Challenging categorical thinking: A mixed methods approach to explaining health inequalities

Abstract

"Categorical thinking" in social science research has been widely criticised by feminist scholars for conceptualising social categories as natural, de-contextualised, and internally homogeneous. This paper develops and applies a mixed-methods approach to the study of health inequalities, using social categories meaningfully in order to challenge categorical thinking. The approach is demonstrated through a case study of socio-economic (SES) inequalities in maternal healthcare access in Zambia.

This paper's approach responds to the research agenda set by intersectional social epidemiologists by considering potential heterogeneity within categories, but also by exploring the context-specific meaning of categories, examining explanations at multiple levels, and interpreting results according to mutually constitutive social processes.

The study finds that meso-level institutions, "health service environments", explain a large share of SES inequalities in maternal healthcare access. Women's work, marital status, and levels of "autonomy" have heterogeneous implications for healthcare access across SES categories. Disadvantaged categories and their reproductive behaviours are stigmatised as 'backwards', in contrast to advantaged categories and their behaviours, which are associated with 'modernity' and 'development'. Challenging categorical thinking has important implications for social justice and health, by rejecting framings of a specific category as problematic or non-compliant, highlighting the possibility of change, and emphasising the political and structural nature of progress.

1. **Introduction**

Social categories such as gender, socio-economic, or ethno-racial categories are key to analysing health inequalities quantitatively. However, the prevalence of "categorical thinking" in public health research has been widely criticised. In the maternal and child health literature, for example, lack of theory, ascribing explanation to categorical membership, and assumptions of homogeneity within categories have simultaneously led to findings that blame the victim and strip subjects of agency (Desai, 2000; Gabrysch and Campbell, 2009; Kumar, 2013). Raewyn Connell originally coined the term "categorical thinking" to denounce the operationalisation of gender in the social and medical sciences (Connell, 1987), though anthropologists have noted that "the mechanical concept of the social" in global health can affect all social categories (Adams et al., 2019, p. 3).

Categorical thinking exhibits several inter-related characteristics, which together discourage productive analysis of the explanations for health inequalities (Bauer, 2014). Firstly, the existence and definition of the category, as well as individuals' membership of a given category, are treated as 'obvious'/'self-evident'/'unproblematic' (Adams et al., 2019; Westbrook and Saperstein, 2015). Secondly, categories are seen as 'fixed'/'unchangeable'/'constant' across space and time (Adams et al., 2019; Connell, 2012). Thirdly, members of a given category are understood to be homogeneous and categorical dimensions as operating independently from each other (Crenshaw, 1989; Mohanty, 1984). Fourthly, categorical thinking focuses on differences between categories while ignoring social processes, e.g.: focusing on race rather than systems of racial oppression (Brewer et al., 2002; Choo and Ferree, 2010).

Challenging categorical thinking is important because failure to adequately explain inequalities results in policies with a programmatic focus on individual-level behaviour rather than structural changes (Adams et al., 2019; Bauer, 2014). Homogenising members of a category leads to policies designed for those who are relatively more advantaged or visible within a given category (Crenshaw, 1989). Categorical thinking focuses attention on fixing "problem" categories rather than systems of privilege and oppression (Connell, 2012). Finally, categorical thinking's inability to explain inequalities continues to "*reinforce the intractability of inequity*" (Bauer, 2014, p. 12).

Challenging categorical thinking in social research does not necessarily mean dispensing with social categories. Social categories structure social hierarchies and the resulting opportunities, constraints and self-image that people contend with in their daily lives (Anthias, 2013). Though they are not the ultimate explanation for inequalities, they have real effects, including on resource allocation (Anthias, 2013). The aim of this paper is to develop and apply a mixed methods approach for explaining health inequalities that uses social categories *meaningfully* in order to challenge categorical thinking. In line with this objective, an "inter-categorical" approach to intersectional complexity is applied. The focus is therefore on comparing diverse combinations of categories rather than deconstructing them or focusing on a single intersection of multiple marginalised categories (McCall, 2005).

This paper directly responds to the research agenda proposed by quantitative intersectional scholars in this field: Bauer (2014) and Evans (2019a) both separately emphasise the importance of using theory to guide analysis and interpret findings, and of considering explanations located at the structural level. Bauer further recommends analysing mutually constitutive social processes rather than categorical difference. Evans urges quantitative scholars to pay attention to the context-specific meanings and construction of categories.

This paper's approach is demonstrated through a specific empirical case: an analysis of socio-economic inequalities in access to facility-based childbirth in Zambia. This case was selected because categorical thinking is prevalent in public health research about countries in the "Global South" (Adams et al., 2019; Kumar, 2013). Assumptions about the uniformity and inevitability of economic and social development contained in modernization theories, and the construction of the formerly colonized as a uniform "other" for the purposes of colonial and neo-colonial projects, obscure the specificity of categorical meanings within time and space (Mohanty, 1984; Thornton, 2001). For example, Desai (2000) offers a powerful analysis of how the social category of maternal education has been essentialised in the literature on child mortality in the Global South, to the point where individual mothers' putative power and responsibility to ensure child survival was enshrined in World Bank policy in the 1990s. Some of the recent systematic reviews on the link between maternal education and child health continue to display elements of categorical thinking (e.g.: Forshaw et al., 2017; Kiross et al., 2019).

Intra- (and cross-) country inequalities in facility-based childbirth are much larger than inequalities in other primary care interventions, such as child immunisation (Hosseinpoor et al., 2011). Because the intrapartum period is the most risky stage for maternal survival, access to quality care in childbirth is particularly important (Campbell and Graham, 2006). While such care is typically only available in a health facility in many low- or lower-middle income countries, giving birth in a health facility is no guarantee of quality (Lohela et al., 2019). Zambia has high-quality geo-referenced secondary data on both facility childbirth and health facility infrastructure and staffing. This enables measurement of a meso-level institution that might explain healthcare access inequalities: health service environments.

This study answers three research questions:

1. What are the meanings of socio-economic categories for Zambian women who are pregnant or giving birth?
2. To what extent are socio-economic inequalities in access to a facility delivery explained by individual and household-level attributes versus health service environments?
3. Is there heterogeneity in how health service environments or individual attributes are associated with facility delivery across socio-economic categories?

In order to present this study's approach in the most compelling way, methods are only briefly described in the body of the paper. Detailed explanation and justification of methods, including limitations, are provided in Appendix 1-6.

2. A mixed methods approach to challenging categorical thinking

This paper's approach combines six non-consecutive steps to explain health inequalities while challenging categorical thinking. The approach challenges the notion that the reason for health(care) inequalities is obvious by:

(1) *Grounding empirical analysis in theory.*

(2) *Using quantitative data at multiple levels.*

The approach challenges the decontextualized nature of categories by:

(3) *Examining the context-specific meanings of socio-economic categories.*

(4) *Contrasting quantitative results based on different dimensions of socio-economic status.*

The approach challenges the assumption that there is homogeneity within categories, by:

(5) *Explaining health inequalities while allowing for heterogeneous effects.*

Finally, it challenges categorical thinking's focus on differences between categories to emphasise the mutually constitutive macro-level social processes creating categories and the inequalities between them, by:

(6) *Framing results within the intersectional macro-level context.*

2.1. Grounding empirical analysis in theory

Categorical thinking implicitly assumes that the reasons behind health inequalities are obvious and tautologically explained by categorical "membership". While there have been numerous theoretical developments to explain health inequalities (e.g.: fundamental causes (Link and Phelan, 1995), psychosocial (Marmot, 2004), neo-materialist (Smith et al., 1994), and eco-social theories (Krieger, 1994)), many empirical studies in public health research, including on health inequalities, remain a-theoretical (Hammarström and Hensing, 2018; Øversveen et al., 2017). Use of theory can prompt new research questions (Hancock, 2019), and makes underlying assumptions explicit (Bauer, 2014). This improves the quality of debate and accelerates progress towards reducing inequalities (Evans, 2019a; Krieger, 2001).

The research paradigm informing this study is intersectionality. Intersectionality originates in the scholarly contributions of Black feminist scholars and activists in the US, in reaction to feminist thought that emphasised the experiences of White women, and critical race scholarship that focused on the experiences of Black men (e.g.: Combahee River Collective, 1977; Crenshaw, 1989; hooks, 1982; Lorde, 1984). While other theoretical perspectives could be valuable, depending on the empirical case, intersectionality is particularly well suited to challenging categorical thinking because its main

theoretical premise is that "*analytic categories and concepts […] are socially constructed and mutually modifying*" (Sigle, 2016, p. 222; emphasis added).

From the insight that categories are socially constructed, intersectional scholars direct their attention to the social processes constructing these categories as an explanation for the inequalities between categories, rather than to assumed differences between the categories themselves. Because these processes are social, they and the categories they create are analysed through the lens of a specific time and place, shaped by prior history. It is further posited that these social processes are embedded within institutions, at multiple levels, and in multiple sites (e.g.: national policies, workplace, family, etc.) (Bauer, 2014; Gkiouleka et al., 2018). People are not fully constrained by these institutions but have some agency, both in terms of the social position they assume and how they affirm or resist these social processes. The second key insight is that these social processes are mutually modifying – for example, racist institutions do not operate in the same way for men and women, but interact with patriarchal power structures and gendering processes to modify the workings of racism according to gender (Choo and Ferree, 2010). While there are many possible ways to analyse intersectional complexity, this study is primarily "inter-categorical", focusing on the intersections between categories (McCall, 2005).

2.2. Using quantitative data at multiple levels

An analytical approach that includes socio-structural levels is important to challenge categorical thinking's assumption that inequalities are explained at the individual level by categorical "membership" or individual attributes correlated with it (Choo and Ferree, 2010). Such an approach also engages with intersectional theory, which highlights the importance of institutions.

In this empirical case, relevant meso-level institutions are conceptualised as "health service environments". These are multidimensional environments defined at the interface between population needs and health services. Health service environments summarise how accessible health services are, both geographically and socially, given systems of discrimination connected to the social meanings of socio-economic status (SES) categories. The five dimensions are: affordability, cognitive accessibility, psychosocial accessibility, geographic accessibility, availability, and perceived quality of care (Sochas, 2020) (Appendix 2, Table A2.1).

I use Geographic Information Systems to link birth-level data (Zambia DHS 2013-14) to health facility-level data (SARA 2010), thereby allowing explicit modelling of micro (individual and household attributes) and meso levels of analysis (health service environment). The 2010 Service Availability and Readiness Assessment (SARA) is a census of all health facilities in 17 out of Zambia's 72 districts. The 2013-14 Zambia Demographic Health Survey (DHS) is a nationally representative two-stage cluster sampling household survey of women of reproductive age (Appendix 1).

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Quantitative variables are briefly presented in Table 1 and further detailed in Appendix 2. The health service environment variables have been previously validated in a published study (Sochas, 2020). The selection and construction of variables were informed by 12 key informant interviews (KIIs) organised in July-August 2017 with individuals holding senior roles in policy, academic and clinical care (Appendix 4) and a Zambia-focused literature review of maternal healthcare access. The variables operationalise the accessibility dimensions as barriers: i.e. there are coded 1 if there is no accessibility along that dimension.

