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The health impacts of women's low control in their living environment: A theory-based systematic review of observational studies in societies with profound gender discrimination

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ABSTRACT

We conducted a systematic review of observational evidence on the health impacts of women's low control/autonomy in the living environment in societies with profound gender discrimination and gender bias. Thirty observational studies of varying methodological quality were included. Overall, the evidence suggests that women's lower control or autonomy (for example lack of freedom of movement outside the home, lack of authority to access healthcare for sick children) was associated with poorer mental and physical health for women and higher morbidity and mortality for their children, after adjusting for their socioeconomic circumstances. Further studies are needed to disentangle and understand the pathways between low control and health outcomes in contexts of profound gender discrimination. This systematic review has highlighted the general low quality of the evidence base on this research question. It identifies the pressing need for high quality, longitudinal studies in the future.

1. Introduction

The proposition that the control that people have over their own lives is important for the health of individuals and societies is becoming more widespread in the public health and development literature (Whitehead et al., 2016). The Nobel Laureate, Amartya Sen, concludes:

"*the success of an economy and of a society cannot be separated from the lives that members of the society are able to lead. Since we not only value living well and satisfactorily, but also appreciate having control over our own lives.*" (Sen, 2003).

Both Sen and Marmot argue that control over your own life is a crucial determinant of health, well-being, and longevity (Sen, 1999a; Marmot, 2004). Furthermore, the global Commission on Social Determinants of Health (CSDH) concluded that inequalities in level of control and participation play a big part in generating social inequalities in health (CSDH, 2008).

There is a reasoned set of theories about how low control could lead to poorer health and contribute to inequalities in health (Whitehead et al., 2016), but what about the empirical evidence? There is a relatively strong body of observational evidence relating to the work environment, where robust measures of 'job demand' (the pressures of the workload) and 'job control' (degree of autonomy/latitude in managing that workload) have been developed in high income country contexts (Karasek and Theorell, 1990; Demerouti et al., 2001). These measures try to quantify 'actual' level of control that the employees experience in their jobs, rather than merely their perceptions or beliefs about how much control they feel they have. These studies generally show that high job demands coupled with low job control constitute health-damaging stressors that may lead to mental or physical ailments such as CVD (Van der Doef and Maes, 1999; Kuper and Marmot, 2003; Kuper et al., 2005; Bosma et al., 2005; Theorell et al., 2015). There is evidence that this combination of high demand but low control is more

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common in lower skilled jobs, thereby providing a mechanism for generating inequalities in health between different occupational groups (Marmot et al., 1997).

The literature on the health effect of control in the living environment is less well developed and disparate, compared with the formal work environment. By 'living environment' we mean the households, communities and societies in which people live and go about their daily lives outside paid work. It is much more difficult to devise the equivalent measures of 'actual' control relating to the relatively unstructured setting of the living environment and to disentangle impact of control on health from all the other influences.

One approach has been to study the most severe forms of restricted control in the living environment: the limitations placed on women in societies with profound gender discrimination and gender bias (i.e. preference for sons). For millions of women in some low and middle-income countries with this profound gender discrimination, women's lives are highly restricted. They need a male relative's permission for all kinds of everyday caring activities, such as seeking healthcare for themselves and their children and going outside the family compound for any reason, even visiting other family members. They need to be accompanied by a male relative on such excursions outside their home. Women's access to schooling, to paid employment in the formal labour market, to food and nutrition may be severely limited.

Population health theories suggest that such lack of control and narrowly circumscribed autonomy in the living environment may have adverse effects on women's health and the survival of their children (Sen, 1999a, 1999b). One pathway between women's low control/limited autonomy and health is through reduced access to key determinants of health – including limited control over access to preventive and curative health services, education and paid employment opportunities, food and nutrition, fertility and reproductive rights. In turn, this reduced access to determinants of health may lead to poorer health including higher levels of anxiety and depression, malnutrition, health risks from greater numbers of pregnancies and childbirth, and domestic violence against women. Survival of the women's children may be adversely effected by not being allowed to take a sick child to hospital or for immunisations and other preventive procedures. In addition, in societies with marked son preference, lower female survival rates may also occur through mechanisms such as neglect or infanticide of girl babies and, in recent decades, as sex determination and selection technologies have become widely available, the practice of sex-selective abortion (Banister, 2004). Although women's autonomy in the living environment is generally constrained in cultures with profound gender discrimination, there is still variation across households and communities in the degree to which a woman is free to make decisions concerning key determinants of health. This variation provides opportunities for research to make comparisons between women with relatively low and high levels of control.

We set out to conduct a systematic review of empirical evidence of the impact of women's low control in the living environment on health outcomes, based on the hypothesised pathways between control and health in societies exhibiting profound gender discrimination.

