach is appropriate to health psychology because people do think about their bodies and their well-being in varying and dynamic ways. Respondents had different understandings of what constitutes well-being and what contributes to their own well-being so answers are incomparable to each other across individuals or groups. Interview data can help to contextualise the current assessment by providing information on past and anticipated future states of health and well-being for that individual.

3.2 Measuring health and well-being - the theoretical approach

The methodological combination for the portfolio of tools used in this thesis involved a systematic and careful decision-making process including elimination of other possible methods. Five main factors were taken into account for the selection of each choice and for validating the combination as a whole.

1. **Validity in UK populations** - All measures and scales used have been tested and statistically validated for adult populations in the UK. The complexity and phrasing of the questions must be in language appropriate for the participants; they have to be able to understand all the items including all health terminology. Pilot tests of the questionnaire were conducted with the target populations to ensure easy comprehension within the anticipated time limit, and an expected variance in outcome scores.
2. **Comparability to other studies** - All measures and scales have been successfully used in previous studies and are accepted by peer-reviewed bodies of literature including health and well-being studies in the social and behavioural sciences, landscape studies, and environmental psychology.
3. **Practical feasibility**
 - (a) **Cost** - Using multiple tools can lead to quick increases in the financial cost of data collection depending on the resources required. All questionnaire scales used in the thesis are freely available to use and reproduce. Semi-structured interviews do not have a direct monetary cost. However, instruments to measure physiological indicators are expensive. Sampling salivary cortisol is a stand-alone measure that does not require expensive devices which would be liable to loss or damage if entrusted to participants.
 - (b) **Acceptability by the participants** - All measures must be as minimally intrusive as possible and not have a direct effect on their health or well-being. Questionnaires and interviews were not triggering. Providing samples of salivary cortisol was done independently by the participant

while they were going about their everyday lives and was not considered intrusive. Feedback from participants was always solicited to ensure that it did not negatively impact their moods or duties.

- (c) **Frequency of measurement** - Each tool provides recommendations for the timing and frequency of measurement. They can all be used once per participant in an observational study design or they can be used in the context of an intervention, with measurements made before and after an intervention. Measurements can also be made at regular intervals over a prolonged period of time. Because of seasonal changes in gardens and plants, the tools used were chosen for the possibility of taking measurements every three months, as well as being representative of the fortnight or month the person has experienced rather than a measure of satisfaction with their life as a whole.
- (d) **Method of administration** - The questionnaires can be answered both on paper in person and through an online platform. This adaptability is important so that the questionnaire could be disseminated to a large (unlimited) target population online as well as completed without a portable device or internet connection in the field. Interviews can be conducted face-to-face in the field. Saliva samples are also easily collected by distributing the Salivettes in a prepared 'kit' box and collecting them once the samples are ready. It does not require any technical or medical knowledge from the researcher or the participant.
- (e) **Length of procedure** - To avoid participant fatigue, all tools must be as short as possible, especially as multiple measures will be taken in one sitting. The aim was for online questionnaires not to take longer than 20 minutes to complete so the stress and well-being scales must be able to be completed in 5 to 10 minutes maximum. This is also important so that the same questionnaires can be completed immediately prior to an in-depth semi-structured interview, with the whole session completed within 45 minutes at the participant's house. The consequences of a longer procedure include the increased likelihood of participants not answering every question and missing data. For the SWEMWBS and the PSS, up to 3 items missing responses could be computed based on the median score.

4. **Responsiveness to intervention** - All measures used must be sensitive to differences in the expected outcomes. The responsiveness of an instrument describes its ability to detect change where there is a known change in an individual's condition, or a difference between groups of respondents. The main methods of examining responsiveness are the effect size and standardised response mean, taking into account the expected outcomes. The expected outcomes of this study are related to well-being and overall quality of life rather than a directly health-related quality of life that focuses on medical interventions.

5. **Balance** - Health is not a uni-dimensional quantity. It is complex and multidimensional so a range of indicators is needed to assess a person's health and well-being. Health measures classified as objective (based on clinical or physiological outcomes) and subjective (based on the respondent's self-report of how they are feeling by answering specific questions) are both important and should be used alongside each other. While objective measures may seem the most scientifically rigorous, these are dependent on the presence or absence of measurable effects of poor health as well as the means to measure them. Certain symptoms must be taken subjectively, such as pain or fatigue. Although caution must be used when relying on subjective measures and self-reported indicators, they can and do play an important role when carefully applied and interpreted as they can reflect what people think and feel (New Economic Foundation, 2009). In orchestrating the portfolio of tools used in this thesis, a balance between these factors was taken into account, as well as a balance between measures focusing on mental and physical health (these are not distinct states of health both two sides of the same coin).

3.2.1 Elimination of alternative indicators

Based on the criteria above, many other indicators of human health and well-being were not chosen to be measured. Established scales designed to measure happiness or life satisfaction "all things considered", or instantaneous snapshots of positive and

negative moods while completing the questionnaire were not appropriate to quantifying impacts of a horticultural intervention. Moreover, the inability to complete basic self-care and personal hygiene such as showering is a concern of health-related quality of life measures but not of the research questions in this thesis. A greener garden would not have an impact on someone's ability to do this but might improve outcomes such as stronger feelings of independence.

The goal was not to diagnose medical issues in people. Tools used in the health service to monitor specific clinical health conditions such as body mass index, anxiety, depression, or personality disorders would also be unresponsive to expected differences in garden landscapes on the spatio-temporal scale of this project. Indeed, such changes would not be expected to change as the front garden intervention did not require a large change in lifestyle in terms of diet, physical exercise, or therapy. In the same vein, because this study focuses on the individual and neighbourhood scales, economic valuations such as social returns on investment were not appropriate. The latter measure wider health, social, environmental and economic outcomes of, for example, a large community regeneration project that would likely impact the health and well-being of a large number of people over a long period of time.

While some studies create their own specific indicators for the express purposes of measuring a new outcome variable, this was not the goal for the present research project. Existing tools are more than sufficient, and comparability to other studies is an important factor in making valid and contextualised inferences from the data. In addition, the creation of a new indicator would have required extensive psychometric validation and pilot testing beyond the scope of this PhD.

Regarding physiological indicators of stress, others were considered alongside salivary cortisol. Alternatives included heart rate variability, blood pressure, electrical skin conductance, and accelerometry. These indicators require an electrocardiogram and are increasingly used to measure stressful triggers and recovery from exposure to stress, as well as levels of physical activity. Smart watches and other smart devices do have these functionalities but using expensive technology to measure health and well-being would have been inappropriate for this particular thesis because of the design of the intervention study. It would have required one device per participant because the intervention was implemented at the same time for all of them rather than sequentially in a laboratory. In addition, due to battery life span and device memory,

the device would need regular charging and downloading of data so these methods are only appropriate for limited time activities such as an intervention that occurs over the course of an hour or two. Finally, entrusting the devices to participants for long periods of time in their home environment may lead to loss or damage of the devices.

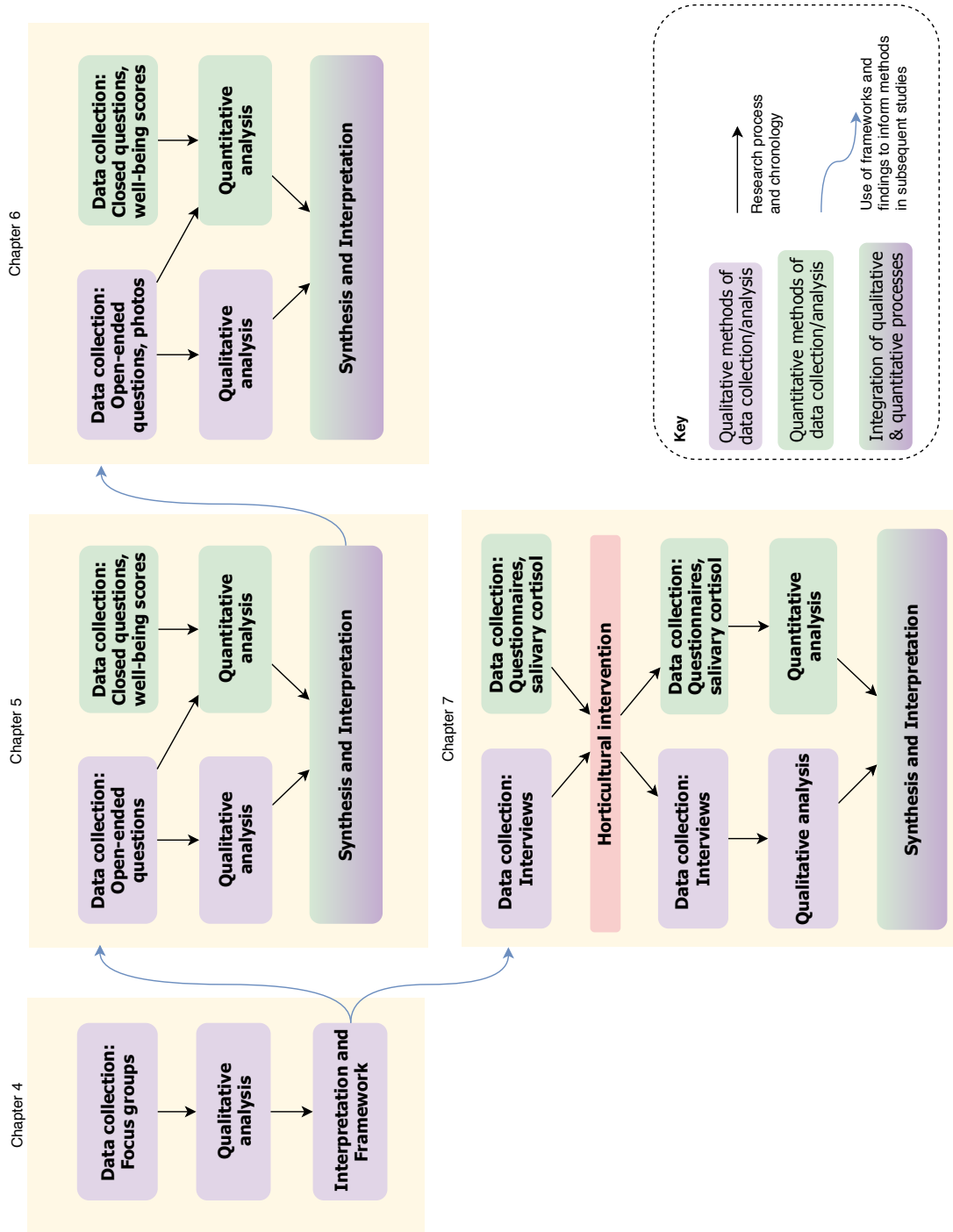
3.3 Rationale for a mixed method research approach

Given the range of tools used to measure health and well-being and the multitudes of types of data and analysis used to answer the research questions, it is clear that this thesis takes a mixed method approach. Indeed, this is an intentional strategy to achieve the purposes of the research. Academics, policy-makers, and practitioners all value the complementarities of quantitative and qualitative analyses (Frost and Shaw, 2015). Comprehensive histories of mixed methods research are available in Creswell (2003); Bergman (2008); Tashakkori and Teddlie (2010). Indeed, it is not novel to use mixed methods, especially in the social sciences or in health and well-being research.

This research project has mixed methods of data collection, data analysis, and a mixed research design that includes both interventionist quasi-experimental designs and non-interventionist observational studies. The research includes both explanatory research which seeks to identify causes, factors and correlations as well as interpretative research which seeks to generate understanding through an articulation of thematic rationales. Integration of the different methods happens at many stages. Figure 3.1 provides an overview of the methods used in the four studies and the relevant thesis chapters.

Critics of mixed methods approaches such as Howe (1988) argue that a variety of different methods cannot maintain philosophical, theoretical, ontological or epistemological coherence. Bergman (2008) rejects this notion by examining the mixed applications of both qualitative and quantitative research and by differentiating between data collection methods and data analysis methods. Combining different axiological assumptions only becomes an impossibility if qualitative research is associated solely with constructivism and quantitative research is conflated with the assumptions of positivism. There is no issue with incompatible ontologies or epistemologies within individual chapters or across this thesis as a whole.

Figure 3.1: Mixed methods research design



Focusing on the research questions moves the researcher away from paradigmatic debates. Tashakkori and Teddlie (2010) argue that methodological eclecticism is more than merely meshing together different methods. It is also the knowledgeable use of the best technique to answer the research questions. This strategy leads the way for an iterative and cyclical approach to research which uses both inductive and deductive ways of knowing in a process of both testing hypotheses and generating hypotheses.

Complete understandings of socio-cultural processes and causal pathways further justify the need for a mixed method approach. Quantitative measures can be confirmed with qualitative experiences, quantitative models may add structure to qualitative findings, and qualitative explanations can deepen understandings of quantitative results (Collins, 2015). For example, the different indicators of health complement each other well to produce a corpus of multi-faceted data. The use of multiple methods increases the sophistication of the evaluation by using concurrent designs to triangulate methods.

As can be seen in table 3.1, the combination of qualitative and quantitative data in this thesis provides a wider and deeper understanding for four of the six research questions. The first and the fourth research questions are adequately answered with qualitative methods for the former and quantitative methods for the latter.

Specifically regarding the quasi-experiment of chapter 7, a mixed method approach adds power to the research findings. Experimentation in the real world rather than in controlled laboratory conditions exposes the studies to internal validity threats (Mark, 2015). Using only quantitative data to evaluate change may not fully explain the results of an intervention. Therefore, the process of project implementation should be assessed through additional qualitative monitoring before, during, and after the intervention. Without this, research designs are less able to eliminate alternative explanations of design or implementation failure. As an illustration of this, the lack of statistically significant results has consequences for practical recommendations regarding future replications of the study including study design and delivery.

Table 3.1: Data types and analytical methods used to answer each research question

Research question	Qualitative	Quantitative
1. What relationships do gardeners have with their front gardens?	Textual, oral accounts	
	Interpretative phenomenological analysis(Smith et al., 1999)	
2. What are the health benefits of the presence of (a) vegetated front gardens? (b) gardening in front gardens?	Textual, oral accounts	
	Interpretative phenomenological analysis	Content analysis (Joffe and Yardley, 2004), Network analysis
3. How does a sense of community and social cohesion emerge from the presence of (a) vegetated front gardens? (b) gardening in front gardens?	Oral accounts	
	Interpretative phenomenological analysis	Content analysis
4. Do gardeners report higher levels of well-being than non-gardeners?		Stress & well-being scores, Regularity of gardening
		Statistical analysis
5. Are certain garden features more conducive to positive emotions and higher well-being than others?	Textual and photographic accounts	Stress & well-being scores
	Interpretative phenomenological analysis	Content analysis, Feature analysis, Statistical analysis
6. Does introducing plants to front gardens that are currently paved over improve well-being and other cultural ecosystem services for residents?	Textual, oral accounts	Stress & well-being scores, Cortisol concentrations, Area ratings
	Interpretative phenomenological analysis	Content analysis, Statistical analysis

3.4 Validity and credibility

The detail and level of transparency in this chapter goes some way in demonstrating the credibility and dependability of the methods used in this thesis. The goal of this work is to make inferences based on a suitable research design used and implemented seamlessly and comprehensively, generating credible results, using plausible explanations, and eliminating rival explanations. Throughout this thesis, validity threats are eliminated through design and statistical rigour - using appropriate statistical tests for detecting relationships at the 95% significance level.

In addition, the integration of the mixed methods of data collection and analysis does not necessarily mean creating a single understanding of the impact of front gardens on health and well-being. Several meaningful conclusions can be made on the basis of consistent or inconsistent results (Bergman, 2008). Inferences are made based on the elaboration, contrast, and comparison between different findings that do not need to corroborate to be valid. Divergence may add to the richness of the evaluation as each method measures a different facet of the operating processes at play.

3.5 Methods of data collection and analysis

This section provides a summary of the methods used for data collection and analysis in the four experimental chapters. The outlines below provide a succinct overview of all the methods while also allowing for more direct comparisons between sample sizes, recruitment strategies, and research settings of the four studies. All further details can be found in the methodology section of the relevant chapter.

Chapter 4 - Building a framework for the relationship between gardeners and their gardens

Data collected: Qualitative data on the relationship between gardeners and their gardens, health benefits of gardening, the relationship between front gardens and sense of community.

Data collection methods: Focus group discussion. The community focus of these gardeners justify the use of focus groups rather than one-to-one interviews. Focus groups allow for an analysis of the social gathering, the interactions between participants, and the degree of consensus on given topics.

Sample size: 20 research participants from three different Britain in Bloom groups (run as three focus groups).

Research setting: Three different neighbourhoods in Greater London that have active Britain in Bloom gardening communities.

Recruitment: The Britain in Bloom communities were identified with the RHS Head of Communities based on a loose criteria of 1) whether their projects included front gardens, 2) urban locations, 3) accessibility by train, 4) availability and interest in participating in the research study, and 5) a spread of socio-economic demographics. Group leaders were contacted to inform them about the study and to gauge their interest in participating. The group leader then reached out to group members to volunteer for the focus groups.

Data analysis methods: Qualitative analysis to develop a thematic framework.

Chapter 5 - Modelling well-being and perceived stress

Data collected: Quantitative data on where and how regularly respondents garden, the state of their front garden, sense of community, perceived stress and well-being, physical activity levels, and socio-economic circumstances. Qualitative data on the health benefits of gardening, motivations for gardening, and health barriers to gardening.

Data collection methods: Online questionnaire hosted on Qualtrics available on computers or mobile devices with an internet connection. Open-ended questions and closed multiple choice questions.

Sample size: 6,015 respondents. The questionnaire was targeted to two groups of people: gardeners and non-gardeners (with acknowledgment that they are not distinct; there was a scale of categories for respondents to express how interested they are in gardening and how often they actually garden). The sample of

respondents was drawn from the population of adults who have internet access and voluntarily clicked on the link to the questionnaire.

Research setting: Online

Recruitment: The questionnaire was circulated via an article and link in RHS monthly members' magazine as well as other RHS media outlets (website, Facebook, Twitter, member emails, and newsletters). Because of the dissemination through gardening-related channels, respondents were more likely to be gardeners. To reach non-gardeners, respondents were asked to pass the link on to a non-gardener who is otherwise similar to them. Other efforts to reach non-gardeners included collaboration from various other online platforms publicising the link: home and interior magazines, health and well-being magazines, psychology digests, and mindfulness centres. Most significantly, BBC news included the link to the questionnaire in a science article covering the research project. This was picked up on by both BBC Radio Coventry and Warwickshire and BBC Radio Sheffield, who highlighted the opportunity for listeners to take part in the research by completing the questionnaire. The BBC news article also led to the story being covered by other outlets with wide readership such as Country Living and the websites of garden centres around the country.

Data analysis methods: Using R statistical package, statistical analysis of quantitative data using robust analyses of variance, and linear modelling. Testing for correlations and multivariate relationships. Thematic analysis of qualitative responses from open-ended questions and quantitative content analysis of responses.

Chapter 6 - Emotions in the garden

Data collected: Quantitative data on how regularly respondents garden in the summer and winter, perceived stress and well-being, physical activity levels, perceived physical and mental health, garden feature and design priorities, and socio-economic circumstances. Qualitative data on the health benefits of gardening, motivations for gardening, the most peaceful/disappointing/frustrating/satisfying gardening activities and parts of the garden, and favourite plants. Photographs of the part of the garden that respondents appreciate the most.

Data collection methods: Online questionnaire hosted on Qualtrics available on computers or mobile devices with an internet connection. Open-ended questions and closed multiple choice questions. Submission of the photograph required an embedded Typeform question that was linked based on the participant's ID number. This integration was seamless to the participant and appeared as one single questionnaire.

Sample size: 850 total respondents for the qualitative data. Of these, 666 respondents completed the questionnaire including demographic information, and 178 submitted photographs. The sample of respondents was drawn from the population of adults who have internet access and voluntarily clicked on the link to the questionnaire.

Research setting: Online

Recruitment: The questionnaire was circulated via an article and link in RHS monthly members' magazine as well as other RHS media outlets (website, Facebook, Twitter, member emails, and newsletters). BBC news In Pictures included the link to the questionnaire in a article covering the research project as part of National Gardening Week 2018. This enjoyed celebrity coverage and the participation of well-known gardening personalities such as Monty Don, who also shared the link on his Facebook page, which has over 16,000 followers.

Data analysis methods: Using R statistical package, statistical analysis of quantitative data using t-tests, and analyses of variance. Testing for correlations and multivariate relationships. Thematic analysis of qualitative responses from open-ended questions and quantitative content analysis of responses through text mining. Photographs analysed based on visual features and pixel colours.

Chapter 7 - Quasi-experimental horticultural intervention in front gardens to reduce stress

Data collected: 1) Pre-intervention baseline - Quantitative data on subjective well-being scores, perceived stress scores, physical activity levels, socio-economic circumstances, sense of community, neighbourhood perceptions and diurnal

salivary cortisol concentration profiles. Qualitative data on how participants are feeling about their lives, well-being, mental and physical health, street, neighbourhood, and community, engagement with nature and gardening, attitudes towards the intervention, motivations for participation in the research, expectations regarding the outcomes of the intervention.

2) Three months after the intervention and at regular 3-monthly intervals over the course of the following year - Quantitative data on subjective well-being scores, perceived stress scores, physical activity levels, socio-economic circumstances, sense of community, neighbourhood perceptions and diurnal salivary cortisol concentration profiles. Qualitative data on how participants are feeling about their lives, well-being, mental and physical health, street, neighbourhood, and community, engagement with nature and gardening, attitudes towards the intervention, expectations regarding the outcomes of the intervention, comments from neighbours or visitors, levels of interaction between the household/neighbourhood and the new plants.

3) Throughout the study period - Qualitative data from researcher's field diary including observation of the street, visual notes about changes in other front gardens, and informal conversations with passers-by and neighbours.

Data collection methods: Experimental design involving a horticultural intervention that introduced container plants and trees to previously paved and grey front gardens. Semi-structured in-depth interviews, paper questionnaires with closed multiple choice questions, salivary cortisol sampling four times a day (3, 6, 9, and 12 hours after waking) for two consecutive days using Salivette collection tubes.

Sample size: 42 total research participants who received the intervention. 28 participants provided data both pre- and post-intervention. 21 participants provided cortisol samples during the study. Of these, 16 provided cortisol samples both pre- and post-intervention.

Research setting: Residential terraced houses with front gardens in suburbs of Salford, Greater Manchester, northern England. The participants live on nine different roads across different Salford suburbs. All the front gardens were initially largely composed of hard, impermeable surfaces with no plants growing in them other than weeds. All data was collected from the participants at their

home at mutually agreed times. The area is deprived, with some of the participants living in wards that are amongst the 10% most deprived neighbourhoods in the country (Ministry of Housing, Communities & Local Government 2015).

Recruitment: Residents living on nine separate residential streets across different Salford suburbs were approached to take part in the research between Jan-May 2017, initially via a posted information leaflet, followed by a door to door ‘calling’ approach. 237 households were canvassed and leafleted (a response rate of 13.1%).

Data analysis methods: Using R statistical package, statistical analysis of quantitative data using t-tests, and analyses of variance. Testing for correlations and multivariate relationships. Thematic analysis of qualitative responses. Salivary cortisol samples assayed at the University of Westminster by Dr Nina Smyth and raw data analysed using cortisol reference ranges and statistical analysis alongside the other quantitative data.

3.6 Limitations

All research studies face limitations, some of which can be addressed to a certain extent, and all of which must be acknowledged when drawing conclusions. This section explains the issues encountered during the research studies.

Firstly, this work was all undertaken by a lone female researcher. This created a few issues during the horticultural intervention. Data collection “in the field” at participants’ private homes required a research buddy for safety. Ideally, the same two researchers would have been conducting the interviews, administering the questionnaires, and noting observations for the duration of the intervention and following all the same procedures. However, the research buddy was a different person for most of the field visits, as no one else had responsibilities to do this so it depended on the availability of peers, colleagues, friends, and family. In practice, this did not appear to have an impact on the respondent’s attitude towards the research nor their answers to the questions. The rapport was built with the main researcher, who was the only

one asking questions and principally interacting with the respondents. The second person - the changing research buddy - was a silent observer. The participants understood that they were present purely for safety reasons and had no issues with this.

Secondly, having only one researcher on this project meant that the same person was conducting the pre- and post-intervention measurements as well as implementing the intervention itself. Because the intervention involved planting containers in front of the respondents' houses, they could see that it took a week of clearing, installing, and planting (all in the rain). They were witnesses to efforts going into what they were receiving for free and they could see these efforts coming from someone they knew and would see again, and who would ask them about their thoughts on the intervention. This was potentially a threat to the validity of the post-intervention interviews. To mitigate against this, the respondents were specifically asked for any negative impacts that may have arisen from the intervention either directly or indirectly. They were told that these were important to raise for a fair evaluation. In addition, respondents were asked to put aside the fact that they knew it was the same person who had done the intervention as the person asking them. Respondents understood why this was made explicit. Furthermore, the inclusion of mixed methods here was also crucial in providing more objective data as the perceived stress and well-being scales asked nothing about the intervention or the researcher specifically so those quantitative scores should not have been impacted by this issue at all.

Concerning the first questionnaire deployed online, one limitation is associated with the time of sampling. The questionnaire was active and collecting responses for five months from November to April. Mental well-being is hypothesised to be impacted by seasonal variations (Grimaldi et al., 2008). In a similar vein, the time of year is likely to have an effect of the regularity of respondents' gardening activity. The question was worded for them to average this across the year. Despite this, it is certain that gardening activities are vastly different across the four seasons. To take this into account, the date of the responses are recorded and kept as part of the dataset. As a further remedy, the second questionnaire included a more detailed version of the question: respondents were asked how regularly they gardened in summer and in winter, and the average length of a 'session' in both seasons.

Limitations of using salivary cortisol as an outcome measure are that it is costly to buy all the equipment needed for the collection, transportation, storage, and assaying

of the saliva samples. It may yield lower completion rates as it requires participants to stick to an elaborate timetable of samples, eating, and drinking, while also avoiding smoking and most drugs.

3.7 Research ethics and integrity

All aspects of the research project were compliant with the UK Data Protection Act (1998). The stages of data collection still ongoing after 25th May 2018 (the second online questionnaire and the final stages of the intervention study) are also compliant with the European General Data Protection Regulation (GDPR) that came into effect on that date. All four experimental studies were approved by the Department of Landscape Research Ethics Committee on behalf of the University Research Ethics Committee (UREC). Risk assessments were completed for the safety and security of all researchers and research participants. All participants were 18 years old or older.

Regarding data storage, data collected through Qualtrics and Typeform platforms (both used for the online questionnaires) was kept in the EU according to the Data Protection Act and the GDPR. Once downloaded, data was stored securely on a personal laptop and on the University drive.

Despite involving human tissue, collecting saliva samples from participants in the intervention study did not require any further procedures for full ethical clearance. Through the regular application process, the University of Sheffield UREC is in a position to provide ethical approval for the collection of samples and their transportation to the University of Westminster, where they were stored and assayed by Dr Nina Smyth. The laboratory in question has previously been approved by the Human Tissue Authority under the Human Tissue Act (2004) for the storage, use, and disposal of human tissue. All of the above was confirmed in writing by the UK's Health Research Authority after a referral from the Secretary of the UREC.

Beyond confirming that all necessary ethical approval was obtained for all parts of the thesis, this section also demonstrates that research integrity has been upheld throughout the process. Issues of informed consent, participant vulnerability, topic sensitivity, minimising harm, data confidentiality, participant payment, and the moral role of the researcher are treated below.

All research participants were given information sheets and consent forms before their participation in the respective studies. Focus group participants were given the information sheet and consent form by email before the discussion and had at least two weeks to ask for more information or clarifications. On the day of the focus group, the moderator went through the information sheet and consent form orally and made sure that everyone understood and agreed with their role in the research study. Informed consent was obtained by signing the form. For the online questionnaires, the first landing page contained all the relevant ethics information. This also included the researchers' contact details in case potential respondents had any further questions or needed any clarifications before proceeding. The question on this page asked respondents whether they gave their consent to participate in the research project. Informed consent was obtained by clicking 'Yes' and 'Next' to proceed with the questionnaire. This was a compulsory question and if participants chose 'No' they were immediately screened out. The second question screened out respondents if they indicated that they were below 18 years old.

The focus groups and the online questionnaires were not designed to involve potentially vulnerable participants and it was not expected that specific accommodations should be made for these studies. In contrast, because of the nature of the horticultural intervention experiment and its situation in areas that are amongst the 10% most deprived areas of the country, it was very likely that participants could be categorised as potentially vulnerable. It was expected that participants may be financially vulnerable, suffer from psychiatric or personality disorders, may have disabilities, or be in frail health. A decision was taken not to intentionally exclude any potential participants from the research for these reasons. Indeed, the intention of the research is to understand how front garden landscapes can improve the health and well-being of the general population, which includes people who suffer from mental or other health problems, as is often the case in poor and marginalised areas. No participants were made to be more vulnerable through their participation in this research. On the contrary, it was hypothesised that participants would be empowered to have ownership of their street and an increased sense of belonging in their neighbourhood.

If they were able to give their full and informed consent, then it was ensured that everything was in place to protect these participants in particular. If it was felt that consent was wavering or if their continued participation in the project was posing a risk to themselves, they were encouraged to remove their consent and opt out, with

no negative consequences to them. As an example of how this worked in practice, during the first door-knocking recruitment phase, one person answered their door, spoke at length about their (filthy and overgrown) front garden, and their health. They were living alone, in poor health with various serious and life-threatening conditions. They were not against participating in the project and expressed the view that it might be a change in a positive direction. They also explained that one health issue in particular limited their memory and decision-making capacity. The person eventually asked the researcher to decide, on their behalf, whether it would be a good idea for them to participate. This was not something the researcher was in a position to do so after an apology, no further contact was initiated with this person.

It is a fundamental principle that ethical research always attempts to minimise harm to participants. It was anticipated that there should be very minimal potential psychological inconvenience and no physical harm. All questions and tasks that participants were asked were designed so as not to promote any risk-taking. In the study involving the horticultural intervention, all participants were fully informed about the physical necessities of maintaining the new gardens. This was designed to be absolutely minimal to zero active maintenance thanks to the self-watering containers and the choice of hardy plants. If they did not feel physically able to have a container garden in their front garden, they were not pressured to participate. For people who did want to participate but had a physical impairment or condition that means they would struggle to navigate or maintain the garden, they were proactive in arranging help from friends, family, or neighbours. None of the plants were toxic nor did roots cause structural problems because they were in containers. If a plant died, the participants were not liable nor held responsible.

To answer each research question empirically, participants were asked to share information about their health and well-being. These can be sensitive topics especially in cases of ill health and poor well-being. Participants were always reassured that their answers would never be personally identifiable, that all information would be kept anonymous, and published only in the context of the research project. No confidential medical information or files were ever asked for. For online questionnaire participants, all questions were optional so participants were under no obligation or pressure to respond to questions that were perceived to intrude on their comfort and privacy. Two participants in the intervention expressed concern that their data may be shared with their consulting doctor or that mental health diagnoses could be

made without their consent. Both were categorically ruled out and participants were all satisfied to continue. No further issues regarding confidentiality or anonymity arose over the study period.

Respondents completing the two online questionnaires were not required to provide their names or other personally identifiable information. Because the method of dissemination of the first questionnaire involved asking gardener respondents to refer a friend, family member or colleague to the questionnaire, some respondents did provide their name and their contact's email address. This information was destroyed immediately after passing on the link to the questionnaire to the contact. At the end of the second questionnaire, respondents were asked to submit a photograph of their garden. Because this was deemed to be their creative property, respondents were given the possibility to waive their anonymity in order to be given due credit if their photograph was published or curated. Some respondents provided either their name, a pseudonym, or an email address that are used to credit the photographs used in Chapter 6. For the intervention study, all participants were assigned a number and this number was used at all stages of data collection and analysis. In effect, none of the responses were personally traceable. All personal information has now been destroyed.

Neither financial nor in-kind payments were given to focus group participants or questionnaire respondents. Intervention participants each received a free front garden as part of the intervention. This included two half-barrel self-watering containers, compost to fill them, a watering can, access to horticultural advice through the RHS advisory service, and all plants (as detailed in chapter 7). This was a critical part of the experiment and it would have been prohibitive to expect the participants to pay for this themselves. The containers were gifted rather than loaned to the participants to foster a real sense of ownership. Participants were given the option for the container front garden to be removed at the end of the study period but none asked for this to be done. The participants who were in the second intervention group receiving the gardens a year later were offered a choice of either the same front garden (container, compost, plants, etc.) or a cash alternative of £80 - a fair compensation for their time and commitment to the research project. This is ethically justifiable because they had to be provided with the same incentives as the first group. No one in this second group opted for the cash alternative.

It was anticipated that it would be extremely unlikely for any illegal activities to be discovered or revealed through interactions with the participants. However, in the field, it did become apparent that at least two participants were behaving illegally or engaging in abusive behaviour. In the UK, private citizens do not have a general legal obligation to report illegal activity to the relevant authorities. However, circumstances did raise complex questions about the moral role of the researcher, particularly regarding reporting criminal activity as part of professional ethics, and being a witness to abuse. Reporting would involve a breach in the confidentiality of the data the participant provided as well as the trust and rapport developed with the individuals in the neighbourhood. Breaching this trust could potentially have created difficulties for the researcher to safely return to the street. Following ethical guidance from supervisors, counselors, and more experienced researchers, none of these activities were reported as they were not believed likely to result in serious and immediate harm to others. Furthermore, they did not relate to any definite obligations to report child protection offences such as the physical or sexual abuse of minors, the physical abuse of vulnerable adults, money laundering and other crimes covered by prevention of terrorism legislation.

Building a framework for the relationship between gardeners and their gardens

4.1 Introduction: aims and hypotheses

To begin empirical research into the impacts of front gardens on health and well-being, this chapter is based on a series of focus group discussions undertaken with keen gardeners. This chapter aims to create a thematic framework of the relationships between gardeners and their front gardens:

1. To understand the psychology of why people garden in front gardens;
2. To understand how community and social cohesion may emerge from gardening activities in front gardens;
3. To have an insight into the health benefits of the presence of front gardens and of gardening in front gardens.

To achieve these aims, the discussions held between enthusiastic gardeners from Britain in Bloom communities are analysed. Britain in Bloom is a national campaign to help people improve their local environment through gardening. This is a campaign that brings together communities in a horticultural competition. Over 1,600 UK communities take part each year. While the national judging process is led by the Royal

Horticultural Society's (RHS) Head of Communities, Britain in Bloom does not have a top-down hierarchical structure, and each group runs itself. Each group, therefore, tends to have a designated leader principally for communication purposes.

Doing research through Britain in Bloom provides an accessible way to speak to people who have some of the greenest and most colourful front gardens. They may perhaps hold more developed opinions on their (health) impacts. The majority of participants have entered the front garden competition, and some of the participants have won prizes. While it is acknowledged that the competition aspect is not a common experience for the vast majority of domestic gardeners, it should not alter the effects of greening front gardens beyond providing a stronger motivation to take part. It, therefore, remains appropriate to build a theoretical framework using responses from Britain in Bloom participants and to safely remove the competitive aspects that emerge when applying it to non-competitive gardeners and non-competitive people wanting to green their front gardens. A final reason for focussing on Britain in Bloom is to offer the first empirical academic research surrounding this longstanding national competition.

The purpose of constructing a theoretical framework is to inform the subsequent chapters and analyses of the thesis and to begin to unpack the socio-cultural mechanisms through which front gardens may lead to well-being outcomes. The cultural ecosystem services provided by the presence of green front gardens and the act of gardening in front gardens will also be explored.

Gross (2018) reviewed the research on personal meanings of residential gardens to cover themes of creativity, ownership, identity, retreat, sense of place, and social networks. By analysing opinions on changing streetscapes, encouraging gardening and its therapeutic effects in this study, it is expected to find that people enjoy the public nature of gardening in the front garden as it affords them more compliments from passers-by and that this, in turn, creates social connections in the local area that might otherwise have never formed. It is also expected that the greening of house frontages helps to create and maintain a positive aesthetic for the street that all residents can benefit from. Regarding the health benefits of gardening in the front garden, it is anticipated that respondents will share stories of relaxation, fulfilment, and creativity.

4.2 Methodology

To achieve the aims set out above and to contextualise the existing literature with a UK population, three focus group discussions were held with 20 participants from the Britain in Bloom community gardening programme. The focus group format, as opposed to one-to-one interviews, uncovers aspects of community cohesion better. Focus groups afford the analysis of the social gathering, of the interactions between participants, and the degree of agreements and disagreements on given topics.

4.2.1 Recruitment process

Participants were recruited by working with the RHS Head of Communities to identify three to five Britain in Bloom communities to contact, asking them if they would be interested in holding a focus group in their neighbourhood. The Head of Communities is the national lead of the Britain in Bloom judging process, knows many of the Britain in Bloom groups and has professional contacts with them. In the first instance, the communities were identified based on loose criteria of 1) whether their projects included front gardens as well as community spaces, 2) urban locations, 3) accessibility by public transport, and 4) a spread of socio-economic demographics. The group leaders were first approached by the Head of Communities. If the group leaders expressed a personal interest in participating and if they anticipated that a sufficient number of group members would also be available and interested in participating in the research study, the RHS Head of Communities shared their contact information.

In this way, four groups in Greater London were contacted with the information sheet, consent form and a draft schedule of focus group questions. The contact lead then personally reached out to members of their group to circulate the information. If a sufficient number of people (5-8) responded positively, the researcher arranged dates, times, and local room bookings through an online poll to accommodate the most number of people. Once this was fixed, the final details were circulated again in case others who had not responded to the initial call could now also attend. The geographical focus on Greater London is appropriate to the study as this is the largest urban built-up area in the UK and has the highest concentration of recently paved-over front gardens (Greater London Authority, 2005; Smith et al., 2011; Royal Horticultural Society, 2015).

The described recruitment process worked well, and there was no need to resort to the back-up plan of attending regular scheduled Britain in Bloom (or similar) meetings to explain the project orally to a captive audience.

4.2.2 Running the focus groups

One focus group was organised for each Britain in Bloom group, so several respondents in each group did already know each other through their gardening community. The focus group discussions were held in accessible, communal spaces that the participants were likely to be familiar with. Two moderators ran each focus group. The main researcher asked all the questions and the second researcher assisted with the recording of the session.

When participants arrived, they were given hard copies of the participant information sheets, consent forms, and demographic questionnaire which they were to sign and fill in. Everyone was given and wore name badges to encourage familiarity and openness within the group. Chairs were placed in a circle to encourage discussion between participants. Both facilitators were also sitting in this circle.

The focus groups were based on a prepared script of questions (appendix A.1), which was loosely followed based on the direction and flow of the discussion. The moderator encouraged participants to respond to each other and long periods of time could pass without any intervention from the moderator. This was intentional and positive as in almost all cases the conversations remained relevant. People talked freely, listened actively, and responded to each other throughout. They were also receptive to moderation and prompt questions. In all focus groups, there was clear rapport and constructive interactions between the participants. Each focus group lasted approximately one hour.

4.2.3 Analysis

Drawing on phenomenological psychology, the analysis of the focus group discussions emphasises the subjective and idiosyncratic perceptions and motivations of individual participants (Stewart et al., 2007). The aim was not necessarily to look for

shared meanings nor points of contention, but for the detailed and in-depth reasons each person uses to explain their opinions.

While the analysis of focus group discussions was mainly qualitative, the number of different people who cited certain ideas is reported. Abbreviated transcripts were coded thematically, and textual analysis was complemented by analysis of tone and other observational notes. During transcribing and coding stages, the audio recordings were listened to numerous times while taking thematic notes on each participant.

Analytical notes included issue order, the frequency with which a concept was mentioned, how many different people mentioned the concept, emotional intensity, how much detail was provided by respondents, time spent on the issue, whether individual respondents remain consistent in their views, and whether it was an important concept to the participant. If responses provided more detail or were said with stronger emotion, the comment was given more weight. This was also the case if many other participants voiced their agreement with a comment.

Some of the responses evoked gardening spaces other than front gardens such as back gardens or community allotments. This was especially the case when talking about gardening as a physical activity, which is not different in its movements whether performed in front of or behind the house. Outside of discussions about physical activity, the focus on front gardens was maintained in the analysis.

4.3 Results

Three focus groups in three boroughs of Greater London were conducted with a total of 20 people (5, 13, and 2 people in each group). The demographics of the respondents are summarised in table 4.1. The three Britain in Bloom groups that participated in the focus groups are not named or situated to preserve the anonymity of the focus group participants. However, table 4.2 provides some contextual information about the areas for a clearer idea of the types of urban landscapes and communities that the respondents are living in. One of the groups was not a neighbourhood community of residents but a workplace initiative set in a corporate context of neighbourhood greening.

Table 4.1: Demographics of the 20 research participants

Gender	13 women 7 men
Age	27-85 years old (mean age 66)
Occupation	12 retirees 3 self-employed 5 employed full-time
Education	3 GCSE or equivalent 6 A Levels or equivalent which allows entry to university 7 Bachelors/Undergraduate University degree or equivalent 1 Masters/Postgraduate Taught University degree or equivalent 1 Doctorate/Postgraduate Research University degree or equivalent 2 Other recognised academic or vocational qualification (e.g. teacher training, nursing...)
Ethnicity	19 White British 1 Black British
Involvement with Britain in Bloom	Since 1990 to 2015 (26 years to 1 year). Mean length of involvement with Britain in Bloom: 8.5 years
Gardening spaces	17 have a front garden 17 have a back garden 5 have a shared or community garden 3 have an allotment

Table 4.2: Description of areas of the three focus groups

Group	Greater London	Fare zone	Urban typology	IMD * (2015)
A	South West	4/5/6	Suburban, residential	30% least deprived
B	North East	3	Urban, residential, small businesses	30% most deprived
C	Central	1	Dense urban, mix of business workers, local residents, students attending local university, homeless people	40% most deprived

* The English Index of Multiple Deprivation (IMD) measure is based on LSOA (Lower Super Output Areas i.e. neighbourhoods), which are ranked out of 32,844 LSOAs in England; where 1 is the most deprived LSOA. Deciles are calculated from rankings. Data sourced from the Ministry of Housing, Communities & Local Government (2015).

In the interest of clarity, summarised results from the focus groups are reported in this section by question. The thematic discussion and conceptualisation of the theoretical framework of gardeners' relationships with their gardens is in the following analysis section.

1. Did you garden before participating in the Britain in Bloom campaign?

Two people had “dabbled” in gardening before joining their respective Britain in Bloom groups and were relatively new gardeners. Five people have been gardening for a long time. They often alluded to gardening since they became homeowners. Eleven people had been gardening since their childhood. None of the respondents began gardening as a result of Britain in Bloom.

2. What convinced you to get involved in the campaign?

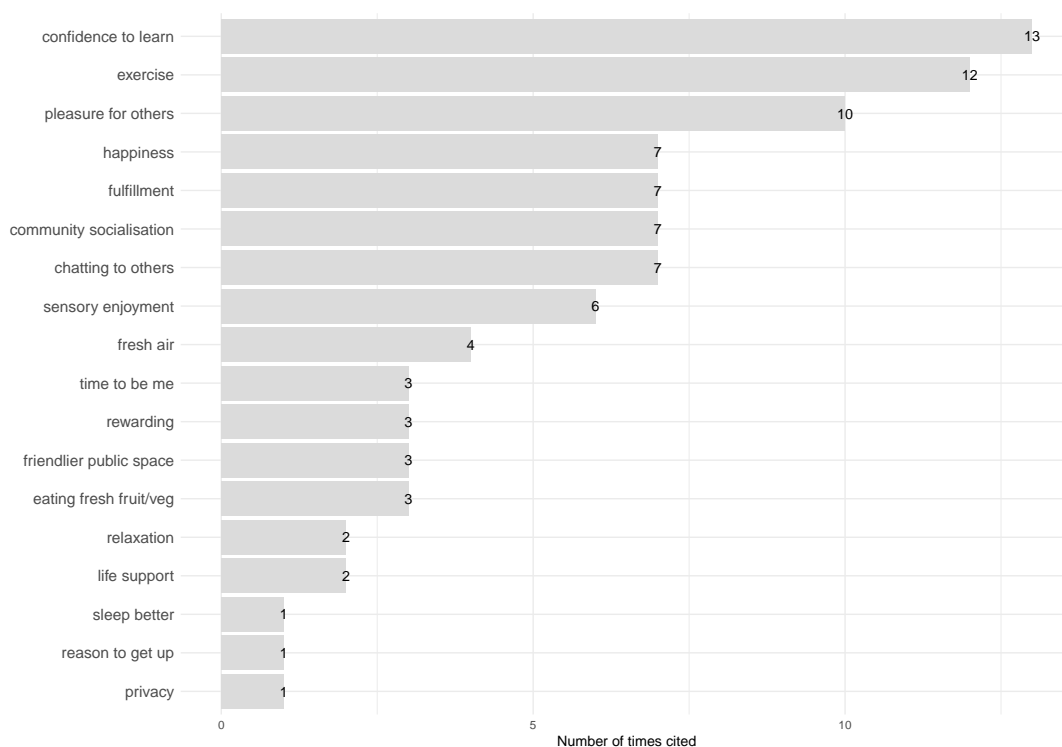
For the majority of people, their involvement with the campaign began through word of mouth. They had been told about Britain in Bloom by friends or

passers-by and were told they should enter the competition or could win if they entered. Two people were involved in gardening as part of their jobs. A further two people had started by being involved in efforts to clean up and tidy their neighbourhood, which eventually moved on to gardening community spaces and house frontages.

3. Has the campaign had any therapeutic benefits for you or your community?

Participants had many responses to this question, citing different therapeutic benefits both for themselves and the community (figure 4.1). Items relating to physical health include physical exercise, fresh air, and eating fresh produce. Items relating to mental health include the confidence to partake in a learning process and to make mistakes, happiness, fulfilment, and relaxation. In many cases, the benefits to the individual and those to the community were intertwined and not easily separable (such as socialisation within the community, and friendlier public spaces).

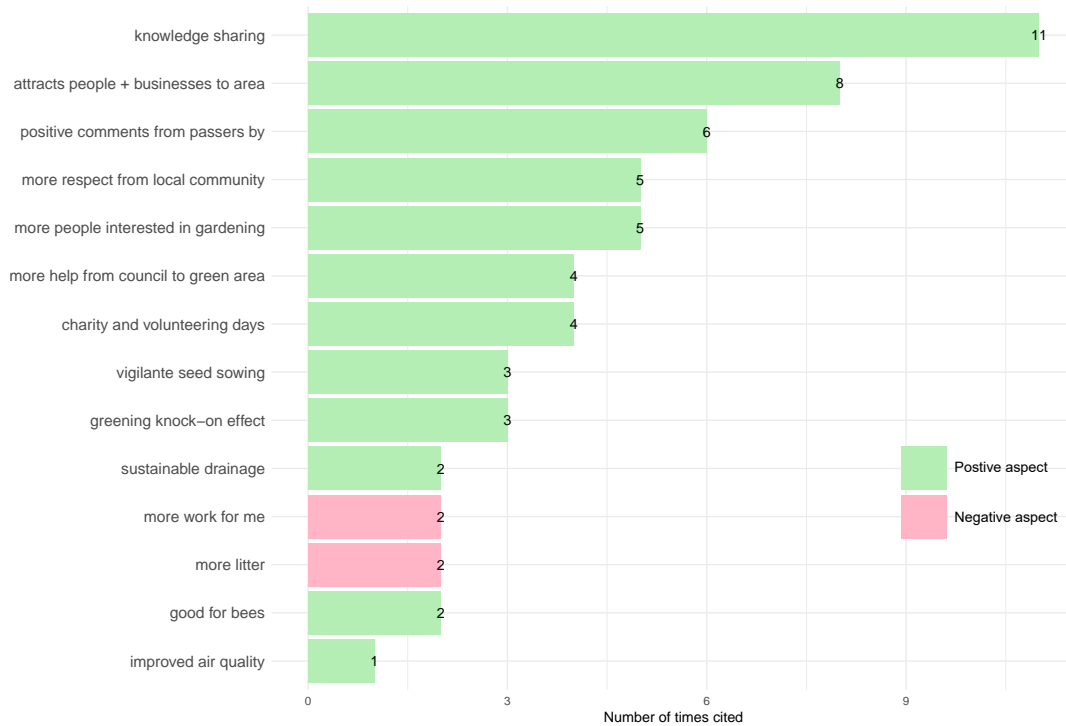
Figure 4.1: Focus group responses to “Has the campaign had any therapeutic benefits for you or your community?”