Due to secondary data limitations, the affordability, cognitive, and psychosocial barriers could not be directly measured at the intersection of population needs and health service provision. Instead, they are measured here according to characteristics that are discriminated against (or not accommodated) in the Zambian health system. The cognitive barrier was operationalised as having a birth order of two or higher because findings from the KIIs and the literature review showed that experienced mothers were more likely to believe that they were not at risk of obstetric complications, which is a misconception (e.g.: Mulenga et al. 2018). The psychosocial barrier was operationalised as having a birth order of six or above because these women were likely to be discriminated against by healthcare workers who saw them as irresponsible for having "too many" children (Sochas, 2019).

Table 1 here

2.3. Examining context-specific meanings of SES

Analysing categorical difference in a way that ignores the specificities of time and place is one of the hallmarks of categorical thinking (Adams et al., 2019), yet this part of the categorical thinking critique is most ignored by quantitative intersectional studies (Evans, 2019a). Analysing the meanings of categories in a specific place highlights the social construction of categories, a process which is itself implicated in the creation of health inequalities. Doing so connects the micro or meso-level analysis to macro social processes that are often missing from quantitative models (Evans, 2019a).

The context-specific meanings of different SES dimensions were analysed using semi-structured interviews with a diverse sample of 42 women who had given birth in the previous year (Appendix 5). Ethical clearance was obtained from the London School of Economics Ethics Committee [ref. 000576] and the University of Zambia Biomedical Research Ethics Committee [ref. 005-06-17]. These interviews were carried out in May-June 2018 in a specific district, Mansa (Luapula Province). Respondents were recruited using a mix of purposive and convenience sampling from nine infant health clinics across urban and rural areas. The interviews were conducted in Bemba by two Zambian female interviewers within the perimeter of the clinic, in an aurally private location. Interviews covered women's own recent experience of pregnancy and childbirth and their views on how women with different socio-

demographic characteristics might have different experiences. This second theme was supported by the use of verbal and visual vignettes (Appendix 5). The audio recordings were directly translated into English transcripts by the interviewers and two research assistants. For the purpose of this study, I retrieved transcript passages that I coded as discussing differences in pregnancy, birth, or general life experience according to SES. I then conducted a thematic analysis of these, separately for education, wealth, and rural-urban differences (Appendix 5).

2.4. Contrasting quantitative results based on different dimensions of SES

In this study, SES is defined as the extent to which individuals, households, and communities have access to *material resources* (money, infrastructure), as well *prestige* or influence (Krieger et al., 1997). Material resources and prestige give people better control and autonomy over their own life, as well as power over others. Many studies have shown that different measures of SES, such as wealth, income, profession or education are not interchangeable within and across contexts (Braveman et al., 2005; Regidor, 2006). Contrasting results across different measures of SES reveals the specific meaning of each of these SES measures, as well as what they have in common. This process improves our understanding of these categories and triangulates findings.

In this study, SES is quantitatively measured using three variables: the rurality of the DHS sampling clusters, household wealth, and mother's education (Table 2) (Appendix 2). These three concepts are important and inter-related markers of SES in Zambia (Cole et al., 2015; Evans, 2018a; Phiri and Abebe, 2016; White and Jha, 2018), and are strongly associated with access to maternal healthcare (Pons-Duran et al., 2016). Occupation of the mother was considered but not selected because of the differential meaning of work across SES (Section 3.3). Income is not available as a measure from the DHS, though some authors argue that wealth is a more appropriate measure in agricultural settings (Brockington, 2019). SES variables were operationalised in a binary way as this is required by K-O-B decomposition.

Table 2 here

2.5. Explaining health inequalities while allowing for heterogeneous effects

This study uses a decomposition method in order to *explain* inequalities. This explanatory objective challenges categorical thinking assumptions that inequalities require no further explanation than categorical membership. Furthermore, intersectionality theory posits that power structures are mutually modifying: the institutional constraints they create are not likely to have the same effect or meaning for everyone. While heterogeneous effects can be quantitatively explored using many different tools such as interaction terms, multi-level analysis of discriminatory accuracy and individual level heterogeneity (MAIHDA), and others (Bauer and Scheim, 2019; Evans, 2019b; Sigle-Rushton,

2014), this study uses a decomposition method that also allows for heterogeneous effects: K-O-B decomposition (Appendix 3).

I first explain the "explanatory objective" of decomposition with reference to concentration index (CI) decomposition, a popular method in global health studies that does not allow for heterogeneous effects. CI decomposition aims to quantify the extent to which different variables explain an inequality. A given variable explains a large share of the inequality in healthcare access between rich and poor if: (1) The variable is strongly associated with healthcare access, controlling for other variables (e.g.: "Those who live closer to the facility are more likely to access healthcare"); and if: (2) This variable is unequally distributed across rich and poor ("Poor women live further away from the health facility than those who are not poor").

K-O-B decomposition is a type of decomposition method that further asks – do these explanatory variables have the same "effect" on access across groups? ("Does distance discourage access for the poor to a greater extent than for the rich?"). The results of K-O-B decomposition are therefore presented in two parts: the contribution of variables to "Levels" - or compositional - inequality ("Are the determinants of healthcare access unequally distributed between rich and poor?") and the contribution of variables to "Effects" inequality ("Does the association of each variable with healthcare access differ across rich and poor?)".

2.6. Framing results within the intersectional macro context

The quantitative analysis presented in this study is exclusively focused on women, which prevents quantitative explanations related to gender relations. The data is drawn from contemporary Zambia (rather than multiple settings across time and/or place), which precludes a quantitative analysis of enduring colonial or neo-colonial influences (Connell, 2012). Feminist and critical race scholars have questioned these analytical practices and the real world implications they have in terms of framing solutions to health inequalities as technocratic rather than political (Kumar, 2013). The final part of this approach therefore interprets findings in relation to the mutually constitutive, macro-level context of power structures that influence both the creation of categories and the inequalities between them. To support this framing, I draw on published social science studies of Zambia, including the following disciplines: sociology, psychology, human geography, anthropology, and health studies.

3. Findings

3.1. Context-specific meaning of SES categories

Four key findings emerge when analysing the situated and gendered meanings of SES categories for women experiencing pregnancy and birth in Zambia. Firstly, all three dimensions of social status

have meanings relating to both material resources and social prestige. Secondly, financial resources depend on social relationships, particularly for less advantaged women. Thirdly, the categories "rural", "poor", and "uneducated" are deeply stigmatised, with narratives of personal responsibility driving moralisation. Lastly, more advantaged categories and their behaviours are associated with modernity and development, whereas other behaviours are characterised as traditional and backward.

Urbanicity and rurality

The meaning of urbanicity was strongly connected to better employment opportunities, which could enable gendered independence: "*if she was living in town, she would have found a job to work. She would have fought for her livelihood in town.*" [03_10_01]. This was contrasted with hard physical labour in rural areas: "*[…] in this village there is nothing but suffering, every day one has to go in the bush [to farm]*" [04_05_02]. The greater availability of resources in urban areas extended to public infrastructure: in town, "*the health facilities are nearby*" and "*everything is available […] unlike rural areas*".

The prestige element of towns relative to villages was linked to a contrast between 'modern' and 'traditional' ways of being. Rurality's assumed connection to traditional medicine, for some respondents, was associated with backwardness, in opposition to 'modern' knowledge. This was illustrated through disapproving respondents' depictions of those who use traditional medicine in childbirth: women living in the fieldwork district (which is predominantly rural and remote); uneducated women; those influenced by grandmothers; those in polygamous marriages; non-Christians. Conversely, facility childbirth itself is a symbol of modern development: "*[…] when you give birth [at the clinic], they [health workers] feel happy because they know that development is going forward at the clinic*" [03-06-03]. The traditional versus modern tension was also illustrated by narratives of rural 'progress'. Whereas "*elders*" used to hold knowledge and advise women in rural areas on how to give birth and look after children, now it was "*the government*", and people "*from different places and Lusaka*" [03_09_02].

Wealth and poverty

Poverty was summarised as not "*living well*" or not "*keeping well*". The main sign of not keeping well was not having enough food, but it also had broader meaning around not being cared for or not caring for oneself and one's household "*properly*". Wealth, in contrast, was imagined as a state free from worry about how to meet basic needs. Respondents explained that poverty can result from women being unable to claim support from their social network, including husbands, fathers of their children, relatives, and friends (also noted in: White and Jha, 2018). This was particularly true in

pregnancy and post-partum, when the mother and baby needed special and additional foods, new clothes, birthing materials, and when the mother was less able to do physical work in the fields.

Women's poverty was strongly moralised. Personal responsibility was heavily emphasised in discussions of female poverty, with visible markers of poverty being interpreted as a lack of personal dignity (*"we do not care for ourselves"*) and a lack of respect for the health facility (*"[dressed] like you are not going to the facility"*). Women who did not save for the materials required by the health facility for childbirth were not "*in their right mind*" because "*We work for it, you can even ask for piece-work from your friend" [04_06_03].* Women were seen as responsible for their failures, since it was believed that there were always opportunities to get money through working and mobilising social networks. This frame coexisted with the baby's father being constructed as the person primarily responsible for bringing material resources to the household, especially during pregnancy. Poor women were additionally blamed for getting pregnant if they were poor, unmarried or had 'too many' children: *"[…] they label them to be like they are bad people, why get pregnant when you don't have a husband or why get pregnant when you can't afford." [03_04_01].*

Education

The meaning of education was similarly connected to both prestige and resources. On the resources front, education was valuable because it enabled women to access "*a government job*" or "*a job in town*" (also described in: Evans, 2018a). Without a formal job, education was "*just a name*". An educated woman with a job could provide for herself and her children without having to be married (or dependent on her relatives). Education that led to a 'good' job also represented a gendered path to material independence: "*I mean she can provide for herself." [03_04_01].*

Education was also about prestige; more educated women were more likely to be included in community groups or chosen as community health volunteers: "*they choose that this one has been to school and is the right person." [03_06_01].* Educated women aligned themselves with health facilities' biomedical knowledge, and away from "*traditional*" knowledge. This meant they believed in spacing and limiting their pregnancies, as well as giving birth in the health facility. One educated respondent with two closely spaced children expressed shame about her un-normative behaviour. Uneducated women were sometimes seen as "*backward"* and "*ignorant"*, particularly in terms of their choices in pregnancy and childbirth: *"maybe the one that [gives birth at] home has never been to school, they have never learnt." [04_07_02].* They were sometimes blamed for this assumed behaviour: *"lack of education forces you from good things but you force yourself [you choose not to know], it is just lack of education." [04_10_01].*

3.2. Health service environment or individual attributes?

This section explores whether SES inequalities in access to a facility delivery in Zambia are primarily explained by health service environments or by individual and household-level attributes. This research question is answered by referring to "Levels" inequality [i.e.: Low SES groups are more likely to face barriers to access] rather than "Effects" inequality [i.e.: These barriers have a more negative effect for low SES groups]. This is because a limitation of K-O-B decomposition is that the proportion of the "Effects" inequality explained by a specific variable is not invariant to scale (Appendix 3). Additionally, the results show that at least 70% of the inequality is explained by "Levels" inequality.