2. Methods

2.1. Logic model and search strategy

The search strategy and interrogation of the evidence was guided by the logic model in Fig. 1. This shows the hypothesised pathways between the low status and constrained autonomy of women in their living environment in societies exhibiting profound gender discrimination/bias (column 1) and poorer health outcomes (column 4). Lower control/reduced power to use available resources that influence health (column 2) is hypothesised to act as a mediating factor, leading to adverse health-related effects (column 3), which result in poorer health outcomes for women and for their children (column 4). Son preference is shown in a separate pathway as having both direct and indirect effects on child survival.

We searched the electronic databases MEDLINE and MEDLINE In-Process, PsycINFO, Social Science Citation Index, and Conference Proceedings Citation Index - Social Sciences and Humanities for articles published between January 1980 and December 2016 on the association between women's levels of control in their living environment and health-related outcomes. We also drew on relevant results of an earlier search from a broader review of associations between control/empowerment and inequalities in health. Reference lists of included studies were scanned for relevant articles. We also requested data from researchers who had published previously on control and health-related outcomes. The Medline search strategy is available in Web Supplement/Appendix 1.

2.2. Inclusion and exclusion criteria

A study was only included if it reported empirical data from quantitative observational studies in low and middle-income countries (LMIC) with strong gender discrimination, that included all three of the following components:

a) ***Measured women's level of control in their living environment***. The measures had to indicate the degree of 'actual' control that the woman could exercise in her day-to-day life in the society in which she lived. For example, how much freedom of movement she had outside her home; whether she had autonomy to take a sick child for medical treatment. Many studies developed autonomy indices, combining several measures of what women reported they were able to do or not do in daily decision-making. Studies were excluded if they only measured perceived control or control beliefs, e.g. a general (non-specific) question about how much control a woman perceives that she has in her household. This exclusion also covered studies from the psychological literature that examined perceived 'locus of control' of individuals as a personality trait, without reference to the living environment or women's status in society. Studies which measured degree of control in the work environment were also excluded because they did not relate to the living environment. A substantial body of literature was located relating to the effects of son preference on survival, but these studies were excluded because they did not measure level of control.
b) ***Measured a health outcome***. Studies that measured women's physical or mental health or that of their children were included. Studies were excluded that only went as far as measuring intermediate health-related outcomes depicted in column 3 of Fig. 1(e.g. access to health care), but did not go on to measure the health outcome. Application of this criterion led to exclusion of a large body of studies that examined level of control and health-seeking behaviour, but failed to measure health outcomes.
c) ***Made some adjustment for socioeconomic factors/circumstances (SES) that may operate in the pathways to influence women's health.*** SES is a powerful determinant of population health in its own right, with the poverty and material disadvantaged suffered by poor rural women in low and middle-income countries causing higher morbidity and mortality directly. In addition, SES may act as a moderator in the pathway between control and health, or control may act as a mediator in the pathway between SES and health, as depicted in the logic model in Fig. 1. To be included, studies had to make some attempt to take SES circumstances and pathways into account.

2.3. Screening and review

Titles and abstracts of all records were independently screened by two reviewers to identify potentially eligible studies based on the initial

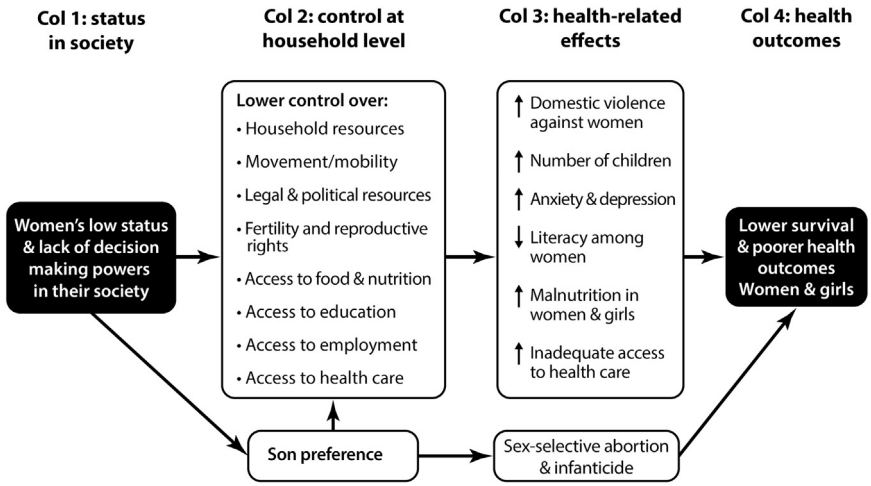

Fig. 1. Logic model of theoretical pathways from women's low control in their living environment to poorer health outcomes. Source: Adapted from (Whitehead et al., 2016).

inclusion and exclusion criteria above. All articles deemed potentially eligible were retrieved in full text. Two reviewers independently screened full text articles using a pre-designed and piloted eligibility assessment form and the software package Eppi-reviewer 4. Reasons for exclusion were recorded. Disagreements were resolved by consensus or by recourse to a third reviewer.

