Housing and inequalities in health: a study of socioeconomic dimensions of housing and self reported health from a survey of Vancouver residents

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Study objective: To investigate the relation between housing, socioeconomic status, and self reported general and mental health. This study is an empirical investigation of social and economic dimensions of housing, specifically, demand, control, and material (affordability, dwelling type) and meaningful (pride in dwelling, home as a refuge) dimensions of everyday life as they occur in the domestic environment.

Design: A cross sectional telephone survey was administered to a random sample of households. Survey items included measures of demand, control, and meaningfulness of the domestic environment, as well as standard measures of socioeconomic status and social support. Main outcome measures were self reported health (excellent, very good, good, fair, poor) and self reported frequency of feeling “downhearted and blue” in the two weeks before interview (from the Rand Mental Health Index).

Setting: Households (n=650) from 12 neighbourhood areas in the city of Vancouver, Canada.

Participants: One randomly selected adult from each of 650 households completed the interview and constitute the sample for this study.

Main results: In bivariate analyses, measures of housing demand, control and meaningfulness exhibited strong and significantly graded relations with self reported health and somewhat less strong relations with mental health. In logistic regression analyses housing demand and control variables made significant contributions to health both general and mental health. Respondents were more likely to report fair/poor health if they: reported that they couldn’t stand to be at home sometimes (OR=2.29, p<0.05); rated their domestic housework as somewhat or quite a strain (OR=5.71, p<0.001); were somewhat or very dissatisfied with their social activities (OR=3.41, p<0.001); and reported that they were constantly under stress a good bit of the time or more (OR=3.56, p<0.05). In terms of mental health, respondents were more likely to report poorer mental health if they: lived longer in their neighbourhood (OR=1.05, p<0.05); reported their housework duties to be somewhat or quite a strain (OR=5.55, p<0.001); reported that they did not have somebody that could help them if they needed it (OR=9.28, p<0.001); and reported that they were constantly under stress a good bit of the time or more in the two weeks before the interview (OR=5.26, p<0.001). One of the main hypotheses investigated—that meaningful dimensions of housing are associated with health status—found support in bivariate analyses without controls, but did not contribute to multivariable models.

Conclusions: The influence of housing demand and control variables superseded a well known correlate of health status, educational attainment, attesting to their importance. The findings of this paper lend support to the hypothesis that features of the domestic environment, especially as they pertain to the exercise of control and the experience of demand, are significant predictors of self reported general and mental health status. Housing is a concrete manifestation of socioeconomic status, which has an important part to play in the development of explanations of the social production of health inequalities.

At one time, there was a strong convergence between analyses of socioeconomic inequalities in housing and socioeconomic inequalities in health in industrialised countries. The link between housing conditions and the transmission of infectious disease was a crucial component of the public health reforms of the 19th century. But the decline of infectious disease during the late 19th and early 20th centuries, emblematic of the epidemiological transition, has largely severed one dimension of the logical link between housing conditions and health—that of infectious disease transmission.

In the contemporary era, by contrast, it is well established that in the industrialised countries of the world there exists a monotonic gradient in the relation between social status and health status, no matter how each is measured. Greater income, education, and occupational class are all positively related to better health, whether measured by positive health status or the propensity to experience injury, morbidity, or mortality by nearly any cause. The social gradient in health spans the entire social spectrum and cannot be attributed solely to the effects of reverse causation, access to medical care, genetics, nor adverse health behaviours. The benefits of relative affluence and prestige are believed to translate into biological outcomes through the cumulative effects of attenuated physiological stress responses across the life course. Sustained, chronic stress is known to stimulate immunosuppression and promote a maladaptive stimulation of the neuroendocrine system, leading to a wide range of life threatening conditions, including cardiovascular and coronary heart disease.

Despite the widespread agreement about the existence of the social gradient in health, and the plausibility of biological mechanisms underlying it, there is little agreement about the relevant factors for the social production of health inequalities. There are two logical arguments, however, that can give rise to an emergent framework of understanding.

Firstly, one thing that is clear from the available evidence is that the social gradient in health is not only about income, even among the most affluent of industrialised societies. The relation between income and health status holds for educational
attainment and occupational grade, which are not entirely con-
differentiated with income. Income is important at the extreme low
end of the spectrum, of course, as it buys necessities of daily
living—they can sustain nutrition, shelter, clothing, etc. Beyond
subsistence levels, what does income buy? One thing it is asso-
ciated with is better psychosocial working conditions, which
have been shown to strongly influence health. A great deal of
evidence suggests that the most important dimensions of the
work environment are: psychological job demand, task control
(or decision latitude), and social support. The more demanding
the job, the less the control and the less the social support, the
greater the health risk for a wide variety of conditions.5 If these
are the three most important attributes of workplace conditions
for health, it follows that similar factors must be important
during the other 16+ hours of the day, and that the home would
be a logical nexus for such influences to occur.6
The second logic informing a new framework for under-
standing health inequalities follows from the work of Richard
Wilkinson.1 He argues for a “psychosocial interpretation” of
the social gradient in health, claiming that:

