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Protocol for a quasi-experimental study: How effective is the Forestry Commission Scotland's woodland improvement programme — 'Woods In and Around Towns' (WIAT) — at improving psychological wellbeing in deprived urban communities?

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ABSTRACT

Introduction: There is a growing body of evidence that suggests greenspaces may positively influence psychological wellbeing. This project is designed to take advantage of a natural experiment where planned physical and social interventions to enhance access to natural environments in deprived communities provide an opportunity to prospectively assess impacts on perceived stress and mental wellbeing.

Study design and Methods: A controlled, prospective study comprising a repeat cross-sectional survey of residents living within 1.5km of intervention and comparison sites. Three waves of data will be collected: pre-physical environment intervention (2013); post-physical environment intervention (2014) and post-woodland promotion social intervention (2015). The primary outcome will be a measure of perceived stress (Perceived Stress Scale – PSS) pre- and post-intervention. Secondary, self-report outcomes include: mental wellbeing (SWEMWBS), changes in physical activity (IPAQ-short form), health (EuroQoL EQ-5D), perception and use of the woodlands, connectedness to nature (Inclusion of Nature in Self Scale), social cohesion and social capital. An environmental audit will complement the study by evaluating the physical changes in the environment over time and recording any other contextual changes over time. A process evaluation will assess the implementation of the programme. A health economics analysis will assess the cost consequences of each stage of the intervention in relation to the primary and secondary outcomes of the study.

Ethics and dissemination: Ethical approval has been given by the University of Edinburgh, Edinburgh College of Art Research, Ethics and Knowledge Exchange Committee (ref. 19/06/2012). Findings will be disseminated through peer-reviewed publications, national and international conferences and, at the final stage of the project, through a workshop for those interested in implementing environmental interventions.

ARTICLE SUMMARY

Article focus

- This article describes the study protocol for the evaluation of Forestry Commission Scotland's woodland improvement programme — 'Woods In and Around Towns' (WIAT) to assess how it can improve psychological wellbeing in deprived communities.

Key messages

- The primary aim of this study is to understand the impacts on perceived stress and mental wellbeing of physical and social forestry interventions in woodlands adjacent to deprived urban populations.
- Differential impacts on baseline psychological health status by gender and other demographic/individual characteristics will be investigated and the research will assess changes in access to, and use of, forests, green spaces and other environmental resources created and improved by the WIAT process.

Strengths and limitations of this study

- The study is sufficiently powered to detect an effect of the WIAT programme at each post-intervention wave, and the cost consequences of each stage of the intervention will be assessed.

INTRODUCTION

The high prevalence of poor mental health is a major public health problem in the economically developed world. It is estimated that 27% of the EU adult population experienced at least one mental disorder in the past year.[1] The annual economic cost of poor mental health in Scotland, where this project is based, has been estimated at £10.7billion (2009/10).[2] Improving mental health and wellbeing is therefore a public health priority but there is uncertainty about how to achieve it at the population level. Environmental influences on health are of particular interest because of their potential to affect large numbers of people.[3] Epidemiological investigation and public health policy have long seen environment primarily in terms of threats to human health but there is now growing interest in its salutogenic attributes, i.e. those with the potential to maintain and/or improve health.[4] There is good evidence from both individual and population level studies that contact with natural environments, such as parks and woodlands, is salutogenic.[5-7]

How do natural environments affect health? Three mechanisms have been proposed.[8] First, they may be conducive to physical activity.[9] Second, they may foster and support social contact and improve psychological wellbeing.[10, 11] Third,

contact with natural environments may, *per se*, reduce stress, improve wellbeing and promote immune response.[12-14]

This direct effect of natural environments on mental health, known as 'psychological restoration', may operate via psychoneuroendocrine pathways and has been demonstrated in both laboratory and field experiments.[7, 13, 15] Empirical evidence for restoration is supported by well-developed theories about its origin, hypothesising it to be a psycho-evolutionary response to environments which have proved favourable for survival.[16-18] The balance of evidence on the three potential mechanisms currently supports restoration as the most likely explanation for health benefits of access to natural environments, although the mechanisms may be additive or supra-additive.[8] A recent systematic review examined 28 experimental studies, asking "how effective is direct accessing of natural environments in the promotion of health and wellbeing compared with other forms of 'exposure' to the natural environment or with accessing 'synthetic' environments?".[19] Meta analyses demonstrated significant beneficial effects on several dimensions of mental health, including measures of anger, fatigue and, most importantly, depression/sadness. The authors acknowledged the dominance of short-term studies, often using single exposures to natural environments, and noted there are few studies in which access to natural environments, or the environments themselves, have been experimentally altered, permitting investigations of causality.