4. What were the positive and negative aspects of Britain in Bloom engagement in your community? (Talking specifically about front gardens)

As with the previous question, this question also elicited a range of responses. There was an overwhelming majority of positive aspects of Britain in Bloom in the local community as opposed to negative aspects (figure 4.2). The opinions cited by the most number of different participants included knowledge sharing between gardeners and from gardeners to passers-by, the increased attractiveness of the local area, and fostering more respect for the area by the local community. The negative aspects included more visible litter in the greener spaces and more work for those organising the competition.

Figure 4.2: Focus group responses to “What were the positive and negative aspects of Britain in Bloom engagement in your community?”



5. How might Britain in Bloom be improved for better engagement?

Respondents were mostly happy with their groups. One group was considering looking for more attractive prizes for the next year and for changing the nomination process from self-nomination to peer-nominations. There were ideas

from three people who are no longer able to do the more physically demanding aspects of gardening such as heavy lifting and digging to have support from someone who is able within the community. Regarding broadening the demographics of the people involved, eight participants wanted to encourage young families to get involved through schools (suggested by five people) or simple ideas to start such as with houseplants or herbs (suggested by three people).

4.4 Thematic analysis

The thematic framework constructed from the results provides answers to the three aims of this chapter: the psychology of why people garden, the community and social cohesion that may emerge from gardening activities, and the perceived health benefits of gardening. The following discussion is structured around the four key themes that emerged from the focus groups: self-identity, community, fulfilment, and health.

The following discussion uses direct quotes from the focus group participants to bring their ideas alive and incorporates relevant research to compare and contrast with the existing literature. Following the linear exploration of these four themes, a conceptual diagram illustrates how these four themes come together and are inextricably linked.

4.4.1 Self-identity

Cultivating a strong sense of self was a deeply rooted concept for the majority of Britain in Bloom gardeners. Their self-identity was linked to both the front garden itself and the act of gardening in the front garden. As Freeman et al. (2012) and Gross (2018) summarised, gardens are expressions of their owners' identities. For the focus group participants, this was manifest in several different ways.

Firstly, there was the link to their childhood and a measured nostalgia for days gone by. Childhood memories arguably form the oldest and firmest sense of self that cannot be shaken by events later on in the lifecourse (Gross and Lane, 2007; Bhatti et al., 2009; Cherrie et al., 2018). When describing their own identities as gardeners, participants quickly alluded to their earliest memories:

“my first recollection as a small child is digging a hole in the earth in the bottom of the back garden and making myself a flower shop”.

Gardens having always been part of their lives, they remain so today. To explain why he gardened, one participant simply noted that “my parents and family and everyone have all loved to garden”. These attachments to parents or grandparents were strongly associated with what the participants continue to do today. For example, even though they don't grow well in her present garden, one lady is particularly fond of lupins and dahlias because they were the plants growing in her late father's garden. She always has “the most wonderful feeling” when she sees the single dahlias coming up:

“I think that memories and smells [...] are very important in [...] what you actually end up doing”.

One other participant remembered that she began taking an interest in gardens

“with [her] father, collecting wild roses from the countryside and he used to turn a rose round with raffia and he used to show me how to do that”.

These vivid recollections are manifestations of the psychological role that gardens can play and are an example of how gardens provide the opportunity for ‘being away’ - a key component of Attention Restoration Theory (ART) (Kaplan and Kaplan, 1989).

The importance of the garden for participants' sense of identity can also be seen in the merit they attributed to themselves and the control they felt they had on the environment immediately surrounding them. It was their means of self-expression and of creativity. Indeed, Bhatti (2014) understood that domestic gardens provide the context for a sense of self both as a creative being and as a social actor. One participant took pride in her individual power to shape her garden:

“at least I know that if anything goes wrong it's my fault and if it's all lovely it's my fault”.

There were also cases where a participant's identity was much more intimately tied with the garden. One man who had often won first prize in the front garden category claimed that "I'm known as Mr Front Garden now" and another lady said that, even without having any particular technical gardening knowledge, "[gardening] gave me time to just be me". These ideas were even more strongly expressed in cases where without the garden, they wouldn't be able to cope:

"I'd never be without a garden, I think it's my support".

Finally, the sense of identity was also manifested through not only the individual but the family or couple. Three participants explained that the divisions of labour in the garden between husband and wife was an immutable part of their household's identity as "the front gardens are a central part of your living". For example, the husband gardens in the front and the wife in the back, and together they form a team. In the Britain in Bloom context, this was also a prize-winning team.

4.4.2 Community

Gardening in the front garden created several layers of community amongst gardeners and within the local area. Knowledge sharing between gardeners themselves but also between gardeners and non-gardeners builds a community based on the learning processes involved to get to know each other, to pass on advice, and to have space to experiment. Synchronously, a sense of community is built of several factors: the beautification of the neighbourhood, and the pleasure that greening front gardens brings to other local residents.

During the focus groups themselves, there were several exchanges of shared emotions: encouragement, consolation, commiseration, and astonishment in response to fellow participants' gardening tales. It was evident that there was an empathetic understanding amongst them about the joys and challenges of gardening. As a community, there were battling similar challenges (stray golf balls, slugs, cats, etc.) and aiming for similar goals and prizes. All of the participants said that people notice what their neighbours are doing and that they themselves take inspiration from what they see other gardeners doing in their front gardens. Additionally, even though everyone

gardens in their own gardening spaces, they also come together as a community outside of these spaces. One charity event based on a plant swap and coffee raised over £6000 by bringing together the enthusiasm of both keen and fledgling gardeners.

Gardening is a broad skill to acquire and individual learning has been shown to be supported by intentional experimentation in the garden (Armitage et al., 2008) One lady provided a useful analogy that several women agreed with:

“I do it like I do my cooking, I make it up as I go along”.

Both within the community of gardeners and with passers-by, there is a camaraderie formed between the front garden and the pavement. There were many mentions of this phenomenon:

“I live next door to the park and they all stop and talk. ‘What’s the name of that’, ‘What did you do with your lavender?’”.

This common attitude gives people the confidence to improvise and to learn from their mistakes, as “I think I learn something new every day [...] there are always new challenges”. These interactions are based on knowledge sharing inherent to the learning processes of gardening including: trial and error, exchanging old or new information gleaned from television shows, magazines, catalogues, knowledge passed down from generation to generation and neighbour to neighbour, through allotments or over the hedge. Indeed, social development occurs when these skills are shared and developed based on deliberation and discussion within a group of gardeners (Plummer and FitzGibbon, 2007; Chan et al., 2015).

For the focus group participants, gardening in front gardens was not just about themselves as individuals or as a community of gardeners, but there was a strong sense that it was about creating a better local community through beautifying the area and creating pleasure for others. One respondent involved in the judging process explained that he favours “gardens with kerb appeal and lots of colour”. The concept of kerb appeal alludes to the attractiveness of the exterior of the residence being an aesthetic experience to be viewed from the street. Because of the public nature of the front garden (private land in the public eye),

“we concentrate on front gardens and residential frontages because it isn’t just for our own pleasure, it’s also for the community”.

Indeed, there’s an added sense of responsibility:

“because it’s public, I thought it’s quite important to make an effort”.

Interestingly, one participant stressed the importance of his own privacy from the road. When he is indoors, he appreciates the “defensible space” created by the plants in the front garden by blocking the clear run from the road to his bay window. From his living room, he could see the plants through the window with the added comfort that passers-by could not look into his home but enjoy the outdoor display he had provided them. In an exploration of English gardeners’ relationships with their back gardens, Alexander (2002) dismissed front gardens as merely acting to distance the road and pavement from the house with what he assumes are blocking walls, fences, and hedges. Singlehandedly, this focus group participant adds complexity to Alexander’s view. His front garden does buffer his home from the street but the barrier is not visually impermeable and it certainly does not preclude the owner’s intimate relationship with the front garden or positive impacts for passers-by.

Moreover, the pleasure of front gardens with kerb appeal is not just targeted or applicable to people who can distinguish the differences between the different marigolds, as “you don’t have to know which flower it is to think it’s a pretty flower”. For everybody, a greener area is nicer to walk around because it becomes a friendlier space. One participant hypothesised that

“if you suddenly took away all the plants tomorrow, it would suddenly look pretty grim and grey. This area is very hard and intimidating. The plants make it look softer”.

This idea of softening the hard edges of urban landscapes by adding window boxes and container plantings was brought up by many participants, noting that even in small front yards where there is only space for two bins,

“people are making an effort to detract from the wheelie bins in the front yard. You walk past and you see the wheelie bins and the flowers - but the flowers detract from the wheelie bins”.

Referring back to the literature, Hareli et al. (2016) have shown that for vegetation in an urban environment, humans do prefer curved over angular visual stimuli. Softer shapes are associated with peacefulness while angular shapes have been related to anger, aggression, and antagonism.

This attractiveness associated with front gardens was repeatedly said to be raising the status of the borough:

“It beautifies the road and makes the neighbourhood attractive”

and

“it attracts people and it brings in tourism [...] it’s bringing in business as well, and so your garden has a real knock-on effect”.

Green and colourful front gardens become a positive sell for the area. Residents in one focus group have noticed real estate agents deliberately passing in front of greener front gardens when showing prospective clients the more attractive side of a property’s street and neighbourhood. An economic benefit is perceived by businesses too, as local companies in one of the areas are willing to pay, in addition to taxes, for the greening of these publicly visible spaces in front of private buildings. Their rationale is that it is better for them to reinvest in the local area. In the same vein, the local councils are said to be encouraged to do more in the area as local residents get more interested.

The importance of perception in residents’ evaluation of neighbourhoods is not to be underestimated. The appearance of the neighbourhood affects what individuals prefer and what actions they might be likely to take in their own front gardens (Nassauer et al., 2009). According to the US Census (2004), the appearance of a neighbourhood is an important reason home owners choose where to live.

One of the consequences of a greener urban environment is the sense of respect that it instils in the local area. Applicable to both residents and visitors, “the more you do, the more people respect it so it doesn’t get trashed”. This was echoed by another participant, who said that “greening an environment is just amazing, especially when it’s shared, everybody cares together about their street and their area”. Cooper (2006) also found that a cultivation of care and concern arose when a garden was visibly valorised by the gardener and shared with the local community.

In a study based on 299 respondents in the USA, Hur and Nasar (2014) found that perceived neighbourhood upkeep by others led to actual upkeep, lower fears of crime, and improved neighbourhood satisfaction. Participants in one focus group noticed that while they used to have a problem with anti-social behaviour and street drinking near a pub, this situation has improved because revellers realise the area is cared for. Similarly, empty spaces that previously got “lots of dog mess”, are now spared because “dog owners realise there’s some respect going into this place”. A possible reason for this change in perception is that “gardening shows the positive side of people, it shows you’ve got respect for the place”. Nonetheless, there are still cases of unhelpful behaviour such as smokers leaving cigarette butts in compost and littering in green spaces.

Chatting in a friendly and informal manner to other people was a major topic of conversation in all three focus groups. The appeal of open-ended, non-transactional small talk to get to know others in their vicinity was a strong reason for gardening in the front garden. Participants love just chatting to neighbours and people they have never met before, noting that this is especially relevant for people living in isolated situations. There was a strong recognition that this generated a lot of pleasure for the other party in the conversation as well as for themselves. Greener front gardens lead to more socialisation in the local community as they become an ice breaker for people who might not otherwise strike up a conversation with each other. For example, areas frequented by students, local residents, and workers on their lunch breaks mean that daily patterns of use are established and spontaneous chats make the area friendlier. Focus group participants highlighted that some people are key figures in the community and act as gardening champions to encourage the local kids and their parents to get involved with greening residential frontages.

As further evidence that other people than themselves enjoy vegetated front gardens, focus group participants said that they often witnessed a knock-on effect in their local

area. Two focus groups in particular broached the topic of the many people who think they are too busy to garden, or are simply not interested so would prefer to just pave over the front gardens to park a car and minimise maintenance. One Britain in Bloom campaign leader acknowledged that while it is harder to motivate tenants who rent as opposed to home-owners to take pride in their front gardens, that there has been involvement from both renters and owner-occupiers.

He assigns this universal appeal to the fact that neighbours tend to keep up with each other:

“if people see nice gardens in their field of visions, they’ll try to copy”.

Following their efforts, all focus group participants have gradually noticed more window troughs, hanging baskets, balconies fitted with flower pots, from people at the homes of neighbours who had previously never had this on their priority lists. This finding adds to the conversation in the literature concerning the existence of a spatial contagion effect of garden styles and practices between adjacent front gardens and the potential power of garden role-models at a street or neighbourhood scale. While there is statistical evidence for neighbourhood diffusion in Montreal (Zmyslony and Gagnon, 1998), this does not seem to be the case in Tasmania (Kirkpatrick et al., 2009). However, in Canada, government regulation and planning concerning the streetscape is tighter than in the UK and the neighbourhoods analysed in the Australian study were composed of detached houses all with existing surrounding green space. These are not in the same contexts as that of the present focus groups in Greater London, consisting of mainly terraced houses with mainly paved over front gardens, where residents are anecdotally reporting that green front gardens are having a knock-on effect.

In cheeky confessions, two participants mentioned that they had undertaken some front garden “guerrilla gardening and when he found out the tenant was really chuffed, asked if I wanted a cuppa. People aren’t that territorial it seems”. Another vigilante team were sowing wildflower seeds at local roundabouts; eventually appreciated by all apart from the local council who wanted to prosecute the unknown authors. These findings align with a study by Adams et al. (2015), focussing on guerrilla gardeners and their impacts on the local community.

4.4.3 Fulfilment

Fulfilment has been identified as a standalone theme though it is strongly interlinked with the other three themes. Certainly feelings of satisfaction do derive from all three. To justify this classification, focus group responses did refer to a sense of fulfilment that was independent of a growing community, self-identity or good health but purely stemming from the front garden itself and the act of gardening in the front garden. In the literature about horticultural therapy, it is widely known that a sense of belonging is a key factor in enabling social inclusion through meaningful occupations fostering affirmation, feedback, a sense of achievement, and the possibility for self-determination (Diamant and Waterhouse, 2010).

Everyone has their own reasons for gardening but through this inevitable fulfilment, one's confidence grows. This was expressed in several ways such as: "it's good to see things grow". Given that many gardeners are often trialling plants and methods for the first time, learning as they go along, added satisfaction comes from this process and potential successes. Gardening in the front garden was described as "an ongoing project" accompanied by "contentment that varies through the year" and that the whole endeavour is "immensely satisfying". Sometimes there were more specific features mentioned, such as "weeding, which I find to be a very very fulfilling thing to do" or enjoyment linked to a particular plant or sensory stimulus: "when the lavender was out, it's just brilliant to walk past it, the scent!". Lavender was a firm favourite for many. Participants see gardening as a worthwhile activity in itself that culminated in "always feel[ing] much better afterwards".

"it makes you feel happy, blissful. It detracts from the urban landscape, you know all the concrete. That helps my well-being".

Even when there were struggles or health obstacles that limited gardening activities, participants are striving to and advising each other: "don't overdo it do what you can do".

In addition to the innate satisfaction from gardening, participants also enjoyed talking about the rewarding feelings from contributing to their local community and to the pleasure of others. The fulfilment they felt when congratulated by fellow Britain

in Bloom gardeners was highly valued - whether when winning a prize or receiving a heartfelt comment about their garden. Moreover, the knowledge that they were contributing to others' enjoyment was relished. One self-described introspective participant recognised that the front garden is his only outlet of

“exhibitionism, it’s important to be seen and I can justify it because I know it’s lovely and it inspires people. I get a lot of positive reinforcement from it”.

All the participants shared uplifting anecdotes of people coming by: “it is satisfying for me because people do come up and chat”. One participant lives in the vicinity of a popular park and school so she observes that often children look at her flowers and she can see the joy they are getting from her front garden. Another particularly evocative story that enchanted the rest of the focus group participants involved

“two Japanese young ladies [...] knocked on the door and said ‘excuse me, do you mind if we take a photo of your front garden because we think it’s so beautiful’. I said ‘My goodness please do!’ and it made my day”.

Participants had many such stories of the satisfaction they felt when people express happiness when seeing beautiful front gardens.

4.4.4 Health

While one of the focus group questions did directly ask about the potential therapeutic benefits of gardening, the intention was that the discussion not solely be about health. Time at the beginning of the focus group was deliberately protected without any mention of health and well-being firstly to allow for other themes to emerge naturally, and secondly to see if any participants would bring up the topic without being prompted by the researcher. While three people mentioned aspects of well-being in passing, no one provided any unprompted specific or passionate comments on the health benefits of their front gardens. This explains why it was not accorded centre stage with other feelings and emotions in the analysis of the focus groups. Having said this, it is undeniable that the core hypotheses of this thesis concern the health and

well-being impacts of front gardens, and that the emerging themes of self-identity, community, and fulfilment are closely linked to well-being. In effect, a significant part of the well-being benefits of gardens and gardening was via a fulfilled self-identity and a sense of belonging in a community. When asked, participants could quickly and succinctly specify therapeutic benefits, with some experiencing and overcoming depression and other physical illnesses.

Most participants cited moderate physical exercise as the first and most obvious health benefit of gardening. Regular gardening results in many of the health benefits associated with a physically active life, though muscle strains and overused joints may limit the benefits (Franke et al., 2013). One participant told the story of someone they met through Britain in Bloom (not present at any of the focus groups) who was initially overweight, took a very active role in the group, and lost 20 kilograms in a year. Any type of exercise was beneficial and even 10 minutes outdoors is therapeutic. Indeed, a study on gardeners over the age of 62 found that gardening activities can preserve physical function in older adults (Park and Shoemaker, 2009).

The level of control that gardeners have over what they can and cannot do contributes to injury prevention. One participant who is getting older and finding herself gradually restricted in her gardening activities beamed that

“it is wonderful for you to get out in the fresh air and to get some exercise do a bit of bending and stretching and maybe settle down on the patio with your cocktail. Life could not be more perfect”.

Everybody agreed that the uniqueness of gardening as a physical activity was that it is adaptable to physical (dis)ability, injury, and fitness levels. Similarly, Scott et al. (2014) also found that the majority of respondents over the age of 60 reported that they had made physical adjustments to their gardening activities to cope with their declining abilities.

Other aspects of physical health included easier access to more fruit and vegetables. For example, one participant explained how she accidentally became self-sufficient in blueberries. Another participant proposed that the air quality in the garden was probably better with a greater density of green spaces and that being outdoors is

always beneficial. Finally, one participant mentioned that he noticed healthier sleep patterns after gardening.

Moving on to mental health, participants were mostly coming back to the aforementioned themes of fulfilment, self-confidence, and a sense of belonging in a good community. More specifically about mental ill health, one lady explained that she continues to garden despite several back-related problems and depression. Although she gets exhausted and finds the mental and physical exertion difficult, she sees that she is better when she is active and takes managed risks. A different participant made a poignant statement that led to a contemplative silence in the room and murmurs of agreement:

“if you can learn to grow something which is beautiful in front of you I think you can grow a garden in your heart. And I think people who can grow a garden in their heart, are the people who can overcome all sorts of terrible personal pain, grief, all sorts of things”.

Despite treating physical health and mental health in separate paragraphs, the line between the physical and mental impacts of gardens is not clearly demarcated (Gendle, 2016) nor does it seem to be a relevant distinction for the focus group participants. Taken together, the presence of green front gardens and gardening in the front gardens does have a role to play in the health and well-being of the Britain in Bloom members.

4.4.5 Competition

As alluded to in the above thematic discussions, the competitive aspect of Britain in Bloom does play a role in participants' involvement and continued enthusiasm but it is not an all-consuming factor in their interest. As one lady summarised,

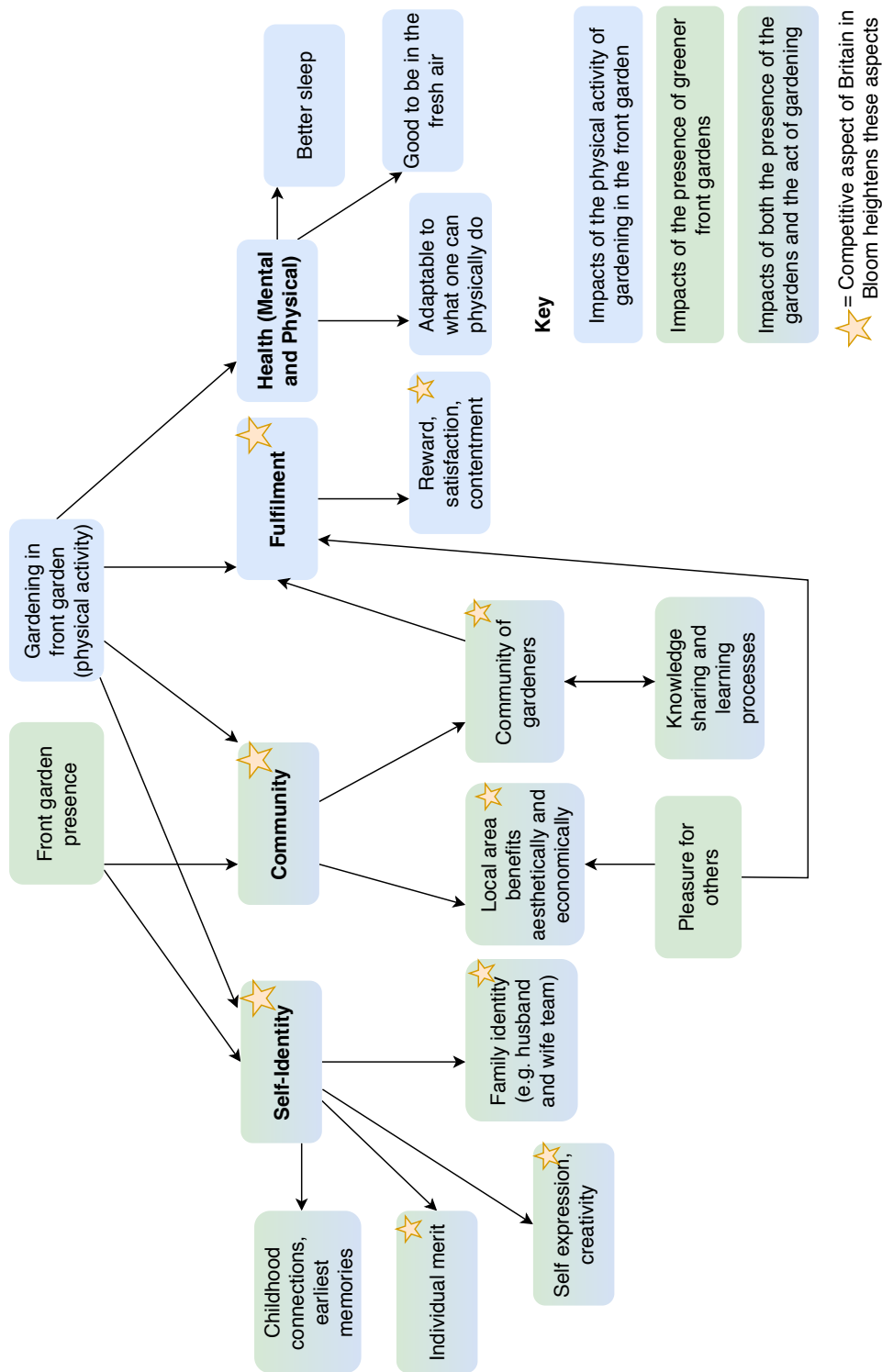
“I've always said I'm not competitive and I honestly don't believe I am but it sort of pushes you to do a bit more and a bit more and as best you can”.

Having said this, there was one participant - who takes the competition extremely seriously every year - who strives to win and is disappointed when he does not. He had even cancelled a holiday abroad to make sure his front garden would be ready for the judges. He said he takes this attitude because he enjoys it and winning has become a part of his identity just as much as his garden has. Barring this exception, all other focus group participants did note the low-level pressure that came from aiming to be the best Britain in Bloom category but insisted that the main consequence of the competitive element was increased encouragement between neighbours to beautify and green up house frontages. These impacts strengthen the three themes of self-identity, fulfilment, and community. Therefore, the competitive aspect of participants' relationship with their front gardens was more important than hypothesised.

4.4.6 Theoretical framework

In qualitative work, the focus is not on providing causal explanations but on deepening understanding of phenomena under study (Patton, 2002). The conceptual diagram in figure 4.3 has been developed by bringing together the themes emerging from the focus groups. This becomes the theoretical framework through which the key research questions are answered as linkages between themes are more readily drawn diagrammatically than in inherently linear text. The diagram is best read from the top down, following the arrowheads for sequence. The four themes of self-identity, community, fulfilment, and health are in the centre row and are developed into their constituent parts. The theoretical framework adheres to criteria outlined by McMillan and Schumacher (2001) for theories useful to the further development of knowledge: it provides a simple narrative of the observed phenomenon, is consistent with observations, provides means for verification and revision, and stimulates further research.

Figure 4.3: Conceptual diagram showing results from the focus group discussions



4.5 Conclusion

Through focus group discussions with members of three Britain in Bloom communities in Greater London, this chapter has thoroughly analysed the relationships between keen gardeners and their front gardens. Previous work of this nature was limited to back gardens or community gardens only. The aims of this chapter have all been addressed through the exploration of four emerging themes of self-identity, community, fulfilment and health. Participants garden in their front gardens because it is a strong part of who they are and how they express themselves, because they see it as a positive contribution to the local area and to the pleasure of others around them, because they are rewarded with feelings of satisfaction, and because they do derive some health benefits. Gardening activities in front gardens is an effective means of building a community in a neighbourhood or street and social cohesion can emerge in this way. Mechanisms through which this occurs includes informal chatting, knowledge sharing, and making the area more attractive for residents, visitors, and businesses. The health benefits of front gardens do come from gardening as a physical activity as well as from the fulfilment derived from the presence of these highly visible green spaces. These socio-cultural mechanisms through which front gardens lead to well-being outcomes have been brought together in figure 4.3, which can be used in further research on the impact of front gardens and community greening initiatives in private spaces.

Furthermore, this chapter, has also contributed to the psychology of communicating the impacts of front gardens with the general public and with keen gardeners. The ideas of self-expression, belonging in a community, fulfilment, and health are easily understandable and can quickly convey expected impacts of greening front gardens that are currently paved over. Although the currently more dominant rationales for urban greening are linked to climate change and environmental ecosystem services (see Miller and Hobbs 2002; Gaston et al. 2005; Tratalos et al. 2007; Galluzzi et al. 2010; Goddard et al. 2013), only two focus group participants even mentioned that front gardens might create more sustainable drainage (and this without any details or emotion). When not in an explicitly ecological context, narratives based on flooding or permeability are not a common motivation for gardening for this demographic, nor do they make gardening relevant to people's everyday lives. Gardening as a means to mitigate flooding could be quite an abstract concept for a layperson. On the

other hand, people can be reached in emotional terms on issues of the self and of the community. This observation thus provides a rationale for shifting the focus from flooding to community and well-being when trying to encourage people to garden or when promoting green spaces to policy-makers. This provides a mechanism through which to battle the 'tyranny of small gardening decisions' (Dewaelheyns et al., 2016) taken by individual residents.

Modelling well-being and perceived stress: the influence of gardening regularity, neighbourhood characteristics, and the front garden

5.1 Introduction: aims and hypotheses

The purpose of this research is to evaluate how front garden landscapes influence health and well-being and to assess the psycho-socio-cultural value of gardens. This chapter uses quantitative methods to test whether gardeners report higher levels of well-being than non-gardeners, and to understand the therapeutic benefits of the presence of (a) vegetated front gardens and (b) gardening in front gardens.

The hypotheses for this chapter are as follows:

- Gardeners and people with vegetated front gardens directly attribute specific health benefits to their interactions with front gardens but they may also gain health benefits they are not immediately aware of. These health benefits include increased well-being, decreased stress, and a better overall health status. Health benefits are associated with how much vegetation is in the front garden.
- Well-being and stress levels are related to gardening activity and time spent in the garden.

To achieve these aims and to test the above hypotheses, an online questionnaire was circulated to both gardeners and non-gardeners. This was designed using a case-control method. The results from the questionnaire's 6,015 respondents were analysed statistically using multivariate regression analysis and textual analysis for the open-text responses. This chapter builds on the theoretical framework developed in chapter 4 following the focus group discussions by understanding the results of the questionnaire in light of the themes of self-identity, community, fulfillment, and health, and is mindful of the pathways to health outcomes conceptualised in the literature review.

5.2 Methodology

5.2.1 Data collection

Quantitative data collected included: where and how regularly respondents garden; the state of their front garden; sense of community, perceived stress and well-being; physical activity levels; and socio-economic circumstances. The Perceived Stress Scale (PSS) was used as an indicator of stress and the Shortened Warwick and Edinburgh Mental Well Being Scale (SWEMWBS) was used as an indicator of well-being. Qualitative data collected included: the therapeutic benefits of gardening; motivations for gardening; and health barriers to gardening.

An online questionnaire was used for reasons of easy dissemination to a large number of people. The questionnaire was hosted online on Qualtrics website platform available on computers or mobile devices with an internet connection. The data was collected from 26 November 2016 to 30 April 2017. The questionnaire included open-ended questions and closed multiple-choice questions. The questionnaire was open to anybody above the age of 18. The questionnaire was targeted at two groups: gardeners and non-gardeners (but they are not distinct, there is a scale of categories for them to express how interested they are in gardening and how often they actually garden). Respondents did not need to have a front garden.

The questionnaire was piloted with colleagues who are well-versed in landscape research as well as friends and family who are not. It was piloted with as broad a range

of people as possible - people whose first language is not English, as well as with a variety of ages and educational backgrounds.

The questionnaire was circulated to 480,000 RHS members via an article and link in RHS monthly magazine 'The Garden' as well as other RHS media outlets (website, Facebook, Twitter, member emails, and newsletters). Because of the dissemination through gardening-related channels, respondents were more likely to be gardeners. Therefore, to reach non-gardeners, respondents were asked to pass the link on to a non-gardener who is similar to them in other ways to try to have a group of people who are more similar to RHS members than the general population. Respondents also had the option to provide an email address for the researchers to contact this person directly. Other efforts to reach non-gardeners included collaboration from various other online platforms publicising the link: home and interior magazines, health and well-being magazines, psychology digests, and mindfulness centres. Most significantly, BBC news included the link to the questionnaire in a science article covering the research project. This was picked up on by both BBC Radio Coventry and Warwickshire and BBC Radio Sheffield, who highlighted the opportunity for listeners to take part in the research by completing the questionnaire. The initial BBC news article also led to the story being covered by other outlets with wide readership such as 'Country Living' and the websites of garden centres around the country.

Appendix A.2 includes a copy of the online questionnaire, and the comprehensive list and screenshots of dissemination channels. This section serves to highlight the important role of the media as part of the methodology and eliciting responses that will be used and analysed to investigate the impacts of gardening activity on health and well-being.

5.2.2 Data cleaning and analysis

There was a total of 6,914 respondents. 116 were screened out as they did not provide consent (32); they didn't answer any questions after providing consent (65); or they were less than 18 years old (19). A further 747 responses were removed for incomplete answers with the majority of questions left blank. 72 duplicate answers were deleted (the second of the two answers was removed). Duplicate responses were identifiable

by IP address and identical demographic details, as well as nearly word for word open-text answers. A total of 899 responses were removed during the cleaning process, resulting in a final 6,015 responses used for analysis.

Using R software, statistical analysis of quantitative data uses linear modelling and robust analyses of variance (ANOVA). The latter used trimmed means (20% trimming level) using Wilcox' Robust Statistics (*WRS2* package in R, Mair and Wilcox, 2019) because of the heavy-tailed distribution of the data.

Qualitative data analysis involved linguistics-based text analysis in the IBM SPSS Text Analytics for Surveys package. Data was transformed into quantitative data to identify relationships between concepts. This iterative processes of extraction and categorisation while taking into account synonyms and word tokens reduce the ambiguities of human coding, and uncover patterns in a large amount of data on the attitudes, beliefs, and opinions of the respondents.

5.3 Results

The demographic information and responses from the 6,015 respondents is in appendix A.2. To summarise, there were 5,766 gardeners and 249 non-gardeners. There is also a map of where the 5,548 people who provided a postcode are living to show that they are well distributed across the UK. The participants are more likely to be older adults, female, and house-owners, as Gross (2018) found in most gardening studies. All potential confounders (including demographic variables) were tested for in the analysis. Unless explicitly mentioned, these were not found to be statistically significant. All values are rounded to 2 decimal points. Data is presented as mean \pm standard error.

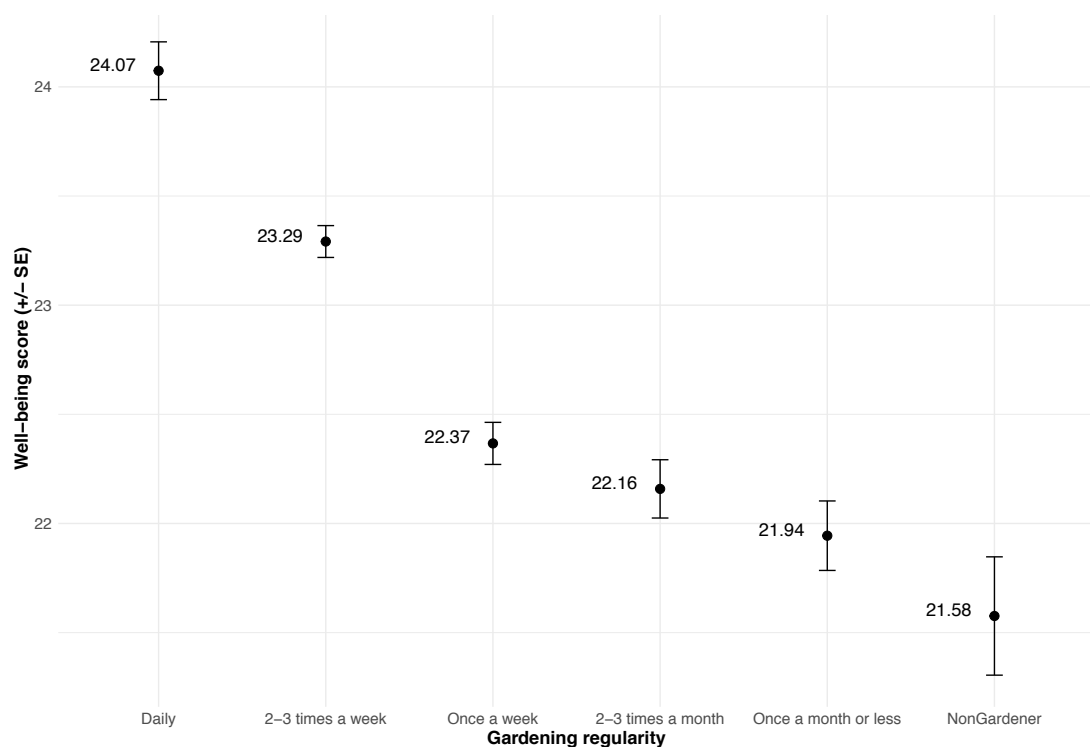
5.3.1 People who garden more regularly have a higher well-being score and lower perceived stress score

A robust one-way ANOVA was conducted to determine if mental well-being (SWEM-WBS) was different for groups who gardened with different regularity. Well-being

score was statistically significantly different between groups of different gardening regularity: $F(5,720,78) = 42.31$, $p < 0.01$, explanatory measure of effect size = 0.27. Well-being score increased from the non-gardeners (21.58 ± 0.27), to once a month or less (21.9 ± 0.16), to 2-3 times a month (22.16 ± 0.13) to once a week (22.37 ± 0.10), to 2-3 times a week (23.29 ± 0.07), to daily (24.07 ± 0.13) gardening, in that order (figure 5.1).

Post-hoc tests using linear contrast for trimmed means revealed that the increase from 2-3 times a week to daily (0.75, 95% CI [0.20, 1.23]) was statistically significant ($p < 0.01$), as well as the increase from 2-3 times a week to once a week (0.94, 95% CI [0.53, 1.35], $p < 0.01$), and the increase from once a month or less to once a week (0.438, 95% CI [0.16, 1.02], $p = 0.02$). No other group differences were statistically significant.

Figure 5.1: Mean mental well-being scores and gardening regularity

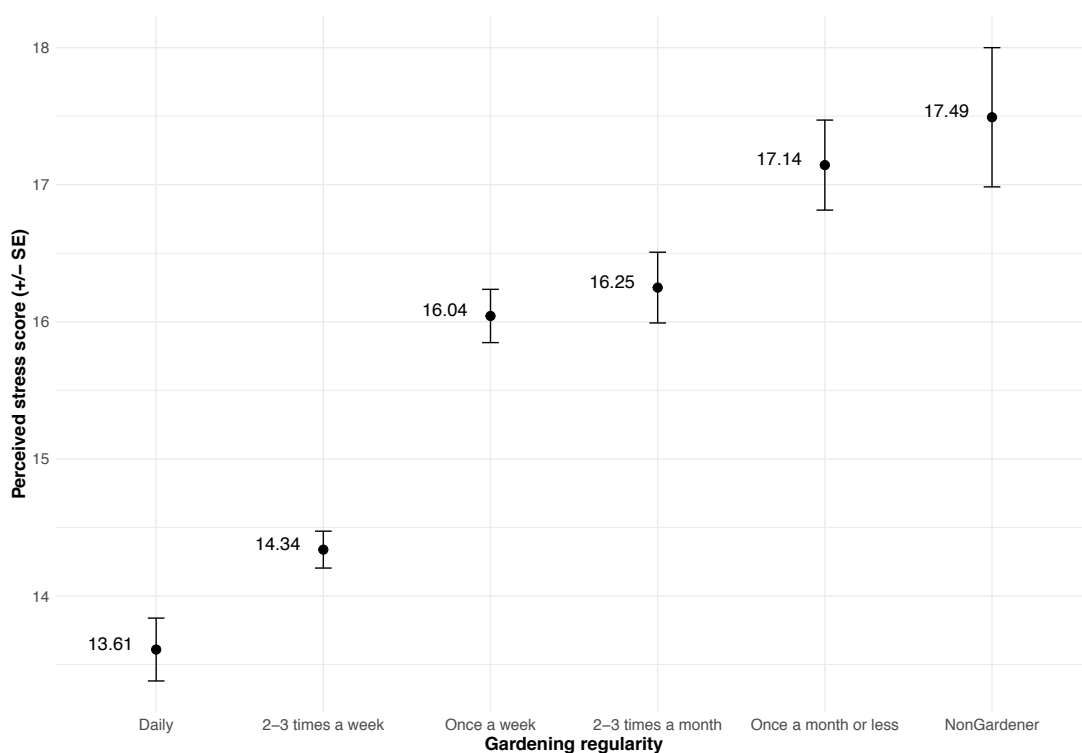


A robust one-way ANOVA was conducted to determine if perceived stress (PSS) was different for groups who gardened with different regularity. PSS was statistically significantly different between groups of different gardening regularity: $F(5, 725,27)$

= 35.36, $p < 0.01$, explanatory measure of effect size = 0.24. Perceived stress decreased from the non-gardeners (17.49 ± 0.51), to once a month or less (17.14 ± 0.33), to 2-3 times a month (16.25 ± 0.26), to once a week (16.04 ± 0.19), to 2-3 times a week (14.34 ± 0.13), to daily (13.61 ± 0.23) gardening, in that order (figure 5.2).

Post-hoc tests revealed that an increase in activity from 2-3 times a week to daily (-0.84 , 95% CI $[-1.70, 0.02]$) significantly reduced perceived stress scores ($p = 0.00248$), as did increasing gardening from once a week to 2-3 times a week (-1.77 , 95% CI $[-2.54$ to $-0.99]$, $p < 0.01$), and an increase from once a month or less to once a week (-1.29 , 95% CI $[-2.57$ to $-0.01]$, $p < 0.01$). No other group differences were statistically significant.

Figure 5.2: Mean perceived stress scores and gardening regularity



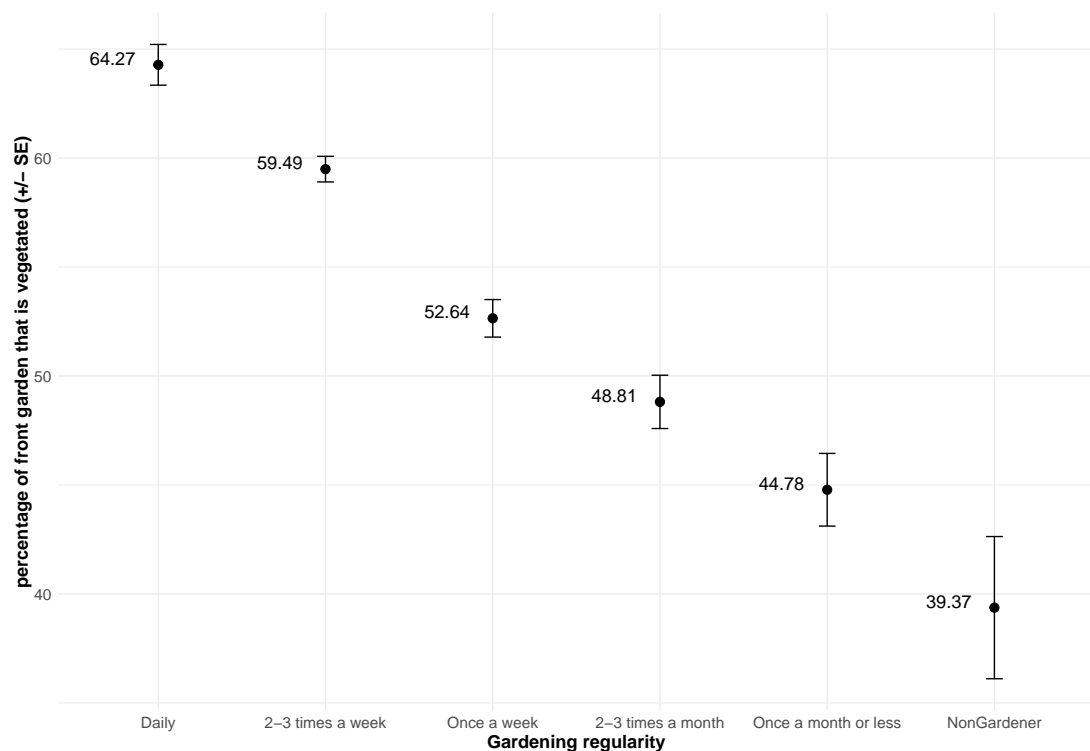
Robust tests for a two-sample trimmed mean test which allows for the presence of unequal variances proposed by Yuen (1974) revealed that people who reported any therapeutic benefits from their garden, have a higher well-being score than those who did not ($p < 0.01$). There was a small effect size of 0.14.

A robust one-way ANOVA was conducted to determine if the percentage of planted surface area in the front garden was different for groups who gardened with different

regularity. The percentage of vegetated cover was statistically significantly different between groups of different gardening regularity: $F(5, 454.04) = 42.34$, $p < 0.01$, explanatory measure of effect size = 0.33. The amount of vegetation present in gardens increased from non-gardeners ($39.37\% \pm 4.68$), to those who gardened once a month or less ($44.78\% \pm 2.48$), to those who gardened 2-3 times a month ($48.41\% \pm 1.88$) to those who gardened once a week ($52.64\% \pm 1.44$), to those who gardened 2-3 times a week ($59.49\% \pm 1.09$), and to those who gardened daily ($64.27\% \pm 1.68$), in that order (figure 5.3).

Post-hoc tests revealed that the increase from 2-3 times a week to daily (7.08, 95% CI [2.31, 11.85]) was statistically significant ($p < 0.01$), as well as the increase from 2-3 times a week to once a week (7.67, 95% CI [3.21, 12.13], $p < 0.01$), the increase 2-3 times a month to once a week (4.58, 95% CI [1.90, 11.07], $p = 0.028$), the increase 2-3 times a month to once a month or less (5.64, 95% CI [-3.24 to 14.52], $p = 0.04$).

Figure 5.3: Mean percentage of front garden that is vegetated and gardening regularity

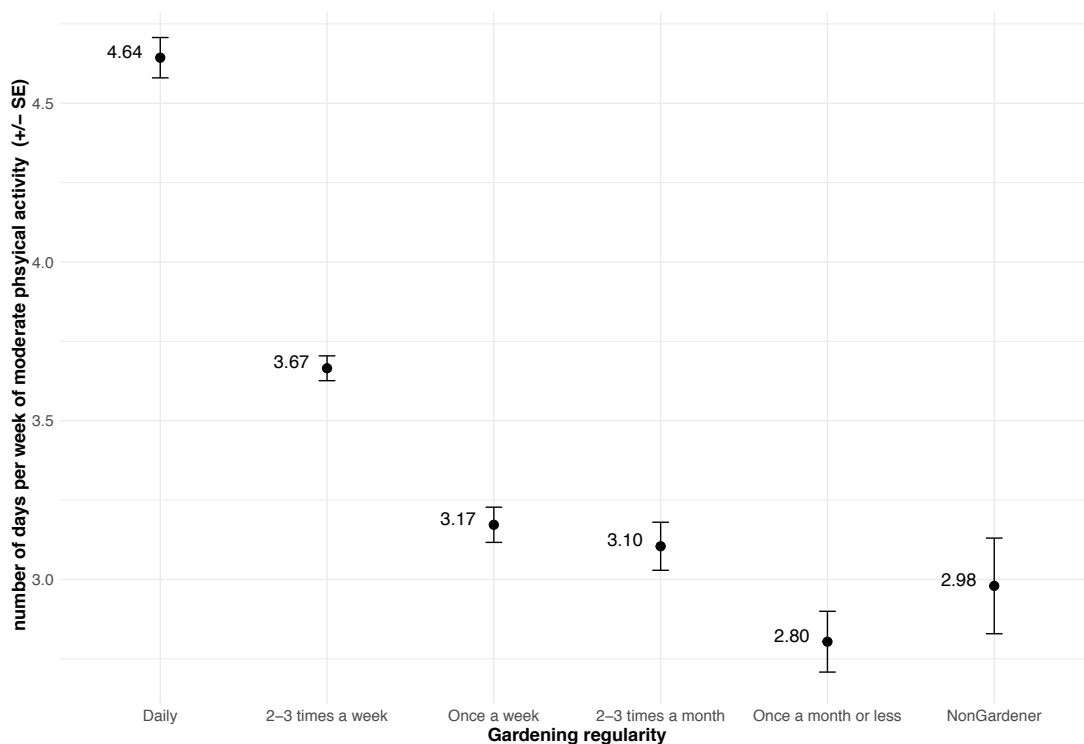


A robust one-way ANOVA was conducted to determine if the number of days per

week that people are physically active for more than 30 minutes with a raised breathing rate was different for groups with who gardened with different regularity. Physical activity was statistically significantly different between groups of different gardening regularity: $F(5, 739.63) = 75.4521$, $p < 0.01$, explanatory measure of effect size = 0.35. Days per week of physical activity was not statistically different for the non-gardeners (2.98 ± 0.15), people who gardened once a month or less (2.80 ± 0.09), people who gardened 2-3 times a month (3.10 ± 0.27), and once a week (3.17 ± 0.16). Days per week of physical activity increased for those who gardened to 2-3 times a week (3.67 ± 0.13), to daily (4.64 ± 0.42) gardening regularity groups, in that order (figure 5.4).

