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Could “Holistic” Area-Based Regeneration Be Effective for Health Improvement?

Abstract

Regeneration is intended to tackle the negative effects of area disadvantage. Studies of health impacts of regeneration over thirty years have produced mixed and inconsistent results. This study translates the theory of wider determinants of health into a framework of five residential environments that may be impacted by regeneration: physical; services; economic; social; and psychosocial. It uses repeat cross-sectional survey data across a decade to assess differential change in physical and mental health for residents of regeneration areas compared with other areas. Across the deprived areas in the study, all five types of environment are associated with mental health, but associations are fewer and less consistent for physical health. The results indicate a small negative association between living in a regeneration area and physical health and a modest positive association with mental health. Suggestions are made for how regeneration might become more holistic and effective as a public health intervention.

Keywords: Area effects; regeneration; housing; mental health; physical health.

Introduction

For much of the latter part of the twentieth century, regeneration policy in the UK was characterised as 'property-led', involving either state-led housing renewal without the necessary additional environmental or amenity improvements, or private-sector-led property development, aided by state planning and subsidies (Turok, 1992). Property-led regeneration, particularly of the latter type in the 1980s and 1990s, is said to have been unclear about who would benefit or how, and to have offered little to disadvantaged communities (Imrie and Thomas, 1993). Moreover, property-led regeneration often ignores issues of human capital that also affect people's economic prospects, with a lack of education and training being highlighted (Turok, 1992), although to that we could add health as another limiting factor. However, regeneration policy in the UK over the past twenty years has exhibited a broader range of priorities, with health attracting increased policy attention, and is often described as a concerted effort to improve the quality of life of residents in deprived areas, and/or to narrow the gap between the deprived areas and other places.

Although often criticised, a specific version of property-led regeneration, namely housing refurbishment programmes, has been shown to have health impacts, more often in respect of general or physical health and less often on mental health, although notably, area-based schemes are said to be less effective than person-targeted programmes (Thomson *et al.*, 2001; Thomson *et al.*, 2013). As regeneration has become more wide-ranging in its scope, or 'holistic' (see below), most evaluations have been of the 'black box' variety, with no attempt to investigate the relative importance of different elements of the regeneration package. This study examines an area-regeneration programme over a period of a decade in order to assess whether, if indicators relevant to the different elements of regeneration are separately considered, there is indicative evidence that a holistic approach to regeneration, in theory or in practice, could be effective in having impacts upon physical and mental health. The paper describes the development of holistic regeneration in England & Wales, and

Scotland and reviews the available evidence for health impacts from regeneration in the UK. It then sets out how, if regeneration is attempting to improve a number of types of residential environment, it is likely to be acting upon many of the wider determinants of health (Dahlgren & Whitehead, 1991) and therefore expected to have health impacts. The paper then proceeds to describe the current study and reports its main findings before discussing their implications for our understanding of holistic regeneration and health.

Regeneration and Health

Holistic Regeneration Policy

A turn towards an avowedly more 'holistic' approach to regeneration policy has been prompted by three realisations: that urban problems are complex and interactive, requiring action on more than one front simultaneously (CLG, 2008); that past regeneration programmes have been overly focused on physical aspects without enough action on social and economic dimensions, producing temporary rather than long-lasting solutions (Fyfe, 2009); and that interventions in one area, if designed appropriately, can have interrelated impacts in other areas, with one of the examples being health gains from reduced unemployment (Taylor, 2008). This has led policy-makers to argue that regeneration should be more 'holistic', 'joined-up' and 'boundary-crossing' in nature, although this has been accompanied by claims that regeneration policy will therefore be less spatially focused (Campbell, 2011) or that a 'place-making' focus provides the means to achieve integration among the elements (Dodds, 2011).

Regeneration under New Labour (late 1997 to 2010) has been described as focusing upon the urban problem as a supply-side issue to be tackled through 'intervention on the neighbourhood level and on endogenous factors' (Hall & Hickman, 2002, p.695). Key characteristics of regeneration policy in this

period were said to include area-based interventions in deprived neighbourhoods on the inter-linked factors of housing, education, employment, crime and health. In addition, there were emphases on community capacity building and community involvement in the regeneration process itself, as well as an effort to make local services co-ordinated and responsive to local needs. New Labour's approach has been termed 'holistic' and 'joined-up', not only due to its breadth of action, but also in its recognition of the need to address structural causes of area disadvantage through linking local interventions with regional economic policy (Tallon, 2010). In the flagship programme of this period, the New Deal for Communities (NDC), action on health featured alongside other priorities: a third (32%) of NDC expenditure went on housing and the environment, with a tenth spent on health (11%), and other expenditures on community (18%), education (17%), worklessness (12%) and crime (10%) (Batty *et al.*, 2010). Thereafter, under the Coalition Government, neighbourhood regeneration programmes were discontinued in England, and the policy emphasis shifted to strategies for business and economic development in cities, counties and growth corridors. However, many of the plans devised by the Local Economic Partnerships (LEPs) maintained an intention to tackle worklessness in deprived neighbourhoods (Lupton & Fitzgerald, 2015).

A similar trajectory can be seen in regeneration policy in Scotland (where this study takes place), although the route taken has been different. The last nationally organised area-based regeneration programme in Scotland comprised Social Inclusion Partnerships (SIPs), which covered 48 areas across the country and ran from 1999 to 2004. SIPs included the aim of improving health outcomes, although this was not as well assessed an outcome as were housing improvements (Robertson, 2014), with a feature being that 'regeneration and housing actions were in close accord' (Adamson, 2010, p.27). However, another strength of SIPs was said to be their commitment to community engagement (ODS, 2006; MacPherson *et al.*, 2007). Regeneration policy changed in Scotland from 2006, as in England, with a stronger focus on economic development pursued through capital investment in land and

infrastructure via six Urban Regeneration Companies in particular places. This was very reminiscent of the Urban Development Corporations of the 1980s (Scottish Executive, 2006; Phillips, 2014;). The other area-based component of national regeneration policy consists of the Transformational Regeneration Areas programme in Glasgow (see below), which is partly funded by the Scottish Government and governed through a partnership organisation with Glasgow City Council. National policy also includes an emphasis on 'community-led regeneration' (Campbell, 2011), with the Scottish Government providing legal rights and funding for community organisations and community ownership of 'assets'.