How useful could these effects be for *population* health? Observational studies have found associations between access to natural environments and mortality rates for diseases in which stress, immune function and physical activity play a role in aetiology (see, for example,[20-23]). Studies in the UK show a typical reduction in the risk of mortality from cardio-respiratory disease of 5-10% in urban dwelling populations with good access to natural environments, compared to those with poor access.[24, 25] In Denmark, Stigsdotter et al. found reported levels of stress to be about 40% lower among those with good access to natural environments (< 300m distance) than those with poor access (> 1km distance).[26] A number of studies have shown greater use of green space when it is more proximate.[27-29] However, there is also evidence that, within certain distance parameters, quality may be more important than proximity.[30] The Stigsdotter et al. findings on stress levels closely match work in Scotland, showing a 50% difference in risk of high GHQ score for those not using woods/forests regularly for physical activity.[31] Furthermore, the impacts of access to natural environments appear particularly beneficial for deprived populations and this may also be one explanation for the evidence that socio-economic health inequalities are narrower among populations with greater access to natural environments.[24] It is important to note, however, that results from observational studies vary by individual characteristics; in particular, it appears that at a population level in England and Wales, effects may be greater for men than for women.[25]

The present study focuses on the evaluation of a woodland improvement programme run by the Forestry Commission Scotland (FCS). FCS' £8m/year Woods In and Around Town (WIAT) programme[32] works with deprived urban communities to regenerate, improve and then promote local woods as safe and accessible places to enjoy the outdoors. WIAT aims to increase local residents' contact with woodlands, thus lowering levels of stress and, in turn, improving mental health and wellbeing. So far, a small-scale, controlled pilot evaluation of WIAT showed beneficial impacts of the intervention on the mechanisms by which health and behavioural outcomes may be improved and which the current project will assess: the study revealed a positive impact on use patterns and perceptions of the woodlands, pre- and post-intervention.[33]

AIMS AND OBJECTIVES

The primary research question is:

1. What is the impact of the WIAT programme of interventions on perceived stress in the community?

Secondary research questions will be addressed in support of this objective:

2. Is any impact on mental health associated with a change in levels of engagement with the woodland environment (physical and/or visual) after WIAT intervention?

3. What is the impact of the intervention on length and frequency of visits to local woods, the experience of local woods, awareness of them (knowledge of their qualities and availability for use), activities undertaken there, self-reported physical activity levels, visual contact with woodland, the sense of connectedness to nature, and community cohesion and social connectedness?

4. Are changes to the physical woodland environment sufficient to have an impact on mental health and/or woodland awareness and use by the community or are organised activities such as led walks and other promotional initiatives also required?

5. Are there gender differences in the impacts of the interventions?

6. Are there differences in patterns of woodland use, and in impacts of the interventions, according to distance of woodlands from participants' homes, and is there any distance threshold for impacts?

7. What are the cost consequences of each stage of the intervention (including time input from FCS rangers and community participants) in relation to the primary and secondary outcomes of the study?

Figure 1 represents the broad conceptual model for the proposed study in context, illustrating how the different elements of the study fit together.

Figure 1 – Conceptual model of mental health impacts of the WIAT programme on deprived communities. (LLTI = long life term illness: SES = Socioeconomic Status)

DESIGN AND METHODS

Study setting

In partnership with FCS, six woodland sites were selected within the Scottish Lowlands Forest District with associated communities that meet current WIAT inclusion criteria and are in the worst 30% of socio-economic deprivation in Scotland as assessed using the Scottish Index of Multiple Deprivation (SIMD).[34] The woodland sites have a minimum size of 4ha and have not received investment or direct promotion within the last five years. Three intervention sites will receive the WIAT programme between mid- 2013 and early 2015, three comparison sites will not (although they are eligible to receive it once the study is complete). The intervention programme is in two stages: firstly, it will make changes to the physical woodland environment designed to facilitate greater use; secondly, it will undertake community social engagement activities to advertise and promote woodland use.

