

Environment and Human Health

Urban green space, mortality and morbidity

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This research is part of the Scottish Government's GreenHealth project. It asks if there is a link between green space and population health in Scotland. Overall, it finds evidence that access to, and use of, green space is favourably associated with risk of mortality and risk of poor mental health for some people, but relationships between green space and health are weaker in Scotland than England and Wales.

Main Findings

- Relationships between the amount of green space in a neighbourhood and risk of mortality for the resident population as a whole are largely weak or absent in Scotland; however, more green space in the neighbourhood is associated with a lower risk of mortality among Scotland's poorest men.
- In contrast to England and Wales, socio-economic health inequalities are not significantly narrower in Scotland's greenest urban areas.
- Scots who use green spaces for physical activity have a much lower risk of poor mental health than those who use non-natural environments such as the gym or streets.
- Green space is not associated with a reduced risk of obesity, or with markers of poor cardiovascular or respiratory health, in Scotland.

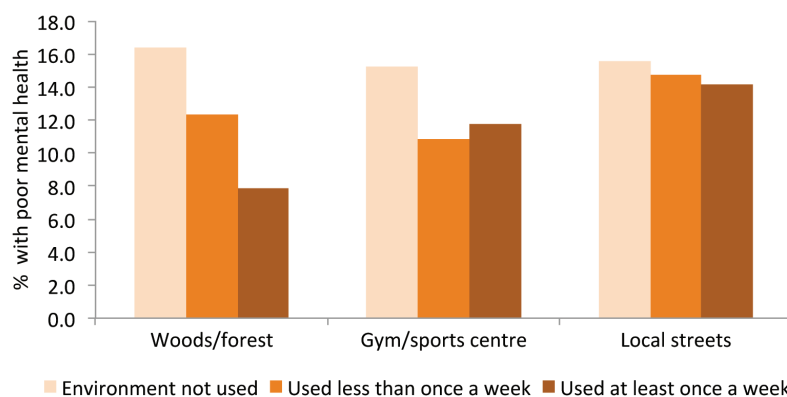


Figure 1: Relationship between where people are physically active, and their mental health

Background

Studies from around the world have found a link between how much green space a neighbourhood has and the health of the resident population. We expect to find this link because evidence from experimental studies in the laboratory and field suggests that being in natural environments may reduce stress, enable recovery from fatigue, lower blood pressure and promote healing. Green spaces may also encourage physical activity, and social contact. However, not all studies found a link between green space and health; the relationship varied by country, gender, socio-economic position and, importantly, by the measure of health used. The reasons for this variation are not yet clear.

There has been very little work looking at the relationships between green space and health in Scotland specifically. This research asked three key questions: (1) is there a link between green space and population health in Scotland? (2) is the strength of any link different to that in England and Wales? (3) does the amount of green space in the neighbourhood or use of green space matter more for health?

The research used several different definitions of health and looked at how the answers to the research questions varied by age, gender and level of affluence.

Research undertaken

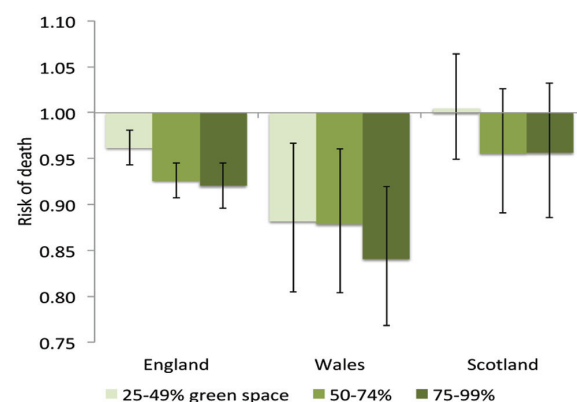
This research used pre-existing data. Analyses of mortality risk used death records made available to us by the Office for National Statistics and General Register Office For Scotland under special license. We matched them to data describing amount of green space in the deceased's neighbourhood, where the definition of green space included parks, forests and areas of open grass, but excluded domestic gardens. We defined neighbourhood using Census Area Statistics Wards, an administrative unit used in reporting of the decennial census. We allowed for other factors which might explain the association between green space and mortality, including age and sex, affluence (because wealthier people are both more likely to live in greener areas and to be healthier), and air pollution (because greener areas tend also to have less air pollution).