“...psychosocial factors related to deprivation and
disadvantage are involved. That is to say it is less a mat-
ter of the immediate physical effects of inferior material
conditions than of the social meanings attached to those
conditions and how people feel about their material cir-
cumstances and about themselves.10 (emphasis added)

This study uses social survey methods to investigate the rela-
tion between housing, socioeconomic status, and self reported
general and mental health. Housing is understood to have both
significant material dimensions (housing costs, wealth genera-
tion and storage, controlled physical environment, protection
from elements, etc) and meaningful dimensions (housing as a
reflection of self identity and pride, a place of refuge, a site for
the exercise of control, a source of social status, etc) for
health.11,12 This study is an empirical investigation of the support
for a convergence of logical arguments concerning the import-
ance of demand, control, and material and meaningful dimen-
sions of everyday life to the social production of social gradients
in health status—in this case, as they occur in the domestic
environment. Conceptually, the following analysis investigates
the empirical basis for a contemporary convergence of housing,
socioeconomic status, and health inequalities.

METHODS
Participants
All adult residents of households in the city of Vancouver,
Canada were eligible for inclusion in this study. The survey
was administered by telephone to a random sample of house-
holds in 12 neighbourhood areas (n=650 total). One adult
individual was randomly chosen within each household to
participate in the survey. Neighbourhood areas were defined
on the basis of a recent mortality atlas of Vancouver that
roughly conform to neighbourhoods used by the City of Van-
couver’s Planning Department for neighbourhood area
planning.13 Survey administration was conducted in a way
that attempted to achieve an equal number of completed
interviews across the 12 neighbourhood areas.

The survey was administered by a Vancouver based survey
research firm between 3 May 1999 and 16 June 1999. The
sampling frame was purchased from Dominion Directories
Information Services, a division of the Stentor Group of Com-
panies, the company that compiles telephone listings for most
Canadian cities. Their listings are updated monthly, and con-
tain all households and businesses with telephones. Their list-
ings do not, however, include the numbers of households who
have asked that their number be unlisted. As households with
unlisted numbers are more likely to be affluent, inferences
about the upper portions of the social spectrum must be
drawn from the current dataset cautiously. A random sample
of 5000 telephone numbers with Vancouver based postal codes
was purchased from Dominion for use as the sampling frame.
A Computer Assisted Telephone Interviewing (CATI) system
then drew telephone numbers randomly from the sample
frame until 650 completed interviews had been achieved.
In total, 4137 numbers were attempted: 3962 were deemed elig-
ible (that is, in service, not a fax, not a business), 2965 poten-
tial respondents were contacted and asked to participate, and
2054 cooperative contacts were reached. Of these, 1404 were
disqualified, usually because the quota for their neighbour-
hood had been reached. The remaining 650 completed the
interview and constitute the sample for this study. Overall,
the administration of this questionnaire achieved good
response rates. The refusal rate was 30.7%, the crude response
rate was 51.8% (cooperative contacts ÷ total asked to partici-
pate), and the adjusted response rate was 69.3% (cooperative
contacts ÷ total number eligible phone numbers).

Housing and socioeconomic status measures
The questionnaire administered to respondents included a
number of items intended to tap constructs related to respond-
ents’ investment of meaning in the home14,15 and their experience of demand and control in
the domestic environment. Respondents were asked to rate on a
Likert scale the extent to which they: (a) felt like they belonged
in their neighbourhood, (b) were proud to live in their
neighbourhood, (c) were proud to show their home to visitors,
(d) felt like they couldn’t stand to be at home sometimes (home
as place of refuge), (e) felt like their home was well located to meet their everyday needs, (f) felt like their home reflected their
identity, (g) were worried about being forced to move, and (h)
fee to it was a strain to meet their monthly housing costs.
In addition, respondents were asked to estimate how many hours
per week they spent doing household chores and how much of
a strain they found their domestic workload.

In several items respondents were asked to report on both
their general (do you have someone you can confide in?, is there
someone who can help them if you need it?, in general, how sat-
isfied are you with your social activities?) and neighbourhood
dependent social ties (how friendly are your neighbours?, how often
to you talk with your neighbours?). The survey also collected
respondents’ basic sociodemographic characteristics (age, sex,
marital status, employment status, education, income, etc).