Each comparison site was paired with an intervention site matching on woodland and demographic characteristics. Criteria for matching comparison to intervention sites included demographic and socioeconomic factors, as well as housing type (see Table 1), at output area level.

Table 1. Variables used for matching comparison to intervention sites

Demographic	Neighbourhood housing type	Economic factors	Multiple Deprivation	Health
Age profile Mean Age Percentage of non-white residents	Proportion of: detached houses; semi-detached; terraced; flats/ tenements	Income (number of income deprived people)	SIMD (Scottish Index of Multiple Deprivation	SMR (Standardised Mortality Rate) Proportion of population being prescribed drugs for anxiety, depression or psychosis

Site choice was based on an extensive site analysis by the researchers and discussed in detail with Forestry Commission Scotland. The potential sites were visited by a group of researchers and members of the FCS (who are actively involved in running the WIAT programme). After the site visits, FCS confirmed

whether the sites were appropriate as intervention or comparison sites (eligible for future intervention), and land ownership and future plans for the woodlands were checked for each site. Some sites had to be excluded due to planning applications for development in that woodland. The final six sites were agreed in December 2012 and Forestry Commission Scotland then arranged for land owners' approval and management agreements to be drawn up for the intervention sites. FCS has subsequently initiated development of detailed intervention plans.

Study design

The study comprises four components: firstly, a repeat cross-sectional survey; secondly, an environmental audit to track perceptions of environmental quality and change in the woodlands; thirdly, a mixed-method process evaluation; fourthly, a cost-consequence analysis of the interventions.

a) *Repeat cross-sectional questionnaire survey* of individuals resident in communities who will receive an intervention, and in comparison communities, assessing health impacts and community-level change resulting from the same programme of interventions. Data will be collected in three waves:
   i. wave 1 (baseline pre-intervention, 2013);
   ii. wave 2 (follow-up, min. 3 months post physical environment intervention, 2014);
   iii. wave 3 (follow-up, min. 3 months post social intervention, 2015).

b) *Environmental audit*. This will evaluate and track changes in the environment and the social context as perceived by communities. First, a record of perceptions of the baseline condition (in winter and summer conditions) of all woodland sites – 'environmental audits' - will be undertaken by trained field surveyors as well as with a cohort of participants from each study community, using well-tested methods.[35, 36] This will be repeated twice in each year of the study (summer and winter), to track perceived quality of the environment after the first and second stages of intervention. The process ensures that perceptions of any unintended consequences of the intervention are recorded, as well as any unanticipated change in comparison sites.

c) *Process evaluation of the intervention*. This will be used to assess the implementation of the different intervention elements and approaches.
   i. A record of the planning and implementation of the WIAT programme in each community (including any monitoring data collected by FCS) will be kept and reviewed annually. This will include assessment of the content, reach and effectiveness of social interventions.
   ii. Two sets of focus groups towards the end of the study, at points 6 and 12 months after the completion of the interventions, will capture perceptions of the effectiveness of interventions, both by those

undertaking them (e.g. forestry professionals) and by the communities targeted, including identification of factors that heighten or diminish any impact.

d) *Cost consequence analysis of the intervention.* This will be used to assess whether the intervention represents good value for money.

i. Time and physical resources required to implement the physical intervention will be recorded and costed.

ii. Time and resources required to deliver the programme of social interventions will be recorded and costed.

iii. Costs for each stage of the interventions will be compared to the primary and secondary study outcomes using a balance sheet approach.

Participants

Inclusion and exclusion criteria

Participants will be eligible for the study if they are adults, defined as aged 16 and over, reside in the intervention or comparison communities, and live within 1.5km of a WIAT- eligible woodland site.

