Green Time & Mental Health - Existing Interventions and Green Time Needs of Stressed Students

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Abstract

Introduction. The individual, interpersonal, societal, and economical effects of mental health issues are large. Especially cost- and resource-effective interventions are needed to help clinically ill individuals. Green time (GT) has been shown to yield positive effects on mental and physical health. While the use of GT for e.g. children is widely researched, the benefits of GT interventions for psychologically ill individuals are less explored. **Aim.** This two-parted study aimed to explore already existing GT interventions and their effects on clinical samples, as well as the knowledge, needs, and barriers towards spending GT in stressed students. **Methods.** First, a systematic literature review was conducted to review papers about GT increasing interventions for clinical samples measuring effects on mental health. Second, an interview study with fifteen stressed students was conducted to explore their knowledge, beliefs, needs, and barriers towards spending GT. Additionally, the interviewees were asked for possible ways to overcome their obstacles towards spending GT. The quality assessment tool for quantitative studies revealed most studies as being of low quality (n = 4), while each one was of moderate (n=1) and high quality (n=1). The six included articles described several forms of GT increasing interventions, involving walking interventions, interventions based on societal need, animal-assisted therapy and nature-based therapy (NBR). Positive effects of GT on mental health in adult clinical samples, as for example decreased depression or increased self-efficacy were found in six studies. The interviews resulted in clusters of needs, beliefs, and barriers towards spending GT in stressed students. Having too little free time or access to green spaces were obstacles most participants experience. All participants mentioned experiencing positive feelings through spending GT. Fourteen named the change of scenery and sensations as compared to their daily life as a key factor of the positive influences of GT on them. **Discussion.** GT can help stressed students to maintain their mental health and distress, as well as clinical samples to deal with their symptoms and gain quality of life. Knowledge about GT (increasing interventions) needs to be spread to relevant stakeholders and clinically ill individuals. The combination of self-efficacy treatment with GT, and of farm animal care with GT could be efficient ways to enhance GT levels and its effects in clinical samples and stressed students. The effects of GT increasing interventions on specific groups, like anxious individuals, must be further validated. Current results need to be replicated through studies of high quality.

Keywords. Green time increasing interventions, clinical samples, literature review, interview study, mental health

Introduction

Mental illnesses affect millions of individuals around the world. Many factors influence human well-being, and psychological disorders affect people of all walks of life (Golightley & Kirwan, 2015). The Global Burden of Disease Study 2017 revealed that mental disorders show greater prevalence's than 10% in all 195 countries assessed (GBD 2017 Disease and Injury Incidence and Prevalence Collaborators, 2018). If looked at not the global impact of mental disorders, but at their effects in the Netherlands, high prevalence's can be found, too (de Graaf et al., 2012). Around every second to third (41.2%) Dutch person faces a mood, anxiety and or substance use disorder in their lifetime (de Graaf et al., 2012). Out of Graaf et al.'s (2012) society representative sample, 18% met criteria for at least one disorder in the last 12 months. Major depression (5.2%) and specific phobia (5.0%) were the most prevalent. Moreover, the study revealed that around one third of individuals who fulfilled criteria for one disorder in the last 12 months, also showed comorbidity (de Graaf et al., 2012). Comorbidities can complicate the treatment process and worsen treatment outcomes (Olatunji, Cisler, & Tolin, 2010). Additionally, the COVID-19 crises led to higher occurrence of mental distress and psychological symptoms in the Dutch population (Stewart, 2021). The prevalence's of various disorders were high and stable between 1996 and 2009 and are therefore not of only current appearance but an ongoing and developing problem (de Graaf et al., 2012). This underlines the importance of developing strategies to (re-)integrate individuals with psychological disorders and enable them to gain quality of life. Currently, the varying ways in which individuals are classified as psychologically ill are divided into 158 different diagnoses in The Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM–5), all affecting individuals around the world. Every diagnosis brings its own challenges and might call for different treatment (American Psychiatric Association (APA), 2013).

The Effects of Mental Disorders on Different Levels

Mental disorders influence the life of affected individuals, but also whole communities. On an individual level, mental disorders affect thoughts, emotions, and behaviour. For example, depression has been proven to be triggered by high amounts of negative thinking, but also provoking further negative thoughts and impeding the retrieval of positive memories (Teasdale, 1983). In general, mental disorders are a strong predictor of suicidal thoughts and suicidal

ideation (Brådvik, 2018). Changes in mood, like mood swings and overall negative moods are common in different disorders, for example bipolar disorder (Rakofsky, & Rapaport, 2018). Additionally, there are many ways in which different mental disorders affect the behaviours of affected individuals. Diverse mental disorders change the sleep and eating behaviours of affected individuals. They also influence one's perception of the quality of one's own work life and hamper job searches (Lanctôt et al., 2012). Overall, mental disorders often lead to a diminished quality of life (Brådvik, 2018). Individuals with mental disorders also show an increased mortality rate (Walker et al., 2015). On average, clients lose ten years of life (Walker et al., 2015). With causing 14.3% of deaths worldwide, mental disorders represent one of the biggest causes of death (Walker et al., 2015). It is important to ease the effects of mental disorders on individuals to create a safer and healthier way of living for everyone.

On an interpersonal level, mental disorders can influence an individual's family and social life, as well as their work experience. Family life can get especially exhausting when care of the own spouse or child is required (Walton-Moss et al., 2005). In general, mental disorders can disrupt family dynamics and lead to increased symptoms of mental and physical distress in family members (Walton-Moss et al., 2005). Some mental disorders, like social phobia, especially influence the interpersonal life of the affected. For example, social phobia was shown to impede friendship quality significantly (Rodebaugh, 2009). Through changes in family dynamics and work behaviour, mental disorders affect many people.

Next to the burden of mental disorders on affected individuals and their direct environment, they also lead to societal and economic problems. The lost resources during (e.g. lower productivity), and out of work (treatment costs), set a high burden worldwide (Insel et al., 2015). Globally, around 2.5 trillion dollars are spent every year on these (in)direct costs of mental disorders; experts estimate that the number will increase to 6 trillion dollars by 2030 (Insel et al., 2015). Through their chronic nature and high prevalence, especially disorders like depression, dysthymia, alcohol dependence, simple, and social phobia pose a high burden on the population's health and economics (Lokkerbol et al., 2013). The increased levels of sick leave are placing a strong financial burden on the economy, too (Koopmans et al., 2011). Overall, it is evident that the global society and economy needs improved mental health resources to counteract the negative impact of mental illnesses (GBD 2017 Disease and Injury Incidence and Prevalence Collaborators, 2018).

Green Time and Mental Health

Time spent in, or exposure to natural environments, elements, or contents, so-called green time (GT), has shown to have protective and positive effects on mental health (Barton, & Pretty, 2010; Oswald et al., 2020; van den Berg et al., 2016; Xie et al., 2022). Therefore, GT might be an affordable source to positively affect the mental states of millions of individuals around the world. GT was defined by Oswald et al. (2020) as further specifiable through incidental exposure or purposive use, the accessibility, as well as contexts of use of green space and/or natural elements. This rather broad definition of GT evolved as a response to diverse used definitions in concerning literature. Important for the effect of GT might for example be the size and specific features of green spaces and the level of time spent in them (Oswald et al., 2020).

Research on the positive effects of GT on mental health often lean on the stress reduction theory (SRT) by Ulrich et al. (1991) and/or the attention restoration theory (ART) by Kaplan and Kaplan (1989). The SRT comprises multiple effects of GT on health and explains GT as reducing mental stress and evoking positive emotions (Ulrich et al., 1991). The theory describes GT as promoting stress recovery and time spent in urban settings as hindering stress reduction. Ulrich et al. (1991) theorise that through the non-threatening character of green spaces, positive emotional responses are awoken, and stress responses are diminished. Sustained attention can be revoked, and negative emotions and thoughts are blocked. In comparison, dealing with urban settings demands high levels of arousal and therefore exhausts humans' ability to restore from stress and stay attentive (Ulrich et al., 1991). Adding to these effects, ART indicates positive effects of GT on multiple health indicators such as attention diversion and cognitive fatigue of individuals (Kaplan and Kaplan, 1989). The theory suggests restorative effects of environments through fascination, evoking a feeling of "being away" from stressors, the ability to move and explore (called expansion), and compatibility of the space and the needs and wishes of visitors (Kaplan & Kaplan, 1989).

Many studies about the positive effects of GT on mental health have been conducted. Rather small but significant and constant positive effects of more hours of GT on mental health have been indicated (van den Berg et al., 2016). For example, GT was shown to have positive effects on self-esteem and mood independent of culture and climate (Barton &Pretty, 2010). The strongest self-esteem improvements occurred in mentally ill participants (Barton &Pretty, 2010).

As already short durations of GT (e.g. five minutes) can significantly enhance well-being, Barton and Pretty (2010) strongly suggest the uptake of GT as part of treatment for individuals with mental disorders. Noteworthy, the positive effects of GT on mental health are not only due to increased levels of physical activity (Park et al., 2011). While walking through a forest can decrease mood disturbances, urban walks seem to enhance them (Park et al., 2011). The higher possibility to restore from negative events while spending GT might be the reason individuals show consistently higher concentration, well-being and general health scores after moving to more green areas (Alcock et al, 2014). Even though this study also suggests that individuals can adapt relatively fast to areas of living which are less green, it has strong negative short-term effects on mental well-being (Alcock et al., 2014). Overall, GT has been proven to have many positive effects on physical, as well as psychological health. Therefore, GT gained more attention in psychological practice in the last decades (Annerstedt & Währborg, 2011; Berger & McLeod, 2006).

GT in Mental Health Care

Mental health services are ever-changing and developing. As a rather modern addition to classical therapy, approaches around GT are developing. Those are especially of interest, as individuals continuously spend less green time and more screen time (e.g. Bratman et al., 2012; LeBlanc et al., 2017). Since the COVID-pandemic, individuals spend even more time at home and in front of screens, leading to more screen exposure than ever (Sultana et al., 2021). Several ways of spending GT were explored to investigate restorative effects of GT on mental health. Today, spending time in nature is part of many different forms of treatment and therapy for individuals with many varying diagnoses (Annerstedt & Währborg, 2011; Berger & McLeod, 2006). For example, attending group walks in nature was shown to increase mental well-being and positive affect, as well as decrease depressive symptoms, negative affect, and perceived stress (Marselle et al., 2012).

