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Green Space, Gender and Health: A Re-Examination of the Literature

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ABSTRACT
This paper aims at reviewing evidence and identifying research gaps in the studies of green space, gender and health. A detailed literature search was conducted using relevant search terms. The evidence and gaps in the studies of green space and its relationships to human health were synthesised from the review. Evidence suggests the use of green space is salutogenic, though there are few inconsistent findings. There is limited evidence of gender differences in use as well as the health impacts of green space. However, safety concerns, quality and quantity of green space, limited leisure time and gender role potentially account for the differential use of green space between males and females. The literature provides a mechanistic structure towards investigating the gender differences in the relationships between green space and health. Therefore, there is need to investigate gender differences in the frequency of use and type of use as well as gender differences in the effectiveness of each mechanism for salutogenesis.
Keywords: *Green space, natural environments, gender, human health, salutogenic*

INTRODUCTION

There are concerns over the rising individual and population level of chronic non-communicable diseases such as diabetes mellitus, hypertension, depression and cancers, which some authors have described as the diseases of modernity [1,2]. The current approach in combating these diseases is primarily the orthodox medical practice, which is pharmacotherapy-centred. However, this approach appears ineffective [3], and capital intensive. Consequently, attention is turning to whether salutogenic environments can assist in combating these problems, and one of such environments is green space/natural environment [3]. Green spaces or natural environments encompass urban and rural context, public open space and private gardens, urban streets, parks and squares, woodlands and forest, countryside greenery and natural spaces such as rivers and coastal landscapes [2].

In view of the potential health benefits of the use of, and/or contact with, green space, it is worth examining the literature in order to assess evidence which can inform public health policy including urban designs, and to stimulate further research by exposing the gaps in the literature. For example, there is little or no study examining gender difference in the relationships between green space and health, specifically only one study to date has specifically investigated this.

METHOD

Literature search was conducted continuously from October 2010 to July 2011 and [5] databases were searched. Internet searches of relevant websites, hand searches of relevant journals and references in the included papers and reviews in identified literature including grey literature, were also used as appropriate. Table 1 shows details of the literature search undertaken, while differences between references found and references relevant represent an application of the inclusion and exclusion criteria.

RESULTS AND DISCUSSION

Green Space and Health

Many studies have been able to provide evidence of positive associations between exposure or access to green spaces and health [4-15]. However, there are a few studies that were not able to

establish any positive association between green space and health [16, 17]. These exceptions were studies conducted in New Zealand, and these findings strengthen the suggestion that there may be variations (national and environmental) in this relationship.

Some experimental researches have been conducted [18-23], to support the mounting evidence from observational studies. However, there is still need to replicate studies in diverse settings and improve upon study design, because positive associations found in observational cross-sectional studies are not necessarily causal [24,9].

Table 1: Literature search results

Database	Search Terms	References Found	References Relevant	Inclusion Criteria	Exclusion Criteria
Pubmed	(Green Space or park and forest or woodland)* Health	166	16	Written in English Studies closely related to green space and human health. All years	Other languages, Studies related animals, studies unrelated to health and green space Duplicated studies
Pubmed	Natural environment or natural environments* and health	595	18	Written in English Studies related to human and natural environments (green space, forest, woodland e.t.c). All years	Other Languages, Studies not related to health and natural environment, Studies not related to human
Web of Knowledge	(Gender or Sex) AND health inequality or health inequity or (health inequalities or health inequities)	74	46	Written in English Studies exploring sex differences or analyzing for sex in relation to health. All years	Other languages, Studies that controlled for gender or not related to human health and gender
Ovid (Embase, Medline and Eric)	(1)(Health or Cardiovascular diseases*or heart disease*or stroke or respiratory disease*or asthma or bronchitis or emphysema or lung disease*).mp and (2)gender.mp and(3)(green space or park or parks or forest* or woodland).mp	153	13	Written in English Only Human Studies, Years- Embase: 1996 - week 27 2011; Eric: 1965-July 2011; Medline In – Process: 1950-2011	Other languages, Studies unrelated to human health and green space, Embase: Years Before 1996; Eric: Years Before 1965 and Medline In-Process: Years before 1950
Ovid (Embase, Medline and Eric)	Social contacts* and 1 and 2	125	13 (excluding duplicates)	English Language, Studies on social capital, cohesion and	Other languages, Studies not related to social contact/cohesion and human health