Post-hoc tests revealed that the frequency of self-reported physical activity increased significantly when gardening increased from 2-3 times a week to daily (1.22, 95% CI [0.94, 1.50], $p < 0.01$), and from once a week to 2-3 times a week (0.53, 95% CI [0.29, 0.77], $p < 0.01$). Increases from once a month or less to once a week was also significant (0.47, 95% CI [0.05, 0.88], $p < 0.01$), and from once a month or less to 2-3 times a month (0.38, 95% CI [-0.07, 0.83], $p = 0.01$).

Figure 5.4: Mean number of days per week of moderate physical activity and gardening regularity



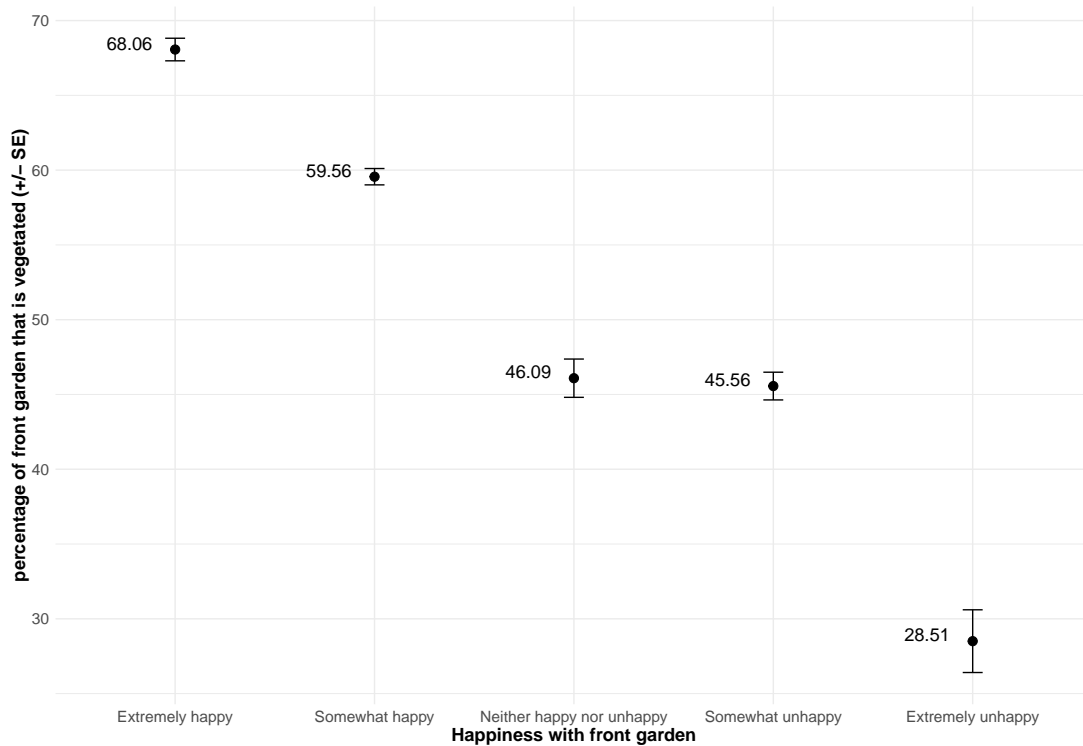
5.3.2 Front gardens have indirect influence on peoples' well-being and stress

People being happy with their front garden is strongly associated with their judgement of the local area. An asymptotic linear-by-linear association test (chi-squared test for ordinal variables) was conducted to see if the area, community, and neighbourliness self-ratings have an impact on well-being and stress scores. The Z -score of 12.89, with a p -value < 0.01 shows that there is a statistically significant association: people in excellently rated areas were mostly extremely happy with their front garden, people living in areas rated as average were mostly neither happy nor unhappy, somewhat unhappy, and extremely unhappy. Based on standardised residuals, there was also a strong association between people who were extremely unhappy and those living in poorly rated areas. Area rating, community rating, and regularity of neighbourly favours are collinear.

There is also an association between how happy people are with their front garden and the extent to which it is planted, measured as the percentage of the whole surface area that is vegetated. A robust one-way ANOVA was conducted to determine if the percentage of planted surface area in the front garden was different for groups who were happy or unhappy with their front gardens. Front gardens with a greater proportion of vegetation were statistically significantly different between different groups of respondents: $F(4, 604.3) = 179.28$, $p < 0.01$, explanatory measure of effect size = 0.51. Percentage of the front garden that is vegetated increased from people who are extremely unhappy with their gardens ($28.51\% \pm 2.10$), to somewhat unhappy ($45.56\% \pm 0.93$), to neither happy nor unhappy ($46.09\% \pm 1.28$) to somewhat happy (59.56 ± 0.55), to extremely happy ($68.06\% \pm 0.75$), in that order (figure 5.5).

Post-hoc tests using linear contrast for trimmed means revealed that the increase in the percentage of vegetation present increased significantly with those who were extremely happy with their gardens to those who considered themselves somewhat happy (10.59, 95% CI [7.58, 13.60], $p < 0.01$). Similarly the proportion of vegetation was also significantly higher between the somewhat happy category compared to the neither happy nor unhappy category (16.34, 95% CI [11.27, 21.40], $p < 0.01$). The lowest percentage of vegetation was associated with the extremely unhappy category, significantly less than somewhat unhappy category (23.00, 95% CI [15.38, 30.63], $p < 0.01$).

Figure 5.5: Mean percentage of front garden that is vegetated and how happy people are with their front garden



5.3.3 Variation in perceived stress explained by area rating, garden ratings, and physical activity

Multiple linear regression was carried out to investigate the relationship between perceived stress, area self-rating, percentage of front garden that is vegetated, happiness with their front garden, happiness with their back garden, and number of days per week of physical activity.

There was a significant relationship between these variables. For each step-increase in area rating, there was a 6.49 decrease in PSS ($p < 0.01$). For each step-increase in happiness with front garden, there was a 1.45 decrease in PSS ($p = 0.01$). For each step-increase in happiness with back garden, there was a 3.16 decrease in PSS ($p < 0.01$). For every percentage increase of vegetated surface area, there was a 0.01 decrease in PSS for each percentage of vegetation extra ($p = 0.03$). For each additional day per week of moderate physical activity, there was a 0.42 decrease in PSS ($p < 0.01$). The adjusted R^2

value was 0.11 ($p < 0.01$) so 11.40% of the variation in perceived stress can be explained by the model containing percentage of front garden that is vegetated, area rating, happiness with their front garden, happiness with their back garden, and number of days per week of physical activity. The data met the assumptions of homogeneity of variance and linearity and the residuals were approximately normally distributed.

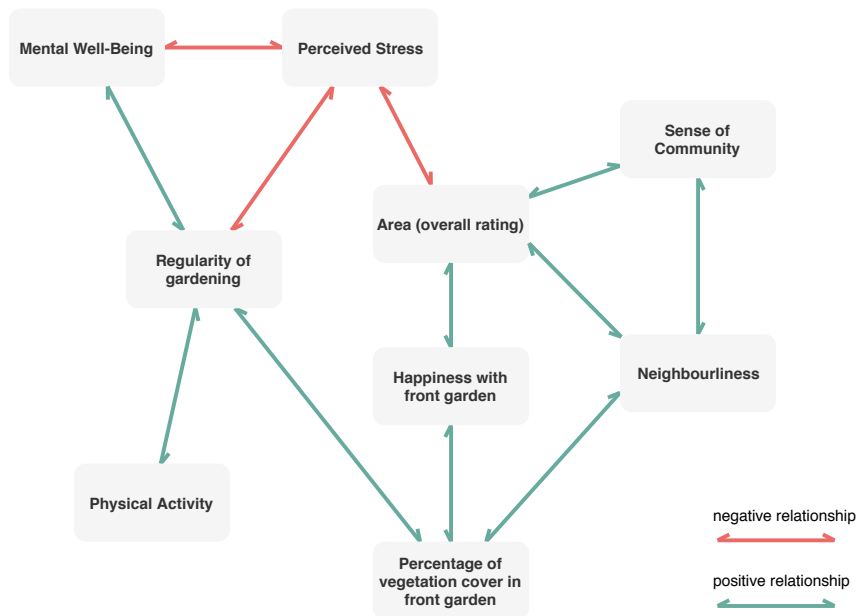
5.3.4 Variation in mental well-being explained by area rating, and more vegetated gardens

Multiple linear regression was carried out to investigate the relationship between well-being score, percentage of front garden that is vegetated, area self-rating, how happy they are with their front garden, and how they rate their back garden. There was a significant relationship between these variables. For each step-increase in area rating, there was a 2.26 increase in SWEMWBS ($p < 0.01$). For each step-increase in happiness with front garden, there was a 0.75 increase in SWEMWBS ($p < 0.01$). For each step-increase in happiness with back garden, there was a 1.89 increase in SWEMWBS ($p < 0.011$). For every percentage increase of vegetated surface area, there was a 0.01 increase in SWEMWBS ($p < 0.01$).

The adjusted R^2 value was 0.1288 so 12.88% of the variation in well-being can be explained by the model containing percentage of front garden that is vegetated, area rating, how happy they are with their front garden, and how they rate their back garden. The data met the assumptions of homogeneity of variance and linearity and the residuals were approximately normally distributed.

A visual summary of the relationships between well-being, perceived stress, and front gardens based on all the statistically significant associations in the quantitative data outlined in this section illustrates the direct and indirect effects of gardening and front gardens on mental well-being and perceived stress (figure 5.6). The findings presented here are comparable to a Dutch choice-based questionnaire which also found that roadside vegetation in urban areas positively influenced preference for the street van Dongen and Timmermans (2019). Furthermore, high levels of urban greenery have been associated with stronger place-identity and place-attachment, as well as higher well-being (Knez et al., 2018).

Figure 5.6: Relationships between well-being, perceived stress, and front gardens



5.3.5 Motivations for gardening do not have an impact on well-being effects

The open-ended questions in the questionnaire allows respondents to provide an unstructured, varied, and textured response about what they think and feel about their motivations for gardening, and therapeutic benefits. Based on responses from 5,418 people (90.17%) who answered the free-text question about why they garden, nine emergent categories were developed to describe the main motivations for gardening in this UK sample:

1. Pleasure and enjoyment
2. Multi-sensory stimulation
3. Health and well-being benefits
4. A connection to nature, growth, wildlife and the outdoor environment
5. Self-expression, self-identity
6. Home maintenance and appearance

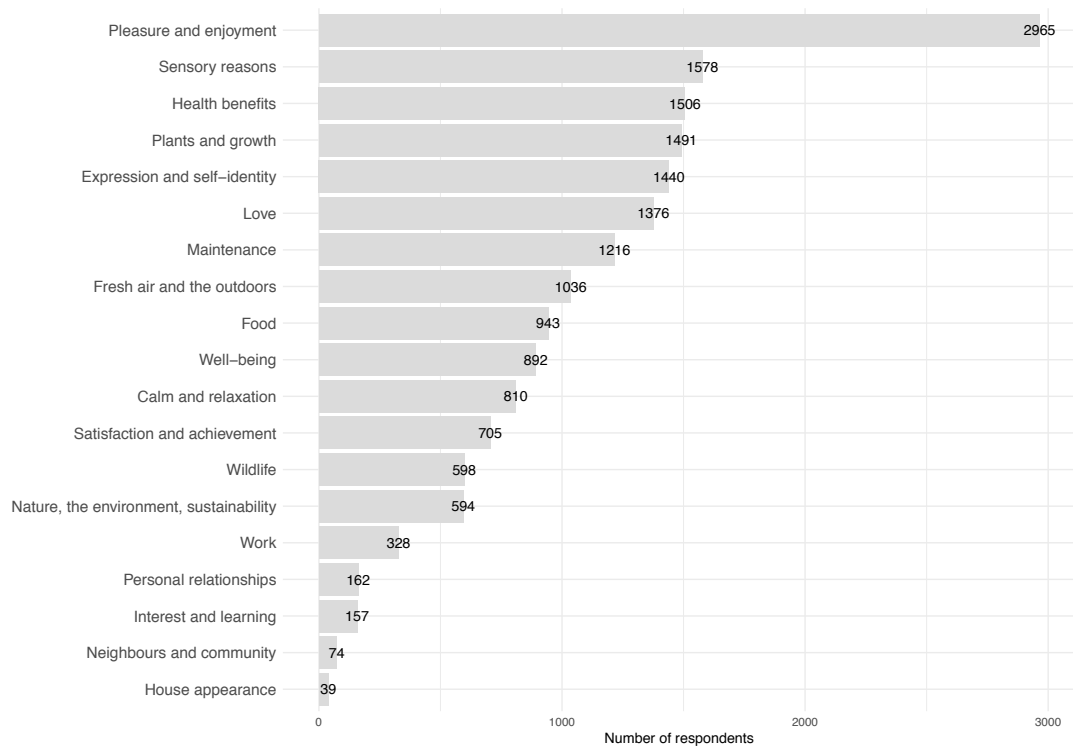
7. Satisfaction and achievement

8. Food harvesting

9. The development of personal relationships and a sense of community

These themes speak to the four main studies that have attempted to explain the motivations behind gardening as a leisure activity (Beard and Ragheb, 1983; Francis and Hester, 1990; Ashton-Shaeffer and Constant, 2006; Gross and Lane, 2007) in the USA, Norway, and New Zealand (table 2.1). It is the first time that such a large sample of gardeners has been surveyed, Categories are further detailed in figure 5.7 and in appendix A.2. For example, sensory motivations include: visual, touch, smell, and aural.

Figure 5.7: Motivation for gardening

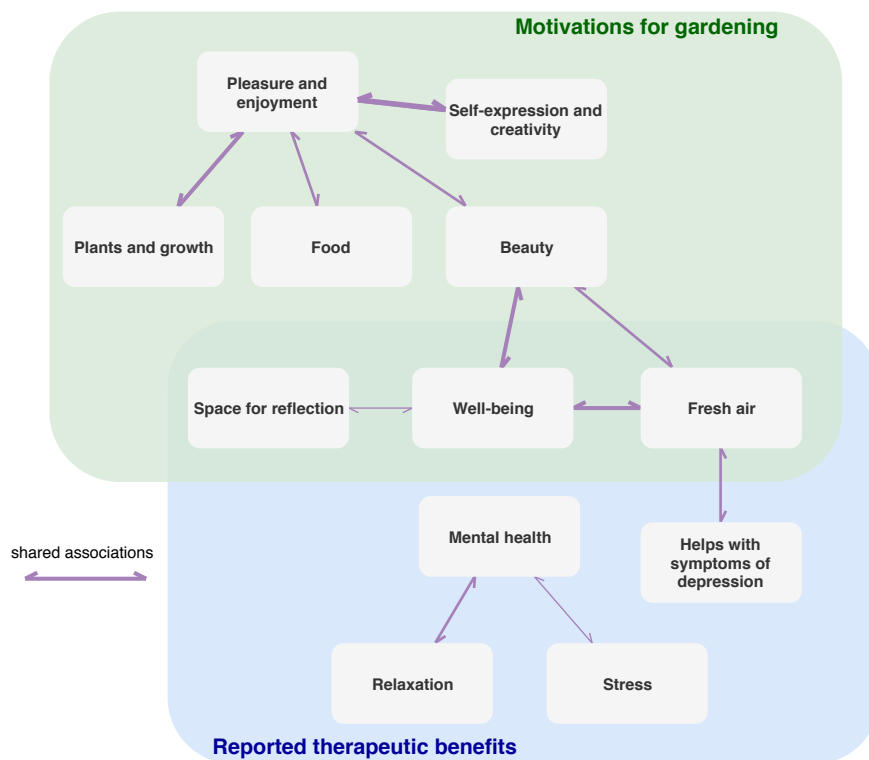


There is no statistically significant association between the reason why people garden and all the statistical relationships outlined in previous sections. This means that whether the respondent gardened for professional reasons, for stress relief, to be outdoors, for their own pleasure, for self-expression, or for health reasons, this was

not expected to make a difference to their health and well-being outcomes. In other words, no matter the primary reason for gardening, health and well-being outcomes would be expected.

Psycho-social connections between gardens and well-being were further explored by visualising the network of associations between responses regarding gardening motivation and perceived therapeutic effects of gardening (figure 5.8). The network visualisation does not depict deterministic outcomes but structures that underpin the data and their relationships with each other and the research question. This adds psycho-social nuance to the statistical relationships between front gardens and well-being, as well as fleshing out potential causal pathways.

Figure 5.8: Categories most commonly overlapping in free-text responses on motivations for gardening and therapeutic benefits



5.3.6 Gardeners facing health barriers do experience therapeutic benefits from gardening

40.50% of respondents (2,436 people out of 6,015) said that they faced health barriers that made it difficult for them to garden. The types of impairments as they may

be relevant to gardening were most commonly back-related and relating to manual dexterity (figure 5.9). Indeed, specific types of health issues encountered included back-related issues and arthritis (figure 5.10).

Figure 5.9: Health barriers making it difficult to garden - Types of impairments

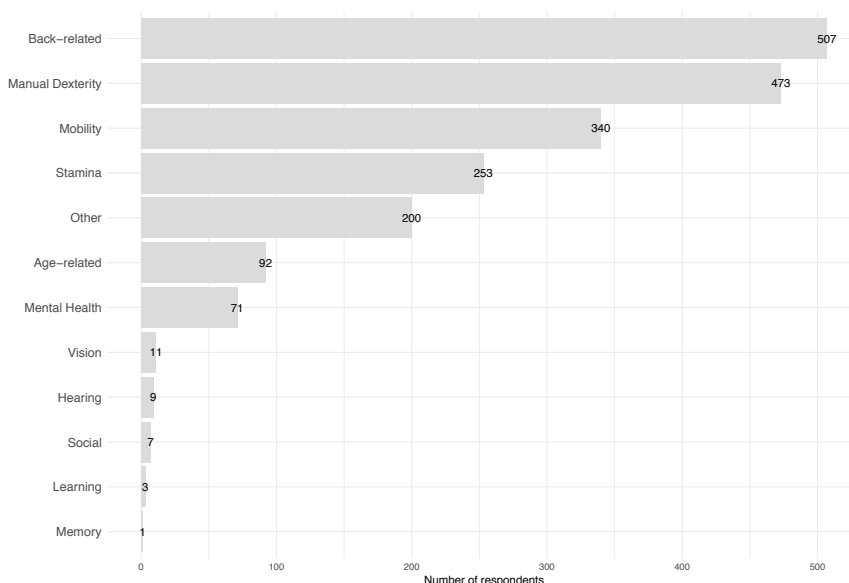
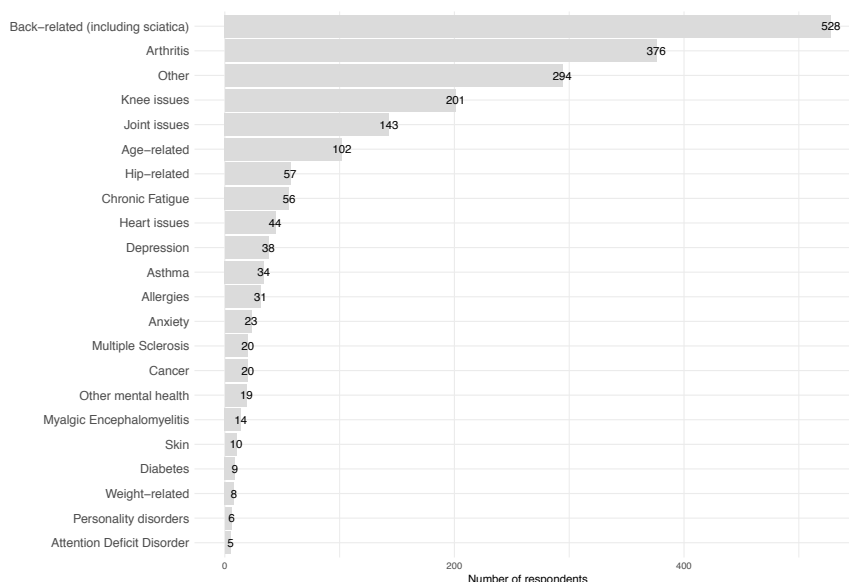


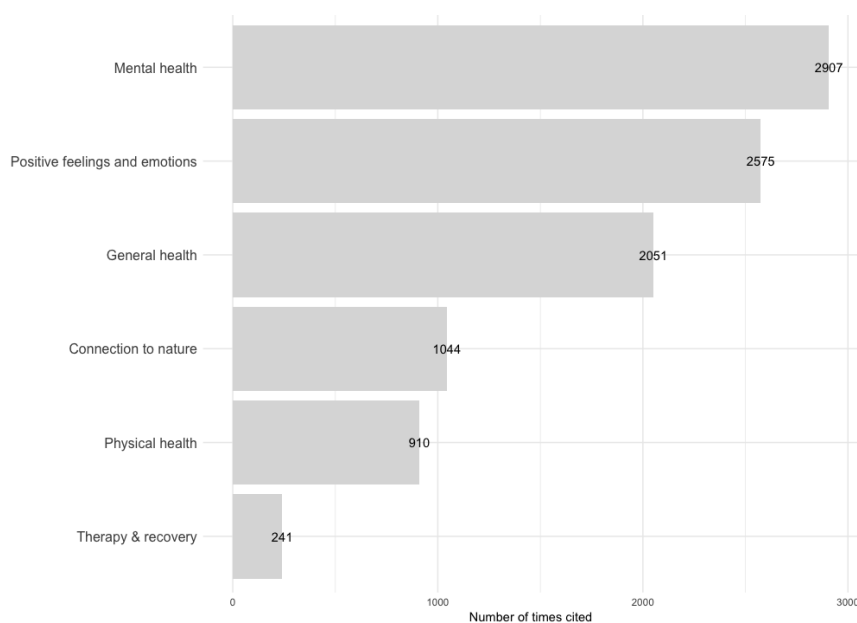
Figure 5.10: Health barriers making it difficult to garden - Specific issues



The same 40.50% of questionnaire respondents reported experiencing therapeutic benefits from gardening and from their front garden (figure 5.11). Each category is itself

made up of multiple aspects. For example, mental health includes: dealing with stress, having space for reflection, helping with experiences of depression, helping with experiences of anxiety, creating perspective, escaping from everyday life or problems, mindfulness, concentration and focus, purpose, and improved self-esteem. The full breakdown of other categories is in appendix A.2. The citation counts add up to more than 2,436 people because most people experienced more than one health benefit - whether in the same or different category. For instance, someone who cited that gardening is both a way to relax and helped them deal with symptoms of depression counts as two in the mental health category.

Figure 5.11: 40.50% of respondents experienced therapeutic benefits from gardening



5.4 Discussion

5.4.1 Dose-response curve for the health effects of gardening

Unprecedented in the literature, the results show that people who garden more regularly have higher mental well-being and lower perceived stress. It is also the first time that a study has demonstrated a dose-response curve for the health effects of gardening. This is an assessment of the effects of the regularity or frequency of gardening

(as a form of direct exposure to nature). Further research should seek to assess intensity and duration - the other key components of exposure to nature (Shanahan et al., 2015). The presence of statistically significant thresholds at the daily and two to three times a week marks provides a strong indication of a broad-scale recommendation of gardening frequency for maximum health benefits. Any frequency of gardening provides health benefits but gardening daily or two to three times a week maximises these benefits.

5.4.2 Social value of increased well-being due to daily gardening

The Housing Associations' Charitable Trust (HACT) have developed a social value bank to assess movement between two points on the SWEMWBS scale to value improvements in mental health (Fujiwara et al., 2014; Trotter and Rallings Adams, 2017). The HACT model values from the Social Value Bank for investment in communities represent the additional money the average individual would need to improve their well-being by the same amount as the increase in the well-being score. HACT have based their values on large, national datasets: the British Household Panel Survey, Understanding Society, The Crime Survey for England and Wales, and the Taking Part survey.

Applying this approach to the results from the online questionnaire can provide a deeper understanding of the impact of gardening every day. HACT's novel link between well-being and social value uses a well-being valuation approach to discern more gradual improvements in mental well-being. For example, while an intervention may improve an individual's mental health, it may not go as far as to lead to a full recovery from depression or anxiety. In these instances, a comparison of depression or anxiety rates before and after an intervention would not reveal any differences.

The difference in well-being score between someone who gardens daily and a non-gardener is $24.07 - 21.58 = 2.49$. Using the HACT model values, $£22,944 - £21,094 = £1,850$.

According to HACT's additionality guide, 27% of people experiencing a health improvement would have achieved it regardless of the intervention so this must be deducted from the difference: $2.491 - 27\% = 1.817$. Using the HACT model values, $£1,850 - 27\% = £1,350.50$.

The monetary worth of social impact per person for people who garden daily as opposed to those who do not garden is £1,350.50. It is unfortunately not possible to extrapolate a national figure because the questionnaire respondents were not representative of the national population.

5.5 Conclusion

This chapter has provided a robust quantitative evaluation of direct and indirect effects of private gardening on health and well-being. Gardeners and people with vegetated front gardens directly attribute specific health benefits to their interactions with front gardens. Even those that do not directly attribute the benefits to their gardening activities, do receive health benefits the more regularly they garden. People who gardened daily had higher well-being levels and lower perceived stress levels. The dose-response curve shows that gardening regularity of daily and two to three times a week are critical thresholds. Applying a social well-being valuation approach to the results, it has been possible to calculate a monetary value of the social impact of gardening daily.

In addition, statistically significant relationships between the percentage of vegetated area in the front garden, self-rating of the residential area, physical activity, perceived stress, and mental well-being. These linear models could explain 11-12% of the variation in perceived stress and mental well-being scores.

A framework of nine categories was constructed to summarise participants' main motivations for gardening: pleasure and enjoyment; multi-sensory stimulation; health and well-being benefits; a connection to nature, growth, wildlife and the outdoor environment; self-expression, self-identity; home maintenance and appearance; satisfaction and achievement; food harvesting; and the development of personal relationships and a sense of community.

Emotions in the garden: garden activities, features, views, and favourite plants

6.1 Introduction: aims and hypotheses

By investigating emotional self-regulation and associations in the garden, this chapter explores how gardeners relate to, and value their own gardens. Based on a questionnaire about the emotional relationships that gardeners have with different garden features and gardening activities, this study aims to determine which aspects of residential gardens are the most restorative.

Private gardens are dynamic places which can invoke a wide range of emotions through different garden features and gardening activities. Chapters 4 and 5 treated gardens as relatively static places, and gardening as a singular activity. Borrowing a metaphor from circuit theory and systems thinking, previous chapters thus took an opaque ‘black box’ approach focussing only on observable inputs and outputs, without any knowledge of the internal workings of the garden. In contrast, the present chapter unpacks this to understand the features, activities, and emotional processes through which gardens impact health and well-being. Gardens and other green spaces are not simply green (Jorgensen and Gobster, 2010).

Spending time in natural environments has been shown to decrease negative emotions such as fear and aggression and increase positive emotions (Hartig et al., 1991,

2003). Favourite places can regulate negative mood after negative antecedents. (Korpela and Ylén, 2007). People need reassurance and the garden is a vehicle for reassurance by the familiar - familiar landscapes but also familiar conventions such as the lawn, herbaceous border, rose garden, wild garden. Reassurance is also linked to affirmation of values. The most dominant statement is that nature is benign: docile and tractable. Poisonous plants, weeds, are forgotten from this concept of benign nature (Francis and Hester, 1990).

The purpose of this chapter is to evaluate whether certain garden features are more conducive to positive emotions and higher well-being than others. More specifically, this chapter seeks to answer the following questions:

- How are gardens used as places to regulate or deal with emotions?
- Which types of gardening activities are the most restorative?
- Which types of garden features are the most restorative?
- Is there an association between restorative gardening activities or features and how people design their gardens or prioritise the inclusion of garden features?
- Which garden views are the most appreciated and which garden features do they include?
- What role do aesthetic preferences and favourite plants play in gardeners' emotional relationships with their gardens?

This chapter puts forward the hypothesis that green and colourful garden features are associated with stronger positive emotions and higher well-being than hard, non-natural surfaces. It is expected that gardeners' favourite parts of their garden reflect their attachment to features more conducive to positive emotions. In this way, gardening activities are associated with different emotions.

Evolutionarily, each discrete emotion can be understood as an adaptation to deal with a specific challenge or opportunity. In the contemporary context, it remains unclear whether emotions have an impact on longer term health outcomes (Considine and Tedlie Moskowitz, 2007). Nonetheless, there are an increasing number of studies exploring the link between emotional affect and health outcomes. Negative affect has

been linked to heart disease, cancer, and diabetes through inflammation and activation of the hypothalamic-pituitary-adrenal axis (Donker, 2000; Carnethon et al., 2003; Reiche et al., 2005). There is also now the consideration that positive affect may be linked to lower hospital readmission rates, reduced risk of stroke, and lower mortality in older adults (Middleton and Byrd, 1996; Ostir et al., 2001). Regarding health behaviour, negative affect has been linked to overeating unhealthy foods, reduced exercise, and smoking (Kawachi et al., 1996; Kassel et al., 2003; Dubé et al., 2005). Positive affect has been linked to exercise and healthier nutrition (Griffin et al., 1993; Kelsey et al., 2006). With clear links to attention restoration, Korpela (2003) defined emotional regulation as actively coping with moods and emotional situations. People can use environmental strategies to moderate emotions based on features found in that place such as sensory stimulation, visceral processes, or social factors.

6.2 Methodology

6.2.1 Data collection

To achieve the aims set out above, an online questionnaire was used for easy dissemination to a large number of people. The questionnaire also invited respondents to submit photographs of their garden to limit the self-reporting bias. An online questionnaire was also the best method to request, receive, and manage photographic data from respondents. Quantitative data collected included: the approximate size of respondents' garden; which features they would prioritise if redesigning their garden from scratch; how regularly they garden in summer and winter; the length of a gardening session in summer and winter; perceived stress and well-being; physical activity levels; and socio-economic circumstances.

Qualitative data collected included: respondents' attitude to gardening; their perception of their own health and well-being; which gardening activities they find most relaxing, frustrating, and challenging; their favourite part of the garden; the part of the garden that they find the most peaceful, that they wish to improve and that they feel disappointed or depressed by; a description of views from their garden. Respondents were also presented with hypothetical scenarios of dealing with positive and negative

emotions in the garden. Finally, respondents were asked to submit a photograph in answer to the question “Which aspect of your garden do you appreciate the most?”.

The questionnaire was hosted on the Qualtrics website and was available on computers or mobile devices with an internet connection. The data was collected from 19 April 2018 to 31 August 2018. The questionnaire included ordinal questions, open-ended questions, closed multiple choice questions, and a question allowing respondents to upload a photograph. The photo submission portal was a Typeform question embedded into the Qualtrics questionnaire. The questionnaire was open to anybody above the age of 18. Appendix A.3 includes a copy of the online questionnaire.

The questionnaire was piloted with as broad a range of people as possible - people whose first language is not English, as well as with a variety of ages, educational backgrounds, and familiarity with landscape research.

The same, successful dissemination strategy as the previous questionnaire in chapter 5 was replicated. This questionnaire was circulated to RHS members via an article and link in the monthly magazine ‘The Garden’ as well as other RHS media outlets (website, Facebook, Twitter, member emails, and newsletters). BBC news included the link to the questionnaire in an ‘In Pictures’ news article covering the research project. Appendix A.3 details the comprehensive list and screenshots of dissemination channels.

6.2.2 Data cleaning

There was a total of 1,016 questionnaire responses. 149 were screened out as they did not provide consent (8); or did not answer any questions after providing consent (141). 10 duplicate answers were deleted (the second of the two answers was removed). Duplicate responses were identifiable by IP address and identical demographic details, as well as nearly word for word open-text answers. 7 responses were removed as they had no private gardening space. A total of 166 responses were removed during the cleaning process, resulting in a final 850 responses. However, only 666 respondents completed the whole questionnaire including demographic information so these 666 responses were used for analysis. Of these 666 respondents, 178 submitted a photograph of their garden.

6.2.3 Data analysis

Using R software, statistical analysis of quantitative data uses robust analyses of variance (ANOVA), and proportion testing. Analysis tests for correlations and multivariate relationships, as well as drawing out any other patterns in the data. The indicator of stress used is the Perceived Stress Scale (PSS) and indicator of well-being is the Shortened Warwick and Edinburgh Mental Well Being Scale (SWEMWBS).

Open-ended textual responses were analysed using linguistics-based text mining with the R *stringr* and *tm* packages. Qualitative data was transformed into quantitative data to analyse the most frequently cited words. This required cleaning the responses to remove all punctuation, to convert all text to lower case, and to group together the words that were typed differently. For example “dead heading” is considered equal to “deadheading” and “propagation” with “propagating”. The full list of equivalents made and common English words removed is listed in appendix A.3.

6.3 Results and analysis

The demographic information and responses from the 666 respondents is in table 6.1.

Table 6.1: Basic descriptive statistics of questionnaire respondents

	Total	Female	Male	P-value
	N=666	n=572	n=94	
Education				0.086
Lower than GCSE	16 (2.4%)	10 (1.7%)	6 (6.4%)	
GCSE	78 (11.7%)	64 (11.2%)	14 (14.9%)	
A-Levels	69 (10.4%)	57 (10.0%)	12 (12.8%)	
Foundation degree	44 (6.6%)	36 (6.3%)	8 (8.5%)	
Bachelors degree	211 (31.7%)	187 (32.7%)	24 (25.5%)	
Masters degree	145 (21.8%)	130 (22.7%)	15 (16.0%)	
Doctorate	33 (5.0%)	27 (4.7%)	6 (6.4%)	
Other recognised academic or vocational qualification (e.g. teacher training, nursing...)	58 (8.7%)	50 (8.7%)	8 (8.5%)	

Table 6.1: Basic descriptive statistics of questionnaire respondents

No response provided	12 (1.8%)	11 (1.9%)	1 (1.1%)
Income	0.26		
26 000 - 34 999	65 (9.8%)	61 (10.7%)	4 (4.3%)
35 000 - 49 999	83 (12.5%)	70 (12.2%)	13 (13.8%)
50 000 - 70 000	67 (10.1%)	57 (10.0%)	10 (10.6%)
More than 70 000	71 (10.7%)	60 (10.5%)	11 (11.7%)
No response provided	380 (57.1%)	324 (56.6%)	56 (59.6%)
Ethnicity	0.88		
African/Caribbean/Black British	2 (0.3%)	2 (0.3%)	0 (0.0%)
Asian British/ any other Asian background	8 (1.2%)	8 (1.4%)	0 (0.0%)
White British/ any other white background	630 (94.6%)	539 (94.2%)	91 (96.8%)
Mixed/multiple ethnic groups	7 (1.1%)	6 (1.0%)	1 (1.1%)
Other	13 (2.0%)	11 (1.9%)	2 (2.1%)
No response provided	6 (0.9%)	6 (1.0%)	0 (0.0%)
Tenure	0.44		
Resident owner	600 (90.1%)	511 (89.3%)	89 (94.7%)
Tenant	60 (9.0%)	55 (9.6%)	5 (5.3%)
Lodger	2 (0.3%)	2 (0.3%)	0 (0.0%)
No response provided	4 (0.6%)	4 (0.7%)	0 (0.0%)
Status	0.01		
Employed full time	202 (30.3%)	163 (28.5%)	39 (41.5%)
Employed part time	96 (14.4%)	89 (15.6%)	7 (7.4%)
Self-employed	70 (10.5%)	64 (11.2%)	6 (6.4%)
Retired	210 (31.5%)	178 (31.1%)	32 (34.0%)
Student	13 (2.0%)	10 (1.7%)	3 (3.2%)
Unemployed	21 (3.2%)	17 (3.0%)	4 (4.3%)
Other	48 (7.2%)	46 (8.0%)	2 (2.1%)
No response provided	6 (0.9%)	5 (0.9%)	1 (1.1%)

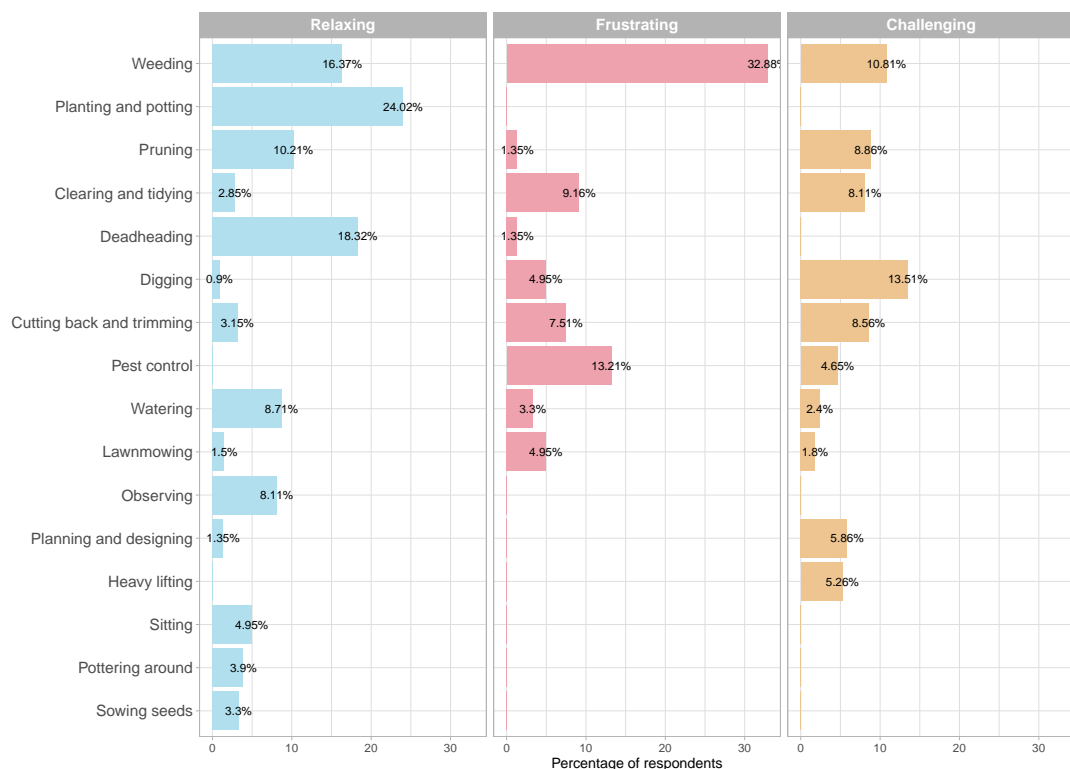
P-values refer to Fisher's exact test for proportions and Wilcoxon rank sum test for continuous values.

6.3.1 Relaxing, frustrating, and challenging garden activities

Questionnaire respondents were asked which gardening activities they found to be the most relaxing, frustrating, and challenging. These questions were intentionally chosen to elicit free-text answers in order to capture the full range of gardening activities that respondents undertake and to avoid prompting by providing choices to choose from. The answers were then analysed quantitatively using linguistics-based text mining.

Acknowledging that emotional responses to activities and events are highly personal, clear patterns do emerge. Gardening activities are strongly associated with a range of emotions. Results indicated that planting, deadheading, and weeding were the most relaxing gardening activities (figure 6.1). Weeding, pest control, and clearing and tidying were the most frustrating activities. Digging, weeding, and pruning were the most challenging activities.

Figure 6.1: Gardening activities associated with relaxing, frustrating, and challenging feelings



The range of activities described as relaxing was larger than frustrating or challenging activities. Each of the different gardening activities involve different types of skills, physical activity, repetition, focus, creativity, and knowledge. In the garden, the connection between pleasure and self-expression is manifested through planting. Drawing on understandings from chapter 5, motivations for gardening, such as the search and creation of beauty, are associated with a sense of well-being and relaxation. Given the finding from chapter 5 that there is an association between spaces for reflection and well-being, it is not surprising that activities such as observing, deadheading, watering, weeding, sitting, and pottering around are some of the most relaxing activities cited. Such activities do enable the gardener to contemplate and enter a highly-focussed state of mind including 'flow', a concept coined by Csikszentmihalyi (1990). Isham et al. (2019) explored the well-being and environmental impacts of flow-inducing leisure activities but did not include gardening in their study.

Weeding is revealed to be an emotionally diverse gardening activity. As well as being relaxing to 16.37% of respondents, it was listed as frustrating by 32.88% of respondents and challenging by 10.81% of respondents. It is easy to understand why weeding, a repetitive and never-ending task, can be frustrating or challenging. Moreover, the connotations of weeds are negative; unwanted plants in the wrong places continually thwarting the gardener's vision and that should be removed (Ginn, 2014; Stelling et al., 2017). As for weeding being a relaxing activity, Diamant and Waterhouse (2010) explain that it provides focus, instant feedback, and affirmation when the target is visibly achieved. It is also a flexible activity in terms of tools and methods, meaning that it is enabling in terms of choice and self-determination (Rebeiro, 2001).

In order to further analyse these results, respondents were divided into 3 age groups: less than 44 years old (157 respondents), 45-64 years old (361 respondents), and older than 65 (144 respondents). Correspondance analysis was conducted on responses from each of these age groups. Beyond providing information on potential age-related differences between age groups, this strategy also allows for replication of the data. It was decided to split the respondents by age group as opposed to gender because there was a gender imbalance in the respondents with more females responding. This is a common phenomenon in survey responses (Sax et al., 2003; Parsons and Manierre, 2014; Keusch, 2015).

A chi-square test of independence was conducted between age group and relaxing gardening activities. There was a statistically significant association between age

group and relaxing activities, $\chi^2(26) = 56.91$, $p < 0.01$. Inspecting the adjusted standardised residuals larger than 2, planting and potting as a relaxing activity was more associated with respondents younger than 44 and deadheading was more associated with respondents older than 45. This explains the rejection of the null hypothesis of independence and shows that other activities were not associated with a particular age group.

Correspondence analysis using a chi-square test of independence was conducted between age group and frustrating gardening activities. There was a statistically significant association between age group and frustrating activities, $\chi^2(24) = 53.76$, $p < 0.01$. Inspecting the adjusted standardised residuals larger than 2, frustration about heavy lifting was more associated with respondents younger than 44. This can explain the rejection of the null hypothesis of independence and shows that other activities were not associated with a particular age group. No respondents older than 45 reported being frustrated by heavy lifting, this could be because they do not do much heavy lifting or receive assistance.

Correspondence analysis using a chi-square test of independence was conducted between age group and challenging gardening activities. There was no statistically significant association between age group and challenging activities, $\chi^2(24) = 29.455$, $p < 0.20$. Across all age groups, gardeners find digging, cutting back and trimming, and weeding as the most challenging gardening activities.

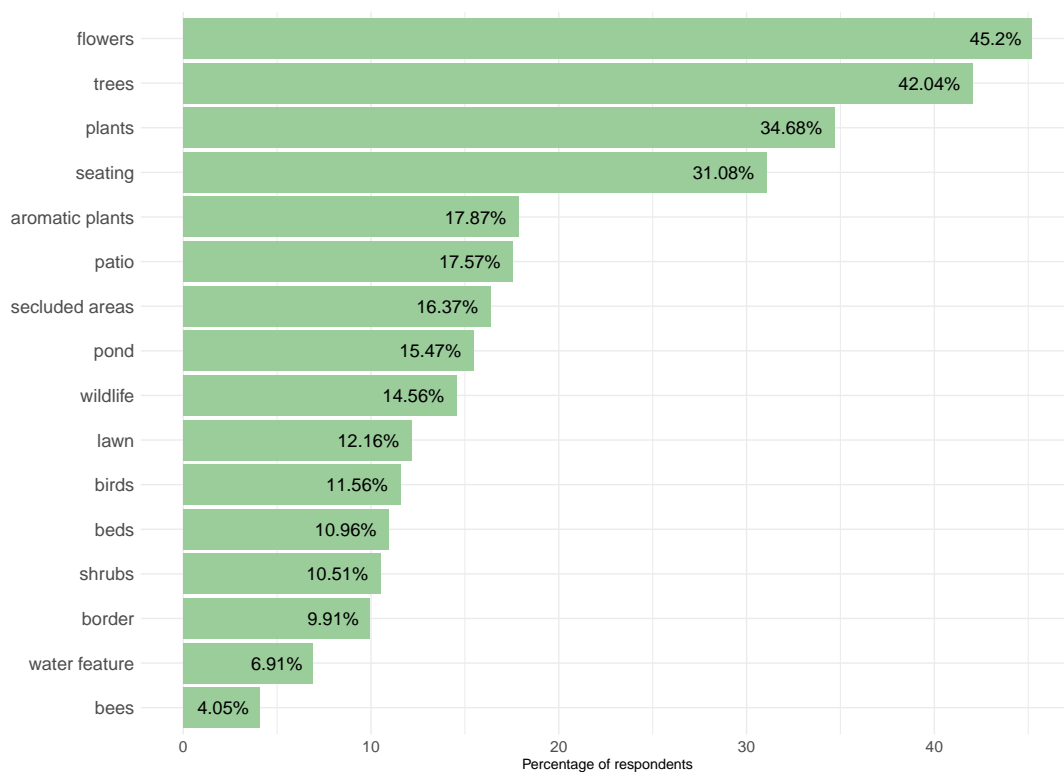
6.3.2 Flowers and trees are the most peaceful aspects of a garden

Respondents reported flowers, trees, plants, and seating to be the most peaceful aspects of their gardens (figure 6.2). Even though they were asked to pick the single most peaceful aspect, sufficient numbers of respondents could not just pick one and instead listed an average of three items. It is not surprising that a collection of features rather than any single one contributes to creating a peaceful atmosphere in a garden. Correspondence analysis using a chi-square test of independence was conducted between age group and peaceful aspects of the garden. There was no statistically significant association between age group and peaceful parts, $\chi^2(30) = 21.89$, $p = 0.858$. Across all age groups, gardeners reported flowers, trees, plants, and seating to be the most peaceful aspects of their garden.

When looking at these results in conjunction with the most relaxing gardening activities, it becomes apparent that relaxing activities such as planting, deadheading, and weeding involve being in close proximity to parts of the garden that are considered peaceful. Interestingly, secluded areas were cited relatively often. This corroborates with theories that healing gardens are marked off from their surroundings (Stigsdotter and Grahn, 2002) with fences, hedges, or trees to create a sense of privacy and confidentiality (Marcus and Sachs, 2013).

In addition to the above psychological elements of a tree or hedge ‘barrier’, both deciduous and evergreen trees are known to remove toxins and particulates from the air through their leaves to provided added health benefits through improved air quality and thermal cooling (Cameron and Blanusa, 2016). In their study on the emotional influences of flowers, Haviland-Jones et al. (2005) found that flowers had immediate and medium-term effects on emotional reactions, mood, social behaviours, and episodic memory. Presenting flowers to participants elicited true (Duchenne) smiles and higher positive moods three days later.

Figure 6.2: Most peaceful aspects of the garden



6.3.3 Gardens are places of emotional refuge

A person's mood and emotions have an impact on their intentions of where they go and what they do there (Russell and Snodgrass, 1987; Korpela, 2003). Favourite natural settings are a resource for coping with perceived stress and regulation negative emotions (Korpela and Ylén, 2007). Indeed, regulating emotions can be a strong motivation for seeking out nature, and these people appear to experience the benefits (Johnsen, 2013).