Sample size

Quantitative study

The literature suggests there are likely to be gender differences in the observed effects at a population level.[25] In order to answer the primary research question, the required sample size needs to be large enough to (i) detect an effect of the WIAT programme in the intervention group compared to the comparison group at each post-intervention wave; and (ii) to detect a gender difference in that effect. Based on data from Stigsdotter et al,[26] to detect a male/female difference in means of 1.2 in perceived stress scale in each group (intervention and comparison), with a common standard deviation of 6.2 based on a two-sided, two-sample test with a 5% level of significance and 80% power, requires a minimum of 420 males and 420 females in each wave of the study. Therefore, a total sample size of 1680 comprising 840 intervention and 840 comparison participants is required, with an equal split of male and female participants in each of the comparison and intervention groups. The study is not powered for further sub-group analysis. However, since it is not possible to completely rule out a clustering effect, and data are not available to calculate precisely the design effect due to clustering within sites, the sample size was increased by 25% beyond that based on the above power calculations, to take

account of this. Thus the total sample size at each wave of survey will be 2,100 (1,050 per intervention or comparison group).

Environmental audit

The sample size for the environmental audit is based on previous experience achieved during the pilot WIAT study, where the environmental audit tool achieved high levels of inter-rater reliability.[36] It has subsequently been tested for sensitivity and reliability in research on green space in English deprived urban areas.[35] Consistency and reliability are ensured by employing a number of auditors — qualified environmental designers (minimum two) — and local residents, with a minimum of five participants. An initial cohort of 10 participants for each community will be recruited (to allow for up to 50% drop-out) with the aim of reflecting the diversity of the study population. The total sample size will be a minimum of 30 participants (five per site) for each wave of environmental audit.

Process evaluation

For the community focus groups, 18 members of each local community that was subject to an intervention will be recruited to participate at points 6 months and 12 months after completion of all interventions. Three focus groups of about 6 people each will be held with each community and each time point, aiming for a balance of male and female participants from a range of age groups and life stages.

Focus groups with FCS staff members will have approximately 6 participants for each group at each time point, associated with each intervention site.

Recruitment

Quantitative study - repeat cross-sectional survey

Using face-to-face surveys is the gold-standard when conducting community surveys and helps maximise response rates. Other methods, such as telephone and postal surveys, have shown declining response rates in recent years, especially in disadvantaged areas,[37] making the proposed approach the most effective method of enrolment. An achievable response rate of 70% was assumed, based on the pilot study, and a quadruple call back will be required for all addresses from which there is no response before surveyors move to the next randomly assigned address.

Participants from each of the study communities will be selected from a distance stratified random sample of household addresses within 1.5km of each woodland site. The sampling frame will be Address Point, a directory of all deliverable addresses in the UK, and which can distinguish between business and domestic users. Business addresses will be excluded from the sampling frame. Each domestic deliverable address has a grid reference and this will be used to stratify the sample by distance from the local woodland. Stratification by distance is considered to be

necessary because previous research suggests that the use of woodlands for populations living nearby may decline with distance[29] but also that the quality of the natural environment may moderate the effect of distance,[30] and the WIAT intervention is aimed at improving woodland quality. The sample will be stratified into five units ranging from <150m up to 1.5km, to ensure adequate sample numbers across the range of distances.

Environmental audit

Community participants for the environmental audit will be recruited through the baseline survey, using a check-box to indicate if they would be prepared to take part in a further, in-depth, longitudinal study. If necessary, further recruitment, using snowballing techniques, will take place through collaboration with local community groups and facilitators. Participants taking part in the first audit will be invited to take part in all subsequent environmental audits.

Process evaluation

Participants for the community focus groups will be invited through the contacts from the baseline survey and in collaboration with community groups and facilitators. FCS members and other staff who have been involved in implementing the WIAT projects will be invited to take part in the second set of focus groups.