				contacts in relation to human health and gender. Years as above	or gender
Web of Knowledge	Topic= (Green space* and Health) and(Human*)	283	55 (excluding duplicates)	English language, Studies related to human All years	Other languages, Studies not related to green space, greenery, vegetation and forest. Animal studies
Total= 3		1396	161		

One study suggested that income - related health inequalities seems to be ameliorated by exposure to green space, with the populations that are exposed to highest quantity of greenery also showing the lowest level of income-related health inequalities [11]. However, this is not absolute, because the determinants of health are multi-factorial i.e., transcends the natural environments [25]. Furthermore, the salutogenic effects of green space seem to be universal- cutting across all age groups. This was substantiated by Takano *et al*, [14], who investigated, using a cohort study, the association between nearby residential walk-able green space and longevity of senior citizens in a developed mega-city. After adjusting for age, sex, marital status and socio-economic factors, walk-able nearby green space was positively associated with longevity of senior citizens over the following five years of follow up.

In conclusion, the evidence for the health benefits of green spaces from population level studies seems relatively strong even though there are a few studies that found no association.

Theoretical Mechanisms behind the Relationship between Green Space and Health

There are three major theoretical mechanisms behind the relationships between green spaces and health. These are: restorative effect on stress and mental fatigue, facilitation of social contacts and stimulation of physical activity (8,26). These mechanisms are examined below.

Encouragement of Social Contact by Green Space

This sub-section is divided into two- the first part discusses social contact as a health resource, while the second part explores social contact as mediated by green space.

Social Contact and Health

Increasing findings suggest that social contact is a resource to health and well-being [27,28]. Though the mechanisms have not yet been fully elucidated, there is a suggestion in the literature that social contacts and relationships may affect health, especially cardiovascular diseases risk, by influencing the activation of sympathetic nervous system [29]. The positive health impacts of social relationship/support are not limited to cardiovascular diseases. For example, the impact of social support on mental health, particularly depression, was buttressed by a 14-year longitudinal study conducted in Finland by Heponiemi *et al* [30]. The study revealed that lower levels of perceived social support were associated with increased depressive tendencies after five years and lower levels of depressive tendencies prospectively [30].

Social Contact Mediated by Green Space

Development and sustainability of local communities and social relationships is partly dependent on availability of meeting opportunities [31-33]. Natural environments provide such opportunities to develop and strengthen social cohesion [8,14,31,34]**.** Sugiyama *et al* [13], for example, found that walking, social interaction and social cohesion are more likely to take place frequently in areas where there are more green spaces. The association between greenery and mental health was partly explained by recreational walking and social cohesion [13], though the study relied on self-reported measure of greenness and walking, which is subjective. However, in contrast, Maas *et al*, (35) did not find greater social contacts with neighbours and friends mediated by green space.

Summary

There is some evidence that green space promotes social contact by providing opportunities for development and sustainability of social tie and relationships as well as development of communal identity and attachments.

Facilitation of Physical Activity

This section presents available evidence supporting the health benefits of physical activity and critically describes the evidence for and against the facilitation of physical activity by greenery.

Health Impacts of Physical Activity and Relationship with Green Space

The beneficial effects of physical activity for physical and mental well-being are well known (8,20,36). Adequate level of physical activity reduces the risk of coronary heart diseases and stroke, hypertension, diabetes, colorectal and breast cancers as well as depression [36]. Physical inactivity has been documented as the fourth leading risk factor for death globally [36]. Despite this, physical activity levels in many countries, especially developed nations, have been declining with attendants increase in the prevalence of chronic non -communicable diseases [36].