The degree to which health service environments are accessible is measured through six dimensions: affordability, cognitive accessibility, psychosocial accessibility, geographic accessibility, availability, and perceived quality of care. Individual or household-level attributes are factors measured at the individual or household level that have been shown to be associated with maternal healthcare access in the literature in Zambia and in other low or middle-income countries. These include: who decides on wife's access to healthcare (husband, wife, jointly); literacy of mother; age of mother at birth; more than one woman of reproductive age in the household; being married; mother's work (not working, agricultural work, other work) (Appendix 2).

The mean difference in access to facility delivery between high and low SES categories ranges from 32 percentage points (p.p.) for the rural-urban inequality, 25 p.p. for the wealth inequality, to 23 p.p. for the education inequality (Table 3). The fact that low SES groups are more likely to face unfavourable health service environments compared to high SES groups explains a very large share of the "Levels" inequality in access to facility delivery: 84% for rural-urban, 77% for wealth and 75% for education inequalities (Table 3). Different individual or household-level attributes across SES groups explain the remainder of the "Levels" inequality. Being involved in "agricultural work", which is negatively associated with healthcare access and is more likely for low SES groups, explains most of this small contribution (3-4 p.p.). Within health service environments, the fact that low SES groups are more likely to face affordability, geographic, availability and quality of care barriers, explains more of the "Levels" inequality than differences in the probability of facing cognitive and psychosocial barriers across SES groups. There are some differences across SES dimensions: for example, geographic barriers are particularly important for rural-urban inequalities, and cognitive and psychosocial barriers are relatively more important for inequalities in access by education.

3.3. Heterogeneity of effects?

This section investigates whether there is heterogeneity in how health service environments or individual attributes are associated with access to facility delivery across women in different socio-economic groups. While differential "Effects" only explain a small portion of the inequalities (Section

3.2), it is interesting to examine where these exist. For example, age has a strongly positive effect on access for high SES women but a strongly negative effect for low SES women (Appendix 8). While my qualitative data does not provide a pertinent interpretation, the strength of this result warrants further research.

Of the statistically significant heterogeneous effects in Table 3, I primarily discuss those relating to one of the themes identified by the analysis of categorical meanings: the gendered enmeshment of financial resources and social relationships. These are: the differential effects of "not working" (for wealth inequality); "married" (for education inequality); and "% wives who say husband decides" (for all SES inequalities – see Appendix 2 for a full explanation of this variable).

Table 3 here

Not working has no effect on access to a facility delivery for women who are not poor, which likely indicates a middle-class male breadwinner model, but a strongly negative effect for women who are poor (Appendix 8). Being married has a negative effect for more educated women but a positive effect for less educated women, who may have a greater need for financial support from their partner (Appendix 8).

For more advantaged women, there is no statistically significant difference in facility delivery according to decision-making practices in the community. For less advantaged women, however, a greater % of wives who say their husband decides alone about the wife's healthcare has a large and statistically significant *positive* effect on facility delivery relative to % of wives who say it is a joint decision (and controlling for the % of wives deciding alone) (Appendix 8). Other authors have found a similar relationship between marital "autonomy" and chronic energy deficiency in Zambia (Hindin, 2005 cited in Schatz and Williams, 2012), while Banda et al. (2016) found that low "autonomy" is damaging only for *wealthy* women's maternal health in Zambia, using the 2007 DHS. The gendered meanings of work, marital status, and decision-making norms for access to facility birth are therefore not uniform, but rather depend in important ways on socio-economic status.

4.   Connecting findings to mutually modifying macro-level social processes

In this section, I summarise some of the key findings and draw on existing literature to suggest higher-order explanations that illuminate macro-level intersectional power structures and social processes. Firstly, findings on the context-specific meanings of SES show that less advantaged women and their pregnancy and birth behaviours are often characterised as "traditional" and "backward", as well as immoral. The meaning of making un-"modern" fertility "choices" such as having "too many" children, is embedded in the definition of the psycho-social barrier (Table 1): women with birth orders

of six and above are more likely to be discriminated against by health workers and their peers, who judge them negatively for their high fertility. Conversely, biomedical childbirth itself is a symbol of "modernity" and "development".

The meaning of modernity is strongly influenced by ideas of developmental idealism, spread through European colonial endeavours and the subsequent world balance of power (Hunt, 1999; Thomas, 2003). Developmental idealism posits that "modern society", based on colonial states' cultures, is good, attainable and the pinnacle of development. In turn, modern society and families (use of contraception, low fertility, birth in hospitals) are believed to be required for economic development (Thornton, 2001). For example, Evans (2018b) documents that having a lower national rate of facility delivery compared to neighbouring countries such as Zimbabwe was a national embarrassment for Zambian policy-makers. The unequal effects of developmental idealism in the context of maternal and reproductive healthcare have been previously documented in many contexts, including India (Nandagiri, 2019; Van Hollen, 2003, p. 210), Nepal (Brunson, 2020) and the Democratic Republic of Congo (Hunt, 1999, p. 13).

Because biomedical childbirth is portrayed as a modern, and therefore moral choice, women who do not give birth in a facility are constructed as backward and immoral, and punished by health workers, traditional authorities and their peers for their betrayal of national development objectives. Those who are not wealthy, urban and educated, in a word – modern – are penalised for their lack of modernity even if they do access a facility delivery, since the rules of the health facility are designed to produce a "modern", "respectable" woman. In another study using the same qualitative data in Zambia, I document that antenatal care providers told respondents they were not allowed to undertake hard manual labour during their pregnancy, an impossible injunction for some rural women who had to carry out extra agricultural work in order to have enough food post-partum (Sochas, 2019). Therefore while inequalities of wealth, residence and education shape inequalities in facility delivery, the meaning of facility delivery in context and the way it is organised as a social interaction also reinforces and shapes what it means to be a poor, rural, and uneducated woman.

Secondly, the findings show that inequalities in access to facility delivery are primarily explained by the fact that low SES women face worse health service environments than high SES women. Health service environments explain a greater share of the inequality than differences in other individual or household attributes across SES levels. Geographic accessibility, availability of human resources for health, perceived quality of care, and affordability are particularly important. Furthermore, unequal chances of facing favourable health service environments across SES levels explains more of the inequality than the different effects of health service environments on access across SES levels.

Insufficient public funding of the health sector in Zambia is partly responsible for the fact that accessible health service environments are not universal. For example, part of the reason why women require substantial financial resources for facility delivery is that health facilities lack key items such as disinfectant, cord clamps, plastic sheets, buckets, etc. (Chibuye et al., 2018; Mulenga et al., 2018). Zambia's economy was strongly affected in the 1980s by a collapse of the global price of copper and general economic downturn (Ferguson, 1999). Structural Adjustment Programmes and a neo-liberal policy orientation followed in the 1990s, an approach spearheaded by the IMF and the World Bank globally in the context of an unequal neo-colonial distribution of power between states, which resulted in the shrinking of the state with negative consequences for public services (Hansen, 2005). Zambia's health sector remains dependent on external development assistance, with fluctuations in health coverage and health outcomes observed as a result of aid volatility (Chansa et al., 2018; Jackson et al., 2020).

Lastly, findings show that markers of gendered independence, such as working, not being married, and the wife making decisions by herself are negatively associated with access to a facility delivery (or neutral) for low SES women, whereas they are positively associated with access to a facility delivery (or neutral) for high SES women. As explained above, financial resources are needed to purchase transport and materials required by the facility for delivery. In parallel, gender relations construct the man as the primary household provider (Kaiser et al., 2019a; White and Jha, 2018). However, as shown in the analysis of SES meanings, education and the formal job opportunities it brings, particularly in urban areas, offer women a privileged path to financial independence that is differentially available across rural-urban areas and different socio-economic origins.

Gendered social processes are therefore modified by economic relations of power; they have also been historically influenced by colonial powers, through efforts to create "respectable", "modern" families in their image. Matrilineal Bemba women, the largest ethnic group in Zambia today, had greater financial independence from their husbands prior to the mid colonial period (1920s-50s). At that time, laws and policies were enacted to limit women's ability to work in urban areas, while wage labour in mines enabled men to become sole household providers (Evans, 2014). Christian missionaries, and later mining companies, taught European gender roles of that era to miners' wives in "homecraft" and "mothercraft" classes (Ferguson, 1999).

5.   Reflecting on the approach

5.1. Limitations in the application of the approach

This study uses secondary quantitative data from the DHS, which by virtue of its cross-country uniformization does not take into account local realities in the construction of its concepts, survey questions, or variables (Harnois and Hewamanne, 2020; Randall et al., 2011; Schatz, 2012). Some variables measuring aspects of the health service environment (affordability, cognitive and psychosocial accessibility) are not defined at the intersection of population needs and health service provision (Appendix 2), while wealth is operationalised both as an SES measure and the variable measuring affordability. Individual agency within institutional and social constraints was not sufficiently explored in the qualitative analysis. Due to resource limitations, the primary qualitative data is sourced from only one district in Zambia and was collected in 2018, while the quantitative data is sourced from 17 districts and was collected four years prior. Further limitations are discussed in Appendix 6.

Additional resources could improve the application of the approach, by nesting primary quantitative and qualitative data collection (Schatz and Williams, 2012), using primary quantitative data from context-sensitive surveys (Strong, 2021), or collecting qualitative data using ethnographic instead of interview methods (Messac et al., 2013). The approach could also be adapted in a less resource-intensive direction, by relying solely on already published historical and ethnographic literature to explore categorical meanings (Harnois and Hewamanne, 2020). The approach requires quantitative analysis of multiple levels of explanation, the data for which may not always be available.

5.2. How innovative is this paper's approach?

Grounding analysis in theory and using appropriate methods for the research question is arguably "just" good social science and has been advocated and practiced by many scholars of health inequalities (e.g.: Krieger, 2001). Acknowledging the socially constructed nature of categories, the potential for heterogeneity, and the workings of power at all levels has long been the hallmark of intersectional feminist scholars and critical ethnographers. Williams (2010) advocates for quantitative demographers to follow similar steps to this approach: extreme caution in conducting comparative analysis; using multiple methods; triangulating variables to measure categories; measuring categories at multiple levels of analysis; intersectional analysis; reflexivity. More recently, another paper demonstrates how to reconcile a relational theory of gender with data in DHS report tables, by drawing on existing literature to: provide historical context; contextualise rates and means; and highlight variation within categories (Harnois and Hewamanne, 2020).