The current regeneration strategy in Scotland professes to be 'holistic, making connections between the physical, social and economic dimensions'. Its overall purpose could be described as attempting to make people and places sustainable for the future with less need for recourse to high levels of state aid. The Scottish Government describes regeneration as being about 'reversing the economic, physical and social decline of places' (www.gov.scot/policies/regeneration) so as 'to help create a Scotland where all places are sustainable' and 'where people want to live, work and invest' (Scottish Government, 2011). The people element concerns 'ensuring equality of opportunity and support for the places and people that need it' (*ibid.*), with the Scottish Parliament asserting that regeneration is 'interlinked with issues such as economic development, health inequalities, social integration and educational development' (Scottish Parliament, 2014, p.11). The context or rationale for regeneration is that 'Too many of Scotland's people still live in communities suffering the effects of deprivation and disadvantage', with references made to low educational attainment, crime and fear of crime, and premature mortality (*ibid.*). For this reason, regeneration policy has an interest in 'health promoting environments', with 'good physical and mental health' featuring among the national regeneration outcomes, and an objective of 'tackling area-based disadvantage' (Scottish Government, 2011, p.10, p.13, and p.18). Its critics, however, described it as focusing on economic opportunity rather than

need, being ‘an overtly private property-led approach to regeneration’ and as marking ‘the withdrawal of area-based regeneration funding from poor neighbourhoods’ (Robertson, 2014, p.17 and p.23).

Thus, there are questions about whether recent regeneration policy has been as holistic as it claims. The term ‘holistic’ is now regularly used by policy-makers and practitioners, and might imply that area-based regeneration has a number of characteristics, in contrast to its previous guises, namely that it: tackles underlying structural causes of disadvantage as well as local factors; addresses the needs of all resident groups; is multi-faceted with programmes established to improve conditions across a range of domains; co-ordinates actions across those domains, giving attention to their relative scale, sequencing and potential combination in order that the effects of the sum are greater than the effects of the parts alone; and that the process of delivering regeneration, in particular through resident consultation and involvement, is important, i.e. how things are done matters as well as what things are done. It is clear that this is a shift beyond a predominant focus on property improvement, but it is not self-evident that all these qualities of being ‘holistic’ are achieved in regeneration programmes bearing that descriptor. In this paper, we focus on the effects of ‘holistic’ regeneration as a multi-faceted intervention which can address health, using a residential environments framework (see below).

Evidence of Health Impacts from Regeneration in the UK

Two reviews of the evidence about regeneration and health were conducted during the early 2000s. Reflecting the health sector’s growing interest in regeneration, Popay (2001) conducted a selected literature review on regeneration for the King’s Fund. She concluded that housing improvements, improved neighbourhood conditions and employment and welfare advice measures were potentially positive for health. On the other hand, regeneration could have negative effects on health due to

relocating residents, increased housing costs, and as a result of lack of control and uncertainty on the residents' part. Thomson *et al.* (2006) conducted a systematic review across a twenty-five-year period (1980-2004) that embraced nine UK area-based regeneration programmes. They found three studies relating to two programmes – New Life for Urban Scotland (NL) and Single Regeneration Budget (SRB) – that included an assessment of health outcomes. For the most part, the studies reported a deterioration in self-reported health for regeneration area residents (Rhodes *et al.*, 2002), and improvements in mortality rates (Brennan *et al.*, 2000; Cambridge Policy Consultants, 1999). The authors concluded that 'there was little evidence to demonstrate the impacts on socioeconomic or health outcomes' (p.114).

Since 2000, there have been five further studies of regeneration and health in the UK, including quasi-experimental and longitudinal designs. Each of these evaluated a different regeneration programme. In a Neighbourhood Renewal Area (NRA) programme in Newcastle, mental health (measured by five items of psychological distress) was found to have improved over a five-year period for those receiving housing improvements, with this tentatively attributed to improvements in safety and drafts in the buildings (Blackman *et al.*, 2001). An evaluation of a Housing Action Trust (HAT) in Liverpool studied those relocated from high-rise blocks to better quality low-rise housing over a two-year period. Compared with a control group who were not moved, the re-housed group experience no significant change in either physical or mental health measured using the SF-36 health-related quality of life scale (Critchley *et al.*, 2004). A Single Regeneration Budget (SRB) area in Manchester receiving changes in housing, education and training was compared with similarly deprived neighbouring areas by Huxley *et al.* (2004). Over a two-year period, there was no significant difference between the intervention and control areas in mental health change as measured by the GHQ-12 scale, a psychiatric morbidity screening instrument (Goldberg & Williams, 1988; Hankins, 2008). The Welsh Communities First (CF) regeneration programme, which funded a range of community-defined projects in the most deprived

wards in Wales, was evaluated for mental health impacts using the MHI-5 sub-scale of the SF-36. Compared with comparison areas, the intervention neighbourhoods were found to have experienced a small increase in mental health over a seven-year period (White *et al.*, 2017). Finally, the health impacts of the NDC multi-faceted regeneration programme were examined over a six-year period, revealing no difference in change over time between the intervention and control areas, for both self-rated general health or mental health, again using the MHI5 inventory (Walthery *et al.*, 2015).

The evidence relating to health impacts of regeneration is relatively sparse given the number, cost and extent of the programmes over the past thirty or more years and, moreover, the results are mixed and inconsistent. The most recent rapid review of the field concluded that the most likely type of regeneration to have small health impacts was housing refurbishment, with rehousing being less consistent in its health impacts, while the health consequences of tenure- and social-mixing were insufficiently studied (McCartney *et al.*, 2017). Other gaps can be identified, such as the paucity of studies examining impacts upon both physical and mental health using comparable measures. Most studies are short-term, with only two so far reporting outcomes over a period of more than five years; this is important since one study has noted that mental health improvement was greater the longer the duration of residence in the intervention area (White *et al.*, 2017). Lastly, only one study has considered whether health impacts vary according to the components of the programme, with none identifying which aspects of area change matter most for health. In order to examine the latter, we turn to considering a framework for doing so.

Residential Environments and Health

In their seminal paper on promoting health equity, Dahlgren & Whitehead (1991) presented their 'rainbow diagram' of the determinants of health (Figure 1), which included four 'layers of influence'

(p.12) beyond the characteristics of the individual, which were: individual lifestyle factors; social and community networks; living and working conditions, which included services such as housing, health care, water and sanitation and education; and general socio-economic, cultural and environmental conditions, which they considered to be long term structural issues. The four layers were also identified as four levels of policy intervention to reduce threats to health or to promote or protect better health. In a later discussion on tackling inequalities in health, the same authors argued that 'the most important determinants of health may differ for different socioeconomic groups' (Dahlgren & Whitehead 2007, p.24). They also identified income inequalities, poverty and lack of social cohesion as 'upstream factors' affecting the 'total burden of disease' and a variety of health behaviours as 'downstream factors'.

It is in the light of this influential debate about the wider determinants of health and health inequalities that we can consider the role that holistic regeneration might play in improving health in deprived areas and communities through its actions upon several types of environment that relate to elements in the four layers in Dahlgren & Whitehead's model. Notably, a review of the evidence for the effectiveness of interventions on the wider determinants of health looked at the home environment, work environment and a range of services including transport, health and social care, education, food, water (Bambra *et al.*, 2010). For the purpose of assessing the potential for area-based interventions to impact upon health, we consider that holistic regeneration programmes aim to intervene upon five environments which are known to be associated with health (Figure 2). In our research we adopt the WHO's definition of health as 'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity' (WHO 1948). We operationalised this broad concept through a variety of validated measures of self-reported physical and mental good and poor health, and positive mental wellbeing.