Outcome measures
Two self reported health status measures were used: general
self reported health (fair/poor as opposed to good/very
good/excellent) and a single item from the Rand Mental
Health Inventory (MHI)16—“...how much of the time in the past
two weeks have you felt downhearted and blue?” (response
categories were: all of the time, most of the time, a good bit of
the time, some of the time, a little of the time, none of the
time). The former measure is used widely17 and has been
shown to be highly correlated with other “harder”, physical
measures of health (mortality, diagnosed morbidity, symptom
reporting)18,19 and also functional status.20 In general, the MHI
is a robust screening instrument that can predict, with accept-
able accuracy, the likelihood that a person suffers from
clinically diagnosable depression or anxiety. It measures mental
health in terms of psychological distress and wellbeing,
 focusing on affective states, and was developed for use in popu-
lation surveys.21 The single MHI item “downhearted and blue”
was selected for inclusion in this survey to minimise respondent
burden and provide an efficient means to assess mental health
and wellbeing. There is evidence to suggest that this item has
the capacity to adequately and efficiently assess mental health
and wellbeing, performing even better than the General Health
Questionnaire (GHQ), using diagnoses from the Diagnostic
Interview Schedule (DIS) as the standard for comparison.21,22

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### Statistical analysis

Statistical analysis was performed using SPSS 10.0 software. Descriptive statistics showing the frequencies of selected variables are presented in the first instance. This is followed by bivariate analyses using non-parametric tests of significance for measures of interest (with emphasis on meaning, demand, and control). The final component of the analysis uses logistic regression analysis to investigate the simultaneous influence of housing related and other socioeconomic variables on the health outcomes. To calculate the models, self rated health status was dichotomised into two categories, “fair/poor” on the other. The mental health indicator, “downhearted and blue” was in the case of the first block of variables (age, gender, educational attainment of respondent, and housing tenure), entered in conceptually coherent blocks in an additive fashion, keeping only those variables that made a contribution to the model before adding the next block. The only exception to this was in the case of the first block of variables (age, gender, educational attainment of respondent, and housing tenure), which were forced into the model because of their a priori importance. Models were run using a backward stepwise elimination procedure, and variables were judged to contribute to the model if the significance level for the Wald inclusion statistic was 0.10 or lower.

### RESULTS

#### Descriptive results

Table 1 shows descriptive results from completed surveys. Mean length of residence in dwelling was 7.18 years while mean length of residence in current neighbourhood was 10.1 years. These differ from median length of residence in dwelling and neighbourhood, 3.04 and 5.0 years, suggesting a modest but not insubstantial degree of residential transience. Roughly 42% of respondents reported that they spend more than 30% of their monthly income on housing costs and a similar proportion reported that they found it somewhat or extremely difficult to meet their monthly housing costs. For each of the survey questions designed to assess housing demand, control and meaning, between 10% and 20% assessed their housing situation negatively. The results of selected non-parametric tests for significant intergroup differences are displayed in histograms in Figures 1A to 6B. The objective of displaying the results of these analyses in this way is to look for gradients in demand, control, and meaningful dimensions of housing on the one hand, and the two health outcomes, on the other. The numbers on the y axes of these histograms have no intrinsic meaning, they are simply the

### Table 1

**Descriptive statistics. Housing and quality of life in Vancouver**

<table>
<thead>
<tr>
<th>Gender</th>
<th>Household characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>% female</td>
<td>54.3</td>
</tr>
<tr>
<td>Mean number of people per household</td>
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</tbody>
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| Age distribution of sample respondents | Mean crowding index (bedrooms per person) |
| 18–34 | 39.3 |
| 35–54 | 42.0 |
| 55–64 | 7.2 |
| 65 or older | 10.5 |

| Marital status | Median length of residence in current neighbourhood (years) |
| % married or common law | 50.3 |
| 50.3 |
| % single | 34.2 |

| Income* | % of respondents spending >30% of income on housing† |
| % with less than high school education | 6.0 |
| % completed high school | 18.5 |
| % completed university | 32.2 |
| % with income less than $25000 | 19.1 |
| % with income between $25000 and $59999 | 30.6 |
| % with income greater than $60000 | 26.8 |

| Housing demand / control / meaning | % agree or strongly agree |
| I feel like I belong in neighbourhood | 85.2 |
| I feel proud to live in my neighbourhood | 84.5 |
| I am proud to show my home to visitors | 81.1 |
| I can’t stand to be at home sometimes | 22.2 |
| My home provides a good place to live my life | 89.3 |
| I often worry about being forced to move | 12.6 |

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| Dwelling characteristics | % reporting fair / poor health |
| % living in single house | 38.5 |
| % living in semi-detached house | 10.2 |
| % living in self contained apartment in a house | 8.8 |
| % living in low rise apartment | 26.5 |
| % living in high rise apartment | 15.8 |

| I often worry about being forced to move | 12.6 |

| Housing tenure | % reporting feeling constantly under stress “fairly often” or more in past 2 weeks |
| % who own their home | 45.4 |
| % who rent their home | 54.6 |

| I feel proud to live in my neighbourhood | 84.5 |

*23.5% of sample respondents refused or did not know their household annual income, †this figure is calculated with only those persons who reported their annual income.