Rather than proposing novel methodological solutions, this paper's innovation lies in the combined application of the approach's individual steps within a single, empirical, inter-categorical study. The paper provides an innovative demonstration of how scholars can challenge categorical thinking by using categories in a meaningful way. This study moves the conversation from agenda-setting (Bauer,

2014; Evans, 2019a) to a still-rare demonstration of the feasibility of such an approach, even when resources are limited. Evans (2019a) argues that most intersectional studies of health inequalities are either: (1) "specific" (focusing on just one or a few categories), analytical (seeking to explain inequalities), and qualitative, *or:* (2) "comprehensive" (large number of intersected categories), descriptive, and quantitative. This paper's approach is innovative in that it combines these dimensions in new ways: it is specific, analytical, and uses mixed methods. Finally, most quantitative intersectional studies to date analyse health inequalities in the Global North (e.g.: Axelsson Fisk et al., 2018; Bauer and Scheim, 2019), despite studies in the Global South being particularly vulnerable to categorical thinking (Adams et al., 2019; Kumar, 2013).

The approach also generates novel findings relative to the maternal and child health literature. While this study's results emphasise the importance of health service environments, many decomposition studies of maternal or child health(care) inequalities in the Global South do not take health service environments into account or proxy for them using unreliable variables on self-declared access problems (e.g.: Goli et al., 2017; Liu et al., 2014; Nwosu and Ataguba, 2019). More studies are measuring aspects of the health service environment since 2010, yet the quality of variables and the comprehensiveness of the accessibility dimensions included are still limited (Wong et al., 2017).

This study found that "autonomy" can be negatively associated with facility delivery for low SES women. However, without an analysis of heterogeneity across SES, "autonomy" has been found to be positively associated with facility delivery in reviews of studies spanning low- and middle-income countries and Sub-Saharan African countries respectively (Gabrysch and Campbell, 2009; Moyer and Mustafa, 2013). While this study is not the first to show heterogeneity in the meaning of "autonomy", marital status, or work according to women's SES in the Global South, most studies of maternal or child healthcare access inequalities in the Global South still use concentration index decomposition methods that do not allow for the analysis of heterogeneous effects. Recent exceptions include Blunch et al. (2020) for child health in India and Johar et al. (2018) for general healthcare access in Indonesia, who also apply Kitagawa-Oaxaca-Blinder.

5.3. When is this approach useful?

This approach best fits the "inter-categorical" family of approaches to intersectional complexity (McCall, 2005), in that it seeks to compare outcomes across quantitative categories. The argument that an inter-categorical analysis of health inequalities *can* challenge categorical thinking is contentious among some critics of categorical thinking, most notably the originator of this concept, Raewyn Connell (2012, 1987). Connell (2012) argues that the use of quantitative categories is ill-suited to analysing the historical, dynamic social processes that create categories and the inequalities between them, as well as the contestation and agency at play in how people interact with and situate

themselves within these processes. Anthropologists have offered similar critiques (e.g.: Adams et al., 2019; Bourgios and Hart, 2011 cited in Messac et al 2013).

While the approach outlined in this paper makes connections between its findings and macro social processes based on existing literature, novel analysis of macro social processes based on primary data is indeed beyond its scope. Given qualitative methods, and particularly ethnography's, strengths in analysing the complexity of social processes in a particular context, it is important to give these methods equal space in public health policy and research, whether standing alone or as part of mixed methods studies (Messac et al., 2013).

What then is the value of this paper's inter-categorical, mixed methods approach, given its remaining limitations in challenging categorical thinking? To quote Oakley (1998, p. 723), *"quantification is essential to feminist social science's emancipatory aim".* The strength of quantitative analysis lies in the ease with which the analyst can consider variation at different levels (Bauer, 2014) and the greater political credibility and power with which policy-makers have imbued quantitative analysis, a status quo that should also be directly challenged (Barker, 2005; Messac et al., 2013). Quantitative analysis is further valued for the statistical generalisability of its findings (Alvarez and Evans, 2020; Schatz, 2003; Williams, 2010), though qualitative studies also build wider knowledge from specific cases through "communicative generalisation" (Cornish, 2020).

The social category of primary concern in this study, socio-economic status, is not only analysed inter-categorically, but operationalised as a *binary* quantitative variable. While the KIIs did inform the cut-off for these variables, they are to some extent arbitrary in the sense of being imposed on the context rather than emerging from it (Alvarez and Evans, 2020; Walby et al., 2012). Categorising social complexity into binary categories has been heavily criticised as a form of categorical thinking (Springer et al., 2012). This paper's approach "provisionally adopts" (McCall, 2005, p. 1773) these binary categories because doing so is required by K-O-B decomposition, which combines analysis of heterogeneity with an explanatory objective. While there is certainly a tension there, K-O-B decomposition challenges two hallmarks of categorical thinking: assumptions of homogeneity and assumptions that inequalities do not require explanation.

Lastly, K-O-B decomposition's explanatory objective limits the inter-categorical analysis to a small number of categories. The qualitative investigation of the categorical meanings also puts limits on the number of categories that can be explored in depth. Descriptive quantitative work focusing on a much larger number of intersections is also valuable and can be rooted in theory (Evans, 2019a). In summary, this approach is useful for those who seek to challenge categorical thinking using a *mixed methods*, *inter-categorical*, and *explanatory* research objective.

6. Conclusion

Going beyond categorical thinking has important practical implications for social justice. In this conclusion, I highlight but two. Including health service environments as an explanation for health inequalities avoids stigmatising certain women as problematic or non-compliant, against which punitive action such as fines or denial of healthcare are currently taken in Zambia (Sochas, 2019). Instead, findings imply that the Government of Zambia and external partners should continue to improve the equitable distribution of health services and should address stigmatising attitudes embedded in the health system.

Findings of heterogeneity in the meaning of "autonomy", work and marital status according to SES should encourage programmes promoting women's "empowerment" or male involvement in maternal health to recognise that decisions about pregnancy and childbirth are social behaviours, embedded in mutually constitutive and unequal power relations. Interventions that do not address, or even compound these power inequities, for example by denying women access to antenatal care if they come without their husband, result in further harm. Challenging categorical thinking in health inequalities research is important in order to create a more equitable and just world. The approach outlined in this paper offers a feasible way of doing so.

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SUPPLEMENTARY MATERIAL

Appendix 1: Quantitative datasets

The quantitative analysis in this study is based on two geo-referenced datasets, linked together using Geographic Information Systems in order to understand individuals' characteristics and health seeking behaviour, as well as their health service environment. The first dataset is the 2010 Service Availability and Readiness Assessment (SARA) (Republic of Zambia Ministry of Health, 2010), which collected information on the location, staffing, infrastructure, and readiness to provide obstetric signal functions of health facilities. The sample is comprised of all facilities located in 17 out of Zambia's 72 districts, regardless of level or ownership. The districts were selected evenly but not randomly from across the country, although all of Zambia's 9 provinces are represented. Some districts were purposefully chosen in order to evaluate Global Fund activities, and malaria sentinel districts were also purposefully included. After excluding facilities without a valid geo-reference, or where the facility was revealed to be located outside a SARA district's shapefile, the final sample is composed of 596 health facilities.

The second dataset is the 2013-14 Zambia Demographic Health Survey, a nationally and regionally representative cross-sectional household survey (Central Statistical Office [Zambia], 2014). This survey collects information on socio-economic and demographic characteristics, attitudes and behaviour related to health and gender, and place of delivery for any births in the five years prior to interview, from women aged between 15 and 49 years. The two-stage sampling strategy is based on sampling clusters, which are comprised of an average of 130 households. For this study, only the sampling clusters located within the SARA dataset's 17 districts were included in the analytical sample. While the sampling clusters are geo-referenced, their exact location is "jittered" for confidentiality reasons. The location is randomly displaced by 0 to 2 km for urban clusters and 0 to 5 km for rural clusters (of which 1% is displaced by 0-10km). The study sample is at the birth level, and includes all live births for which there is place of delivery information (19% of births that occurred in the five years prior to interview are missing this information), where the mother has not migrated since the birth, and where the birth was a singleton birth. The final sample (with no missing values on any variable) is composed of 248 sampling clusters and 2,963 live births.

Appendix 2: Quantitative variables

Socio-economic status variables

Socio-economic status is measured according to three main dimensions: education of the mother, wealth of the household, and rural-urban location of the sampling cluster, all measured at the time of interview. As expected, the three dimensions of socio-economic disadvantage are correlated with each other: for example, the poor are less likely to be educated and are more likely to live in a rural area (Figure A2.1). Scholars of health inequalities emphasise that studies should include or at least consider a range of levels at which SES can be defined (Krieger et al., 1997; Braveman et al., 2005). In this study, education is measured at the individual level, wealth at the household level, and rurality at the neighbourhood level.

Education of the mother is measured according to highest educational level reached (binary variable, at least some primary school and below versus some secondary school and above). Key informants (KII) confirmed that the secondary school cut-off is important in terms of accessing formal employment, for example as a sales clerk in a shop.

Wealth is measured by a household wealth index, computed by the Demographic Health Survey Program using factor analysis on the basis of household assets. Since the assets signifying wealth are

different in rural and urban areas, the index is separately constructed by the DHS for rural and urban households, and then mapped onto a common index in a way that respects levels and dispersion (Rutstein, 2008). In the binary form of the wealth variable, people in the "poorest" and "poor" wealth quintiles are classified as "poor" while those in the "middle", "richer" and "richest" wealth quintiles are classified as "not poor". Wealth is unlikely to measure the same dimension as income, which is not available as a measure from the Demographic Health Survey. Evidence from rural Tanzania suggests that in that context, wealth may be a better measure of people's long-term financial well-being than income, since the latter is highly variable and consumption (a common way to estimate income in this context) is often foregone in order to invest in capital assets or to avoid having to sell productive assets (Brockington, 2019).

Urban-rural residence is measured at the sampling cluster level, on the basis of rural-urban definitions used by the Zambia statistical office (urban areas are "localities of 5 000 or more inhabitants, the majority of whom all depend on non-agricultural activities" (United Nations, 2006)).

The cut-offs selected for these binary variables are to some extent arbitrary, though informed by the KII findings. Alternative cut-offs for wealth and education do not yield qualitatively different conclusions in the K-O-B analysis (results available upon request).

