REVIEW

The impact of restorative green environment on mental health of big cities and the role of mental health professionals

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Purpose of review
To provide an update on insights into the effectiveness of the green environment and forest on the mental health of city dwellers; and the role of mental health professionals in advocating green restorative therapies.

Recent findings
The studies reviewed in this paper confirmed the mental health benefits on individuals who engaged in the green environment and forest. Results of studies showed that the participants reported significantly higher positive effects. However, it is difficult to compare studies because of marked differences in methodology and often lack of biological markers. With the recent global concern about climate warming, mental health professionals have a critical role to influence city planners on the importance of the green environment and the forest. In Singapore, the 'Therapeutic Garden' project and 'Therapeutic Rainforest' program are examples of mental health professionals working with government agencies for a 'city in nature'.

Summary
The benefits of the green environment and forest are emphasized especially on the psychological well being. In the light of the danger of climate warming, this review highlights the need for city planners to collaborate with mental health professionals to incorporate high-quality green spaces when planning the city of the future. There is an urgent need for better consultation between health agencies and local city government to create an appealing and diverse green environment within the city.

Keywords
city life, green environment, mental health, therapeutic forest

INTRODUCTION

The recent United Nations COP26 Climate Conference in Glasgow highlights the importance of the forest and green environment to prevent global warming. Beyond economics, the deleterious effect of deforestation on mental health has not been well reported.

Nature can provide physiological and psychological benefits [1▪]. Poor psychological well being often leads to a lower quality of life. At present, pharmacological and psychological therapies are the mainstay of treatment of mental disorders. Encouraging patients to walk in the park or forest is not the prescriptive habit of many doctors or psychiatrists.

Globally, over half (55%) of the world's population live in urban settings [2]. With the ferocity of the pace of life in the city, many people have difficulty in managing high stress level or respond to crises positively [3]. Prolonged distress could lead to anxiety and fatigue, causing physical and mental health problems [4]. Therefore, it is crucial to provide means for urban-dwelling communities to manage their stress well and support them in re-establishing a balanced life. At the time of writing, the coronavirus disease 2019 (COVID-19) pandemic has swept through the world and significantly affected the health and well being of many individuals. With the additional stressor of the COVID-19 pandemic, it is evident that many people living in crowded cities find it difficult to cope with work and family life.

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KEY POINTS

- The green environment and forest are therapeutic to our mental well being.
- City planners should collaborate with mental health professionals to incorporate green spaces when planning the city of the future.
- Protecting the therapeutic rainforest will prevent climate warming and enhance mental health.

Mental health professionals have a role to champion the promotion and implementation of nature-based programmes in cities [5▪], and their opinion on 'nature prescription' is sometimes sought [6]. However, with the urgency of climate warming, mental health professional should embark on a more proactive role in assisting city-planners to protect the limited forest areas and design green environment as 'breathing spaces' in congested cities.

Immersing in nature encourages us to understand and appreciate trees, forests, birds, and animals. Some studies conducted in forest settings [7] and green spaces in the cities have demonstrated the effectiveness in enhancing well being, relieving stress, and relaxation [8–11]. Many urban dwellers are faced with increased stress levels with daily exposure to noise and environmental pollution [12]. If left unmanaged, stress can become a precursor to many mental health problems such as depression and anxiety [13]. People experiencing mood disorders face an increased risk of developing physical health problems such as cardiac illness and hypertension when compared to those without mental health problems [1▪]. Given the association between stress and its negative impact on the body, it is essential to learn how to manage stress as a preventive measure. The green environment can be a cost effective method in preventive psychiatry.

We used Cooper's five-stage framework [14] to ensure a rigorous review on the selected research studies. Articles included in this review were recently published from 1 December 2019 to 31 May 2021, presenting the latest discussion on the therapeutic effects of the green environment on mental health in large cities worldwide. In addition, the review paper will provide insights into the effectiveness of nature-based prescriptions and the role mental health workers can adopt in green restorative therapies.

THERAPEUTIC FOREST

The forest as a natural environment has gained popularity as a form of therapy for health and well being recently [15,16]. A total of 29 articles were selected from the past eighteen months and included in this review. A range of positive health outcomes, including stress reduction and improvement of depression and anxiety can be attributed to the forest [1▪,17▪▪,18▪,19,20▪,21,22,23▪,24▪▪,25,26,27▪,28▪,29▪▪]. In these studies, the authors reported a wide range of research methodologies to examine the effect of forest on mental health including the number of visits to the forest which ranged from just a single session [19,25,29▪▪] to multiple sessions over several few weeks [23▪,24▪▪,26,28▪,30]. The duration for each visit also varies ranging from 10 [31▪] to 15 min [18▪,32▪] or up to 300 min [28▪,33].