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*23.5% of sample respondents refused or did not know their household annual income, †this figure is calculated with only those persons who reported their annual income.
mean of the ranking of all respondents (in a given health category) on the test variable. On the whole, there is evidence of a graded relation between a number of dimensions of housing and self rated health, with somewhat less defined gradients in the mental health measure. Beginning with figure 1A, there is evidence of a statistically significant income gradient and a statistically significant educational gradient in self rated health status, and a non-significant relation between age and health status. The income gradient in health remains significant after adjusting for household size by dividing household income by the square root of the number of people in the household. The unusually high mean rank on income and educational attainment for respondents reporting poor health is the only deviation from the gradient pattern, and further analyses (not reported) suggest that this anomaly could be attributable to a small number of respondents who simultaneously reported poor health, a disability, and high income and educational attainment. Figure 1B shows similar results for the mental health status measure, but with gradients that are somewhat attenuated. Nevertheless, statistically significant, graded relations can be observed for income, income adjusted for household size, and educational attainment.

A different picture emerges when considering material dimensions of housing, as measured by both objective and subjective measures of the burden of housing costs (relative to income). Figure 3A shows a weak and inconsistent, but statistically significant gradient between crude housing costs and self rated health. For mental health (fig 3B), differences in reporting “downhearted and blue” are statistically significant, but there is not a consistent, monotonic gradient. When measured relative to income, housing costs strongly and significantly differentiate between respondents with poor or fair self rated health and the remainder of the sample (fig 3A). For mental health, modest evidence of a statistically significant housing affordability gradient in mental health status is shown in figure 3B. Capital gains on current residence (in 1996 dollars) were calculated for the subset of respondents who were owner-occupiers and who provided complete information on purchase price, length of ownership, current estimated market value, and outstanding mortgage sums (n=167). No statistically significant differences were found for either self reported health or mental health. For most households, housing represents their single largest monthly expenditure and their single largest asset. Capital gains, it follows, can be interpreted as markers of household wealth/
equity. A Mann-Whitney U test on housing tenure (owner-occupier versus tenant—not shown) against both health status measures showed that owner-occupiers were significantly more likely to report better mental health status (*p<0.01), but not self reported health.

In addition to the demonstrated association between housing costs and self reported health, figures 3A and 3B also show a graded relation between self reported strain of monthly housing costs and both self reported health status and the mental health measure. Respondents who reported greater strain in meeting their monthly housing costs were significantly more likely to report poorer general and mental health (with one inconsistency to the gradient in the case of mental health).

The other main source of housing demand investigated was domestic work (figs 4A and 4B). There was no significant relation between self reported number of hours spent doing domestic work and either self rated health status or mental health, but there was a statistically significant general and mental health gradient in self rated strain of housework (with one inconsistency in the mental health gradient). Further analyses (not reported) revealed that there was a significant gender component to this relation, with women much more highly represented among those who reported their weekly housework to be a greater strain. The final variable tested for its relation to self rated health and mental health (shown in fig 4A and 4B) was a general stress measure. It showed a statistically significant, monotonic health gradient for both general and mental health.

The importance of housing as a site for the exercise of control can be inferred from the fact that in Canadian culture, like most Western cultures, the home is one of the few places in an individual’s everyday life where they are socially (and legally) sanctioned to have complete control. Coupled with the importance of control and decision latitude in the work and health literature, it follows that control in the home has the potential to be associated with health status. The results of analyses shown in figures 5A and 5B provide some support for this hypothesis. In general, respondents who reported that they couldn’t stand to be at home “sometimes” or more were more likely to report poorer self rated health (nearly a monotonic gradient) and poorer mental health. Respondents who agreed more strongly that their home was a “good location to live their life” were significantly more likely to report better self reported health (in a nearly monotonic fashion), while the intergroup differences for mental health were not graded, despite being statistically significant. Finally, respondents who
reported that they worried about being forced to move were significantly more likely to report poorer self-reported health and mental health in a nearly monotonic gradient. These findings lend support to the hypothesis that control in the domestic environment could be an important factor in shaping socioeconomic differences in health.

The final dimension of housing investigated in this analysis, meaningfulness of housing, follows from Wilkinson's argument described in the introduction. The results here are mixed, with figures 6A and 6B showing no significant health differences for respondents who agreed more strongly that they felt they belonged in their neighbourhood. Pride in neighbourhood was associated with better general and mental health, in a predominantly graded fashion, consistent with Mitchell et al. Finally, respondents who agreed that their home was a good reflection of their identity were more likely to report better general and mental health. Similarly, respondents who agreed that they were proud of their dwelling (home) were significantly more likely to report good health, also in a (nearly) monotonic fashion.