Also interventions for specific psychological problems were tested. One example is a nature-based program including six guided nature-based activities sessions (a nature walk, a nature experience walk, a workshop about land art, a workshop about bird feeder, a cycling tour, and an edible nature walk) which lead to significantly lower burnout scores (Daniels et al., 2022). On a population level, the interventions dealing with the provision of green spaces have already

shown positive effects of higher amounts of green spaces in neighbourhoods on mental health. For example, Xie et al. (2022) researched the effects of the East Lake Greenway on the resident's mental health and found significant benefits of more greenery on mental health. The found benefits decreased with increasing distance from the green space. Due to the results, large-scale greenway interventions could be accesible tools to enhance the mental health of many individuals (Xie et al., 2022). These different approaches towards promoting GT all proved beneficial for the participants and therefore need to be further explored and implemented to aid (mental) health.

Well-known examples of therapeutic approaches based on nature are nature – based therapy (NBR), nature – assisted therapy (NAT) and wilderness therapy (Annerstedt & Währborg, 2011; Berger & McLeod, 2006). As humans are more detached from nature as in earlier decades, therapy forms like NBR and NAT can be beneficial (Berger & McLeod, 2006). The roots of NBR and NAT can be found in various disciplines and subparts of them. A few examples are Gestalt, narrative, as well as environmental psychology (Annerstedt & Währborg, 2011; Berger & McLeod, 2006). While nature – based therapy is neither nationally standardised nor has a clear-cut definition, NAT comprises any interventions aimed at treating clients or helping them in their recovery through the involvement of natural materials, without the help of human or other living beings help (Annerstedt & Währborg, 2011; Bergenheim et al., 2021). Interventions based on NAT are often focussed on either horticultural activities or the provision of natural environment (Annerstedt & Währborg, 2011).

Other ways of including nature into therapy were explored in the review of Berger and McLeod (2006). They found many different methods through which nature can be embedded in therapy and help clients to engage with and benefit from nature. Nature can be used as the setting for talking therapy, but can also play an active part of therapy, e.g. through letting the client build something in nature. Incorporating nature – based activities in therapy, has shown positive effects on the therapeutic progress and relationship (Berger & McLeod, 2006). Possible effects are i.a. enlarged self-efficacy beliefs, feeling of sense in life, and decreased symptoms (Annerstedt & Währborg, 2011; Berger & McLeod, 2006). Nature can also be brought to the client's awareness to introduce them to the benefits of including nature in their daily life (Berger & McLeod, 2006). Processes in nature, like the growth of plants or the natural cycle of life and death, can be embedded and observed in therapy to accept progress in the client's own life (Berger & McLeod, 2006). Especially for schizophrenic, depressed and addicted individuals. positive effects on

(mental) health were shown in most of the studies reviewed by Annerstedt and Währborg (2011).

Even though varying positive and no negative effects of GT and nature embedding forms of therapy on psychological and physical health have been observed, there is little scientifically reported research into that direction and the existing evidence is scattered (Annerstedt & Währborg, 2011; Berger & McLeod, 2006). The conducted research often lacks clinical relevance through inconsistencies, missing documentation, unclear definitions, and unprofessional methodology (Robinson et al., 2020; Wilkie & Davinson, 2021). A systematic review about wilderness therapy included nine studies focussing on adolescents and one on adults, which serves as example of the imbalance between GT studies focussing on adolescents compared to GT studies focussing on adults (Van Hoven, 2014).

Current study

Even though there is a strong base of evidence that GT interventions serve mentally ill individuals and might be the cost- and resource-efficient solution the world needs, most studies and reviews about GT interventions do not deal with adult clinical samples. The existing studies often lack methodological quality (Robinson et al., 2020; Wilkie & Davinson, 2021). The state of the art of existing papers about GT increasing interventions must be reviewed to assess which further research should be conducted to gain methodological evidence of GT effects which support the inclusion of GT in mental health care. Additionally, to start the integration of health behaviours into societies, individuals and their behaviour change must be targeted directly (Crosby & Noar, 2011). Therefore, the current study aims at investigating already existing GT interventions and their effects on clinical samples, as well as the knowledge, needs, and barriers towards spending GT in stressed students. A systematic review, as well as a small-scale interview study with stressed students will be conducted. Together, the results combine information about researched and perceived effects of GT on mental health and stress.

Methods: Review

Aim and Design of Study

As growing evidence suggests positive effects of GT on (mental) health, GT might offer a convenient and cost-effective addition for treatment of psychological distress and disorders. Structured research and reviewing of it is needed to validate the effects. This study aims at understanding the current state of the art of interventions aiming at mental health improvements through GT. The review is conducted following the PRISMA guidelines by Page et al. (2021).

Eligibility criteria

Eligible for this review were studies which were:

- peer-reviewed published journals
- of all designs except single-case qualitative designs
- dealing with the promoting of green time in mentally ill individuals and its effects on mental health
- dealing with all clinical samples above the age of 18 with a diagnosis according to the ICD or DSM (APA, 2013; World Health Organisation, 2019)
- in English language

If several articles dealt with the same intervention, all articles including different outcomes were included, the others were removed from the review.

Data Sources and Search Strategy

The literature search was conducted via MEDLINE and PsychInfo. The data extraction was conducted on the 26th of May 2022. For the search, a search string including terms based on the two constructs, GT and clinical samples, was created. Additionally, terms related to the sample age were included to reduce the amount of unnecessarily to be scanned studies. The constructs and their related parts of the search string are represented in table one. All studies found through entering the search string into the fields `title`, `key words`, and `abstract` were included.

Table 1

Constructs and Relating Part of the Search String

Construct	Relating Part of Search String

GT	("green areas" OR natur* OR "green time" OR outdoor OR park OR "green space" OR garden* OR "blue exercise" OR "green exercise" OR NBR)
Clinical Samples	(anxiety OR depress* OR "eating disorder" OR "adjustment disorder" OR alcohol OR addiction OR mental* OR "stress-related mental" OR wellbeing OR "well being" OR "well-being" OR "clinical sample")
Sample Age	(adult* OR senior* OR worker OR employees)

Study records: Data management and Outcomes looked for

EndNote X9.3.3 was used to extract the articles. In EndNote, duplicates were automatically identified and removed. Afterwards, different groups were used to sort articles based on their title, abstract or full text. The main focus of the review is on the effects of GT on measures of mental health and symptoms of participants. Therefore, all found effects of GT interventions on mental health of clinical samples, as assessed by validated scales or physical measures, are included in the review. Authors, publication date, sample size, duration of the intervention, sample diagnosis/diagnoses, study design, nature, aim, instruments, and findings of each study/intervention were reported.

Methodological Quality Criteria and Bias Risk Assessment

The quality assessment of the included studies was based on the quality assessment tool for quantitative studies by the Effective Public Health Practice Project (EPHPP; Effective Public Healthcare Panacea Project, 2019). The quality of the studies was rated along eight components: selection bias, study design, confounders, blinding, data collection methods, withdrawals and dropouts, intervention integrity, and analysis. Each construct was rated as weak, moderate, or strong. The overall rating is dependent on the number of weak subcomponents. Only studies with no weak rated components are rated as strong overall.

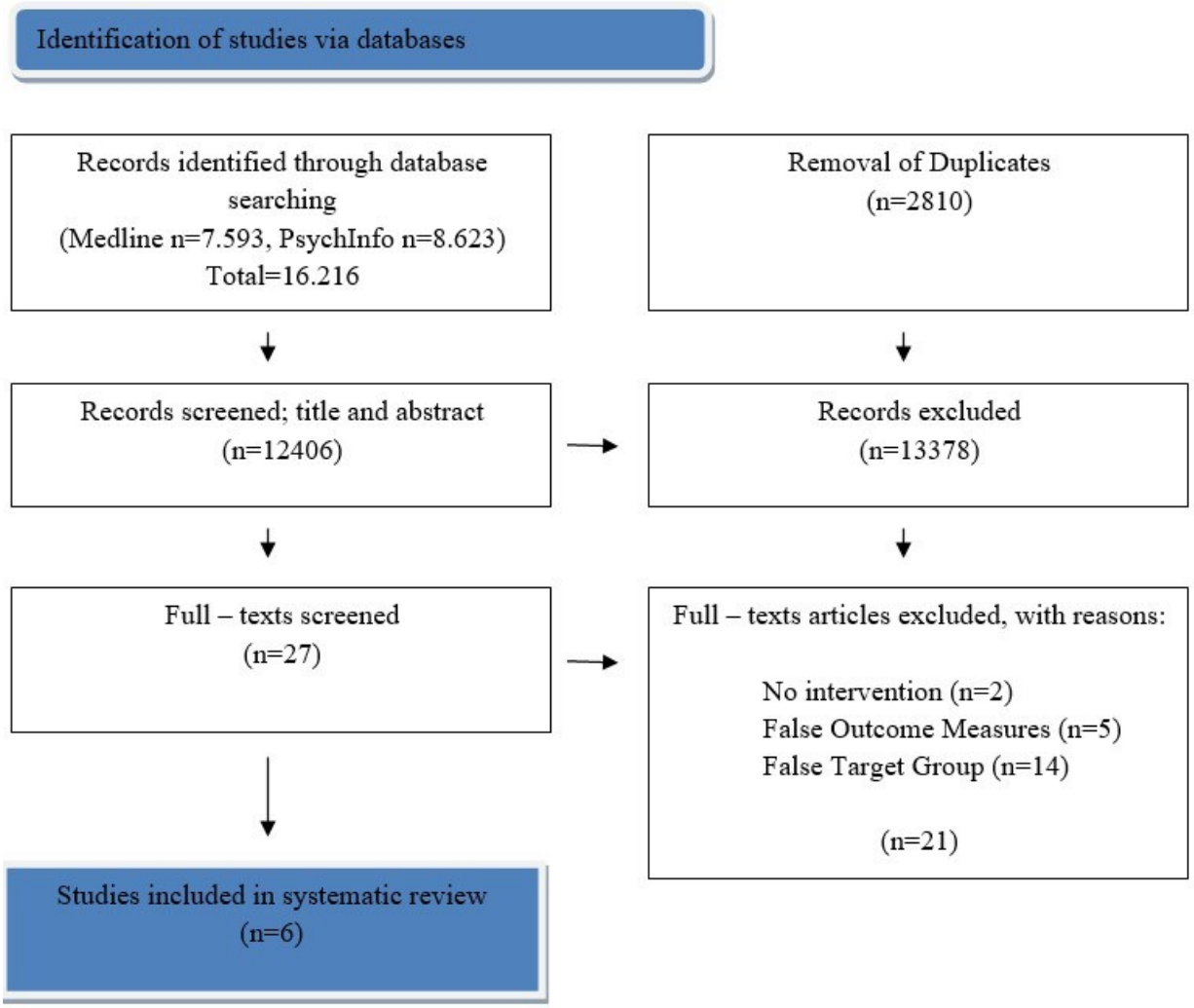
Results: Review

Included articles

The current literature search identified 16.216 studies. After excluding 2810 duplicates, 13378 studies were screened on title and abstract. Of these, 27 studies were examined in detail for further consideration. Overall, six studies met the inclusion and eligibility criteria. A PRISMA flow diagram of the study identification process is presented in Figure 1.