Data collection and outcome measures

Quantitative data collection

A survey company with demonstrable experience of recruitment in communities similar to those of the study will be used to administer a 25-minute, face-to-face, computer-assisted interview (CAPI). A pilot study was conducted, in July 2012, within two communities that met the WIAT site criteria, to assess the appropriate length and comprehension of the questionnaire. Prior to the survey, introductory letters were posted to residents in the sample area informing them about the survey. Participants will be invited to give informed consent to complete the survey and all ethical and legal requirements regarding data protection will be explained and complied with. Fieldworkers employed by the survey company will be given full training on administering the questionnaire, and their recruitment, conduct and supervision will be required to comply fully with ISO 20252 standards. Interviews will be carried out by local fieldworkers, to help maximise recruitment.

Outcome measures

The primary outcome will be a measure of psychological wellbeing, assessed using the Perceived Stress Scale (PSS). PSS is a well validated measure of the degree to which situations in one's life are appraised as stressful by considering coping resources and feelings of control.[38] PSS has been used in studies relating to natural environments and stress, and is sensitive to change.[39] Stress reduction measured using PSS has been shown to be correlated with biological effects such as changes in brain structure.[40] PSS scores in the intervention communities will be compared with those in the comparison communities at each survey time point.

The following secondary outcomes will also be assessed:

a. Self-reported measures of visits to and experience of local woods, awareness (knowledge of their qualities and availability for use), activities undertaken there, visual contact with woodland, engagement and frequency of involvement in community woodland activities (e.g., led walks, community events, educational activities, conservation or woodland management work)[35, 36, 41-43]

b. Self-reported measures of visits to local green spaces[36]

c. Perceptions of neighbourhood environment[36]

d. Emotional connection to the natural world (connectedness with nature) will be measured using the Inclusion of Nature in Self Scale[44]

e. Perceived restorativeness of the woodland environment (using four items from the Perceived Restorativeness Scale measuring two core components of psychological restoration, 'being away' and 'fascination', i.e. the level of interest in the setting).[45]

f. Physical activity levels will be captured using the IPAQ-Short Form[46]

g. General self-reported health, quality of life and mental wellbeing will be captured using EuroQoL EQ-5D-3L,[47] and The Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS).[48]

h. Social cohesion and social capital will be assessed based on Poortinga's work on the role of social capital in building community resilience and health, using standard questions from the English Citizenship Survey.[49]

i. A range of socio-demographic variables will also be collected. Participants will be asked their gender, age, ethnicity, country of birth, working status, disability, annual income, financial strain, level of education, type of accommodation, accommodation satisfaction, presence or absence of a garden, dog ownership, access to a motor vehicle, home address and postcode.

Environmental audit data collection

Changes in the nature and quality of the woodland sites in summer and winter each year will be monitored using an environmental audit tool specifically developed by the researchers for this purpose.[50] This tool enables change in a site over time to be captured in a systematic manner, covering key aspects of perceptions of the woodland (user-friendliness, woodland character, spatial qualities, use, safety and neighbourhood environment). In addition, expert mapping of the sites twice a year will utilise a proprietary method to record 'path experience' - the dynamic experience of walking through the woodlands - and changes in the spatial experience over time.[51, 52]

Process evaluation data collection

Focus groups with members of the local communities and FCS staff will take place 6 and 12 months after the stage 2, social intervention. In both sets of focus groups the discussion will focus on the nature and perceived effectiveness of interventions. Participants will be encouraged to reflect on their knowledge and experience of any of the interventions. Participants from the local communities will also be asked to reflect more widely on elements of life related to the outdoor environment and wellbeing that have remained constant or changed throughout the duration of the study, and how any interventions impacted their (and their families') lives. FCS and partner staff members will be invited in their focus groups to reflect on the implementation process, best practice and lessons learnt.

Alongside the focus groups, monitoring and evaluation data will be collected after each of the stage 2 intervention activities (number of participants, gender, age group, involvement in previous activities and post code) by FCS or partner organisation staff involved in the delivery of activities.