**Logistic regression analysis**

The results of logistic regression analyses on the two outcome variables are shown in tables 2 and 3. In both instances the likelihood of the less favourable health outcome (fair/poor health or downhearted and blue a good bit of the time or more) is regressed on six thematic blocks of variables. Each block of variables was entered sequentially to build a cumulative model. Each block was entered using a backwards stepwise elimination procedure, except the sociodemographic characteristics block, which was forced into the model. Before calculating the regression equation for the first block, however, the single variable “age” was regressed on the likelihood of reporting fair or poor health, because of its a priori importance. The explanatory performance of subsequent iterations of the model was then compared with the performance of this base model containing only age as a covariate. Explanatory variables were tested for multi-collinearity using both parametric and non-parametric tests. Only length of residence in dwelling (LGTHDWEL) and length of residence in neighbourhood (LGTHHOOD) were strongly correlated (r>0.8); no other variable pair showed a correlation greater than 0.5 and all but two pairs were below 0.4. The removal of LGHTDWEL and then LGTHHOOD from the regression models did not substantially change the results reported here.

In the case of self-rated health (table 2), when the first full block of variables was entered, education emerged as the only sociodemographic variable significantly related to the outcome, with each level of educational attainment being associated with roughly a fourfold reduction in the likelihood of reporting fair
or poor health. The addition of the housing characteristics (tenure, crowding index, length of residence in dwelling, and length of residence in neighbourhood), added one variable to the model. Respondents living in rented dwellings were 2.11 times more likely to report fair/poor health than owner-occupiers (p<0.05), and education remained a significant contributor to the model with nearly the same odds ratio.

The addition of housing demand/control variables (hate to be at home sometimes; home a good location to live life; worry about a forced move; strain of housing costs; strain of housework) added three new variables, two of which were statistically significant in the model. Respondents were more likely to report fair/poor health if they: lived in a rented dwelling (OR=1.99, p<0.05); (strongly) agreed that they “hate to be at home sometimes” (OR=2.09, p<0.05); and reported the strain of housework to be a strain or quite a strain (OR=5.26, p<0.001).

The addition of meaningful dimensions of housing (feel like you belong in your neighbourhood, proud of neighbourhood, home a good reflection of self, proud of dwelling) failed to make any contribution to the cumulative model. This occurred despite some evidence in the bivariate analysis of associations between these variables and self rated health. The addition of neighbourly social support variables (how friendly are your neighbours, how often to you talk with your neighbours, how often to you exchange help with your neighbours) also failed to add anything to the cumulative model, although this is consistent with the bivariate analyses above.

The final block of variables to be added were measures of general (non-residential, non-housing) social support, and overall stress (how often in the last two weeks have you felt “constantly under stress”). Not surprisingly, satisfaction with social life and general stress made strong and statistically significant contributions to the cumulative model. Respondents who were somewhat or very dissatisfied with their social life were 3.41 times more likely to report fair/poor health (p<0.001) and respondents who were constantly under stress a good bit of the time or more were 3.56 times more likely to report poorer health (p<0.05). “Hate to be at home” and strain of housework maintained their significance in the final cumulative model, but tenure lost statistical significance in the final model. The final cumulative model performed relatively well, showing a $\rho^2$ of 0.264, which Wrigley describes as within the range of “very good fit”.

The results for mental health (table 3) are similar to those of self rated health. The outcome measure in this case is the likelihood of a respondent reporting that they felt “downhearted and blue a good bit of the time” or more in the two
weeks before the interview. Table 3 shows that none of the sociodemographic variables were significantly associated with the outcome. After the addition of housing characteristics, tenure, and length of residence in neighbourhood remained in the model, with only the latter making a significant contribution (OR=1.03, p<0.05). When housing demand/control variables were added, “hate to be at home sometimes” and “strain of housework” entered the model, both making a statistically significant contribution to the model. Housing tenure also emerged as a significant contributor. At this point in the modelling, respondents were more likely to report feeling downhearted and blue a good bit of the time or more if they: lived in a rented dwelling (OR=2.13, p<0.05); lived longer in their neighbourhood (OR=1.03, p<0.05); (strongly) agreed that they hated to be at home sometimes (OR=2.42, p<0.01); and reported their housework duties to be somewhat or quite a strain (OR=7.14, p<0.001).

Similar to the case for self rated health, the addition of meaningful dimensions of home to the model made no impact. Neither pride in dwelling or neighbourhood, nor sense of belonging in neighbourhood or home as reflection of self remained in the model after being entered. Unlike the case for self rated health, however, one variable concerning neighbourly social support did remain in the model upon addition of that block of variables. Previous effects remained similar, and in addition, respondents who reported that their neighbours were (very) unfriendly were 2.6 times (p<0.05) more likely to have felt downhearted and blue a good bit of the time in the two weeks before the interview.