Studies that met the initial inclusion criteria were then critically appraised using a modified version of a tool tested for use in the appraisal of observational studies (Barker et al., 2000). Critical appraisals were conducted independently by two reviewers, with any disagreements resolved by consensus or by recourse to a third reviewer. Only those studies that met a set of pre-defined minimum quality criteria - in terms of selection bias, confounding, data collection and withdrawals/dropouts - were eventually included in the review (see Web Supplement/Appendix 2).

Reviewers extracted data from the included studies into pre-designed and piloted forms. Data extractions were checked for accuracy and completeness by a second reviewer. Extracted data included: study aims, study design, setting (country), measures of control/autonomy, adjustment for SES, health outcomes and main findings. The review team identified a typology of appropriate quantitative observational study designs (following the approach outlined by Petticrew and Roberts, 2003) to help organise the evidence (Web Supplement/Appendix 2), with evidence from higher quality studies being reported first and in more detail. Studies were assessed to determine whether they provided any empirical evidence on the relationship between women's level of control/autonomy in the living environment and health outcomes. Results were synthesised narratively.

3. Results

From an initial 2443 records, thirty studies on women's low control in the living environment and health outcomes in LMICs with strong gender discrimination were included. Fig. 2 shows the progression of studies through the review process.

All thirty studies measured the degree of control that women could exercise in the living environment in the societies in which they lived, including measures of their autonomy in making decisions about household resources, sexual and reproductive decision-making, freedom of movement and control over decisions to seek healthcare. Box 1 contains examples of the measures of women's control/autonomy used in the studies.

The observational designs employed in the studies ranged from a higher quality longitudinal study using individual level data, to lower quality single time-point cross-sectional designs. A range of health outcomes was measured for women and for their children (Tables 1, 2). All the included studies adjusted for socioeconomic characteristics of the study participants to varying extent.

3.1. Findings of higher quality studies

Three of the 30 studies in the review employed higher quality longitudinal study designs (Table 1) and are described in greater detail here.

Hossain et al. (2007) studied the effect of women's status on infant and child mortality in four rural areas of Bangladesh. Bangladesh is a society in which women's autonomy and status is severely constrained, coupled with strong son preference over the period of data collection. Observing that Bangladeshi women are the key household decision-makers for child health care and nutrition, the study tested the hypothesis that women's constrained authority and autonomy adversely affects the survival of their children, partly through reduced access and ability to use preventive and curative child health services. Data on individual women from a 1988 cross-sectional 'women's status' survey were used to construct indices of women's autonomy and authority and linked to data on the subsequent mortality of the surveyed women's children. Demographic and socioeconomic characteristics of the mother and household from previous surveys were also linked with the child data and used as statistical controls. Enhanced autonomy for women (an index including measures of freedom of movement to visit friends/family, and access to healthcare for sick children) was significantly associated with lower post-neonatal mortality of their children (RR = 0.88, $p < 0.05$). Enhanced household authority for women (an index of measures on household decisions on, for example, access to healthcare and education) was also associated with significantly lower mortality of their children aged 1–5 (RR = 0.84, $p < 0.05$). These relationships do not differ significantly by gender of child – suggesting, according to the authors, that the pronounced effect of selective gender bias on the survival of girls in Bangladesh is unrelated to the household autonomy and authority of their mothers. While lower autonomy was generally associated with women from poorer households, the exception was for the custom of purdah, the most extreme form of restriction on women in this society. Purdah was associated with richer, higher status, households. It was the higher status women who experienced the most extreme lack of autonomy over their lives to such an extent that purdah was treated as a marker for household wealth in this analysis. The custom was weakly associated with decreased neonatal mortality, but not postneonatal of under-5 survival of children.

Alemayehu et al. (2015) conducted a study in Ethiopia to examine the association between women's SES (measured by maternal education level) and infant death, and the possible mediation or moderation