Figure A2.1: Distribution of the sample according to intersectional SES dimensions, Zambia 2013-14
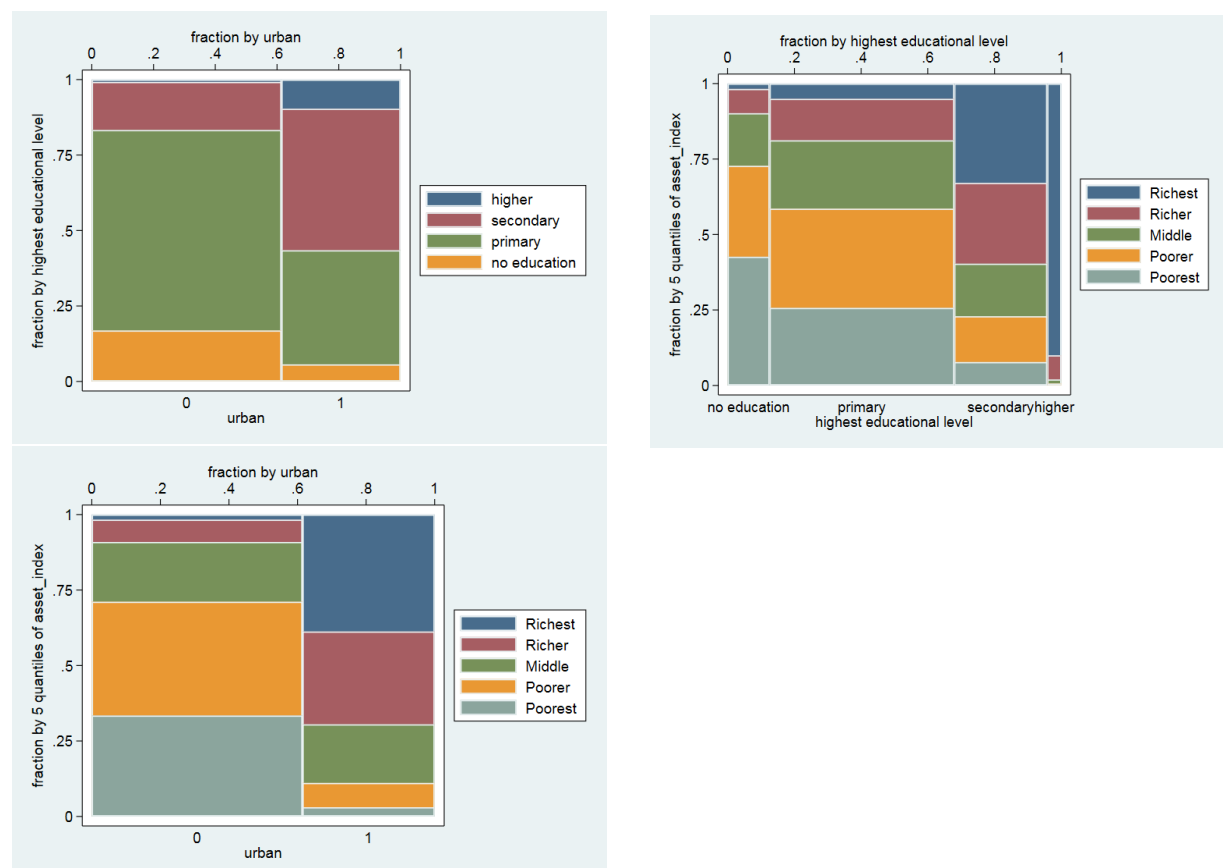
Health service environment variables

The variables selected to measure the health service environment reflect six key dimensions of healthcare accessibility. These dimensions were identified based on three major "relational" healthcare access frameworks (Penchansky and Thomas, 1981; Bertrand et al., 1995; UN, 2000; Choi et al., 2014) and are defined in Table A2.1. A relational approach to the concept of accessibility defines access as the extent to which the health system is accessible relative to the population's varied needs, capacities and expectations (Ricketts and Goldsmith, 2005). The chosen variables were selected to reflect the

context of maternal healthcare access in Zambia, informed by 12 key informant interviews (KII) and a Zambia-specific literature review. These "health service environment" variables explain an important share of the variance in facility delivery in Zambia (Sochas, 2020). While the selected variables do not perfectly or comprehensively represent each accessibility dimension, they have relevance and legitimacy in the Zambian context, are available for the vast majority of the study's sample and are measured using good quality data. The accessibility dimensions are all formulated as access barriers when operationalised as variables (i.e. =1 if the accessibility dimension is *not* present for a specific birth).

Table A2.1: Conceptual framework

ACCESSIBILITY DIMENSIONS	DEFINITIONS
Availability	"The relationship of the volume and type of existing services to the clients' volume and types of needs" (Penchansky and Thomas, 1981)
Geographic accessibility	"The relationship between the location of supply and the location of clients, taking into account client transportation resources and travel time, distance and cost" (Penchansky and Thomas, 1981)
Affordability	"The relationship of prices of services to the clients' income, ability to pay, and health insurance" (Penchansky and Thomas, 1981)
Perceived quality of care	Clients' perception of the extent to which they are likely to receive effective care once they access a facility
Cognitive accessibility	"Extent to which potential clients are aware if the locations of service (…) points and of the services available at these locations" (Bertrand et al 1995). Also includes clients' awareness of the benefits of quality biomedical care
Psychosocial accessibility	"Extent to which clients are constrained by psychological, attitudinal or social factors in seeking out (…) services" (Bertrand et al 1995). E.g.: shame; fear of disrespect from health workers and others; unacceptable care in the context of beliefs.

Note: Definitions are referenced where appropriate. Non-referenced definitions were developed by the author.

The affordability, cognitive, and psychosocial barriers could not be directly measured at the intersection of population needs and the health system. Instead, they are measured according to characteristics that are discriminated against (or not accommodated) in the Zambian health system, according to KIIs and previously published studies. For example, while user fees have been eliminated, the cost of delivering in a health facility remains high compared to average rural incomes because of the cost of transport and materials (clothes, nappies, cord clamps, plastic sheet and bucket, disinfectant, etc) (Kaiser, McGlasson, et al., 2019). Similarly, the KIIs and literature review confirmed that women with birth orders of two and above were more likely to believe that they were not at risk of obstetric complications, which is a misconception (Mulenga et al., 2018). Women with birth orders of six and above are likely to be discriminated against by nurses and midwives who judge them negatively for their high fertility (Sochas, 2019).

The geographic, availability and quality of care barriers were defined according to a straight-line distance of 10km. While the policy relevant distance is set at 5km in Zambian health strategy documents, the random displacement of DHS sampling clusters means that a distance of 10km is recommended in order to minimise misclassification errors (Burgert and Prosnitz, 2014; Wang et al., 2015). By construction, women facing the geographic barrier will also face the availability and perceived quality of care barriers, and women facing the availability barrier also face the perceived quality of care barrier. Similarly, any woman facing the psychosocial barrier will also face the cognitive barrier.

Individual and household attributes

Individual or household attributes might also affect women's access to a facility birth. Selection of these attributes was similarly informed by key informant interviews, semi-structured interviews with women who had recently given birth, and by the maternal healthcare access literature in Zambia (e.g.: Chibuye et al., 2018; Kaiser et al., 2019a; Mulenga et al., 2018; Scott et al., 2018; Sialubanje et al., 2015, 2014b). Apart from mother's age at birth, all variables are measured at the time of interview, as they were not available at the time of birth.

The autonomy variables were included at the DHS sampling cluster level, rather than the individual level, for two reasons. Firstly, it is recommended that variables relating to the gender order are measured at the "community level" (Schatz and Williams, 2012). Secondly, this meant that non-married respondents could be retained in the sample. The results do not change substantially when using the community vs. individual-level variable for the married sample. The variable is based on the following question, asked to married women only: "Who usually makes decisions about health care for yourself: you, your (husband/partner), you and your (husband/partner) jointly, or someone else?". Two variables are constructed: one is the average share of married women at the DHS sampling cluster level who say "husband decides alone". The other is the average share of married women at the DHS sampling cluster level who say "I decide alone". The reference category is the average share of married women at the DHS sampling cluster level who say "husband and wife decide together". Less than 0.5% of the sample answered "someone else" or "other".

Table A2.2: Descriptive statistics, Zambia 2013-14

Variable	Obs	Mean	Std. Dev.	Min	Max
Facility delivery	2,963	74%	0.44	0	1
Poor (& affordability barrier)	2,963	43%	0.49	0	1
More educated	2,960	34%	0.47	0	1
Urban	2,963	40%	0.49	0	1
Cognitive barrier	2,963	81%	0.39	0	1
Psychosocial barrier	2,963	25%	0.43	0	1
Geographic barrier	2,963	21%	0.41	0	1
Availability barrier	2,963	38%	0.49	0	1
Quality of care barrier	2,963	57%	0.50	0	1
Community share of wives who say husband decides their healthcare	2,963	33%	0.25	0	1
Community share of wives who decide by themselves on own healthcare	2,963	24%	0.23	0	0.93
Literate	2,963	45%	0.50	0	1
Age at birth	2,963	27.04	6.89	13	47
More than one woman of reproductive age in the HH	2,963	31%	0.46	0	1
Married	2,963	81%	0.39	0	1
Not working	2,963	38%	0.48	0	1
Farm work	2,963	36%	0.48	0	1

Note: The data is not weighted

Table A2.3: Linear probability regression (OLS) of facility delivery on health service environment and individual, household and community attributes, Zambia 2013-14

	Coef.	Robust Std. Err.	t statistic	P value	[95% Conf. Interval]	
Affordability barrier	-0.070	0.027	-2.630	0.009	-0.122	-0.017
Cognitive barrier	-0.073	0.019	-3.870	0.000	-0.110	-0.036
Psychosocial barrier	-0.062	0.027	-2.320	0.021	-0.115	-0.009
Geographic barrier	-0.195	0.056	-3.460	0.001	-0.305	-0.084
Availability barrier	-0.093	0.051	-1.820	0.071	-0.193	0.008
Quality of care barrier	-0.075	0.033	-2.300	0.022	-0.140	-0.011
Community share of wives who decide by themselves on own healthcare	0.022	0.055	0.390	0.694	-0.087	0.130
Community share of wives who say husband decides their healthcare	0.112	0.064	1.740	0.083	-0.015	0.238
Literate	0.059	0.017	3.430	0.001	0.025	0.094
Age at birth	-0.001	0.002	-0.580	0.563	-0.005	0.003
More than one woman of reproductive age in HH	0.019	0.017	1.100	0.272	-0.015	0.053
Married	0.021	0.021	1.030	0.302	-0.019	0.062
Not working	-0.045	0.017	-2.620	0.009	-0.080	-0.011
Farm work	-0.083	0.029	-2.830	0.005	-0.141	-0.025
_cons	0.952	0.059	16.000	0.000	0.835	1.069

Appendix 3: Kitagawa-Oaxaca-Blinder decomposition method

Kitagawa-Oaxaca-Blinder (K-O-B) decomposition (Kitagawa, 1955; Oaxaca, 1973; Blinder, 1973) is used to understand the extent to which maternal healthcare inequality is driven by the fact that different groups are differentially likely to face barriers (the "Levels" part, referred to as the "Explained" part in the economics literature) or by the fact that the effect of barriers on facility delivery differs in more advantaged versus less advantaged groups (the "Effects" part, referred to as the "Unexplained" part in the economics literature). The latter is left unexplored by other decomposition methods such as concentration index decomposition, which assume that the effect of the variables on facility delivery are equal across groups. Unlike concentration index decomposition, however, K-O-B decomposition can only explain differences between binary groups (e.g.: poor vs. rich) instead of the whole distribution (e.g.: the entire distribution of wealth).

Following Jann (2008), I define two models of healthcare access, one for the privileged SES category (A group) and another for the disadvantaged SES category (B group), with reference to the same vector of explanatory variables, X.

$$y_A = \alpha + X'_A \beta_A + \varepsilon_A$$

$$y_B = \alpha + X'_B \beta_B + \varepsilon_B$$

The difference between the mean of y_A and the mean of y_B, R, can be decomposed as follows:

$$R = [E(X_A) - E(X_B)]' \beta^* + [E(X_A)'(\beta_A - \beta^*) - E(X_B)'(\beta^* - \beta_B)]$$

The "Levels" part of the inequality, $[E(X_A) - E(X_B)]' \beta^*$, is the part explained by the difference in mean Xs between the groups, evaluated according to a neutral or non-discriminatory coefficient β^*,

which is obtained from a pooled regression that includes both groups (and where group membership is included as a variable in the regression, as recommended by Jann (2008)).

