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Parity and Parents' Health in Later Life:

The Gendered Case of Ismailia, Egypt

Running Head: Parity and parents' health in later life

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Abstract

In this paper, we investigate the link between reproduction and functional health in later life for both men and women in a gender-stratified setting. Studying men, women, sons, and daughters allows us to consider the influence of both biological mechanisms and social relationships in linking fertility and later-life health in this society. Analyses of recent data from Ismailia governorate, Egypt, show a statistically significant association between parity and difficulty with activities of daily living (ADLs), controlling for demographic and socioeconomic factors and other co-morbid conditions. We also find that the number of daughters (but not sons) is associated with worse physical functioning, and this association is more pronounced for older fathers than for older mothers. Our results indicate that in this resource-poor and highly gender-stratified setting, social norms and familial roles may underlie a differential impact of sons and daughters on the health of mothers and fathers in later life.

Keywords: parity, childbearing, gender, functional status, activities of daily living (ADL), disability

Parity and Parents' Health in Later Life: The Gendered Case of Ismailia, Egypt

Children are poor men's riches.

Children suck the mother when they are young and the father when they are old.

- *English Proverbs*

Children are desired for a multitude of emotional, social and practical reasons, and bearing and rearing children is widely recognized to encompass both joys and challenges of proverbial proportions. The notion that parenthood takes a physiological toll that becomes manifest in later life is intuitive in many cultures and was formalized in the *disposable soma theory* (Kirkwood and Rose 1991), which posits a trade-off between the bodily resources devoted to reproduction and those needed for survival. Studies testing this theory have focused on the relationship between parity and longevity (e.g. Friedlander 1996; Westendorp and Kirkwood 1998; Doblhammer 2000; Smith, Mineau, and Bean 2002), and more recently, the consequences of parity for health in later life among women (e.g. Grundy and Holt 2000; Grundy and Tomassini 2005; Spence 2008). However, a long tradition of research in Gerontology has shown that the implications of total family size for health are not purely biological, nor are they limited to women. Studies consistently confirm that children draw upon the social and economic resources of parents early in life and return benefits to them later in life in the form of support and caregiving (e.g. Spitze and Logan 1990; Wolf, Freedman, and Soldo 1997; Rahman 1999; Duflo 2000). These relationships are influenced by the roles and expectations for men and women both as parents and as children.

Using data on Egyptian men and women aged 50 years and older, we show an inverse relationship between parity and functional status that is mediated by the gender composition of children. Considering the role of gender in both the parental and child generations, we investigate a link between reproduction and health in later life that is as much a function of social relationships as it is due to underlying biological mechanisms. The majority of previous studies on this subject have drawn on data from populations in Europe and North America (e.g. Westendorp and Kirkwood 1998; Helle, Lummaa, and Jokela 2002; Harrell, Smith, and Mineau 2008; Grundy and Kravdal 2008). This study provides a distinctive opportunity for exploring the nature of these associations in a resource-poor and highly gender-stratified setting.

Background

Parity, Longevity, and Health: Biodemographic Connections

Evolutionary biology posits that natural selection is the primary force through which population-level changes in human characteristics take place over time. Selection may thus shape the aging process via mechanisms that operate before and during the reproductive years (Wachter and Finch 1997; Carey 2003). The accumulated physiological demands of repeated childbearing and close spacing of births has been linked to malnutrition, loss of energy, and poor consequent health – a process known as maternal depletion (Winkvist, Rasmussen, and Habicht 1992). However, selection cannot adequately explain improvements in longevity and health in later life precisely because post-reproductive differences are not subject to selection (Comfort 1956). Some argue that aging in human populations may simply reflect a process of slow decline – akin to the failure of complex mechanical systems (Gavrilov and Gavrilova 1991, Carey 2003). Alternately, the *disposable soma* theory proposes an explicit trade-off between survival and well being in later life and reproduction, which demands resources and potentially accelerates the pace of senescence (Kirkwood and Rose 1991). This relationship is expected to be most acutely observed in high-fertility settings, where women bear children throughout their reproductive years. High parity also may be evolutionarily beneficial in allowing parents to ensure the survival of their later offspring (Austad 1997; Lee 2003).

Research exploring the connection between reproductive histories and survival outcomes in both historical and contemporary populations has yielded mixed results. Some studies find lower mortality for women who had never borne children (Beral 1985; Friedlander 1996) whereas others report increased longevity with higher parity (Green, Beral and Moser 1988; Manor et al. 2000; Muller et al. 2002), or no significant relationship (Menken et al. 2003). Doblhammer (2000) described a U-shaped relationship in the populations of England, Wales, and Austria, with both childless and high-parity women experiencing higher mortality risks compared to women with one or two children. Grundy and Tomassini (2005) report a similar finding. A systematic review by Hurt, Ronsmans, and Thomas (2006) concluded that differential fertility patterns across populations contribute to the inconsistency in findings, and methodological issues also complicate comparisons across studies.

The relationship of parity to overall physical functioning and specific health conditions has been examined mainly with respect to short-term outcomes. Multiple pregnancies have been linked to overweight and obesity (Lassek and Gaulin 2006; Kim et al. 2007), a pattern that has been observed in settings like Egypt, where fertility remains high even as societies undergo nutritional transitions. High parity is also linked to chronic illnesses including diabetes, hypertension, heart disease, and cerebrovascular disease (Beral 1985; Green et al. 1988; Ness et al. 1993; Kvale, Heuch, and Nilssen 1994; Cooper et al. 1999; Lawlor et al. 2003, among others.)