Green spaces may provide opportunity to engage in physical activity at different intensity or extents. Some studies have shown that proximity or availability of green spaces, parks and leisure facilities is associated with physical activity [13, 37]. However, contrary results were reported in other studies; for example, Maas *et al*, [38] observed that individuals and populations with more green spaces in their neighbourhoods are less physically active during leisure time.

Summary

The balance of evidence suggests that green space appears to stimulate physical activity, and that physical activity is good for health and well-being. However, the differences in the outcome of these studies may be attributed to differences in study designs and measures of physical activities as well as environmental variations.

Restorative Effects on Stress and Mental Fatigue

Restoration can be conceived as a process of recovery from physical and mental stresses of everyday life, and also from traumatic life events. When successful, it leads to a state of calmness and relaxation, feeling energetic, satisfaction with life and better ability to concentrate on tasks [39]. Restoration can be detected at the biological level and also psychologically. Experiments to detect it have been guided by two theoretical perspectives: "Psycho-evolutionary theory" by Ulrich [22] and "Attention Restoration Theory" by Kaplan and Kaplan [40]. Both presume that restorative effect of nature is evolutionary and innate [23].

Experimental Evidence of Restorative Effects of Green Space

Experimental studies have also been done to substantiate the restorative power of the natural environment and test the aforementioned theories [7,18-23,38,41].

The positive aesthetic and affective responses (in form of restoration) to visual environment, particularly natural environment was investigated and confirmed by Ulrich [22], when he conducted a quasi-experimental study on post-surgical patients. His findings suggest that natural environments have comparatively therapeutic effects on health through restoration (than the built environment). However, there are a few methodological concerns- age group restrictions, lack of information on blinding and possible differences in results if a more attractive built view was used.

Evidence about the biological impacts of green space was strengthened by experimental field studies in Japan. These field studies, though in a different setting, ("Shinrin-yoku"- walking and /or staying in forests and forest air-breathing-inhalation of transpired air by trees), were conducted and reported by Park and his colleagues,[19, 21], to provide evidence for the Japanese government policy which encouraged regular use of greenery and natural environments, as part of health promotion strategies. Physiological indices taken revealed lower reading after exposure to "Shirin-yoku" [19,21] and were corroborated by subjective evaluation [21]. These findings suggest that the sympathetic nervous system appears to be dampened while the parasympathetic nervous system is enhanced by the forest and natural environments [21].

Ulrich *et al*, [23] also assessed the relationship between the stimulus of natural landscape and psychological and physiological response of interest by conducting a laboratory based study involving human subjects. The study revealed that visual response to natural environment following exposure to stressful film was associated with faster recovery from elevated blood pressure and other physiological measures of stress, as well as self- reported psychological measures, compared to those subjects exposed to unnatural scene [23]. Similar findings were

reported by Pretty *et al* (20). However, other findings suggest that these salutogenic responses to natural environments are not universal, and that there are differences in perceptions and preferences which vary by social groups (42).

In conclusion, there seems to be strong evidence from experimental studies supporting the restorative effects of exposure to green space by man. The mechanism by which physiological and psychological restoration seems to be triggered by green space involves an environment-eye-brain-body connections in which the brain perceives the environment and the favourable response is to reduce the blood level circulation of stress hormones such as cortisol, and possibly its level of arousal (41), and plausibly other neuro-hormones or neuro- transmitters may be involved, impacting on the mood.

Evidence from Observational Studies on Restorative Effects of Green Space

De Vries *et al*, [7] conducted a cross-sectional study using ecological data to substantiate the positive relationship between exposure to green space and mental health; those residing in areas with more green spaces had better mental health, and this association was even stronger for less educated, women at home and the elderly, probably, due to the fact that they are restricted to the neighbourhood, and therefore, more likely to have greater exposure to green space [7] or possibly due to other environmental or social factors not accounted for. Similarly, van der Berg and Maas *et al*,[15] found that green space exert a buffering effect on stress and traumatic life events.