We checked that our results were not particular to the data used and definitions of green space or mortality. We repeated analyses for Scotland, using mortality data at datazone level and an alternative measure of green space from the European Environment Agency. We also checked whether excluding Glasgow (known to have particularly poor population health) affected the results. None of these checks produced different results.

Relationships between green space in the neighbourhood, use of green spaces for physical activity, and morbidity were explored using the 2008 Scottish Health Survey (SHS). Green space data were joined to the SHS survey data under special licence, so that we knew the amount of green space in each SHS respondent's neighbourhood. The SHS also asked respondents about where they undertook physical activity. Our analyses were able to allow for how much exercise people got overall, other environments they used, their levels of income, age, sex, employment status and, when appropriate, their smoking status. We checked for differences in our results by age, sex and income level.

Mortality

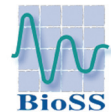
Figure 2 shows the relationship between the amount of green space in urban neighbourhoods and the risk of mortality for working age men. The risk is shown relative to urban areas with the least amount of green space, and the further a bar extends below the horizontal axis, the lower the risk in that type of area.



Black lines (I) are 95% confidence intervals

Figure 2: Risk of mortality by amount of green space in the area (urban areas and working age men only)

The risk of death excludes that from external causes such as traffic accidents or suicide. The graph shows that in England and Wales,



the risk of mortality falls as the amount of green space in an urban neighbourhood increases. This relationship is not found in Scotland.

These relationships were also explored separately for men and women, for older, working and younger age people, for more and less urban areas, for richer and poorer groups, for deaths from cardiovascular and respiratory disease and for different definitions of green space and neighbourhood. In Scotland, we only found a significant, protective relationship between mortality and green space for working age men living in the poorest two income-deprivation quartiles. Among these working-age men, those resident in the greenest urban areas were about 16% less likely to die than those resident in the least green urban areas. The absence of effects for women echoes findings in England and Wales, and is likely linked to gender differences in the frequency and type of green space use. Women are known to use green spaces less often than men.

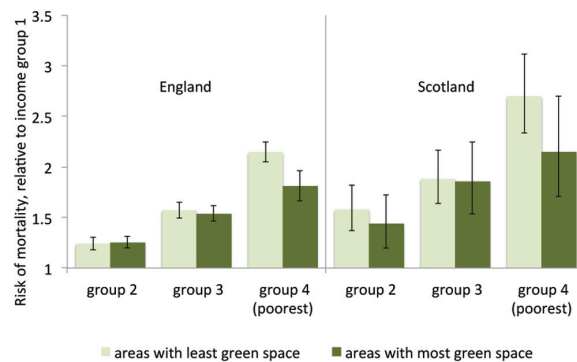
We explored many possible explanations for why some relationships between green space and health appear different in Scotland but were not able to explain it. We could not allow for differences in the quality or types of urban green space within Scotland, and between England, Wales and Scotland, and it is possible that this is partly responsible. More likely however, the Scottish population has a higher level of underlying poor health and risky behaviours such as smoking and drinking. The impact of green space on risk of mortality is, even in England, relatively weak. Any benefits of green space in urban Scotland may be swamped by other things that damage health.

Inequalities

A study in England suggested that socio-economic health inequalities might be narrower among those living in greener urban areas, perhaps because green space in such areas is a freely and readily available resource for protecting health. We looked for the same kind of relationship in Scotland.

We compared the socio-economic health 'gap' between the least and most green urban areas. We measured the gap between 5 income-related groups. Figure 3 shows the risk of mortality in income groups 2-4, compared with the wealthiest group, 1.

As income-deprivation increases, the relative risk of mortality rises (the bars on the graph get taller). However, the rise is less steep in the areas with most green space. In the most green urban areas in England, the gap in risk of mortality between the most and least deprived is significantly smaller than in the least green areas. This is also true in Wales, though these results are not shown in figure 3. Whilst the pattern is similar in Scotland, reduction in the health gap in the greenest areas is not statistically significant.