Studies of fertility and later life health are more recent and limited in number. Spence (2008) reports an association between early childbearing and limitations in activities of daily living, and Grundy and colleagues (Grundy and Holt 2000; Grundy and Tomassini 2005) found that high parity (five or more children) and childlessness, along with early delivery and close birth spacing, were associated with a greater likelihood of older women reporting a long-term illness.

Gender, Family Size, and Later-Life Health

While women's exposure to the physiological impact of pregnancy, childbearing, delivery, and lactation is more evident, the psychological, behavioural, and socioeconomic consequences of childrearing apply to both men and women. Doblhammer and Oeppen (2003) argue that commonalities in the socioeconomic environment and parenting roles shared by men and women would likely explain any effects of parity on men's health or survival, an idea supported by a recent study in Norway that showed similar associations between reproductive histories and mortality for middle-aged women and men in this egalitarian setting (Grundy and Kravdal 2008).

The majority of studies considering the influence of childbearing on later life for both mothers and fathers have found a stronger positive relationship between total parity and mortality for women than men (Friedlander 1996; Christensen et al. 1998; Smith et al. 2002; Doblhammer and Oeppen 2003; Dribe 2004; Zeng and Vaupel 2004; Jasienska, Nenko and Jasienski 2006; Harrell, Smith and Mineau 2008), though Westendorp and Kirkwood (1998) and Smith et al. (2002) showed a significant negative correlation between parity and longevity for both women and men in Great Britain and in Utah (where the effect was weaker for men), and some studies of historical populations found no correlation between parity and longevity for either sex (Le Bourg et al. 1993; Alter et al. 2002). Hurt et al. (2004) found that the mortality of Bangladeshi men but not women decreased with parity, suggesting a psychosocial link between having children and later life outcomes.

The gender of the children matters a great deal as well. The *disposable soma* theory postulates that sons are particularly detrimental to maternal longevity because producing sons demands more physiological energy than producing daughters (Kirkwood and Rose 1991). Historical studies have shown that the number of sons born to a woman reduced her expected longevity (Helle, Lummaa and Jokela 2002), while the number of daughters increased it (Beise and Voland 2002; Helle, Lummaa and Jokela 2002). The negative effect of sons on maternal longevity may be greater among the least privileged social groups (van de Putte, Matthijs, and Vlietinck 2004), a finding reinforced in a contemporary Bangladeshi cohort (Hurt, Ronsmans and Quigley 2006). These effects also may vary by the gender of the parents. Harrell, Smith and Mineau (2008) described an adverse mortality effect of sons for mothers (but not fathers) in Utah, and Jasienska, Nenko and Jasienski (2006) found that the number of daughters was associated with higher longevity for fathers only. The variability of these effects across populations and social classes reinforces the notion that socio-economic pathways play a role beyond the basic biological effects of childbearing.

Supportive ties with living children also link total family size to well-being at older ages. Extensive research in the U.S. has shown that parents receive different care from sons and daughters in later in life (e.g. Raley and Bianchi 2006). Adult daughters are more likely than sons to provide hands-on care to older parents while sons provide more instrumental and material support (Spitze and Logan 1990; Ingersoll-Dayton, Starrels, and Dowler 1996). In general, children of both sexes provide more support to mothers than to fathers (Rossi and Rossi 1990; Silverstein and Bengtson 1997; Silverstein, Gans, and Yang 2006). In low-income countries, where state- and market- based pension and health care systems are less available, parents with more children have a greater opportunity to receive financial resources and personal care

(Rosenzweig 1988; Zimmer and Kwong 2003). Gender differences in the caregiving behaviours of sons and daughters vis-à-vis mothers and fathers (Ofstedal et al. 1999; Climo 2000) and in older people's expectations for filial support (Cong and Silverstein 2008) have been documented in a variety of international settings.

The Egyptian Context

The generation of older men and women in this study bore children at a time when large family sizes are common, and they report a slightly greater number of sons than daughters on average (see Table 2). In Egypt, sons are desired because they enhance a family's prestige, carry on the family line, and are expected to provide financial help to parents in old age (Arnold 1997). The gender composition of the children may influence both parents' total parity and birth intervals, since parents who hope for a male child will likely continue having children until they reach the desired number of sons (Dalla Zuanna and Leone 2001; Gadalla, McCarthy and Campbell 1985; Yount, Langsten and Hill 2000). Son preference also leads to differential treatment of male and female children (Yount 2004.).

In this setting, the benefits and burdens of parenthood also are not uniform across children of different sexes. According to Egyptian norms of *gender complementarity*, fathers, husbands, and adult sons are expected be the economic providers, while mothers, wives, and daughters are expected be the domestic laborers and to rely on the financial backing of male kin (e.g. Nelson and Olesen 1977; Jowkar, 1986). As children grow up, the division of domestic labour and responsibilities, the potential for earning in the labour market, the need to finance weddings, and social norms and expectations for support from children, among other factors, all may influence the impact of having sons and daughters on men and women in Ismailia. The gender of each child may affect the level of perceived and real socioeconomic pressures, since boys can become partners in supporting the family at the end of their education, while girls require finances in preparation for marriage, after which their primary affiliation and filial obligation shifts to their husband's families (Singerman and Hoodfar 1996). While daughters provide social, emotional, and instrumental support to parents, the trousseau that they require at marriage can be costly, and both mothers and fathers tend to believe that daughters provide less financial support in old age than sons (Yount 2005). In settings like Egypt, where women manage the household while their husbands are responsible for the family's financial welfare, women may benefit more from the social support provided by more children while men carry more of the economic burden children entail (Knodel and Ofstedal 2003).