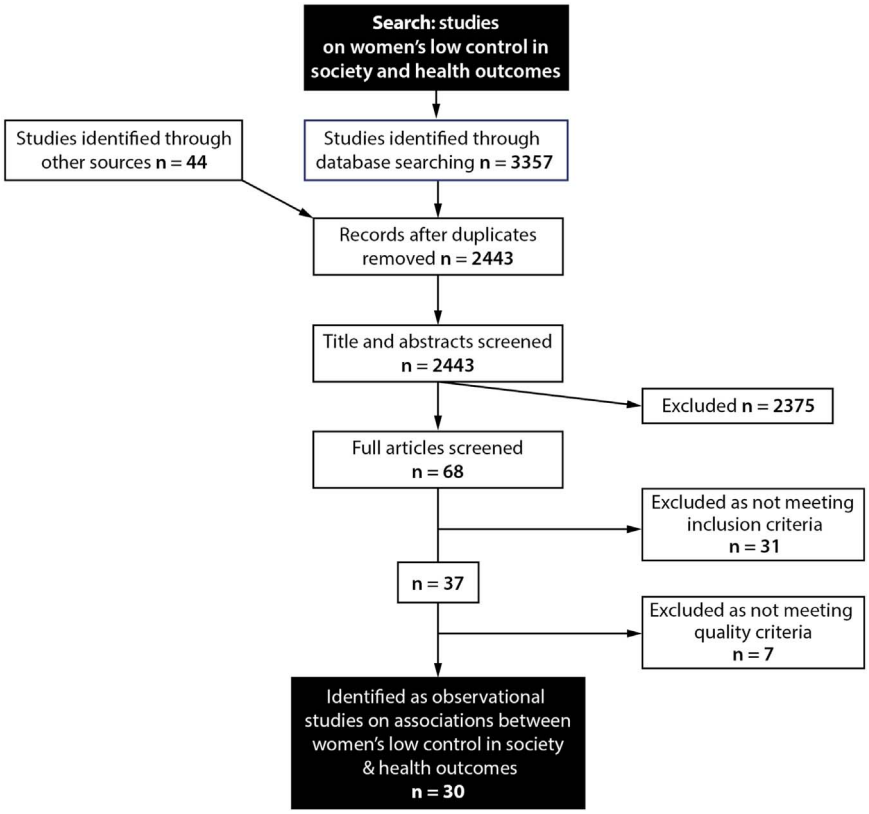

Fig. 2. PRISMA flow chart of the progression of studies through the review.

roles of women's empowerment and household wealth. Ethiopia is a highly male-dominated society, where women in general have a limited say in household-level decisions. A secondary repeat cross-sectional analysis was conducted on data from three rounds of the Ethiopian Demographic and Health Survey in 2000, 2005 and 2011, from which woman's and husband's educational status were separately analysed, and a woman's empowerment index and a household wealth index were constructed. Controlling for three confounders of age, type of residential area and husband's educational status, a woman's educational status was significantly associated with experience of infant death: the higher the maternal educational status the lower the risk of infant death. A mother who completed high school had 31% lower risk of experiencing infant death compared to a mother with no education. Woman's empowerment was associated with woman's educational level, after controlling for the three confounders above, with greater empowerment associated with higher educational level. Mediation analysis, controlling for the three potential confounders and the direct effect of woman's educational level, showed that empowerment partially mediated the education-infant death association: there was a 13% reduction in the initial association which was statistically significant ($p < 0.001$). In contrast, household SES, measured by the Wealth Index, played no part in mediating the education-infant death association. In a stratified analysis by wealth index, however, degree of wealth acted as an effect modifier: the effect of woman's education and of woman's empowerment on infant death was strongest among mothers from richer households and weakest among those from poorer households.

The third higher quality study was carried out in Egypt, representing an Arab Middle Eastern setting, in which senior male kin disproportionately control many resources and women's agency is severely restricted. This individual level longitudinal study analysed data from the 2005 Egypt Demographic and Health Survey and followed up a sample from that survey of 608 ever-married women in 2012. It examined the association between women's empowerment and their subsequent mental health, measured by generalised anxiety (Yount et al., 2014). It tested the hypotheses that 1) women's acquisition of pre-marital enabling resources will be negatively associated with their generalised anxiety at interview, and 2) that women's post-marital agency (exclusive ability to make important household decisions) will be positively associated with women's premarital enabling resources and will partially mediate the resources-anxiety relationship. The results confirmed the first hypothesis: women's higher schooling attainment, premarital paid work, later age at first marriage, and greater proximity to birth family were significantly associated with lower generalised anxiety. The second hypothesis concerning post-marital agency was only partially supported. Making exclusive decisions about visits to family was associated with lower generalised anxiety, whereas making exclusive decisions about personal healthcare and major household purchases were associated with higher generalised anxiety. The mediation analysis indicated that women's post-marital agency may partly mediate the relationship

Box 1.Examples of measures of women's control in the living environment in societies exhibiting strong gender discrimination.

1. **Household decision-making measures**: whether a woman had the final say in decisions on - large household purchases, day-to-day household purchases, health care for herself, and visits to family and friends (Desai and Johnson, 2005).
2. **Women's autonomy index**: whether a woman's husband allows wife to work outside home, go out with friends, work in a male environment (prior to marriage) (Qadir, 2011).
3. **Women's autonomy indices**: household decision making autonomy, child-related decision-making autonomy, financial autonomy, mobility autonomy (Shroff, 2011).

Table 1
Higher quality studies of women's control in their living environment and health outcomes.