Summary

There is strong evidence suggesting that green space is capable of bringing about restoration from stress and mental fatigue in human. Available evidence from the experimental and observational studies suggests that restoration can be psychological and physiological in nature [18,23].

A synopsis of the literature on the relationship between green space and health and its mechanisms has now been reviewed. This lays a template for an exploration of the literature to examine gender, sex and health and gender differences in the three potential mechanisms behind the relationships between green space and human health.

Gender, Sex and Health

"*Gender is the state of being male or female typically used with reference to social and cultural differences while sex is the biological difference between male and female*" [43]. WHO defines gender as *"the socially constructed roles, behaviour, activities and attributes that a particular society considers appropriate for men and women"* [44]. This distinction in roles, behaviours, functions and social qualities may underlie the differences in experience during use and frequency of use of green spaces. This may partly explain the gender differences in the health outcomes- cardiovascular and respiratory disease mortality, as men seems to be protected by increasing green space exposure while women seem not [45].

There are gender differences in many other health conditions, for example, mental health, with the gender-based risk factors, being important as determinants of health [46]. It should be noted that certain innate biological differences contribute to differences in certain health outcomes- particularly cardiovascular diseases, as women seem to be protected during pre-menopausal stage of life [47].

Findings from studies suggest that women are more likely to earn less than men, work part-time, engage in domestic and un-paid jobs and are more likely to live in the most deprived neighbourhoods [48]. These pieces of evidence lend credence to a WHO research publication [49], which says that socio-economic factors and neighbourhoods are critical to inequalities in health between males and females, even in developed countries.

In conclusion, "gender must be included as a determinant of health because of its explanatory power in relation to differences in health outcomes between men and women" [49], and specifically, the gender defining factors must be addressed.

Gender Differences in the Relationships between Green Spaces and Health

In this review, only one study specifically investigated gender differences in the relationships between green space and health. Mortality from cardiovascular and respiratory diseases in males reduced with increasing green space but there were no significant relationships in females [45].

This novel study by Richardson and Mitchell, [45] was the first study that made use of a UK-wide data, hence capturing varied culture and environments to which the urban populations are exposed [45]. It also made use of objective measures of population health and green space

coverage while the majority of the previous studies made use of self-reported measures. However, this study is not without its limitations. For example, it used an ecological approach which is prone to ecological fallacy due to aggregate bias and confounding, and these issues are difficult to resolve [50]. It is an observational cross-sectional study which makes causality difficult to prove, i.e., more green exposure causing better health [9,24]. The ways in which green spaces are being used were not accounted for, and while some confounders were taken into account, others were not, such as education and occupation, which have established associations with health and health behaviour. There are known gender disparities in these characteristics.

From the above findings by Richardson and Mitchell, [45] and findings from the literature, it then follows that these gender differences observed in the relationships between green space and health need further investigation.

Gender Differences in Relations to Green Space and Health

The next sub-sections examine the literature for possible gender differences in the theoretical mechanisms behind the relationships between green space and human health as well as gender differences in the use and reasons for the disparities.

Gender Difference in Health Impacts of Social Contact

It remains unclear whether there is gender difference in the health impacts of social contacts. For instance, Orth- Gomer [27] reported that women seem to be more protected from cardiovascular conditions than men while others [28] found that social contacts seem to be less beneficial to women and may even heighten psychological distress in the face of adverse life events. A plausible theoretical explanation for this gender difference in the impacts of social contact on cardiovascular health outcome could be synergistic interactions between the positive effects of social contacts and the impacts of female sex hormones, particularly among pre-menopausal women. It will therefore be important to find out if men or women use green space more for social contacts.

Gender differences in physical activity

Males appear to be generally more active than females even at younger age [37] and this gap gradually widens from middle age to old age [11]. Different forms of impediments may be responsible for gender differences in physical activity, which range from societal differences in gender roles, environmental barriers [51], cultural beliefs and changes in health status at different stages of life [11]. In other words, it can be argued that gender-based factors (socio-economic, cultural, neighbourhood or environmental, and probably power and resource control) may limit optimal use of green space for physical activities by women.