Figure 1

PRISMA Flow-Chart



Study characteristics

Of the six included studies, four were published between 2008 and 2015 (Berget et al., 2008; Berman et al., 2012; McCaffrey et al., 2010; Sahlin et al., 2015), and two between 2018 and 2022 (Legrand et al., 2018; Thomson et al., 2020). The sample size varied from n = 18 to n = 90 (Legrand et al., 2018; Berget et al., 2008 respectively). As two of the included studies did not specify their sample's age range, and McCaffrey et al. (2010) only indicated having focussed on individuals above the age of 65, the total age range of the included samples cannot be clearly stated (Berman et al., 2012; Legrand et al., 2018). It minimally spans from 18 to 71, but is estimate to go also further. All samples were clinical and diagnoses included depression (sig. mood disturbance (Legrand et al., 2018), depression (McCaffrey et al., 2010), major depression (Berman et al., 2012), schizophrenia and schizotypal disorders (Berget et al., 2008), affective disorders (Berget et al., 2008), anxiety (Berget et al., 2008), disorders of adult personality and behaviour (Berget et al., 2008), stress-related disorder (Berget et al., 2008) and stress-related mental illnesses (adjustment disorder, exhaustion disorder, reaction to severe stress unspecified; Sahlin et al., 2015). One study described their sample as "adult mental health service users" (Thomson et al., 2020). Two studies were conducted in the United States (Berman et al., 2012; McCaffrey et al., 2010), while each one study was conducted in Norway (Berget et al., 2008), France (Legrand et al., 2018), Sweden (Sahlin et al., 2015) and Great Britain (Thomson et al., 2020). Most of the included studies were cohort studies (n=4; Legrand et al., 2018; McCaffrey et al., 2010; Sahlin et al., 2015; Thomson et al., 2020), but also one analytical cohort study (n=1, Berman et al., 2012) and one randomised control trial (n=1, Berget et al., 2008) were included. All study characteristics are listed in Table 3 (see Appendix A).

Quality and Aims of the Included Studies

According to the quality assessment tool for quantitative studies, most studies are of low quality (n = 4; Legrand et al., 2018; McCaffrey et al., 2010; Shalin et al., 2015, Thomson et al., 2020), while one is of moderate (n = 1; Berman et al., 2012) and one of good quality (n = 1; Berget et al., 2008). An overview of the quality of each study can be seen in Table 4 (see Appendix B). Although the specific aims varied, the general aim of all studies was to investigate the effects of GT on the (mental) health of clinical samples. An overview of study aims is provided in Table 5 (see Appendix C).

Study Development/Background

The studies were developed for a variety of reasons, but all responded to the need of further exploration of the effects of GT on mental health measures. While Berman et al.'s (2012) study tried to assess whether positive effects found in existing evidence about healthy samples are transferable to major depressed clients, McCaffrey et al. (2010) assessed whether those effects are evident for depressed seniors. Similarly, Berget et a., (2008) researched whether the documented positive effects of AAT (animal-assisted therapy) with cats and dogs are also given if conducted with farm animals. Former evidence had suggested that the interaction with different animals also leads to a variation of different consequences which led to the first randomised control trial with farm animals (Berget et al., 2008). The studies of Sahlin et al. (2015) and Thomson et al. (2020) were both conducted based on a societal need for (cost- and resource-efficient) treatment. For example, the Swedish community faced increasing sick leave periods due to psychological diagnoses, which led to the exploration of a so far unique museum-based horticulture and art programme to examine the potential of such a combination for mentally ill adults (Sahlin et al., 2015). After a former study, participants wished to combine guidance and self-reflection in one walking intervention, which McCaffrey et al. (2010) realised. Legrand et al.'s (2018) study went one step further and explored whether the positive effects of outdoor walks are attributable to the activity or the natural environment and was the first to report the exact exercise intensity participants went through. A common point of all studies was the trial to find ways to treat the wide mass of clinically ill patients with resource-friendly GT interventions and use the natures potential for healing.

Instruments and Measurements

The included studies used a variety of validated tools and scales, to investigate the effects of GT interventions on a variable of health aspects. Noticeable is the high diversity of tools used by the different research teams, as the BDI-II was the only instrument used twice. An overview of the used instruments and measurements can be seen in table 2.

Table 2

Explored Health Aspects with corresponding Instruments

Health Aspects	Instruments	References
Anxiety	Beck Anxiety Inventory (BAI)	Sahlin et al., (2015)
Burnout	Shirom-Melamed Burnout Measure (SMBQ)	Sahlin et al., (2015)
Coping strategies/ Pressure management	Coping Strategies Scale of the Pressure Management Indicator	Berget et al., (2008)
Depression	Beck Depression Inventory–II (BDI-II)	Legrand et al., (2018); Sahlin et al., (2015)
	Geriatrische Depressions-Skala (GDS)	McCaffrey et al., (2010)
Memory	Backwards Digit Span Task (BDS)	Berman et al., (2012)
Mood/ Affect	Positive and Negative Affect Schedule (PANAS)	Berman et al., (2012)
	Profiles of Mood States (POMS)	Legrand et al., (2018)
Overall well-being/ mental health	Quality of Life Scale – Norwegian (QOLS-N)	Berget et al., (2008)
	UCL Museum Wellbeing Measure	Thomson et al., (2020)
Self-efficacy	General Self-efficacy Scale (GSE)	Berget et al., (2008)

Intervention Main Components

During AAT with farm animals, farmers owning the farms were always close to the participants, taught them some of the routines and then assisted them in different interactions with the animals (Berget et al. 2008). The three most occurring interactions were either physical contact (e.g. patting) or communication (e.g. visual contact) with or moving of animals (e.g. from one pasture to another). Three of the included studies aimed at improving GT through walking interventions (Berman et al., 2012; Legrand et al., 2018; McCaffrey et al., 2010). Berman et al. (2012) sent participants onto two 50-minute walks each (one in an urban and one in a natural

environment) and primed rumination in participants to see whether it circumvents positive effects of GT. The walks were predefined for participants and both 2.8 miles long. "The Stroll" by McCaffrey et al. (2010) included reading about predefined stops of the stroll, reflecting on words about the garden and journaling about predefined topics (awareness, possibility, transition, connection, journey, trust, joy, freedom, forgiveness, reflection, gratitude, and fulfilment; McCaffrey et al., 2010). The third walking study focussed on 20-minute runs of moderate intensity in- or outdoors (Legrand et al., 2018). All participants completed three different experimental sessions: outdoor exercise, indoor exercise, as well as a sedentary control (Legrand et al., 2018). During NBR, participants had a lot of different possibilities to interact with and benefit from nature, either individually or in group settings (Shalin et al., 2015). For example, different garden activities, walks, therapeutic talks, and information meetings in nature were conducted (Sahlin et al., 2015). The "Dual programme of outdoor horticultural activities and indoor nature-based creative activities" conducted by Thomson et al. (2020) involved in- and outdoor engagement with horticulture, art making and museum collections in group meetings. An example outdoor activity was cutting bushes, while using textured painting techniques was done inside. Overall, the designs of the studies varied much, but mainly focused on rather short-term application of nature on symptomatology and life quality of participants.

Findings

Apart from one study (Legrand et al., 2018), all studies found support for positive effects of nature on treatment outcomes.

Outcomes of GT Walking Interventions

The included interventions exploring walking in green spaces found a variety of positive effects on mental health of depressed clients (Berman et al., 2012; Legrand et al., 2018, McCaffrey et al., 2010). In specific, two studies found positive effects of spending GT on depression symptoms, with diminished depression scores ($t = 12.54$, $p = .001$; McCaffrey et al., 2010) and significantly higher feelings of energy after the intervention ($d = 0.77$, $t = 3.19$, $p = .005$; Legrand et al., 2018). Moreover, Berman et al. (2018) found significant positive effects of walking in nature on positive affect ($t(16) = 4.31$, $p < .001$). Therefore, rumination did not

seem to circumvent positive effects of GT. Tested effects of indoor and outdoor exercise on fatigue were not significant (Legrand et al., 2018).

Additionally, two of the studies examined whether the observed positive effects through walking are dependent on a natural environment (Berman et al., 2018; Legrand et al., 2018). Berman et al. (2018) found significantly stronger effects from walking on positive affect in a natural setting than in an urban setting, but similar effects for negative affect. Therefore, the location of the walk influenced the degree of positive, but not negative affect. Legrand et al. (2018) also found no significant difference in effects of indoor compared to outdoor walks on feelings of energy ($t = 0.31$, $p = .758$). Combined, the studies provide evidence for the superiority of a nature setting above urban or indoor settings for positive affect, but not for negative affect and feelings of energy (Berman et al., 2012; Legrand et al., 2018).

Outcomes of GT Interventions based on Societal Need

NBR as studied by Sahlin et al. (2015) led to a range of positive effects. Mean burnout, depression, and anxiety scores of participants all decreased if compared from the onset of the intervention to the twelve-month follow-up (from 5.2 ($SD = 0.88$) to 4.12 ($SD = 1.26$), from 23.3 ($SD = 10.0$) to 13.0 ($SD = 8.7$), from 17.2 ($SD = 11.8$) to 10.2 ($SD = 7.8$), respectively). The mean psychological well-being increased from 41.9 ($SD = 8.1$) to 49.1 ($SD = 10.7$). Combined, these findings support long-lasting positive effects of NBR on individuals with stress-related mental disorders.