First, the *Physical Environment*, including housing conditions and neighbourhood quality. A major rationale for acting upon housing conditions is their known association with poor physical and mental health, particularly dampness, cold and overcrowding (Wilkinson, 1999; Shaw, 2004), with more recent evidence pointing towards the added importance of housing costs and dwelling type (Clair & Hughes, 2019). Positive and negative aspects of neighbourhood quality are associated with health, from green space being beneficial for physical activity and mental wellbeing (Lee & Mahewwaran, 2010) and for general health (Mears *et al.*, 2020), to brownfield land being associated with higher morbidity (Bambra *et al.*, 2014). Other studies have shown that environmental deprivation, comprising restricted access to green space, air pollution, proximity to industry and other factors, is associated with all-cause mortality (Richardson *et al.*, 2010).

Second, and closely related to neighbourhood quality, are attempts to improve the number and quality of local services, i.e. the *Services Environment*. A recent attempt to create a small area index of 'access to healthy assets and hazards' included elements of the retail environment and health services as well as physical environmental indicators (Green *et al.*, 2018). Research has also shown that neighbourhoods with fewer community-based services (both support services and amenities) are associated with worse health outcomes such as higher BMI or lower physical activity (O'Campo *et al.*, 2015). On the other hand, 'environmental bads', i.e. services and amenities that encourage or enable negative health behaviours (tobacco outlets, off licenses etc.), tend to cluster in more deprived areas (MacDonald *et al.*, 2018), thus leading to attempts to remove or replace them with health-supporting amenities as part of regeneration efforts. Over the past decade, research has shown that environmental services are often insufficient in deprived areas, and that the poorest districts have been disproportionately affected by public spending cuts to services (Hastings *et al.*, 2005, 2017).

Third, regeneration often seeks to improve the local *Economic Environment* in deprived areas, through providing premises for employers and firms, advice and assistance to local businesses, and training and skills development for local labour. In addition, economic regeneration is said to involve improvements to transport connectivity, linking deprived areas to areas of economic opportunity, and integrating regeneration plans with regional economic development strategies (Christie *et al.*, 2017). This is not least because evidence suggests that enabling people out of work, including those on disability benefits who often exist in large numbers in deprived areas, to move into employment can result in improved physical and mental health (Curnock *et al.*, 2016).

The other two areas where regeneration programmes often intervene are the *Social and Psychosocial Environments*. Reviews of regeneration practice have tended to report that the social elements of regeneration have received less attention than the physical aspects (Page, 2006; Dodds, 2011). Social regeneration can be thought of as policies and actions to enhance an area's human, social and cultural capital to co-exist with increased physical and economic capital (Kearns *et al.*, 2009). Social networks are a practical and emotional resource for better health, and can aid recovery such as from mental illness and substance abuse (Corrigan & Phelan, 2004; Mericle, 2014). Social interventions are often focused on areas such as health, education & skills, community organisations & facilities, arts & culture, and families & child wellbeing, and aim to improve the confidence, life skills, learning and esteem of individuals, as well as community networking, cohesion, participation and empowerment of communities (Harkins, 2016; Dodds, 2016).

The residential psychosocial environment has been defined as 'those aspects of home and neighbourhood that affect how one assesses one's own position in the social world and in relation to other people, and how one feels about oneself as a consequence' (Kearns *et al.*, 2012, p.416). Health researchers have identified psychosocial risk factors as operating as bridges between the individual

and the social to affect health beyond material deprivation (Martikainen *et al.*, 2002). They comprise interactions in a social context that make people think, feel or behave in a certain way, often pertaining to issues of status and control (Edelman, 2000; Marmot, 2004; Marmot *et al.*, 2006). It has also been shown that elements of the built environment interact with psychosocial factors to influence health behaviours (Carlson *et al.*, 2012).

Regeneration acts upon psychosocial factors within an area in at least three ways. First, through engaging with individuals and communities subject to regeneration as a means of affording them some degree of involvement, influence and empowerment, this becoming 'a well-established consensus' within regeneration practice (Shaw & Robinson, 2010). Second, by introducing more home ownership opportunities into communities dominated by rented housing, which is expected to have positive effects at three levels. At the individual level, home ownership is associated with higher self-esteem and mental wellbeing due to its higher social status and better quality (Ellaway *et al.*, 2004 and 2016). At the community level, social interactive mechanisms are expected to operate in a manner whereby positive expectations and behaviours are transmitted between owners and renters to the benefit of the latter, although the evidence is weak and contested and there may be disbenefits for owners at the same time (Galster, 2012). Third, beyond the intervention neighbourhood itself, a more mixed-tenure community is said to help overcome place-based stigma and enhance the reputation of erstwhile deprived areas (Allen *et al.*, 2005), whilst also offering, via owners themselves, more routes into external networks of power or 'bridging capital'. Third, regeneration programmes are encouraged to actively manage an area's image and reputation in order to overcome long-term area stigmatisation by the public, the media and service providers (Hastings & Dean, 2003).

Aims and Objectives

Having set out how regeneration may act upon a number of types of residential environment which, according to the wider determinants of health perspective, would be expected to have health impacts, our aim is to use this framework to investigate the associations between area regeneration and health.

To do this, we address the following three research questions:

- Are elements of all five types of residential environment associated with physical and mental health in deprived areas, thus indicating that a holistic approach to regeneration could be effective for health improvement?
- Is living in a regeneration area associated with residents' physical and mental health, when compared with living in other deprived areas and is this the case:
 - At both an early and later stage of regeneration.
 - After controlling for socio-economic differences between areas.
- Are there interactive associations between living in a regeneration area and the different types of residential environment on the one hand, and physical and mental health on the other, thus indicating that holistic regeneration may be having effects on residents' physical and mental health?

We address these questions using repeat cross-sectional survey evidence over a decade for deprived communities in Glasgow as described below.

Methods

Study Setting

Glasgow is a post-industrial city with spatial concentrations of deprivation and poor health reflected in relatively high mortality (Martin & Whyte, 2017). The city has traditionally had a large social-rented housing sector and in 2003 the council's housing stock was transferred to an independent housing association (Gibb, 2003). Following this change, a regeneration programme was devised jointly

between Glasgow Housing Association (GHA) and Glasgow City Council (GHA) to bring about improvements to the housing stock in most areas, along with the demolition and redevelopment of several estates (GCC, 2007). Over 50,000 homes were to be improved, nearly 20,000 homes demolished, and around 3,000 new social homes built with further new builds from the private sector (GHA, 2004).