This section demonstrates that gardens are used as emotionally regulating spaces - whether to improve a bad mood or preserve a good mood. Of the 666 respondents, 481 (72.22%) go to the garden to reflect on or banish negative thoughts after having had a bad day. 319 (47.90%) go to the garden to reflect on or celebrate positive feelings such as after having received good news, and 360 (54.05%) go to the garden to cope with feelings of frustration, anger or to calm down from confrontation. This is not surprising as Korpela (2003) found that people with high negative mood scores were more likely to choose natural places to go to. Natural environments can reduce rumination - thinking associated with negative moods including repetitive and intrusive thoughts (Golding et al., 2018). Being resilient to negative emotions and fostering positive emotions does contribute to better cardiovascular health (Fredrickson et al., 2000; Diener et al., 2017).

Results from the analysis of open-text responses regarding what respondents do when they go to the garden to deal with their negative, positive, and angry emotions show that sitting, pottering and walking, observing, and weeding are popular activities for dealing with negative emotions (figure 6.3). Positive emotions are celebrated by eating or drinking outside, socialising, and sitting. Anger is released by sitting, pottering, weeding, clearing, pruning, deadheading, and digging.

Correspondence analysis using a chi-square test of independence was conducted between age group and gardening activities following negative emotional antecedents. There was no statistically significant association between age group and gardening activities, $\chi^2(26) = 27.06, p = 0.41$. Across all age groups, respondents sit, observe, and weed when dealing with negative triggers.

A chi-square test of independence was conducted between age group and gardening activities following positive emotional antecedents. There was no statistically significant association between age group and gardening activities, $\chi^2(24) = 24.14, p =$

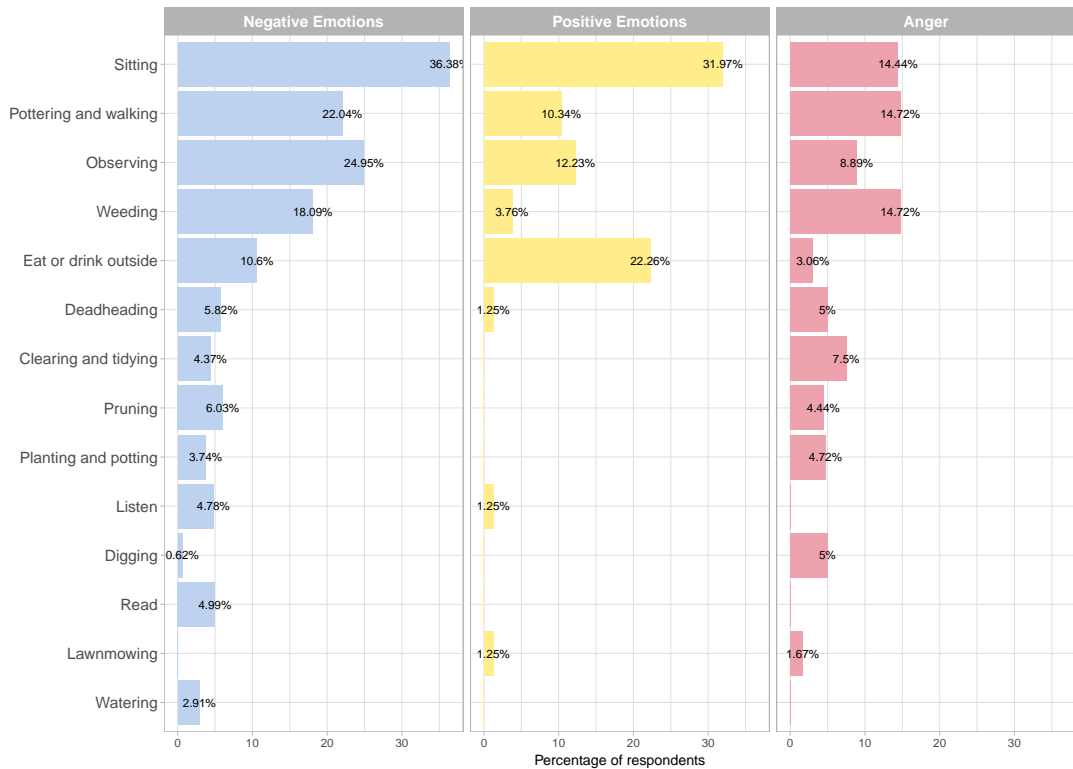
0.45. Across all age groups, respondents sit, eat or drink outside, and observe when processing positive triggers.

A chi-square test of independence was conducted between age group and gardening activities following feelings of anger. There was no statistically significant association between age group and positive celebratory activities, $\chi^2(26) = 19.46$, $p = 0.82$. Across all age groups, respondents sit, potter, weed, clear, prune, deadhead, and dig.

These findings are related to the causal mechanisms of the health impacts of gardens on well-being through Attention Restoration Theory (ART) and Stress Reduction Theory (SRT) to restore negative antecedents (attentional fatigue and stress, respectively) and the physiological changes towards relaxation and the renewal of directed attention involve a mood change (Korpela, 2003). Korpela (2003) found that favourite places afforded people escape from social pressures and the ability to exert more control on their surroundings. The experiential quality of the space rather than the inherent property of the space made it restorative. Gardens are therefore even more likely to be restorative places given that they do have natural features that make them inherently restorative.

The activities that respondents do in their gardens to cope with negative emotions and anger are not the activities that they find the most relaxing (planting, deadheading, and weeding). This might be because planting is something that requires a minimal amount of planning (which plant, where, and when to plant) and deadheading is a seasonal activity. Weeding is a popular garden activity in reaction to negative emotion, likely because it is repetitive, spontaneous, and can be done any length of time at any season. All gardening activities involve some physical activity, that contribute to senses of satisfaction and fulfilment in all age groups including for older adults (Cheng et al., 2010). Adevi and Lieberg (2012) also found that weeding was a remedial activity in horticultural therapy.

Figure 6.3: Most common gardening activities in response to emotional antecedents



Labels refer to the percentage of item citations from respondents who go to the garden in each situation. Totals: 481 for negative emotions, 319 for positive emotions, and 360 for anger.

In their study suggesting that visiting nearby natural favourite places alleviates negative feelings, Korpela and Ylén (2007) call for more research to investigate the association between indices of stress and health and emotional self-regulation through place preference. People do express preferences for places to retreat to when feeling overwhelmed. To test the difference between PSS scores for people who go and do not go to the garden when they are experiencing negative emotions, a non-parametric mann-whitney U-test was used instead of a t-test because of the distribution of the data. The Mann-Whitney U-test showed that there was a significant difference ($W=48168$, $CI [<0.01, 2.99]$, $p = 0.01$) between the PSS scores for the people who do go to the garden compared to the group who do not go to the garden to deal with negative emotions. The median PSS score was 14 for the garden group compared to 15 for those not going to the garden; a difference of 1 point on a scale from 0 to 40. This indicates that people who go to the garden following negative emotional antecedents

are more likely to have lower perceived stress scores than those who do not.

A Mann-Whitney U-test showed that there was a significant difference ($W = 34680$, $CI [-1.67, >-0.01]$, $p < 0.01$) between the well-being scores for the people who do go to the garden compared to the group who do not go to the garden. The median well-being score was 23.21 for the garden group compared to 22.35 for those not going to the garden, a difference of 0.86 on a scale from 7 to 35. This indicates that people who go to the garden following negative emotional antecedents are more likely to have higher mental well-being scores than those who do not.

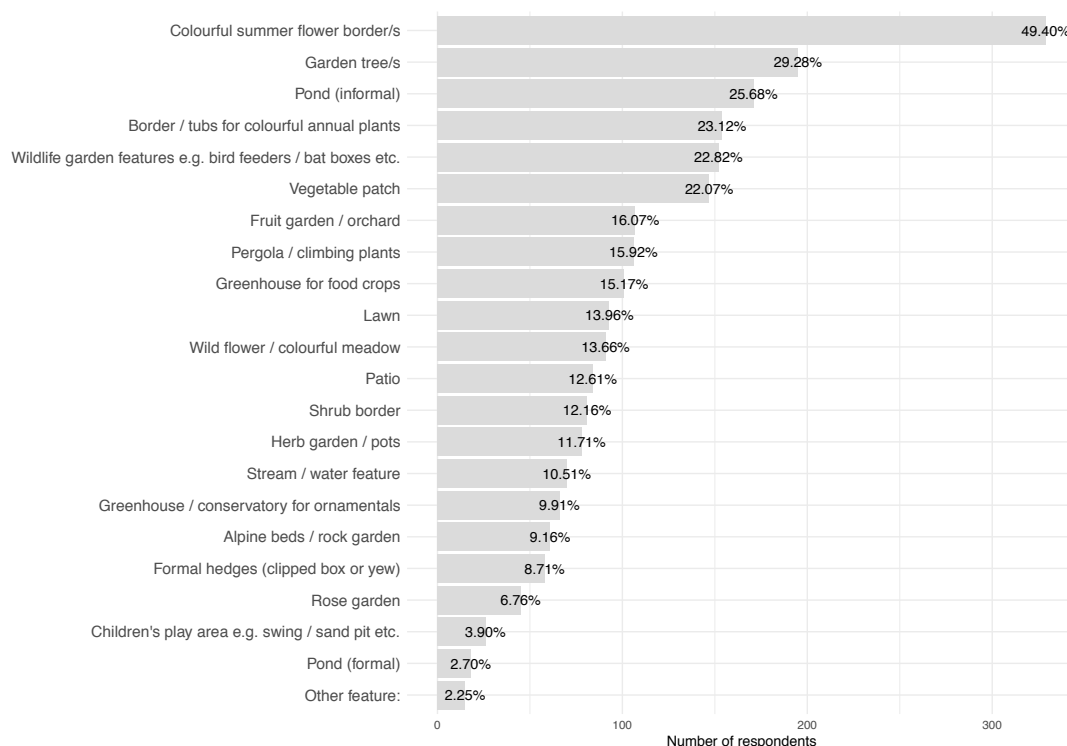
There was no statistically significant difference in perceived stress between those who did and did not go to garden to reflect on or celebrate positive emotions. There was, however a very small difference in mental well-being between those who did and did not go to garden to reflect on or celebrate positive emotions. A Mann-Whitney U-test showed that there was a significant difference ($W = 45960$, $CI [-0.10, >-0.01]$, $p = 0.04$) between the well-being scores for the people who do go to the garden compared to the group who do not go to the garden. The median well-being score was 23.66 for the garden group compared to 23.21 for those not going to the garden, a difference of 0.45. There was no statistically significant difference in perceived stress or mental well-being between those who did and did not go to garden to reflect on or calm down from feelings of anger.

These results show that gardens are places of emotional refuge and can play a key role in enhancing mental well-being and reducing perceived stress, especially at times when people are experiencing negative emotions. Given the dose-response curve developed in chapter 5, it is not surprising that people who garden daily and therefore likely engage in gardening activities in restorative parts of the garden very regularly are likely to cope better with their emotions. Sitting in the garden features highly in all cases and may suggest that having a seat or a place to sit in the garden, that one can walk to or from, with a good view to observe from the seat, may be a design feature that could encourage or foster people going outside to deal with their negative emotions and benefit from the restorative benefits of the garden. Opportunities for reflection, thought, emotional distancing, and creative thought are important for mood regulation by fostering a sense of extent, a crucial aspect of ART (Hammitt, 2000). Emotional regulation may be conscious or automatic, reactionary or anticipatory, and is associated with retreat to favourite, residential, and natural places (Korpela, 2003).

6.3.4 The emotional significance of the most appreciated garden plants and features

Preferences for environments have been strongly associated with their perceived restorative potential (van den Berg et al., 2003; Basu et al., 2018; Menatti et al., 2019). To identify the most desired garden features, participants were asked to imagine a scenario in which they were redesigning their garden from scratch. They were then asked which garden features they would prioritise in the new garden design, assuming that service areas and essential infrastructure such as a driveway or washing lines are already allocated space. Each participant could choose a maximum of three features from a list. Colourful flower borders were prioritised by almost half of the respondents, and garden trees and informal ponds were also highly popular choices (figure 6.4). There was a high appreciation for colour in the garden, as is also noted from the garden photos, which were very colourful. This reflects findings that people prefer compositions of brightly coloured flowers to other vegetation elements (Todorova et al., 2004; Kuper, 2018). Furthermore, Kaplan (2007) found that flowers and large trees were associated with greater levels of satisfaction with the outdoor physical setting.

Figure 6.4: If you were redesigning your garden from scratch, which features would you prioritise?



Correspondence analysis using a chi-square test of independence was conducted between age group and garden features. There was no statistically significant association between age group and garden features, $\chi^2(42) = 42.57$, $p = 0.45$. The only garden feature that was most associated with one age group over others was a children's play area, which was associated with those younger than 44 years old (standardised residual: 3.664). This is to be expected as they are the gardeners most likely to have children. All other garden features were equally prioritised across all age groups.

Favourite plants

Respondents had many favourite plants, most notably trees, roses, and lavender. This open-ended question meant that respondents could describe their favourite plants however they wanted. Reasons most commonly cited were because they were colourful (17.57%), beautiful (13.06%), scented (13.51%), or they attracted bees (6.76%)

and had attractive foliage (5.56%). Responses also provided emotional significance such as the plant being gifted by or in memory of a friend or family member. 589 respondents specifically named 139 unique plants. Table 6.2 highlights the top specifically named plants. All other specifically named plants are listed in appendix A.3. These responses show that gardeners are very emotionally attached to their plants and to specifically named plants. These favourite plants likely provide the soft fascination and compatibility needed for attention restoration according to ART. Some respondents who did not name a favourite plant claimed that it was as impossible as choosing a favourite child.

Table 6.2: What is your favourite plant in the garden?

Plant	Number of respondents	Plant	Number of respondents
Rose	129	Daffodil	12
Lavender	37	Hellebore	11
Clematis	19	Geranium	11
Acer	19	Fuchsia	10
Lily	17	Dahlia	10
Hydrangea	17	Allium	10
Peony	15	Wisteria	9
Apple	15	Salvia	9
Cherry	13	Magnolia	9
Agapanthus	13	Pea	8
Snowdrop	12	Iris	8
Fern	12	Foxglove	8

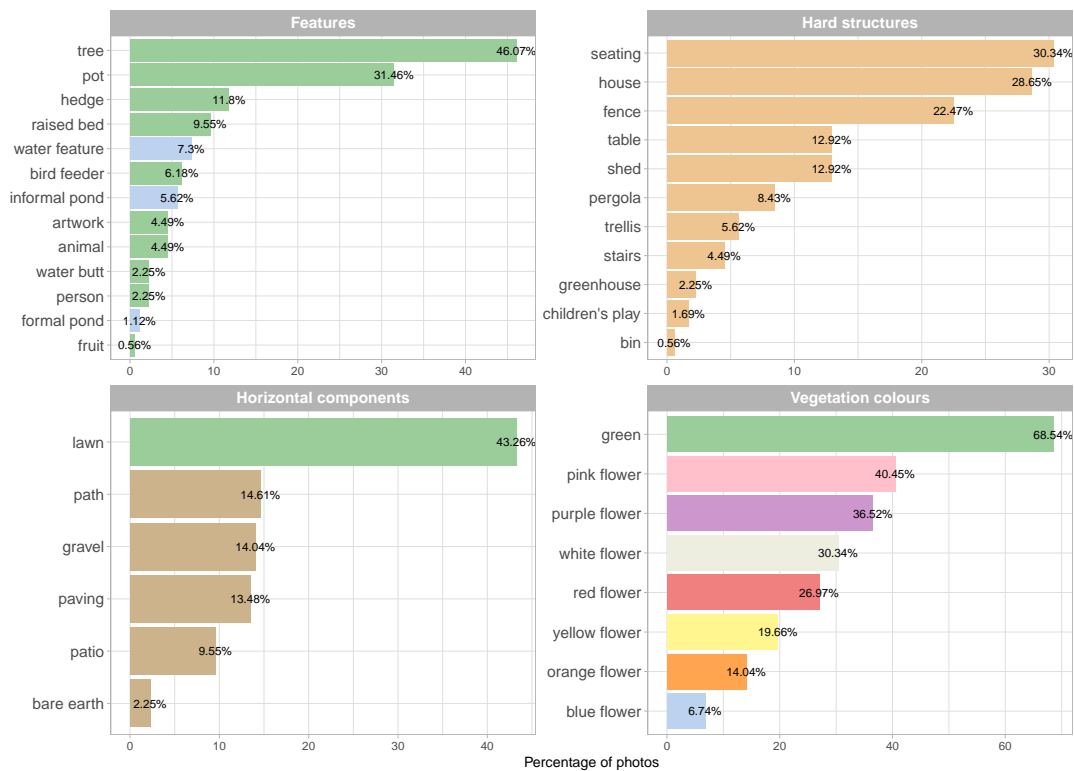
Garden views

Multiple different theories explain landscape preferences as innate or learnt. On one hand, the biophilia hypothesis (Wilson, 1984) says that humans possess an innate affinity for life and lifelike processes, which motivates them to seek contact with animals and plants. On the other hand, evolutionary theories explain landscape preferences as a result of human evolution, with preferences for safer habitats (Orians,

1980), and healthier landscape qualities enhancing survival in early humans (Steg et al., 2012). Prospect-refuge theory (Appleton, 1975, 1988) focusses on role of human as both predator and prey so needing to see without being seen. Views with higher visibility, fewer hiding places, and more accessibility are perceived as less dangerous than other views (Andrews and Gatersleben, 2010). Kaplan and Kaplan (1989) emphasise preferences based on the need for exploration and visual understanding. For example, landscape views can be coherent and allow an immediate understanding of how elements fit together, while the complexity of visual features provide mystery to be further explored. Finally, cultural theories explain landscape preferences for ecological and familiar aesthetics as shaped by social, cultural, personal characteristics (Tuan, 1974; Carlson, 2001; Fry et al., 2009). While landscape preferences have habitually been determined by using researcher-generated images (Jorgensen and Gobster, 2010), this study analyses images provided by participants to capture actual choices (Kendal et al., 2012). Moreover, because prospect-refuge priorities are likely to be different in private gardens as opposed to public parks and woodlands, this study provides a novel insight into garden landscape preferences.

Questionnaire participants were asked to upload a photograph of their garden responding to the question “Which aspect of your garden do you appreciate the most?”. A heterogeneous collection of 178 photographs was thus collected, including views of patio seating, lawn vistas, flower close-ups, children playing, ponds, pets, and colourful borders. Eight examples of photos that were submitted are reproduced in appendix A.3. Content analysis of the 178 photographs revealed the most common features, hard structures, horizontal components, and vegetation colours in the photographs (figure 6.5).

Figure 6.5: Features and colours in most appreciated garden views



Trees were the most popular feature appearing in the photos. Preferences for trees are likely to be explained both by Gibson's concept of affordances (1979), whereby trees offer us more opportunities, and by perceptual fluency theory, which proposes that visually coherent forms are processed more easily and therefore preferred (Joye and van den Berg, 2011; Townsend and Barton, 2018). Water features such as ponds, fountains, streams, and bird baths are often appreciated for their restorative potential, which is in line with findings that water features are perceived to have higher restorative potential (Ulrich et al., 1991; Alvarsson et al., 2010; Gillis and Gatersleben, 2015; Kellert, 2018). Conniff and Craig (2016) further explain that the sound of slow flowing water is a preferred natural sound. On a larger geographical scale, Mears et al. (2019) found that areas of low water cover was associated with higher levels of self-reported poor health. The sounds of birdsong are also associated with high perceptions of restoration (Ratcliffe et al., 2018) so features encouraging the presence of birds may be preferred.

Additionally, lawns were popular features in the photographs. Lawns are often appreciated and are an important part of garden design (van den Berg and van Winsum-

Westra, 2010; Ossola et al., 2019). No doubt this is linked to ideas of a lawn aesthetic and values of civic responsibility and social status (Pollan, 1991; Robbins et al., 2001).

Turning to hard structures, some type of seating features in almost a third of all photographs. It has been established in earlier sections of this chapter that gardeners like seats, that sitting is a relaxing activity in the garden, and that it is considered to be a peaceful part of the garden. Garden chairs and benches are an important feature to fulfil peoples' emotional needs in the garden. Though a bigger garden is associated with better self-reported health (Brindley et al., 2018), the fact that houses and fences are visible from favourite views indicates that it is not necessary to have a vast garden with only natural elements in sight to derive therapeutic benefits from nature. Nearby, urban nature in everyday living environments do restore attention effectively (Kaplan and Kaplan, 1989). The majority of the submitted photographs, however, do not include houses or fences. This can create a restorative aspect by providing a seemingly (if not actually) peaceful secluded refuge or vast sense of extent.

Regarding colour, the submitted photographs indicate that the most appreciated views are overwhelmingly green. There has been image-based research comparing physiological responses to flowering plants of various colours. (Li et al., 2012) showed that people exposed to purple and blue flowers had lower fatigue and anxiety scores compared to people exposed to red and yellow flowers. In agreement with their conclusion that landscape designers and horticulturalists can use plantscape colours for well-being impacts in greenspace, the majority of the photos did also contain colourful flowers in addition to green vegetation. While the colours most popular (pink, purple, and white flowers) with the respondents of this study, do not correspond to the most restorative blues of Li's study, the high popularity of purple is there. Further studies on the impacts of colour are warranted.

6.4 Conclusion

Gardeners relate to their gardens in highly emotional ways that can be associated with specific garden features, plants, and activities. As well as being personal sanctuaries as a whole, private gardens may be made up of specific places or features that

contribute to emotional self-regulation. Across all age groups, people go to gardens, often sitting and weeding, to process antecedent negative emotions. Positive emotions are celebrated in the garden, most commonly by sitting on the patio. Gardeners also go out to their garden to reflect on or calm down from anger. For many, this involves weeding. Indeed, different gardening activities do have a range of emotional impacts. Planting, deadheading, and weeding were reported to be the most relaxing garden activities, while weeding was the most frustrating. Digging and weeding were the most challenging for respondents.

The most peaceful garden features for respondents were flowers, trees, plants, and seating. Trees were regularly reported to be both the most peaceful and the most relaxing aspects of residential gardens. Unsurprisingly, relaxing activities such as planting, deadheading, and weeding involve being in close proximity to parts of the garden that were considered peaceful. Across all age groups, respondents were most likely to prioritise colourful summer flower borders, trees, and informal ponds. There is therefore an association between restorative garden aspects and how people design their gardens through the prioritisation of specific garden features. People include colourful flowers, trees, and seating in their gardens, with borders, flowers, and ponds often being gardeners' favourite parts of the garden. From respondents' photograph submissions, garden views that included greenery were the most appreciated. Other important aspects such as lawns, hedges, water features, and colourful flowers also featured highly. Pink and purple flowers appeared to be the most popular.

Despite these general findings about overall preferences, it remains clear that gardens are a very individual affair, with designs and plant choices reflecting the gardeners' own wider interests, personality, and needs (Kendal et al., 2012). Aesthetic preferences do play an important role in gardeners' emotional relationships with their gardens. People gravitate towards preferred features and plants when they are in their gardens. People who most want to improve their front garden people are also attached to specific favourite plants. By applying this knowledge to garden design, the restorative capacity of residential gardens can be maximised.

Quasi-experimental horticultural intervention in front gardens to reduce stress

7.1 Introduction: aims and hypotheses

This chapter investigates whether introducing plants to paved front gardens improves residents' health and well-being. A quasi-experimental horticultural intervention was designed and carried out alongside pre- and post-intervention questionnaires, interviews, and salivary cortisol sampling. This research aims to evaluate how front garden landscapes influence health and well-being using both quantitative and qualitative methods. The hypotheses for this chapter are the following:

- Introducing plants to paved over front gardens improves resident well-being, lowers stress levels, and provides other cultural ecosystem services for residents.
- People with vegetated front gardens directly link specific health benefits to their interactions with their front gardens but they may also gain health benefits they are not immediately aware of including increased well-being, decreased stress, and a better overall health status.
- Gardening activities in front gardens and greener front gardens in the local neighbourhood encourages social interaction and fosters a sense of community among residents.

The chapter first provides an overview of the city of Salford, where the intervention was conducted, followed by the methodology, results, discussion, and conclusion.

7.2 Setting the scene in Salford

The intervention was carried out in two suburbs of Salford in Greater Manchester, England (approximate grid reference SJ 781999). A historical and current description of Salford establishes the context for the chosen recruitment methods, the typology of the streets, front gardens, and the life circumstances of the participants.

Historically known for textile processing, Salford became an important cotton and silk producer in the 18th century. By the end of the 19th century, it was a major industrial metropolis thanks to the building of the Manchester Ship Canal. Alongside the textile industry, Salford was also a site of extensive coal extraction. Low-quality Victorian terraced housing was built on a large scale to meet the demands of a growing population. This type of high density accommodation housed workers near their cotton mills and collieries (Wallace, 2015).

However, during the Great Depression and the decades following the Second World War, Salford was plunged into significant economic decline. Coal mining had nearly stopped by 1930s, with the last coal mine definitively closed in 1990 (Harper, 1990; Kelly, 2015). Throughout the 20th century, the area experienced chronic poverty and high unemployment to become one of the most deprived and violent areas in the country. The public housing stock and other substandard infrastructures were neglected and poorly maintained (Wallace, 2015). Life in Salford inspired L. S. Lowry, a painter known for his bleak industrial landscapes, as well as the long-standing television soap ‘Coronation Street’, which follows the lives of a tight-knit working class community.

In recent decades, there have been several regeneration projects to attract capital to the Salford Quays area. Famously, the BBC moved to Salford Quays in 2011 and ITV followed suite in 2013 (Schulze Bäing and Wong, 2018). Nonetheless, gentrification remains geographically-limited. In 2015, the Salford local authority area was in the top 25 most deprived local authority districts of 326 local authority areas in England (Department for Communities and Local Government, 2015).

Salford was chosen as the site for this research principally because of the abundance of Victorian terrace houses, with small paved-over (non-vegetated) front gardens). The selected houses are within the 10% most deprived neighbourhoods in the UK (Ministry of Housing Communities & Local Government, 2015) and residents in these wards were predominantly in socio-economic classes 6-8 in the National Statistics Socio-Economic Classification - 6. Semi-routine occupations, 7. Routine occupations, and 8. Never worked and long-term unemployed) (Rose and Pevalin, 2003). Conducting the intervention in archetypical British streets and homes was important to be able to recognisably illustrate that this could be adopted and implemented almost anywhere across the country. Finally, setting the intervention in relatively deprived neighbourhoods is an effort to ensure that the research does not neglect disadvantaged or marginalised populations, while also maximising positive impacts and tangible benefits for the community.

An additional reason for the choice of Salford include Royal Horticultural Society (RHS) institutional priorities as the project sponsor. They are opening a new garden - RHS Bridgewater - in Salford in 2020. There are, therefore, newly established political, social, and professional links in Salford which can facilitate the research project's acceptance, credibility, implementation, and impact.

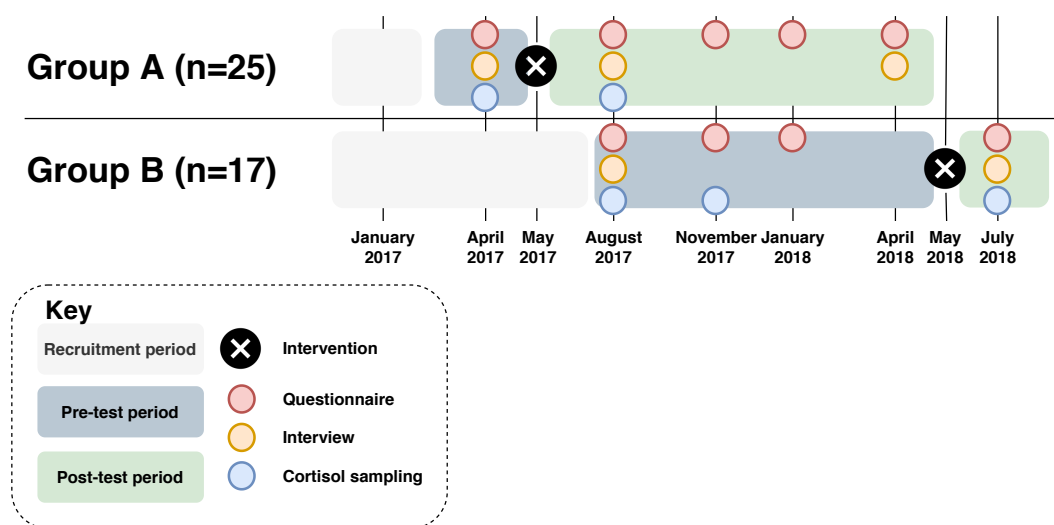
7.3 Methodology

7.3.1 Experimental design

This study evaluates a horticultural intervention that introduced plants to front gardens that were initially paved over. Outcome measures taken include: perceived stress (Perceived Stress Scale, PSS), well-being (Short Warwick and Edinburgh Mental Well-Being Scale, SWEMWBS), diurnal salivary cortisol profiles, connectedness to nature (Connectedness to Nature Scale), sense of community, and other cultural ecosystem services such as creative inspiration, community cohesion, cognitive development, social cohesion, and space for reflection. A baseline on health was measured prior to the intervention and participants were monitored every three months after the intervention for a year.

Residents were recruited based on their willingness to take part in a horticultural intervention that involved placing containers and plants in their front gardens. Based on the location of their home, they were allocated to one of two experiment groups, A and B. The groups were 4 kilometres away from each other to avoid communication between residents in the two groups. The two groups allowed both i. within-group comparison (pre- and post-intervention) and ii. between-group comparisons (control and treatment group over time). Data was collected over an interrupted time-series with multiple post-test measurements (Mark and Reichardt, 2009). Group A received the intervention a year before group B, and as such, group B acted both as a control and then as a replication of A. The complex design follows Reichardt’s (2006) “principle of parallelism” which recommends making comparisons across different groups to better assess the effects of a treatment as opposed to validity threats. The scheduling of recruitment and measurements is detailed in figure 7.1.

Figure 7.1: Schematic timeline of measurements and intervention for both groups of residents.



7.3.2 Recruitment

To identify a long-list of potential streets that could be suitable to receive the intervention, initial contact was made with ForHousing, a housing association and registered provider of social housing in Salford. After site visits to each of these in November 2016, a shortlist of five streets was retained. The main criteria in drafting

the shortlist was that the streets have a) majority paved front gardens, and b) fairly stable populations that are likely to stay over the course of the experiment period (more than one year).

On the researcher's behalf, the housing association disseminated a sounding questionnaire to 15 of their tenants who did not live on either of the shortlisted roads in order to inform how the research should be pitched to potential participants. The sounding questionnaire included a description of the proposed intervention and questions on whether they would take part if approached, what appealed to them most, and what barriers or concerns they might have about participating.

This groundwork informed the drafting of the initial leaflet distributed in a door knocking exercise in early January 2017 to residents living on the first two of the shortlisted streets. To avoid any local area bias, door to door calling was systematised by approaching all houses on the chosen streets. Over ten residents expressed their interest and support for the project. A second letter was posted to residents a week later, including a consent form to be completed and returned if they would like to take part. Three households returned their completed forms. After further rounds of cold calling door-knocking and letter-writing, residents on one street were recruited as the first group to receive the intervention (n=25).

More participants signed up to take part in the second round of the research. The second group were told they would receive the same garden intervention in a year's time after the testing period. They were made aware of the existence of the first group but not told about the geographical locations of the intervention to avoid cross-contamination between groups and to preserve the anonymity of participants. They were also offered a cash alternative of £80.00 as a compensation for their time if they were not interested in receiving a garden. All participants in the second group (n=17) opted for the garden. Had they opted for the financial compensation instead, they would have only served as a control for the first group rather than a replication.

All residences were of terraced (non-detached) housing stock with front gardens varying in size from 3.4 x 1.8 m to 5.1 x 2.2 m. All front gardens were composed of hard, impermeable surfaces with no plants initially growing in them other than weeds. These front gardens were initially being used for bicycle and bin storage, chairs and benches, barbecues, or as dumping grounds for household waste.

7.3.3 Plant selection for the front garden intervention

All participants were offered an upgraded front garden. These re-designed gardens used standard elements, particularly in terms of plant type, form, scale, and colour. Each resident received the same containers, growing media, plants, and growing information, although the layout could vary based on the actual dimensions of individual front gardens or activities therein. For example, access to domestic bins, often situated in front of the property, had to be maintained.

Each front garden was installed with two sturdy self-watering half-barrel containers (diameter: 850mm, depth: 510mm, volume compost: 60L, volume water: 22L, surface area = 0.285 m²). Containers were installed either flush against the house wall or low fence. The containers were of municipal standards and were 'self-watering' with a 22L in-built reservoir of water, which residents were encouraged to fill approximately every two weeks if the weather was dry. Containers were planted by the researcher, and there was no obligation for the resident to be involved with the planting or subsequent management of these. The containers were filled with both ericaceous and non-ericaceous compost (SylvaGrow), Osmocote 12-14 month controlled release fertiliser (Nitrogen, Phosphorus, and Potassium), and one container was mounted with a metal trellis. Residents were also provided with a watering can. Though they were not obliged to garden to take part in the research, residents were encouraged to garden and were given access to horticultural advice from the Royal Horticultural Society Advisory Team. Residents were also provided with an information booklet written in a style accessible to non-gardeners. The information booklet was designed and drafted by an RHS advisor specially for this experiment. A copy of the information booklet is in appendix A.4.

Plants were chosen according to the following criteria: 1) Low maintenance, hardy plants, 2) Appropriate to the climate and weather in Greater Manchester, 3) Aesthetic appeal and bright colours, 4) Familiarity of plants for the participants and the other residents in the community (relatively common garden plants rather than unfamiliar species), 5) Consultation with participants about likes and dislikes of particular plants or garden styles. Plant species and cultivars used in the front gardens are listed in table 7.2. One participant said they did not want any ivy but other participants did not make any requests. All plants were planted in containers, except the two tree taxa, where residents had the option of having these planted in the ground.

Table 7.1: Plant species and cultivars used in each front garden

Plant type	Species / cultivar	Common name
Deciduous tree	<i>Amelanchier canadensis</i> 'Glenn Form'	Serviceberry
Evergreen tree	<i>Juniperus scopulorum</i> 'Blue Arrow'	Rocky Mountain juniper
Shrubs	<i>Rhododendron</i> 'Wombat'	Azalea
Climbers	<i>Clematis</i> 'Jackmanii'	Clematis
	<i>Clematis</i> 'Ville de Lyon'	Clematis
Sub-shrubs	<i>Lavandula angustifolia</i> 'Hidcote'	English lavender
	<i>Rosmarinus officinalis</i> Prostratus Group	Rosemary
Geophytes (bulbs)	<i>Galanthus nivalis f. pleniflorus</i> 'Flore Pleno'	Double snowdrop
	<i>Crocus sativus</i>	Saffron crocus
	<i>Narcissus</i> 'Tête-à-tête'	Daffodil
Bedding plants (annuals)	<i>Viola</i> 'Sorbet Series'	Petunia
	<i>Petunia</i> 'Surfinia Sky Blue'	Viola

The petunias, violas, rosemary, lavender, clematis, snowdrops, daffodils, crocuses were sourced from B&Q. The rocky mountain junipers were sourced from Barchams. The serviceberries were sourced from Frank P Matthews. The azaleas were sourced from Millais Nurseries and Bents Garden Centre.

For illustrative purposes, photographs of some of the front gardens are provided in figure 7.1.

7.3.4 Data collection

Residents were assessed both through quantitative and qualitative methods. Data was collected through semi-structured in-depth interviews, paper questionnaires with closed multiple-choice questions, and salivary cortisol sampling. At a pre-intervention baseline and every three months post-intervention, the researcher contacted the participants to arrange a mutually convenient time for the researcher to come to the participant's home for the interview and questionnaire completion. Participants were provided with the saliva sampling pack to complete sampling in their own time according to the set protocol. Throughout the study period, qualitative data from researcher's field diary included observation of the street, visual notes about changes in other front gardens, informal conversations with passers-by and neighbours were documented.

Data collected included quantitative data on subjective well-being (SWEMWBS) (Tenant et al., 2007), perceived stress (PSS) (Cohen et al., 1983), connectedness to nature scores (Mayer and Frantz, 2004), physical activity levels, socio-economic circumstances, sense of community, neighbourhood perceptions and salivary cortisol concentration (Adam and Kumari, 2009; Roe et al., 2013).

Qualitative data included how residents felt about their lives, well-being, mental and physical health, street, neighbourhood, and community, engagement with nature and gardening, attitudes towards the intervention, motivations for participation in the research, and expectations regarding the outcomes of the intervention. Throughout the study period, additional qualitative data was collected about alterations to gardens (both experimental and otherwise) and based on informal conversations with passers-by and neighbours.

Figure 7.2: Examples of front gardens pre- and post-intervention





f) April 2017

August 2017

March 2018



g) April 2017

August 2017



h) April 2017

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j) April 2017

131 August 2017

Commonly measured in epidemiological studies and stress intervention studies, salivary cortisol concentrations have been robustly linked with psycho-social phenomena and health outcomes, implying clinical relevance (Ryan et al., 2016). Salivary cortisol data was collected following the procedures outlined by Roe et al. (2013). This data allows the modelling of trends and changes in the daily lives of research participants (Schlotz, 2018). In line with best practice guidelines (see Smyth et al., 2013), samples were collected at each assessment period saliva samples by residents, four times a day (3, 6, 9, and 12 hours after waking) for two consecutive days with swabs being inserted into Salivette collection tubes (Smyth et al., 2013). Again, according to best practice guidelines (Smyth et al., 2013), participants were asked to confirm waking time by SMS text on each day as sampling was synchronised to time of awakening rather than clock time. They were subsequently sent SMS text reminders 30 minutes before a sample was due to avoid eating, drinking, or smoking, and when it was time to take the sample. Short delays in sampling are not problematic as changes in cortisol concentrations are not as rapid as during the morning cortisol awakening response (Smyth et al., 2013). Samples were stored in domestic refrigerators for up to 48 hours before collection by the researcher.

7.3.5 Data analysis

Using R statistical package (RStudio 3.4.3), statistical analysis of quantitative data included t-tests, chi-square test, McNemar's test, difference-in-difference estimation, linear modelling, and repeated measures ANOVA for pre- and post-intervention evaluation. Data was tested for standardised predicted values, standardised residuals, and that it met the assumptions of homogeneity of variance and linearity. Transformations were carried out where appropriate to ensure compliance with these assumptions. For example, to correct for the typical positive skew in the cortisol data, data was log-transformed prior to statistical analysis. Longitudinal qualitative data was analysed using interpretative phenomenological analysis with time (pre- and post-intervention) as the main topic of inquiry. To maintain anonymity yet provide context, residents are cited using their gender and age to illustrate the emerging qualitative themes.

Salivary cortisol data

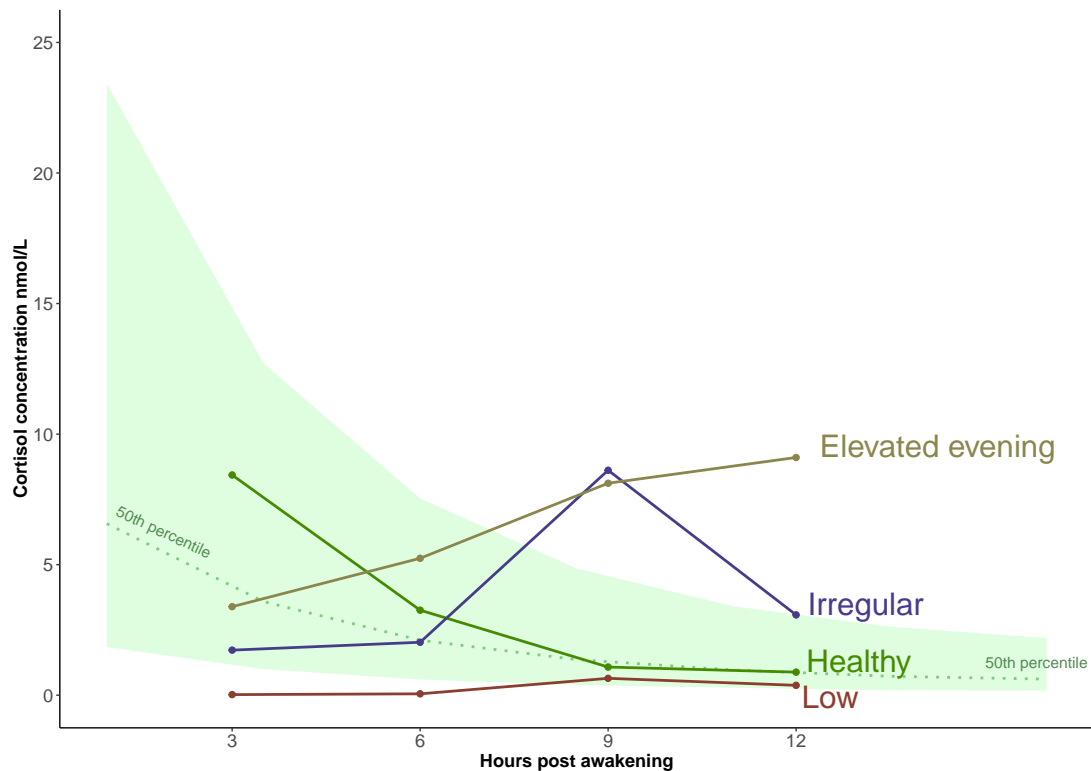
At the laboratory, samples were stored at -20°C until analysis. All samples were assayed in duplicates at the University of Westminster Psychophysiology and Stress Research Group laboratory using standard laboratory protocols. Cortisol concentration was determined by Enzyme Linked Immunosorbent Assay (ELISA) developed by Salimetrics LLC (USA). Assay characteristics: standard range = 0.33-82.77 nmol/L, assay sensitivity = 0.19 nmol/L (lower limit of detection), correlation with serum cortisol = 0.91 ($p < 0.0001$, $n = 47$ samples). After centrifuging thawed samples at 3500 rpm for 10 minutes, duplicate analysis of samples was undertaken. The intra-assay coefficient of variation was $< 10\%$ for all samples. Cortisol samples that indicated possible non-compliance with the sampling schedule were excluded following recommendations by Dmitrieva et al. (2013). These were extremely high values (≥ 60 nmol/L) or samples that demonstrated a rapid increase from the previous value (≥ 10 nmol/L). Four primary outcome measures were calculated as:

1. Daily Average Concentration (DAC) (Gunnar et al., 2001; Nicolson, 2004), calculated as the daily mean of the four samples taken each day.
2. Daily total secretion - Area Under the cortisol Curve with respect to ground level (AUCg), calculated using the trapezoid formula (Pruessner et al., 2003): $\frac{3(6h+3h)}{2} + \frac{3(9h+6h)}{2} + \frac{3(12h+9h)}{2}$, where $3h$, $6h$, $9h$, and $12h$ are the cortisol concentrations at 3, 6, 9, and 12 hours post-awakening.
3. Diurnal cortisol decline (slope profiles of cortisol curves) (Adam and Gunnar, 2001; Adam et al., 2006; Matthews et al., 2006). Slope was calculated as the difference between cortisol concentrations at 12 and 3 hours post-awakening.
4. Proportion of healthy diurnal cortisol profiles. Using discrete cortisol profiles (Ice et al., 2004; Dmitrieva et al., 2013), this assesses the proportion of curves that fit the healthy diurnal cortisol profile.

Cortisol reference ranges were used to determine healthy diurnal cortisol profiles and to compare profiles of the intervention participants with other samples who are healthy and of a similar age. Each resident's raw diurnal cortisol profiles pre- and post-intervention were classified into one of four categories: 1) healthy slope, 2) low

slope, 3) irregular slope, 4) elevated evening slope. Classification was based on percentile reference ranges developed by Miller et al. (2016) as well as following laboratory guidelines (Genova Diagnostics, 2018; ZRT Laboratory, 2018). Changes in the number of samples showing healthy profile were related to pre-/post-intervention times. The four categories are explained and illustrated in figure 7.3, using real examples from participants.

Figure 7.3: Classification of diurnal cortisol profiles



1. **Healthy slope** Peak within first hour of awakening, rapid decline over the morning hours, tapering through the rest of the day and reaching lowest point at night. (Saxbe, 2008)
2. **Low slope** Adrenal fatigue or burnout pattern with overall low cortisol: normal morning cortisol surge is suppressed and diurnal pattern is flattened. General symptoms: chronic stress burden, post-traumatic stress disorder, persistent fatigue, anxiety, depression, predictive of health outcomes such as increased breast cancer mortality, increased coronary calcifications, increased BMI, sugar cravings, and sleep disturbances (Saxbe, 2008; Adam and Kumari, 2009).
3. **Irregular slope** Irregular cortisol, not following the normal pattern. General symptoms: morning and evening fatigue, dips and spikes in energy, anxiety, irritability & impatience, poor concentration, sugar cravings, and low exercise tolerance and poor recovery.
4. **Elevated evening slope** Higher than normal evening and night cortisol production, overall higher than normal cortisol production throughout the day. Appropriate response to a major stressor, perceived insurmountable challenge, or from prolonged stress demands. General symptoms: sugar cravings, feeling tired but alert, insomnia, anxiety, irritability, and low exercise tolerance and poor recovery (Adam and Kumari, 2009).

7.4 Results

After a total of 237 house-approaches, 42 residents took part in the research (response rate of 13.1%). The demographic information and responses of the 42 research participants are in table 7.3. Of the 42 total participants, 21 participants provided cortisol samples. The participants live on nine different roads across different Salford suburbs. Residents had lived in their home for varying lengths of time, from 1 month to 45 years. All 42 residents were offered a front garden re-design, and 38 new gardens (interventions) were completed. Four residents were co-habiting, thus sharing a front garden. 18 residents chose to have a tree planted in the ground (40%). Beyond watering, 14 residents actively engaged with their new gardens, such as deadheading or adding plants (33%).