The creative green prescription programme "Dual programme of outdoor horticultural activities and indoor nature-based creative activities" led to a highly significant increase of well-being in participants ($t(19) = 6.96, p < .001$; Thomson et al., 2020). Strong and highly significant increases were measured on all subscales: activeness, alertness, enthusiasm, excitement, happiness, and inspiration ($t(19) = 5.60, p < .001$, $t(19) = 5.89, p < .001$, $t(19) = 4.72, p < .001$, $t(19) = 5.94, p < .001$, $t(19) = 6.29, p < .001$, and $t(19) = 7.94, p < .001$ respectively). Overall, findings support strong positive effects of combined outdoor horticultural activities and indoor nature-based creative activities on well-being of adult mental health service users.

Outcomes of GT in AAT

During the intervention and shortly after, no significant effects of the intervention on the whole sample were assessed. Nevertheless, looking at patients with affective disorders specifically, the effects of the intervention on self-efficacy were significant during the intervention (TF30(SA-SB) (24.8–22.6) = 2.2, CF30(SA-SB) (25.4–27.3) = -1.9, $F = 5.01$, $p = 0.03$), and from before to six months after (TF30(SSMASB) (28.3–22.6) = 5.7, CF30(SSMA-SB) (27.3–27.3) = 0.0, $F = 6.36$, $p = 0.01$). At six months follow-up the self-efficacy scores were significantly higher than at baseline ($d = 2.6$, $t = 3.68$, p = 0.001) and higher than at the end of intervention ($d = 2.2$, $t = 4.38$, $p = 0.0001$). Therefore, the study partially supports the added positive effects of animal-assisted therapy with farm animals in the form of increases in self-efficacy beliefs. An increase in the quality of life and ability to use coping strategies under pressure was not found.

Rationale of Interview Study

Overall, six out of seven studies provided support for positive effects of GT on a range of different measures assessing (mental) health of clinical samples. The support for reduction in depressive symptomatology and enhancement of well-being in several studies highlight positive effects of GT interventions. GT alleviates a range of clinical symptoms, enhances well-being, and counteracts stress, supposedly. Specifically structured programmes combining different therapeutic methods and adding GT to other treatments seems to be beneficial. Especially NBR leads to strong and significant positive effects and might be a great chance for economical relief. Walks in nature particularly offer cost-effective, widely accessible and resource friendly possibilities to help individuals to ease symptoms and enlarge well-being. The positive effects of nature on mood are also supported by widespread belief, as for example reflected in child upbringing. Even though this open source is available, it is not widely used and waiting lists for therapy are long and thousands of people wait for treatment (Iqbal et al., 2021; Punton, Dodd, & McNeill, 2022). The second part of this study focuses on exploring the awareness of (not)clinically ill, stressed participants of the possible positive effects of GT on their symptomatology and burdens to its usage.

Methods: Interview Study

Objective

Following the first step of the PRECEDE/PROCEED model by Green and Kreuter , the aim of this study is to understand the knowledge, beliefs, needs, and barriers towards spending GT (Crosby & Noar, 2011). According to the model, the first step of influencing health behaviours is getting to know the background of the behaviour and members of the target group need to be contacted to gain insides in their motives (Crosby & Noar, 2011). Therefore, an interview was conducted which contained questions about the attitude of participants towards stress and GT, the perceived effects of GT on their stress symptoms, and their perceived barriers towards spending GT (see Appendix D). Based on these answers, further work can be made to achieve step two to nine of the model and create an effective intervention to motivate stressed individuals to use GT as a resource for stress management and enhancing quality of life/ well-being.

Participants

Non-probability sampling was used to gather participants. At first, the research and participant management system SONA was used to reach university students of the University of Twente, which resulted in 13 participants taking part. Participants who took part via SONA were credited with 0.75 study credits. As it was planned to conduct 15 interviews, two more participants were sampled through social media. The researcher is befriended with nine of the participants. For inclusion, participants had to be university students and able to give consent (≥16 years old). Eligible were those shown to have a stress score of ≥14 as measured by the Perceived Stress Scale-10 (PSS-10; Deary, 1996; see Appendix D & E).

Materials

In this interview study, an online survey was filled in via an experience management platform named Qualtrics (Qualtrics, Provo, UT; see Appendix F). To only gather usable survey entries, all answers in the survey were forced. The demographics of participants were assessed through four questions (age, nationality, gender, and hours of GT per week). Additionally, a multi-item scale, the PSS-10, was used to measure the participant's stress level. The PSS-10 has

been shown to be a valid and reliable tool to quickly assess stress in adults (Lee, 2012). In Lee's review of the PSS they found the PSS-10 to be reliable in all 12 studies in which it was used (α = >.70). The scale comprises ten items and requests users to indicate the frequency of stress symptoms on a scale from 0 (=never) to 4 (=fairly often). Additionally, the interview scheme as represented in Appendix D was used, which comprises questions aimed at understanding the participant's GT beliefs (e.g. "Do you like spending GT?", "Do you believe spending more GT could help you with your stress?"), GT behaviour (e.g. "What do you do when you spend GT?"), and obstacles they perceive towards spending GT (e.g. "Do you sometimes experience the wish or need to spend GT but can`t?"). A Samsung Galaxy A71 was used to record the audio of all interviews.

Procedure

Participants were invited to the entry survey either via SONA or WhatsApp (see Appendix G). Via SONA 19 participants registered for the study of which 16 showed an eligible PSS score. One of those participants cancelled the further participation based on time issues and two participants did not reply. Participants were asked to provide informed consent, complete the entry survey and share their e-mail address for further contact. The participants were also provided with the e-mail of the researcher to withdraw consent during and after the participation process. At the end of the entry survey, participants were provided with different help hotlines in case they experience the need to talk to someone about their stress or in general. PSS-10 scores were generated and participants who did not meet the inclusion criteria received a short thanking e-mail for their willingness to take part and some background information of the study (see Appendix I). Moderately to strongly stressed participants were invited to an interview via e-mail in during the first two days after filling the survey in (see Appendix H). The email always entailed proposed time points in the next days on which the researcher was available and asked whether participants are fine with conducting the interview via Microsoft Teams. After agreeing on a time slot, participants received the invitation link to the planned call via email. The interviews took place via Microsoft Teams between the 26th of July and the 7th of August. At the beginning of the interview, the researcher shortly introduced herself and the study. During the interviews, participants were asked about their feelings towards, the perceived effects of and obstacles regarding GT (see Appendix D). Following, they were offered the chance to pose

questions and informed about the use of their answers (see Appendix D). Recordings will be deleted after the researcher completed their master studies. The transcripts will be kept for five years.

Data Analysis

PSS scores of each participant were calculated individually. To compute the stress level of the participants, scores for the items four, five, seven, and eight must be reversed. A cut-off score of 120 minutes of GT per week and more was used as a cut-off score for spending enough GT per week (White et al., 2019). The interview recordings were transcribed. The transcripts were reread to gain an overall picture of the input gathered. Afterwards, the inductive coding process started. First, notes summarising the content of each statement were added to the transcripts. Second, they were compared among the interviews and overall codes comprising all similar statements were created. The codes were expanded and revised several times, untill every statement fit into the codes. The final codes could be broadly split into codes about the knowledge, needs, and obstacles towards GT. The researcher then checked the statements of each code for similarities and differences.

Results: Interview Study

In the final sample of 15 participants, 11 were moderately stressed (73.3 %) and four strongly stressed (26.7 %). Three participants identified as male (20.0 %) and 12 identified as female (80.0 %). The nationalities of the participants were German (12 people, 80.0 %), Dutch (one person, 6.7 %), Slovak (one person, 6.7 %) and Bulgarian (one person, 6.7 %). While nine participants spent enough GT per week (60.0 %), six participants didn't (40.0 %). Due to an error of Qualtrics, the ages of participants weren't saved and can therefore not be reported.

Beliefs and Needs regarding GT

In the following, the overarching topics in which the statements of interviewees were clustered into are shortly described.

Change of Scenery & Sensations

Most participants (n = 14) named the difference between GT and GT spaces and their

usual activities and surroundings as having positive effects on them. They described GT as a possibility to escape the modern world of technology and screens, but also from obligations. Through being able to spend quality time with themselves or friends, their partners or pets, the participants felt like recovering from their stressful lives full of control, expectations, and technology. Also the change of sensations in their bodies and perception was identified as pleasurable and helping factor. The participants believe in positive effects of fresh air (n = 8), forest sounds and grounds.

Amount of GT & Routine

It came apparent that most interviewees wish to spend GT on a regular basis. All participants mentioned taking walks. Some mentioned the possibility of taking short GT pauses from their daily lives which they believe help them a lot to refocus, calm down and feel happier (n = 9). To feel able to spend enough or regular GT most of the interviewees named the need of incorporating GT in their routine. If GT is a common part of their lives, it gets easier for them to stay active and maintain their GT levels. Nevertheless, some participants also mentioned concerns regarding the planning of GT as it could become another obligation "Probably I should maybe organise myself better but that's also something I'm not sure about because it's always about optimising like oneself, optimising the time, optimising the body, optimising the health, optimising food and stuff. And sometimes I'm just tired of doing all those things, so I'm not sure if this would really, if this wouldn't even stress me out more to organise myself better" (Interviewee 9, female). Three interviewees saw the opportunity to set reminders to spend GT as a useful idea. Additionally, one participant mentioned how external reinforcement could help them.

Knowledge & Awareness about GT

The participants showed different levels of knowledge about GT and its' effects. If asked directly, seven of the participants could name proven effects of GT on health and stress, while eight could not. Of the seven participants who were able to directly name effects of GT on health and stress, five directly named several positive effects of GT on health and stress, while two were able to name one positive effect. None of the participants named possible negative effects of GT on health and or stress when asked for proven effects. The named influencers of GT positively

affecting health and stress included movement, bird noises, larger dopamine intake and fresh air. Calming, relaxing, and distressing effects were named as being proven. Several participants were aware of the positive effects of GT on health, e.g. “I sometimes do it as some form of self-care, even though I don't want to go outside, I just go outside because I know it's good for my mental health” (Interviewee 14, male).

Positive Feelings & Effects – Self-Care

All interviewees view GT as evoking positive feelings, and twelve of them mentioned calmness as a key result of spending GT. They mentioned the belief that they need regular GT to maintain sanity, happiness, and balance. The relaxation they gain through nature cannot be reached through non-GT activities. The spending of GT increases focus and concentration in the intervieews and some of them believe in an energising effect of spending GT. In acute stress situations or in situations with strong feelings, six interviewees escape into nature and calm down through walks. As a consequence of feeling better, two interviewees also mentioned positive effects on their sleeping hygiene and one interviewee also mentioned positive effects on their skin. Due to all the perceived positive effects, all the interviewees view GT as enjoyable and indicated they like spending GT. Four of the interviewees mentioned spending GT as form of self-care.