Shinrin Yoku (forest bathing) has been an ancient traditional cultural practice [34▪] in Japan. The belief is that the trees and the forest environment are essential for maintaining good mental health [35,36▪]. Many studies support the hypothesis of the effects of forest bathing that demonstrates the possibilities of enhancing well being, uplifting moods, decreasing negativity, and, eventually, reducing the consequences of stress [26,37–41].

From this review, an important finding from the study conducted by Markwell and Gladwin [28▪] shows the effectiveness of Shinrin-yoku where participants reported significantly higher positive affect at the 1-month follow-up compared to the participants from the digital Shinrin-yoku group. Furthermore, qualitative findings on Shinrin-yoku complement the quantitative results where the participants mentioned that walking in nature provided a more vitalising and energising impact [42]. It was associated with the positive emotions, tranquil environment, refreshed mind-set, and enjoyment; and most participants were more likely to continue with Shinrin-yoku despite the study ending [28▪].

These findings are supported by two dominant theories, the Attention Restoration Theory (ART) proposed by Kaplan and Kaplan [43] and Stress Reduction Theory (SRT) proposed by Ulrich, Simons [44], where the authors suggested that the benefits not only improved the individuals' cognitive functioning, alleviate stress and reduces attentional fatigue, it would also allow a person to rest and recover attentional capacity.

With the massive deforestation and city building in most parts of the world, it is important to note that living in a city environment with fewer trees will result in a higher risk of developing depression [45▪,46▪,47,48].

Although the results of a few studies of the therapeutic forest showed positive outcomes, there are many factors to consider when comparing the findings.

Firstly, most of the outcomes examined were based on subjective rating scales and most studies

were not randomized controlled trials. Hence there would be a bias for the forest intervention in reporting the results. Additionally, seasonal differences during the conduct of the intervention among the studies could be a confounding factor as many studies have shown that well being is frequently related to change of seasons during the year [49▪,50].

Secondly, in most research, different types of forest were introduced in the interventional studies. For example, in a study by McEwan, Giles [27▪], the intervention was a semi-ancient woodland and in another study, it was in a bamboo forest [17▪▪]. The differences in the vegetation, sunlight, sounds, and temperature could have affected mental well being.

GREEN ENVIRONMENT IN THE CITIES

Urban living is often a shift away from a more naturalistic and greener environment. Many studies have been shown the physical and psychological benefits of the therapeutic effects of green environments [29▪▪,51▪,52▪▪]. A recent review on the impact of urban green space on mental health across Western countries provided a definition of public green environments which include recreational parks and fields, community gardens, undeveloped lands, and protected reserves. This study conducted by Callaghan, McCombe [51▪] suggested that living near more green space was strongly correlated to a lower prevalence of anxiety and depression. The restorative effect of green environments has encouraged more green spaces within cities to improve mental health of city dwellers [53▪].

The therapeutic forest may not be available for those with limited access to forest areas living in an urban setting. Therefore, it is vital to examine the impact of restorative green environments on the mental health of individuals living in big cities. A further review of 12 studies on the effect of green environments on mental health in over thirteen urban cities was evaluated. In these studies, a green environment refers to a space filled with green sceneries within the city. Like a forest setting, a green environment in the cities utilizes the effect of nature, such as trees and parks, to provide a sense of tranquillity to the body. However, instead of wild plants, the structure of the green environment consists of parks and community gardens where greeneries such as grass, trees, and shrubs were carefully scalped for aesthetic appearance.

However, many studies, which were observational cross-sectional designs, only examined the psychological effect after one to two exposures to green environments. Therefore, evidence on the duration and frequency of green exposure to achieve a sustainable impact on psychological health remains scarce. Although some studies suggested improving people experiencing mental health problems for sessions that lasted over 20 min [8,10,42], some would stretch up to 120–180 min [1▪,11]. The frequency of green exposure is another noteworthy factor in evaluating its impact on mental health outcomes. In a study by Zhang and colleagues [54▪], long-term exposure to green environments improves positive mental health outcomes. However, most of the studies would end only after one session [1▪,11,42].

One of the factors that affect the quality of the forested area is the level of biodiversity. According to Cameron and colleagues [55▪▪], people elicit better psychological responses with more substantial engagement with nature. However, the level of biodiversity in the city greens might be significantly lesser than in the forests due to the lack of natural habitat for accommodating the different wildlife species. Therefore, it is important to select appropriate venues when setting up a green environment within the cities as the site must support biodiversity growth. Green environments in the cities need to be created based on available geographical size, demographical needs, and resources availability. Ensuring the availability of high quality, more appealing, and diverse green environment and making the best of what is available locally will bring nature closer to the population who may have the greatest need for them.