The effects of these changes were to be monitored in a selection of fifteen study areas, divided into five Intervention Area Types (IATs), as shown in Table 1, which gives the population size and the basis for definition for all study areas. All the study areas had levels of employment/income deprivation at least twice the national average at the start of the study (Walsh, 2015). Study areas were selected and defined in consultation with the two main intervention partners (Glasgow Housing Association and Glasgow City Council). Apart from the six regeneration areas (see below), the other study areas were defined within the boundaries of known communities, although in some cases we did not include the whole community within the study (e.g. we included half of each of the two large outer estates).

Three Transformational Regeneration Areas (TRAs) comprised entire estates where wholesale demolition of mostly high-rise blocks was to be followed by mixed-tenure redevelopment. Three Local Regeneration Areas (LRAs) were smaller developments, where improvements to the majority of the estate's housing stock (predominantly high-rise) were to be accompanied by partial demolition and redevelopment, again into a mixed-tenure neighbourhood. The regeneration programme for these two types of area had physical, social and economic objectives, with intended outcomes including improved built and natural environments, more effective public services, enhanced community confidence, and increased economic activity and lower unemployment (GHA 2006), the latter assisted through employability programmes delivered as part of the regeneration including apprenticeships and work placements (TCG, 2017). In both types of Regeneration Area, housing and environmental

improvements were to be supplemented by projects addressing other issues, including community engagement (a core part of the delivery of regeneration) and cohesion, financial exclusion and advice, training and employment support, support for children and families, and health behaviours and wellbeing (GHA, 2007). Two Wider Surrounding Areas (WSAs), where improvements to much of the housing stock were planned, were located near one of the TRAs and one of the LRAs, and were intended to receive residents relocated during the demolition programme.

These three types of area —TRA, LRA and WSA— are those most affected by the regeneration programme. In the first two of these, a holistic area-based regeneration programme was operative with actions intended on all five types of local environment. Initially, the regeneration programme was to last ten years, from 2004/5 to 2014/15, with replacement social housing after demolitions taking place over this period (GCC, 2008). Following a series of events, including the global financial crisis in 2008-10, later revisions to the original master plans, and the creation of a new partnership for the delivery of regeneration, timelines for the regeneration programme have been extended to the late 2020s in order to accommodate a slower rate of social housing investment and the later commencement of private sector housing developments in some areas (TCG, 2017); however, firm completion dates have not been declared.

Five Housing Improvement Areas (HIAs) comprised areas of desirable social housing stock due to receive housing improvement works. Two of these areas were predominantly high-rise social housing and three consisted of low- or medium-rise housing with significant amounts of owner occupation. The study included two Peripheral Estates (PEs), where less extensive housing improvement works were to take place, but in addition, private sector in-fill developments were planned to further diversify housing tenure on these large estates. These two types of area (HIAs and PEs), like all deprived areas in Scotland, receive additional or boosted programmes from time to time intended to

improve one or other of the five environments. Whilst not experiencing planned, holistic regeneration, they are relevant to the examination of whether the five environments are associated with health outcomes (our first question).

Data Source

A household survey was conducted in the study areas on four occasions, with all residential addresses selected for inclusion in the six Regeneration Areas and a random selection of addresses used in the other nine areas (Egan *et al.*, 2010). In the present analysis we use the surveys from Wave 1 (2006) and Wave 4 (2015), which achieved response rates of 50.3% and 47.0%, respectively. Response rates in the Regeneration Areas were comparable to those in the Peripheral Estates, but lower than the highest response rates achieved in the Housing Improvement Areas (Table 1). Adult householders were interviewed, with achieved samples of 5,939 at Wave 1 and 3,738 at Wave 4 being used for analysis. The survey asked respondents for their views on their housing, neighbourhoods, communities and their personal health. We did not detect systematic elements of missing data for particular items of interest, however, there are likely to be hard-to-reach and vulnerable groups of non-respondents missing from the survey, who may be less likely to achieve health gains from regeneration. Our first survey was undertaken in the early period of regeneration, after two years of activity involving property clearances, environmental works, and community engagement around masterplanning. The second survey was undertaken after a decade of regeneration activity, at which stage the planned demolitions had mostly occurred, some replacement housing had been provided, improvements to retained housing stock had occurred, and social, environmental and economic projects had been delivered or were ongoing.

Variables

The dependent variables are the SF-12 Physical and Mental Component Scores (SF-12 PCS and SF-12 MCS). The Short Form Health Survey, SF-12v2, is a validated questionnaire to measure health-related quality of life, with respondents asked to report how their physical, emotional and social functioning have been affected by their health. The SF-12 has been found to be highly correlated with the SF-36 that has been used in previous studies of regeneration, irrespective of weight (Wee et al., 2008). Scores are computed from responses to 12 questions and range from 0 to 100, with higher scores indicating better health (Ware et al 2005). There are of course other ways to measure health. Objective measures such as illness episodes or health care treatments would, in the UK, require individual consent for data linkage to health records, which is susceptible to low response. Therefore, we opted for the Short Form Health Survey for two reasons: it is a scale for measuring health-related quality of life, the latter being one of the main objectives of regeneration; and, it has been used in other studies of regeneration and health. In reporting our results, below, we consider a substantive change in a SF-12 PCS or MCS score to be one of at least one-quarter of a standard deviation on the respective scale measured at Wave 1.

The key independent variable is the IAT indicator, for which we use a single six-fold categorical variable with the HIAs as the reference, being the areas considered best-functioning by the regeneration agencies, and least in need of area-wide intervention. Also included as part of the IAT variable are Relocation Areas (RLAs), which comprise other parts of the city to which residents in the Regeneration Areas were relocated during the regeneration programme.

We consider various sociodemographic variables that may affect the health outcomes but are unlikely to be impacted by regeneration: age group (16-39 [ref], 40-64, 65+ years); gender (male [ref], female); long-term illness (no [ref], yes); ethnicity (white British/Irish, other [ref]); household type (adult [ref]; single-parent with dependent children; dual-parent with dependent children; older person

household); and length of residence (<10 years [ref]; >10 years); smoker (no [ref]; yes); and whether drinks alcohol (no [ref]; yes).

A number of variables are used to represent each of the residential environments that may be associated with health. These comprise residents' perceptions or reports of the environmental factors in question. Variables for the Physical Environment comprise home satisfaction, housing occupancy rate, and neighbourhood satisfaction. The satisfaction variables represent how well the quality of the home and neighbourhood match the respondents' expectations. Housing occupancy is associated with both physical and mental health (ODPM, 2004), with crowding and lack of control being sources of poor mental health particularly in areas of high-rise housing (Evans, 2003), where area regeneration has been targeted.

The Services Environment is represented by a composite variable measuring residents' assessment of the quality of ten local services and amenities. These include some of those mentioned in the wider determinants of health model, such as health services and education, but also services for families and other essential local services relating to the physical, economic and social environments. The Economic Environment is measured by the respondent's employment status and by whether the respondent's household is working (vs. workless). Respondent and household circumstances may be expected to change if labour market programmes are introduced or boosted by regeneration, but we do not have a measure of local economic activity in general.