In Egypt, filial obligation norms lead children to provide broad financial and affective support to older parents (Rugh 1984). In accordance with their role as providers, sons are expected to provide financial and co-residential care (Singerman and Hoodfar 1996), though endogamous marriage is frequent and means that married daughters are often available to provide support (El-Zanaty et al. 1996). Previous studies in Egypt have documented marked gender differentials favouring males in health, physical and cognitive functioning among surviving older adults (Yount et al. 2004; Yount and Agree 2005; Yount and Khadr 2006), but the extent to which these health differences may be linked with their reproductive histories or their children's gender composition has not been previously investigated.

The relations between older parents and their adult sons and daughters may yield divergent outcomes for fathers and mothers, depending on the interaction of social and biological influences on health. Our hypothesis is that, for women in Ismailia, the observed relationship of parity and health reflects a combination of the physiological hardships of childbearing and parental investments earlier in life balanced with the benefits of psychosocial, instrumental, and financial support provided by children in later years. For men in Ismailia, while there is no direct biological effect of parity on health, the socio-economic benefits and burdens of parenthood are nonetheless salient. For Egyptian fathers, children may be a source of pride, reflecting the fulfilment of men's masculine responsibility to establish families and provide for them (Rugh 1984). Adult children also provide social and instrumental support to older fathers, though high rates of re-marriage may mean that older men in Egypt rely more on their spouses and less on the care of adult children relative to older women. Furthermore, socioeconomic pressure associated with having to feed, educate, and support many children may lead to accumulated stresses that foster negative health outcomes in later life, particularly in this resource-poor settings. A high number of children, and particularly daughters, who are not considered to provide as large a return on investment as sons, could represent socio-economic stresses for fathers who are expected to support them. Single mothers (e.g. widows or, rarer in this setting, divorcees) who are charged with financial responsibility for their families may exhibit a similar social effect curve in conjunction with the biological effect.

In a society that gives males more opportunities for gaining the skills, income, and influence necessary to support themselves and other family members, the reasons for preferring sons (i.e. the promise they offer for their parents' better financial and physical well-being) might become self-fulfilling prophecies.

Data and Methods

Study Setting and Sample

Ismailia governorate (pop. 844,000) is located in northeastern (Lower) Egypt (CAPMAS 2004). According to the Egypt Human Development Report (UNDP 2003), since 2001 nearly all households have had access to electricity, and a somewhat higher percentage of households in Ismailia had access to piped water relative to the overall population of Lower Egypt (93% vs. 90%). In 2000-2001, real GDP per capita (5989 Egyptian pounds (£E), or US$1746) and rates of literacy (73%) among adults aged 15 years and older were higher than the rates for Lower Egypt at large (5059£E (US$1475) and 65%, respectively). Although women's literacy rates (64%) and labour force participation (17%) have been higher in Ismailia than in other Lower Egypt governorates (53% and 16%, respectively), they constitute only 71% and 21% of comparable rates among men.

The target sample of this study was 450 women and 450 men evenly distributed across the age groups 50-59, 60-69, and 70 and over. In 2003, a complete household census was conducted in primary sampling units selected in one rural and one urban district in Ismailia governorate to generate the sampling frame for the study. Of 1182 age-eligible adults, 1053 (88% including 526 men and 527 women) consented to participate and completed a baseline interview. In the baseline interview, participants were asked to report, among other things, their sociodemographic characteristics (including age, sex, educational attainment), occupational and marital history, number of co-resident and non co-resident children, current levels of difficulty executing physical tasks, basic activities of daily living (ADLs), and instrumental activities of daily living, as well as experiences of acute and chronic illnesses (Yount and Khadr 2006).

The analytic sample was restricted to ever-married men and women with at least one child ever born, and a small number of respondents with missing information on key variables were excluded from the analysis. The final analytic sample consisted of 956 individuals (499 women and 457 men). Given the stratified cluster sample study design, analytic weights were calculated using the inverse of the sampling fractions so that the age-sex distribution of the sample for each district conformed to the distribution of the population aged 50 years and older in the district, by five-year age groups and sex, according to the 1996 census. We fit pooled models for men and women with interaction terms that enabled the investigation of potential differences in the effect of parity on ADL difficulties for men and women.

Dependent Variable

Our primary outcome of interest in this analysis is the number of Activities of Daily Living (ADLs) with which respondents reported having difficulty in the baseline interview. ADLs include bathing, dressing, eating, getting in and out of a chair or bed, walking, going outside, and getting to and using the toilet. Difficulties were self-reported, though a small number were described by a proxy due to a respondent's cognitive impairment. Self-reported ADL difficulties have been shown to be comparable to objective performance measures in predicting functional capacity (Hoyman et al. 1996; Idler and Benyamini 1997; Fried et al. 2001). **Table 1** shows the distribution of reported ADL difficulties by sex. Consistent with other studies of older persons in poor countries (e.g. Lamb 1996) levels of ADL disability are low, with the majority of our sample having either zero or one ADL limitation. Women report more disability than men, with nearly two thirds of women reporting at least one ADL limitation compared with about one third of men.