ROLE OF THE MENTAL HEALTH PROFESSIONALS

Mental health professionals like psychiatrists, psychologists and mental health nurses who have an interest in the green environment can collaborate with horticulturists. They have a role in advising city planners who need to incorporate high-quality green spaces in the city during its planning to improve the overall well being of the city residents. In the United Kingdom (UK), there is a commitment between the UK Government and the Local Nature Partnerships and Health and Wellbeing Boards to create embedded access to the green environment within mental health support services [56]. This, in turn, will improve the use of the green environment as a modality for people to seek mental well being. According to the World Health Organization, the presence of high quality and well maintained green environment will encourage more people to engage in greenery and, most importantly, safely. [57]

Some mental health professionals do recommend walking in the parks for the mental well being of city dwellers. ‘Park prescription’ for their patients has now attracted the interest of the medical

profession in general in the light of its relevance to physical and mental health. The management of mental health conditions should not be narrowly limited to just pharmacological prescription and psychotherapy.

Singapore is reinventing itself from being a 'garden city' to a 'city in nature'. Mental health professionals from the Mind Science Centre of the National University of Singapore are working closely with the National Parks Board, a governmental agency, to conduct therapeutic horticultural research. The first study was a randomized controlled trail on horticultural therapy for seniors living in the community [58▪▪,59▪]. The 6-month study showed that the participants maintained healthy sleep patterns and mental health with improved cognition.

Besides the psychosocial measures, the researchers took blood samples to measure changes of immune and endocrine biological markers including interleukin (IL)-6, BDNF (brain-derived neurotropic factor), cortisol and DHEA (dehydroepiandrosterone). A significant reduction of plasma IL-6 level ($P = 0.02$) was observed in the horticultural therapy group.

An interesting finding of the study is not just an improvement in emotional well being but also in their social health. All of them lived in crowded public apartments and did not know their neighbours well but at the end of the study they became good friends. They would harvest the vegetables they planted and cooked a meal together. This sense of social connectivity has stirred a sense of empathy among them and the active seniors begin to assist the frail elderly in their neighbourhood.

Most studies on the green environment and mental health are from temperate countries like North America, Europe, Japan, Korea, China, New Zealand and Australia, and there is a dearth of data from tropical countries. The joint effort of the Mind Science Centre and National Parks Board in Singapore provides evidence that the nature-based interventions can be translated to programs to benefit seniors living in tropical countries.

The results of the study were presented to the National Parks Board of the Ministry of National Development. With the encouraging findings of the research, the government agreed to build eight 'Therapeutic Gardens' in the communities around the island to benefit seniors. This is an example of how mental health professionals can work with a governmental agency to design the green environmental to enhance the mental health of city dwellers.

Another new project in Singapore is the Therapeutic Rainforest Program where seniors will be guided to walk mindfully in the rainforest and they will also learn the flora and fauna of the forest. This is also a collaborative endeavour of the Mind Science Centre and the National Parks Board. From a pilot study, we found that walking mindfully in the rainforest improved physical, mental and social health of seniors. But what was more interesting was that the seniors began to love the rainforest and donated to the National Parks Board to plant more trees in Singapore [60]. It may be a small step in the greening of Singapore but a giant step if more tropical countries begin to treasure their rainforest.

CONCLUSION

The present review has shown that there are methodological gaps among the recent studies on the green environment and mental health in the city. Firstly, the intervention, like forest bathing, conducted were with varying duration and frequency across all studies. Future studies should be designed with a standardized duration and frequency of interventions implemented for continuous psychosocial benefit. Moreover, there is a lack of understanding of the long-term effects of the therapeutic forest; therefore, studies can adopt a longitudinal approach where the cumulative effects can be examined over time.

Secondly, most studies were primarily based on unguided forest bathing with a different range of activities conducted during the session. Future studies should structure the activities within the studies as this will allow similar experimental situations, ensuring a more robust comparison across different arms within the trial.

Thirdly, most studies relied on self-reporting outcomes among their participants, resulting in a reporting bias on the outcomes. Future studies should consider incorporating either mobile applications, physiological measurements or even biological markers in recording and reporting outcomes.

The green environment has shown its effect in improving mental health but consistencies in interventional methodology and objective measurement for its effect are needed [61]. Although public agencies and organizations have promoted the restoration of green spaces in communities within big cities, there are limited guidelines such as park size, type of facilities, or landscapes for planners to design and map out the green space according to their geographical and demographical profile to achieve the optimal outcome for mental health. To achieve this end, collaborations among city planners, horticulturalists and mental health professionals are strongly recommended.

The Singapore experience as a 'city in nature' can be a model of how mental health professionals

can play an active role with governmental agency to conceive research of translational relevance. The therapeutic garden has benefited seniors living in the community and the therapeutic rainforest program if adopted by more countries can have an impact on protecting the rainforest and prevent climate warming.

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Conflicts of interest

There are no conflicts of interest.

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Papers of particular interest, published within the annual period of review, have been highlighted as:

- ■ of special interest
- ■■ of outstanding interest

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