Table 7.2: Demographic information of the research participants

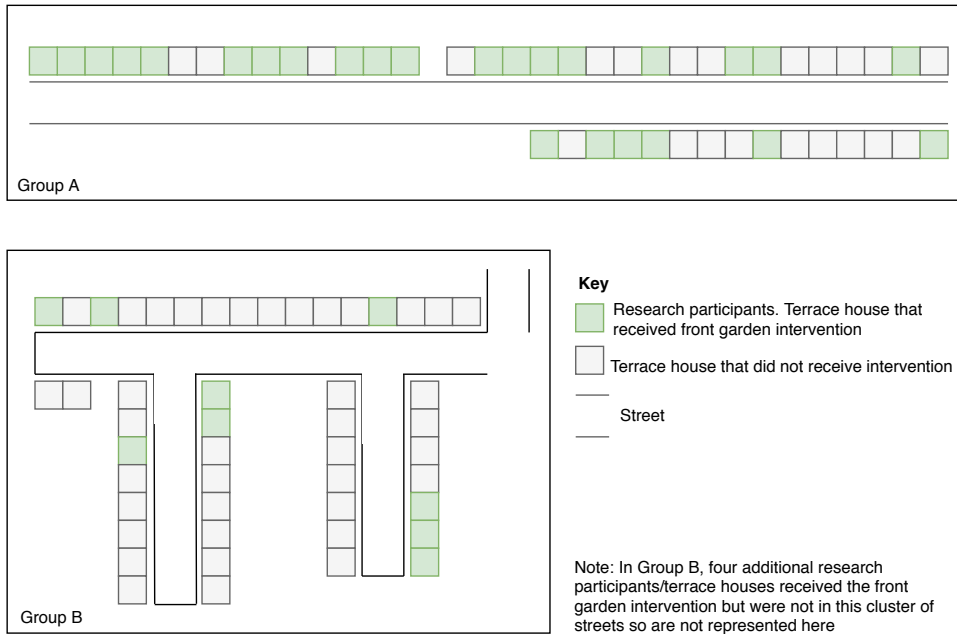
	Total	Group A	Group B	P-value
	N=42	n=25	n=17	
Age				0.70
18 - 24	2 (4.8%)	1 (4.0%)	1 (5.9%)	
25 - 34	7 (16.7%)	6 (24.0%)	1 (5.9%)	
35 - 44	13 (31.0%)	6 (24.0%)	7 (41.2%)	
45 - 54	11 (26.2%)	6 (24.0%)	5 (29.4%)	
55 - 64	6 (14.3%)	4 (16.0%)	2 (11.8%)	
65 - 74	2 (4.8%)	1 (4.0%)	1 (5.9%)	
85 or older	1 (2.4%)	1 (4.0%)	0 (0.0%)	
Ethnicity				1.0
African/Caribbean/ Black British	1 (2.4%)	0 (0.0%)	1 (5.9%)	
Arab British/ Any other Arab background	2 (4.8%)	1 (4.0%)	1 (5.9%)	
White British/ any other white background	39 (92.9%)	24 (96.0%)	15 (88.2%)	
Education				0.71
GCSE	11 (26.2%)	7 (28.0%)	4 (23.5%)	
A-Level	7 (16.7%)	5 (20.0%)	2 (11.8%)	
Foundation degree	4 (9.5%)	2 (8.0%)	2 (11.8%)	

Table 7.2: Demographic information of the research participants

	Total	Group A	Group B	P-value
Other qualifications (e.g. teacher training, nursing...)	6 (14.3%)	3 (12.0%)	3 (17.6%)	
Bachelors degree	3 (7.1%)	1 (4.0%)	2 (11.8%)	
Masters degree	1 (2.4%)	0 (0.0%)	1 (5.9%)	
Doctorate	1 (2.4%)	0 (0.0%)	1 (5.9%)	
No response given	9 (21.4%)	7 (28.0%)	2 (11.8%)	
Net Annual Income (£)				0.18
Less than 15,000	15 (35.7%)	11 (44.0%)	4 (23.5%)	
15,000 - 25,999	10 (23.8%)	4 (16.0%)	6 (35.3%)	
26,000 - 34,999	7 (16.7%)	5 (20.0%)	2 (11.8%)	
More than 70,000	1 (2.4%)	0 (0.0%)	1 (5.9%)	
No response given	9 (21.4%)	5 (20.0%)	4 (23.5%)	
Employment Status				0.75
Employed full time	16 (38.1%)	8 (32.0%)	8 (47.1%)	
Employed part time	12 (28.6%)	7 (28.0%)	5 (29.4%)	
Self-employed	2 (4.8%)	2 (8.0%)	0 (0.0%)	
Retired	5 (11.9%)	3 (12.0%)	2 (11.8%)	
Unemployed	7 (16.7%)	5 (20.0%)	2 (11.8%)	
Tenure				0.015
Resident owner	18 (42.9%)	7 (28.0%)	11 (64.7%)	
Tenant	23 (54.8%)	18 (72.0%)	5 (29.4%)	
Lodger	1 (2.4%)	0 (0.0%)	1 (5.9%)	

To preserve the anonymity of all respondents, the streets and precise locations of the intervention will not be detailed. Figure 7.3 illustrates the relative locations of participating homes on two streets.

Figure 7.4: Schematic map of the relative locations of research participants' houses



A total of 73 barrel planters, 13 *Amelanchier canadensis* 'Glenn Form', and 5 *Juniperus scopulorum* 'Blue Arrow' planted in lifted flagstones meant an increase of around 21 square metres of permeable surface area.

Residents were inconsistent in their responses to requests for questionnaire or cortisol data, as detailed in table 7.3. Due to the complex non-response rates across residents and sampling periods, all of the data were consolidated into two time periods: pre- and post-intervention (as depicted in figure 7.1). The sample sizes for each group are listed in table 7.4. Participants were told not to provide cortisol samples if they were taking steroids or hormonal medication. None of the participants retracted their consent to take part nor asked to be removed from the project but, for various reasons, many did not respond to questions or provide saliva sample at every single time point. The response rates for questionnaire, interview, and saliva sampling for each participant is visualised in an alluvial diagram in appendix A.4.

Table 7.3: Mean outcome measures and sample sizes at each measurement point for both groups of residents.

Time	Group A (n=25)	Group B (n=17)
April 2017	PSS = 17.62 (21)	-
	SWEMWBS = 21.90 (21)	
	Interviews: n = 24	
	DAC = 3.62 (16)	
	AUCg = 18.25 (13)	
	Decline = - 1.95 (14)	
August 2017	PSS = 13.44 (16)	PSS = 16.94 (17)
	SWEMWBS = 22.27 (16)	SWEMWBS = 22.65 (17)
	Interviews: n = 19	Interviews: n = 17
	DAC = 3.55 (8)	DAC = 2.39 (15)
	AUCg = 21.18 (8)	AUCg = 14.46 (14)
	Decline = - 0.4494 (8)	Decline = - 1.51 (14)
November 2017	PSS = 14.60 (5)	PSS = 19.14 (7)
	SWEMWBS = 21.65 (5)	SWEMWBS = 22.10 (7)
	-	DAC = 2.98 (6)
		AUCg = 17.86 (6)
		Decline = - 1.04 (6)
January 2018	PSS = 17.00 (3)	PSS = 16.44 (9)
	SWEMWBS = 21.90 (3)	SWEMWBS = 23.56 (9)
April 2018	PSS = 18.70 (10)	-
	SWEMWBS = 21.72 (10)	
	Interviews: n = 9	
July 2018	-	PSS = 14.21 (14)
		SWEMWBS = 23.07 (14)
		Interviews: n = 15
		DAC = 5.28 (10)
		AUCg = 31.23 (10)
	Decline = - 5.19 (10)	

Table 7.4: Consolidated sample sizes for questionnaires and cortisol evaluations

Complete responses	Questionnaires and Interviews (n=42)		Cortisol (n=31)	
	Pre and Post	Only Pre or Post	Pre and Post	Only Pre or Post
Group A	14	11	8	8
Group B	14	3	8	7
Total	28	14	16	15

Note that pre- and post- periods refer to those shown in figure 7.1.

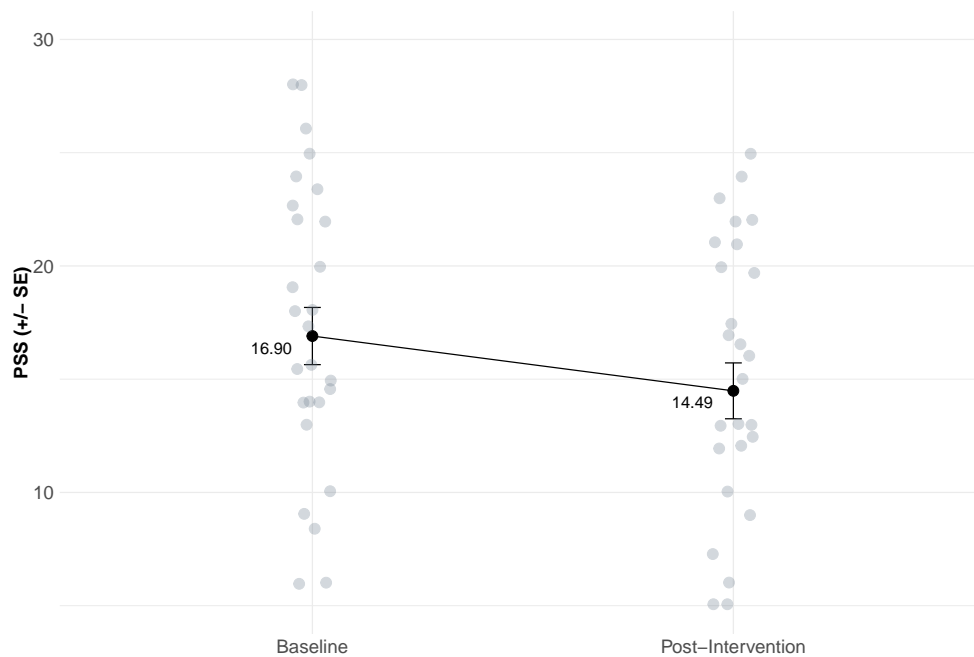
7.4.1 Perceived stress decreased following the intervention

A paired t-test was run on a sample of 28 participants (those in either group with responses both pre- and post-intervention) to determine whether there was a statistically significant mean difference between the baseline perceived stress levels compared to perceived stress levels after the front garden intervention. As shown in figure 7.4, participants had higher perceived stress levels at baseline (16.90 ± 1.26 , SD = 6.68) as opposed to after the intervention (14.49 ± 1.23 , SD = 6.53); a statistically significant decrease of 2.42 units [95% CI, -0.39 to 4.45], $t(27) = -2.4415$, $p < 0.0215$. 2.42 on the PSS scale of 0-40 is 6.05% of a reduction in perceived stress. The assumptions of the paired t-test were met, but even so, due to low numbers of data, a paired randomisation test was also run and the randomisation and the t-test corroborate. Results of the paired randomisation test were mean difference = -2.42 and $p = 0.0220$.

Mental well-being scores and connectedness to nature scores did not show any statistically significant differences between pre- and post-intervention.

The waiting-list design enabled a difference-in-difference regression model to analyse the effect of the intervention for a treatment group (Group A) against a control (Group B) that had not received the horticultural intervention (Mark and Reichardt, 2009). This is done by only using Group B results prior to their intervention a year later than Group A. The difference-in-difference is the interaction term between time (baseline/post-intervention) and treatment group (treatment/control). As shown in figure 7.5, the mean perceived stress score went down in the treatment group by 3.18 points whereas perceived stress has gone up by 4.52 points in the control group. With

Figure 7.5: Mean perceived stress pre and post-intervention in the front garden (n=28)



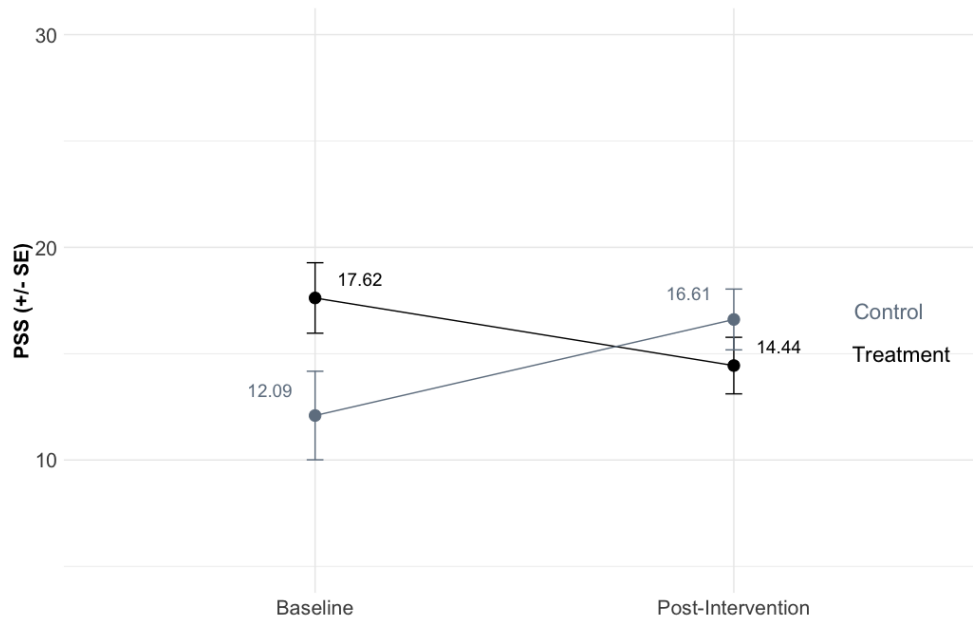
$p = 0.129$ for this difference-in-difference estimation, this result is not statistically significant at the 95% confidence interval. This is likely caused by the small sample sizes of participants with complete data in each group (9 in the treatment group, 14 in the control group). With a larger sample size, it is expected that the trend would be significant. The assumptions of the linear regression model have been met.

This statistical test rests on the assumption that all participants would have had an increase in stress between April and July 2017 of 4.52 points, thereby providing a counterfactual indicating that the intervention mitigated perceived stress by 7.70 points. This remains speculative and cannot be claimed without controlling for personal life events on a larger sample. Possible broad-scale reasons for increases in perceived stress are likely to be linked to the Manchester terrorist bombing in May 2017, and the General Elections in June 2017.

7.4.2 Healthier salivary cortisol diurnal profiles post-intervention

A repeated-measures ANOVA factoring sample day and sample time revealed no significant order effect for day 1 or 2 of sampling using log-transformed values (n=31).

Figure 7.6: The effect of the front garden intervention on participants using differences-in-differences estimation (n=23)



There was a statistically significant main effect of sampling time ($F = 4.39$, $df = 1$, $p < 0.037$), indicating that cortisol means varied across the day. This was a linear decrease over the day. Both results suggested participant adherence to the required sampling protocol (following the exclusion of non-compliant samples as detailed in section 7.3.5) and legitimised averaging cortisol variables (DAC, AUCg, and diurnal decline) across the two sampling days to give the most reliable measures (Roe et al., 2013).

Daily Average Concentration (DAC) - daily cortisol mean

A paired t-test run on the 16 residents with measures both pre- and post-intervention showed a non-significant effect, with pre-intervention concentrations ($3.01 \text{ nmol/L} \pm 0.51$) lower than post-intervention ones (4.51 ± 0.59). This was an increase of 1.51 [95% CI, -0.11 to 3.12], $t(15) = 1.99$, $p = 0.0645$.

Simple linear regression using log-transformed values was carried out to further investigate the relationship between cortisol DAC and pre- or post-intervention sampling.

To interpret coefficients from log transformed dependent variable values, the following formula is used to exponentiate the coefficient: $100(\exp(y) - 1)$. This showed a significant relationship between the pre/post factor and DAC ($t = -2.805$, $p = 0.006$). The DAC increased by 21% from pre- to post-intervention, and the adjusted R^2 value showed that 6.9% of the variation in DAC can be explained by the model, ($p = 0.006$). Participants exhibited very low levels of cortisol throughout the day (< 3 nmol/L) pre-intervention (figure 7.6). Post-intervention, they exhibited higher levels of cortisol, which were closer to reference ranges from healthy participants of similar age and socio-economic status as this sample (Smyth et al., 2019). This is a very small effect.

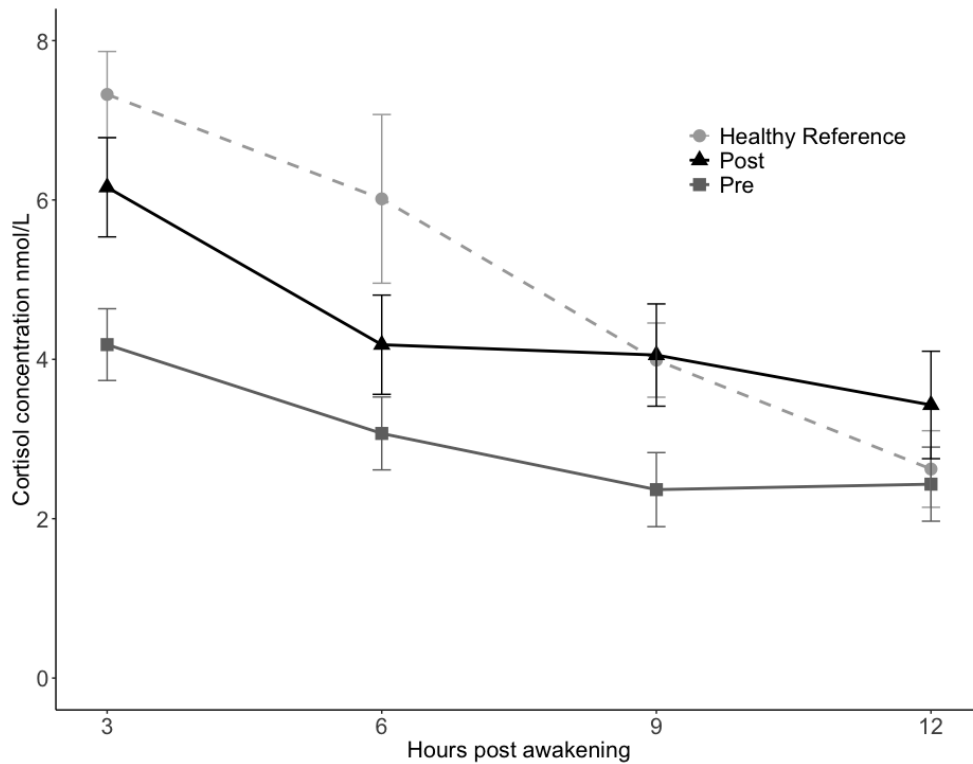
Area Under the Curve with respect to Ground (AUCg) - total cortisol secretion across the day

A paired t-test was also run on data from 14 participants for the Area Under the cortisol Curve with respect to ground levels (AUCg). This showed that residents significantly increased their total secretion post-intervention ($AUCg = 28.37 \pm 3.63$), compared to pre-intervention ($AUCg = 18.60 \pm 2.98$). This was a statistically significant increase of 9.77[95% CI, 0.489 to 19.044], $t(13) = 2.2743$, $p < 0.0405$. A simple linear regression was carried out to investigate the relationship between AUCg and whether samples were taken pre- or post-intervention as a factor. This showed a significant relationship between the pre/post factor and AUCg ($t = -3.488$, $p = 0.0008$). AUCg increased by 10.612 from pre- to post-intervention. The adjusted R^2 value showed that 13.11% of the variation in AUCg can be explained by the model, $p = 0.0008$.

Diurnal cortisol decline (cortisol slope profiles)

A paired t-test was conducted on the diurnal decline (difference between concentrations at 12 and 3 hours post-awakening). This showed that residents had a statistically significant steeper diurnal decline post-intervention (-3.40 ± 1.09) than pre-intervention (-2.52 ± 0.534); $t(12) = -2.34$, $p = 0.038$. Linear regression did not show a statistically significant relationship between the pre/post factor and cortisol decline ($t = -1.79$, $p = 0.078$). A two-way repeated measures ANOVA was conducted to determine the effects of time (pre-or post-intervention) and sample (3 or 12 hours

Figure 7.7: Salivary cortisol concentrations (mean \pm standard error) pre- and post-intervention.



Laboratory reference data from comparable healthy participants included for illustrative purposes; $n=26$, 15 women and 11 men aged 48.6 ± 11.7 years; assayed by the University of Westminster Psychophysiology and Stress Research Group.

post-awakening) on cortisol. There was a statistically significant two-way interaction between the effects of time and sample on cortisol: $F(1, 13) = 5.112$, $p = 0.042$. Pre-intervention cortisol concentration was 4.68 ± 3.25 nmol/L at 3 hours post-awakening and 2.14 ± 2.24 nmol/L at 12 hours post-awakening while post-intervention cortisol was 6.44 ± 3.29 nmol/L at 3 hours post-awakening and 2.21 ± 1.47 nmol/L at 12 hours post-awakening (figure 7.6).

The cortisol decline post-intervention was strongly, negatively correlated with well-being scores. This was statistically significant ($r = -0.67$, $n = 14$, $p = 0.006$). Note that cortisol decline is negative so participants with higher well-being scores had steeper cortisol declines.

The proportion of healthy diurnal cortisol profiles for individual participants increased following the intervention

The relative proportions of diurnal cortisol profiles in a sample of adults can further illustrate trends in the data. The percentage of healthy slopes overall increased from 30% pre-intervention to 53% post-intervention. This increase was statistically significant using a chi-square test of independence ($p = 0.038$). This is comparable to previous findings that 51% (of 48 adults) and 50% (of 109 adults) of their participant samples had healthy diurnal cortisol profiles (Ice et al. 2004; Smyth et al. 1997, respectively).

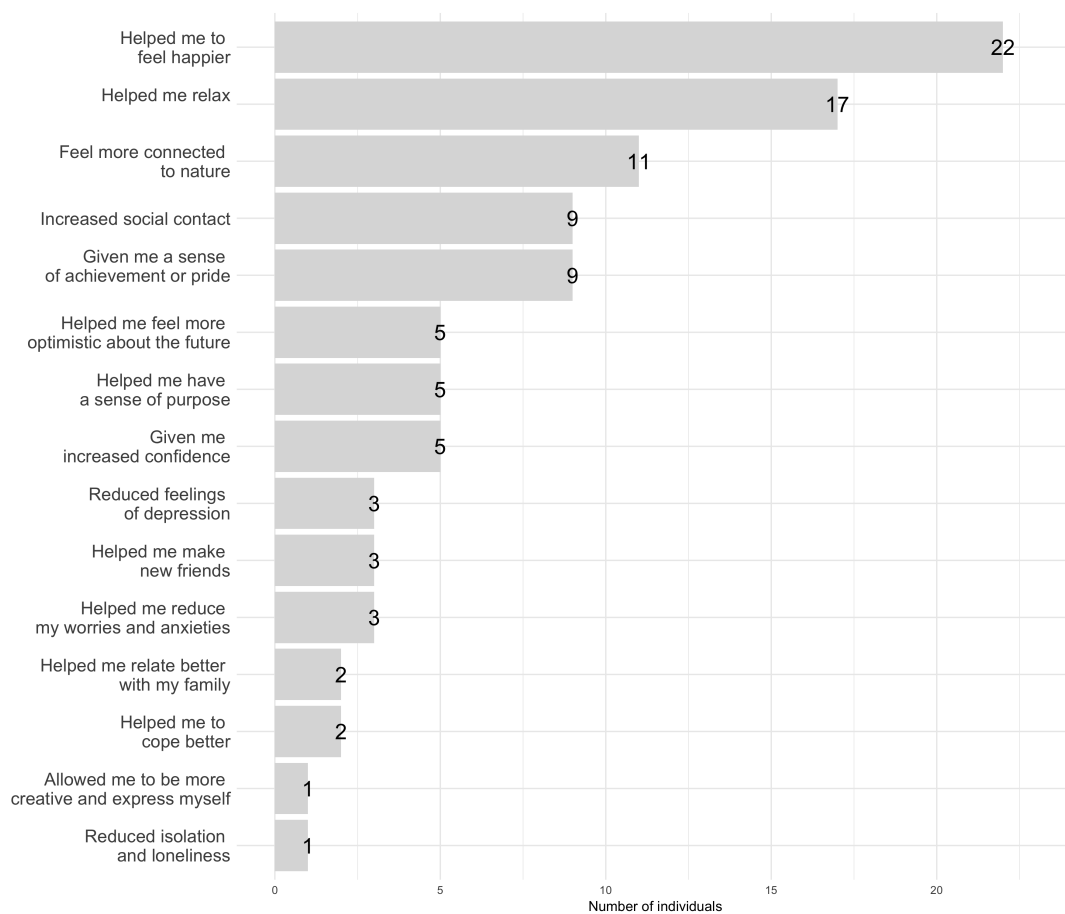
However, of the 31 residents, only 17 residents provided both pre- and post-intervention saliva samples. 13 participants provided samples only pre-intervention and 1 participant provided samples only post-intervention. It was thus ensured that the 14 'drop-outs' were not unhealthier or more stressed than those who completed the full experimental protocol. Using this subset of the population alone, 24% of the diurnal cortisol profiles had healthy slopes pre-intervention, and this rose to 53% post-intervention. An exact McNemar's test with continuity correction determined that the difference in the proportion of healthy slopes pre- and post-intervention was statistically significant, $\chi^2 = 5.56$, $p = 0.018$. In this instance, a McNemars test was used as opposed to the chi-square test of independence because of the within-subjects design of the data.

This change was a consequence of 14 abnormal slopes pre-intervention becoming healthy post-intervention (out of $17 \times 2 = 34$ total samples), but with 4 initially healthy slopes becoming abnormal following the intervention. Potential reasons for their cortisol profiles being irregular after the intervention may include stressful life events or progressive dysfunction (Spiegel and Sephton, 2001). Intriguingly, the latter participants reported decreases in perceived stress (1-2 points on the PSS). Discrepancies between physiological and self-reported subjective stress outcomes are not uncommon (Brant et al., 2010; Karlson et al., 2011; Leininger and Skeel, 2012; Katz et al., 2018). Though it was only possible to collect data over two days of measurements, cortisol profiles are variable across different days (Segerstrom et al., 2017). This highlights self-report biases, the difference between cognitive appraisal of stress and physiological responses to stress, and the potential role of emotional regulation and resilience to stress.

7.4.3 Participants reported other socio-cultural benefits as a result of the intervention

Pre-intervention questionnaires indicated only 13% of residents felt somewhat or extremely happy with their front garden, but this rose to 100% of residents post-intervention. All residents (100%) reported that their health or well-being had improved as a result of the front garden; 22 residents (52%) reported that the garden helped them to feel happier, 17 residents (40%) reported that the garden helped them to relax, and 11 residents (26%) reported that the garden made them feel more connected to nature (Figure 7.8). 3 residents reported that the gardens directly reduced feelings of depression, worry or anxiety. These indicate an improvement in cultural ecosystem services following the intervention.

Figure 7.8: All participants reported that their health or well-being has changed as a result of the front garden (n=42)



7.4.4 Motivation, relaxation, pride, and uplifting emotions: emergent themes from qualitative data

It is important to highlight that all responses were positive and that there were no negative responses to the intervention. Four key themes have emerged from the qualitative interview data to answer the research questions. Introducing plants to paved front gardens has elicited motivation, relaxation, pride, and uplifting emotions for participants. These themes are developed using examples from participants themselves and researcher field notes. Quotations from participant interviews are included to illustrate each theme in relation to the research aims. To maintain anonymity yet provide context, participants are cited using their gender and age.

Motivation

The introduction of plants in participants' front gardens improved motivation to do various things in the garden, in the home, and in participants' personal lives. Firstly, participants had the motivation to plant more in their front and back gardens. One participant who is an amputee described the planters as a starter kit for more planting:

“I wouldn't have been able to [install the planters] myself but I can look after them. When I go shopping I'll go get some more bits. It was beautiful last summer so I'm gonna plant more this summer” - Female, 54.

In the same vein, a stay-at-home mother who recently started shift-work as a cleaner has expressed that the intervention provided the opportunity for her to think about herself and her love for flowers:

“The planters inspired me to buy more flowers and I realised that they are quite cheap. I was going to the market and I've always walked past that man who sells plants and thought I'd get some more. I didn't know what to pick but he told me these [busy lizzies] are good. I didn't have the chance or time or to do things for me. Always for the kids or the house but this is what I like for me.” - Female, 52.

Secondly, the interventions provided participants with the motivation to renovate, repair, or touch up their homes both indoors and outdoors. This included adding seating to front gardens, repainting window sills, new front doors, new wall railings, and improved back gardens. One participant (male, 60) bought a paddling pool for his dog to play in while they both spend time in the front garden, as well as a new table, chairs, parasol, and hanging baskets for the back yard.

Residing on the opposite side the road, a participant with paranoid schizophrenia describes the importance of seeing that positive change is possible for her home:

“It’s the one part of the house that’s nice at the moment so it makes a difference. It definitely makes you want to think about the rest of the house and getting on top of things so I’m having the back garden done next week. It’s started me off, if you get a lift up, it sort of spurs you on. It’s not as hard and more doable than you thought because you see that it can be done at your house. It definitely gets you motivated a bit more”
- Female, 42.

Participants said that the change gave them the energy and push to do things more generally and that it was an encouraging responsibility to have to take care of the plants. This was especially the case for participants with chronic depression and other mental illnesses.

“When I get out the door and I see it, it’s really nice because I hate having a crappy house. It makes me feel a bit more like a normal human being.. like a sort of civilised human. [...] It makes me want to wash the panel which has horrible stains. [...] The thing with depression is that it’s baby steps. I still want to do the house up a little bit. You’ve shown me that it’s relatively doable.” - Female, 51.

There was a knock on effect amongst neighbours who had not signed up to participate in the research study. One resident asked the researcher for the list of plants used and bought them for her own front garden. Another resident laid artificial lawn in his front garden to make it look relatively neater. Other residents bought potted plants for their front gardens, added window boxes, and hanging baskets.

Relaxation

The majority of participants reported that it was relaxing seeing the plants, coming home to them, and watching them grow.

“One of the big things that I’ve noticed, when I come back from work, when all the daffodils have been coming out it’s like a big [sigh/deep breath out] and it kinda switches me into home mode. It’s like a buffer zone between work and home.” - Male, 37.

One participant with paranoid schizophrenia, who was caring both for her ill mother and granddaughter amidst her own relationship problems, explained that it helped her cope when she did not otherwise have time for herself:

“I’ve had a hell of a lot of personal problems... but I’ve been coping by taking one thing at a time, just taking it day by day. I’ve been worrying a lot. I sit out on the step first thing with me coffee. It relaxes me” - Female, 42.

Pride

The introduction of plants in the front garden gave participants a sense of pride in their home that they did not previously have.

“I’ve been complaining to the council lately about people dumping stuff into the alleyways but then when you walk in to the street and you see the nice planters you think ‘Ah it looks good’ and you hope that it will inspire people to look after the street. It makes a difference to the street. [Our neighbours] don’t care about their houses or the street. [...] You don’t want your visitors to think you live in a dump of area, you don’t want them to pity you. It’s nice to come home from work and you see it and it makes you proud of where you’re living and it makes you happy to be living in that house. [...] It gives you pride not just in your own house but in your area. It makes it look like your area has not just been left to rot. ” - Male, 40.

This speaks to findings by Brindley et al. (2019) that there is a positive association between green space cleanliness and self-reported health. One participant who does not know any of his neighbours because “everyone tries to ignore each other here” commented that he felt reassured that other people in his street had signed up to take part in the research experiment:

“It’s nice to know that there are others around who do seem to care. It shows that if you put in a bit of effort, you can care for something for yourself and the street as a community. - Male, 26.

Nonetheless, he was worried that “I’m going to wake up one day and someone will have nicked them because they look good and it’s nice to have them out there. There’s no community spirit here so I wouldn’t have been surprised.”

Many participants noted that the presence of the colourful planters became an indicator of care and a booster to show more care for the home and area.

“It’s remarkable. As soon as there’s anything nice on the street, it gets wrecked. And nothing’s been wrecked. I’ve been here for 14 years and even cat food containers and biscuits go. ... I think there must’ve been some sort of unspoken rule ... I think maybe you’ve touched their hearts a little bit. I think you’ve made a difference” - Female, 51

“I’ve become a street champion because I wrote to the council about the rubbish and the fly-tipping in the area. People don’t care there. Now I’m sort of involved and we’re supposed to be doing a litter pick soon. Nobody knows I’m the street champion though, they’d probably just make fun of me.” - Male, 47

The latter participant, who struggles with isolation because he lives away from his three young sons felt a sense of achievement in keeping plants alive:

“I’d be disappointed if something died, and I’d feel like I’d failed. Otherwise, I don’t have any sort of sense of duty and it’s easy for me to be very lazy and not do anything and it wouldn’t really matter but it is nice to take care of your own garden.” - Male, 47

Finally, the planters improved the sense of pride people have in where they live by becoming a conversation starter between neighbours.

“Turns out the family in [child’s] pre-school live just down the road and we met while admiring the flowers. It’s an opening that wouldn’t be there otherwise. It has been really good just chatting. It’s improved the sense of community because we’ve now got something in common. People are coming out and looking at the plants and chatting to each other. It’s not just teenagers mucking about. It’s giving people a sense of pride in the area.” - Male, 37

Uplifting emotions

All participants reported that the plants made them feel more cheerful, and that they had experienced uplifting emotions when seeing the plants. They talked about better moods in the day as they left the house and in the evenings as they came home. Participants perked up as they saw the first shoots of spring after a long winter. Though experienced by all, this was most acutely appreciated by people struggling with poor mental health.

“It’s lovely. It really cheers me up, honestly. When I look out the back, it’s so horrible, so it’s really nice to have a nice front, I love it. I love nature and I see so little of it. So every time I get out of the house, I get a wave little of pride. It gives me a lift, a little swing in me step. Every time.” - Female, 51.

“Of course it has [changed the street], it brightens it up. I’ve been on here about 34 years. When it blossoms, it’s alright, it brightens the day up. You’re the first person that’s done anything since I’ve been here. [Non-participant resident living opposite] is so jealous of my plants when they’re blooming.” - Male, 60

The importance of the visual impact and colour of the flowers was explained by several participants:

“Aesthetically it does a lot, it adds something to the front of the house that I didn’t think I needed. The outside of the house was probably on the very bottom of our list of things we’d want to do because it’s rented.”
- Male, 26

“It’s just nice to see all the different colours. Otherwise it looks dead bare. It made me feel brighter in me-self” - Female, 86

“In areas like this, the important thing is adding colour. The great big clematis really showed up. The visual impact gives people something that looks nice and it cheers you up a bit and I think it gives people a sense of pride in the area and you hope that it’ll be less likely that people will drop litter. Maybe it’s not so grotty around here after all. That’s de-stressing.” - Female, 62

“I like my front looking nice. It’s the first thing people see when you open your gate. You know when you’re going to a nice house or not cause the front’s the most important thing.” - Female, 55.

One participant, who cannot leave her home unaccompanied was having a particularly bad year due to bereavement, uncertainty surrounding disability reassessments, severe pain, and frequent panic attacks. She explained that because her front and back gardens were the only outdoor spaces she could access on a daily basis, they were extremely important to her:

“I like it out me front now, it’s more appealing. If it’s summer, I see more people. It’s a lot better. - Female, 55

These positive emotions were also shared by participants with people around them, both on social media and in person. One participant who works as a disability minibus driver said that he often told the people using his services about his new plants:

“I talk about it on the minibus, I tell everybody about it.” - Male, 49.

Participants’ home visitors also noticed the changes.

“Everyone says ‘Oh, they’re lovely’. I think it looks better. It’s nicer when you walk down the street than before when there was nothing. It does impact on me and on other people.” - Female, 54

Strongly tying the four themes of motivation, relaxation, pride, and uplifting emotions concludes the thematic analysis of the front garden intervention. One participant expressed all four themes in a way that provides a particularly astute theory of change. Before the intervention, this participant usually felt tired, and could be lethargic for several days at the time. She had many complaints about her street, neighbours, and her local area.

“It was lovely to come home and see it like that and it did brighten it up in me-self. When you walk round the corner and you see it, it makes you feel a bit better. I still don’t like the area but it does make you feel better. It has a big effect on my life.

If you are feeling better in yourself, you want to do more things, you want to try different things. I’ve been wanting to decorate the house, the kids’ bedrooms, get rid of the weeds between the flagstones in the back garden. It is nicer when you come home and you’re not feeling depressed and down, you’re less likely to just stay sitting. For the kids to come home and see that, they really like it. They like growing things.

It is quite relaxing but I never thought I’d say this. I’m quite attached to them now. It sounds weird because they’re only plants but they’re not. They’re mine. And they are living things so you’ve got to look after them. It’s like having a little pet.

I would never have been able to do that me-self. I wouldn’t know where to start, what to buy, what goes with what. It makes me want to do it in the back cause I’ve got more of an idea of what I’m looking at. We can pull some bricks up and have a little garden in the back.” - Female, 37

7.5 Discussion and limitations

7.5.1 Horticultural intervention reduces stress and improves positive emotions

As far as the researcher is aware, this is the first study to evaluate the health benefits of small-scale front gardens. Moreover, the research was relatively innovative in that ornamental landscape plants were used exclusively in an attempt to differentiate responses based on emotion to those of material need (i.e. food). Many previous garden studies indicate food crops were grown, yet the motivations to grow food and non-food plants may be different. The focus here was purely on aesthetic transformations to the front garden. Results of the research support the notion that small-scale ornamental plantings improved residents' mood and self-reported health with respect to perceived stress (figure 7.4). Positive, but subjective, responses to questionnaires were backed up by aggregate measures of salivary cortisol concentrations.

Flatter diurnal cortisol slopes are associated with a wide variety of negative mental and physical health outcomes (Adam et al., 2017). The slope of the diurnal decline of cortisol was steeper post-intervention, indicating a reduction in stress-related dysregulation of circadian and hormonal mechanisms. The proportion of cortisol curves showing a healthy pattern increased significantly (by 29%) after plants were provided to residents. This was mirrored by statistically significant increases in total daily cortisol secretion (AUCg) after the horticultural intervention. AUCg that is too low is associated with chronically low socio-economic status from infancy and poorer health (Desantis et al., 2015). There was also an increase in daily average concentration (DAC) of cortisol, after the intervention. Higher DAC is associated with a higher cortisol awakening response, which in turn has been linked to lower perceived stress (O'Connor et al., 2009). In healthy people, a higher cortisol awakening response activates and provides metabolic resources to help meet the perceived demands of the day (Adam et al., 2006).

Increases in DAC and AUCg indicate that cortisol secretion in participants more closely resembled healthy reference data post-intervention (Smyth et al., 2019). Blunted cortisol levels below reference ranges are linked to depression, post-traumatic stress disorder, suicide attempts, and childhood adversity through the down-regulation

of the hypothalamic-pituitary-adrenal axis after prolonged exposure to chronic stress (Groffen et al., 2015; Keilp et al., 2016; O'Connor et al., 2016; Adam et al., 2017; Bechard, 2017; Koss and Gunnar, 2018). Overall, the increase in the number of cortisol curves with a healthy pattern after the intervention suggests that more residents were experiencing less adrenal fatigue, stress, anxiety, sleep disturbances, or irritability. Indeed, the cortisol decline post-intervention was strongly, negatively correlated with well-being scores.

Positive physiological responses were supported by much stronger positive statements after the horticultural intervention. All 42 residents reported that their health or well-being had changed for the better due to the new front gardens; the gardens were also reported to help residents feel happier (52%), more relaxed (40%) or more connected to nature (26%) (Figure 7.8). Moreover, many of the qualitative personal statements clearly articulated the positive influence the gardens had on peoples' outlook on life, with strong themes developing around more positive attitudes in general, a sense of pride and an enhanced motivation to improve the local environment, as well as the gardens being valued as a place to relax. Comparing the data on perceived stress in this study to others, the positive effects due to the horticultural intervention were approximately equivalent to eight weekly mindfulness sessions (as measured after six months) (Brown and Ryan, 2003; Huang et al., 2015; van Wietmarschen et al., 2018). This could potentially lead to significant savings in public health budgets.

Taken in the round, these datasets support our hypothesis that the horticultural intervention improved residents' well-being and reduced the level of stress residents were experiencing. The planted gardens also induced a variety of positive emotions, with some evidence they promoted cultural ecosystem services, such as a sense of pride in the neighbourhood. Both treatment and control groups experienced interaction with the researcher at the same time, and perceived stress scores decreased in the treatment group while they rose in the control over the same period. This suggests that the positive influence was due to the introduction of the plants and planters, rather than other aspects of the intervention such as gratitude to the researcher for showing an interest in them – which came out as a sub-theme in its own right. For example, *“I think maybe you've touched their hearts a little bit. I think you've made a difference”* - Female, 51.

The positive findings from this study have wide implications for urban planning. As outlined above, there is a trend in urban planning to save space by providing

housing with little or even no garden space (Brook Lyndhurst for DEFRA, 2007). As garden space can account for up to 30% of the total urban area, this has negative consequences for a range of environmental ecosystem services (Cameron and Hitchmough, 2016), but the loss of garden space may also have negative impacts on human health and well-being. Most research on salutogenic aspects of urban green space have focussed on parks (Wolf and Wohlfart, 2014), nature reserves (Adjei and Agyei, 2015) and urban forests (Panagopoulos et al., 2016) and policy makers are beginning to acknowledge the value of such spaces in this respect (Lee et al., 2015). Policymakers and planners should not feel, however, that such places can necessarily directly substitute for gardens and the health benefits they provide.

Private gardens are distinct from other forms of urban green spaces in a number of important ways. They provide an opportunity for citizens to engage with the natural world in an immediately accessible manner, while also being imbued with social and cultural elements. The privacy component alone allows autonomy and opportunities to be creative or reflective in a way that would rarely be feasible in public urban green spaces. Even the social dynamics around domestic gardens may be different from that of communal gardens or allotments, despite the physical activities being very similar. They are also intrinsically linked with the domestic property and can enhance (or if poorly maintained, undermine) the sense of pride that can be aligned with home ownership. One of the principle findings from this research was the capacity for ornamental gardens to provide an immediate, accessible and easily sought place for relaxation. In effect, an important location for some 'down time' and a place to find respite from the stress and strains of urban life. The surprising element, perhaps, was how little green space was actually required to accrue these benefits.

7.5.2 No negative outcomes

Interventions are prone to unintended and negative outcomes. Especially when evaluating psycho-social programmes, it is important not just to focus on intended impacts but also on unintended and negative ones (Balogun and Johnson, 2005). The design of the experiment and its data collection stages did enable such impacts to be investigated and tracked by open-ended questions in interviews both in the short and medium term over the course of the research study. In addition to asking about

anticipated negative effects prior to the intervention, participants were specifically asked for any direct or indirect negative impacts that may have arisen from the intervention.

It speaks a great deal that there was no negative feedback, nor any undesired indirect or direct consequences. Aside from minor comments that the intervention did not change the existing social dynamics on the streets, participants did note that it had an impact on them as individuals. None of the containers, plants, or other accessories were stolen. Nothing was vandalised, no plants died, and nobody was harmed. It is impossible to ascertain why nothing was stolen or vandalised. Participants expressed their surprise about the longevity of the intervention and offered potential explanations including residents' visible sense of ownership and pride, the heavy weight of the containers, the sudden appearance of many containers at the same time indicating a substantial project taking place in the street, and a quickly accepted notion that it was an improvement for the street and area. Some of these reasons suggest that the lack of theft or vandalism is in fact indicative of a broader positive change for the residents and the area.

7.5.3 Results that did not support the main hypotheses

In contrast to the points expressed above, the intervention did not show any significant differences on either mental well-being scores or connectedness to nature scores from the questionnaire. While mental well-being was correlated with post-intervention cortisol declines, the lack of direct relationship between the horticultural intervention and self-reported mental health scores is noteworthy; especially as it somewhat contrasts with the data on perceived and physiological stress, which is also a potential precursor of certain aspects of poor mental health (Toussaint et al., 2016). Although changes in cortisol do suggest longer term impacts, this could be interpreted that the planted gardens are helping to relieve stress in the short- to medium-term, but residents are not feeling they are improving their longer-term mental health issues. This coincides with other studies that indicate that therapeutic gardens and engagement with nature are useful tools to offset day-to-day stress, or provide short-term relief from, for example, mild depression, but are not an antidote to deeper or longer-term mental health problems (Toussaint et al., 2016). Alternat-

ively, the SWEMWBS may not have been the appropriate well-being metric to measure change following this horticultural intervention.

The lack of a significant enhancement in connectedness to nature scores (and perhaps some aspects of mental health evaluations) in this study is interesting. Although on the one hand, gardening, is by definition, working and being in close proximity to nature through the medium of plants (and predominately cultivated forms of plants), it is not necessarily engagement with 'wild nature' *per se*. We saw no strong evidence of residents showing wider engagement with other aspects of urban wildlife, or mentioning taxa other than plants. It is possible that the horticultural intervention was inducing positive affect, but not necessarily just that associated with biophilic responses (Wilson, 1984; Wolf et al., 2017) or biodiversity (Richardson, 2019). Alternatively, it could be that the sample size was too small to detect a statistically significant change in connectedness to nature scores.

Gardens have been linked to an enhanced sense of self-worth through the opportunity for increased creativity, and self-expression (Clayton, 2007). As mentioned above, they can also be a source of pride (Clayton, 2007) or improve a sense of place (Freeman et al., 2012) as this study confirms. These positive aspects of gardens in socio-cultural terms require further investigation.

7.5.4 Limitations

The key limitation was a reduced sample size over time; a common problem in longitudinal studies. Residents did not leave the project (unless they moved house or passed away), but many failed to respond at certain sampling times, mainly due to forgetting to take samples or meet for interviews (despite several reminders). Data was tested to ensure those residents who omitted samples or missed interviews were not atypical of the population in general. For example, residents who dropped out were not correlated with more irregular cortisol profiles than those who finished the evaluation. By participating in the research, all residents showed some enthusiasm for a horticultural intervention in their gardens. Further studies, however, should take care to ensure that later omissions are not in themselves associated with poorer health or greater stress levels. It is recommended that similar studies are conducted with larger sample sizes for higher sample power. When replicated, this experiment

would benefit from having more than one researcher recruiting and interviewing participants. A more concerted, organised recruitment drive or community campaign should recruit more participants, and provide more opportunities for the participants to answer the questionnaires and interviews at different times.

Additional researchers could also have addressed a second limitation of the present study: it was the same researcher who had planted the front garden and interviewed participants pre- and post-intervention. This does mean that the researcher becomes a factor in the experiment and participants may be biased or have a desire to please the researcher by responding in certain ways. This was best addressed by asking participants to try to put aside this fact and to answer as truthfully as possible for a fair evaluation. All participants understood this issue and claimed to not be biased because of it. However, the self-report bias cannot be eliminated, including in the well-being, perceived stress, and connectedness to nature scale ratings.

To date, there is no comprehensive guidance available for the measurement of diurnal cortisol profiles within intervention studies, especially within behavioural and green space interventions (Ryan et al., 2016). The inherent complexity of cortisol profiles and parameters as indicators of stress and health poses challenges for the interpretation of the impacts of the intervention on the different aspects of the hypothalamic-pituitary-adrenal axis function (the central stress response system) (Ryan et al., 2016). This study has been a pioneering proof of concept for the use of salivary cortisol as a physiological biomarker of stress in the context of an urban green space and residential intervention study. The only previously published intervention study the researcher is aware of took participants on a circular walk in an urban park and measured cortisol responses to the Trier Social Stress Test, which artificially presents social threats to participants (Wood et al., 2018).

This study has shown that not only is it possible to recruit compliant participants for longer term cortisol sampling, but has also provided some indication as to an appropriate time frame over which diurnal cortisol profile patterns might change following an intervention (1 week before and 3 months following the intervention). The retention of participants for the course of the follow-up measurements was challenging as only 52% of participants completed samples both pre- and post-intervention.

The horticultural intervention relied on a relatively small volume of new plantings, and was facilitated by both the local housing association and the Royal Horticultural

Society. Questions remain as to the impact of the number of plants used, garden style adopted, and social context (community grassroots initiatives vs. top-down local authority programmes). An agenda for future research will rely on accumulating evidence across multiple designs and the corresponding estimates of effect sizes. This could be tested by expanding the experiment to include various treatments such as: a range of different front garden designs or percentage of greenery, implementation from a grassroots initiative or a top-down council-led programme, housing density of participants in experiment neighbourhoods. Repeat measures could evaluate the longer-term impacts of the intervention, as well as recruiting non-participating neighbours for interviews only in order to understand the impact of the intervention on other residents in the same street.

The quasi-experimental approach in a real-world setting acknowledged the lack of control over certain extraneous variables, including the lack of randomised groups. Factors that were qualitatively taken into account include any other changes in participants' lives or homes, and any significant political, social, or economic events. The differences-in-differences estimation indicated that mean perceived stress score decreased in the treatment group by 3.18, whereas it rose by 4.52 points in the control group (figure 7.5). This statistical test rests on the assumption that all participants would have had an increase in stress between April and July 2017 of 4.52 points, thereby providing a counterfactual indicating that the intervention mitigated perceived stress by 7.70 points. This remains speculative and cannot be claimed without controlling for personal life events on a larger sample. As already mentioned, broad-scale reasons for increases in perceived stress may be associated with the terrorist attack in Manchester and the 2017 General Elections. Many causes of stress could relate to more immediate and personal issues for residents. Stressful life events, such as the death of a family member, serious illness, break-down in family relations etc. (Holmes and Rahe, 1967), were not explicitly controlled for in this small sample, and indeed all 42 residents experienced at least one stressful life event over the course of the experiment. All these events are predicted to raise the odds of susceptibility to stress-induced health problems (Rahe et al., 1970).

Quasi-experiments are established methods in this field (Reichardt, 2006; Colliver and McGaghie, 2008; Sullivan, 2011; Drabble and O'Cathain, 2015), though it is important to strive for randomised controlled trials (RCTs) . In the health and medical fields,

RCTs are the benchmark and gold standard when evaluating evidence of the effectiveness of a drug or treatment (Sackett et al., 1996). While this research and its findings show that there is an important role for non-randomised experiments to play in studies about green spaces and health in applied field settings (Buck, 2016), studies such as by Branas et al. (2018) demonstrate that RCTs are becoming possible given extensive resources.