[Table 1 about here]

Independent Variables

Table 2 describes the independent variables used in the analyses for men and women in the final sample. The main predictor is parity, obtained from self-reports of children ever born (CEB). Parity is a continuous variable, ranging from 1 to 18 in the sample of parents. We explored a number of alternative specifications for modelling parity as a dichotomous, categorical, and quadratic variable as well as testing splines and a log transformation. Results from these models were consistent with those obtained from analyses employing the continuous parity measure, and we consequently employed the continuous measure in our regressions. Analyses including and excluding nulliparous respondents (26 women and 9 men) likewise yielded very similar results, and the statistics reported below are for the sample of parents.

[Table 2 about here]

Women reported slightly higher total parity than men on average (6.78 vs. 6.56). Men's parity is more concentrated between 4 and 9 children ever born, whereas women's total fertility is more variable, ranging from 4 to 12 children ever born. Women more commonly reported both high parity (>9 children) and nulliparousness relative to men (results not shown). While the average reported number of children of both sexes is nearly identical for men and women, relative to women, men report on average slightly more living children and slightly fewer children who died.

The average age of men and women in the sample was approximately 64 years. Slightly more than half of all sampled men and women (53%) live in urban areas, and over twice as many men reported being currently married relative to women (88% vs. 43%). The difference is explained partially by the fact that women more often remain widowed after a spouse's death, whereas men more often reported a higher number of (consecutive and occasionally concurrent) marriages (tabulations not shown). The measure of household economic resources was constructed as an equally weighted count of 17 items, including finished flooring, indoor water source, indoor tap, indoor sink, soap, flushing toilet, radio, television, video recorder, land telephone, mobile telephone, fan, water heater, refrigerator, washing machine, bicycle, and car.

In addition to influencing fertility, household economic resources also may be influenced by parity and family size. As such, the variable is included in the analyses to control for a set of socioeconomic differences between respondents rather than to reflect a deterministic relationship. On average, men had a somewhat higher score (9.9 vs. 9.2) than women on this scale. Since residence incorporates numerous contextual factors related to fertility (e.g. Vignoli 2006) a measure of urban and rural location was also included in the models. A modified Mini-Mental State Exam (M-MMSE) score also was included in each model, because cognitive deficits are associated with functional declines, and also because this cognitive function measure was used to determine the need for proxy respondents in the survey. Men achieved better (higher) scores than women on average (16.6 vs. 14.6). While educational attainment has been linked with factors likely to impact parity such as later entry into both marriage and childbearing and higher female labor force participation (UN 1995), the variable was not statistically significant in our models, and was left out in the interest of parsimony.

Since hypertension, heart disease, and diabetes affect functional capacity and have been linked with parity (see review above), we include these doctor-diagnosed morbidities in the model to investigate their potential roles as mediators between parity and functional disability. Nearly twice as many women as men reported diagnoses of hypertension (45.5% vs. 23.8%), and women reported more diagnoses of heart disease (9.4% vs. 5.7%) and diabetes (16.4% vs. 11.4%) relative to men.

Analytic Approach

Since our outcome variable is a count of ADL difficulties, we fit a negative binomial maximum-likelihood regression model to describe its relationship with the predictors, including parity.

Negative binomial regression is used to estimate count models when a Poisson procedure is inappropriate due to over-dispersion in the data. The negative binomial model estimates the degree of dispersion and corrects the standard errors for this unobserved heterogeneity.

Following standard practice, we parameterize the regression model using a log-link function. The baseline model describes the relationship between the count of ADL difficulties and parity adjusting for sociodemographic variables (age, sex/gender, current marital status, household SES, and urban residence), and respondents' M-MMSE score, taking the form:

$$\log(ADLcount) = \beta_0 + \beta_1 x_{parity} + \beta_2 x_{age} + \beta_3 x_{femaile} + \beta_4 x_{married} + \beta_5 x_{hhses} + \beta_6 x_{urban} + \beta_7 x_{mmse} \quad (1)$$

In subsequent models, an interaction term is added to explore the possibility of a differential effect of parity on ADL difficulties by sex, and the potential role of health conditions in mediating the relationship between parity and functional capacity was examined. Two additional sets of models examine the separate influences of daughters and sons on parents' ADL difficulties controlling for other covariates, and again investigate a potential gender differential through interaction terms. Because we hypothesize a social connection between the number and gender of children and parents' health in later life, we also distinguished between the effects of living children and those who had died.

Point estimates and standard errors for all models were adjusted using the "svy" commands in Stata 10 to account for the stratified cluster sample design. The negative binomial regression coefficients represent the difference between the log of expected counts (or, equivalently, the log of the ratio of ADL difficulty rates). While the onset of ADL difficulties is not the focus of this analysis, the exponentiated regression coefficients are referred to as incidence rate ratios (IRRs), in accordance with common nomenclature. Changes in the magnitude and significance of the IRRs with sequential inclusion of each set of variables separately and together provided evidence about the appropriateness of the models describing the relationship between parity and ADL disability for older parents.

Results

Tables 3-5 summarize the incidence rate ratios (IRRs), or the ratios of expected ADL difficulty counts, from the negative binomial models. **Table 3** provides results from analyses investigating the relationship between total parity and functional capacity in later life among respondents with at least one child ever born. No significant association between nulliparousness and ADL difficulty for either women or men was observed in a separate analysis (results available upon request). Model 1 shows a statistically significant positive association between parity and worse functioning, controlling for sociodemographic factors, household socioeconomic status (SES), and modified MMSE score. Other significant covariates include older age and being female, which were both associated with a higher rate of ADL difficulties, while higher SES and better cognitive function were associated with a lower rate, controlling for other factors.