Upon addition of general social support and stress variables to the model, however, the three housing variables (tenure, hate to be at home, and neighbour friendliness) lost their significance. So in the final analysis, respondents were more likely to report feeling downhearted and blue a good bit of the time or more if they: lived longer in their neighbourhood (OR=1.05, p<0.05); reported their housework duties to be somewhat or quite a strain (OR=5.55, p<0.001); reported that they did not have somebody that could help them if they needed it (OR=9.28, p<0.001); and reported that they were constantly under stress a good bit of the time or more in the two weeks before the interview (OR=5.26, p<0.001).

**DISCUSSION**

The findings of this paper lend support to the hypothesis that features of the domestic environment, especially as they pertain to the exercise of control and the experience of demand, are significant predictors of self reported general and mental health status. Because of the cross sectional nature of the study, of course, it is impossible to be certain that the direction of causality in the relation between housing and

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Figure 5  (A) Housing control and health. (B) Housing control and mental health. *p<0.05, **p<0.01, ***p<0.001.
health is reversed. Previous longitudinal studies, however, have shown that the contribution of reverse causality to the socioeconomic gradient in health is small.\textsuperscript{24–25} Bivariate analyses that tested for the existence of gradients in various housing demand and control factors, including housing tenure, showed relations with self-rated general and mental health, consistent with previous research.\textsuperscript{26–27} In multivariable analyses, demand and control factors were strong and significant contributors to logistic regression models for both health outcomes. The influence of housing demand and control variables superseded a well-known correlate of health status, educational attainment, further attesting to their importance.

The other main hypothesis investigated in the foregoing, that meaningful dimensions of housing are associated with health status, found support in bivariate analyses without controls, but did not contribute to multivariable models. In the case of self-reported general health status, strong and statistically significant evidence of graded relations between meaningful dimensions of housing was evident in bivariate analyses, and similar but weaker associations were observed between meaningful dimensions of housing and the mental health measure. In the multivariable analyses, meaningful dimensions of housing were not significant contributors to models for either health outcome.

Objective measures of housing, such as crowding and length of residence in dwelling or neighbourhood were not associated with either measure of health status in bivariate analyses. The failure of crowding to show an association with health contradicts a longstanding belief in health research. But in a post-epidemiological transition context, where the primary burden of illness is non-infectious conditions, this is a logical result.

This study has made a distinction between material and meaningful dimensions of housing, but in a number of instances, a given variable could be interpreted to be either meaningful or material. Housing tenure is an excellent example. On the one hand, the distinction between owner-occupiers and renters often represents a substantial cleavage in material wealth, property rights, and control over everyday life circumstances. At the same time, however, many Western societies also ascribe a great deal of meaning and prestige to home ownership, which may have a simultaneously positive effect.\textsuperscript{26–28} It follows that the distinction between material and meaningful (roughly synonymous with “psychosocial”) dimensions of socioeconomic status may be an artificial one and that the wider debate between material and psychosocial pathways\textsuperscript{29–30} may be falsely dichotomised concepts that are in fact fundamentally interdependent.

It is worth noting that the strength and significance of housing demand and control variables in the multivariable

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure6.png}
\caption{(A) Housing, identity, status, and health. (B) Housing, identity, status, and mental health. *p<0.05, **p<0.01, ***p<0.001.}
\end{figure}
### Table 2  Housing and self reported health logistic regression analysis

<table>
<thead>
<tr>
<th></th>
<th>Age only</th>
<th>Sociodemographic</th>
<th>Housing</th>
<th>Demand/control</th>
<th>Meaning</th>
<th>Neighbours</th>
<th>Social support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.19 (1.02 to 1.39)*</td>
<td>1.08 (0.91 to 1.29)</td>
<td>1.18 (0.98 to 1.42)</td>
<td>1.2 (0.99 to 1.45)</td>
<td>1.2 (0.99 to 1.45)</td>
<td>1.2 (0.99 to 1.45)</td>
<td>1.16 (0.95 to 1.41)</td>
</tr>
<tr>
<td>Gender (female)</td>
<td>1.14 (0.64 to 2.01)</td>
<td>1.13 (0.63 to 1.99)</td>
<td>0.90 (0.49 to 1.66)</td>
<td>0.90 (0.49 to 1.66)</td>
<td>0.90 (0.49 to 1.66)</td>
<td>0.90 (0.49 to 1.66)</td>
<td>0.92 (0.49 to 1.72)</td>
</tr>
<tr>
<td>Education (high school)</td>
<td>0.26 (0.11 to 0.60)**</td>
<td>0.28 (0.12 to 0.64)**</td>
<td>0.43 (0.17 to 1.09)</td>
<td>0.43 (0.17 to 1.09)</td>
<td>0.43 (0.17 to 1.09)</td>
<td>0.43 (0.17 to 1.09)</td>
<td>0.46 (0.17 to 2.0)</td>
</tr>
<tr>
<td>Tenure (rent)</td>
<td>2.11 (1.11 to 3.99)*</td>
<td>1.99 (1.04 to 3.82)*</td>
<td>1.99 (1.04 to 3.82)*</td>
<td>1.99 (1.04 to 3.82)*</td>
<td>1.99 (1.04 to 3.82)*</td>
<td>1.99 (1.04 to 3.82)*</td>
<td>1.92 (0.99 to 3.71)</td>
</tr>
<tr>
<td>Hate to be at home</td>
<td>1.18 (0.98 to 1.42)</td>
<td>2.09 (1.11 to 3.93)*</td>
<td>2.09 (1.11 to 3.93)*</td>
<td>2.09 (1.11 to 3.93)*</td>
<td>2.09 (1.11 to 3.93)*</td>
<td>2.09 (1.11 to 3.93)*</td>
<td>2.29 (1.20 to 4.39)*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.94 (0.93 to 4.05)</td>
<td>1.94 (0.93 to 4.05)</td>
<td>1.94 (0.93 to 4.05)</td>
<td>1.94 (0.93 to 4.05)</td>
<td>1.94 (0.93 to 4.05)</td>
<td>1.94 (0.93 to 4.05)</td>
<td>1.94 (0.88 to 4.06)</td>
</tr>
<tr>
<td>−2 log likelihood</td>
<td>416.541</td>
<td>354.846</td>
<td>349.354</td>
<td>322.294</td>
<td>322.294</td>
<td>322.294</td>
<td>306.596</td>
</tr>
<tr>
<td>p^2</td>
<td>N/A</td>
<td>0.148</td>
<td>0.161</td>
<td>0.226</td>
<td>0.226</td>
<td>0.226</td>
<td>0.264</td>
</tr>
</tbody>
</table>