7.6 Conclusion

This chapter evaluated whether adding small-scale ornamental plants in previously bare front gardens had an impact on residents' health and well-being. The intervention involved placing colourfully-planted containers and monitoring health and well-being outcomes at baseline and over the course of a year following the intervention. Compared to the pre-intervention baseline, introducing plants to front gardens that are currently paved over is associated with a statistically significant reduction in perceived stress levels (2.42 points on the PSS) after the addition of plants in the participants' front gardens. Reductions in perceived stress were further re-enforced by healthier salivary cortisol diurnal profiles (steeper diurnal declines, increased daily average concentration and total secretion from blunted levels pre-intervention) in salivary cortisol concentrations.

Qualitative analysis of interviews with the residents provided an understanding of the psycho-social mechanisms that cause this effect, particularly surrounding themes of motivation, pride, relaxation, and uplifting emotions. These are part and parcel of a sense of belonging and community, and other cultural ecosystem services emerging following the introduction of plants in front gardens previously paved over. Importantly, there was no negative feedback, no undesired indirect or direct consequences.

Thus, this study suggests that even a small amount of vegetated garden space can relieve some of the negative aspects of urban living, and thus that gardens need to be brought more forcefully into the debates around housing, city densification, and the value of different types of green infrastructure. Indeed, the importance of gardens may be radically underestimated, given their potential as a health intervention facility close to the home and, and perhaps in contrast to other forms of public urban green space, through the autonomy they provide to the homeowner.

The practical implications of this research surround the potential for low-cost, small-scale, urban greening to be replicated elsewhere with potentially significant impacts for residents community and individual well-being. This research calls for a more concerted effort into rolling this out at a larger scale and in more areas across Greater Manchester and the UK. It is possible to scale this intervention up as the planters are not location specific and their modular nature can fit in different yard sizes.

Furthermore, this can be packaged as a model or tool to ensure the delivery of high quality urban green infrastructure at planning stages of new developments. For example, the UK-based Building with Nature benchmark (Jerome et al., 2019) calls for urban green infrastructure that is easily accessible and usable at the home, that supports the mitigation of health inequalities, and that fosters community cohesiveness through the distinctiveness of place. Whether in new builds or existing homes, front garden horticultural interventions such as these will go a long way to make streets greener and more human. They create daily opportunities for contact and engagement with nature, as well as their well-documented ecological functions.

Conclusion

The garden is the smallest parcel of the world and then it is the totality of the world.

— Michel Foucault

Michel Foucault encapsulates how small spaces that are part of our everyday lives can also carry much deeper significance than might be assumed based on their size and ordinariness. To date, front gardens have largely been overlooked. The purpose of this research has been to evaluate how front garden landscapes influence health and well-being. Using mixed research methods, this thesis has shown that there is merit in valuing front gardens not only for the ecological ecosystem services but also for their multiple positive psycho-socio-cultural impacts. As demonstrated in earlier chapters, key benefits of the presence of front gardens and gardening in front gardens include: reduced stress, improved mental well-being, feelings of fulfilment, expression of self-identity, stronger community cohesion, increased motivation, uplifting emotions, pride of place, and improved relaxation.

This thesis has made a number of original contributions. Substantively, new knowledge and empirical evidence has been generated to answer the research questions that were developed from a gap in the existing literature on the impact of green spaces on health and well-being. The thesis has spearheaded an understanding of (visually public) private landscapes as therapeutic places. Methodologically, the thesis

has also contributed original and multi-disciplinary approaches to the field of green spaces and health. The quasi-experimental horticultural intervention was a pioneering method to assess the impact of residential gardens on health and well-being. Innovative field methods of saliva sampling and online photo elicitation were trialled in studies that rarely go beyond questionnaires and interviews.

This chapter summarises the key research findings, proposes recommendations for the application of these findings, discusses the limitations of and lessons learnt from the research, and develops a future research agenda.

8.1 Summary of key research findings

This thesis presents the research findings on the six research questions initially posed in section 1.3.

1. What relationships do gardeners have with their front gardens?

Gardeners have strong and layered relationships with their front gardens. As discussed in chapter 4, focus groups with keen gardeners have shown that front gardens are part of people's identity and self-expression, that it allows them to contribute positively to their neighbourhood. They garden for others' pleasure as well as their own, deriving feelings of satisfaction, well-being, and a sense of community. This echoes and builds on previous findings about gardening in back gardens and community allotments (notably Cooper, 2006; Freeman et al., 2012; Gross, 2018). Gardeners relate to their gardens in highly emotional ways that can be associated with specific garden features, plants, and activities. Personal sanctuaries as a whole, private gardens are also made up of specific places or features that may contribute to emotional self-regulation.

2. What are the health benefits of (a) the presence of vegetated front gardens (b) gardening in front gardens?

According to focus groups participants (chapter 4), health benefits of front gardens come from the physical activity of gardening as well as from the fulfilment derived from their presence and visibility. Furthermore, data collected from over 6,000 questionnaire respondents (chapter 5) showed that people

who garden more regularly have a higher well-being score and lower perceived stress score than those who garden less regularly. The monetary worth of social impact per person for people who garden daily as opposed to those who do not garden is estimated to be £1,350.50. The dose-response curve for the impacts of gardening on mental well-being and perceived stress has advanced our knowledge about the health effects of nature. In addition, front gardens have indirect influence on peoples' well-being and stress through their perception of the local area. There is a statistically significant association between perceived stress and the percentage of front garden that is vegetated, area rating, how happy people are with their front garden, how happy people are with their back garden, and number of days per week of physical activity.

3. How does a sense of community and social cohesion emerge from (a) the presence of vegetated front gardens (b) gardening in front gardens?

Discussions with Britain in Bloom gardening groups (chapter 4) have revealed that gardening activities in front gardens is an effective means of building social cohesion and community in a neighbourhood or street. Mechanisms through which this occurs includes informal chatting, knowledge sharing, and making the area more attractive for residents, visitors, and businesses.

4. Do gardeners report higher levels of well-being than non-gardeners?

Gardeners report higher levels of well-being than non-gardeners (chapter 5). In addition, gardeners who garden daily report higher levels of well-being than gardeners who garden two to three times a week. Whether the respondent gardens for professional reasons, for stress relief, to be outdoors, for their own pleasure, for self-expression, or for health reasons, the motivation for gardening does not make a difference to their health and well-being outcomes. Gardeners facing health barriers also experience health benefits from gardening. Everyday experiences of nature have a positive impact on well-being and a negative impact on perceived stress.

5. Are certain garden features more conducive to positive emotions and higher well-being than others?

The most peaceful garden features for respondents were flowers, trees, plants, and seating (chapter 6). Trees were regularly reported to be both the most

peaceful and the most relaxing aspects of residential gardens. Unsurprisingly, relaxing activities such as planting, deadheading, and weeding involve being in close proximity to parts of the garden that were considered peaceful. Across all age groups, respondents were most likely to prioritise colourful summer flower borders, trees, and informal ponds. There is therefore an association between restorative garden aspects and how people design their gardens through the prioritisation of specific garden features. People include colourful flowers, trees, and seating in their gardens. Borders, flowers, and ponds are often gardeners' favourite parts of the garden. From respondents' photograph submissions, garden views that included greenery were the most appreciated. Other important aspects such as lawns, hedges, water features, and colourful flowers also featured highly. Pink and purple flowers appeared to be the most popular colours.

Garden designs and plant choices reflected the gardeners' own wider interests, personality, and needs. Aesthetic preferences play an important role in gardeners' emotional relationships with their gardens. People gravitate towards preferred features and plants when they are in their gardens.

6. Does introducing plants to front gardens that are currently paved over improve well-being and other cultural ecosystem services for residents?

The study in chapter 7 was the first to evaluate the well-being effects of a horticultural intervention in front gardens in deprived urban communities. Compared to a pre-intervention baseline, introducing plants to front gardens that were initially paved over was associated with a statistically significant reduction in perceived stress levels. Reductions in perceived stress were further re-enforced by healthier salivary cortisol diurnal profiles (steeper diurnal declines, increased daily average concentration and total secretion from blunted levels pre-intervention). Qualitative analysis of interviews with the residents provided an understanding of the psycho-social mechanisms behind this, particularly surrounding themes of motivation, pride in the home and area, relaxation, and uplifting emotions. These are part and parcel of a sense of belonging and community, and other cultural ecosystem services emerging following the introduction of plants in front gardens previously paved over. There was no negative feedback, no undesired indirect or direct consequences.

8.2 Implications and recommendations

From the above findings, there are compelling and actionable implications for policy-makers, practitioners, funding boards, and the general public. The ecological and environmental benefits of front gardens are well-known. Plants and trees intercept intense precipitation and slow runoff (Verbeeck et al., 2013). Unlike hard surfaces, the soil in gardens naturally absorbs rainwater, reducing the pressure on urban drains and, therefore, also minimising the risk of flash flooding (Alexander, 2006). Vegetation also helps to cool the air, lowering temperatures caused by urban heat waves (Ward and Grimmond, 2017). Trees and hedges can bring energy consumption and heating costs down in winter by providing shelter and insulation (Taylor, 2012; Blanus et al., 2019). Finally, domestic gardens of all sizes support a substantial range of wildlife (Davies et al., 2009; Doody et al., 2010). This ecological role will become even more important in the future as the climate changes towards more frequent yet irregular temperature and precipitation extremes (Webster et al., 2017). This thesis has shown that front gardens are also salutogenic places which can improve health. Front gardens provide a range of cultural ecosystem services and a positive impact on human health and well-being.

As current climate and urbanisation trends continue both globally and in the UK, challenges will come not only from altered distributions of pathogens (temperature extremes, allergies, animal-borne diseases, etc.) (McMichael, 2018) but also from fewer salutogenic places (Stott et al., 2015; Lee et al., 2017; Sarkar et al., 2018). While lifestyle decisions taken on the scale of the household have important effects (Gatersleben et al., 2010), continued and galvanised integrated thinking between the environmental green space and health sectors is necessary (Beatley, 2017a).

Conclusions drawn from the findings of this research project have implications for fields of horticulture, landscape architecture, urban planning, and public health. Six recommendations are proposed suggesting ways in which policy-makers, decision-makers, and funding bodies can begin to integrate the value of front gardens in their work, particularly when dealing with front garden paving regulations, future housing developments, and streetscape greenery, amongst others.

1. Create more opportunities for front gardens and greener streets

This thesis supports the social case for more street-facing gardens and green spaces (Oldroyd et al., 2011; Clements et al., 2013; Fields in Trust, 2018). Biophilic building standards (International Well Building Institute, 2019), housing standards (What Works Centre for Wellbeing, 2016), environmentally-focussed urban strategies (USDA Forest Service, 2009), and liveable/walkable street initiatives (IDGO, 2012; Living Streets, 2018) could be a significant way of achieving this. Importantly for landscape architects and other professionals working with designed green spaces, there is scope for considerable impact on human perceptions, health, and well-being (Beatley, 2011, 2017b).

2. Gardening and greening initiatives targeted specifically at people who would not otherwise begin to garden

Outreach programmes, initiatives, or schemes to encourage gardening or exposure to plants should be designed equitably to include people who would not otherwise have this opportunity. This could include people who are disabled, unemployed, socially isolated, in poor physical or mental health, or otherwise marginalised (Mitchell and Popham, 2008; Boyd et al., 2018). People who fall in these categories stand to gain significantly from being exposed to plants in their front gardens, homes, and daily living spaces (Mitchell et al., 2018). Common barriers that make it difficult to set up a front garden include: (perceived) cost, physical inability to plant despite capacity to maintain the plants, (perceived) lack of horticultural knowledge, (perceived) lack of 'design' inspiration, and (perceived) lack of time. These are all real barriers but can be overcome with small-scale funding, physical assistance, and effective guidance. This could be achieved in a variety of ways through outreach from established gardening groups such as Britain in Bloom, by setting up mentor networks, through public funding schemes, horticultural therapy organisations, or by businesses aligned with the above mission.

3. Limits on paving over front gardens

A deeper understanding of the multitude of health benefits front gardens can provide compelling arguments for urban area authorities to discourage hard surfacing and paving over of front gardens. Whether through requiring planning permissions, recurring charges for dropped kerbs, lower fees for on-road resident parking, or other appropriate mechanisms, residents should not be en-

couraged to easily increase impermeable surface areas in their gardens. When regulating on new residential developments, vegetated and permeable front gardens should be favoured.

4. Increased visibility and inspiration for low-maintenance permeable front garden planting designs

The need for off-road parking and the desire for low-maintenance front gardens particularly in the rental sector means that it is often more appealing to pave over the front garden. There are, however, simple and practical possibilities for low-maintenance, permeable front gardens that allow for parking and bin storage. Local and national campaigns to increase the visibility of front gardens with hardy, attractive plants and trees requiring achievable maintenance regimes for non-gardeners are welcomed. Container planting is likely to be more accessible and realistic for many people who live in homes with already paved front gardens. These ideas of viable and attractive alternatives could be signposted by local planning authorities when residents submit applications to pave over their front garden.

5. Encourage daily exposure to gardening

According to the dose-response curve for gardening developed in chapter 5, people who garden more regularly have higher mental well-being and lower perceived stress than those who garden less regularly. There are statistically significant thresholds for maximum health benefits at the daily and two to three times a week marks. This can be suggested to private individuals, housing providers, developers, employers, public green spaces, health and social care workers, policy-makers and funders, schools, and universities. While it is unrealistic to expect most people to garden everyday, the current recommendations focus not on individual behaviour change but on creating a facilitating environment with more exposure to gardens and opportunities to garden.

6. Gardening as therapy

Though the research questions were concerning the health benefits of private front garden and gardening as a personal activity (everyday settings and everyday stressors), the findings do also provide strong support for the use of gardening or horticulture as a basis for health interventions and associated

support mechanisms. This reinforces the successes of horticultural therapy programmes and is aligned with the growing momentum for green or nature-based social prescriptions for people with mental health illnesses (Okuizumi et al., 2014; Noone et al., 2017; Masel et al., 2017; Oh et al., 2018).

8.3 Limitations and lessons learnt

This section reflects on the overarching limitations of this thesis, particularly with the objective of informing future research endeavours. All findings must be situated in the particular place, at the particular time, and under the particular circumstances in which the study was carried out.

A limitation of the subjective well-being and perceived stress scores is that they are self-reported. This means that there is scope for bias in the responses. Nonetheless, self-reporting of perceived health is an accepted method in the social sciences, acknowledging that people's perception of their own mental and physical health is indicative and as important as their physiological health state (Keniger et al., 2013; Diener et al., 2009b; Mezuk and Eaton, 2010). In the statistical analyses and regressions, there was a lack of control for a whole host of confounding variables and all other life events or situations that would influence perceived stress and well-being. Demographic information could control for some variables but it was not possible to control for everything, especially when dealing with smaller sample sizes for the intervention study.

One conspicuous drawback of the research study is that the role of ethnicity was not identified or interpreted in any meaningful way. Indeed, there was very low ethnic diversity in the research participants, who were nearly all white British. This was not due to any barriers preventing non-white people from participating in the research but because the areas sampled were places where local residents were predominantly white and the online methods of questionnaire distribution through the RHS membership mainly reached a white audience. Future research should take this into account and make more effort to recruit participants from different ethnicities. This is particularly important as front gardens have been used as a vehicle for social exclusion and discrimination in neighbourhood politics via local ordinances and housing policies (Grampp, 2008).

The second noteworthy lesson learnt is that a mixed-method approach collecting heterogeneous types of data does not necessarily corroborate. Triangulation is a laudable goal but it need not be the only acceptable outcome. For example, interview responses did not always match questionnaire tick-boxes. Research questions investigated with different methods may lead to different answers and each should be evaluated on the basis of individual rigour as well as in concert with each other. While there were no outright contradictions uncovered throughout the thesis, mixed methods can reconcile diversity (Tashakkori and Teddlie, 2009) as human behaviour and understanding is influenced by a plethora of factors beyond the scope of health and well-being.

8.4 Future research agenda

Outstanding issues that arose from the research process and findings have guided the development of a future agenda for this field of research. An important line of inquiry would be to consider different types of plants, colours, planting structures, and other garden features (Ossola et al., 2019). Given the psychological impacts of colour (Haviland-Jones et al., 2005; Thorpert et al., 2019), aesthetic preferences (van den Berg and van Winsum-Westra, 2010; Kurz and Baudains, 2012; Hoyle et al., 2017; Gross, 2018), and the links between higher biodiversity and well-being (Dallimer et al., 2012), there are countless factors to be explored in terms of their impacts on human health and well-being. Whether this be based on observational or intervention studies, there is a large scope for further research on the typologies of front gardens that lead to improved well-being outcomes for different psychological needs. Taking such research forward would benefit greatly from engaging sufficient numbers of participants to allow for experimentation and randomised trials.

This thesis has also provided a starting point for further theoretical development in terms of hedonic (subjective) and eudaimonic (psychological) well-being. Future framings could allow for comment on possible distinctions between pleasure attainment, pain avoidance, and self-realisation in the gardening context. This scope would encompass emotional regulation and sense of community, as discussed throughout the present thesis. Impacts could be measured for different groups of people in terms of their relationship to the front garden (gardeners as opposed to garden users and passers-by).

Further investigation into the causal mechanisms of the health impact of front gardens would be well-situated within the rapidly growing body of literature on the human microbiome. Direct and regular exposure to nature has been linked to a higher diversity of microbial diversity (Grönroos et al., 2019; Pearson et al., 2019). This has been associated with reduced rates of pediatric allergies (Rook et al., 2015; Horwitz and Parkes, 2019) and healthier immune systems (Rook, 2013; Aerts et al., 2018). Indeed, Flies et al. (2018) find evidence that urban green spaces contribute positively to human health through biodiverse microbial environments. The authors push for a systematic and global healthy urban microbiome initiative to mitigate against the adverse effects of the lack of engagement with natural environments. Thinking more broadly to the so-called exposome - everything an individual has been exposed to from conception to death, this is recognised to have an impact on health, including through the socio-economic environment, lifestyle, occupation, pollutants, and nutrition. The emergence of the study of the exposome outside the field of microbiology and into public health (Kim and Hong, 2017) provides further context to the inclusion of front gardens in the larger interdisciplinary context of planetary and human health (Logan et al., 2018). Planetary health requires fully aligning health and environmental interests and potentials (Nelson et al., 2019). In parallel, minimising adversity and maximising buffers begins at local scales.

There is potential to examine the commercial viability of a low-maintenance, aesthetically-pleasing, and low-cost front garden product bundle. Conceived as a modular package of hand-picked plants, containers, compost, and relevant accessories, the product could be sold as a front garden starter kit. The combination could be targeted to private individuals as well as to local housing providers, city councils, affordable housing developers, or community organisations accompanied by calculations on social return on investment.

In addition, there should be a real consideration to examine factors that lead to varying extents of community cohesion in different communities. Both in the UK and internationally, the range of streetscape typologies and resident demographics means that front gardens can take on greater significance in certain areas than in others. Research conducted in different neighbourhoods, cities, and countries have their own specificities and are embedded in unique socio-political contexts. If replicating a horticultural intervention, programmes led by local authorities, grassroots initiatives, schools, gardening clubs, private businesses, or utilities companies could have an

effect on engagement levels, perceptions of the scheme, and funding availability (Jorgensen, 2017). Future research studies in different localities would benefit from using the conceptual frameworks developed in the present study to compare findings from different contexts.

Moreover, distinguishing impacts for people who are in good health from those in poor mental or physical health would provide a deeper understanding of the impacts of front gardens on health and well-being. Results could inform horticultural therapists as well as other frontline health and social care providers on best practice and effective investments. Related lines of inquiry could prioritise investigations into reducing social isolation or other specific socio-medical concerns. Further considerations include how front gardens can impact health and well-being for people at different ages. Longer-term longitudinal research can be poised to capture the dynamic relationship between people and their front gardens across childhood, adolescence, adulthood, and older age, as well as through specific times of change and transition. Such research could use concepts such as neighbourhood walkability as vehicles to study front gardens in the context of the public street.

Finally, landscape research needs to engage with social and environmental justice (Jorgensen, 2016). As the societal and health issues of our time, it is important that any research agenda address the health equity debate. People with lower socio-economic status, people living in deprived urban communities, and people with disabilities are likely to have poorer access to a front garden, let alone the resources to plant and maintain one. Ethnicity and other cultural relationships can also be explored through the front garden, for example how gardening can facilitate place-belonging for migrants and displaced people.

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Interview schedules and questionnaires

A.1 Chapter 4 - Focus groups

Focus group introductory remarks

Hello, my name is Lauriane. I am a PhD student at the University of Sheffield and this research is funded by the RHS.

First of all, thank you for being here today. You may or may not have led or participated in a focus group before so I will go through how this is going to work. The way this afternoon is going to run is that first you will read the information sheets, sign the consent forms and answer the short demographic questionnaire that I have handed to you. In half an hour's time we'll start the focus group, which should take about an hour and a half so that we're out of the room by 4.30pm. The aim is that I will lead you through on open discussion. My goal is to ensure you feel comfortable to speak spontaneously, and to generate a maximum number of ideas and opinions from all of you.

Our time will be structured around a set of predetermined questions but the discussion will be free-flowing. Ideally your comments will stimulate and influence the thinking of sharing of others. Some of you may even find yourselves changing your thoughts and opinions during the hour. That is absolutely fine. Importantly, a focus group is not a debate, group therapy or a conflict resolution session. It is not an opportunity to collaborate or a problem solving session, not a promotional opportunity nor an educational session. The focus group will be more structured than an open forum or public discussion. My questions will hopefully be short and to the point but if you don't understand something, please ask. The questions will be worded in a way that you cannot just answer with a simple 'yes' or 'no'.

Assisting me is (*buddy name*), who will be running the tape recorder and taking a few notes in case this fails. Because we are a big group today it may be slightly more of a challenge to get everyone equally engaged. I will be doing some moderation to ensure that everyone gets to speak.

The overarching purpose of informed consent procedures is to ensure that you understand that you are not for any reason obligated to participate in the focus group, nor are you required to answer any questions you do not wish to answer. Everything will be anonymous and confidential so could you please also keep confidentiality for your fellow Britain in Bloom members. If you do have any questions about the procedures, please ask them now. If you have questions about my research, can we please keep them till the end of the focus group, or you can always email me too.

Focus group questions

1. Tell us your name and about your history of gardening. Did you garden before participating in the Britain in Bloom campaign?
2. What convinced you to get involved in the campaign?
 - What gardening support did you receive and how crucial was this? (including technical information)
 - Was there any support you did not have that you wished you did?
3. Has the campaign had any therapeutic benefits for you or your community?
4. What were the positive and negative aspects of Britain in Bloom engagement in your community? (Talking specifically about front gardens)
5. How might Britain in Bloom be improved for better engagement?
 - Is there anything else that you would have changed about your gardening experience?

Paper questionnaire completed on arrival

Britain in Bloom Focus Group Questionnaire

1. How old are you?

.....

2. What is your gender identity?

Mark only one oval.

- Woman
- Man
- Other gender identity

3. What is your ethnic group?

Mark only one oval.

- White
- Asian
- Mixed/Multiple ethnic groups
- African/Caribbean
- Arab
- Other:

4. What is your current status?

Mark only one oval.

- Employed
- Self-employed
- Unemployed
- Student
- Retired
- Other:

5. What is your highest level of education?

Mark only one oval.

- GCSE or equivalent
- A Levels or equivalent which allows entry to university
- Foundation degree or equivalent
- Bachelors/Undergraduate University degree or equivalent
- Masters/Postgraduate Taught University degree or equivalent
- Doctorate/Postgraduate Research University degree or equivalent
- Other recognised academic or vocational qualification (e.g. teacher training, nursing...)

6. In which of the following do you garden?

Tick all that apply.

- Back garden
- Front garden
- Shared or community garden
- Allotment
- Other:

7. When did you first get involved with Britain in Bloom?

.....

Information sheet and Consent form



Participant Information Sheet

You are invited to take part in a study forming part of my PhD research. Before you decide whether you wish to take part, please read the information below so that you have a better understanding of the research, how it will be conducted, and the likely outputs. Please feel free to ask if you require any further information. Thank you for reading the participant information sheet.

Project title: Do front garden landscapes influence health and well-being? A study of the Britain in Bloom campaign

- **What is the purpose of the study?**

I am investigating whether introducing plants to front gardens currently paved over will improve the well-being of residents and street users. By studying your Britain in Bloom community, I will explore participation in the campaign, the psychology of why people garden, and how community and social cohesion may emerge from gardening activities. I will also gauge responses to a future study I hope to undertake as part of my PhD research.

- **Who is undertaking this research?**

Lauriane Suyin CHALMIN-PUI, PhD student at the Department of Landscape, University of Sheffield. The Department of Landscape Research Ethics Committee approves this on behalf of the University Research Ethics Committee. For the purposes of this research, I am fully funded by the Royal Horticultural Society (RHS).

- **Why am I invited to participate in this study?**

You have been identified as a member of a Britain in Bloom community group, contacted through the RHS, and have expressed your interest in participating in a focus group concerning health and well-being.

- **Do I have to take part?**

Your participation is voluntary and you are free to withdraw at any time without giving a reason and without any negative consequences. Please contact me should you wish to withdraw from the research. If there are any specific questions that you do not wish to answer, you are free to decline.

- **What will happen if I take part?**

I will lead a focus group discussion, including 6-8 other people who you might already know. The discussion will revolve around why you garden, your involvement in the Britain in Bloom campaign, any perceived impacts of gardens and gardening on your own health and well-being, and how you might respond to a study proposal to re-vegetate your front garden. The focus group will last about 1 hour and will be audiotaped. This recording will only be listened to and used by me to transcribe the discussion. At any point in time, you may ask me to pause the recording. You will also be asked to complete a short questionnaire that will take about 3 minutes.

- **Will my responses be anonymised?**

All information you provide will be kept anonymous and will be securely stored according to the Data Protection Act 1998. Your name will never be associated with any of your answers.

- **What will happen to the findings of the study?**

Some of your answers may be used or quoted in my PhD thesis or any resulting articles, conferences, seminars from this research, but you will not be identifiable in any reports of publications. Due to the nature of this research it is likely that other researchers may find the data collected to be useful in answering future research questions. Your answers may be shared in this way, but will be untraceable back to you before allowing others to use it.

- **Will I be notified of the findings of the study?**

Should you request it, I can offer you a short summary of the research findings when they are available.

If you have any questions or complaints, please contact Lauriane Suyin CHALMIN-PUI (*lchalmin-puil@sheffield.ac.uk*) or her supervisor Dr Ross Cameron (*r.w.cameron@sheffield.ac.uk*)

Date:

Participant Consent Form



Project title: Do front garden landscapes influence health and well-being? A study of the Britain in Bloom campaign

Researcher: Lauriane Suyin CHALMIN-PUI Email: *lchalmin-pui1@sheffield.ac.uk*
Supervisor: Dr Ross CAMERON Email: *r.w.cameron@sheffield.ac.uk*

Participant Identification Number:

- I confirm that I have read and understand the participant information sheet, dated: explaining the above research project and I have had the opportunity to ask questions about the project. I agree to take part in the research.
- I agree to the focus groups being audio recorded.
- I understand that my participation is voluntary and that I am free to withdraw at any time by contacting the above named researcher without giving any reason and without any negative consequences. In addition, should I not wish to answer any particular question or questions, I am free to decline.
- I have been informed about how the confidentiality of the information I provide will be safeguarded. I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the report or reports that result from the research.
- I agree for the data collected from me to be used in future research.
- I have been given a copy of this form and the participant information sheet.

Name of Participant Date Signature

Email, should you wish to be emailed a summary of the research findings

Lead Researcher Date Signature

YOU WILL BE GIVEN A COPY OF THIS FORM TO KEEP

A.2 Chapter 5 - Questionnaire

Questionnaire text

Informed consent



Project title: Do gardens influence health and well-being?

Thank you for your interest in this research, a collaboration between the Royal Horticultural Society and the University of Sheffield. We are investigating how gardening activity and access to domestic gardens influences the health and well-being of residents in the UK. This questionnaire will have questions on your individual circumstances, your gardening activity, your house and outside area, your community, your perceived stress and well-being. It will also ask you to pass it on to a friend, colleague, family member, neighbour or anyone else that you know.

The questionnaire should not take longer than 15 minutes and can be taken on a mobile device.

Your participation is voluntary. If there are any specific questions that you do not wish to answer, you are free to skip it without giving a reason and without any negative consequences. You may also leave the survey at any point. All information you provide will be kept anonymous (you will not need to provide your name) and will be securely stored according to the Data Protection Act 1998.

The lead researcher is Lauriane Suyin CHALMIN-PUI, PhD student at the Department of Landscape, University of Sheffield. The Department of Landscape Research Ethics Committee approves this on behalf of the University Research Ethics Committee. The research is funded by the Royal Horticultural Society (RHS).

If you have any questions or complaints, please contact Lauriane Chalmin-Pui (lchalmin-pui1@sheffield.ac.uk) or her supervisor Dr Ross Cameron (r.w.cameron@sheffield.ac.uk)

Do you give your consent to participate in the research?

By clicking yes, you acknowledge that you have been informed about how the confidentiality of the information you provide will be safeguarded. You give permission

for members of the research team to have access to your anonymous responses and that you will not be identified or identifiable in the report or reports that result from the research. You agree for your responses to be used in future research.

- Yes
- No

Age

How old are you?

- Under 18
- 18 - 24
- 25 - 34
- 35 - 44
- 45 - 54
- 55 - 64
- 65 - 74
- 75 - 84
- 85 or older

Your Garden

Which of these best describe your level of gardening interest and attitude to gardening?

Please tick as many as apply.

- | | |
|--|--|
| <input type="checkbox"/> No interest in gardening | <input type="checkbox"/> Gardens/RHS Shows Visitor |
| <input type="checkbox"/> Occasional gardener | <input type="checkbox"/> Beginner |
| <input type="checkbox"/> Moderate level of interest in gardening | <input type="checkbox"/> Intermediate gardener |
| <input type="checkbox"/> Keen gardener | <input type="checkbox"/> Expert gardener |
| <input type="checkbox"/> Very passionate about gardening | <input type="checkbox"/> Not a gardener |
| <input type="checkbox"/> Reluctant gardener | |

How regularly do you actually garden? (On average, across the year and seasons)

- Daily
- 2-3 times a week
- Once a week
- 2-3 times a month
- Once a month or less
- Never

Why do you garden?

Do you have any health issues that prevent you from gardening or that make it difficult for you to garden? (Leave blank if not)

Are you a Royal Horticultural Society member?

- Yes
- No - I don't know what this is
- No - but I am aware of the Royal Horticultural Society

Are you involved in any Britain in Bloom activities in your city, town or village?

- Yes
- No - I don't know what this is
- No - but I am aware of Britain in Bloom activities

Why do you consider yourself not to be a gardener?

Please select as many as apply.

- I don't have time to garden
- Gardening is too expensive
- I don't have space to garden
- I don't have any practical gardening skills (e.g. weeding, pruning, sowing etc)
- I don't know enough about what plants need
- I don't know what to do when a plant seems to be dying

- I have been an unsuccessful gardener in the past
- Gardening is boring
- Gardening is a chore
- I have health issues that prevent gardening
- Other:

Your garden 2

Which of the following do you have access to?

Please select as many as apply, or none. It does not have to be actively maintained or gardened to count. For example, you may have access to a front garden that is completely paved over and has no plants in it.

- Front garden
- Back garden
- Shared garden
- Allotment
- Container planting/hanging baskets for example on a balcony
- Conservatory or other indoor plants
- Other type of gardening space:

In which of the following do you garden?

Please select as many as apply, or none.

- » Front garden
- » Back garden
- » Shared garden
- » Allotment
- » Container planting/hanging baskets for example on a balcony
- » Conservatory or other indoor plants
- » Other type of gardening space:

Has your **front garden** been paved over in the last 10 years?

- Yes - fully
- Yes - partially
- No
- I don't know

Do you use your **front garden** for off-road parking?

- Yes
- No

Approximately what percentage of your **front garden** is planted?

Move the slider below to show your answer.



How happy are you with your **front garden** currently?

- Extremely happy Somewhat happy Neither happy nor unhappy Somewhat unhappy Extremely unhappy
-

Which of the following activities do you do in your **back garden**?

Please select as many as apply.

- | | |
|---|---|
| <input type="checkbox"/> Grow fruits, vegetables or herbs | <input type="checkbox"/> Other physical activity |
| <input type="checkbox"/> Grow ornamental plants | <input type="checkbox"/> Creative activities e.g. painting, writing |
| <input type="checkbox"/> Play area for children/grandchildren etc | <input type="checkbox"/> Other: |
| <input type="checkbox"/> Outdoor eating | <input type="text"/> |

How happy are you with your **back garden** currently?

- Extremely happy Somewhat happy Neither happy nor unhappy Somewhat unhappy Extremely unhappy
-

Have you experienced any therapeutic benefits in or regarding your garden?

Your well-being

Please read these statements about feelings and thoughts and tick the box that best describes your experience of each **over the last 2 weeks**.

	All of the time	Often	Some of the time	Rarely	None of the time
I've been feeling optimistic about the future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been feeling restful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been feeling relaxed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been dealing with problems well	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been thinking clearly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been feeling close to other people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been able to make up my own mind about things	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In the average week, on how many days do you do any physical activity (of sufficient exertion to raise breathing rate) for at least 30 minutes?

0	1	2	3	4	5	6	7
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

The following questions ask you about your feelings and thoughts **during the last month**.

In each case, you will be asked to indicate how often you felt or thought a certain way.

How often have you...

	Often	Fairly often	Sometimes	Almost never	Never
...been upset because of something that happened unexpectedly?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...felt that you were unable to control the	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

important things in your life?	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
..felt nervous and "stressed"?	Often	Fairly often	Sometimes	Almost never	Never
..felt confident about your ability to handle your personal problems?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt that things were going your way?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Often	Fairly often	Sometimes	Almost never	Never
..found that you could not cope with all the things that you had to do?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..been able to control irritations in your life?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt that you were on top of things?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..been angered because of things that were outside of your control?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt difficulties were piling up so high that you could not overcome them?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Often	Fairly often	Sometimes	Almost never	Never

Accommodation

What type of accommodation are you currently living in?

- Detached house
- Semi-detached house
- Terrace house
- Flat (in a block of flats)
- Flat (in a house)
- Other:

Are you a ... ?

- Resident owner
- Tenant (renting in the private sector)
- Tenant (renting from a social landlord or registered provider)
- Lodger

accommodation 2

How many years have you lived in your current ?

What is the first part of your postcode? (e.g. S10 / SW1 / CB3)

Note that we are not asking for the second part of your postcode so that these answers are not identifiable or traceable to you.

Would you describe the place where you live as...

- a big city
- the suburbs or outskirts of a big city
- a small city or town
- a country village
- a farm or home in the country
- other:

Your community

In general, how would you rate your area as a place to live?

- Excellent
- Good
- Average
- Poor
- Very poor

How would you rate the sense of community spirit in your area?

- Excellent
- Good
- Average
- Poor
- Very poor

About how often do you and people in your neighbourhood do favours for each other?

e.g. Looking after each other's children, helping with shopping, lending garden or house tools, and other small acts of kindness.

- Often
- Sometimes
- Rarely
- Never

Hobbies

Please select all the leisure activities you have engaged with during the past month.

- | | |
|--|---|
| <input type="checkbox"/> Watching television | <input type="checkbox"/> Listening to music |
| <input type="checkbox"/> Walking for pleasure (without a dog) | <input type="checkbox"/> Collecting objects |
| <input type="checkbox"/> Dog-walking | <input type="checkbox"/> Arts and crafts and other DIY projects |
| <input type="checkbox"/> Reading books for pleasure | <input type="checkbox"/> Attending sports events e.g. football matches |
| <input type="checkbox"/> Participating in team sports (e.g. football, rowing) | <input type="checkbox"/> Attending theatre, opera or dance performances |
| <input type="checkbox"/> Participating in individual sports (e.g. tennis, swimming, cycling) | <input type="checkbox"/> Surfing the internet |
| <input type="checkbox"/> Eating or drinking out | <input type="checkbox"/> Visiting natural environments/green spaces |
| <input type="checkbox"/> Playing adult card or board games | <input type="checkbox"/> Visiting a tourist attraction |
| <input type="checkbox"/> Going to the cinema | <input type="checkbox"/> Gardening |
| <input type="checkbox"/> Wildlife watching | <input type="checkbox"/> Cooking/baking |
| <input type="checkbox"/> Visiting art galleries and museums | <input type="checkbox"/> Other: |
| <input type="checkbox"/> | <input type="text"/> |

Please rank your leisure activities from last month in order of regularity. The activity that you did the most often should be ranked at the top and the activity that you did the least often should be last.

You can drag and drop each line in place

» Watching television

- » Walking for pleasure (without a dog)
- » Dog-walking
- » Reading books for pleasure
- » Participating in team sports (e.g. football, rowing)
- » Participating in individual sports (e.g. tennis, swimming, cycling)
- » Eating or drinking out
- » Playing adult card or board games
- » Going to the cinema
- » Wildlife watching
- » Visiting art galleries and museums
- » Listening to music
- » Collecting objects
- » Arts and crafts and other DIY projects
- » Attending sports events e.g. football matches
- » Attending theatre, opera or dance performances
- » Surfing the internet
- » Visiting natural environments/green spaces
- » Visiting a tourist attraction
- » Gardening
- » Cooking/baking
- » Other:

Demographic Questions

What is your gender?

- Female
- Male
- Other gender identity

What is your ethnic group?

- White British/ any other white background
- Asian British/ any other Asian background
- Mixed/multiple ethnic groups
- African/Caribbean/Black British
- Arab
- Other:

What is your current status?

- Employed full time
- Employed part time
- Unemployed
- Retired
- Student
- Other:

We would like to know a bit more about your financial situation. Which of the following ranges of net annual income in £ do you fit into?

- Less than £15 000
- £15 000 - £25 999
- £26 000 - £34 999
- £35 000 - £49 999
- £50 000 - £70 000
- More than £70 000

What is your highest level of education?

- Lower than GCSE or equivalent
- GCSE or equivalent
- A Levels or equivalent which allows entry to university

- Foundation degree or equivalent
- Bachelors/Undergraduate University degree or equivalent
- Masters/Postgraduate Taught University degree or equivalent
- Doctorate/Postgraduate Research University degree or equivalent
- Other recognised academic or vocational qualification (e.g. teacher training, nursing...)

Refer a non-gardener

Now that you have reached the end of the survey and described yourself as a gardener, you are now asked to pass it on to a **non-gardener that is otherwise similar to you in socio-demographic and financial terms**. They do not have to be exactly like you in all ways but should be someone you identify with; perhaps you have a similar outlook in life or current situation.

This may be a friend, colleague, family member, neighbour or anyone else that you know.

I would be very grateful if you could pass them the link to the survey and explain that you have already taken it and have been asked to refer someone else. If you can think of more than one person, that is fine. If you would like to use a template message to contact them, you could use the following:

Dear ____

I have just participated in a research project by the Royal Horticultural Society and the University of Sheffield on the influence of front gardens on health and well-being. The researchers are looking for non-gardeners to answer the same short questionnaire and I was asked to pass on the link to someone similar to me so I thought of you.

The questionnaire is here: ---- and it took me less than 15 minutes to complete.

If you have any questions, you can contact the lead researcher Lauriane Chalmin-Pui directly at lschalmin-pui1@sheffield.ac.uk.

Thank you for your help.

If you would like me to contact them directly, please leave their email address here, as well as who you are and your relationship to them.

Refer a gardener

Now that you have reached the end of the survey and described yourself as a non-gardener, you are now asked to pass it on to a **gardener that is otherwise similar to you in socio-demographic and financial terms**. They do not have to be exactly like you in all ways but should be someone you identify with; perhaps you have a similar outlook in life or current situation.

This may be a friend, colleague, family member, neighbour or anyone else that you know.

I would be very grateful if you could pass them the link to the survey and explain that you have already taken it and have been asked to refer someone else. If you can think of more than one person, that is fine. If you would like to use a template message to contact them, you could use the following:

Dear ____

I have just participated in a research project by the Royal Horticultural Society and the University of Sheffield on the influence of front gardens on health and well-being. The researchers are looking for gardeners to answer the same short questionnaire and I was asked to pass on the link to someone similar to me so I thought of you.

The questionnaire is here: ---- and it took me less than 15 minutes to complete.

If you have any questions, you can contact the lead researcher Lauriane Chalmin-Pui directly at lschalmin-pui1@sheffield.ac.uk.

Thank you for your help.

If you would like me to contact them directly, please leave their email address here, as well as who you are and your relationship to them.

Further details about questionnaire dissemination

BBC news article Interviewed by science correspondent Helen Briggs. 29 January 2017. <http://www.bbc.co.uk/news/science-environment-38772477>

BBC Coventry and Warwickshire radio Interviewed by Mollie Green and Chris Beardshaw on 4 February 2017.

BBC Sheffield radio Interviewed by Kat Cowan on 12 April 2017

Network of Wellbeing guest blog <http://www.networkofwellbeing.org/index.php/blog/post/how-do-gardens-influence-well-being-a-call-for-non-gardeners1>

Preloved guest blog <http://www.preloved.co.uk/blog/quick-reads/greening-grey-britain-turn-grey-area-green/>

University of Sheffield Landscape blog <https://sola-blog.com/2017/04/19/looking-for-people-who-dont-garden-and-other-unexpected-phd-moments/>

Figure A.1: RHS website

The screenshot shows the Royal Horticultural Society (RHS) website homepage. At the top, there is a search bar and a 'Join the RHS' button. Below the navigation bar, the main content area features a large article titled 'Front garden research: we need your help'. The article includes a photograph of a small car parked on a wooden deck in a lush garden. To the right of the article, there is a 'Join the RHS today' banner with a 'Save 25%' offer and a 'Join now' button. Below the banner, there is a 'Useful links' section with a photo of Lauriane and links to her blog, a conference, and a charter. At the bottom right, there is a 'New Cultivar Greenhouses' advertisement. The article text discusses the importance of green spaces and the impact of front gardens on health and well-being, and includes a 'Start survey' button.

Royal Horticultural Society
Saving the best in Gardening

Get involved Gardening Shows Gardens Learn Shop About us My RHS

Science Environmental gardening Greening Grey Britain Why Greening Grey Britain is important Front garden survey

Front garden research: we need your help

Do front gardens influence our health and well-being? A new research project - a collaboration between the RHS and the University of Sheffield - aims to find out

[Start survey](#)

Green space makes us feel better, **fact**. As a society, we're increasingly becoming aware of the impact that nature and green spaces have on our physical and mental well-being - you only have to look at the popularity of nature play groups or the success of the RHS Campaign for School Gardening to see that there is a huge appetite for all kinds of interaction with plants and the natural world, and we see it as an important part of our children's education. We're still very much a nation of gardeners - RHS membership has increased by 100,000 over the past five years.

Despite this, all is not rosy in the nation's front gardens. They're disappearing at an alarming rate - more than 4.5 million of them contain no plants at all, and a quarter of front gardens are now totally paved over. But does this really matter? Despite multiple studies that show the positive effects of green spaces, very little work has been done on front gardens.

Lauriane Suyin Chalmin-Pui, RHS PhD student at the University of Sheffield is researching the therapeutic effects of front gardens and needs your help. Her new project involves a 5-minute nationwide questionnaire to both gardeners and non-gardeners, whether you have a garden or not.

[Start survey](#)

Join the RHS today
Save 25%
[Join now](#)

Useful links

Read Lauriane's blog


Health, Happiness and Horticulture Conference 2016

Health and Horticulture Charter


[Start survey](#)

New Cultivar Greenhouses
Great Range of Victorian and Modern Greenhouses Get an Instant Online Quote Now!
cultivar.com

Figure A.2: RHS email to members

 **Royal Horticultural Society**
Sharing the best in Gardening

    [Contact us >](#)



Do you have 15 minutes to help with a gardening-related PhD project?

Do gardens and gardening activity have an influence on health and well-being? Lauriane Suyin Chalmin-Pui, an RHS PhD student at the University of Sheffield is doing research on the therapeutic effects of urban greenery and would really appreciate your assistance!


As part of her new project Lauriane is circulating an anonymous 15-minute questionnaire to both gardeners and non-gardeners to gain valuable insight into the benefits of gardening.


If you're able to help Lauriane and play a part in our vision to enrich everyone's life through plants and make the UK a greener and more beautiful place, we would be very grateful.

[Take the questionnaire now!](#)

Figure A.3: RHS Twitter feed


You Retweeted


 **The RHS** @The_RHS · Dec 14
Do gardens influence health and well-being? Help Lauriane from @sheffielduni with her research at about.me/frontgardens. Thanks!



3 57 56

You Retweeted

 **The RHS** @The_RHS · Dec 3
Do gardens influence health and well-being? Help Lauriane from @sheffielduni with her research at about.me/frontgardens. Thanks!



8 98 86

Figure A.4: BBC news article


Science & Environment

UK 'need not fear electricity blackouts'

The man who ran National Grid for a decade says news stories raising blackout fears should stop.

30 January 2017 | Business

'No excuse' for energy price rises
National Grid to avoid being broken up
Smart energy 'to stop UK blackouts'



Seed clue to plant size puzzle

The seeds of domesticated plants could offer clues as to why cultivated crops are larger than their wild cousins, a study suggests.

28 January 2017 | Science & Environment



Researchers seek evidence on green spaces

A project aims to investigate the social case for gardens and what impact they have on well-being.

29 January 2017 | Science & Environment



Sharks provide inspiration for drug hope

9 hours ago | Australia

First images of new Amazon coral reef

29 January 2017 | Latin America & Caribbean

'Fairy possum' faces uncertain future

27 January 2017

Watch/Listen

- How three astronauts died on Earth**
27 January 2017 | Science & Environment
2:35
- 'Pink toys didn't put me off science'**
27 January 2017 | Education & Family
1:48
- Uncovering North America's largest diamond**
27 January 2017 | US & Canada
2:32
- Doomsday clock moves closer to apocalypse**
26 January 2017 | World
1:53
- Tim Peake will fly back to space station**
26 January 2017 | Science & Environment
1:17
- CT Scan helps rare washed-up turtle**
26 January 2017 | Wales
1:06

Share with BBC News >

Figure A.5: BBC Sheffield radio Facebook

BBC Radio Sheffield 21 April at 23:16 · 🌐

Wheellie bins or wisteria?
Cars or chrysanthemums?
A PHD student in Sheffield is studying the way our front gardens look, affects the way we all feel.
What's your front garden like?

4k Views
32 Likes 8 Comments 11 Shares

Share

Penny Philcox, Kerry Green, Musarat Javaid and 29 others like this. Top comments ▾

11 shares

Phil Vintin Mine is rubbish. Do said researchers want a street to come and brighten up?
22 April at 01:35

BBC Radio Sheffield Sadly that's down to you! They do though want people (whatever their garden looks like) to take part in a short online survey www.rhs.org.uk/front-garden-survey
2 · 22 April at 09:57 · Edited

Andrew Stringer Mine looks like this at various points throughout the year. There's no ikeafication going on in my house or garden.
<https://m.facebook.com/andrew.stringer.5/albums/427619963710/>




Figure A.6: RHS Garden magazine

Update

News from around the RHS, show previews, special offers and more

New shows in 2017 to inspire more gardeners

RHS Shows are continually evolving in order to share the joy of plants and gardening with more people. Changes this year will bring new shows to southwest and northeast England, and new features at our London Shows.