Study (author, year)	**Country**	**Measures of women's control**	**Health outcome measures**	**Summary of results (statistically significant associations, $p \leq 0.05$)**	**Design and study quality**
Hossain et al. (2007)	Bangladesh	Household autonomy index; Household authority index	Neonatal, post-neonatal & childhood mortality (1 – 5 years)	Lower autonomy for women associated with poorer health and survival for children	Longitudinal, individual-level, linked data; higher quality
Alemayehu et al. (2015)	Ethiopia	Household decision-making index	Infant Mortality	Lower empowerment for women was associated with poorer infant survival	Repeat cross-sectional, individual-level data, retrospective recall of infant death; higher quality
Yount et al. (2014)	Egypt	Women's household autonomy measures	Generalised anxiety (women)	Mixed: Lower mobility autonomy associated with higher anxiety; Lower healthcare and major household purchasing autonomy associated with lower anxiety. No association between daily household purchase autonomy and anxiety.	Longitudinal, individual-level linked data; higher quality

between some of the measures of women's premarital enabling resources and their subsequent generalised anxiety. This study is unique in our review in incorporating a parallel qualitative study, which helped interpret the multivariate findings. The nuanced findings identified the importance of: pre-marital economic activity, particularly market work, for enhancing post-marriage agency and mental health; the women's birth family as a key extra-marital social resource, and the potential adverse costs of having decision-making power in terms of family reaction (Yount et al., 2014).

3.2. Findings from lower quality studies

Twenty-seven studies - one case-control study and 26 single time-point cross-sectional studies - provide lower quality, but largely consistent, evidence of associations between lower levels of control for women in their living environment and higher risks of adverse health outcomes (Table 2). These studies spanned a range of Asian, African and South American settings, exhibiting strong gender discrimination to a greater or lesser extent, and some, in addition, exhibiting son preference. Box 2 summarises the range of adverse health outcomes for women or their children associated with women's lower control/constrained autonomy in the studies in Table 2.

Twenty-one of the 27 lower quality studies found lower control was associated with poorer health outcomes, after adjustment for socio-economic status/circumstances. Three found mixed results, including beneficial and adverse associations across different measures of control and different health outcomes (Nankinga et al., 2016; Hadley et al., 2010; Dancer and Rammahan, 2009). Three studies found no significant associations (Ramaprasad et al., 2016; Sudha et al., 2007; Qadir, 2011). The overall conclusion is that these 27 lower quality studies provide weak evidence on their own, but taken together they point in the same general direction as the three higher quality studies: lower control for women associated with significantly higher risk of adverse health outcomes. More robust study designs are needed to draw firmer conclusions.

4. Discussion

Our systematic review identified thirty observational studies that met our strict inclusion criteria and examined the associations between women's control in the living environment and health outcomes in societies exhibiting profound gender discrimination, coupled in some countries with marked son preference. All the studies were conducted in low and middle-income countries. A consistent finding of nearly all the studies was that women's low control in their living environment was significantly associated with worse health outcomes for the women themselves or for their children, after adjusting for socioeconomic circumstances. Only three studies, however, were of higher quality to provide more robust evidence. These demonstrated a temporal relationship, with enhanced autonomy/empowerment of women associated with a subsequent reduced risk of infant and child mortality in Bangladesh (Hossain et al., 2007) and better mental health of the women in Egypt (Yount et al., 2014). Evidence of a mediation role for women's empowerment was also found: women's empowerment partially mediated the association between women's educational status and infant death in Ethiopia, while degree of household wealth acted as an effect modifier (Alemayehu et al., 2015). A partial mediating role for women's post-marital agency between premarital enabling resources and subsequent mental health was also found in Egypt (Yount et al., 2014).

4.1. Limitations of the reviewed studies

There were several limitations of the studies included in the review. Most of the studies were lower quality, single point cross sectional design that could not establish a temporal relationship: women's

Table 2
Lower quality Studies of women's control in their living environment and health outcomes.