Black lines (I) are 95% confidence intervals

Figure 3: Socio-economic inequalities, by amount of green space (urban areas, working age men only)

For the Scottish population only, we were able to explore relationships between how much green space an individual has in their neighbourhood, their use of green spaces for any kind of physical activity (such as going for a walk), and their socio-economic position. Figure 4 shows that use of green space for physical activity is not strongly related to how much green space there is in the neighbourhood, and that for those on lower incomes more green space in the neighbourhood is not associated with greater use for physical activity. This may explain why Scottish socio-economic inequalities in health do not seem narrower in greener areas.

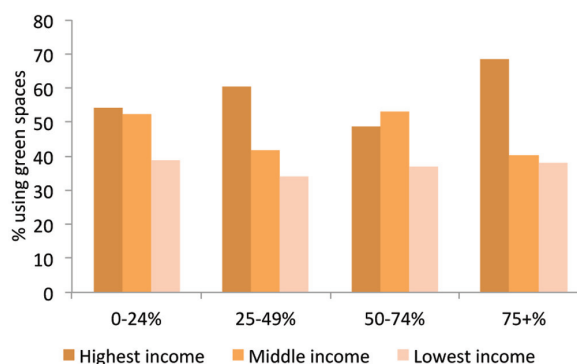


Figure 4: Use of green space for physical activity, by amount of green space in the neighbourhood & income

Morbidity

We explored relationships between green space and mental health, wellbeing, two different measures of obesity, and markers of cardiovascular and respiratory health including blood pressure and c-reactive protein. This work was also able to consider both the amount of green space in a neighbourhood, and whether the individual used green space for physical activity.

We found that regular physical activity in green environments appeared far more protective of mental health than that in other places, like the gym or streets (figure 1, on the front page). Regular users of green space for physical activity had about half the risk of poor mental health among non-users. We also found that levels of c-reactive protein, (a marker of inflammation that predicts cardiovascular disease and for which lower levels are healthier), were lower in men who regularly visited green spaces than in those who did not. We found no other evidence that the amount of green space in the neighbourhood, or regularly visiting green spaces for physical activity brought health benefits that weren't also provided by physical activity in other non-green environments. We also found no evidence that socio-economic inequalities in these aspects of health were related to levels or use of green space.

Conclusions

Relationships between how much green space people have in their neighbourhood and their risk of mortality, are weak or absent in the Scottish population as a whole. This is different to England and Wales. There does, however, appear to be a protective relationship for Scotland's poorest men. There was some suggestion that Scottish socio-economic inequalities in health are narrower among populations with more green space in their neighbourhood, but this relationship was also weak and not statistically significant.

However, those who use their green space regularly are at much lower risk of poor mental health than those who do not, and men who are regular green space users may also have lower, and thus healthier, levels of c-reactive protein.

The protective relationship between regular use of green space and risk of poor mental health is an important finding. Although this kind of study cannot prove that green space *per se* protects

mental health, it does echo findings from small scale laboratory and field experiments, providing more confidence in our results.

Policy relevance

This work has implications for those involved in planning and managing green spaces, and for those involved in protecting and improving population health in Scotland.

- Simply increasing the amount of green space available in urban areas is unlikely to have impacts on population mortality rates or socio-economic health inequalities.
- Regular use of green space does appear to be good for mental health. Helping people to become and stay regular users could be a useful additional means of protecting and enhancing mental health.
- Those who use green spaces as children are far more likely to do so as adults. Schemes proven to be effective in introducing and encouraging children to use these spaces should be expanded. This may produce a lasting, multi-generational impact.
- Evaluations of local walking groups have found them to be effective at introducing adults to, and maintaining their use of, green spaces for physical activity. These should be promoted as a resource for mental as well as physical health.

For more information: Richardson, E.A. and Mitchell, R. (2010) Gender differences in relationships between urban green space and health in the United Kingdom. *Social Science and Medicine*, Volume 71(3):568–575.

Mitchell R. (2012) Is physical activity in natural environments better for mental health than physical activity in other environments? *Social Science & Medicine*, Volume 91, 130–134

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