Connection with & Appreciation of Nature

Five interviewees mentioned their belief in a connection between nature and humans and it’s importance for balance and happiness. Similarly, three participants feel awed by nature and appreciate its parts, effects on humans, and it’s beauty. Two interviewees named star gazing as having strong positive effects on them, while several named the observation of and caring for plants. All interviewees who talked about nature explicitly only talked positively about nature and their reactions towards spending GT. Maintaining a sight for the connection with and appreciation of nature was named as a need and source of happiness.

Reason

Having an explicit reason was shown to be a key motivator for six of the interviewees to spend GT: “Often times, it's just difficult for me because I feel like I need to have something that

I'm going to do and just going out to nature is not really something concrete enough to make me go" (Interviewee 11, female). While five interviewees based their GT on their dog's needs, eleven plan meetings with their friends. Connecting GT with other activities and combining several tasks or activities was seen as a possibility to spend more GT by all interviewees. They came up with diverse activities they combine with GT, after being asked (see Table 6). Overall, all interviewees partially (n = 7) or fully (n = 8) agreed that spending more GT would help them with their stress. An overview of the GT beliefs and needs of participants is provided in table 7.

Table 6

Overview of Activities combined with GT sorted by Frequency

Activity combined with GT	Number of Interviewees
Walking	15
Meeting friends/ partner	11
Doing sports	10
Sitting	7
Reading	6
Dog care	5
Listening to music	4
Eating	3
Studying	3
Drawing	2
Phone Usage	2
Plant care	2
Playing games	2
Smoking	2
Star gazing	2
Breathing Exercises	1
Food Preparation	1
Grocery Shopping	1

Table 7

Overview of Beliefs/ Needs regarding GT

Belief/ Need	Representative Quote

Change of scenery/ sensations	**“**If I'm just in the city, it feels very high paced and like most people are rushing to go somewhere. And nature is one of those places where that that just doesn't happen and you get to have a break.“ (Interviewee 11, female)
Fresh air	**“**if I'm, like, walking around and like the forest or the mountain, also the air is much fresher and it's not as polluted as it is like down in the city. So I do, you know, like, breathing feels so much nicer.“ (Interviewee 4, female)
Amount of GT	**“**Yeah, like there are periods of times where I spent too much time outside, but also periods of times where I spent too little time outside. So during the times I had to spent too much time, I wouldn't do it because I of course have like responsibilities […] so that can go at the cost of me getting things done, of course. So it shouldn't get too much, but it's for sure shouldn't get too little.” (Interviewee 1, male)
Routine/ planning	**“**Also I think another thing that would help is not just planning, but also feeling like I'm like increasing the confidence in my ability to plan. Because of, like, it's typical psychology talk about the like, the perceived power I have over my schedule and my ability to fulfill certain tasks is one of the largest determining factors” (Interviewee 12, male)
Reminders	**“**Just also maybe reminders. If I have it in my calendar, I'll think more about it because I think the most obstacle in those times is that I just don't even consider it” (Interviewee 2, female)

Positive feelings	**“**I usually forget about things that happened in the past or stop worrying about the future. It just feels very, very warm and relaxing in general.” (Interviewee 1, male)
Calmness	**“**Calm mostly. I mean, sometimes it's hard to calm down, but I would definitely say it really calms me“ (Interviewee 2, female)
Focus/ concentration	**“**sometimes when I am out in nature and come back to my room or where I'm staying at the moment, I feel that I can focus a little better” (Interviewee 14, male)
Self - care	**“**I sometimes do it as some form of self-care, even though I don't want to go outside, I just go outside because I know it's good for my mental health” (Interviewee 14, male)
Clear mind	**“**So yeah, it just releases stress, it clears my minds and yeah, I feel quite sharp afterwards“ (Interviewee 1)
Acute stress/ feelings	**“**It helps sometimes, but I'm mostly only doing it when I'm highly, highly stressed. Then I go on walks on my own” (Interviewee 15, female)
Awareness	**“**my brain like making a connection to “okay you should go outside, then you will feel better”” (Interviewee 1)
Connection to nature	**“**It just feels really nice to, I don't know, kind of be one with nature” (Interviewee 4, female)
Reinforcement	**“**I think something like a reinforcement system like if you have those footstep counters on your mobile. And yeah, if you would, this in general motivates me to see how many steps I took. But also if you would maybe get some reward if you reach a certain step count that would motivate me“ (Interviewee 3, female)

Energy	**“**Especially when you have to study a lot. If you have like a studying period and you go for a walk for like 20 minutes afterwards, you feel more energized again“ (Interviewee 8, female)
Reason	**“**I sometimes feel like I need a reason to go outside, for example like walking the dog” (Interviewee 15, female)
Appreciation of nature	**“**it's just really beautiful and I really like looking at it and especially looking at flowers, when I like walk the streets and I see flowers on those sidewalks, I always go there and look at them for a few seconds” (Interviewee 8, female)
Sleep	“It's just that I get to rest correctly. You know, I don't feel as tired. I like sleep more or not even sleep more, I just sleep like in the right time of the night. Not, you know, like go to sleep in the morning and wake up in the afternoon” (Interviewee 4, female)
Skin	“we drove to the “Nordsee” and it was a pretty stressful time for us and when we came back my skin was pretty refreshed and I felt like the irritations were gone” (Interviewee 6, female)

Barriers towards GT and self-derived Possible Solution Approaches

Throughout the interviews, the participants identified diverse factors hindering them from spending GT (see table 8). The barriers named towards spending GT were often similar and most of them were suspect to change. All participants named lacking (free) time as reason to spend less GT and apart from one participant all participants explicitly named studying and or work as obstacles towards spending GT. It was hard for participants to come up with possibilities to combine work or studying with GT. Two possible solutions participants named were working/studying outside and spending short GT like walks in working breaks. Nevertheless, access towards GT spaces near their work, missing GT company at work, and the workspace

conditions were named as further complicating these solutions e.g. “I feel like and it feels weird to go outside alone at work, because like my work is in the middle of a city, kind of. And there's like this huge traffic going on around and then it’s like there's a small park that would count as green time because there are trees” (Interviewee 5, female) and “I think it's because I want everything to be in reach. And always like grabbing everything like my glasses, my water, my laptop, my notebook and just spreading all of this out on the table. Get the chair out. Get the like cushions for the chairs out and just even though this takes 2 minutes at max, maybe four or five it still feels like too much of a chore for me” (Interviewee 12, male).

Through time problems (n = 14) or other factors leading to overwhelming feelings of stress (n = 6), several interviewees mentioned not being able to spend GT. As an example solution, one interviewee described the steps to be taken to be able to spend GT “I mean in the end, usually when I'm overwhelmed, it helps to go outside, but not in the first stages of when I'm overwhelmed. So I would have to first calm down and then go outside, so it might help me to like make the plan when I'm overwhelmed to go like later.” (Interviewee 14, male). The topic was seen very differently by different interviewees and while considering different contexts. As named before, acute stress or other feelings were also often motivators to spend GT.

Another common barrier towards spending GT is weather. While some participants spoke about wishing for specific weather conditions e.g. “not really the sun per se because I most of the time enjoy it more to be outside when it's not sunny” (Interviewee 3, female), another mentioned adjusting to weather conditions through appreciation of the different moods GT evokes in them “I mean it just depends also on the weather a little bit. I think if it's for example raining, it can be kind of a melancholic feeling or a little bit, yeah, a little bit sad, but in a good way. So it's kind of enjoyable. And I think if it's good weather, then it's more like a happy, calm feeling that it brings” (Interviewee 2, female). As possible solutions to overcome the weather conditions, the interviewees mentioned umbrellas, weather suitable clothing and working on their motivation to get going.

Lacking company for GT was identified as a barrier towards spending (more) GT. Interviewees mentioned lacking the motivation to go on a walk on their own. Solutions for that problem the interviewees came up with included for example talking to friends about spending GT together, creating peer GT spaces and searching for GT groups e.g. “But maybe I can sign myself up for some hiking courses or whatever you like or somemof this sports courses

somewhere. Or just find a group of people that you can do those things with so you're getting motivated even more" (Interviewee 1, male). Another possibility was named through the company of dogs. Five of the participants mentioned their dogs as motivating factors to spend GT and helping factor to not feeling alone while spending GT.

Access to GT spaces and facilities is one of the main problems identified. Twelve interviewees mentioned to be influenced by having (no) access to a balcony or garden, sitting opportunities in local GT spaces and the general presence and environment of GT spaces in their home, study and work areas. A factor influencing whether they use the GT spaces available to them is also dependent on their knowledge about their existence e.g. "I don't really know that many places where I can spend time in nature because I'm not that familiar with the place as well" (Interviewee 11, female). While knowledge about GT spaces can be gathered, interviewees see limited possibilities towards overcoming missing access. Driving towards GT locations was denied by several interviewees e.g. "because I don't see like much sense in if I had to go by car like for a long time by car to the green place" (Interviewee 5, female).

Further, the presence of insects hindered two interviewees from spending time in their gardens, while allergies hindered one further participant from spending GT. The interviewees did not identify ways to overcome these obstacles apart from avoiding GT (in their gardens). One interviewee additionally raised safety concerns if GT would be spent alone at night. They came up with the conclusion that "with the safety feeling for example, in the dark, then that you have a light with you, or you have take another person with you or if the pathways are good and maybe there are lanterns […] Or generally the feeling of safety when I know when the neighbourhood appears to be either very busy and with children and stuff, so there are people, but also when there are really no people" (Interviewee 3, female).