Study (author, year)	**Country**	**Measures of women's control**	**Health outcome measures**	**Summary of results (statistically significant associations, p ≤ 0.05)**	**Design and study quality**
Fantahun et al. (2007)	Ethiopia	Household decision-making index	Childhood mortality	Lower decision-making for women associated with poorer survival for children	Prospective case-control; lower quality
Desai and Johnson (2005)	Benin, Malawi, Mali, Uganda, Zimbabwe, Egypt, India, Nepal, Haiti, Colombia, Nicaragua, Peru	Women's household decision-making authority measures	Child nutritional status (height-for-age); Childhood mortality (between 13 and 60 months)	Lower decision-making authority for women was associated with lower nutritional status in India and Malawi, and with higher mortality in Egypt, India, Mali and Nepal. No significant associations in other countries.	Cross-national ecological comparative (single point cross-sectional); lower quality
Hindin (2006)	Zimbabwe, Zambia, Malawi	Women's household decision-making measures	Women's anthropometric status (chronic energy deficiency/low BMI)	In Malawi, lower decision-making for women was associated with poorer health for women. In Zambia, lower decision-making for women was associated with poorer health for women in urban (but not rural) areas. No association in Zimbabwe	Cross-national ecological comparative (single point cross-sectional); lower quality
Agustina et al. (2015)	Indonesia	Maternal agency measures	Diarrhea and acute respiratory tract infections in children < 2 yrs of age	Low maternal agency associated with poorer child health (both outcomes)	Cross-sectional (two time-points); lower quality
Sudha et al. (2007)	India	Women's autonomy index; Economic autonomy index	Reproductive Tract Infections	No associations	Single time-point cross-sectional
Nankinga et al. (2016)	Uganda	Measure of women's involvement in decision-making about her own health care; Sexual empowerment index;	Women's sexually transmitted infections	Mixed: Lower decision-making for women about own health care was associated with higher STI rates. Lower sexual empowerment for women was associated with lower STI rates	Single time-point cross-sectional
Hadley et al. (2010)	Uzbekistan	Women's autonomy measures (ownership autonomy; purchasing autonomy; travel autonomy; body-sex autonomy; final decision autonomy)	Depressive symptoms; systolic & diastolic blood pressure (women)	Mixed: Greater travel autonomy associated with lower odds of depressive symptoms, greater decision autonomy associated with higher odds of depression. No autonomy-depression association with ownership autonomy or control over purchases.	Single time-point cross-sectional
Qadir et al. (2011))	Pakistan	Women's autonomy index	Women's psychological morbidity	No association.	Single time-point cross-sectional
Barchi (2012)	Botswana	Women's autonomy measures (freedom of movement, economic independence, control of household resources, household-related decision-making.	Women's self-reported health status (SRHS), depression, suicidal ideation	Lower autonomy for women (economic independence; control of household resources) was associated with lower women's SRHS, No associations between autonomy measures & depression or suicidal ideation	Single time-point cross-sectional
Mabsout (2011)	Ethiopia	Women's decision-making index	Women's low BMI; anaemia scores	Lower decision-making for women associated with poorer health for women	Single time-point cross-sectional
Hindin (2000)	Zimbabwe	Women's household decision-making measures	Women's anthropometric status (chronic energy deficiency/low BMI)	No say in decision-making for women associated with poorer health for women	Single time-point cross-sectional
Singh et al. (2015)	Democratic Republic of the Congo, Egypt, Ghana, Liberia, Mali, Nigeria, Uganda, Zambia	Women's household decision-making index	Women's low BMI	Low decision-making for women was associated with having low BMI	Single time-point cross-sectional (pooled data)
Sethuraman et al. (2006)	India	Women's empowerment measures (household decision-making, mobility)	Maternal malnutrition and anaemia; Child nutritional status (malnutrition),	Lower empowerment for women (both measures) was associated with poorer health for children (aged 6–24 months)	Single time-point cross-sectional
Mashal et al. (2008)	Afghanistan	Maternal autonomy measures (autonomy in seeking healthcare for herself and children)	Major child illness (acute diarrhea, acute respiratory infection); Child nutritional status	A lack of maternal autonomy was associated with poorer child health (growth retardation, acute respiratory infection)	Single time-point cross-sectional

(continued on next page)

Table 2 *(continued)*

Study (author, year)	**Country**	**Measures of women's control**	**Health outcome measures**	**Summary of results (statistically significant associations, p ≤ 0.05)**	**Design and study quality**
Rahman et al. (2015)	Bangladesh	Mother's decision-making autonomy measures	Child nutritional status (growth stunting, wasting, underweight)	No say in decision-making for women was associated with poorer child health	Single time-point cross-sectional
Chakraborty and Anderson (2011)	India	Maternal autonomy index	Low Birth Weight	Low maternal autonomy associated with poorer health for new-borns	Single time-point cross-sectional
Roushdy (2004)	Egypt	Women's investment in children's human capital decision-making measures (schooling and nutrition)	Child nutritional status (growth stunting)	No association between women's autonomy and child health	Single time-point cross-sectional
Shroff et al. (2009))	India	Women's financial and physical autonomy indices	Child nutritional status (growth stunting)	Lower autonomy for women associated with poorer health for children	Single time-point cross-sectional
Shroff et al. (2011)	India	Women's autonomy indices	Infant nutritional status (malnutrition, wasting)	Lower autonomy for women associated with poorer health for children	Single time-point cross-sectional
Ramaprasad et al. (2016)	India	Mother's decision-making autonomy measures	Child nutritional status (growth stunting, wasting, underweight)	No associations	Single time-point cross-sectional
Bose (2011)	India	Women's autonomy index (household decision-making; movement)	Child nutritional status (malnutrition); gender disadvantage in nutritional status (likelihood of girls being malnourished compared to boys)	Lower autonomy for women associated poorer health (higher malnutrition in all children), and with higher probability of girls being malnourished, compared to boys.	Single time-point cross-sectional
Brunson et al. (2009)	Kenya	Women's autonomy index	Child nutritional status (malnutrition)	Low autonomy for women was associated with poorer health for children aged 3–10 yrs. No association between women's autonomy and younger children's (aged 0–35 months) health.	Single time-point cross-sectional
Dancer and Rammohan (2009)	Nepal	Maternal autonomy measures (household decision-making; healthcare decision-making)	Child nutritional status (wasting; growth stunting)	Lower maternal autonomy associated with poorer health outcomes, particularly for girls.	Single time-point cross-sectional
Ross-Suits (2010)	Tanzania	Maternal autonomy measures (healthcare decision, financial autonomy)	Child nutritional status (malnutrition; growth stunting)	Low healthcare decision autonomy for women was associated with poorer child health outcomes (growth stunting). No associations between other variables.	Single time-point cross-sectional
Roy (2013)	India (state level)	Household decision-making measures	Neo-natal and Post neo-natal mortality	Lower decision-making for women associated with poorer health for infants	Single time-point cross-sectional
Hossain (2015)	Bangladesh	Measures of women's participation in household decisions; movement autonomy measures	Infant mortality	Lower decision-making for women was associated with higher infant mortality	Single time-point cross-sectional
David (1999)	Egypt	Personal autonomy measures	Childhood mortality	Lower autonomy for women associated with higher child mortality	Single time-point cross-sectional