Members in and around Devon can now add the RHS Garden Rosemoor Flower Show to their diaries. Taking place from 18–20 August it completes the line up of all four RHS Gardens staging their own summer flower show. At this mix of local and national nurseries and trademarks, visitors can search out garden favourites and harder-to-find plants and sundries. Set within Rosemoor when high summer colour is at its peak, it will be an inspirational day out with food and refreshments available from the Garden Kitchen Restaurant.

The largest new event for members this year is the RHS Chatsworth Flower Show (7–11 June) partnered by Wedgwood. With the majestic backdrop of Chatsworth House, Derbyshire, it will deliver the traditional features expected of an RHS event combined with innovative garden designs and immersive installations. Bisected by the River Derwent, the show features a representation of Joseph Paxton's Great Conservatory as a centrepiece to the Floral Marquee, a florally adorned bridge, Artisan Kitchen Theatre, FreeForm expressive installations, and an RHS Show Feast to demonstrate how gardeners can adapt and continue to enjoy their gardens in a changing climate.

Improved shows in the capital

Although the timetable is fewer London Shows in the Horticultural Halls, those taking place will feature new and more diverse content. To reflect the enhanced shows, and to help support our charitable aims such as helping young people into horticulture, there will be a small entry charge to some London Shows for members (see panel, below).

"The flower show season is extremely busy," said RHS Director General Sue Riggs. "We think fewer, but better, London Shows will give visitors an improved experience and engage more of our members, as well as new audiences."

The shows will include comprehensive programmes of talks, workshops and demonstrations, new exhibitors, access to the RHS Lindley Library exhibitions and exciting new local food producers.

The schedule for the rest of the year includes two more shows in both the Lindley and Lawrence Halls, which include Late Events to allow for after-work shopping and eating. There will be two shows in the Lindley Hall only, including the new RHS Summer Urban Garden Show (22–23 July, Free (new 11 July)).

© www.rhs.org.uk/shows



London Shows are a great place to see impressive plant displays and learn new skills.

More show news and dates pp103–104

Pharmaceutical giant Novartis is setting up the new RHS Cliftonville Flower Show.

Order your RHS seeds soon!

The closing date for ordering seeds collected at RHS Gardens is 31 March 2017 (see November 2016, p81). As an exclusive membership benefit, UK and EU members can order 12 packets of seeds for just £8.50. You can download the seed list and order online at www.rhs.org.uk/seedlist or call 020 3765 8800.

Alys Fowler at Hyde Hall

As part of the Essex Book Festival 2017 writer and journalist Alys Fowler, former presenter of BBC Gardeners' World and The Guardian columnist, will give a talk at RHS Garden Hyde Hall on 28 March (7pm). She will share her expertise in edible gardening, including how to start and preserve home-grown produce. Tickets £7. Booking essential at www.essexbookfestival.org.uk

Record-breaking year at Harlow Carr

RHS Garden Harlow Carr in North Yorkshire has reported record visitor numbers for the sixth year running, topping the 400,000 mark for the first time. Laura Heckling from Weiborthy was the 400,000th visitor through the doors. He and his wife Pauline are regular visitors to Harlow Carr and have been RHS members for more than 15 years. To mark the occasion, they were given a planter featuring some of the garden's most striking winter plants, presented by the Mayor and Mayoress of Harrogate.

© www.rhs.org.uk/harlowcarr
See also p98.



RHS Life

A new research project will assess the impact of fresh produce on our health and wellbeing.

Your help is needed for front garden research

If you can spare 15 minutes to complete an online questionnaire, you will be taking part in groundbreaking research and helping our Greening Great Britain campaign.

Supported by the RHS and University of Sheffield, PhD student Lauriane Suvyn Chalmers-Pui is researching the therapeutic effects of front gardens on our health and wellbeing. Many studies have shown the positive effects of green spaces but little research has been done on front gardens, which have been disappearing at an alarming rate – a quarter of them are now totally paved over.

The anonymous and confidential questionnaire can be taken on mobile devices as well as computers. At the end of the questionnaire you will be asked to pass it on to a non-gardening friend, colleague, family member or neighbour, in order to get a balance of responses.

Read more and complete the survey (until April 2017) at www.rhs.org.uk/front-garden-survey

Guide to greening the smallest of spaces

Inspired by our Greening Great Britain campaign, the new RHS Big Ideas, Small Spaces is a practical and creative book aimed at anyone who has a small outdoor space they wish to 'green up' – be it a balcony, windowill, wall or narrow passageway.

Bestselling author Kay Maguire and 2013 RHS Young Designer of the Year Tony Woods provide stylish design ideas, growing tips and advice to help you turn even the tiniest outdoor space into a green oasis.

The 30 step-by-step projects include ideas for hanging planted screens, mobile gardens, balcony rail planters and potted shelves. Learn the things you need to know to get your garden started and how to overcome common problems, to ensure your garden, however small, is beautiful all year round.

© RHS Big Ideas, Small Spaces, by Kay Maguire and Tony Woods, RHS/Mitchell Beazley, March 2017, mms 9781784220780, RRP £16.99, RHS price £12.99 (until 31 July 2017) from RHS shops, www.rhsopac.uk or 01483 211320 (p&p applies).



Full results

Descriptive statistics of demographics of questionnaire respondents

	Total	Gardeners	Non-Gardeners	P-value
	N=6,015	n=5,766	n=249	
Age				< 0.0001
18 - 24	87 (1.4%)	65 (1.1%)	22 (8.8%)	
25 - 34	509 (8.5%)	453 (7.9%)	56 (22.5%)	
35 - 44	946 (15.7%)	892 (15.5%)	54 (21.7%)	
45 - 54	1,269 (21.1%)	1,225 (21.2%)	44 (17.7%)	
55 - 64	1,724 (28.7%)	1,676 (29.1%)	48 (19.3%)	
65 - 74	1,258 (20.9%)	1,237 (21.5%)	21 (8.4%)	
75 - 84	202 (3.4%)	198 (3.4%)	4 (1.6%)	
85 or older	20 (0.3%)	20 (0.3%)	0 (0.0%)	
Ethnicity				0.45
African/Caribbean/ Black British	13 (0.2%)	12 (0.2%)	1 (0.4%)	
Arab	3 (0.0%)	3 (0.1%)	0 (0.0%)	
Asian British/ any other Asian background	72 (1.2%)	63 (1.1%)	9 (3.6%)	
Mixed/ multiple ethnic groups	69 (1.1%)	65 (1.1%)	4 (1.6%)	
White British/ any other white background	5,545(92.2%)	5,318 (92.2%)	227 (91.2%)	
Other	64 (1.1%)	61 (1.1%)	3 (1.2%)	
No response	149 (2.1%)	244 (4.2%)	5 (2.0%)	
Education				0.055
Lower than GCSE	126 (2.1%)	121 (2.1%)	5 (2.0%)	
GCSE	622 (10.3%)	603 (10.5%)	19 (7.6%)	
A-Levels	600 (10.0%)	579 (10.0%)	21 (8.4%)	

	Total	Gardeners	Non-Gardeners	P-value
Foundation degree	334 (5.6%)	322 (5.6%)	12 (4.8%)	
Other recognised academic or vocational qualification	605 (10.1%)	589 (10.2%)	16 (6.4%)	
Bachelors degree	1,819 (30.2%)	1,740 (30.2%)	79 (31.7%)	
Masters degree	1,218 (20.2%)	1,149 (19.9%)	69 (27.7%)	
Doctorate	413 (6.9%)	392 (6.8%)	21 (8.4%)	
No response	278 (4.6%)	271 (4.7%)	7 (2.8%)	
Net Annual Income (£)				0.26
Less than 15 000	584 (9.7%)	563 (9.8%)	21 (8.4%)	
15 000 - 25 999	715 (11.9%)	672 (11.7%)	43 (17.3%)	
26 000 - 34 999	575 (9.6%)	539 (9.3%)	36 (14.5%)	
35 000 - 49 999	544 (9.0%)	512 (8.9%)	32 (12.9%)	
50 000 - 70 000	260 (4.3%)	249 (4.3%)	11 (4.4%)	
More than 70 000	221 (3.7%)	211 (3.7%)	10 (4.0%)	
No response	3,116 (51.8%)	3,020 (52.4%)	96 (38.6%)	
Employment Status				< 0.0001
Employed full time	1,944 (32.3%)	1,827 (31.7%)	117 (47.0%)	
Employed part time	1,189 (19.8%)	1,144 (19.8%)	45 (18.1%)	
Self-employed	93 (1.5%)	87 (1.5%)	6 (2.4%)	
Retired	1,997 (33.2%)	1,956 (33.9%)	41 (16.5%)	
Student	121 (2.0%)	104 (1.8%)	17 (6.8%)	
Unemployed	287 (4.7%)	275 (4.7%)	12 (4.8%)	
Other	121 (2.0%)	116 (2.0%)	5 (2.0%)	
No response	263 (4.4%)	257 (4.5%)	6 (2.4%)	

Descriptive statistics of questionnaire respondents' gardening activities

	Total	Gardeners	Non-Gardeners	P-value
	N=6,015	n=5,766	n=249	
Gardening regularity (on average, across the year and seasons)				< 0.0001
Daily	931 (15.5%)	928 (16.1%)	3 (1.2%)	
2-3 times a week	2,479 (41.2%)	2,468 (42.8%)	11 (4.4%)	
Once a week	1,211 (20.1%)	1,204 (20.9%)	7 (2.8%)	
2-3 times a month	682 (11.3%)	670 (11.6%)	12 (4.8%)	
Once a month or less	454 (7.5%)	443 (7.7%)	11 (4.4%)	
Never	52 (0.9%)	44 (0.8%)	8 (3.2%)	
Non-Gardener	197 (3.3%)	0 (0.0%)	197 (79.1%)	
No response	9 (0.1%)	9 (0.2%)	0 (0.0%)	
Percentage of front garden with plants growing				< 0.0001
Mean (SD)	56.1 (\pm 28.1)	56.5 (\pm 27.9)	42.3 (\pm 32.3)	
No response	1,144 (19.0%)	1,035 (18.0%)	109 (43.8%)	
Front garden paved over in last 10 years				0.0002
Yes - fully	201 (3.3%)	183 (3.2%)	18 (7.2%)	
Yes - partially	1,030 (17.1%)	1,001 (17.4%)	29 (11.6%)	
No	3,938 (65.5%)	3,836 (66.5%)	102 (41.0%)	
I don't know	113 (1.9%)	110 (1.9%)	3 (1.2%)	
No response	733 (12.2%)	636 (11.0%)	97 (39.0%)	
Front garden used for off-road parking				0.74
Yes	2,303 (38.3%)	2,239 (38.8%)	64 (25.7%)	
No	2,968 (49.3%)	2,880 (49.9%)	88 (35.3%)	
No response	744 (12.4%)	647 (11.2%)	97 (39.0%)	

How happy are you with your front garden?				< 0.0001
Extremely happy	1,151 (19.1%)	1,134 (19.7%)	17 (6.8%)	
Somewhat happy	2,383 (39.6%)	2,335 (40.5%)	48 (19.3%)	
Neither happy nor unhappy	559 (9.3%)	515 (8.9%)	44 (17.7%)	
Somewhat unhappy	985 (16.4%)	955 (16.6%)	30 (12.0%)	
Extremely unhappy	203 (3.4%)	190 (3.3%)	13 (5.2%)	
No response	734 (12.2%)	637 (11.0%)	97 (39.0%)	
How happy are you with your back garden?				< 0.0001
Extremely happy	1,496 (24.9%)	1,470 (25.5%)	26 (10.4%)	
Somewhat happy	3,015 (50.1%)	2,953 (51.2%)	62 (24.9%)	
Neither happy nor unhappy	370 (6.2%)	334 (5.8%)	36 (14.5%)	
Somewhat unhappy	567 (9.4%)	534 (9.3%)	33 (13.3%)	
Extremely unhappy	87 (1.4%)	72 (1.2%)	15 (6.0%)	
No response	480 (8.0%)	403 (7.0%)	77 (30.9%)	
RHS membership				0.57
Yes	2,579 (42.9%)	2,557 (44.3%)	22 (8.8%)	
No - but I am aware of the Royal Horticultural Society	3,012 (50.1%)	2,982 (51.7%)	30 (12.0%)	
No - I don't know what this is	148 (2.5%)	148 (2.6%)	0 (0.0%)	
No response	276 (4.6%)	79 (1.4%)	197 (79.1%)	

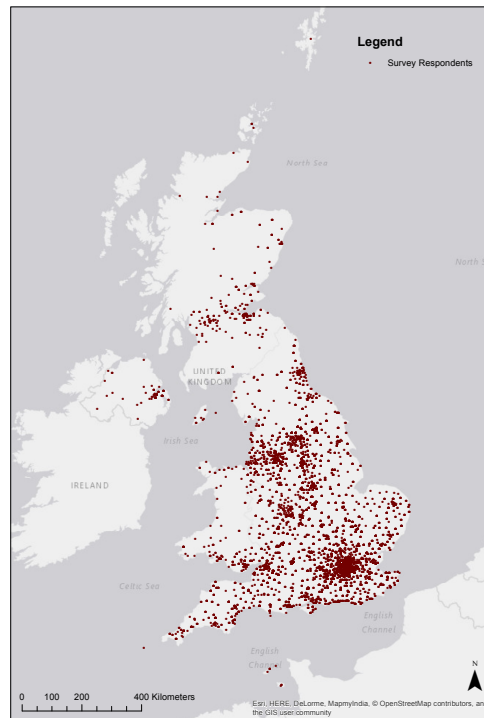
Britain in Bloom involvement 0.83

Yes	259 (4.3%)	256 (4.4%)	3 (1.2%)
No - but I am aware of Britain in Bloom activities	4,846 (80.6%)	4,803 (83.3%)	43 (17.3%)
No - I don't know what this is	676 (11.2%)	670 (11.6%)	6 (2.4%)
No response	234 (3.9%)	37 (0.6%)	197 (79.1%)

Descriptive statistics of questionnaire respondents' self assessment of their physical and mental health

	Total	Gardeners	Non-Gardeners	P-value
	N=6,015	n=5,766	n=249	
Short Warwick & Edinburgh Mental Well-being score				< 0.0001
Mean (SD)	22.9 (±3.6)	23.0 (±3.6)	21.7 (±3.7)	
No response	305 (5.1%)	293 (5.1%)	12 (4.8%)	
Perceived Stress Score				< 0.0001
Mean (SD)	15.1 (±6.8)	15.0 (±6.8)	17.3 (±7.1)	
No response	212 (3.5%)	202 (3.5%)	10 (4.0%)	
Number of days per week physically active				< 0.0001
Mean (SD)	3.6 (±2.0)	3.6 (±2.0)	3.0 (±2.1)	
No response	29 (0.5%)	28 (0.5%)	1 (0.4%)	

Figure A.7: Location of UK respondents



Descriptive statistics of accommodation of questionnaire respondents

	Total	Gardeners	Non-Gardeners	P-value
	N=6,015	N=5,766	N=249	
Accommodation type				< 0.0001
Detached house	2,339 (38.9%)	2,260 (39.2%)	79 (31.7%)	
Semi-detached house	1,985 (33.0%)	1,924 (33.4%)	61 (24.5%)	
Terrace house	1,005 (16.7%)	964 (16.7%)	41 (16.5%)	
Flat (in a block of flats)	237 (3.9%)	195 (3.4%)	42 (16.9%)	
Flat (in a house)	179 (3.0%)	162 (2.8%)	17 (6.8%)	
Other	248 (4.1%)	240 (4.2%)	8 (3.2%)	
No response	22 (0.4%)	21 (0.4%)	1 (0.4%)	

Years living in present accommodation				< 0.0001
Mean (SD)	13.9 (\pm 12.1)	14.1 (\pm 12.2)	10.3 (\pm 10.0)	
No response	850 (14.1%)	829 (14.4%)	21 (8.4%)	
Location of accommodation				< 0.0001
Big city	578 (9.6%)	522 (9.1%)	56 (22.5%)	
Suburbs or outskirts of a big city	1,396 (23.2%)	1,329 (23.0%)	67 (26.9%)	
Small city or town	2,121 (35.3%)	2,035 (35.3%)	86 (34.5%)	
Country village	1,303 (21.7%)	1,273 (22.1%)	30 (12.0%)	
Farm or home in the country	320 (5.3%)	315 (5.5%)	5 (2.0%)	
Other	212 (3.5%)	209 (3.6%)	3 (1.2%)	
No response	85 (1.4%)	83 (1.4%)	2 (0.8%)	
Tenure				< 0.0001
Resident owner	5,213 (86.7%)	5,043 (87.5%)	170 (68.3%)	
Tenant (renting from a social landlord or registered provider)	192 (3.2%)	181 (3.1%)	11 (4.4%)	
Tenant (renting in the private sector)	453 (7.5%)	408 (7.1%)	45 (18.1%)	
Lodger	98 (1.6%)	78 (1.4%)	20 (8.0%)	
No response	59 (1.0%)	56 (1.0%)	3 (1.2%)	
In general, how would you rate your area to live?				0.0002
Excellent	2,233 (37.1%)	2,153 (37.3%)	80 (32.1%)	
Good	2,877 (47.8%)	2,772 (48.1%)	105 (42.2%)	
Average	685 (11.4%)	635 (11.0%)	50 (20.1%)	
Poor	127 (2.1%)	118 (2.0%)	9 (3.6%)	
Very poor	22 (0.4%)	21 (0.4%)	1 (0.4%)	
No response	71 (1.2%)	67 (1.2%)	4 (1.6%)	

How would you rate the sense of community spirit in your area?				< 0.0001
Excellent	940 (15.6%)	906 (15.7%)	34 (13.7%)	
Good	2,377 (39.5%)	2,298 (39.9%)	79 (31.7%)	
Average	1,867 (31.0%)	1,794 (31.1%)	73 (29.3%)	
Poor	659 (11.0%)	610 (10.6%)	49 (19.7%)	
Very poor	90 (1.5%)	81 (1.4%)	9 (3.6%)	
No response	82 (1.4%)	77 (1.3%)	5 (2.0%)	
How often do people in your neighbourhood do favours for each other?				< 0.0001
Often	1,590 (26.4%)	1,553 (26.9%)	37 (14.9%)	
Sometimes	2,628 (43.7%)	2,539 (44.0%)	89 (35.7%)	
Rarely	1,374 (22.8%)	1,300 (22.5%)	74 (29.7%)	
Never	336 (5.6%)	292 (5.1%)	44 (17.7%)	
No response	87 (1.4%)	82 (1.4%)	5 (2.0%)	

Motivations for gardening - responses from 5418 respondents (90.07%)

General Motivation	Detailed	Percentage	Times cited
Pleasure and enjoyment		49.29	2965
	Total	26.23	1578
Sensory reasons	Visual beauty	24.92	1499
	Touch	0.88	53
	Smell	0.86	52
	Aural	0.47	28
	Total	25.04	1506
Health benefits	Physical exercise and fitness	8.73	525
	Mental health	4.67	281
	Stress	2.83	170
Plants and growth	Total	24.79	1491
	Flowers	5.99	360
Expression, self-identity	Total	23.94	1440

General Motivation	Detailed	Percentage	Times cited
	Creativity	20.45	1230
Love		22.88	1376
Maintenance		20.22	1216
Fresh air, the outdoors		17.22	1036
Food		15.68	943
Well-being		14.83	892
Calm and relaxation		13.47	810
Satisfaction, achievement	Total	11.72	705
	Focus and determination	0.62	37
Wildlife		9.94	598
Nature, the environment	Total	9.88	594
	Seasonal change	2.01	121
Work		5.45	328
Personal relationships		2.69	162
Interest and learning		2.61	157
Neighbours and community		1.23	74
House appearance		0.65	39

Types of therapeutic effects experienced by 2436 respondents (40.50%)

Type of therapeutic effect	Therapeutic Effects	Percentage	Times cited
	Total	48.33	2907
Mental health	Dealing with stress	15.53	934
	Space for reflection	13.73	826
	Helps with experiences of depression	12.57	756
	Helps with experiences of anxiety	2.38	143
	Creates perspective	1.80	108

Type of therapeutic effect	Therapeutic Effects	Percentage	Times cited
	Escape from everyday life or problems	1.43	86
	Mindfulness	1.43	86
	Concentration and focus	0.86	52
	Purpose and improved self-esteem	0.37	22
	Total	42.81	2575
Positive feelings and emotions	Relaxation	19.60	1179
	Satisfaction	9.51	572
	Calming	6.73	405
	Uplifts mood	5.65	340
	Rewarding achievements	4.64	279
	Peace	3.61	217
	Happiness	2.72	164
	Creativity & self-expression	1.43	86
	Sense of control	0.08	5
	Combats isolation & loneliness	0.07	4
	Total	34.10	2051
General health	Sense of well-being	13.13	790
	Energy levels	12.09	727
	Nutrition	3.79	228
	Intellectual stimulation	1.73	104
	Improved sleep	0.83	50
	Total	17.36	1044
Connection to nature	Fresh air & outdoors	9.38	564
	Quiet & privacy	1.16	70
	Faith & spirituality	0.38	23
	Total	15.13	910
Physical health			

Type of therapeutic effect	Therapeutic Effects	Percentage	Times cited
	Physical exercise	13.482	811
	Positive social interactions	3.29	198
	Weight loss/management	0.52	31
	Total	4.01	241
Therapy & recovery	Living with pain/pain management	1.26	76
	Bereavement & grief	0.62	37
	Living/managing chronic conditions & disability	0.58	35

A.3 Chapter 6 - Questionnaire

Questionnaire text

Informed consent

Project title: How do gardeners relate to their gardens?

Thank you for your interest in this research, a collaboration between the Royal Horticultural Society and the University of Sheffield. Gardens are dynamic places that evoke a range of emotions. We are investigating how gardeners relate to their gardens and whether attitudes change as gardens change. This questionnaire contains questions on your garden, emotions, perceived stress and well-being, and individual circumstances. It will also ask you to send us a photograph of your garden - the part that you appreciate the most. Thank you for taking part in this research.

Please have a photograph ready to upload from your current device that responds to this question: Which part of your garden do you appreciate the most?

The questionnaire should not take longer than 15 minutes and can be taken on a computer or a mobile device. It will be easier if you have the photograph ready on your computer or mobile.

Your participation is voluntary. If there are any specific questions that you do not wish to answer, you are free to skip it without giving a reason and without any negative consequences. You may also leave the survey at any point. All information you provide will be kept anonymous (you will not need to provide your name or email) and will be securely stored according to the Data Protection Act 1998 and is compliant with the new General Data Protection Regulation. You must be at least 18 years old.

The lead researcher is Lauriane Suyin CHALMIN-PUI, PhD student at the Department of Landscape, University of Sheffield. The Department of Landscape Research Ethics Committee approves this on behalf of the University Research Ethics Committee. The research is funded by the Royal Horticultural Society (RHS). According to data protection legislation, we are required to inform you that the legal basis we are applying in order to process your data is for research 'carried out in the public interest' - Article 6(1)(e) and for 'scientific or historical research purposes' - Article 9 (2) (j). The data controller is the University of Sheffield.

If you have any questions or complaints, please contact Lauriane Chalmin-Pui (lchalmin-pui1@sheffield.ac.uk) or her supervisor Dr Ross Cameron (r.w.cameron@sheffield.ac.uk). If you have any concerns specifically about the use of your personal data, you can also contact the University's Data Protection Officer, Anne Cutler (a.cutler@sheffield.ac.uk).

Do you give your consent to participate in the research?

By clicking yes, you acknowledge that you have been informed about the project and that you understand the legal basis for the collection and use of your personal information as part of this research. You acknowledge that you have been informed how the confidentiality of the information you provide will be safeguarded. You give permission for members of the research team to have access to your anonymous responses. You will not be identified or identifiable in any reports or publications that result from the research. You agree that your anonymised responses, including your submitted photograph, can be legally used in future research.

Yes

No

Screening

Do you have a **private** gardening space?

This may be a garden that you own, rent or share. Allotments do not count.

Yes

No

Gardening and your garden

Which garden activity do you find the most peaceful or relaxing?

Which garden activity do you find the most frustrating?

Which garden activity do you find the most challenging?

What is your favourite part of the garden?

Which part of your garden would you wish to improve?

Is there any part of the garden that disappoints or even depresses you? Why?
Can you describe the key features or plants you can see from there?

Which part of the garden would you describe as the most peaceful?
Can you describe the key features or plants you can see from there?

What is your favourite plant in the garden? Why?

If you were redesigning your garden from scratch which features would you include and how would you prioritise?

Please drag your preferred items into the relevant box: highest priority, and those you would also prioritise. **Please only rank your top 3 features in the highest priority box.** If you would not include a feature, do not drag it over but leave it in its original column. Assume service areas and essential infrastructure (e.g. driveway, washing lines etc.) are already allocated space.

Items	Top 3: Highest priority
Alpine beds / rock garden	
Border / tubs for colourful annual plants	
Children's play area e.g. swing / sand pit etc.	
Colourful summer flower border/s	
Formal hedges –clipped box or yew	
Fruit garden / orchard	
Garden tree/s	
Greenhouse / conservatory for ornamentals	
Greenhouse for food crops	
Herb garden / pots	
Lawn	
Patio	
Pergola / climbing plants	
Pond – formal	
Pond - informal	
Rose garden	
Shrub border	
Stream / water feature	
Vegetable patch	
Wild flower / colourful meadow	
Wildlife garden features e.g. bird feeders / bat boxes etc.	
Other feature:	

Which of the following statements do you think applies **most** to your attitude to your garden?

- Gardening is my tonic – I can deal with most things in life as long as can have a few quiet moments in my garden.
- My garden is the introduction to the house – it needs to be in harmony and reflect the style of the interior spaces.
- My garden reflects my artistic endeavours – it is my living, dynamic painting.
- Gardens are for family, friends and fun – a great place to socialise and play.
- My wildlife haven, a place to relax and let nature do its own thing.
- The garden would be lovely if it wasn't for the slugs, snails, greenfly, rose blackspot etc. always trying to thwart me!

Your health and well-being

How would you rate your physical health / fitness?

Please choose one of the following that best describes you:

- I am active and fit – I could walk 10 miles in a day with only minor aches and pains afterwards.
- I am fairly fit – I am happy with a brisk walk, an hour cycling or half a day gardening.
- OK, but I am challenged by long walks, or continuous moderate physical activity for more than an hour or so.
- I enjoy activities, such as walking / gardening, but like to / need to take frequent breaks.
- I tire easily and apart from short walks around the garden pulling the occasional weed, I leave most of the heavy work to others.
- I am fairly immobile, but still enjoy views of the garden from the house / patio
- I would rather not say

How would you rate your mental health?

Please choose one of the following that best describes you:

- Very good, pretty positive about my life and my circumstances.
- Good, happy most of the time, although I can dwell on negative issues from time to time.
- OK – I have my ups and downs.
- Mixed – I am positive most of the time, but have experienced significant mental stress on occasions
- Poor - life can be frustrating and get me down from time to time.
- Very poor e.g. I often feel negative about things and can suffer bouts of depression / anxiety
- I would rather not say

Please read these statements about feelings and thoughts and tick the box that best describes your experience of each **over the last 2 weeks**.

	All of the time	Often	Some of the time	Rarely	None of the time
I've been feeling optimistic about the future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been feeling restless	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been feeling relaxed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been dealing with problems well	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been thinking clearly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been feeling close to other people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been able to make up my own mind about things	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In the average week, on how many days do you do any physical activity (of sufficient exertion to raise breathing rate) for at least 30 minutes?

0	1	2	3	4	5	6	7
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

The following questions ask you about your feelings and thoughts **during the last month**. In each case, you will be asked to indicate how often you felt or thought a certain way.

How often have you...

Often	Fairly often	Sometimes	Almost never	Never
-------	--------------	-----------	--------------	-------

	Often	Fairly often	Sometimes	Almost never	Never
..been upset because of something that happened unexpectedly?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt that you were unable to control the important things in your life?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt nervous and "stressed"?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt confident about your ability to handle your personal problems?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt that things were going your way?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Often	Fairly often	Sometimes	Almost never	Never
..found that you could not cope with all the things that you had to do?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..been able to control irritations in your life?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt that you were on top of things?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..been angered because of things that were outside of your control?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt difficulties were piling up so high that you could not overcome them?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Often	Fairly often	Sometimes	Almost never	Never

Your garden

Are you a .. ?

- Resident owner
- Tenant
- Lodger

How many years have you had access to your garden?

In its current form, did you plan/design/develop/evolve your garden yourself?

- Yes
- No, I inherited a garden I already liked – only minor changes since I have taken charge.
- No, I brought in a garden designer / landscaper
- Other:

Who else influences the garden design / management?

Please tick all that apply

- Just me
- Partner
- Children
- Other family members
- Friends
- Colleagues
- Professional gardener or landscaper
- Other:

What is the approximate size of your garden? *Please indicate in metres or yards.*

Length	<input type="text"/>
Width	<input type="text"/>
Units (metres/yards)	<input type="text"/>

What can you see beyond the garden?

Please choose the view that is the most dominant.

- Walls/fences/other infrastructure
- Buildings/Built infrastructure
- Countryside view
- Other gardens
- Woodland view

- Coastal view
- Other:

Your gardening activity

In the summer, how regularly do you garden?

- Daily
- 2-3 times a week
- Once a week
- 2-3 times a month
- Once a month or less
- Never

In the summer, how long is a typical gardening 'session'?

- Less than 1 hour
- 1-2 hours
- 2-3 hours
- 4-5 hours
- 6 hours or more

In the winter, how regularly do you garden?

- Daily
- 2-3 times a week
- Once a week
- 2-3 times a month
- Once a month or less
- Never

In the winter, how long is a typical gardening 'session'?

- Less than 1 hour
- 1-2 hours
- 2-3 hours
- 4-5 hours
- 6 hours or more

You the gardener - negative

Coping with negative feelings:

Imagine that you have just had a bad day e.g. at work. Where would you go to reflect on this or banish negative thoughts?

Where do you go to reflect on or banish negative thoughts?

The garden

Other

Where in the garden do you go to and what do you do?

How much time might you spend here?

Which plants can you see/does this involve?

Please leave blank if it does not involve any plants.

You the gardener - positive

Coping with positive feelings:

Imagine that you have just received some very good news e.g. from your family.

Where would you go to reflect on this or celebrate?

- The garden
- Other

Where in the garden do you go to and what do you do?

How much time might you spend here?

Which plants can you see/does this involve?
Please leave blank if it does not involve any plants.

You the gardener - anger

Coping with anger / confrontation / frustration

Imagine that you have just been in an argument or had a confrontation with someone.

Where would you go to reflect on this or calm down?

- The garden
- Other

Where in the garden do you go to and what do you do?

How much time might you spend here?

Which plants can you see/does this involve?
Please leave blank if it does not involve any plants.

Household

Including yourself, how many people live in your household?

- 1
- 2
- 3
- 4
- 5
- 6+

Please put yourself in the mind of **someone else in your household**. Where would they go in the following scenarios?

	Garden	Elsewhere
Responding to negative feelings	<input type="radio"/>	<input type="radio"/>
Responding to positive feelings	<input type="radio"/>	<input type="radio"/>
Responding to anger/confrontation/frustration	<input type="radio"/>	<input type="radio"/>

Where in the garden would they go and what would they do? What plants does this involve, if any?

Age

How old are you?

- Under 18
- 18 - 24
- 25 - 34
- 35 - 44
- 45 - 54
- 55 - 64
- 65 - 74
- 75 - 84
- 85 or older

Demographic Questions

What is your gender?

- Female
- Male
- Other gender identity

What is your ethnic group?

- White British/ any other white background
- Asian British/ any other Asian background
- Mixed/multiple ethnic groups
- African/Caribbean/Black British
- Arab
- Other:

What is your current status?

- Employed full time
- Employed part time
- Self-employed
- Unemployed
- Retired
- Student
- Other:

We would like to know a bit more about your financial situation. Which of the following ranges of net annual income in £ do you fit into?

- Less than £15 000
- £15 000 - £25 999
- £26 000 - £34 999
- £35 000 - £49 999
- £50 000 - £70 000
- More than £70 000

What is your highest level of education?

- Lower than GCSE or equivalent
- GCSE or equivalent
- A Levels or equivalent which allows entry to university
- Foundation degree or equivalent
- Bachelors/Undergraduate University degree or equivalent
- Masters/Postgraduate Taught University degree or equivalent
- Doctorate/Postgraduate Research University degree or equivalent
- Other recognised academic or vocational qualification (e.g. teacher training, nursing...)

What is the first part of your postcode? (e.g. S10 / SW1 / CB3)

Note that we are not asking for the second part of your postcode so that these answers are not identifiable or traceable to you.

Photographs

Which part of your garden do you appreciate the most?

Can you please send a photograph of this. For example, this could be an image of a view you stop and admire your garden from, or what you see from a favourite garden seat. We are interested in understanding garden features people respond to.

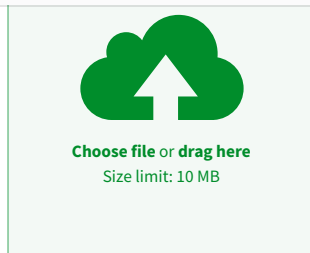
Please upload the photo by entering your ID number, scrolling down, and choosing the file from your device.

Your ID number is 6 digits: your : $\{e://Field/random\}$

This is so that we can link your photo to your responses.

If you would like to do this at a later date, you may go directly to the page with this link: <https://gardens.typeform.com/to/GeRxEc> Please note down your ID number: $\{e://Field/random\}$

2 → Which part of the garden do you appreciate the most? *



3 → Why have you picked this photograph? How much time do you spend here? What does it mean to you?



Further details about questionnaire dissemination

BBC news article 1 May 2018. <https://www.bbc.co.uk/news/in-pictures-43919614>

RHS members email July update

University of Sheffield Landscape Department Website, Facebook, Twitter

Figure A.8: BBC news In Pictures



Figure A.9: Landscape Department Facebook

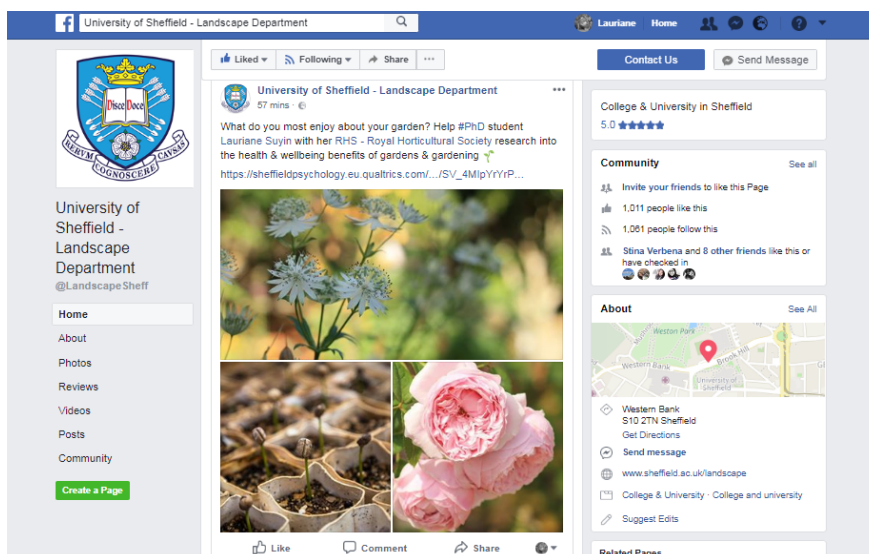


Figure A.10: The Garden Magazine July 2018 issue

Around the RHS this July

1 READ Graham Rice's New Plants blog
Garden writer and plantsman Graham Rice writes a regular blog on our website about the latest new plants available to gardeners. From shorter, bushier penstemons to the blackest *Heuchera*, Graham brings you the most desirable new cultivars. Recently he has looked at some of the plants nominated for Chelsea Plant of the Year 2018. To read these and Graham's previous blog posts, visit rhs.org.uk/new-plants-blog

2 TAKE PART Greening Grey Britain research
In the second stage of her research into the therapeutic effects of front gardens, Lauriane Suyin Chalmin-Pui, RHS PhD student at the University of Sheffield, has launched a new online survey to help her investigate how people relate to their gardens and whether attitudes change as gardens change. The questionnaire asks about your garden, emotions, perceived stress and wellbeing, and individual circumstances. It will also ask you to upload a photograph of the part of your garden that you appreciate the most. Take part at rhs.org.uk/fgsurvey by 31 July 2018.

3 SEE RHS Photographic Competition
The winners of the 2018 RHS Photographic Competition, sponsored by the *Sunday Times*, will be announced at the RHS London Plant & Art Fair (11-12 July; see p85) where winning entries will be on display. From August the display will tour the four RHS Gardens. See RHS Life next month for a selection of the winning images. rhs.org.uk/photocomp

4 VOTE for your favourites at Wisley
Visit the Wisley Trials Field to cast your vote in two People's Choice awards: Fleuroselect's Year of the Marigold display, featuring more than 140 cultivars of Tagetes; and a bedding plant display with more than 80 of the latest cultivars. Vote before the end of September.

5 VISIT Late-evening garden openings
On selected summer dates, RHS Gardens offer a chance to enjoy an evening visit. Normal garden admission applies (free for members) reduced after 5pm to £5 for non-members at Rosemoor, Hyde Hall and Harlow Carr. Wisley 22 June, 27 July and 17 August; last entry 7pm. Hyde Hall 21 and 26 June, 5, 12, 19 and 26 July; last entry 8pm. Harlow Carr 5, 12, 19 and 26 July; last entry 7.30pm. Rosemoor 6, 13, 20 and 27 July; last entry 8pm. rhs.org.uk/gardens



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80 Vincent Square, London SW1P 2PE
020 3176 5800 rhs.org.uk
Director General: Sue Biggs
To contact The Garden, see page 5.

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Membership rhs.org.uk/membership

GARDENING ADVICE
gardening@rhs.org.uk
01483 497000 (weekdays 10am-1pm)
rhs.org.uk/advice
By post: RHS Gardening Advice, RHS Garden Wisley, Woking, Surrey GU24 0QB
In person: Advice Desk, RHS Garden Wisley (11am-3.30pm); RHS Garden Harlow Carr, Mon and Fri (1-3pm) and 1st Sat of month (11am-3pm); RHS Garden Hyde Hall, Wed (1-3pm)

GARDENS AND EVENTS
For information on all RHS Gardens and RHS Partner Gardens rhs.org.uk/gardens
For events, see RHS Life (pp81-101) rhs.org.uk/events

LIBRARIES
RHS Lindley Library 020 7821 3050
Library, London rhs.org.uk
RHS Harlow Carr Library 01423 724686
library.harlowcarr@rhs.org.uk
RHS Wisley Library 01483 212428
library.wisley@rhs.org.uk

SHOWS
For all dates and ticket information rhs.org.uk/shows

EDUCATION AND LEARNING
Qualifications & training, courses and workshops, bursaries 01483 49748
rhs.org.uk/education

COMMUNITIES
RHS Britain in Bloom, It's Your Neighbourhood and Affiliated Societies rhs.org.uk/communities
School gardening rhs.org.uk/schoolgardening

SHOPPING
RHS Books & Gifts Mail Order 01483 211320 rhsshop.co.uk
RHS Plants Mail Order 01344 570838 rhsplants.co.uk

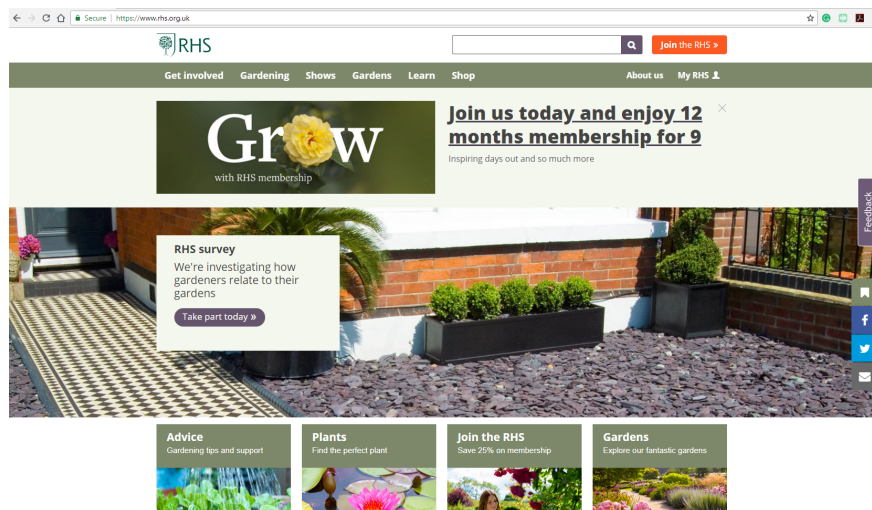
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For more news, events and gardens to visit from across the RHS, see *RHS Life*, pp81-101

rhs.org.uk
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Figure A.11: RHS homepage



The screenshot shows the RHS homepage with a navigation bar (Get involved, Gardening, Shows, Gardens, Learn, Shop, About us, My RHS) and a search bar. A large banner for 'Grow with RHS membership' features a yellow rose and a 'Join us today and enjoy 12 months membership for 9' offer. A survey pop-up asks 'We're investigating how gardeners relate to their gardens' with a 'Take part today' button. Below are four service tiles: Advice (Gardening tips and support), Plants (Find the perfect plant), Join the RHS (Save 20% on membership), and Gardens (Explore our fantastic gardens). A Facebook share button is visible on the right side.

Figure A.12: Monty Don's Facebook page

The image shows a screenshot of Monty Don's Facebook page. At the top, there is a profile picture of Monty Don and a cover photo of him sitting on a grassy hill with two golden retrievers. Below the cover photo, the page name "News from Monty Don" and the handle "@themontydon" are visible. A navigation menu on the left includes "Home", "Posts", "Videos", "Photos", "About", "Community", and "Events", with a "Create a Page" button at the bottom. The main content area features a post from "News from Monty Don" dated "1 hr" ago. The post text asks, "Do you think your garden influences your health and wellbeing? Why not be part of some research into how gardeners relate to their gardens - and whether our mental attitudes change as our gardens develop..." and includes a link to "https://www.rhs.org.uk/.../gardening-in-.../front-garden-research". The post has 55 likes and 3 shares. Below the post, there are two smaller images: one of a garden path and one of a woman's face. To the right of the post, there is a "Public figure" section with "Community" information: "14,529 people like this" and "16,149 people follow this". Below that is an "About" section with the website "www.montydon.com" and "Public figure" status. Further down, there is a "Pages liked by this Page" section listing "Claire Thorogood Dog...", "Hodder Books", and "Le Jardin Secret. Méd...". At the bottom right, there are language options for English (UK), English (US), and Français (France), along with links for "Privacy", "Terms", "Advertising", "AdChoices", "Cookies", and "More".

Data cleaning for text mining

After removing all punctuation, converting all text to lower case, and removing common words (a, the, of), the following words were transformed to be grouped together:

deadheading dead-heading, dead heading

propagation propagating

repotting potting

observation observing

sit sitting

weed weeds, weeding

plural singular e.g. rose, roses and slug, slugs

rear back

patio decking

smell scent

beauty beautiful

Some words were removed as they were likely to be reiterating or not answering the question: "garden", "love", "area", "can", "like", "really", "get", "none", "just", "see", "year", "see", "large", "peaceful", "lots", "also", "around", "top", "lovely", "whole", "one", "favourite", "many".

Results

Favourite plants

Following on from Figure 6.2, specifically named favourite plants are listed below:

7 responses: verbena, primula, jasmine

6 responses: lilac, birch, tulip, delphinium, maple, viburnum, aquilegia, dogwood, buddleia

5 responses: lemon, penstemon, hosta, rhododendron

4 responses: bluebell, poppy, olive, yew, walnut, echinops, honeysuckle, fritillary, heuchera, hollyhock

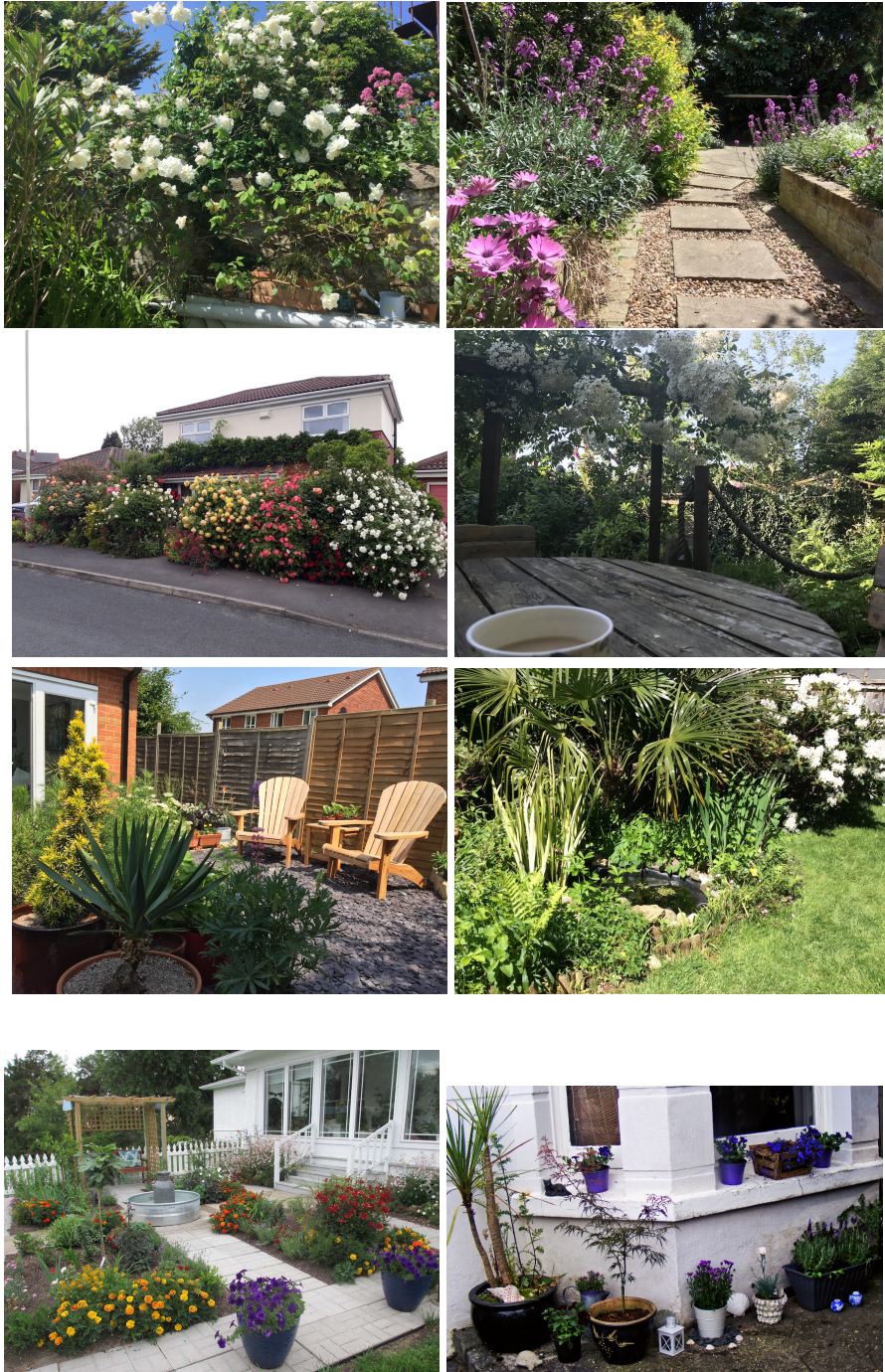
3 responses: euphorbia, oak, hibiscus, fig, ivy, raspberry, willow, bamboo, pittosporum, azalea, strawberry, cyclamen, antirrhinum, amelanchier, mulberry, tomato, courgette

2 responses: camellia, pansy, viola, alchemilla, thistle, fennel, helenium, hebe, echinacea, catmint, ligularia, rosemary, lime, pumpkin, aeonium, orchid, prune, quince, crocus, sunflower, rowan, gooseberry, phormium, agapanthus, apricot, petunia, chestnut, forget-me-not, gladioli, ceanothus

1 response: crocosmia, anemone, chamomile, garlic, sage, thyme, stachys, grape, peach, pear, amaryllis, spruce, hemerocallis, mimosa, campanula, daphne, stipa, phlox, kniphofia, ophiopogon, cottoneaster, oleander, epimedium, rhubarb, eryngeum, alstroemeria, daisy, oxeye, hazel, gingko, cucumber, yucca, agave, bougainvillea, blueberry, asparagus, chives, hawthorn, eucalyptus, oregano, blackcurrant, cypress

Photograph submissions

Figure A.13: Photograph submission examples in response to the question “Which aspect of your garden do you appreciate the most?”