The "Effects" part of the inequality, $[E(X_A)'(\beta_A - \beta^*) - E(X_B)'(\beta^* - \beta_B)]$ is the part explained by the difference in coefficients between the groups, once more evaluated with respect to coefficients from a pooled regression, β^*. This interpretation is only valid if we assume there are no omitted variables. Otherwise, the difference in coefficients could be picking up differences in means of relevant explanatory variables that were not included in the model.

The K-O-B decomposition is implemented in Stata using the *oaxaca* command with the *pooled* and *vce(cluster)* options. The latter command estimates standard errors that account for clustering by DHS sampling cluster. While we can meaningfully ask which predictors contribute most to the "Levels" part, this cannot easily be done with the "Effects" part, because the results are not invariant to the choice of scale.

Due to the fact that detailed decomposition is more difficult in the context of a logistic regression (because it is hard to separate out the contribution of the endowments from the coefficients in a non-linear model), I use a linear probability model.

Analyses in this study are not weighted. This is partly because the sample of the DHS used for this study, a non-random sample of districts from all provinces, is not statistically representative of the country- or district-level. Weighting would therefore not result in statistically representative findings. Secondly, the study has an analytic focus, with the aim to uncover relationships between variables, for which weighting is not required.

Appendix 4: Key informant interviews

I conducted 12 key informant interviews (KIIs) in Lusaka between the 26th July and the 4th August 2017. These interviews were conducted in English with respondents from academic, government, international aid, and medical backgrounds, selected purposively for their knowledge of healthcare access in Zambia (Table A4.1).

Rationale

Including insights from key informants was important for three reasons. Firstly, it was important to select a single variable per health service environment dimension in order to avoid an exponential increase in the number of variables. The accessibility dimensions are very broad concepts, such that there is no single variable that can adequately measure them. Drawing on the opinion of a group of experts was therefore very useful to improve the legitimacy of the selected variable. Secondly, the key informants were highly knowledgeable about the ways in which these accessibility dimensions operate in Zambia, and/or about the quality of different data sources, thus providing valuable technical input into the selection of variables. Thirdly, experts' different views contributed to my understanding of the advantages and disadvantages of the selected variables, aiding the interpretation of the results.

Table A4.1: Key informant characteristics (N=12)

Gender	Sector	Seniority	Producer or user of data	Zambian	Maternal health specialist
25% Female	50% Government of Zambia	25% Low	33% Producer and user	92% Zambian	25% Yes
75% Male	50% Academic	8% Medium	67% User	8% non-Zambian	75% No
	42% Medical	67% High			
	25% International aid				

Note: These percentages do not add up to 100% as some key informants had more than one affiliation

Conducting the interviews

9 out of 12 interviews were audio-recorded. The interviews lasted between 15 minutes and four hours (most lasted between 30 and 60 minutes). Respondents were asked to comment on the conceptual framework and to identify any missing barriers that were not in the framework. Respondents who had a limited amount of time were asked to select a set of four accessibility dimensions they wanted to focus on. For each concept, they were asked to: select the variable they believed was most appropriate out of a set of variables I provided from prior research on available data (between 1 and 5 choices per concept); explain why it was a better measure than other variables; give a grade to all available variables between 0 and 10; and suggest any other variables that had not been part of the original set. Respondents were reminded that I was interested both in the variable's conceptual closeness to a given accessibility dimension, but also in the availability of high-quality data to measure this variable in the Zambian context. Respondents were also asked to identify the socio-demographic variables that might describe significant inequalities in facility delivery in Zambia, and to suggest sensible cut-off points for these in order to generate binary variables.

Analysis & use of KIIs in this paper

Quantitative scores given to variables were recorded in a table and contrasted across respondents (within accessibility dimensions). Qualitative statements made in the interviews were simultaneously coded and transcribed by typing them into matrix, with variables in columns and respondents in rows. KII results were used to (1) validate the health service environment framework, (2) inform the selection of variables to measure each dimension, (3) inform the choice of important SES categories, (4) inform the choice of cut-offs for binary variables. I use "inform" to reflect that this was not an mechanical process – in some cases, there were feasibility concerns with implementing KII recommendations, or there was a lack of consensus among KIIs. Few KIIs commented on appropriate cut-offs. In conjunction with KII input, I also conducted a non-systematic literature review on maternal healthcare access in Zambia. Together with my own academic judgement, this evidence-base also supported my choices of variables.

Ethics & Reflexivity

Following ethical clearance from [redacted] and [redacted], written informed consent was sought and obtained from all respondents. These interviews were for the most part elite interviews, with the respondents having relatively more power than the interviewer, particularly for older male respondents. As a small example, the interviews were held in their offices, at a convenient time for them. Because of this dynamic, there was somewhat limited scope to address potential inconsistencies or misunderstandings in respondents' answers, particularly when the interview was kept short due to respondents' busy schedule. This is not to deny the fact that, as virtue of my nationality (European) &

race (white), I undoubtedly had more power and access than I would have had in a European Ministry of Health, for example.

Several challenges were faced during the KIIs. It was difficult to encourage respondents to consider data quality and availability, even though they had this knowledge, as they preferred to select variables based on validity. As a result, several suggestions made were not feasible (e.g. linking cost data from a survey that was not geo-referenced). Respondents found it much easier to measure barriers from a health system perspective instead of the individual's perspective, as most of them were used to developing health system indicators for policy use. Many suggested indicators that could only be used at an aggregate level, such as the share of population accessing skilled birth attendance. It was also challenging for respondents to fully engage in an overly complex methodology given time pressures.

Appendix 5: Semi-structured interviews with women who had recently given birth

Site selection

The semi-structured interviews were conducted in only one district: Mansa, in Luapula Province. Luapula Province was purposively selected because it has one of the lowest averages for facility delivery in the country according to the last available Annual Health Statistical Bulletin of 2013 (39%). Mansa district hosts the capital of Luapula Province and was selected due to high levels of contrast between its urban and rural areas, both in terms of distance to well-equipped health facilities and type of livelihood. Mansa district has 56 facilities (of which 1 hospital and 6 urban health centres) and 4 ambulances for approximately 258,800 people (Worldpop, 2016). There were only two consultant obstetricians at the time of fieldwork in June 2018, both based in the provincial hospital in Mansa town. There are typically no doctors in health centres, where deliveries should be conducted by nurses (who may or may not have midwifery training) or clinical officers.

Recruitment

Interviewees were considered eligible if they were women aged 18 or older and had given birth within the previous 12 months. Interviewees were recruited from nine infant clinics, from a mix of rural and urban locations. The proportion of infants who receive at least one vaccination is nearly universal. Some of these clinics were held at health centres while others were held in outreach locations. The aim was to recruit a diverse sample out of the 20-50 women who came to the immunisation clinic daily. Interviewees were recruited using a mix of convenience and purposive recruitment strategies. Recruitment was structured according to the characteristics anticipated from the literature and key informant interviews to be associated with inequalities in healthcare access and in the experience of maternal healthcare: age, marital status, education, parity, rural vs. urban residence, education and poverty.

Table A5.1: Sample characteristics

Category	Sub-category	% (n = 42)
Age	18 to 20	17%
	21 to 35	60%
	Above 35	21%
	Not collected	2%
Education	No education	2%
	Some primary education	40%
	Some secondary education	41%
	Some higher education	10%

	Not collected	7%
Marital status	Single, widowed or divorced	26%
	Married to father of child after conception	7%
	Married to father of child prior to conception	67%
Work	Farmer	43%
	Other informal work	10%
	Formal work	7%
	No work outside the home	40%
Parity	1st birth	29%
	2nd to 5th birth	48%
	6th or more birth	24%
Residence	Rural	50%
	Urban	50%
Poor	Not poor	64%
	Poor	36%

Conducting the interviews

42 semi-structured interviews were conducted in May-June 2018, using an interview guide that listed both topics for discussion and specific questions, depending on the section. The interviews, lasting between 35 and 60 minutes, focused on women's own pregnancy and birth experiences, as well as what they thought about how women's pregnancy and birth experiences might be affected by their age, marital status, wealth, education, occupation, number of children, or rural-urban residence (each interviewee was only asked about some of these characteristics). The interview guide was initially drafted by the author and adapted in a pre-data collection workshop with the interviewers, according to their understanding of the field site's context. It was progressively modified during data collection in order to further explore themes raised by respondents (such as home delivery, fines, finding money for the birth, etc.), based on daily discussions between the interviewers and myself.

Interviews were held within the health centre's compound, or close to the outreach location. Initially, we attempted to hold interviews in a room inside the health centre, where available, but quickly discovered that these interviews were constantly interrupted by staff looking for items. We then decided to hold the interviews outside, with the rationale that it would at least confer aural, if not visual, privacy.

The interviews were led by two Zambian female interviewers, mainly in the Bemba language (the main language in Mansa) or more rarely in English, depending on the preference of the interviewee. I recruited the two interviewers in Lusaka from a large pool of qualified applicants and conducted a five-day workshop with them, covering the purpose of the study, ethical interviewing, recruitment of respondents, sense-checking and improving the interview guide, translation of the interview guide to Bemba, interviewing role-play, and pilot interviews.

Early on, we encountered potential respondents who were not comfortable with my presence in the interview. As a result, I was only present for two interviews with women who explicitly gave their consent to my presence. I observed the workings of the immunisation clinic itself, taking note of my observations and of my interactions with health workers who spoke English. I also took notes on informal conversations (not recorded) with two district health officers and one senior health worker at the Provincial Hospital. A daily debrief session was carried out as a team, where we discussed the day's interviews based on the interviewers' notes and memory, and established what questions had worked well or not, which fed into the progressive iteration of the interview guide. Iteration stopped roughly

one third of the way through data collection, but data collected using earlier versions of the interview guide were still retained for analysis though they were of lower quality. Because of resource limitations, there was no iteration between data collection and data analysis.

Vignettes

Women's views on how pregnancy and birth experiences are shaped by socio-demographic characteristics were collected both through a direct question and with the support of vignettes. These vignettes briefly describe hypothetical women's stories, narrated by the interviewer, and were supported by illustrations painted by a Mansa-based artist, Victor Mwakalombe. In each interview, two vignettes, chosen at random out of 8 vignettes, were used to elicit respondents' thoughts about how women's pregnancy and birth experiences might differ according to their socio-demographic characteristics.