Gender Differences in Mental Restoration

There is no evidence of gender difference in the way the psychological and physiological mechanisms are triggered by green space. Therefore, a plausible explanation for any gender difference in mental restoration is that men may use natural environments more than women and this allows the restorative mechanism to be triggered more frequently in men. The question then arises whether gender-based disadvantages may be at play in preventing women from using green spaces as much as men. It is important to now examine evidence for gender differences in the use/access to green space, and then exploring the reasons for the differences.

Do men and women access or use green space differently?

There are a limited number of studies that have examined gender differences in the use and access to green spaces. The reason for this could be as a result of methodological approach in studying leisure sciences and arguably, a subtle or inadvertent gender discrimination. However, the available literature suggests that women are often under-represented, both in organised and unorganised events [37,51- 54] and they are more likely to differ in terms of activities and/or the extent of such activities undertaken in recreational spaces [37,52]. There are a number of factors or considerations that may have been responsible for these gender differences and these are examined below.

Why do men and women access green space differently?

Women, even in contemporary society are more likely to undertake household chores and consequently, they have relatively limited leisure time compared to men [11]. Women spend considerable time within the neighbourhood and are more involved in care and supervision of children, engaging in household chores and working part time [55]. Consequently, they are under-represented in their use of green spaces, compared to their population [36,54].

Furthermore, women's activities in recreational spaces are influenced by traditional gender and family roles [52], thus preventing varied and optimal use of greenery and other recreational facilities. In addition, evidence also suggests that socialisation processes (and gender role) also seem to strongly modulate the use of park and recreational spaces with women being at disadvantage [52].

Fear and safety, being one of the causes of women's under-representation in green spaces, is critical. People, especially women, wards and minority racial groups are more likely to conceive parks as frightening and unsafe, and thus limiting their benefits from recreation and leisure [48,53,54]. Fear has been consistently found to be a significant factor guarding the use of parks with its intensity and cause varying with social straits of gender, race and age, and also responsible for differences in spatial behaviour in park use [52,53].

There is a suggestion in the literature that the quality of available green space may be more important to women than men [45] and this may influence their frequency of use or visit to green space. The quality and quantity of green space has been found to influence its use by people [56]. This implies the quality and quantity of green space is a potential driver of differential use of green space by gender.

CONCLUSION

- Overall, there has been gradual increase in the volume of available evidence suggesting the beneficial effects of exposure to green space on health. The evidence is substantial, though there are a few inconsistent findings, which appear to stem from differences in study designs, sample size, green space measure, and limited control of confounders. Moreover, national and environmental variations probably due to differences in perceptions and preferences may also account for some of these inconsistencies. There are also potential concerns for the association not being necessarily causal, as it is possible that the issue of "reverse causality" and "temporality" have affected the results, given the preponderance of cross-sectional studies.
- Many of the studies were conducted in the Netherlands, which might have under-estimated the positive effects of green space because of imprecise estimate of green spaces following the exclusion of small land areas of greenery; however, this weakness was addressed in a UK study by Richardson and Mitchell [45].
- The majority of the observational studies are cross-sectional designs without full control for potential confounders, particularly neighbourhood deprivation levels and to some extent socio-economic characteristics. Furthermore, there are numerous confounders that should be taken into account when investigating the relationships between green space and health as well gender disparities in the relationships.
- There is limited evidence of gender difference in use of green spaces; however, there is probably one study that unravels possible gender difference in the ways in which green spaces are used.
- Almost all the studies did not analyse or check for possible gender differences in the relationships between green space and health until recently when Richardson and Mitchell (45) did, which prompted this study.
- There are indications from the literature suggesting that fear and safety concern, relatively limited leisure time, gender role and socialisation process, and quality and quantity of green are potential factors affecting green space use by women.
- The literature also provides a strong mechanistic structure or approach towards investigating the reason(s) for the gender differences in the relationships between green spaces and health, given the identification of the theoretical mechanisms behind the relationships. Therefore, there is need for research to investigate gender differences in the frequency of use and what the space is used for (physical activity, social contact and restoration) as well as gender differences in the effectiveness of each mechanism for improving health.