We explored the potential of a differential effect of parity for men and women through an interaction term in model 2. The interaction was marginally statistically significant ($p \leq 0.1$), and showed an attenuation of the parity effect for women relative to men. The IRRs for parity and being female increased in magnitude, though some p-values rose slightly.

To evaluate the potential role of chronic conditions as mediators between parity and ADL difficulties, we explored variables representing three health conditions described above – high blood pressure, heart disease, and diabetes – in model 3. All were positively and significantly associated with ADL difficulties. Parity remained significant in this model as it was in the baseline model, suggesting that chronic health conditions were not on the causal pathway between parity and ADL difficulties in later life for these men and women. Throughout, the models show relatively little change in the magnitude and significance of our control variables.

[Table 3 about here]

Tables 4 and 5 present results from analyses investigating the role of children's gender composition as a potential mediator of the relationship between parity and health. While no statistically significant association was found between the number of sons and ADL difficulties, the relationship with the number of daughters was positive and statistically significant. In other words, having more daughters, but not more sons was associated with a higher risk of ADL difficulties (model 1 in both tables). We next examined the differential effect of daughters and sons on their mothers' and fathers' ADL difficulties through the inclusion of an interaction term. As model 2 shows, the effect of daughters (**Table 4**) on ADL difficulties was attenuated for mothers relative to fathers (though the main effect for parity increased), but no such difference was observed for sons (**Table 5**). Thus, the positive association between number of daughters and ADL difficulties is smaller for older women than for men. These findings were robust to including both the number of sons and daughters as well as the interaction terms in a single model (results available upon request). Furthermore, while including the number of daughters as well as the sex-interaction term in models substantially decreased the IRR for parity and eliminated its significance, parity remained significant in similar models including the number of sons (models 3 and 4 in both tables).

Models 5 and 6 in both tables differentiate between surviving children and those who had died. **Table 4** shows that the results discussed above are statistically significant for living daughters, but not daughters who had died. **Table 5** shows only marginal significance for the number of living sons, and no effect of either living or dead sons when an interaction term is added. Finally, model 7 in both tables includes the variables reflecting diagnosed health conditions. Adding sons or daughters rather than overall parity to the equation does not substantially change the results obtained for overall parity, though once again the number of daughters but not sons registers significance. Interaction terms for each of the chronic conditions by sex/gender were also tested, but none were statistically significant.

[Tables 4 and 5 about here]

Discussion

Biodemographic theories and empirical analyses of mortality raise the expectation of a biological connection between parity and physical function in later life. Our analysis suggests that gendered social support may be another key component of this relationship. While the biological link between childbearing and later life health is most readily conceptualized for women, social pathways that have to do with shared environments, lifestyle factors, and family relationships operate for both women and men, though perhaps differently for each – particularly in a setting, like Egypt, with traditionally-defined gender norms and roles.

As expected, being female, older, of lower SES, and having poor cognitive functioning all are associated with a greater number of ADL difficulties in later life. Higher parity is also associated with worse physical functioning even when controlling for socio-demographic variables, cognition, and chronic conditions. The long-term effects of parity on health appear to involve more than the physiological impact of bearing children. Across all models, the positive adjusted association of being female with more ADL difficulties supports a *sex*-differentiated link between childbearing and health in later life, while the differential effects of sons and daughters on functional health for mothers and fathers points towards at the importance of *gendered* social factors in the context of Ismailia. In Ismailia, young sons and daughters require different resources from – and provide different resources to – their mothers and fathers at different ages and stages of life. In addition, adult sons and daughters may have acquired different resource portfolios with which to support their older parents. Thus, social roles and structures may differentiate between the impact of sons and daughters on mothers and fathers both during their child-rearing years and in later-life.

Our analysis supports the idea that while mothers experience more long-term physiological consequences of childbearing than men, they also may gain social, emotional, and economic support from children – and especially daughters – across multiple realms, helping to neutralize some of the potentially adverse physiological effects. Prior research in Egypt shows that mothers may benefit more directly than fathers do from the help that daughters provide with domestic chores (Yount 2004). While older women tend to live alone more often than older men, women are also more likely to have co-residential support in later life (Yount and Khadr 2008).

For men, a significant, positive association between parity and ADL difficulties was observed, further supporting the notion of a non-biological pathway linking family size and functional capacity in later life. In Lower Egypt, the positive association between parity and poorer health outcomes for men in later life may result from the economic stress and emotional strain associated with having to feed, clothe, educate, and support children. In resource-poor settings in particular, educational fees, marriage payments, and other expenditures for additional children may translate into higher economic burdens across the lifespan. In a society where men are the primary (and often sole) breadwinners, these financial burdens (and associated social anxieties) belong primarily to men. Furthermore, the gender of each child – and the number of children of each gender – may influence the level of perceived and real socioeconomic pressures independent of the child's own characteristics.

While both boys and girls require family resources at a young age, boys are raised to become partners in supporting the family at the end of their education, while girls require the provision of additional resources, in the form of a trousseau, before they marry and leave the household. Wedding costs for the bride's family have been rising steadily since the 1960s, and the financial burden is particularly harsh for households in poverty, where fathers and older brother may have to take second jobs or temporary migrate for more lucrative labour options (Singerman and Ibrahim 2003). While daughters may provide mothers with assistance with domestic chores, unlike sons, they lack the potential to help with men's agricultural or professional chores because of the gendered division of labour. Our analysis suggests that the effect of the number of daughters on ADL difficulties in later life was more detrimental for men than for women, though we emphasize that the type of link demonstrated in our data is socially and culturally contingent. Socio-economic changes, such as rising rates of women's participation in the labour force and increased geographical dispersion of families may eventually change the intergenerational dynamics described here.