The literature emphasises that it is important that vignettes feel real within the research context. These vignettes (approximately 3 sentences per vignette) were developed by four Zambian research assistants during a five-day training workshop, based on 8 different combinations of socio-demographic characteristics I provided. The RAs were tasked with writing a short life story for each of these 8 hypothetical women that would make sense in the local context. Importantly, the vignettes combined many different permutations of characteristics (age, education, work, marital status, number of children, relationship with family, class, residence, disability or illness), which meant that while the vignettes were very short, they did present a multi-faceted view of the character. The research assistants lived in Lusaka and were of a higher socio-economic status than most respondents, although they did speak Bemba. While the research assistants did not share precisely the same geographical or social context as most respondents, then, they were familiar with the context where the research was to be conducted.

Vignettes were chosen as a *complementary* method in order to anchor the discussion relative to women holding specific characteristics. As Figure A5.1 shows, the vignettes were introduced after asking women a similar, unanchored question about how women's experiences of pregnancy and childbirth may differ. In addition to anchoring, another advantage of vignettes is that they can serve as a distancing device, allowing respondents to talk about their own experiences through the medium of hypothetical stories (Hughes, 2012). In this study, I selected vignettes as a complementary method in order to allow women holding stigmatised identities to potentially distance themselves from such identities and speak about them in the third person if they wished.

One criticism of vignettes is that they over-simplify the real world (Hughes and Huby, 2004). In the context of this study, the over-simplification aspect is somewhat less of a concern because rather than describing a situation and asking for a behavioural response, the vignettes solely described the characteristics of a hypothetical woman and left the respondent to imagine the character's experiences, based on the respondent's own social knowledge.

Figure A5.1: Semi-structured interview guide extract

SECTION 4
Some women in pregnancy or childbirth might feel afraid, ashamed, angry or depressed. What kind of pregnancy or birth experience might make them feel this way?   Probe: aside from medical difficulties, what else?   What kind of women are most likely to have that experience [REFERRING TO ANSWER ABOVE]? What do people say about them?
SECTION 5
Now I am going to tell you some women's stories, and I would like you to imagine what sort of pregnancy and birth experiences they might have: *PICK TWO VIGNETTES AND READ THEM OUT*

> Who, of: **A** or **B** would be more likely to feel afraid, ashamed, angry or depressed in pregnancy or birth? Why?

Translation & analysis

The interview recordings in Bemba were directly transcribed into English by the two interviewers and two additional research assistants. The latter carried out only a quarter of the transcriptions, which were reviewed by the original interviewer. As a result of the translation, the words used in analysis were heavily influenced by the transcribers. In order to manage this limitation, the translation and transcription were carried out within one month of conducting the interview. The rationale for this was to enable sufficient recall of the interview situation and non-verbal clues in order to infer meaning behind words. Transcribers worked together to agree on coherent translations and were instructed to translate expressions as literally as possible without substituting English-language expressions, in order to limit the amount of interpretive meaning-making. Instead, interpretation was jointly practiced. I re-read all transcripts as they were produced and asked interviewers to suggest multiple meanings and connotations where there was potential ambiguity or where the English translation was not intelligible.

Once the translation was completed, I conducted the analysis (alone). I started by coding all transcripts according to their content, working with small passages (typically a few sentences). Some codes emerged from the transcripts, while others were informed by the interview guide. For the purpose of this study, I retrieved transcript passages that were coded as discussing differences in pregnancy, birth, or general life experience according to socio-economic status. These included both women's own experiences and what they had said about how they thought other women's experiences would differ according to SES. However, these were all instances where the respondents had imposed meaning on these SES categories; i.e. their own or others' experience is identified as being *caused by* living in a rural or urban area; being poor or not; being more educated versus less educated. I did not compare transcripts of rural vs. urban women to identify differences in their pregnancy or birth experiences beyond what they attributed to these categories themselves. This means that I identified respondents as lacking financial resources in the final analysis solely according to their own accounts. I then conducted a thematic analysis of these coded passages, separately for education, wealth, and rural-urban differences. The results are therefore very much concerned with the *meaning* ascribed to these categories in-context instead of "real" or "objective" differences in experiences according to SES.

Ethics & reflexivity

Ethical clearance for primary data collection was obtained from the London School of Economics Ethics Committee [ref. 000576] and the University of Zambia Biomedical Research Ethics Committee [ref. 005-06-17]. Written or oral informed consent was obtained for all interviews, according to the preference of the respondent. The information sheet was summarised orally for the respondent, stressing anonymity and confidentiality, and the consent form was read out fully. Both were written in plain language, with Bemba and English versions available. Respondents could take an information sheet and a copy of the consent form home with them, which included contact details in case respondents wanted to retract their participation. Respondents were given a token of appreciation for their time (a baby-gro and chitenge cloth).

All interviews were audio-recorded with respondents' consent. Transcripts were transferred to my own laptop from research assistants' computers using an encrypted USB and stored in an encrypted folder. Research assistants deleted the transcripts after transferring them. Names of people and places were redacted in the quotes and the respondents themselves are referred to with codes.

A number of ethical concerns were identified over the course of data collection. By holding interviews outside, the interviews were private from health workers. However, complete privacy was challenging to achieve in some contexts, with respondents' friends coming to say hello, or passers-by

walking close-by on a path. One of the interviewers reported that respondents were concerned that their friends could see them signing with a thumb print instead of signing their name on the consent form, implying that they were not literate. In the beginning of the interview process, we realised that asking health workers or other patients to help us recruit interviewees was leading to undue pressure to participate, or stigmatising discourses (e.g. when we attempted to recruit participants who had not given birth in a facility); as a result, we stopped involving others in recruitment but instead approached women who were waiting on an individual basis. Another ethical concern was that unbeknownst to me or my team, one nurse in charge maintained a rural outreach clinic for our benefit, which would otherwise have been cancelled. In order to meet immunisation quotas in the upcoming maternal and child health week, the nurse refused to provide immunisations to the infants, simply measuring and weighing them.

There was a clear power imbalance between the interviewing team and most of our interviewees, whether this was based on age (Interviewer 2 was a woman in her 50s), class (myself and my two interviewees were white-collar workers), living in the capital city (both interviewers were from Lusaka), and race & nationality (I am white and European and was occasionally mistaken for an American Peace Corps volunteer). This may have encouraged respondents to give socially desirable answers – in the context of this paper, perhaps emphasising moral judgements and narratives of personal responsibility. It is also likely to have reinforced some of the stigma felt by low status respondents, an ethical concern.

Appendix 6: Limitations of the study

The empirical analysis presents several limitations, including in its application of the approach outlined in the study. The context-specific meanings of the explanatory variables were not interrogated as thoroughly as the socio-economic categories, though this does not imply that they are less of a social construction. The K-O-B decomposition highlights how the association between these variables and access to facility delivery changes according to the dimension and level of SES, implying heterogeneity of meaning.

The respondents for the semi-structured interviews consisted solely of women who had recently given birth. Because of the socially constructed nature of SES categories, it would have been useful to interview others about the meanings of these categories, such as men, relatives, health workers, and policy-makers. The semi-structured interview data is additionally limited by the fact that stories showcasing respondents' agency were not sufficiently explored. Due to resource limitations, the qualitative data comes from a specific district in Northern Zambia, whereas the quantitative data is sourced from across nine provinces. This is an important limitation, as the paper uses the findings of the qual data, which may be specific to that district, to interpret quantitative data sourced from across the country. In addition, the qualitative data was collected roughly 4 years after the quantitative data.

The more recently collected Zambia 2018 DHS, published in January 2020, demonstrates further improvements in both average access to facility delivery (67% to 84%), and in reducing inequalities, compared to the 2013-14 DHS. The latter DHS was not used in this paper because a more recent census of health facilities with adequate information on staffing and quality of care has not been conducted since the 2010 SARA. In order to partly remedy this limitation, qualitative social science studies conducted in other places across the country were used to confirm the qualitative findings where feasible (e.g.: Cole et al., 2015; Evans, 2018; Phiri and Abebe, 2016; White and Jha, 2018).

The variables define some individual characteristics (poverty, birth order) as affordability, cognitive or psychosocial barriers, which are dimensions of the health service environment. It is therefore unsurprising that health service environments, which comprise the affordability barrier, are an important explanation for wealth inequalities. This limitation has been partly addressed: inequalities are explained according to multiple socio-economic dimensions, instead of simply analysing inequalities by wealth.

Finally, the estimated importance of "Effects" vs. "Levels" explanations of inequalities in the K-O-B decomposition, and the unbiased identification of heterogeneous effects, depends on the assumption that there are no omitted variables correlated with the explanatory variables and facility delivery. Since it is very likely that omitted variables are at play, it is possible that differences in coefficients between high vs. low SES groups might be due to differences in the levels of omitted predictors. This is not a major concern for two reasons. Firstly, I show that heterogeneous levels matter more than heterogeneous effects – including omitted variables would simply accentuate this result. Secondly, I do not interpret heterogeneous effects as causal, but as differing social meanings. For example, I show that being out of work has no association with facility delivery for women who are not poor, but a strongly negative association for women who are. I interpret the fact of 'not working' as having a different meaning relative to women's financial and social resources for those who are poor relative to women who are not.

Appendix 7. Full Kitagawa-Oaxaca-Blinder decomposition of SES inequalities in access to facility childbirth, Zambia 2013-14

	Rural-urban inequalities			Wealth inequalities			Education inequalities		
	Coef.	Robust SE	P value	Coef.	Robust SE	P value	Coef.	Robust SE	P value
Overall									
Mean access high SES category	0.93	0.01	0.00	0.84	0.01	0.00	0.89	0.01	0.00
Mean access low SES category	0.61	0.02	0.00	0.59	0.03	0.00	0.66	0.02	0.00
Difference in mean access	0.32	0.03	0.00	0.25	0.03	0.00	0.23	0.02	0.00
"Levels" inequality	0.22	0.04	0.00	0.18	0.02	0.00	0.19	0.03	0.00
"Effects" inequality	0.10	0.03	0.00	0.07	0.03	0.01	0.04	0.03	0.21
Levels inequality									
Affordability barrier	0.03	0.02	0.08	NA	NA	NA	0.03	0.01	0.01
Cognitive barrier	0.01	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00
Psychosocial barrier	0.01	0.01	0.04	0.01	0.00	0.03	0.02	0.01	0.03
Geographic barrier	0.07	0.02	0.00	0.04	0.02	0.00	0.03	0.01	0.01
Availability barrier	0.05	0.03	0.09	0.04	0.02	0.07	0.03	0.01	0.08
Quality of care barrier	0.02	0.03	0.53	0.04	0.02	0.02	0.03	0.01	0.03
% of wives who decide by themselves	0.00	0.01	0.88	0.00	0.01	0.69	0.00	0.01	0.71
% of wives who say husband decides	-0.01	0.01	0.13	-0.01	0.01	0.10	-0.01	0.01	0.10
Literate	0.02	0.01	0.00	0.02	0.01	0.00	0.03	0.02	0.26
Age at birth	0.00	0.00	0.55	0.00	0.00	0.64	0.00	0.01	0.53
> 1 woman of reproductive age in HH	0.00	0.00	0.34	0.00	0.00	0.28	0.00	0.00	0.28
Married	0.00	0.00	0.25	0.00	0.00	0.36	0.00	0.00	0.31
Not working	-0.01	0.00	0.05	-0.01	0.00	0.02	0.00	0.00	0.04
Farm work	0.03	0.01	0.02	0.04	0.01	0.01	0.03	0.01	0.01
Effects inequality									
Affordability barrier	0.01	0.01	0.16	NA	NA	NA	0.01	0.01	0.53
Cognitive barrier	0.05	0.03	0.08	0.02	0.03	0.53	0.03	0.03	0.27