The Social Environment is represented by variables reflecting residents' views of safety, cohesion and support. Feelings of safety are a high priority for those living in deprived areas, are associated with mental wellbeing (Bond et al. 2012), and are a focus of many programmes seeking to improve quality

of life in deprived areas where anxiety about crime and antisocial behaviour can be high. Community cohesion in the form of trust in neighbours and the ability to rely upon those close by when needs be has been a concern of public policy in the UK for some time, particularly in areas where of residential instability and rapid social change; interventions in such areas often professes to trying to ‘bring people together’. We use two variables which have been used in previous surveys to measure cohesion: the perceived honesty of neighbours and the degree to which people feel they can rely on neighbours to intervene (Home Office 2004). Policy has often spoken of assisting people to ‘help themselves’ within communities, which we measure using resident reports of available social support of three types —practical, emotional and financial—, such support being understood as protective of health (Reblin & Uchino, 2008). All three elements of the social environment —safety, cohesion and support— depend to a large extent on a degree of familiarity between co-residents, which interventions often attempt to increase through supporting opportunities for social interactions between residents.

Finally, the Psychosocial Environment is represented by home ownership, as this is said to bring benefits of self-esteem, status and control (Kearns *et al.*, 2000; Ellaway *et al.*, 2004), reported housing and community empowerment and perceived internal and external neighbourhood reputation.

The construction of these variables is explained in Table 2; all but one (occupancy rate) are based on categorical (usually ordinal) response questions in the survey. Variables are either binary, or have been converted into trichotomous variables, and are used on their own (e.g., feelings of safety) or combined with one or more other variables within the same domain in an additive manner (e.g., rating of quality of services). The unstandardized regression coefficients in the modelling results (see below) show the effect of a one-step change in response to the single or combined variable.

Analysis

In the first part of our analysis we examine the health and socio-demographic characteristics of respondents in 2006 and 2015. We note how some of the wider determinants of health have changed over time between the samples, particularly employment/financial factors and health behaviours. We then model the two health outcome variables at both time points, using OLS regression. The modelling is conducted in four stages: including Intervention Area Type (IAT) only, to see if there are IAT-based differences in health; adding sociodemographic variables; then including residential and community variables; finally, testing for interactions between IAT and the residential and community variables. We report the results in three steps. First, we look at the effects of IAT on health before and after the inclusion of socio-demographic variables, to see if any area-type differences may be explained by area composition (Models 1 and 2). In relation to our second research question, if regeneration as a whole is beneficial for health, we would expect to see stronger positive associations between regeneration areas and health at T2 than at T1. Second, we focus on the effects of the variables included in our five residential environments (variables in Table 1). In considering our first research question, if the residential environments are associated with health in the ways the wider determinants of health theory suggests, we would expect to see significant associations at either or both time points, with repeat associations more strongly indicative of a consistent relationship (Model 3). Third, we consider whether there are any significant interactive associations between the IATs and the residential environment variables, and the health outcomes (Model 4). In relation to our third research question, any such interactive associations for the three regeneration affected areas (TRA, LRA, WSA) would indicate that regeneration was likely to be impacting health through the residential environments, over and above the general effects of those environments on health in deprived areas; we are particularly interested to see if any such interactions are sustained or change over time.

Limitations

There are several main limitations to this study. First, the data are cross-sectional rather than longitudinal, although the comparison of two time points provides stronger indications of potential causality than data from a single time. We have used data over a period of a decade, which may be sufficient time for some environmental changes to impact health but not others. For example housing improvements and safer neighbourhoods may lead to improvements in mental health in a relatively short time (Curl *et al.*, 2015), but neighbourhood and infrastructure improvements that lead to increased physical activity may take longer to feed through to reduced cardiovascular disease and lower risk of diabetes. While many such pathways have been set out in evidence reviews, no time periods have been stipulated for them (Bell, 2017), and this remains an underspecified aspect of regeneration studies. The duration of the study is longer than most other similar studies, but nonetheless, the regeneration programme is ongoing; previous shorter studies have not always indicated whether the intervention is complete at the time of follow-up. Second, the health data are self-reported and not independently sourced from health records. The two health scales used are validated for use in general populations, though one might argue that they lack validation specifically for deprived populations. The variables used to represent the five residential environments are selected from those available within our survey data-set. We have mostly opted for general variables or combinations of variables, rather than using variables for very specific aspects of each environment, reflecting the fact that there is little consensus among researchers about which variables to use when studying neighbourhoods and health (Schaefer-McDaniel *et al.* 2010), and that our interest is mostly in the environments as a whole, rather than particular elements within them. There will therefore be some aspects of the residential environments that others might investigate that have not been included here. We cannot identify respondents who have received, experienced or been involved with any particular intervention, and thus assume that all residents are potential beneficiaries of any or all elements of the regeneration. The effect this may have on our results is unclear. On the one hand, improvements targeted at individuals in need are said to have the greatest impact (Thomson *et*

al., 2013), but conversely, ecological studies are said to be more likely to find associations between neighbourhoods and health than individual level studies (Schaefer-McDaniel *et al.*, 2010). Lastly, the study is in a single city that, although typical of post-industrial cities, has particularly challenging problems of long-term poor health which remain inadequately explained (Walsh, 2013).

Results

Health and socio-economic changes over time

The samples from Wave 1 (2006) and Wave 4 (2015) are compared in Table 2. The gender balance is similar in both samples, at 60%:40% female:male. The later sample is marginally older, with more middle-aged respondents, and has a 14 percent higher incidence of long-term illness. The rate of employment is slightly higher by Wave 4, alongside a large (10 percent) reduction in the prevalence of workless households at this later time. The balance between white and non-white respondents is unchanged at 86%:14%, respectively, although there has been a shift from non-white non-British to non-white-British in citizenship terms. There has been a 7 percent reduction in the number of households with children and a corresponding increase in adult households. In housing terms, owner occupation has dropped by 6 percentage points in the sample, reflecting city-wide trends since the financial crisis of 2008 (Freeke, 2016). The average occupancy rate has fallen, possibly due to the rise in adult households and reflecting the effect of regeneration in clearing overcrowded dwellings. In health terms, physical health scores have dropped by 3 points on the SF-12 PCS scale and mental health has marginally increased by 0.4 on the SF-12 MCS scale. Interestingly, at Wave 4, the mean PCS score for those who moved to a Relocation Area at 44.00, is in between the mean values for those living in the Regeneration Areas (TRA=41.56; LRA=46.44). The mean MCS score for those in Relocation Areas at 45.16 is lower than for those living in the Regeneration Areas (TRA=50.14; LRA=47.21). There is therefore no *prima facie* evidence that those relocating to other areas are in better health at Wave 4 than those remaining in regeneration areas. Smoking has fallen by 3 percentage points but remains

very high at almost twice the national rate (Gray & Leyland, 2016a). Drinking alcohol has significantly increased, which is counter to the national trend (Gray & Leyland 2016b) and may reflect a reduction in the number of migrants (who are more likely not to drink alcohol) in some of the study areas as a result of clearance.