The evidence regarding the influence of children's gender composition on the relationship between parity and ADL difficulties is a step towards corroborating the social mediation hypothesis. While a variety of chronic conditions are strongly associated with ADL difficulties for women and men in Ismaiilia, these associations do not explain away the long-term relationship between parity and health in later life. Results showing a significant association between the number of living (but not dead) children and parent's health in later life lend further support to the notion that child bearing *per se* is distinct from the social dimensions associated with rearing children and with the potential support they may provide when they are adults.

Limitations and Future Research

The outcome measure in this analysis is a self reported measure of ADL difficulty, rather than a score on an objective test of functional performance. However, research in the U.S. and international contexts has shown that compared to performance measures, self-reports of function are accurate for the majority of men and women across a range of socioeconomic and cultural contexts (Merrill et al. 1997; Wray and Blaum 2001; Kuhn, Rahman, and Menken 2004).

Our main predictor, respondents' self-report of children ever born, may be subject to recall bias and inaccuracy, particularly given the levels of child mortality in Egypt during the past 50 years. While our data did not contain the ages of children who had died, differences between men and women in reported parity may in part be an artefact of differential recollections, with women more likely to report all children, including those who died young, relative to men, who may only report children who survived beyond infancy.

It is also important to acknowledge that people may be selected into their particular parity by non-random SES and structural factors, as well as by their health earlier in life. While we do not address these concerns in detail above, earlier analyses did test the impact of early life SES on later-life functional health outcome, but none of the relevant measures were significant in models including parity. Furthermore, while men and women with long-term chronically illness bear fewer children, this type of "fecundity selection" would bias measured effects of parity on health towards zero, rendering our results conservative.

Further research, particularly in the context of countries undergoing economic, political, and social change, should consider both biological and social mechanisms for a fuller understanding of the links between reproduction and later-life health. Children provide and receive several different types of support throughout their lives, and capturing the nuanced positive and negative influences of sons and daughters will likely require more detailed variables. Future research needs to examine more thorough reproductive histories that better capture variation in the experience of childbearing and fuller accounts of intergenerational transfers in order to better understand the degree to which social support shapes the relationship between childbearing and rearing and functional health in later life.

Conclusion

There appears to be more to reproduction's effect on later-life outcomes than the direct biological impact of the number of births posited by the *disposable soma* theory. While biological pathways may seem invariable, neither they nor social pathways are necessarily so. Our analysis suggests that in addition to biological links, social roles and relationships should be further investigated as part of the explanation. In the context of Lower Egypt, gender roles are important in defining the specific responsibilities of mothers and fathers vis-à-vis their children, the resource needs of boys and girls, and the capacities of grown sons and daughters to contribute to their older parents' well-being.

References

Alter, G., M. Oris, M. Neven, and G. Brostrom. 2002. "Maternal depletion and mortality after the childbearing years in nineteenth-century East Belgium." Working Paper Series 2002: No. 7. Available at www.indiana.edu/~pirt/ELC/WP/ELCpaper2002-07.pdf (March 5, 2006).

Arnold, F. 1997. "Gender preferences for children." *Demographic and health Surveys Comparative Studies* 23. Calverton, MD: Macro International.

Austad, S.N. 1997. "Postreproductive survival." Pp161-174 in *Between Zeus and the Salmon: The Biodemography of Longevity*, edited by K.W. Wachter and C.E. Finch. Washington, DC: National Academy Press.

Barakat, H. 2005. The Arab family and the challenge of social transformation. In H. Moghissi, ed. *Women and Islam: Social conditions, obstacles, and prospects.* Taylor & Francis, p.145-165.

Beise J., and E. Voland. 2002. Effect of producing sons on maternal longevity in premodern populations. *Science* 298(5592), 317.

Beral, V. 1985. "Long term effects of childbearing on health." *Journal of Epidemiology and Community Health* 39:343-346.

Carey, J.R. 2003. "General biodemographic principles." Pp. 176-199 in *Longevity: The biology and demography of the life span.* Princeton, NJ: Princeton University Press.

Central Agency for Public Mobilization and Statistics, Egypt (CAPMAS). 2004. http://www.capmas.gov.eg/eng_v/news/populationestimatedinandout2.htm (accessed September 17, 2004).

Christensen, K., D. Gaist, B. Jeune, and J.W. Vaupel. 1998. "A tooth per child?" *Lancet*

352(9123): 204.

Climo, J. J. 2000. "Eldercare as "Woman's Work" in Poor Countries." *Journal of Family Issues* 21(6): 692-713.

Comfort, A. 1956. *The Biology of Senescence.* London: Routledge & Kegan Paul.

Cong, Z., and M. Silverstein. 2008. "Intergenerational support and depression among elders in rural China: Do daughters-in-law matter? *Journal of Marriage and Family* 70:599-612.

Cooper, G.S., S.A. Ephross, C.R. Weinberg, D.D. Baird, E.A. Whelan, and D.P Sandler. 1999. "Menstrual and reproductive risk factors for ischemic heart disease." *Epidemiology* 10(3):255-259.

Dalla Zuanna, G, and T. Leone. 2001. "A gender preference measure: the sex ratio at last birth." *Genus* 57(1):33-56

Doblhammer, G. 2000. "Reproductive history and mortality later in life: A comparative study of England and Wales and Austria." *Population Studies* 54(2): 169-176.