Health economics data collection

In addition to health outcome data collected as part of the quantitative analysis described above, the health economic evaluation will also make use of resource data collected directly from FCS. An assessment of the costs of the WIAT programme will be developed using a top-down approach based on resources committed by the FCS to regenerate and open up access to woodland areas. For the physical intervention this activity will be contracted to third-party contractors, therefore the cost will equate to the contract value. In addition, costing will take into account the time commitment by members of the FCS team to support the physical intervention including administering the contracting process and monitoring compliance with the successful contractor. The FCS staff involved in the WIAT programme have agreed to regularly complete a form to estimate the time spent supporting the WIAT interventions for the duration of the study. This records percentage time commitment on a weekly basis

for different grades of staff. This time commitment will then be costed at an agreed unit rate that covers staff salaries and overheads to provide a cost for the FCS support of both the physical and social interventions in the programme.

Data analysis plan

Quantitative study

Questionnaire data will be cleaned using range, consistency and logic checks. Analysis will first address the primary outcome: *what is the impact of the WIAT programme of interventions on psychological health?* The analyses for this part of the project will centre on regression models, testing for a differential impact associated with living in an intervention area (relative to a comparison area). The effect of the WIAT programme will be determined by the magnitude of the interaction between living in an intervention area and the wave of the survey, and will be assessed by comparisons of waves 1 and 2, waves 1 and 3, and waves 2 and 3. Analyses will adjust for key confounding variables (age, sex, SES, ethnicity, education level, employment status, financial strain, limiting illness and life events). The individuals sampled will be clustered within six sites (three intervention, three comparison). With only six sites it will not be possible to use multilevel modelling (random effects) to adjust for differences between sites. A fixed-effects approach will not work either since this would prohibit the inclusion of the intervention; for this reason the sites have been matched as closely as possible. If there are suitable clusters within sites (e.g., based on area of residence such as output area) then clustering will be taken into account using multilevel modelling.

Analysis will also address the secondary outcome measures using a similar approach but with each outcome of interest forming the dependent variable of an appropriate form of regression across different waves of survey.

Environmental audit

The woodland environmental quality audits provide an independent measure, over time, of consistency or change in the physical environment, both from the perspective of the longitudinal cohort of community participants and from the perspective of trained expert surveyors. These measures provide a record of environmental quality that can be compared with community perceptions captured through the questionnaire survey and with FCS site staff records of work carried out. They allow comparisons of perceptions with records of environmental state and interventions to that physical environment, and assist in understanding the impact of the interventions.

Qualitative data from process evaluation

Anonymised transcripts of community and FCS staff focus groups will be analysed using NVivo and a Grounded Theory approach,[53] starting with open coding to establish emerging themes and categories, connecting, analysing and revisiting them in an iterative process to identify key concepts and their interaction in order to generate theory. Alongside these data, FCS monitoring and evaluation data collected from community members who participate in stage 2 interventions such as led walks, events, and educational activities will be drawn upon in order to assess their perceptions of the WIAT social and community engagement work.

Discordant voices will be accorded attention and contradictions as well as consistencies in findings will be sought by attempting to triangulate qualitative and quantitative survey data and to identify factors that appear to contribute to the success or otherwise of interventions. An in-depth understanding of the nature and experience of the WIAT interventions, the practicalities of their implementation and any unexpected positive or negative outcomes will be sought both from the perspective of the communities and from the FCS staff and partners planning, managing and implementing the interventions.

The theory building arising from all of the qualitative work, to explain how people experience and respond to the WIAT activities, will be used more generally to help answer questions raised by the questionnaire survey findings and any observed change in outcome measures. It will contribute to a better understanding of the mechanism of action behind any change in psychological wellbeing, health and quality of life that is found to be associated with the WIAT intervention.

Health economics analysis

The economic appraisal of the programme will proceed in two stages. Firstly, a cost consequence analysis will be presented based on the observed data, before attempting to provide a summary measure of overall health benefit.[54] The costs of the physical and social interventions will be related to the changes in the primary and secondary outcomes observed between the intervention and comparison areas and will be presented as a 'balance sheet' of costs and benefits.[54] Uncertainty in sampled outcomes will be presented using the appropriate statistical confidence intervals.

In the second part, the overall cost-consequence analysis from the first exercise will be extended to a more formal economic appraisal by estimating the likely quality adjusted life year (QALY) benefits that might be expected from the programme. This part of the analysis will involve extrapolation over time and as such will be subject to more than just sampling variability. This analysis will be supported by extensive sensitivity analysis to explore the importance of different extrapolation assumptions — for example, regarding the durability of effects, the likely requirements for upkeep

maintenance of access to woodlands, and possible health benefits of any increase in physical activity.