Physical Health in Regeneration-Affected Areas

Table 4 presents the results of the regressions of SF-12 PCS scores at waves 1 and 4. First, we examine the effects of area type at both times by looking at the results of models 1 and 2. At Wave 1, all four area types are positively associated with physical health compared with the reference area type of Housing Improvement Areas, but the positive association with physical health disappears in the case of the two regeneration area types (TRAs and LRAs) after inclusion of the sociodemographic variables. The surrounding areas (WSAs) and peripheral estates (PEs) are positively associated with physical health at Wave 1 before and after controlling for socio-demographic variables. At Wave 4, in contrast, the large regeneration areas (TRAs) are negatively associated with physical health, and this effect remains after including compositional, sociodemographic variables. However, none of the area associations with physical health that exist after controlling for socio-demographic variables is substantive in size.

From model 3 we can see significant associations with physical health across the study areas in three of the five environments. In the Physical Environment, there are small positive associations with physical health for both housing and neighbourhood satisfaction at Wave 1, though not at Wave 4. In the Economic Environment, being employed (or in full-time education) has a positive association with physical health at both Waves, while living in a working household has a small positive association at Wave 1. In the Psychosocial Environment, owner occupation has a negative association with physical

health at Wave 1, but no association at Wave 4. Housing empowerment has a small positive association with physical health at Wave 1, but not Wave 4. A positive internal area reputation has a small negative association with physical health at Wave 4 only. Neighbourhood empowerment is associated with physical health at both Waves, though the relationship is negative at Wave 1, but positive at Wave 4. None of the variables in the Services or Social Environments is associated with physical health at either Wave.

Of the various associations, only two are repeated and substantive, in that a change in circumstance or change in response (from one end of the spectrum to the other) produces a change in the physical health score of at least a quarter of a standard deviation on the SF-12 PCS scale. Employment is consistently positively associated with physical health, though causation could run in both directions: you may need to be physically healthy to be in employment and/or employment may help maintain physical health. Neighbourhood empowerment is negatively associated with physical health early on, but positively associated in later years, which could reflect the fact that older people tend to be involved in community issues, but that the range of those involved may change over time as community engagement projects expand and achieve traction with residents.

Turning to model 4, there are only a few instances where living in one of the regeneration-affected areas is associated with added impacts on physical health via any of the residential environments. In the two regeneration areas, TRA and LRA, a negative external reputation is associated positively with physical health at Wave 1, with the interactive effect being substantive. It may be that those in better physical health are more mobile and aware of the areas' external image towards the start of regeneration. In the areas surrounding the regeneration areas (WSAs) community cohesion is negatively associated with physical health at Wave 1, but positively associated at Wave 4, while feelings of safety are negatively associated with physical health at Wave 4, though none of these

associations is substantive. More substantive however is the fact that the dwelling occupancy rate is negatively associated with physical health in the WSAs at Wave 4. This could reflect the effects of relocating families out of tower blocks in the regeneration areas into smaller housing in the surrounding areas. Lastly, there is a substantive positive association with physical health of being in employment in a Relocation Area.

Mental Health in Regeneration-Affected Areas

Table 5 presents the results of the regressions of SF-12 MCS scores at Waves 1 and 4. At Wave 1, the surrounding areas (WSAs) and peripheral estates (PEs) are positively associated with mental health, both before (model 1) and after (model 2) the inclusion of socio-demographic variables. By Wave 4 this is still true for the surrounding areas, and is also true for the larger regeneration areas (TRAs). In contrast at Wave 4 the areas of relocation (RLAs) are negatively associated with mental health. None of these area associations is substantive, although the association with TRAs is closest (see result also in model 3).

From model 3 we can see significant associations with mental health across the study areas in all five environments. In the Physical Environment, housing satisfaction is positively associated with mental health at both Waves, while neighbourhood satisfaction is positively associated at Wave 1. Housing occupancy rate is positively associated with mental health at Wave 4. In the Services Environment, the average quality of local services is positively associated with mental health at both waves. In the Economic Environment, being employed oneself, and living in a household which contains employed people, are both positively associated with mental health at both waves. In the Social Environment, cohesion is positively associated with mental health at Wave 1, social support at Wave 4, and safety

at both Waves. In the Psychosocial Environment, home ownership is positively associated with mental health at Wave 4, while housing empowerment is positively associated with mental health at Wave 1. A negative external area reputation shows a small positive association with mental health at Wave 1, but a larger negative association at Wave 4. Feelings of neighbourhood empowerment hold a small negative association with mental health at both waves.

Only one of these associations is repeated and substantive, namely that being employed is consistently, positively associated with mental health across time. Three other associations are substantive at one time point. The largest association found was the negative association at Wave 4 between a poor external area reputation and lower mental health, with the effect of moving from disagreement to strong agreement being equivalent to one half of a standard deviation on the baseline MCS distribution. Both neighbourhood empowerment and housing satisfaction were positively associated with mental health at Wave 1, with the size of effect of moving from a negative to a strongly positive view equivalent to one quarter of a standard deviation on the MCS distribution, though in neither case was the effect repeated at Wave 4.

Turning to the interactions in model 4, we can see substantive associations between elements of certain environments and mental health in different types of regeneration-affected areas, but none that is consistent across the two time points. In the case of the larger regeneration areas (TRAs) safety is positively associated with mental health at Wave 1, while cohesion is positively associated with mental health at Wave 4. In the smaller regeneration areas (LRAs), both safety and cohesion are positively associated with mental health at Wave 1, i.e. in the direction expected. However, home satisfaction, a positive internal area reputation and a negative external reputation were associated with mental health in unexpected ways at Wave 1, the first two negatively and the last positively. However, none of these associations held true at Wave 4. In the areas surrounding regeneration areas

(WSAs), both cohesion and employment were substantively and positively associated with mental health at Wave 4. Once again, variables in the Psychosocial Environment displayed unexpected results: housing empowerment was negatively associated with mental health at Wave 1, while a negative external reputation was positively associated with mental health at Wave 4. There were no significant interactions between elements of the five environments and mental health in the Relocation Areas.