*p<0.05, **p<0.01, ***p<0.001.

### Table 3  Housing and mental health logistic regression analysis

<table>
<thead>
<tr>
<th></th>
<th>Age only</th>
<th>Sociodemographic</th>
<th>Housing</th>
<th>Demand/control</th>
<th>Meaning</th>
<th>Neighbours</th>
<th>Social support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.87 (0.71 to 1.06)</td>
<td>0.86 (0.69 to 1.06)</td>
<td>0.79 (0.6 to 1.04)</td>
<td>0.78 (0.59 to 1.04)</td>
<td>0.78 (0.59 to 1.04)</td>
<td>0.78 (0.59 to 1.04)</td>
<td>0.74 (0.54 to 1.007)</td>
</tr>
<tr>
<td>Gender (female)</td>
<td>1.02 (0.55 to 1.87)</td>
<td>0.97 (0.52 to 1.78)</td>
<td>0.75 (0.39 to 1.44)</td>
<td>0.75 (0.39 to 1.44)</td>
<td>0.74 (0.38 to 1.43)</td>
<td>0.75 (0.36 to 1.53)</td>
<td>0.75 (0.36 to 1.53)</td>
</tr>
<tr>
<td>Education (high school)</td>
<td>0.52 (0.17 to 1.58)</td>
<td>0.64 (0.21 to 1.96)</td>
<td>1.47 (0.42 to 5.22)</td>
<td>1.47 (0.42 to 5.22)</td>
<td>1.59 (0.46 to 5.53)</td>
<td>2.18 (0.47 to 10.1)</td>
<td>3.97 (0.78 to 19.8)</td>
</tr>
<tr>
<td>Tenure (rent)</td>
<td>1.99 (0.96 to 4.11)</td>
<td>2.13 (1.01 to 4.49)*</td>
<td>2.13 (1.01 to 4.49)*</td>
<td>2.12 (1.005 to 4.46)*</td>
<td>1.86 (0.85 to 4.04)</td>
<td>1.86 (0.85 to 4.04)</td>
<td>1.86 (0.85 to 4.04)</td>
</tr>
<tr>
<td>Length of residence in neighbourhood (years)</td>
<td>1.03 (1.002 to 1.07)*</td>
<td>1.03 (1.001 to 1.07)*</td>
<td>1.03 (1.001 to 1.07)*</td>
<td>1.04 (1.002 to 1.07)*</td>
<td>1.05 (1.01 to 1.08)*</td>
<td>1.05 (1.01 to 1.08)*</td>
<td>1.05 (1.01 to 1.08)*</td>
</tr>
<tr>
<td>Hate to be at home</td>
<td>2.42 (1.24 to 4.72)**</td>
<td>2.42 (1.24 to 4.72)**</td>
<td>2.49 (1.27 to 4.86)*</td>
<td>1.99 (0.95 to 4.15)</td>
<td>1.99 (0.95 to 4.15)</td>
<td>1.99 (0.95 to 4.15)</td>
<td>1.99 (0.95 to 4.15)</td>
</tr>
<tr>
<td>Strain of housework</td>
<td>7.3 (3.29 to 16.1)**</td>
<td>7.3 (3.29 to 16.1)**</td>
<td>7.14 (3.21 to 15.9)**</td>
<td>5.59 (2.31 to 13.5)**</td>
<td>5.59 (2.31 to 13.5)**</td>
<td>5.59 (2.31 to 13.5)**</td>
<td>5.59 (2.31 to 13.5)**</td>
</tr>
<tr>
<td>Neighbour friendliness (unfriendly / very unfriendly)</td>
<td>2.6 (1.19 to 5.66)*</td>
<td>2.6 (1.19 to 5.66)*</td>
<td>2.6 (1.19 to 5.66)*</td>
<td>2.6 (1.19 to 5.66)*</td>
<td>2.6 (1.19 to 5.66)*</td>
<td>2.6 (1.19 to 5.66)*</td>
<td>2.6 (1.19 to 5.66)*</td>
</tr>
<tr>
<td>Have someone to help when you need it (no)</td>
<td>9.28 (2.95 to 29.2)**</td>
<td>9.28 (2.95 to 29.2)**</td>
<td>9.28 (2.95 to 29.2)**</td>
<td>9.28 (2.95 to 29.2)**</td>
<td>9.28 (2.95 to 29.2)**</td>
<td>9.28 (2.95 to 29.2)**</td>
<td>9.28 (2.95 to 29.2)**</td>
</tr>
<tr>
<td>Constantly under stress (good bit of time or more)</td>
<td>5.35 (2.61 to 10.99)**</td>
<td>5.35 (2.61 to 10.99)**</td>
<td>5.35 (2.61 to 10.99)**</td>
<td>5.35 (2.61 to 10.99)**</td>
<td>5.35 (2.61 to 10.99)**</td>
<td>5.35 (2.61 to 10.99)**</td>
<td>5.35 (2.61 to 10.99)**</td>
</tr>
</tbody>
</table>