Doblhammer, G and J. Oeppen. 2003. "Reproduction and longevity among the British peerage: The effect of frailty and health selection." *Proc Biol Sci* 270(1524): 1541-7.

Dribe, M. 2004. "Long-term effects of childbearing on mortality: Evidence from pre-industrial Sweden." *Population Studies* 58(3): 297-310.

Duflo, E. 2000. "Child Health and Household Resources in South Africa: Evidence from the Old Age Pension Program." *American Economic Review* 90(2): 339-398.

El-Zanaty, F., Hussein, E.M., Shawky, G.A., Way, A.A. and Kishor, S., 1996. *Egypt demographic and health survey 1995*. Macro International, Inc, Calverton, MD.

Foner, N. 1984. *Ages in Conflict: A Cross-Cultural Perspective on Inequality between Old and Young.* New York: Columbia University Press.

Fried, L.P., Y. Young, G. Rubin, and K. Bandeen-Roche. 2001. "Self-reported preclinical disability identifies older women with early declines in performance and early disease." *Journal of Clinical Epidemiology* 54(9): 889 – 901.

Friedlander, N.J. 1996. "The relation of lifetime reproduction to survivorship in women and men: a prospective study." *American Journal of Human Biology* 8(6): 771-783.

Gadalla, S., J. McCarthy, and O. Campbell. 1985. "How the number of living sons influences contraceptive use in Menoufia Governorate, Egypt." *Studies in Family Planning* 16(3):164-169.

Gavrilov, L.A. and N.S. Gavrilova. 1991. *The Biology of Life Span*. Chur, Switzerland: Harwood Academic Publishers.

Green, A., V. Beral, and K. Moser. 1988. "Mortality in women in relation to their childbearing history." *British Medical Journal* 6(6645):391-5.

Grundy, E. and G. Holt. 2000. "Adult life experiences and health in early old age in Great Britain." *Social Science and Medicine* 51(7): 1061-74

Grundy, E. and C. Tomassini. 2005. "Fertility history and health in later life: a record linkage study in England and Wales." *Social Science and Medicine* 61(1):217-28.

Grundy, E., and O. Kravdal. 2008. "Reproductive history and mortality in late middle age among Norwegian men and women." *American Journal of Epidemiology* 167(3): 271-279.

Harrell, C.J., K.R. Smith, and G.P. Mineau. 2008. "Are girls good and boys bad for parental longevity? The effects of sex composition of offspring on parental mortality past age 50." *Human Nature* 19:56-69.

Helle, S., V. Lummaa, and J. Jokela. 2002. "Sons reduced maternal longevity in preindustrial humans." *Science* 296:1085.

Hoeymans N., E.J. Feskens, G.A. van den Bos, and D. Kromhout. 1996. "Measuring functional status: cross-sectional and longitudinal associations between performance and self-report (Zutphen Elderly Study 1990–1993)." *J Clin Epidemiol* 49:1103–10.

Hurt, L.S., C. Ronsmans, O.M.R Campbell, S. Saha, M. Kenward, and M. Quigley. 2004. "Long term effects of reproductive history on all-cause mortality among adults in rural Bangladesh." *Studies in Family Planning* 35(3): 189-196.

Hurt L.S., C. Ronsmans, and M. Quigley. 2006. "Does the number of sons born affect long-term mortality of parents? A cohort study in rural Bangladesh." *Proceedings of the Royal Society B* 273:149-155.

Hurt, L.S., C. Ronsmans, and S.L. Thomas. 2006. "The effect of number of births on women's mortality: Systematic review of the Evidence for women who have completed their childbearing." *Population Studies* 60(1): 55-71.

Idler, E.L. and Y. Benyamini. 1997. "Self-rated Health and Mortality: A Review of Twenty-seven Community Studies". *Journal of Health and Social Behavior* 38: 21-37

Ingersoll-Dayton B., M.E. Starrels, and D. Dowler. 1996. "Caregiving for parents and parents-in-law: is gender important?" *Gerontologist* 36(4):483-91.

Jasienska, G., I. Nenko, and M. Jasienski. 2006. "Daughters increase longevity of fathers, but daughters and sons equally reduce longevity of mothers." *American Journal of Human Biology* 18:422-425.

Jowkar, F. 1986. "Honor and shame: a feminist view from within." *Feminist Issues* 6(1): 45 – 65.

Kim, S.A., K.M. Yount, U. Ramakrishnan, and R. Martorell. 2007. "The relationship between parity and overweight varies with household wealth and national development." *International Journal of Epidemiology* 36(1):93-101.

Kirkwood, T. and M. Rose. 1991. "Evolution of senescence: late survival sacrificed for reproduction." *Philosophical transactions of the Royal Society of London* B 332:15-24.

Knodel J, and M.B. Ofstedal. 2003. "Gender and aging in the developing world: Where are the men?" *Population and Development Review* 29(4):677-698.

Kvale, G., I. Heuch, and S. Nilssen. 1994. "Parity in relation to mortality and cancer incidence: a prospective study of Norwegian women." *International Journal of Epidemiology* 23(4):691-9.

Kuhn, R., O. Rahman, and J. Menken. 2004. "Relating Self-Reported and Objective Health Indicators to Adult Mortality in Bangladesh." Available at: http://www.colorado.edu/IBS/pubs/pac/pac2004-0004.pdf

Lamb, V.L. 1996. "A cross-national study of quality of life factors associated with patterns of elderly disablement." *Social Science & Medicine* 42(3):363-77.