Studies are ordered by health outcomes where possible (fourth column).

Box 2.Associations between low control for women and adverse health outcomes identified in single-point cross-sectional studies in Table 2.

Higher rates of:

- Infant, child and maternal mortality
- Malnutrition (for infants, children and women)
- Infant and child growth
- Gender disadvantage in childhood nutritional status/malnutrition (for girls)
- Low birth weight
- Anaemia (for women)
- Diarrhea and acute respiratory tract infections in children < 2 yrs of age

Lower levels of:

- Self-reported health status for women

control and health outcomes were measured at the same point in time. Conclusions that could be drawn from these studies were therefore limited to whether statistically significant associations were present, and the general direction of those associations, after adjusting for socioeconomic circumstances. We gave more weight in our review to the findings of the two individual level longitudinal studies and the one ecological longitudinal study, which attempted to establish temporal ordering and/or explore intervening mechanisms. More longitudinal studies of this nature are needed in future research.

Adjustment for confounders, mediators and effect modifiers was relatively crude in most studies. It is particularly important to adjust for differences in socioeconomic circumstances in the living environment as these are important determinants of population health in their own right (CSDH, 2008). All the included studies did attempt to adjust for socioeconomic circumstances or pathways (those that did not were excluded from the review), but the scope for unmeasured effects was still considerable.

In all studies, the conceptualisation and measurement of control was challenging. Most, however, developed proxies for women's control or autonomy that were clearly based on theory and succeeded to a degree in capturing actual or 'real' control, as opposed to general perceptions of control or control beliefs. Developing appropriate measures of actual control in the living environment is a key area for future research in this field to match the robust measures that have been developed in the work environment in high-income countries (e.g. Karasek and Theorell, 1990).

4.2. Limitations of this systematic review

Our systematic review had certain limitations, predominantly related to the strict inclusion and exclusion criteria, which restricted the number and nature of studies eventually included in the review.

First, the review did not cover the many studies on son preference and health, which relate to the pathway in the lower part of the logic model in Fig. 1. This is mainly because the studies did not measure women's level of control in their living environment and so did not meet essential criterion 'a' as specified in our Methods section. We did, however, locate over 100 studies on the impact of son preference on relative survival of female infants and children into adulthood, which are currently the subject of a separate systematic review.

Second, there is a large body of evidence linking low control to intermediate health-related outcomes, such as healthcare seeking behaviour, domestic violence, and use of contraceptive services. These reveal important information about potential mechanisms linking low control in the living environment to poorer health, but as the studies did not go on to measure health outcomes, they did not address our review question fully and were excluded.

Third, all the studies in the review measure women's control in the living environment within their households, but women also face constraints on their autonomy imposed by their communities or neighbourhoods in societies with profound gender discrimination. Our search (and helpful reviewers) identified some studies that, on the surface, analysed how community-level control affects women's health, but on assessment all were excluded for two main reasons. Most, if not all failed to measure control at the community level directly, but used measures of socioeconomic status, such as rates of women's educational attainment, wealth, or employment. These SES indicators are conceptually distinct from the notion of 'control' and, indeed, are known to be determinants of health in their own right, for which 'control' may act as a mediator in the pathway between SES and health outcomes. In addition, all the community-level studies that we located failed to measure health outcomes, but rather assessed intermediate outcomes, such as use of healthcare services. They were therefore excluded as not meeting the review's criteria and addressing the review question. This finding from the review highlights the gaps in the observational evidence on community-level control in relation to women's autonomy and health, and identifies the need for the development of robust measures of control at the community level for future studies.