Discussion

We can now reflect on our main findings to address the three research questions, firstly in relation to physical health and then in respect of mental health. In relation to our first question, elements of only three of the five environments were associated with physical health across the deprived areas (i.e. in the whole sample): the economic and psychosocial environments were associated with physical health at both time points, whereas the physical environment was associated with physical health at the first time point only. Only one factor, however, was positively and substantively associated with physical health at both time points; thus, employment may be beneficial to health for low-income groups, rather than being detrimental as feared in an era of low-quality, temporary and insecure jobs (Virtanen *et al.*, 2005), although it may also be the case that the most healthy residents in deprived areas are those most likely to have a job. The fact that we did not find the services or social environments to be associated with physical health in the whole sample may reflect a number of factors. First, services across the most deprived areas in the city may not be of sufficient quality to positively impact on physical health in any locations. This may be particularly the case in a decade of austerity and service cuts which disproportionately affect deprived areas (Hastings *et al.*, 2017). Second, a supportive and cohesive social environment may be incapable of overcoming the excessive physical health burden in deprived areas, and relative inequalities in mortality and morbidity between the most deprived and

the least deprived areas in Scotland have either worsened or remained unchanged over the past twenty years, with the gap in premature mortality reaching its highest point in 2018 (Scottish Government, 2020).

The influence of residential context was broader in the case of mental health, with elements of all five environments being associated with mental health across the sample at both time points, suggesting that holistic action across the environments could be beneficial for mental health for people in deprived areas. However, two elements stood out as having substantive associations with mental health, namely employment in a positive way and area reputation (where negative) in a negative way. The psychosocial environment is interesting in that elements within it did not always behave in ways we might expect, with positive elements sometimes holding negative associations with health outcomes, and for some items, the direction of association with health changed over time. This might suggest that some associations are not causative, reflecting the nature of those residents who are more inclined to feel empowered or more aware of area reputations. In other cases, it might indicate that the effects of the psychosocial environment become more apparent over time, for example the positive effect of neighbourhood empowerment on physical health or the negative effect of a poor external reputation on mental health only being identified after nearly a decade of regeneration. It may also be the case that the pathways from the psychosocial environment to health are not as linear and straightforward as imagined (Bell, 2017) in the case of deprived neighbourhoods for two reasons. First, the social capital that provides empowerment may also have a 'downside' that promotes unhealthy behaviours or social division (Portes & Landolt, 1996). Second, a negative area reputation can be a source of resilience and pride in a 'defended neighbourhood' (Suttles, 1972), with a positive sense of attachment to a place and identity strengthened by having to resist external forces of change or denigration (Wilton, 1998; Forrest & Kearns, 2001).

In relation to our second research question, we found that area associations with physical health at Wave 1 were largely due to compositional factors, with only the surrounding areas (WSAs) having a small positive association after controlling for socio-demographic factors. At the later time point, only the larger regeneration area (TRA) had a small negative association with physical health, which may be understandable given the ageing of the study population and relocation of many households out of regeneration areas. These results do not, however, indicate a positive impact on physical health from residing in a regeneration area.

With regard to mental health, the regeneration areas had no association at Wave 1 but the larger regeneration areas (TRAs) had a modest, positive association by Wave 4, when the programme was at its mid-point, with demolitions undertaken, improvements to retained housing stock completed, and some new build having occurred; in other words, there had been some (visible) progress with area regeneration. Living in the LRAs was negatively associated with mental health at both time points (though not significant), possibly indicating that the scale and extent of renewal activity may be important for mental health gains. The surrounding areas (WSAs) had a small positive association with mental health at this time also, whilst relocation to other areas (RLA) was negatively associated with mental health, reflecting concerns about the psychological effects of relocation, although the modest size of the effect may also reflect the role of choice and support services in modern-day relocation processes (Kleinhans, 2003; Varady & Kleinhans, 2013).

Turning to our third research question, our findings suggest that holistic area-based regeneration may not have been successful in boosting physical health; none of the factors that we might have expected to show a positive association with physical health after ten years of activity in the Regeneration Areas (TRAs & LRAs), such as environmental factors, services and the social environment, did so at either Wave. The areas surrounding the regeneration areas (WSAs) showed a strong negative association

between dwelling occupancy and physical health at Wave 4, which suggests that relocation to nearby neighbourhoods may have resulted in overcrowding for some of those with poor health. In contrast, relocation to other areas may have increased appreciation of the neighbourhood (satisfaction) and social support for those with poor physical health, as both these factors were negatively associated with physical health in the Relocation Areas (RLAs) at Wave 4. It may also be the case that levels of social support in these areas are not sufficient to compensate for any loss of social networks as a result of relocation at distance (Young & Willmott, 1957; Thomas, 1986). On the other hand, moving from regeneration to an RLA and either retaining or getting a job appears substantively beneficial for physical health, indicating that relocation may have positive effects, possibly overcoming locational constraints on employment (spatial mismatch) for some people (Houston, 2005).

We also found holistic regeneration to be uneven in its impacts upon mental health. Elements of three of the five environments (social, psychosocial, economic) were associated with mental health in the three types of area most affected by the regeneration programme (TRA, LRA, WSA) but none of these associations was uniform across the three areas, nor consistent over time. In the earlier stages of regeneration, social factors such as safety were positively associated with mental health in the regeneration areas (TRAs & LRAs) but these effects were not sustained over the course of the decade. The other notable social factor is community cohesion, which had substantive positive associations with mental health in the larger regeneration areas (TRAs) and surrounding areas (WSAs) at Wave 4, and in the smaller regeneration areas (LRAs) at Wave 1, again, however, not sustained over time. In all these areas, the presence of significant minority ethnic populations has contributed both to organic, mutually supportive interactions and to additional state supported efforts to boost community integration, with a strengthening of community cohesion over time, indirectly as a product of regeneration, particularly in the WSAs (Kearns & Whitley, 2018). The fact that positive social effects

exist in the areas surrounding regeneration areas is interesting, given that negative social spill-over effects might have been expected (Varady & Kleinmans, 2013).

It is notable that we did not find interactions between regeneration areas, neighbourhood empowerment and mental health. Although community engagement has become an integral part of regeneration and is heavily promoted by government (Scottish Government & Cosla, 2009; Scottish Government *et al.*, 2016), and notwithstanding that perceived neighbourhood influence has been increasing over time (Mason & Kearns, 2017), we do not find evidence here that it is positively influencing mental health. This is in accord with the existing understanding that the evidence for a link between community engagement and health gain is weak (Milton *et al.*, 2011; South & Phillips, 2014). The other aspect of the psychosocial environment where regeneration may be under-performing is in relation to the management of area image and reputation, something often missing from regeneration programmes (Kearns *et al.*, 2013). We found no evidence that a positive external area reputation was associated with better mental health in the intervention areas, indeed the opposite was the case in the smaller regeneration areas (LRAs) and surrounding areas (WSAs) where a negative external reputation was positively associated with mental health, more indicative of a resilient mind-set than a celebratory one.