Waived anonymity for photograph credits: Alexa, zaliedal@aol.com, Martin Howe, Ruth Gaskins, Kev.young2015@gmail.com, Onyx Stewart

A.4 Chapter 7 - Quasi-experimental intervention

Interview schedules

First interview schedule

My goal is to ensure you feel comfortable to speak spontaneously, and to hear your ideas and opinions from all of you. The discussion will be free-flowing.

- Are there any specific indicators that make you realise whether you are feeling particularly well or unwell – mentally or physically?
- If so, can you tell me how you are feeling now? Was this different recently?
- Are there any events in your life that are particularly positive or negative? Even if they are not recent, if you think they are still having an impact on your well-being that is still relevant.
- Who do you live with and what is your relationship with them?
- How is work? (if employed)
- How long do you spend in your front garden?
 - Have you been doing any gardening?
 - Are there any plants you like or don't like?
 - Do you think it has changed anything in the street?
 - Do you notice your front garden?
 - What is your favourite part of the front garden?
 - Is there anything in your garden that you think is of therapeutic value?
- What do you think about colourful flowers in your garden? What do they do for you? Do they have any link to your well-being?
- What do you think about fruit and vegetables in your garden? What do they do for you? Do they have any link to your well-being?
- Do you think the garden has any link to your health and well-being?
 - Physical activity?
 - Sleep?

- Mood?
 - Social contact?
 - Neighbourliness?
 - Community belonging?
 - Sense of pride?
 - Sense of achievement?
 - Psychological restoration?
 - Stress restoration and relaxation?
 - Connection with nature?
 - Self-expression?
 - Link to childhood?
- Have you noticed any wildlife, including bees or other insects in your garden?
 - Has your garden had any impact on the street?
 - Fly tipping?
 - Have you done any gardening before? Why? Why not?
 - On a scale of 1-5 how has ____ (person/event/disability/health issue etc) influenced your attitude towards gardening?
 - Is the front garden difficult to maintain?
 - What are your main modes of transport for work? What are your main modes of transport for leisure?
 - How often do you walk somewhere?
 - How well do you know your neighbours? Do you have good relations with your neighbours?
 - Do you feel a sense of belonging to your street? Do you use the park at the bottom of the road?
 - Have any passers-by commented anything about the front garden or the street in general?
 - Are you part of any community groups?
 - Do you do any activities specifically to relax?
 - How often? Is this effective?
 - Is there anything else you'd like to talk about that is going on in your life now or recently? (I cannot and am not well-placed to offer therapy or replies or advice!)

Follow-up interview schedules

My goal is to ensure you feel comfortable to speak spontaneously, and to hear your ideas and opinions from all of you. The discussion will be free-flowing.

- How are you are feeling recently? (Follow up from previous interview)
- How long do you spend in your front garden?
 - Do you notice your front garden?
 - Are there any plants you like or don't like?
 - Have you been doing any gardening?
 - Is the front garden difficult to maintain?
 - Do you think it has changed anything in the street?
 - Have the plants made a difference to your day-to-day life?
 - Is there anything in your garden that you think is of therapeutic value?
- Is there anything you don't like about the changes? Is there anything in your garden that you think is of therapeutic value?
- Would you say your health or well-being has changed as a result of the changes?
Deeper questions:
 - Has anything changed in your life? and what do you think is somewhat or in part attributable to the garden?
 - Helped me to feel happier / Given me increased confidence / Given me a sense of achievement or pride/ Helped me have a sense of purpose / Helped me feel more optimistic about the future / change in mood
 - Helped me relax / Been therapeutic for me / psychological restoration
 - Helped me to cope better / Helped me reduce my worries and anxieties
 - Sleep patterns?
 - Reduced feelings of depression
 - Reduce social isolation and loneliness
 - Helped me make new friends / increase social contact
 - Helped me relate better with my family
 - Allowed me to be more creative / self-expression
 - Improved my physical fitness / levels of physical exercise
 - Helped me gain qualifications

- Helped me gain employment
- Connected to nature?
- Link to childhood?
- What do you think about colourful flowers in your garden?
 - What do they do for you?
 - Do they have any link to your well-being?
 - Smell of lavender and rosemary?
- What do you think about herbs (rosemary) in your garden?
 - What do they do for you?
 - Do they have any link to your well-being?
- Did you use or refer to the booklet I sent? Was it helpful?
- Have you noticed any wildlife, including bees or other insects in your garden?
- Has your garden had any impact on the street?
 - Fly tipping?
- How well do you know your neighbours?
 - Do you have good relations with your neighbours?
 - Do you feel a sense of belonging to your street?
 - Do you use the park at the bottom of the road?
 - Have any passers-by commented anything about the front garden or the street in general?
- (If there are any children) Have children been involved?
- How often do you walk somewhere?
- Are you part of any community groups?
- Is there anything else you'd like to talk about that is going on in your life now or recently or anything about the changes to the front gardens? (I cannot and am not well-placed to offer therapy or replies or advice!)

Final interview schedule

My goal is to ensure you feel comfortable to speak spontaneously, and to hear your ideas and opinions from all of you. The discussion will be free-flowing.

- How are you are feeling recently? (Follow up from previous interview)
- How long do you spend in your front garden? Do you notice your front garden? Are there any plants you like or don't like? Have you been doing any gardening? is it difficult to maintain? Is the front garden difficult to maintain? Do you think it has changed anything in the street? Have the plants made a difference to your day-to-day life? Is there anything in your garden that you think is of therapeutic value?
- Is there anything you don't like about the changes? Is there anything in your garden that you think is of therapeutic value?
- Would you say your health or well-being has changed as a result of the changes?
- Looking back at the past year, how did it change over the seasons? Different from previous years? Deeper questions:
 - Has anything changed in your life? and what do you think is somewhat or in part attributable to the garden?
 - Helped me to feel happier / Given me increased confidence / Given me a sense of achievement or pride/ Helped me have a sense of purpose / Helped me feel more optimistic about the future / change in mood
 - Helped me relax / Been therapeutic for me / psychological restoration
 - Helped me to cope better / Helped me reduce my worries and anxieties
 - Sleep patterns? Reduced feelings of depression
 - Reduce social isolation and loneliness
 - Helped me make new friends / increase social contact
 - Helped me relate better with my family
 - Allowed me to be more creative / self-expression
 - Improved my physical fitness / levels of physical exercise
 - Helped me gain qualifications
 - Helped me gain employment
 - Connected to nature?
 - Link to childhood?

- What do you think about colourful flowers in your garden? What do they do for you? Do they have any link to your well-being? Smell of lavender and rosemary? What do you think about herbs (rosemary) in your garden? What do they do for you? Do they have any link to your well-being?
- Did you use or refer to the booklet I sent? Was it helpful?
- Have you noticed any wildlife, including bees or other insects in your garden?
- Has your garden had any impact on the street? Fly tipping?
- How well do you know your neighbours? Do you have good relations with your neighbours? Do you feel a sense of belonging to your street? Do you use the park at the bottom of the road? Have any passers-by commented anything about the front garden or the street in general?
- (If there are any children) Have children been involved?
- How often do you walk somewhere?
- Are you part of any community groups?
- Would you think it is a good thing to do on other streets? How might that work? Who should do it?
- Is there anything else you'd like to talk about that is going on in your life now or recently or anything about the changes to the front gardens? (I cannot and am not well-placed to offer therapy or replies or advice!)
- Since it is the end of the project, is there anything else you'd like to know?

Pre-intervention questionnaire

First Questionnaire July 2017
Participant ID: _____

Q1 How old are you?

- Under 18
- 18 - 24
- 25 - 34
- 35 - 44
- 45 - 54
- 55 - 64
- 65 - 74
- 75 - 84
- 85 or older

Q2 What is your gender?

- Female
- Male
- Other gender identity

Q3 What is your ethnic group?

- White British/ any other white background
- Asian
- Mixed/multiple ethnic groups
- Black British/African/Caribbean
- Arab
- Other: _____

Q4 What is your current status?

- Employed full time
- Employed part time
- Unemployed
- Self-employed
- Retired
- Student

Q5 If you are employed, we would like to know a bit more about your financial situation. Which of the following ranges of net annual income in £ do you fit into?

- Less than £15 000
- £15 000 - £25 999
- £26 000 - £34 999
- £35 000 - £49 999
- £50 000 - £70 000
- More than £70 000

Q6 What is your highest level of education?

- GCSE or equivalent
- A Levels or equivalent which allows entry to university
- Foundation degree or equivalent
- Bachelors/Undergraduate University degree or equivalent
- Masters/Postgraduate Taught University degree or equivalent
- Doctorate/Postgraduate Research University degree or equivalent
- Other recognised academic or vocational qualification (e.g. teacher training, nursing...)

Q7 What type of accommodation are you currently living in?

- Detached house
- Semi-detached house
- Terrace house
- Flat (in a block of flats)
- Flat (in a house)
- Other: _____

Q8 Are you a ... ?

- Resident owner
- Tenant
- Lodger

Q9 How many years have you lived in your current accommodation?

Q10 Which of these best describe your level of gardening interest and attitude to gardening? Please tick as many as apply.

- No interest in gardening
- Occasional gardener
- Moderate level of interest in gardening
- Keen gardener
- Very passionate about gardening
- Reluctant gardener
- Gardens/RHS Shows Visitor
- Beginner
- Intermediate gardener
- Expert gardener
- Not a gardener

If you are not a gardener, skip to question 15

Q11 How regularly do you actually garden?

- | | |
|---|---|
| <input type="checkbox"/> Daily | <input type="checkbox"/> 2-3 times a month |
| <input type="checkbox"/> 2-3 times a week | <input type="checkbox"/> Once a month or less |
| <input type="checkbox"/> Once a week | <input type="checkbox"/> Never |

Q12 Why do you garden?

Q13 Are you a member of a gardening club, allotment group or organisation such as the Royal Horticultural Society?

- Yes : _____
 No

Q14 Are you involved in any Britain in Bloom activities in your city, town or village?

- Yes
 No

If you are a gardener and have answered questions 11-14, skip to question 16

Q15 Why do you consider yourself not to be a gardener? Please select as many as apply.

- I don't have time to garden
 Gardening is too expensive
 I don't have space to garden
 I don't have any practical gardening skills (e.g. weeding, pruning, sowing etc)
 I don't know enough about what plants need
 I don't know what to do when a plant seems to be dying
 I have been an unsuccessful gardener in the past
 Gardening is boring
 Gardening is a chore
 Other: _____

End of branching - For all respondents

Q16 Do you have any chronic illness or disability that requires special attention in the context of gardening? These might be physical or mental disabilities or illnesses including dementia, autism, Asperger's.. Please remember that this information will be held entirely confidential and anonymous. Please leave blank if not applicable.

Q17 Which of the following do you have access to? Please select as many as apply, or none. It does not have to be actively maintained or gardened to count. For example, you may have access to a front garden that is completely paved over and has no plants in it.

- Front garden
- Back garden
- Shared garden
- Allotment
- Container planting/hanging baskets for example on a balcony
- Conservatory or other indoor plants
- Other type of gardening space: _____

If you do not have access to any of the above, skip to question 25

Q18 In which of the following do you garden? Please select as many as apply, or none.

- Front garden
- Back garden
- Shared garden
- Allotment
- Container planting/hanging baskets for example on a balcony
- Conservatory or other indoor plants
- Other type of gardening space:

If you have access to a front garden, answer questions 19-22

Q19 Has your front garden been paved over in the last 10 years?

- Yes - fully
- Yes - partially
- No
- I don't know

Q20 Do you use your front garden for off-road parking?

- Yes
- No

Q21 Approximately what percentage of your front garden is planted?

Q22 How happy are you with your front garden currently?

- Extremely happy
- Somewhat happy
- Neither happy nor unhappy
- Somewhat unhappy
- Extremely unhappy

If you have access to a back garden, answer questions 23-24

Q23 Which of the following activities do you do in your back garden? Please select as many as apply.

- Grow fruits, vegetables or herbs
- Grow ornamental plants
- Play area for children/grandchildren etc
- Outdoor eating
- Other physical activity
- Creative activities e.g. painting, writing
- Other: _____

Q24 How happy are you with your back garden currently?

- Extremely happy
- Somewhat happy
- Neither happy nor unhappy
- Somewhat unhappy
- Extremely unhappy

End of branching - For all respondents

Q25 In general, how would you rate your area as a place to live?

- Excellent
- Good
- Average
- Poor
- Terrible

Q26 How would you rate the sense of community spirit in your area?

- Excellent
- Good
- Average
- Poor
- Terrible

Q27 About how often do you and people in your neighbourhood do favours for each other? e.g. Looking after each other's children, helping with shopping, lending garden or house tools, and other small acts of kindness.

- Often
- Sometimes
- Rarely
- Never

Q28 Please select any leisure activities that you have engaged with in the last month, by ranking them in order of regularity. The activity that you did the most often should be ranked as number 1, followed by numbers 2, 3, etc. Please leave blank activities that you did not engage with.

- Watching television
- Walking for pleasure (without a dog)
- Dog-walking
- Reading books for pleasure
- Participating in team sports (e.g. football, rowing)
- Participating in individual sports (e.g. tennis, swimming, cycling)
- Eating or drinking out
- Playing adult card or board games
- Going to the cinema
- Wildlife watching
- Visiting art galleries and museums
- Listening to music
- Collecting objects
- Arts and crafts and other DIY projects
- Attending sports events e.g. football matches
- Attending theatre, opera or dance performances
- Surfing the internet
- Visiting natural environments/green spaces
- Visiting a tourist attraction
- Gardening
- Cooking/baking
- Other: _____

Q29 Please read these statements about feelings and thoughts and tick the box that best describes your experience of each over the last 2 weeks.

	All of the time	Often	Some of the time	Rarely	None of the time
I've been feeling optimistic about the future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been feeling restless	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been feeling relaxed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been dealing with problems well	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been thinking clearly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been feeling close to other people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been able to make up my own mind about things	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q30 In the average week, on how many days do you do any physical activity (of sufficient exertion to raise breathing rate) for at least 30 minutes?

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7

Q31 The following questions ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. How often have you...

	Often	Fairly often	Sometimes	Almost never	Never
..been upset because of something that happened unexpectedly?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt that you were unable to control the important things in your life?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt nervous and "stressed"?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt confident about your ability to handle your personal problems?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt that things were going your way?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..found that you could not cope with all the things that you had to do?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..been able to control irritations in your life?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt that you were on top of things?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..been angered because of things that were outside of your control?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt difficulties were piling up so high that you could not overcome them?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please answer each of these questions in terms of the way you generally feel.

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I often feel a sense of oneness with the natural world around me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think of the natural world as a community to which I belong.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I recognize and appreciate the intelligence of other living organisms.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often feel disconnected from nature.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I think of my life, I imagine myself to be part of a larger cyclical process of living.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often feel a kinship with animals and plants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel as though I belong to the Earth as equally as it belongs to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have a deep understanding of how my actions affect the natural world.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often feel part of the web of life.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel that all inhabitants of Earth, human, and nonhuman, share a common 'life force'	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Like a tree can be part of a forest, I feel embedded within the broader natural world.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I think of my place on Earth, I consider myself to be a top member of a hierarchy that exists in nature.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often feel like I am only a small part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My personal welfare is independent of the welfare of the natural world.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Post-intervention questionnaire

Second Questionnaire August 2017
Participant ID: _____

Q1 Approximately what percentage of your front garden is planted?

Q2 How happy are you with your front garden currently?

- Extremely happy
- Somewhat happy
- Neither happy nor unhappy
- Somewhat unhappy
- Extremely unhappy

Q3 In which of the following do you garden? Please select as many as apply, or none.

- Front garden
- Back garden
- Shared garden
- Allotment
- Container planting/hanging baskets for example on a balcony
- Conservatory or other indoor plants
- Other type of gardening space:

Q4 Which of the following activities do you do in your back garden? Please select as many as apply.

- Grow fruits, vegetables or herbs
- Grow ornamental plants
- Play area for children/grandchildren etc
- Outdoor eating
- Other physical activity
- Creative activities e.g. painting, writing
- Other: _____

Q5 How happy are you with your back garden currently?

- Extremely happy
- Somewhat happy
- Neither happy nor unhappy
- Somewhat unhappy
- Extremely unhappy

Q6 In general, how would you rate your area as a place to live?

- Excellent
- Good
- Average
- Poor
- Very poor

Q7 How would you rate the sense of community spirit in your area?

- Excellent
- Good
- Average
- Poor
- Very poor

Q8 About how often do you and people in your neighbourhood do favours for each other?
e.g. Looking after each other's children, helping with shopping, lending garden or house tools, and other small acts of kindness.

- Often
- Sometimes
- Rarely
- Never

Q9 What is your current status?

- Employed full time
- Employed part time
- Unemployed
- Self-employed
- Retired
- Student

Q10 Which of these best describe your level of gardening interest and attitude to gardening? Please tick as many as apply.

- No interest in gardening
- Occasional gardener
- Moderate level of interest in gardening
- Keen gardener
- Very passionate about gardening
- Reluctant gardener
- Gardens/RHS Shows Visitor
- Beginner
- Intermediate gardener
- Expert gardener
- Not a gardener

If you are not a gardener, skip to question 14

Q11 How regularly do you actually garden?

- Daily
- 2-3 times a week
- Once a week
- 2-3 times a month
- Once a month or less
- Never

Q12 Why do you garden?

Q13 Are you a member of a gardening club, allotment group or organisation such as the Royal Horticultural Society?

- Yes : _____
- No

If you are a gardener and have answered questions 11-13, skip to question 15

Q14 Why do you consider yourself not to be a gardener? Please select as many as apply.

- I don't have time to garden
- Gardening is too expensive
- I don't have space to garden
- I don't have any practical gardening skills (e.g. weeding, pruning, sowing etc)
- I don't know enough about what plants need
- I don't know what to do when a plant seems to be dying
- I have been an unsuccessful gardener in the past
- Gardening is boring
- Gardening is a chore
- Other: _____

Q15 Please select any leisure activities that you have engaged with in the last month, by ranking the top 3 in order of regularity. The activity that you did the most often should be ranked as number 1, followed by numbers 2, 3. Please leave blank activities that you did not engage with.

- Watching television
- Walking for pleasure (without a dog)
- Dog-walking
- Reading books for pleasure
- Participating in team sports (e.g. football, rowing)
- Participating in individual sports (e.g. tennis, swimming, cycling)
- Eating or drinking out
- Playing adult card or board games
- Going to the cinema
- Wildlife watching
- Visiting art galleries and museums
- Listening to music
- Collecting objects
- Arts and crafts and other DIY projects
- Attending sports events e.g. football matches
- Attending theatre, opera or dance performances
- Surfing the internet
- Visiting natural environments/green spaces
- Visiting a tourist attraction
- Gardening
- Cooking/baking
- Other: _____

Q16 Please read these statements about feelings and thoughts and tick the box that best describes your experience of each over the last 2 weeks.

	All of the time	Often	Some of the time	Rarely	None of the time
I've been feeling optimistic about the future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been feeling restless	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been feeling relaxed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been dealing with problems well	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been thinking clearly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been feeling close to other people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've been able to make up my own mind about things	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q17 In the average week, on how many days do you do any physical activity (of sufficient exertion to raise breathing rate) for at least 30 minutes?

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7

Q18 The following questions ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. How often have you...

	Often	Fairly often	Sometimes	Almost never	Never
..been upset because of something that happened unexpectedly?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt that you were unable to control the important things in your life?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt nervous and "stressed"?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt confident about your ability to handle your personal problems?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt that things were going your way?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..found that you could not cope with all the things that you had to do?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..been able to control irritations in your life?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt that you were on top of things?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..been angered because of things that were outside of your control?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
..felt difficulties were piling up so high that you could not overcome them?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q19 Please answer each of these questions in terms of the way you generally feel.

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I often feel a sense of oneness with the natural world around me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think of the natural world as a community to which I belong.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I recognize and appreciate the intelligence of other living organisms.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often feel disconnected from nature.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I think of my life, I imagine myself to be part of a larger cyclical process of living.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often feel a kinship with animals and plants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel as though I belong to the Earth as equally as it belongs to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have a deep understanding of how my actions affect the natural world.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often feel part of the web of life.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel that all inhabitants of Earth, human, and nonhuman, share a common 'life force'	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Like a tree can be part of a forest, I feel embedded within the broader natural world.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I think of my place on Earth, I consider myself to be a top member of a hierarchy that exists in nature.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I often feel like I am only a small part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My personal welfare is independent of the welfare of the natural world.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Cortisol sampling information sheet

Collecting saliva with the salivette for Cortisol determination

You have been given a small cardboard box with all the material needed to give samples of your saliva. The box contains 8 containers each containing a 'salivette' which in turn contains a small swab. The containers and salivettes are labelled from A.1 to A.8. There is a number in front of this, for example 1A.1 or 2A.1, this is your participant ID number and all your containers should have this number.



Please follow these instructions on two consecutive days

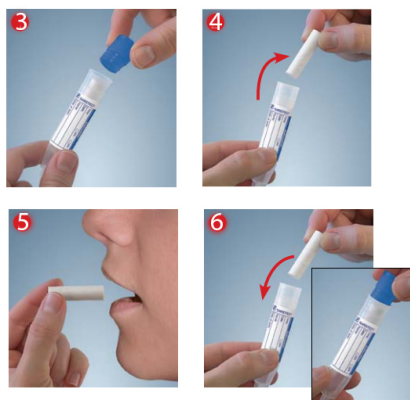
1. Collect a sample of saliva at each of the following times
 - 3 hours after you wake up
 - 6 hours after you wake up
 - 9 hours after you wake up
 - 12 hours after you wake up

For example, if you wake up at 8am, you should collect samples at 11am, 2pm, 5pm, and 8pm.

To help you plan this, please note your waking time on the back of this sheet and calculate to take a sample every three hours after this. I will send you text message reminders 30 minutes before you need to take a sample and then again when you need to take a sample. These times will be based on when you let me know you will be waking up.

Do not eat or drink anything but water at least 30 minutes before taking a sample. You may eat and drink immediately after having finished collecting a sample.

2. Open the box provided to you and take out the container labelled A.1 for the first sample (A.2 for the second, A.3 for the third, etc, as indicated in the saliva sampling form overleaf). Open the screw cap and take out the blue salivette.
3. Remove the blue stopper. Removal of the stopper is easier if you slightly push it to the side at the same time.
4. Take out the swab from the salivette.
5. Gently chew the swab for 1 minute. Keep the swab in your mouth until you feel that you can no longer prevent yourself from swallowing the saliva you are producing.
6. Return the saturated swab to the salivette and close it tightly with the blue stopper.
7. Fill in the date and time of your sample on the label of the salivette.
8. Place the salivette back in its plastic container and screw the cap back on.
9. Store the container back in the box.
10. Fill in the saliva sampling form overleaf.



Please store your samples in the fridge if possible if you are at home. If you will be out at the time you will be taking samples, please take the container with you.

When packing your 8 samples back in the box, make sure each container has its cap tightly screwed on and that all 8 samples are in the protective foam bag. Put your form back in the box too.

It may not seem like it, but the 8 containers do fit in the box, if arranged with the caps facing in alternate directions and one container aligned in the opposite direction, as in the photo below.

Lauriane will collect the boxes and form from you and send them to the laboratory.

Thank you!

Any questions, email Lauriane at lschalmin-pui1@sheffield.ac.uk or text/call 07546611558



Saliva sampling form

Participant ID number (*the number on your box*):

Date of 1st day of saliva sampling:	Salivette number	Most recent food or drink (note the time at which you finished eating or drinking) You should not eat or drink 30 minutes before collecting a sample
Wake up time:	-	-
Time of Sample 1:	A.1	
Time of Sample 2:	A.2	
Time of Sample 3:	A.3	
Time of Sample 4:	A.4	
Date of 2nd day of saliva sampling:	Salivette number	Most recent food or drink (note the time at which you finished eating or drinking) You should not eat or drink 30 minutes before collecting a sample
Wake up time:	-	-
Time of Sample 5:	A.5	
Time of Sample 6:	A.6	
Time of Sample 7:	A.7	
Time of Sample 8:	A.8	

An example of a completed form:

Date of 1st day of saliva sampling: 24 April 2017	Salivette number	Most recent food or drink (note the time at which you finished eating or drinking) You should not eat or drink 30 minutes before collecting a sample
Wake up time: 8.15 am	-	-
Time of Sample 1: 11.15 am	A.1	Coffee at 9am
Time of Sample 2: 2.15 pm	A.2	Sandwich lunch at 12.30 pm
Time of Sample 3: 5.15 pm	A.3	Tea at 4.45 pm
Time of Sample 4: 8.15 pm	A.4	Chicken at 7 pm
Date of 2nd day of saliva sampling: 25 April 2017	Salivette number	Most recent food or drink (note the time at which you finished eating or drinking) You should not eat or drink 30 minutes before collecting a sample
Wake up time: 7.30 am	-	-
Time of Sample 5: 10.30 am	A.5	Biscuit at 10 am
Time of Sample 6: 1.30 pm	A.6	Lunch and tea at 12 pm
Time of Sample 7: 4.30 pm	A.7	Apple at 4 pm
Time of Sample 8: 7.30 pm	A.8	Dinner at 7pm

Information booklet for Research participants



RHS
Greening
Grey Britain

The RHS Front Garden Project

 Royal
Horticultural
Society
Sharing the best in Gardening

Caring for your plants

- ◆ Introduction
- ◆ Weekly checklist and rogues' gallery
- ◆ Planting plans and plant spotter
- ◆ A 'how to' guide
- ◆ Plant calendar

Welcome

Thank you for taking part in this science project. We are delighted to be working with the Royal Horticultural Society and the University of Sheffield.

Once the containers and plants are installed, they will need a little looking after while the research is undertaken in 2017. This mainly just involves topping up the water in the containers, but this guide provides more in-depth information should you need it. As to explaining what plants are and how you can identify them, we have included a list of plants so that you can continue to grow the plants provided off for the experiment is complete.

We hope this guide provides the answers to your gardening questions. However, if you need further gardening help, you can contact RHS Gardening Advice (see contact details below).

Questions about the project

If you have any queries about the project, contact the organisers Lauriane Sjoyn Chahim-Pu by email (lchahim-pu@sheffield.ac.uk) or call 072546 611558.

More gardening advice

If you need further help caring for your plants, contact RHS Gardening Advice at gardeningadvice@rhs.org.uk or call 01483 479700 (Mon-Fri 10am-6pm Mar-Oct; 10am-1pm Nov-Feb). Please quote the number 27338823.

For RHS Gardening Advice online, visit rhs.org.uk/advice



Plant spotter

Here are a few facts about each plant, arranged roughly in order of size, from big to small. Use their full names if you want to find out more from books or websites. Except for the petunias and violas, these plants should last for many years.



Serviceberry 1

Amelanchier canadensis
'Glem Farm'
Small white flowers for bees in spring; blue-black berries for birds in summer; red, yellow and orange leaves in autumn. Can reach 5m (15ft).



Juniper 2

Juniperus scopulorum
'Blue Arrow'
Evergreen conifer. Makes a narrow column of steel blue foliage and can reach 4m (13ft). Junipers help clean the air by trapping pollution.



Clematis 3

You may have one of these two clematis – 'Jackmanii' (left) or 'Ville de Lyon' (right). In December 2017, January cut all stems off at 20cm above ground level. They may well entirely regrow up the trellis.



Rosemary 4

Rosmarinus officinalis Prostratus Group
Aching branches with aromatic, woody stems. Use in cooking. Small blue flowers are also edible, and good for bees.



Azalea 5

Rhododendron 'Wombur'
Usually it looks like a woody plant with bright pink flowers in early summer.



Lavender 6

Lavandula angustifolia 'Hidcote'
A dwarf bush, with silvery, evergreen leaves and dark purple flowers that bees love. Cut and dry the flowers for cooking, or sprinkle some in the bath.



Petunia 7

Petunia *Suecica* 'Six Bells'
Masses of scented, light purple flowers from late spring to late autumn. Remove dead flowers to encourage more. Plants will die in winter.



Viola 8

Viola *Suecica* Series, mixed
Small combinations with many different colour combinations from autumn to spring. May die in late summer; reseeded to probing flowering. Double flowers look pretty in solid.



Daffodil 9

Narcissus 'Tête-à-tête'
An onion-like bulb producing bluish-green leaves and pairs of golden-yellow flowers in early spring. Let them die in late summer. Don't cut them off or let them up.



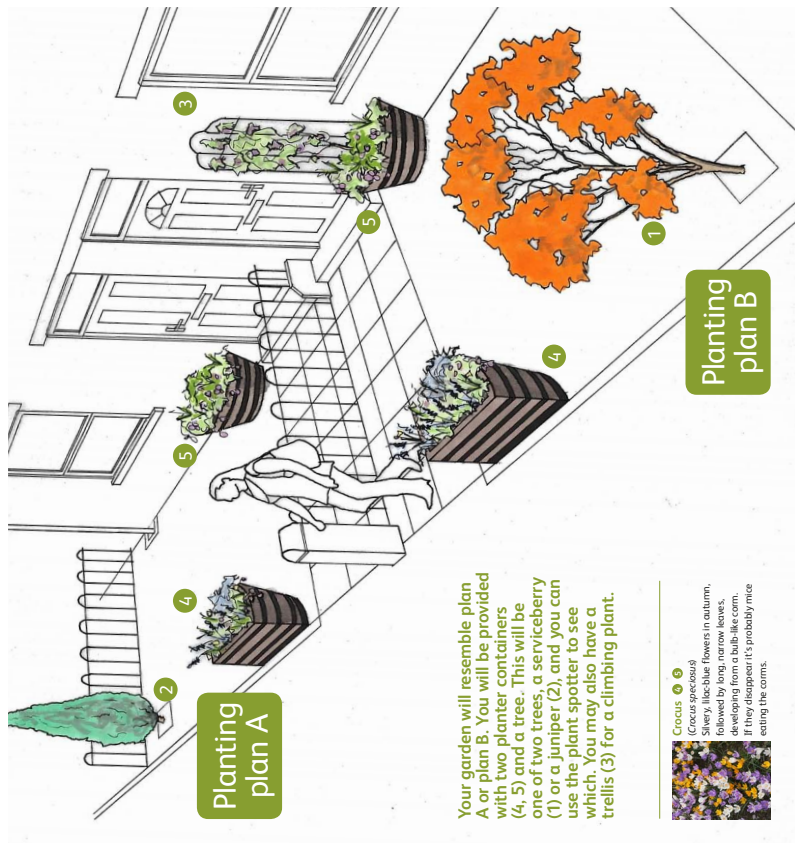
Bluebell 10

Hyacinthoides non-scripta
Shiny, dark green leaves and arching stems of deep blue, fragrant flowers, which are very hardy. This is our native bluebell, which grows wild in the countryside.



Snowdrop 11

Gaillardia *axillaris*
Orange-red flowers and healthy, upright stems. Plants are hardy from small bulbs in late winter, which ever the weather.



Planting plan A

2

4

5

5

3

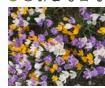
5

4

1

Planting plan B

Your garden will resemble plan A or plan B. You will be provided with two planter containers (4, 5) and a tree. This will be one of two trees, a serviceberry (1) or a juniper (2), and you can use the plant spotter to see which. You may also have a trellis (3) for a climbing plant.



Crocus 4-6

Crocus *spectabilis*
Every year, their flowers in autumn, orange, yellow and white, are developing from a bulb-like corn. If they disappear it's probably mice eating the corns.

How to...

1. Prune lavender

Lavenders need a haircut once a year to keep the bushes neat and compact. In late summer, once the petals have shrivelled, you can pick the scented flower heads for drying in the house. You then need to cut off most of the new growth, which will be relatively soft and leafy. Just leave about 1–2cm (½in) above the older, woodier stems.

2. Prune the serviceberry, juniper, rosemary and azalea

Thankfully these plants do not need regular pruning. Check them over in spring and autumn and remove any bits that have died, are getting in the way, or spoiling the overall shape. If these plants get too big you can cut them back – refer to the Plant Calendar for the best time. Make sure your cutting tools are sharp and cut just above a bud or side branch. This avoids creating dead stumps.

3. Feed your plants

Plants growing in containers need added fertiliser to keep them healthy and growing well. Your planters already have enough fertiliser for the first year, but you will need to add more next year. The easiest way is to add a controlled-release fertiliser in spring. This releases food slowly and lasts the whole season. One packet (available from garden centres and hardware shops) usually provides enough for several years' applications, or share with your neighbours. The planters contain about 60 litres of compost, and there will be instructions on the fertiliser packet for how much to add. The trees will not need feeding.



Rogues' gallery

Your plants will attract insects and other mini-beasts. Useful ones include bees which pollinate crops, and ladybirds which eat greenfly. Most other insects you see will be harmless. However, pests such as greenfly and slugs may damage plants so see below for advice on what to do. **If using pesticides, always read the label and use them safely.**

1. Greenfly (aphids)

These are small, sap-sucking pests about 2mm (¼in) long. A few will do little harm and may be eaten by ladybirds or birds. If numbers increase they can distort and damage shoots. Squashing them by hand is quick and effective. If you want to use a spray, try one based on natural products first such as Bug Clear for Fruit & Veg Gun! and Bayer Organic Bug Free. Never spray plants in flower, to avoid harming bees.

2. Rosemary beetle

This pretty beetle is only 7mm (¾in) long. The adults and their greyish grubs feed on rosemary and lavender. If they start damaging your

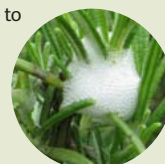
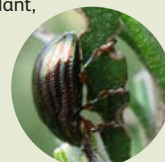
plants, treat the same way as greenfly, as these products are suitable for edible plants.

3. Cuckoo spit

This is the bubbly home of a sap-sucking bug called a froghopper, which looks like an oversized greenfly. It may appear on any plant, but seems to like lavender. A few cause no real harm. If numbers build up, treat as for greenfly.

4. Slugs and snails

Often unseen, as they feed mainly at night, slugs or snails can be responsible for damage to soft-leaved plants. That includes clematis, as snails are good climbers. Silvery slime trails help give them away but are not always seen. The kindest control is to collect them up into a container and take them to a patch of waste ground away from gardens. You can attract them with half a scooped out orange, or melon skin, cut side down. If you have real problems then slug pellets are an option. Choose ones based on ferric phosphate (Garden Slug Killer, Bayer Organic Slug Bait), which should not harm wildlife or pets.



All images © RHS except cover (*Clematis* 'Ville de Lyon') © Dorling Kindersley. Illustration: Richard Eborn.

Your Plant Calendar

		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
All plants	Remove any shoots or branches that have died over winter												
	In future years add controlled-release fertiliser to the planters (see 'how to' guide)												
	Remove any dead, dying or diseased shoots or branches (see 'how to' guide)												
All bulbs	In future years, allow leaves to die down naturally – don't cut or tie them												
	Clear away any dead tree leaves from round new bulb shoots												
Azalea	Trim any shoots that spoil the shape (see 'how to' guide)												
Clematis	Tie new shoots to the support with soft string												
	Continue to tie new shoots to the support with soft string as needed												
	Cut off all stems about 30cm above the compost and pull away from trellis												
Crocus	Look out for the flowers appearing – you may need to clear a bit of space for them												
Juniper	Trim branches if necessary (see 'how to' guide)												
Lavender	Prune bushes once flowers are finished (see 'how to' guide)												
	Pick flowers for drying												
Petunia	In future, replace plants in late May												
	Remove dead plants once killed by frost												
Rosemary	Trim branches if necessary (see 'how to' guide)												
Serviceberry	Remove any unwanted branches (see 'how to' guide)												
Viola	Cut shoots back by about two thirds once flowering finishes												
	These may last for two or three years, but will then need replacing in autumn												

Your weekly checklist

Watering

Plant roots like to be in moist soil – not dry, not drowned. The planters have a reservoir in the base to keep the compost moist, so you just need to top this up as needed. Check every day at first, until you get used to how much the plants use. During its first two years your tree will need water too if the weather is dry. If the soil looks dry below the surface, slowly add a watering canful (10 litres / 2 gal) each evening until the soil stays moist overnight – or the rain does the job for you.

Deadheading

Removing dead flowers improves plants' appearance, stops them wasting their energy on unnecessary seeds,

and can encourage production of more flowers. Just snap or cut the stem below each dead flower. At the same time you can remove any dead or sickly leaves

Pest control

Luckily many insects are harmless, or actually do good, but check regularly and use our Rogues' Gallery to nip problems in the bud.

Weeding

Weeds look untidy, and compete with your plants for food, water and light. Try to remove weeds when small, as this causes least disturbance. A trowel or old spoon can help ease them out. Remove any litter and debris at the same time

Full results

Demographic and other responses from all research participants, stratified by whether they provided salivary cortisol samples or not

	Total Mean (n=41)	Total SD	No cortisol Mean (n=10)	No cortisol SD	Cortisol Mean (n=31)	Cortisol SD
Percentage sample			0.26		0.74	
Gender						
Female	0.64		0.64		0.65	
Male	0.36		0.36		0.35	
Age						
18 - 24	0.05		0		0.06	
25 - 34	0.17		0.09		0.19	
35 - 44	0.31		0.27		0.32	
45 - 54	0.26		0.18		0.29	
55 - 64	0.14		0.27		0.10	
65 - 74	0.05		0.09		0.03	
85 or older	0.02		0.09		0	
Ethnicity						
Arab	0.05		0		0.07	
Black British/African/ Caribbean	0.02		0.05		0.03	
White British/ any other white background	0.93		1		0.90	
Status						
Employed full time	0.38		0.45		0.35	
Employed part time	0.29		0.18		0.32	
Retired	0.12		0.27		0.06	

	Total Mean (n=41)	Total SD	No cortisol Mean (n=10)	No cortisol SD	Cortisol Mean (n=31)	Cortisol SD
Self-employed	0.05		0		0.06	
Unemployed	0.17		0.09		0.19	
Income						
Less than 15 000	0.45		0.625		0.40	
15 000 - 25 999	0.30		0.125		0.36	
26 000 - 34 999	0.21		0.25		0.20	
35 000 - 49 999	0		0		0	
50 000 - 70 000	0		0		0	
More than 70 000	0.03		0		0.04	
Education						
GCSE	0.33		0.43		0.31	
Foundation degree	0.12		0.14		0.12	
Other recognised academic or vocational qualification	0.18		0.14		0.19	
A Levels	0.21		0.29		0.19	
Bachelors	0.09		0		0.12	
Masters	0.03		0		0.04	
Doctorate	0.03		0		0.04	
Tenure						
Lodger	0.02		0		0.03	
Resident owner	0.43		0.18		0.52	
Tenant	0.48		0.82		0.45	
Gardener						
Keen gardener	0.17		0.20		0.16	
Non-gardener	0.22		0		0.29	

	Total Mean (n=41)	Total SD	No cortisol Mean (n=10)	No cortisol SD	Cortisol Mean (n=31)	Cortisol SD
Occasional gardener	0.61		0.80		0.55	
Years lived in house	10.46	10.89	13.46	15.67	9.60	9.24
Perceived Stress Score (PSS) pre	17.43	6.51	14.43	6.29	18.11	6.46
PSS post	14.5	6.27	13.14	4.38	14.90	6.75
Perceived Well-being (SWEMWBS) pre *	22.26	3.63	25.11	3.71	21.50	3.26
SWEMWBS post	22.6	2.83	22.67	2.94	22.57	2.86
Connectedness to Nature pre	3.43	0.39	3.52	0.29	3.40	0.41
Connectedness to Nature post	3.57	0.45	3.50	0.80	3.59	0.36
Happy with front garden pre	3.70	1.10	3.43	1.27	3.78	1.06
Happy with front garden post	1.26	0.41	1.19	0.37	1.29	0.43
Neighbourly favours pre	2.26	1.10	2.00	1.07	2.33	1.11
Neighbourly favours post	2.38	0.98	2.19	1.03	2.45	0.97
Area rating pre	2.71	0.68	2.5	0.53	2.77	0.71
Area rating post	2.58	0.76	2.5	0.76	2.60	0.77
Community rating pre	2.79	0.86	2.25	0.71	2.93	0.85

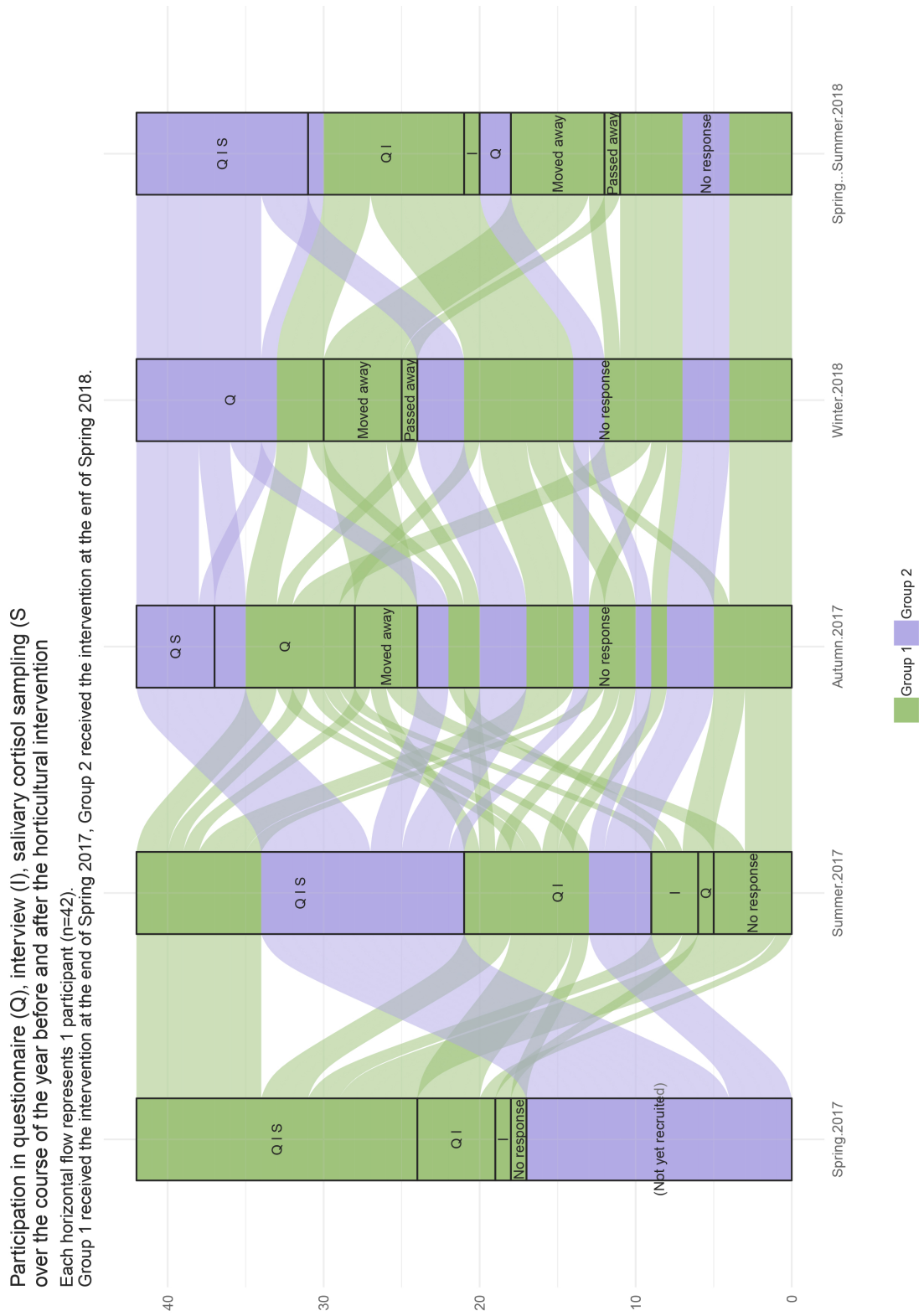
	Total Mean (n=41)	Total SD	No cortisol Mean (n=10)	No cortisol SD	Cortisol Mean (n=31)	Cortisol SD
Community rating post	2.86	0.91	2.75	0.65	2.90	0.99
PSS change (post-pre)	-2.46	5.30	1.25	5.74	-3.07	5.09
SWEMWBS change (post-pre)	0.15	3.01	-2.32	4.17	0.68	2.50
Connectedness to nature change (post-pre)	0.09	0.32	-0.01	0.20	0.10	0.33

* a statistically significant difference between participants who did and did not provide cortisol samples $p < 0.05$ (Mann Whitney U Test for continuous data, Fisher's exact count test for categorical data).

Response rates

Each stratum represents one participant. It is therefore possible to follow individual participants and track their responses over the course of the intervention. For example, following the top-most stratum, this participant returned questionnaire and interview responses, and provided saliva samples in Spring 2017. They returned all three in Summer 2017. In Autumn 2017, the same participant only returned a questionnaire. In Winter 2018, the participant again only returned a questionnaire. In Spring 2018, the participant returned both questionnaire and interview responses.

Figure A.14: Alluvial diagram showing response rates for longitudinal research



Sponsorship and assistance

As mentioned in the acknowledgements, many individuals have assisted the project in their professional capacities. Their contributions are detailed below.

The Royal Horticultural Society: Paul Alexander (supervision and guidance at inception of research), Leigh Hunt (horticultural advice and putting together advice booklet for research participants), Andrea van Sittart (initiating focus group contacts), Laura Robins Hoy (general and financial administration), Chris Young (press and outreach), Garfield Myrie (press and outreach), Anisa Gress (press and outreach), Ian Reynolds (press and outreach), Ian Tomson (press and outreach), Sophie Dawson (press and outreach), Matt Rooke (press and outreach), Rosemary Ward (advice booklet), Richard Eborn (advice booklet), Richard Sanford (advice booklet), Laura Scruby (press and outreach), Anna da Silva (fieldwork assistance), Hannah Curry (fieldwork assistance).

Full sponsorship for university tuition fees, student stipend, and project expenses.

United Utilities: Julia Holland (sponsorship contact point)

£30,000

ForHousing: Jill Fenlon, Martin Hague, Rebecca Whittle (location scouting, arranging licensing, sponsorship)

£15,000

The University of Sheffield: Tim Heaton (statistical assistance), Paul Brindley (programming assistance), Paul Buck (IT assistance), Janet Richardson (financial administration)

The University of Virginia: Clay Ford and Marieke Jones (statistical assistance)

The University of Westminster: Nina Smyth (assaying of saliva samples)

Amberol UK: Patience Atkinson-Gregory (30 containers free of charge, 43 containers at cost price)

BHGS: David Mason (fertiliser free of charge)

B&Q: Gin Tidridge (plants for treatment street free of charge, and arrangements for buying plants for control street)

Frank P Mathews: (trees free of charge)

Gardman: Laura Kew (trellises free of charge)

Hultons: Rory Littlewood and Jordan (clearing and planting), Leo Cahalan and Rick Emerson (project management)

Melcourt: Neil Gray (compost free of charge)

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