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REFERENCES

1. Hanlon, P. & Carlisle, S. (2008). Do we face a third revolution in human history? If so how will public health respond? *Journal of Public Health*,; 30(**4**): 355-361.
2. Ward Thompson, C., Aspinall, P., Bell, S. (2010). Introduction In: Ward Thompson, C., Bell, S. and Aspinall, P., editors. Innovative Approaches to Researching Landscape and Health. Oxford: Routledge. 1- 6.
3. Grahn, P., Stigsdotter, U., A. (2003). Landscape planning and stress. Urban Forestry and Urban Greening.2: 1- 18.
4. Abraham, A., Sommerhalder, K., Abel T.(2010). Landscape and well-being: a scoping study of health promoting impact of out-door environments. *International Journal of Public Health*. 55:59-69.
5. Annerstedt, M., Wahrborg, P. (2011). Nature-assisted therapy: systematic review of controlled and observational studies. *Scandinavian Journal of Public Health*. 39: 371 – 381.
6. Bowler, D. E., Buyung- Ali, L. M. Knight, T. M, Pullin, A.S. (2010). A systematic review of evidence for the added benefits to health of exposure to natural environments. BMC Public Health, 10: 456.
7. de Vries, S., Verheij, R., Groenewegen, P. & Spreeuwenberg, P.(2003). "Nature environment - healthy environments? An exploratory analysis of the relation between nature and health". *Environment and Planning A*. 35 (**10**): 1717-1731.
8. Health Council of the Netherlands and Dutch Advisory Council for Research on Spatial Planning, Nature and the Environment. Nature and Health: the influence of nature on social, psychological and physical wellbeing. (2004). The Hague, Health Council of the Netherlands (GR) and RMNO.
9. Lee, A.C.K., Maheswaran, R. (2010)..The health benefits of urban green spaces: a review of the evidence. *Journal of Public Health* ; p 1-11 doi: 10.1093/pubmed/fdq068
10. Maas, J., Verheij, R. A., Spreeuwenberg, P. Schellevis, F.G., Groenewegen, P.P. (2009). Morbidity is related to green living environment. *Journal of Epidemiology and Community Health*.63: 967-973.
11. Mitchell, R. & Popham, F. (2007). Green space, urbanity and health: relationships in England. *Journal of Epidemiology and Community Health*. 61(**8**): 681-683.
12. Stigsdotter, U.K., Ekholm, O., Schipperijn, J.,Toftager, M., *et al*. (2010). Health promoting outdoor environments-Associations between green space, and health, health-related quality of life and stress based on a Danish national representative survey. *Scandinavian Journal of Public Health*. 38: 411 – 417
13. Sugiyama, T., Leslie, E, Giles Corti, B. Owen, N. (2008). Associations of neighbourhood greenness and with physical and mental health; do walking, social coherence and local social interaction explain the relationship? *Journal of Epidemiology and Community Health*. 62 (**5**): e9.
14. Takano, T. Nakamura, K. and Watanabe, M. (2002). Urban residential environments and senior citizens' longevity in megacity areas; the importance of walkable green spaces. *Journal of Epidemiology and Community Health.;* 56: 913-918