Table 8

Overview of Barriers towards spending GT

Barrier towards GT	Representative Quote

Feeling too stressed for GT	**“**It's just that I would say is sometimes it's easier to forget about it because stress can really overwhelm you and if you spend like a bit more time just at home and not really going out and focus on like all of those things that make you stressed, it's harder to convince yourself to just go outside and be like, you know, like, I can just go outside and spend some time outside. It would be really nice. You know it, but sometimes it's a bit hard to convince yourself if you're too stressed“ (Interviewee 4, female) “Yeah, especially in weeks or month where I have a lot of stress and this is also where I do the least sporty activities. And as I said, I often combine it so if I don't go jogging, I also have less green time” (Interviewee 9, female)
Too less free time	“So I didn't really have enough free time to just go out“ (Interviewee 4, female) “But I guess the one thing that needs the one condition that needs to change for me to go outside more is that I have more time“ (Interviewee 5, female)
Having to study/work, obligation & procrastination	“if I'm too stressed about exams because those, those are the things that I'm mostly stressed about like now it's like this age and at this phase that I'm in, but I like if I for example if it's like the week before the exam, I feel obligated to only stay at home and study even though I'm not obviously studying all the time, I do kind of feel obligated” (Interviewee 4, female) “So like when I'm studying I was like, afraid to stop studying because I thought, oh, you missed this time to study and then you are less prepared” (Interviewee 5, female)

Weather	“If it's cloudy or like gray outside, I don't like it “ (Interviewee 12, male) “I don't go out if it's if it's too hot because I really struggle with heat” (Interviewee 15, female)
Friends/Peers	**“**my friends really like to spend time outside which motivates me to spend more time outside. But for example, where I went to school, the people didn't really like going outside. So we spent most of our time inside” (Interviewee 8, female) **“**Also, having the opportunity to like, meet like-minded people would also help. If you would like visit certain points of interest in like local nature parks or forests like 90% of the people there are just like above 60 or something, which is of course not an issue but a lot of times I wish I could go somewhere with also other like similarly middle-aged people like us, that would be cool” (Interviewee 12, male)
access	**“**I don't really like it here because it's not really pretty outside and soon we are going to move and I'm really excited for that because I think when we are finally moving there the I will be spending more green time because it's like way more exciting and prettier there” (Interviewee 6, female) “it greatly depends on where I am when I'm in the city, I can't really work outside because I can't really go into nature to work, but for example, when I'm at my parents, I can go into the garden, for example, to work there” (Interviewee 14, male)

energy	**"**I think it the the biggest reasons for it would be um having too little time or having no energy" (Interviewee 1, male)
insects	"I almost never do it [spending time in garden] because I think it's because there are so many insects, and if I'm in my garden, I'm not moving and if I'm not moving the insect can land on me. So yeah, maybe insects also kind of restrict me in going outside more. " (Interviewee 3, female)
allergies	**"**I actually have pretty strong allergies to a lot of things, so I have to restrict it. Yeah, to some point where I can be, like, confident that nothing will happen to me. It's pretty bad sometimes." (Interviewee 6, female)
safety	**"**If it's dark, then I also don't like going outside. Yeah. If it's too late, then I maybe have the wish to go outside and to experience, yeah nature or having the effect of being outside, but yeah, then I don't feel safe" (Interviewee 3, female)

Discussion

In this paper, existing evidence about GT increasing interventions for adult clinical samples has been reviewed and expanded through information about the GT knowledge, beliefs, and needs of stressed students. The combined findings underline the possibility of GT to complement existing stress treatments and psychotherapy, but also the need to conduct and report more high-quality research on the modes of action of GT and its usability for specific subgroups of adult psychologically ill individuals.

Main Findings

The first main finding is that GT can help a variety of psychologically ill individuals, as well as stressed students, to deal with their symptomatology and restore from stressors. The reviewed studies found support for positive effects of GT interventions on depression and stress

symptoms, anxiety, and self-efficacy. Stressed students mentioned experiencing a variety of positive effects through spending GT including enhanced mood as well as lowered feelings of stress and restlessness. Especially the most structured and researched approach included, NBR, showed strong positive effects on participants, but it is also noteworthy that both the review as well as the interviews suggest well-being enhanced through unsupervised short amounts of GT.

The second main finding is the high existing interest in GT, but low awareness about and reflection on GT knowledge and needs in stressed students. Especially the exploration of possibilities to overcome obstacles towards spending GT seemed challenging and new for participants, even though the majority wanted to spend more GT. The knowledge about GT and its uses for the health of the participants was very limited. Their needs and beliefs regarding GT are varying. The biggest barriers interviewees named were having too little time for GT and access to green spaces, as participants find both factors hard to overcome. Nevertheless, the interviewees came up with several possible solution approaches, often including short amounts of GT between tasks and embedding GT into their daily routine. The main drive to incorporate GT in their daily life seems to be the change of scenery and sensations while spending GT compared to their daily life. The combination of GT with creative tasks, spending time with others or animals and awareness/ appreciation was positively noted through studies, as well as by the interviewees.

The third main finding is the lack of high-quality studies on the effects of GT on mental health in adults. As the few existing reports on interventions are quite diverse in tested interventions, outcome measures, and sample characteristics, the results can only be partially compared. Additionally, most of the included studies are of low quality, which calls for the conduction of randomised control studies to (re)test the effects of GT interventions in different settings and samples. In the remainder of this section, the connection of GT and self-efficacy, as well as the possibilities of GT with farm animals are further elaborated. Additionally, the gathered evidence is compared with the suppositions of the SRT (Ulrich et al., 1991) and ART (Kaplan & Kaplan, 1989).

GT and Self - Efficacy

Self-efficacy beliefs and GT levels and effects seem to be intertwined and while perceived self-efficacy can increase GT levels, GT interventions can also heighten self-efficacy beliefs.

Therefore, a combination of GT interventions and self-efficacy treatments might be especially effective. The dependence of GT levels on self-efficacy beliefs was reflected by most interviewees mentioning feeling unable to overcome at least one of the obstacles towards spending GT and being hindered by fears regarding their study performance. One interviewee also mentioned their wish to be able to believe in their ability to plan their lives so that they can spend more GT. Therefore, GT levels of stressed students might be dependent on their self-efficacy beliefs towards studying and planning. These results are in line with a paper from Von Ah et al. (2004) who found self-efficacy beliefs to be a strong predictor of several health behaviours including physical activity, which is often linked to GT. Additionally, GT has been shown to increase self-efficacy in varying samples (Bell et al., 2018; Kwack & Jang, 2014; Pedersen et al. 2011). Therefore, self-efficacy might be an important predictor of GT and a target variable for GT increasing interventions at the same time. Combinations of interventions aiming at increasing self-efficacy and interventions aiming at increasing GT should be tested to investigate whether those enhance therapeutic results.

GT with Farm Animals

Interventions and programmes combining GT and animal care offer a way to help clinically ill individuals to deal with their symptomatology and give something back to society at the same time. The review as well as the interview study showed positive effects of animal care on the frequency of GT and its effects. The care of animals who either need to be walked with (e.g. dogs) or spend their lives partially or completely in greenery (e.g. wild or farm animals) is a strong motivator to spend GT. In general, the positive effects of caring for animals on (mental) health have been confirmed by a large body of research (Acqudro et al., 2022; Hawkins, 2021; McDonald, 2022; Mulvaney-Roth, 2022). For example, Hawkins' study (2021) showed an increase in motivation and decrease in symptomatology in psychologically struggling individuals owning a pet. The interaction with pets like cats and dogs is well researched, while the integration of farm animals into therapeutic care still needs to be further explored (Berget et al., 2008; Pedersen et al., 2011). The discovery that therapeutic results profit from the interaction with farm animals might provide a chance to work towards the construction and maintenance of small local farms, which Europe is in desperate need of (Arnalte-Mur et al., 2020). In that way, clinically ill participants could be (re)integrated into society and work on their coping methods

while supporting the local environment and agriculture. As returns to work are of high relevance, but often quite challenging for psychologically ill individuals (Nielsen et al., 2017), the care of farm animals could be a way to ease the transition from unemployment or sick leave to (full time) jobs. This could further enlarge the positive economic effects of nature-based therapies (Busk et al., 2022). Another positive side effect through the intentional contact with nature could be the promotion of pro-environmental behaviours in participants (Martin et al., 2020). Overall, a cooperation of therapeutic facilities and farms could lead to a variety of benefits for the environment, economy, and clients.

Match of Evidence with the Stress Reduction and Attention Restoration Theories

The results of the current study match well with the SRT and ART. The finding that a change of scenery and sensations from arousing urban areas to calming natural environments is a main driver for stressed students to spend GT is in line with the SRT, as well as the ART (Kaplan & Kaplan, 1989; Ulrich et al., 1991). Most interviewees mentioned calming effects of GT and a heightened ability to restore from stressors during GT. Some interviewees also mentioned restored ability to stay concentrated after spending GT, which is in line with the assumed attention restoring effects of GT (Kaplan & Kaplan, 1989; Ulrich et al., 1991). Not only the "being away", but also fascination, ability to move and explore, and the compatibility of space and needs which are suspected to influence the restorative effects of environments were brought up by interviewees (Kaplan & Kaplan, 1989). The fascination for specific aspects of nature like flowers or stars not only enhanced the perceived enjoyment and positive effects of GT, but also served the stressed students as a motivator to spend GT. Being able to move and explore was mentioned as especially interesting if no or not many strangers are around. But while freedom in moving and being was mentioned to be enlarged with fewer people around, the absenteeism of people or the presence of just one stranger also sometimes frightened one interviewee. Another example for the needed compatibility of the green space and the individual's wishes is weather and lighting. While some interviewees preferred warm or hot weather, others preferred colder weather. Similarly, some mentioned a wish to spend GT in the dark, while others mentioned not wanting to spend GT at night. Therefore, in line with the theories, especially the change of scenery and sensations helps individuals to profit from GT. Nevertheless, the conditions of GT need to be different for everyone to result in optimal restoration and satisfaction.

Strength and Limitations

The rather uncommon combination of a scoping review and an interview study offered the opportunity to combine statistical outputs regarding the effects of GT on clinically ill individuals with in-depth statements by stressed students. This design enabled the researcher to first lay a basis of evidence for the need of GT interventions, to then start the investigation of why stressed students do not use GT (more).

Another strength of this review is the focus on adult clinical samples. While several literature reviews have already compared and evaluated the effects of GT increasing interventions on (non-)clinical children's samples and workers, not much work has been done to review the effects on adult clinical samples. Therefore, the first part of this study provides an unique possibility to overview the current status of GT increasing interventions for adult clinical samples as represented by published studies.

A third strength of the study is the open exploration of possible solutions by members of the target group themselves, as that could already have a positive impact on the participants. Exploring and finding own solutions was shown to be successful in changing health behaviours and increasing mental health (Bannink, 2007). Based on this insight, the exploration of obstacles and possible solutions might not only be useful for the further development of GT increasing interventions, but also for the interviewees.

A limitation regarding the exploration of GT beliefs, needs, and behaviours of stressed students was the vague definition of GT used. Six of the interviewees mentioned confusion about the definition and components of GT at different points in the interviews and, one even requested a large change in their GT spent per week as they misunderstood the definition of GT completely. It is unclear whether all participants viewed the same activities as entailed in GT, and it is not clear whether the effects of GT are dependent on the self-classification as GT by the individual.