4.3. Putting women's low control in context

Key mechanisms indicated in the higher quality studies in this review need further teasing out in the light of specific societal contexts. First is the finding that in the Ethiopian context that women's empowerment partially mediates the maternal education-infant death relationship, but still leaves the largest part of the mechanism unexplained (Alemayehu et al., 2015). The wealth of the household played no part in the mediation, but did act as an effect modifier in a very intriguing way: both empowerment and education had the strongest inverse association with infant deaths among women from the richest households and weakest among those from poorest households. One possible explanation is that poverty and material deprivation experienced by the women in the poorest households has such an overwhelming effect on their access to the pre-requisites for health that empowerment can do relatively little to counter the effects of this deprivation. For women in the richest households, however, where poverty is not blocking access to healthcare, education, employment and so on, then differences in women's power may play a greater role in influencing the observed health outcomes between women with different degrees of control in their daily lives. Other studies have postulated the reverse: that women's higher levels of autonomy will have a greater effect on children's health in poorer households where resources are severely constrained (Brunson et al., 2009). The nature of these differing mechanisms need unpicking further, and certainly point to the need for stratified analysis by SES in all such studies, as well as high quality qualitative studies to illuminate why the associations have developed.

Second, is the tricky issue of how to treat '*purdah*' in these analyses and how to interpret the results. In the Bangladeshi context, Hossain et al. (2007) contend that, while *purdah* can be seen as the most extreme manifestation of the subjugation of women, in practice the custom has been eroded in recent years. It has become increasingly associated with richer households, because the costs of *purdah* (additional clothing, transport, not being able to work outside the home) have become unsustainable for poorer households. In Hossain et al.'s analyses, the net effect of *purdah* is therefore taken to portray the effect of household economic status rather than women's level of control within the household. The finding that the index of purdah was weakly associated with lower neonatal mortality was speculated to be due to women in *purdah* acquiring access to antenatal and postnatal care that more deprived households could not afford. The effect wears off by the postneonatal and early childhood periods. Further studies, both quantitative and qualitative, are needed to disentangle the net effect of *purdah* from economic status.

Third, is the issue of whether women's greater autonomy can mitigate the effects of gender bias – son preference – and the selective deprivation of girls. In the Bangladeshi study, the hypothesis that the effects of gender bias on the autonomy and authority of mothers will be more harmful for the survival of girls than for boys was not supported (Hossain et al., 2007). The effect was similar for girls and boys. It may be that individual women's autonomy may be insufficient to affect the underlying dynamic that drives son preference in such a gender-biased society. On the policy front, this flags up the potential importance of societal level efforts to reduce or eliminate gender discrimination, which may then go on to influence the drivers of son preference. The health impacts of such societal level efforts need to be evaluated and, indeed, efforts in Bangladesh over the last two decades have shown marked success in improving the survival of girls, particularly poor girls who had the worst chances of survival, relative to rich girls and poor and rich boys (Bhuiya et al., 2001; Orton et al., 2016).

Finally, questions arise about the difficulties of conducting research of this nature and interpreting the results in the overarching societal context in which the reviewed studies took place. All the studies attempted to exploit the variation in levels of women's control or autonomy found in their study countries to assess associations with health outcomes. But it is likely that the degree of variation in women's autonomy is still relatively small in the societies with profound gender discrimination and gender bias. The variation may, therefore, be insufficient to detect an effect on health, even if such an effect is present. Given this constraint, it is surprising that so many studies were able to detect an association, even if modest. One suggestion for further studies to address this issue is to compare meaningful jurisdictions within a society, such as comparisons of the experience of women in Indian states, known to differ significantly in terms of women's rights and status.

5. Conclusion

The impetus for conducting research on women's low control in society and impact on health stems from knowledge of the very restricted lives in which many women live in some societies. This is due, for example, to extreme gender discrimination and ingrained cultural practices that limit women's freedom to go about their daily lives in their living environment (Sen, 1999a and 199b). The notion that low status and lack of control over decisions may have adverse effects on population health has been raised in the development literature as a key public health concern by Amartya Sen and others for many years (Sen, 1989, 2001; Wickrama and Lorenz, 2002).

The studies identified by this systematic review demonstrate serious efforts on the part of researchers to devise empirical measures that capture women's experiences of lack of control over their daily lives in the context of specific cultures and societies in which the women live. These measures represent methodological advances, but there is still a need for further refinement of such measures. These would feed into empirical studies that seek to understand the extent and nature of any health impact, as an aid to working out what can be done to prevent or ameliorate adverse health effects, as well as to empower women more directly. This systematic review is timely in identifying and synthesising the available empirical evidence, which does, indeed, show some disturbing health impacts, but also provides insights into the methods and measures that could be further developed to investigate this important issue.

This is the first theory-based systematic review of observational evidence of the health impact of low control of women in the living environment in societies with profound gender discrimination and gender bias. The evidence suggests that women's low control is associated with adverse health outcomes measured at the population level. Further studies, including in-depth qualitative investigations, are needed to disentangle and understand these pathways in greater depth.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.healthplace.2018.02.001.

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