Within the traditional domain of property-led regeneration (Turok, 1992) housing has some impacts as expected, though more consistently for mental health than physical health. Although this is in accord with the conclusion of a recent review that housing refurbishment was the element of regeneration most likely to have health impacts, it also qualifies that understanding (McCartney *et al.*, 2017). Area-based housing improvement programmes, taking place in the Housing Improvement Areas (reference category) and Peripheral Estates, have more positive associations with physical health (albeit modest in size) than the Regeneration Areas, but the picture is less clear-cut for mental

health, where the larger regeneration areas are more positively associated with mental health by Wave 4,

Wider neighbourhood regeneration, for example in terms of the local environment and services, appears to be rather weak and inconsistent over time in its relationship to health outcomes; thus, the extension of the traditional housing-led regeneration remit is not currently very effective. A recent review also concluded that the evidence for impacts from urban regeneration and physical environmental changes upon mental health and quality of life indicators was weak (Moore *et al.*, 2018). What is more, the lack of impact of environmental changes and regeneration more broadly upon worsening physical health in Glasgow's deprived areas should be of concern. This weak and inconsistent association with health is partly reflective of insufficiency of scale and somewhat ineffective delivery of regeneration. Recall that we did not find the same positive association with mental health in smaller regeneration areas as we found in larger regeneration areas. Moreover, after a decade of activity, the renewal of the larger regeneration areas is still far from complete: neither new housing, tenure-mixing, nor environmental and service improvements have been delivered to the extent originally planned, and the completion date for the regeneration is some way off, but not explicitly stated.

There are some encouraging signs of positive social impacts upon mental health, even in locations where those would be less expected, and despite it being noted that social regeneration often lags behind physical regeneration (Dodds, 2011; Harkins, 2016). Our results show the importance of community cohesion (trust) and safety for health, and that regeneration has been more consistent in supporting these social elements of deprived areas for mental health benefits. The fact that this can be achieved both in large regeneration areas and in surrounding areas – both of which are also areas of ethnic diversity – but not in small regeneration areas, is an important signal to regeneration

programmes elsewhere. Conversely, in the domain of psychosocial area effects, regeneration does not appear to have been effective, proving incapable of creating positive health links with area reputations or neighbourhood empowerment, two elements central to holistic regeneration and to mental wellbeing (Kearns *et al.*, 2012).

Conclusion

In this paper, we have sought to demonstrate a way of assessing whether or not holistic regeneration could be effective for health improvement through an approach that others could follow or develop further. First, we translated the theory of 'wider determinants of health' into a model of five residential environments that may be acted upon by area regeneration programmes. Second, we considered whether living in a regeneration area was associated with physical and mental health outcomes, compared with other deprived areas in the same city, including areas where the predominant regeneration activity is area-based housing improvements (which we used as a reference). Third, we examined whether elements of each of the five environments were associated with health outcomes in regeneration areas, over and above any links found across deprived areas in general, in order to identify those elements where regeneration's impacts might be particularly beneficial for health. In doing this, we added two further dimensions that other studies might also consider. First, we examined two time points in order to see whether regeneration was consistent in its impacts from early on in the programme to a decade later. Second, we included not only regeneration areas themselves but also adjacent, surrounding areas and more distant relocation areas, being two other locations where regeneration can have effects.

This study echoes earlier reviews and research in finding few substantial impacts upon health from the receipt of regeneration, even though the present study has a longer follow-up interval than others

(Thomson *et al.*, 2006; Critchley *et al.*, 2004; Huxley *et al.*, 2004). It also adds to the sparse evidence on the impacts of so-called 'holistic' regeneration. While an earlier study of holistic regeneration in the UK found no change in mental health from residing in the intervention areas (Walthery *et al.*, 2015), we found a small gain in mental health and a small reduction in physical health associated with living in large regeneration areas.

It has been argued that urban regeneration 'should be seen as a public health intervention, enhancing the social determinants of health' and, as such, should also be 'holistic', 'directed towards the physical and social environments' (Macgregor, 2010, p.48 and p.49). It is expected that housing improvements will boost physical and mental health and that wider urban regeneration will also positively affect mental health (*ibid.*). However, we found that across a period of a decade the associations of living in a regeneration area and of particular elements of holistic regeneration are more common for mental than for physical health, and for the most part modest in size, and not always positive. It would seem therefore that planners have not yet found an effective means of designing and implementing area-based regeneration programmes that are capable of achieving substantial, measurable improvements in residents' health and acquiring the status of a public health intervention.

Our results prompt the question as to what regeneration must do better if it is to have greater, positive health impacts, and in this regard several suggestions are made. First, regeneration partnerships are often not as inter-sectoral and all-embracing as a holistic agenda would merit, and require much greater involvement from key partners in some of the 'sticky' problem areas identified above, for example from further and higher education, economic development, public relations and public health. Second, regeneration programmes could be more responsive to context. Even in a single city such as that studied here, the most deprived areas subject to area regeneration can differ in significant respects such as property and neighbourhood type, population diversity, locational (dis)advantages,

and the extent of poor health. The formulation of a regeneration programme to fit its context would, in Glasgow's case, for example, have to consider the argument that poor health in Scotland is partly a consequence of 'excessively accumulating life stress', itself a function of low socio-economic status, alongside cultural resistance to healthier lifestyles (Cowley *et al.*, 2016), such that improvements in residential environments, although necessary, will be insufficient to produce health improvements.

Although regeneration may not always be housing-led, it is still the case that property investment expenditure is the largest sectoral component within regeneration, with other sectoral budgets being much smaller. For example, within the NDC programme in England, health expenditure accounted for a tenth of the expenditure (Batty *et al.*, 2010). Holistic regeneration requires more balanced expenditures across the sectoral areas of activity, in accord with a policy agenda that is evidence-based and appropriate for the urban context in question. The deficiencies of cross-sectoral participation and investment in regeneration were acknowledged by the Scottish Parliament in its review of the delivery of the government's regeneration strategy, stating that successful delivery required 'A sustained and co-ordinated approach across all partners involved in delivering regeneration, across a wide range of outcomes and utilising resources from across mainstream budgets, such as housing, health, justice and education (amongst others)' (Scottish Parliament, 2014, p.21), with only the first of these budgetary contributions being a common occurrence.

In relation to inter-sectoral working, it would also be helpful if regeneration as a practice made greater use of logic models that are common in both national and community-based health policy and practice. Such logic models 'map...the relationship between a program's resources, activities and intended results [and] identify the program's underlying theory and assumptions' (Kaplan & Garrett, 2005, p.167). At present, holistic regeneration tends to comprise a range of investments and activities not assembled in line with a clear theory or hypothesis about 'what works', but much more

opportunistically as result of who or what can be easily attracted to the regeneration programme, on the assumption that 'every little bit helps'. The result is that success is a hit or miss affair rather than an expected product of good planning.

Lastly, regeneration investment needs to be of sufficient scale and intensity to achieve substantive change in the wider determinants of health and to attain a desired end state within a reasonable time-scale; and, thus, not comprise an ongoing, or never-ending programme of activity without a defined endpoint or estimated duration. Without a clearly defined end state, progress cannot be assessed or termination of the policy rationally decided (Strines, 1997), and hence holistic regeneration risks becoming a permanent requirement and a recurring disappointment.

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Notes on Contributors

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