15. Van den Berg, E. A., Maas, J., Verheij, R. A., Groenewegen, P. (2010). Green space as a buffer between stressful life events and death. *Social Science and Medicine.*; 70: 1203 -1210.
16. Richardson, E., Pearce, J., Mitchell, R., Day, P., Kingham, S.(2010). The association between green space and cause-specific mortality in urban New Zealand: an ecological analysis of green space utility. BMC Public Health,; 10 (240): 1 - 14.
17. Witten, K., Hiscock, R., Pearce J., Blakely, T. (2008). Neighbourhood access to open space and the physical activity of residents: a national study. *Preventive Medicine.*; 48: 299-303.
18. Hartig, T., Mang, M. Evans, G.W. (1991). Restorative effects of natural environment experiences. *Environment and Behaviour*.; 23: 3 -27.
19. Park, B.J., Tsunetsugu, Y., Kasetani, T., Kagawa, T., Miyazaki, Y. (2010). The Physiological effects of Shinrin-yoku (taking in the atmosphere of the forest or forest bathing); evidence from field experiments in 24 forests across Japan. *Environmental Health and Preventive Medicine.*; 15; 18 -26.
20. Pretty, J., Peacock, J., Sellens, M., & Griffin, M. (2005). The mental and physical outcomes of green exercise. *International Journal of Environmental Health Research*.; 15(**5**): 319 – 337.
21. Read, J. G., Gorman, B. K. (2010). Gender and health inequalities. Annual Review of Sociology.; 36;:371 – 386.
22. Tsunetsugu, Y., Park, B.J., Ishii, H., Hirano, H., Kagawa, T., Miyazaki, Y. (2007). Physiological effects of Shirin-yoku (taking in the atmosphere of the forests in an old-growth broadleaf forest in Yamagata Prefecture, Japan. *Journal of Physiological Anthropology*.; 26 (2): 135 – 142.
23. Ulrich, R., S. (1984).View through a window may influence recovery from surgery. Science. 224: 420- 421.
24. Ulrich, R., S. Simons, R. Losito, B., D., Fiorito, E., Miles, M., A., Zelson, M.(1991). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology*. 1991; 11: 201 – 230.
25. Bradford-Hill, A. (1965). The environment and disease: "association or causation"? *Proceedings of the Royal Society of Medicine.* 58: 295 – 300.
26. Marmot, M. (2005). Social determinants of health inequalities. Lancet; 365: 1099 – 1104
27. de Vries, S. (2010). Nearby nature and human health: looking at mechanisms and their implications. In: Ward Thompson, C., Bell, S. Aspinall, P., editors. Innovative Approaches to *Researching Landscape and Health*. Oxford: Routledge. 77-96.
28. Orth-Gomer, K. (2009). Are social relations less health protective in women than in men? Social relations, gender and cardiovascular health. *Journal of Social and Personal Relationships*.; 26(**1**): 63-71.
29. Ziersch, A., Baum, F., Darmawan, I.G.N., Kavanagh. A. M., Bentley, R.J. (2009). Social capital and health in rural and urban communities in South Australia. *Australian and New Zealand Journal of Public Health*. 37: 7 - 16.