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	Rural-urban inequalities			Wealth inequalities			Education inequalities		
	Coef.	Robust SE	P value	Coef.	Robust SE	P value	Coef.	Robust SE	P value
Psychosocial barrier	-0.01	0.01	0.29	-0.03	0.01	0.08	-0.02	0.01	0.02
Geographic barrier	0.00	0.00	0.23	-0.01	0.02	0.38	-0.01	0.01	0.39
Availability barrier	0.01	0.01	0.28	-0.01	0.03	0.79	0.00	0.02	0.83
Quality of care barrier	0.02	0.03	0.54	0.03	0.04	0.45	0.02	0.02	0.42
% of wives who decide by themselves	-0.03	0.04	0.40	-0.05	0.04	0.23	-0.05	0.03	0.08
% of wives who say husband decides	-0.05	0.02	0.03	-0.07	0.03	0.02	-0.05	0.02	0.01
Literate	0.00	0.02	0.87	0.00	0.01	0.85	-0.03	0.03	0.26
Age at birth	0.24	0.09	0.01	0.30	0.11	0.01	0.20	0.08	0.02
# women of reproductive age in HH	-0.02	0.01	0.05	-0.01	0.01	0.24	-0.01	0.01	0.28
Married	-0.02	0.03	0.47	-0.02	0.04	0.57	-0.06	0.03	0.07
Not working	0.02	0.02	0.16	0.04	0.02	0.04	0.01	0.01	0.51
Farm work	0.02	0.01	0.11	0.01	0.03	0.69	0.00	0.01	0.88
_cons	-0.14	0.10	0.17	-0.14	0.12	0.24	0.00	0.09	0.97

Appendix 8: Underlying coefficients and levels in Kitagawa-Oaxaca-Blinder decomposition of SES inequalities in access to facility childbirth, Zambia 2013-14

	Rural-urban inequalities			Wealth inequalities			Education inequalities		
	Coef.	Robust SE	P value	Coef.	Robust SE	P value	Coef.	Robust SE	P value
Coefficients: High SES category									
Affordability barrier	0.017	0.048	0.725	NA	NA	NA	-0.036	0.048	0.457
Cognitive barrier	-0.047	0.019	0.012	-0.065	0.020	0.001	-0.056	0.022	0.012
Psychosocial barrier	-0.050	0.024	0.039	-0.086	0.030	0.005	-0.126	0.044	0.004
Geographic barrier	-0.314	0.031	0.000	-0.252	0.069	0.000	-0.249	0.073	0.001
Availability barrier	0.106	0.049	0.031	-0.090	0.061	0.138	-0.073	0.058	0.213
Quality of care barrier	-0.039	0.042	0.352	-0.051	0.035	0.149	-0.056	0.034	0.102
% of wives who decide by themselves	-0.024	0.028	0.383	-0.033	0.033	0.304	-0.055	0.034	0.102
% of wives who say husband decides	-0.028	0.057	0.618	-0.004	0.060	0.944	-0.054	0.064	0.397
Literate	0.059	0.016	0.000	0.059	0.019	0.001	0.000	(omitted)	
Age at birth	0.004	0.002	0.018	0.003	0.002	0.073	0.004	0.002	0.039
> 1 woman of reproductive age in HH	-0.019	0.015	0.203	-0.002	0.018	0.914	-0.004	0.021	0.857
Married	0.004	0.017	0.811	0.001	0.019	0.952	-0.031	0.023	0.181
Not working	-0.015	0.017	0.377	-0.010	0.017	0.574	-0.029	0.020	0.135
Farm work	-0.003	0.043	0.948	-0.096	0.038	0.012	-0.074	0.046	0.111
_cons	0.851	0.048	0.000	0.880	0.055	0.000	0.977	0.052	0.000
Coefficients: Low SES category									
Affordability barrier	-0.061	0.031	0.052	NA	NA	NA	-0.074	0.031	0.015
Cognitive barrier	-0.111	0.031	0.000	-0.091	0.037	0.014	-0.094	0.028	0.001
Psychosocial barrier	-0.028	0.037	0.442	0.001	0.046	0.983	-0.027	0.032	0.396
Geographic barrier	-0.184	0.055	0.001	-0.172	0.067	0.010	-0.181	0.061	0.003
Availability barrier	-0.097	0.053	0.070	-0.079	0.069	0.258	-0.091	0.058	0.117

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	Rural-urban inequalities			Wealth inequalities			Education inequalities		
	Coef.	Robust SE	P value	Coef.	Robust SE	P value	Coef.	Robust SE	P value
Quality of care barrier	-0.042	0.048	0.383	-0.104	0.059	0.077	-0.090	0.042	0.032
% of wives who decide by themselves	0.089	0.121	0.463	0.123	0.140	0.380	0.078	0.081	0.332
% of wives who say husband decides	0.202	0.093	0.031	0.264	0.105	0.012	0.193	0.081	0.017
Literate	0.054	0.027	0.047	0.049	0.033	0.147	0.031	0.030	0.290
Age at birth	-0.005	0.003	0.083	-0.008	0.004	0.027	-0.004	0.003	0.145
> 1 woman of reproductive age in HH	0.041	0.028	0.142	0.047	0.037	0.206	0.033	0.026	0.199
Married	0.034	0.036	0.354	0.029	0.043	0.507	0.048	0.033	0.145
Not working	-0.071	0.038	0.061	-0.121	0.053	0.024	-0.049	0.027	0.067
Farm work	-0.103	0.041	0.013	-0.104	0.052	0.047	-0.084	0.036	0.020
_cons	0.993	0.092	0.000	1.020	0.110	0.000	0.981	0.080	0.000
Coefficients: Pooled model									
Affordability barrier	-0.049	0.028	0.081	NA	NA	NA	-0.069	0.027	0.009
Cognitive barrier	-0.073	0.019	0.000	-0.073	0.019	0.000	-0.070	0.019	0.000
Psychosocial barrier	-0.056	0.027	0.036	-0.062	0.027	0.020	-0.058	0.027	0.030
Geographic barrier	-0.195	0.056	0.000	-0.195	0.056	0.001	-0.194	0.056	0.001
Availability barrier	-0.087	0.051	0.084	-0.093	0.051	0.069	-0.091	0.051	0.074
Quality of care barrier	-0.022	0.035	0.534	-0.075	0.033	0.021	-0.073	0.032	0.025
% of wives who decide by themselves	0.008	0.056	0.879	0.022	0.055	0.693	0.020	0.055	0.710
% of wives who say husband decides	0.104	0.064	0.107	0.112	0.064	0.081	0.115	0.064	0.073
Literate	0.054	0.017	0.002	0.059	0.017	0.001	0.033	0.029	0.258
Age at birth	-0.001	0.002	0.541	-0.001	0.002	0.562	-0.001	0.002	0.529
> 1 woman of reproductive age in HH	0.016	0.017	0.330	0.019	0.017	0.269	0.019	0.017	0.270

	Rural-urban inequalities			Wealth inequalities			Education inequalities		
	Coef.	Robust SE	P value	Coef.	Robust SE	P value	Coef.	Robust SE	P value
Married	0.024	0.020	0.231	0.021	0.021	0.300	0.021	0.021	0.305
Not working	-0.040	0.017	0.018	-0.045	0.017	0.009	-0.045	0.017	0.008
Farm work	-0.069	0.029	0.017	-0.083	0.029	0.005	-0.083	0.029	0.004
_cons	1.066	0.073	0.000	0.952	0.059	0.000	0.948	0.060	0.000
Levels: High SES category									
Affordability barrier	0.046	0.012	0.000	NA	NA	NA	0.166	0.022	0.000
Cognitive barrier	0.753	0.014	0.000	0.780	0.012	0.000	0.661	0.017	0.000
Psychosocial barrier	0.115	0.011	0.000	0.188	0.013	0.000	0.076	0.009	0.000
Geographic barrier	0.008	0.008	0.316	0.110	0.021	0.000	0.099	0.022	0.000
Availability barrier	0.019	0.014	0.157	0.193	0.027	0.000	0.194	0.028	0.000
Quality of care barrier	0.085	0.028	0.003	0.338	0.034	0.000	0.327	0.035	0.000
% of wives who decide by themselves	0.427	0.026	0.000	0.375	0.020	0.000	0.393	0.022	0.000
% of wives who say husband decides	0.159	0.018	0.000	0.190	0.015	0.000	0.187	0.015	0.000
Literate	0.657	0.025	0.000	0.599	0.020	0.000	1.000	.	.
Age at birth	26.364	0.244	0.000	26.925	0.213	0.000	25.219	0.253	0.000
> 1 woman of reproductive age in HH	0.403	0.019	0.000	0.379	0.016	0.000	0.416	0.020	0.000
Married	0.761	0.015	0.000	0.797	0.012	0.000	0.722	0.016	0.000
Not working	0.454	0.023	0.000	0.444	0.019	0.000	0.435	0.022	0.000
Farm work	0.068	0.020	0.001	0.172	0.020	0.000	0.142	0.020	0.000
Levels: Low SES category									
Affordability barrier	0.683	0.023	0.000	NA	NA	NA	0.558	0.026	0.000
Cognitive barrier	0.849	0.009	0.000	0.850	0.011	0.000	0.887	0.008	0.000
Psychosocial barrier	0.340	0.017	0.000	0.330	0.020	0.000	0.338	0.016	0.000

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	Rural-urban inequalities			Wealth inequalities			Education inequalities		
	Coef.	Robust SE	P value	Coef.	Robust SE	P value	Coef.	Robust SE	P value
Geographic barrier	0.344	0.048	0.000	0.340	0.050	0.000	0.264	0.039	0.000
Availability barrier	0.627	0.047	0.000	0.635	0.048	0.000	0.476	0.042	0.000
Quality of care barrier	0.895	0.031	0.000	0.877	0.031	0.000	0.690	0.035	0.000
% of wives who decide by themselves	0.259	0.020	0.000	0.262	0.021	0.000	0.293	0.018	0.000
% of wives who say husband decides	0.295	0.022	0.000	0.307	0.023	0.000	0.266	0.019	0.000
Literate	0.305	0.019	0.000	0.242	0.017	0.000	0.163	0.013	0.000
Age at birth	27.501	0.256	0.000	27.197	0.304	0.000	27.979	0.238	0.000
> 1 woman of reproductive age in HH	0.240	0.016	0.000	0.207	0.019	0.000	0.250	0.015	0.000
Married	0.845	0.011	0.000	0.830	0.013	0.000	0.857	0.011	0.000
Not working	0.325	0.027	0.000	0.287	0.028	0.000	0.347	0.023	0.000
Farm work	0.551	0.031	0.000	0.603	0.031	0.000	0.466	0.029	0.000

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