Ethics and dissemination

The study has been granted ethics approval by the University of Edinburgh, Edinburgh College of Art (eca) Research, Ethics and Knowledge Exchange Committee. The study has also been endorsed, at the highest level, within Forestry Commission Scotland.

Findings will be disseminated through peer-reviewed publications, national and international conferences and, at the final stage of the project, there will be a workshop for land managers or others interested in implementing environmental interventions to share findings, best practice and lessons learnt.

DISCUSSION

The proposed study is timely and highly policy relevant and. The recent Marmot Review of Health Inequalities[55] has the creation of healthy and sustainable places and communities as a key policy objective to improve health and reduce health inequalities, and Scotland's pioneering 'Good Places, Better Health', sets out a public health agenda for Scotland with a social-ecological model of health at its heart.[56]

The study as a whole is a controlled, programme level evaluation of the WIAT intervention. Having a single and effective facilitator in Forestry Commission Scotland means there is control over the sequence and timing of the intervention. However, it is important to recognise that there will be context-specific delivery of the programme as a result of the community consultation process. There will be a common palette of interventions, drawing on newly published guidance for such work [57] but there will be individual differences among WIAT sites in how they are delivered. This is why the research has a comparison site to match the intervention for each community. The study is underpinned by a clear theoretical model as to how effects will be generated by the intervention, and its design is firmly rooted in existing empirical evidence. The primary outcome measure has been shown to be associated with this type of intervention in individual level studies.[39]

Lastly, the findings will be important for a wide audience including researchers, policy makers, land owners and managers, planners and managers in public health, environmental studies, urban design, landscape architecture, forestry and natural resources, geography and economics. They will be of relevance to the NHS, local authorities, the private and public sectors and voluntary sector organisations.

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Contributors All authors contributed to the development of the study protocol. ESO drafted the manuscript and is the study coordinator; CWT is the principal investigator. CWT, RM and SC developed the overall research design with contributions from PA and JR; AB designed the health economics aspects of the study; AL developed the quantitative analytical framework. All authors provided critical feedback in developing the manuscript and approved the final version. The views and opinions expressed therein are those of the authors and do not necessarily reflect those of the NIHR PHR Programme or the Department of Health.

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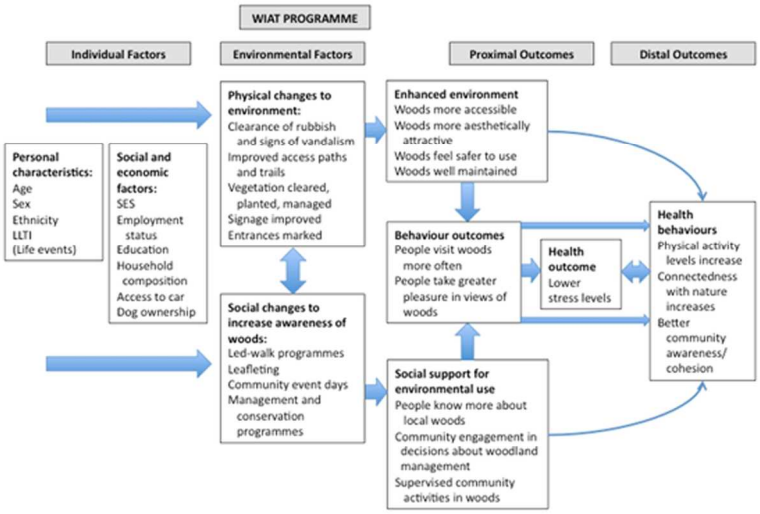
Figure Legends

Figure 1 – Conceptual model of mental health impacts of the WIAT programme on deprived communities. (LLTI = long life term illness: SES = Socioeconomic Status). 6



Conceptual model of mental health impacts of the WIAT programme on deprived communities. (LLTI = long life term illness: SES = Socioeconomic Status)
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