30. Kamarck, W., Peterman, A.H., Raynor, D.A. (1998). The effects of the social environment on stress-related cardiovascular activation: current findings, prospects and implication. Annals of Behavioural Medicine ; 20 (4): 247 – 256.
31. Heponiemi,T., Elovainio, M., Kivimaki, M., Pulkki, L., *et al*.(2006). The longitudinal effects of social support and hostility on depressive tendencies. *Social Science and Medicine*. 63: 1374 -1382.
32. Cattell, V., Dines, N., Gesler, W., Curtis, S. (2008). Mingling , observing and lingering: everyday public spaces and their implications for well-being and social relations. Health and Place. 14 (3): 544- 561.
33. Kuo, F.E., Sullivan W.C. & Wiley, A. (1998). Fertile ground for community: inner city neighbourhood common spaces. *American Journal of Community Psychology*.; 26: 823-851.
34. Volker, B., Flap, H.D., Lindenberg, S. (2007). When are neighbourhoods communities? Community in Dutch neighbourhoods. European Sociological Review.; 23(1): 99 -114.
35. Coley, R.L., Kuo, F.E. & Sullivan, W.C. (1997). Where does community grow? The social context created by nature in urban public housing. Environment and Behaviour.; 29(4): 468 - 494.
36. Maas, J., Van Dillen, S., Verheij, R. & Groenewegen, P. . (2009). Social contact as a mechanism behind green space and health. Health and Place; 15: 586 - 592.
37. World Health Organisation. Global recommendation on physical activity for health. (2010). WHO, Switzerland. Downloaded on 22nd June, 2011 @ http://whqlibdoc. who. int/publications/2010/9789241599979_eng.pdf
38. Cohen, D.A., Mckenzie, T.L., Seghal, A., Williamson, S. *et al*. (2007). Contribution of public parks to physical activity. American Journal of Public Health. 97(3): 509 - 514.
39. Maas, J., Verheij, R. A., Spreeuwenberg, P. Groenewegen, P.P. (2008). Physical activity as a possible mechanism between green space and health: a multilevel analysis. BMC Public Health; 8: 206,
40. Korpela, K.M., Ylen, M., Tyrvainen, L. Silvennoinen, H. (2010).Favorite green, waterside and urban environments, restorative experiences and perceived health in Finland. Health Promotion International ; 25(2): 200-209.
41. Kaplan, R. & Kaplan, S. (1989). The experience of nature; a psychological perspective, Cambridge . Cambridge University Press.
42. Sternberg, E. M. Healing Spaces (The Science of Place and Well-being) (2009).. The Belknap Press of Havard University, Cambridge, Massachusetts, London, England.
43. Curtis, S. (2010). 'Virtuous Landscapes'; Therapeutic Material Settings. In Allison, W. and Elliott, S., editors. Space, Place and Mental Health (Geographies of Health) Surrey, England; Ashgate.; 35 – 63
44. Annandale, E., Hunt, K. (2000). Gender inequalities in health: research at the crossroads. In Annandale, E. and Hunt, K., editors. Gender Inequalities in Health. Open University Press; Buckingham.; 1- 35.
45. World Health Organisation, Geneva, Switzerland. Gender. 2011. Available @ http://www.who.int/ topics/gender/en/
46. Richardson, E. A & Mitchell, R. (2010). Gender differences in relationships between urban green space and health in United Kingdom. Social Science and Medicine.; 71: 568 - 575.
47. Wake, R., Yoshiyama, M. 2009; Gender differences in Ischaemic Heart Diseases. Recent Patents on Cardiovascular Drug Discovery. 4; 234- 240.
48. Texas Heart Institute (at St. Luke's Episcopal Hospital). Heart diseases risk factors. Accessed online @ http://www.texasheartinstitute.org/hic/topics/hsmart/riskfact.cfm
49. Read, J. G., Gorman, B. K. (2010). Gender and health inequalities. Annual Review of Sociology.; 36:371 – 386.
50. World Health Organisation, Geneva, Switzerland. Women and Health: today's evidence, tomorrow's agenda. (2009). http://whqlibdoc.who.int/ publications/2009/ 9789241563857_ eng.pdf
51. Freedman, D. A. (1999). Ecological inference and the ecological fallacy. International Encyclopaedia of Social and Behavioural Sciences Technical Report No. 549:1-7.
52. Hoyles, M. Future of urban parks and open spaces: Lost connections and new directions. The private garden and the public park. Working Paper No 6.
53. Hutchison, R. (1994). Women and the elderly in Chicago's public parks. *Leisure Sciences* ; 16 (**4**): 229 - 247.
54. Madge, C. (1997). Public parks and geography of fear. Tijdschrift voor Economische en Sociale Geografie. 88(**3**): 237-250.
55. Ward Thompson, C., Aspinall, P., Bell, S., Findlay, C. (2002). Open space and social inclusion: local woodland use in central Scotland. Research Information Note. Open space: the Research Centre for Inclusive Access to Outdoor Environments In association with Landscape Architecture, Edinburgh College of Art and the School of Built Environment, Heriot-Watt University, United Kingdom.
56. Kavanagh, A. M., Bentley, R., Turrell, G., Broom, D.H. & Subramaniam, S.V. (2006). Does gender modify association between self-rated health and the social and economic characteristics of local environments? *Journal of Epidemiology and Community Health*. 60: 490-495
57. Mitchell, R., Astell-Burt., T., Richardson, E. A. (2011). A comparison of green space indicators for epidemiological research. *Journal of Epidemiology and Community Health*, doi 10.1136/jech.2010.119172