p^2: N/A, 0.11, 0.127, 0.207, 0.207, 0.221, 0.33

*p<0.05, **p<0.01, ***p<0.001.
That each meaningful dimension of housing was captured by another measure in this study. Secondly, it is possible that the mean- 

Key points

1. Housing is a significant engine of social inequality that has both material and psychosocial dimensions that may contribute to health differences.
2. Self rated health was associated with housing tenure, housing demand, and housing control, after controlling for age, gender, education.
3. Mental health was associated with housing tenure, housing control, housing demand, and neighbour friendliness, after controlling for age, gender, education.
4. Housing effects did not contribute to health as strongly as assessed social stress and self support.
5. Housing factors may operate both directly and indirectly to modify the underlying factors shaping health status, like social support and stress.

analysis was attenuated by the addition of measures of social support and self reported stress. The result for respondents’ experience of their home as a place of refuge was mixed. The variable created from a self rating on the statement “can’t stand to be at home sometimes,” maintained significance after the addition of social support and stress variables in the case of general self reported health, but lost significance in the case of the mental health measure.

The only housing related variables to occupy a strong and significant place in the multivariable analyses, after the addition of social support and stress variables, were “hate to be at home” (a measure of home as a refuge) and self rated demand of housework chores. As noted above, the pattern of reporting on strain of housework was strongly gendered, with women far more likely to rate their weekly housework as “a strain” or “quite a strain”. This finding points to the need for future research to adopt a more explicitly gendered stance in the analysis of health effects of demand and control in domestic environments, but also with reference to work strain, as in the “double duty” hypothesis.11 12

The dominance of social support and self reported stress in predicting general and mental health status is not too surprising, given the consistency of associations between social sup- port and health and stress in the literature. That social support and stress “drown out” the effects of some housing demand and control variables, however, does not minimise the potential importance of the latter. It is plausible that interventions designed to increase control and reduce demand in the domestic environment could reduce overall levels of stress and enhance social support. Housing factors, in other words, may operate both directly and indirectly to modify the underlying factors shaping health status, like social support and stress.

The failure of meaningful dimensions of housing to reach statistical significance in multivariate analysis is somewhat paradoxical considering their statistically significant bivariate relation to general self rated health. Several possible explanations could be advanced. Firstly, it is possible that the meaningful dimensions of housing have been inadequately measured in this study. Secondly, it is possible that the meaningful dimensions of housing are captured by another variable, for example, housing tenure. Finally, it is possible that each individual dimension of the meaning of home (feeling of belonging in neighbourhood, home as a reflection of self, pride in dwelling, pride in neighbourhood) is not a universally relevant construct, but it may still be that meaningfulness of home in general is relevant. This is another area in need of further study, especially given claims about the importance of the meaning ascribed to material factors in the social production of health.11 Meaning, however, is created not just through its ascription to income, educational attainment and place in the job hierarchy, it is also ascribed to the materiality of individuals’ everyday life. Housing—central as it is as an expression of so many important social norms, economic security factors, and cultural symbols—is likely to be a pivotal feature of any understanding of the role of meaning, as well as materiality, in the social production of health.

REFERENCES

7. Sapolsky R. One secret of health is more straightforward than you might think: money.