Another limitation of this study is the online execution through only one researcher. Reviews, quality assessments, as well as interview studies are normally conducted by at least two researchers to include all relevant data, reach inter-rater reliability, and minimise personal biases (Effective Public Healthcare Panacea Project, 2019; Nightingale, 2009; Weston et al., 2001). The conduction online brought up problems through an intervening flatmate, a fly on the camera, and connection issues. In general, the distance between the researcher and participants might have

influenced the participants regarding the lengths and richness of detail in their statements (Heath et al., 2018).

Future Recommendations

This two-part exploration leads to several fields of future recommendations based on the availability and quality assessment of studies regarding GT in clinical samples, as well as beliefs, needs, and perceived obstacles of the interviewees.

The first main recommendation for future GT research is the high-quality exploration of the modes of action of GT and its suitability for specific clinical subgroups. With those, further insight in the efficacy and working mechanisms of GT increasing interventions for clinically ill individuals can be gained. Also the suitability of certain interventions for specific samples needs to be explored to match the needs of each sample. Additionally, the studies included did not imply how much GT the participants spent before and after the interventions and are therefore hard to compare to the standard of 120 minutes GT needed to better deal with stress by White et al. (2019). Future research should explore further if the amount of GT or rather the specific nature of GT predicts outcomes. Further, future studies should use specific definitions of GT. Therefore, a standard definition of GT should be derived. A larger body of GT increasing intervention research will serve health organisations and states to inform adult mental health care on the basis of trustworthy evidence.

The second main recommendation for the future is spreading the knowledge about GT increasing interventions and its effects on health to relevant stakeholders and clinically ill individuals. Spreading information about the positive effects of GT on mental health could enlarge the number of clinical institutions adopting nature-based methods. Therefore, institutes educating therapists and psychological personnel can teach ways to inform clients about GT effects and motivate them to spend GT. On the client side, information spreading could enlarge the willingness to participate in GT interventions, as well as their beliefs in the effectiveness of such treatments. To reach all possibly affected, educational organisations and institutes could integrate the importance of GT for health and the opportunities it provides for mental health and growth into their curricula. As part of therapy, GT increasing interventions could motivate clients to participate in life, gain distance from their stressors and enable them to help themselves. After therapy, more clients might use the resource- and cost-efficient possibilities of nature to enhance

their well-being.

The last main recommendation is to not only conduct steps two to nine of the PRECEDE/PROCEED model (Crosby & Noar, 2011) regarding GT increasing interventions, but also using the self-derived solution approaches of the interviewees to overcome obstacles towards spending GT. For example, GT groups for stressed students might be a way for them to spend more GT. Similarly, smartphone apps or programmes supporting individuals to plan their daily life, including reminders for self-care and GT might help them and adults in general to make space for GT in their busy everyday lives. The incorporation of other activities the individuals like to do (e.g. drawing, listening to music, plant care) seems to enlarge the probability of individuals spending GT and provides them with a reason to spend GT. Nevertheless, the results may only be partially transferred to clinical samples. Before designing GT increasing interventions for clinical samples, interviews should be redone with clinically ill individuals. It would also be interesting to explore whether individuals with different diagnoses face different obstacles and therefore need separate GT increasing interventions. If so, interviews and design processes should take place with individuals of each diagnosis separately.

Conclusion

Overall, this study found positive effects of GT increasing interventions on mental health aspects such as depressive symptoms, affect, and self-efficacy in clinical samples and of spending GT on mood and perceived stress in stressed students. Regarding therapy, further exploration of the needs of different samples regarding GT increasing interventions is needed. Also specific GT increasing treatment forms like the combination of self-efficacy treatment with GT or GT interventions with farm animals should be further reserached. For stressed students, the combination of GT with other free time activities and or seeing friends, partners or animals seems to be one of the most promising approaches to enhance GT levels and effects. Especially the change of scenery and sensations is a main driver to overcome obstacles towards spending GT like having little free time or limited access to green spaces.

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Appendices

Appendix A- Table 3 Overview of Study and Intervention Characteristics

Table 3

Overview of Study and Intervention Characteristics

Author(s)	Year	N	Age Range (M), % female	Duration	Sample (diagnosis/diagnoses)	Study Design	Intervention
Berget et al.	2008	90	18 –58 (34.7), 65.60% female	2 3-hour sessions each week for 12 weeks	Clinical (schizophrenia & schizotypal disorders, affective disorders, anxiety & stress-related disorder, disorders of adult personality and behaviour)	Randomized control trial	Animal–Assisted Therapy with Farm Animals (compared to treatment as usual)
Berman et al.	2012	20	Not given (26), 60.00% female	2 3-hour sessions of 90 minute walks in 2 weeks	Clinical (major depressive disorder)	2 x 2 design, counterbalanced within-subjects design, cohort analytical	Walk in Nature/ Urban Setting

Legrand et al.	2018	18	Not given (26.3), 66.67% female	3 sessions of 20-minute walks in 9-15 days	Clinical (mood disturbance/depression)	3 x 2 within and between subject design, cohort study	Running at 64%–77% of age-specific maximal heart rate outdoors/indoors (compared to sedentary behaviour)
McCaffrey et al.	2010	40	> 65 (71.3), Not given	12 2-hour walks in 3 month period	Clinical (depression)	Pre- post within subject design, cohort study	Stroll for Well-being: Garden Walks at the Morikami Museum
Sahlin et al.	2015	57	26–63 (45), 92.98% female	Around 28 weeks	Clinical (stress-related mental illness: adjustment disorder, exhaustion disorder, reaction to severe stress unspecified, and/or depression and/or anxiety)	observational follow-up study, cohort study	NBR
Thomson et al.	2020	20	44-70 (53), 45% female (age descriptive of phase 1 & 2, here used is only phase 2)	10 2-hour sessions taking place every consecutive tuesday	Clinical (Adult mental health service users)	exploratory sequential mixed methods design (here used: quantitative within participants design (phase 2)), cohort study	creative green prescription programme: Dual programme of outdoor horticultural activities and indoor nature-based creative activities

Appendix B – Table 4 Quality of Included Studies as assessed by the Quality Assessment Tool for Quantitative Studies

Table 4

Quality of Included Studies as assessed by the Quality Assessment Tool for Quantitative Studies

Study	Selection Bias	Study Design	Confounders	Blinding	Data Collection Methods	Withdrawal & Drop-outs	Global Rating
Berget et al.	strong	strong	strong	moderate	strong	moderate	strong
Berman et al.	weak	moderate	strong	moderate	strong	strong	moderate
Legrand et al.	weak	moderate	strong	weak	strong	strong	weak
McCaffrey et al.	weak	moderate	weak	weak	strong	strong	weak
Sahlin et al.	moderate	moderate	weak	weak	strong	strong	weak
Thomson et al.	moderate	moderate	weak	weak	strong	strong	weak

Appendix C – Table 5 Overview of Intervention Aims, Instruments & Findings

Table 5

Overview of Intervention Aims, Instruments & Findings

Study	Aims	Instruments	Findings
Berget et al.	Examination whether animal-assisted therapy for psychiatric patients was associated with higher self-efficacy, coping ability & quality of life after treatment and at six months follow-up, assessment if there were different treatment responses in the different diagnostic groups, and the investigation of the relationship between changes in self-efficacy, coping ability and quality of life and specific questions related to the intervention.	GSE, Coping Strategies Scale of the Pressure Management Indicator, QOLS-N	GSE: larger increase in self-efficacy for the treatment group post treatment and at six month follow-up; QOLS-N: increase in quality of life in affective patients; Coping Strategies Scale of the Pressure Management Indicator: significant positive change in scores for the treatment group between before and six months after intervention ➔ Findings partially support that outdoor animal-assisted therapy with farm animals on top of treatment as usual improves treatment effects compared to indoor talking therapy for psychiatric patients, support for efficacy for affective patients
Berman et al.	Examination whether interacting with nature has beneficial effects on memory performance and affect in individuals diagnosed with MDD (specifically on impaired short-term memory/working memory performance in MDD), examination whether mood	PANAS, BDS	PANAS: positive affect improved to a greater extent after the nature walk than the urban walk; negative affect decreased after both walks

	would change differentially after a walk in nature vs. a walk in an urban environment, examination of the relation between mood and memory effects		BDS: participants' memory capacity increased significantly, more after the nature walk than after the urban walk ➔ Findings support that nature settings increase the positive effects of walks on positive and negative affect, as well as memory capacities in major depressed
Legrand et al.	Quantification of the effects of exercise completed outdoors and indoors on feelings of energy and fatigue among adults with depressive symptoms	BDI-II, POMS (subscale: vigour & fatigue)	POMS: exercise resulted in statistically significant and large improvements in feelings of energy, no statistical difference between outdoor and indoor exercise; exercise effects on feelings of fatigue were not statistically significant ➔ Findings did not support that environment moderates the effects of exercise on feelings of energy in people with depressive symptoms
McCaffrey et al.	Determination of the effect of garden walking and reflective journaling on adults who are 65 years old and older with depression	GDS	GDS: lower depression scores ➔ Findings support that garden walks can decrease depression as assessed by the GDS
Sahlin et al.	Exploration of effects of NBR in patients with exhaustion disorder or stress-related mental disorders; exploration of the mental health and well-being improvements of NBR	SMBQ, BDI-II, BAI, PGWB	SMBQ: burnout scores decreased significantly BDI-II: depression scores decreased significantly, overall movement from moderate to mild depression BAI: anxiety scores decreased significantly, overall movement from moderate to mild anxiety

			PGWB: well-being scores increased significantly ➔ Findings support long-lasting gradual positive effects of NBR on burnout, depression, anxiety and well-being of individuals with stress-related mental illness
Thomson et al.	Exploration of the health and wellbeing outcomes derived from engagement in a combined programme of horticulture and creative, arts-based activities	UCL Museum Wellbeing Measure	UCL Museum Wellbeing Measure: Well-being increased strongly and highly significant overall and on all subscales (Activeness, Alertness, Enthusiasm, Excitement, Happiness and Inspiration) ➔ Findings support positive effect of combined outdoor horticultural activities and indoor nature-based creative activities on well-being of adult mental health service users

Notes. GSE = General Self-efficacy Scale, QOLS-N = Quality of Life Scale (Norwegian), PANAS = Positive and Negative Affect Schedule, BDS = backwards digit span task, BDI-II = Beck Depression Inventory–II, POMS = Profiles of Mood States, GDS = Geriatrische Depressions-Skala, SMBQ = Shirom-Melamed Burnout Measure, BAI = Beck Anxiety Inventory, PGWB = Psychological General Well-being Index, HAM-D = Hamilton Depression Rating Score, CGI = Clinical Global Impression rating scale, PD-S/D-S = Paranoid-Depressivitäts-Skala und Depressivitäts-Skala

Appendix D
Interview Scheme

Welcome to my interview!
As you know, I am Kim and I am exploring some mechanisms around exposure to natural environments, elements or contents – called green time – and stress as part of my master thesis. Your GT minutes per week indicated that you (don't) spend enough GT a week, as 120 minutes per week were shown to be enough by research.

The interview will start with questions about your attitudes towards GT, the effects you notice if you spend or don't spend GT, and your knowledge about GT and health.

The whole interview will take around 70 minutes. I ask you to give honest answers. You can cancel your participation whenever you would like to. If you have any further questions feel free to ask.

Please be assured that your responses will be kept confidential, which means that it is not possible to trace them back to you. The data will only be used for the indicated research aim of investigating the awareness, effects and obstacles towards GT. The data will not be provided to third parties just the research team has access to the data. Your participation includes no risks or consequences.

Can you shortly reframe what the interview will be about? Are you fine with me posing the first question?

1) First, I would like to ask you whether you like spending GT?
   probes yes: What do you like about it? What does it give you? What do you do when you spend GT?

   probes no: What don't you like about it? What do you like to do instead?

2) How do you feel during spending GT?
3) Next, I would like to know how you notice it when you are stressed. Which symptoms do you notice?
4) Do you notice any difference in these symptoms compared before and after GT?
5) Do you notice any difference in these symptoms in weeks in which you don't spend enough GT compared to weeks in which you spend enough GT?
   If yes, what about GT do you think helps you (the most)?
6) Do you believe spending more GT could help you with your stress?

7) If not answered yet: Do you spend GT to alleviate stress?
8) Are you aware about any proven effects of GT on stress?

Thank you for answering all these questions about your attitudes towards and knowledge about GT, as well as about your knowledge about the effects of green time. Do you want to add anything towards these topics?

9) Great, thank you. Now I would like to continue with exploring factors influencing whether you spend GT or not. Is that okay?
10) Are there any conditions you are aware of which have to be met for you to spend GT?
    Possible topics: weather, free time, location
11) Do you sometimes experience the wish or need to spend GT but can`t?
    If yes, what hinders you then?
12) Thank you for sharing that with me. Are you aware of any possibilities to tackle that obstacle towards spending GT?
13) In general, do you have any ideas what would motivate you to spend more GT?
    Do you think other activities you like might be combinable with GT?

Thank you for answering all my questions. If you don't have any questions at the moment I would like to tell you a bit more of the background of the interview.

The interview results will be collected and compared to see overall tendencies of how individuals who perceive themselves as stressed view GT, its benefits and obstacles towards it. I want to assess the knowledge, beliefs, needs and barriers towards spending GT as well as the GT behaviour of stressed students in general. Together with data of a literature review I conducted the results shall provide a base of further research into GT and mental health and for the development of GT increasing interventions.

Do you still consent to the usage of your answers?

Thank you for your participation.

Appendix E

PSS-10

Perceived Stress Scale

A more precise measure of personal stress can be determined by using a variety of instruments that have been designed to help measure individual stress levels. The first of these is called the **Perceived Stress Scale**.

The Perceived Stress Scale (PSS) is a classic stress assessment instrument. The tool, while originally developed in 1983, remains a popular choice for helping us understand how different situations affect our feelings and our perceived stress. The questions in this scale ask 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. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer fairly quickly. That is, don't try to count up the number of times you felt a particular way; rather indicate the alternative that seems like a reasonable estimate.

For each question choose from the following alternatives:
0 - never 1 - almost never 2 - sometimes 3 - fairly often 4 - very often

_____ l. In the last month, how often have you been upset because of something that happened unexpectedly?

_____ 2. In the last month, how often have you felt that you were unable to control the important things in your life?

_____ 3. In the last month, how often have you felt nervous and stressed?

_____ 4. In the last month, how often have you felt confident about your ability to handle your personal problems?

_____ 5. In the last month, how often have you felt that things were going your way?

_____ 6. In the last month, how often have you found that you could not cope with all the things that you had to do?

_____ 7. In the last month, how often have you been able to control irritations in your life?

_____ 8. In the last month, how often have you felt that you were on top of things?

_____ 9. In the last month, how often have you been angered because of things that happened that were outside of your control?

_____ 10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

Appendix F
Entry Survey Qualtrics

Green Time - Effects & Obstacles: Entry Questionnaire

Start of Block: Info & Informed Consent

Welcome to this survey!

I am currently working on my master thesis and am now starting to collect data for my study. Generally, I am investigating peoples' attitudes towards stress and green time (GT). GT is time spent in, or exposure to natural environments, elements or contents.

Procedure

If you agree to participate, you will fill in three different parts. You will begin with a general demographi cs questionnaire (age, gender, nationality, GT per week). Next, I ask you to fill in a short questionnaire about stress. At the end, you will be provided with some further information. This first part of the study will take you around 10 minutes to complete and if you are participating via SONA, you will be granted 0.25 credits. You will be asked to state your e-mail address, so that I can contact you after I calculated your stress score. If applicable, I will invite you to an interview afterwards.

Participants Rights

Your participation in this research is voluntary. You have the right to withdraw at any time without any reason, prejudice or consequences.

Risks and Benefits

This study poses no risks. This study is ethically approved by the Ethical Review Committee of the Behavioural Management Sciences Faculty.

Confidentiality

Please be assured that your answers will be kept completely confidential and anonymous, as no personally identifying information (e.g. names) are asked. The information you provide will be used for scientific research only and not disclosed with any third parties.

Questions

If you would like to contact the principal investigator in the study to discuss the research, please e-mail Kim Nina Strohmeier (k.n.strohmeier@student.utwente.nl). If you would like to talk with someone other than the researcher, or have questions about the rights of research participants, please contact the Ethical Review Committee of the Behavioural and Management Sciences Faculty, University of Twente, Netherlands, at ethicscommittee-bms@utwente.nl.

By clicking the "I consent" button below, you acknowledge that your participation in the study is voluntary, you are 18 years of age or older, a student and that you are aware that you may choose to terminate your participation in the study at any time and for any reason.

- ○ I consent
- ○ I do not consent

Skip To: End of Survey If Welcome to this survey! I am currently working on my master thesis and am now starting to colle... = I do not consent

End of Block: Info & Informed Consent

Start of Block: Demographics

Please indicate your age

_____

Please indicate your gender

- ○ Male
- ○ Female
- ○ Non-binary
- ○ Prefer not to say
- ○ Other _____

Please indicate your nationality

- ○ German
- ○ Dutch
- ○ Other _____

Please indicate the amount of minutes you spend with GT each week.

_____

End of Block: Demographics

Start of Block: PSS-10

The Perceived Stress Scale (PSS) is a stress assessment instrument. The questions in this scale ask 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. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer fairly quickly. Indicate the alternative that seems like a reasonable estimate.

	Never	Almost never	Sometimes	Fairly Often	Very often
In the last month, how often have you been upset because of something that happened unexpectedly?	○	○	○	○	○
In the last month, how often have you felt that you were unable to control the important things in your life?	○	○	○	○	○
In the last month, how often have you felt nervous and stressed?	○	○	○	○	○

In the last month, how often have you felt confident about your ability to handle your personal problems?	○	○	○	○	○
In the last month, how often have you felt that things were going your way?	○	○	○	○	○
In the last month, how often have you found that you could not cope with all the things that you had to do?	○	○	○	○	○

In the last month, how often have you been able to control irritations in your life?	○	○	○	○	○
In the last month, how often have you felt that you were on top of things?	○	○	○	○	○
In the last month, how often have you been angered because of things that happened that were outside of your control?	○	○	○	○	○

In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	○	○	○	○	○

End of Block: PSS-10

Start of Block: Info

Please indicate your e-mail below. It will be solely used to contact you in order to discuss the further progress.

_____

End of Block: Info

Start of Block: Info & Help

Thank you for your participation!

Your responses will help me to check your suitability for my study. In any case, I will contact you via the

stated e-mail adress to notice you about the further process.

If you find yourself in a stressful situation in which you feel the need to reach out, you can call the below-listed hotlines:

Student Affairs Coaching & Counselling UT: +3153 489 2035 (English)
Seelsorge: 0800/111 0 111, 0800/111 0 222 or 116 123 (German)
Stitching 113Online: 0900 0113 (Dutch)

End of Block: Info & Help

Appendix G

Invitation to Entry Survey

Are you a student of 16 years or older who would like to share some of your experiences with stress and spending time in nature? Perfect! I am currently conducting research in exactly those aspects. The concept of green time (GT) is a rather under-represented topic in research which concerns the effects of nature exposure on (mental) health. As part of my master thesis, I want to explore the uses of GT for stressed students, as well as obstacles towards spending GT. The entry survey lasts about 10 minutes and if applicable I will invite you to an interview afterwards which will be around 70 minutes. Thank you for taking your time!

Appendix H

Invitation to Interview

Dear participant,

Thank you for your participation in my study about green time and stress. After you completed the entry survey I computed your score and the PSS-10 suggests that you are (moderately/severly) stressed. Therefore, you are part of my target group and I would like to invite you to an interview. The interview will last around 70 minutes. I am available at X, are you available then too?

I am looking forward to hearing from you!

Thank you already,
Kim Nina Strohmeier

Appendix I

E-mail to Non-Stressed Participants of the Entry Survey

Dear participant,

Thank you for your participation in my study about green time and stress. After you completed the entry survey I computed your score and the PSS-10 suggests that you aren't stressed. Already conducted research suggests positive effects of GT on stress and might therefore offer a resource effective and accessible treatment possibility. My goal is it to investigate how stressed students use GT already and which barriers exist towards using it more often. The information shall be the base for future interventi ons aiming at helping stressed individuals to use GT to alleviate stress symptoms. Therefore, you are not part of my target group and I will not invite you to an interview. Of course you will still receive the 0.25 Sona Credits if you accessed the survey via Sona.

Kind regards,
Kim Nina Strohmeier