Lassek, W.D., and S.J. Gaulin. 2006. "Changes in body fat distribution in relation to parity in American women: a covert form of maternal depletion." *Am J Phys Anthropol*. 131(2):295-302.

Lawler, D.A., J.A. Emberson, S. Ebrahim, P.H. Whincup, G. Wannamethee, M. Walker, and G.D. Smith. 2003. "Is the association between parity and coronary heart disease due to biological effects of pregnancy or adverse lifestyle risk factors associated with child rearing? Findings from the British Women's Health and Health Study and the British Regional Heart Study." *Circulation* 107:1260-1264.

Le Bourg, E., B. Thon, J. Legare, B. Desjardinds, and H. Charbonneau. 1993. "Reproductive life of French-Canadians in the 17-18th centuries: A search for a trade-off between early fecundity and longevity." *Exp Gerontol* 28(3): 217-232

Lee, R.D. 2003. "Rethinking the evolutionary theory of aging: Transfers, not births, shape senescence in social species." *PNAS* 100(16):9637-9642.

Manor, O., Z. Eisenbach, A. Israeli, and Y. Friedlander. "Mortality differences among women: The Israel longitudinal mortality study." *Social Science & Medicine* 51(8): 1175-1188.

Menken, J., L. Duffy, and R. Kuhn. 2003. "Chidbearing and women's survival: New evidence from rural Bangladesh." *Population and Development Review* 29(3):405-426.

Merrill, S.S., T.E. Seeman, S.V. Kasl, and L.F. Berkman. 1997. "Gender differences in the comparison of self-reported disability and performance measures." *Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 52(1): M19-M26

Muller, H.G., J.M. Chiou, J.R. Carey, and J.L. Wang. 2002. "Fertility and life span: late children enhance female longevity." *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 57(5): B202-B206.

Nelson, C., and V. Olesen. 1977. "Veil of Illusion: A Critique of the Concept of Equality in Western Thought." *Catalyst* 10:8-36.

Ness, R.B., T. Harris, J. Cobb, K.M. Flegal, J.L. Kelsey, A. Balanger, A. J. Stunkard, and R.B D'Agostino. 1993. "Number of pregnancies and the subsequent risk of cardiovascular disease." *N Engl J Med* 328(2):1528-33.

Ofstedal, M. B., J. Knodel, and N. Chayovan. 1999. "Intergenerational support and gender: a comparison of four Asian countries" *Southeast Asian Journal of Social Science* 27(2): 21-41.

Rahman, O. 1999. "Family matters: The impact of kin on the mortality of the elderly in rural Bangladesh." *Population Studies* 53 (2): 227-235.

Raley, S., and S. Bianchi. 2006. "Sons, Daughters, and Family Processes: Does Gender of

Children Matter?" *Annual Review of Sociology* 32: 401-421

Rosenzweig M.R. 1988. "Risk, implicit contracts and the family in rural areas of low-income countries." *The Economic Journal* 98(393): 1148-1170.

Rossi, A. S., and P.H Rossi, P. H. 1990. *Of human bonding: Parent-children relationship across the life course*. Hawthorne, NY: Aldine.

Rugh A. 1984. *Family in Contemporary Egypt.* Syracuse, NY: Syracuse University Press.

Silverstein, M., and V. L. Bengtson. 1997. "Intergenerational solidarity and the structure of adult child-parent relationships in American families." *American Journal of Sociology,* 103: 429-460.

Silverstein, M., D. Gans, and F.M. Yang. 2006. "Intergenerational Support to Aging Parents: The Role of Norms and Needs" *Journal of Family Issues* 27(8): 1068-1084.

Singerman, D. and Hoodfar, H., 1996. The household as mediator Political economy development and gender in contemporary Cairo. In: Singerman, D.H. and Hoodfar, H., Editors, *Development, Change, and Gender in Cairo*. Bloomington and Indianapolis: Indiana University Press, pp. xi–xl.

Singerman, D. and B. Ibrahim. 2003. The cost of marriage in Egypt: A hidden variable in the new Arab demography. In: Hopkins, N.S. Editor, *The new Arab family.* Cairo: American University in Cairo Press, pp. 80-116.

Smith, K.R., G.P. Mineau, and L.L Bean. 2002. "Fertility and post-reproductive longevity." *Social Biology* 49(3-4): 185-205.

Spence, N.J. 2008. The long-term consequences of childbearing: Physical and psychological well-being of mothers in later life. *Research on Aging* 30(6): 722-751.

Spitze, G. and G. Logan. 1990. "Sons, daughters, and intergenerational support." *Journal of*

Marriage and the Family 52(2): 420-430.

United Nations. 1995. *Women's education and Fertility behaviour: Recent evidence from demographic and health surveys.* New York: United Nations.

United Nations Development Programme (UNDP) and Institute of National Planning (INP). 2003. *Egypt Human Development Report 2002-2003*. Cairo: UNDP and INP.

van de Putte, B., K. Matthijs, and R. Vlietinck. 2004. A social component in the negative effect of sons on maternal longevity in pre-industrial humans. *Journal of Biosocial Sciences* 36(3): 289-297.

Vignoli, D. 2006. "Fertility Change in Egypt: From Second to Third Birth." *Demographic Research* 15, 499-516. Available online at http://www.demographic-research.org/volumes/vol15/18/15-18.pdf

Wachter, K.W. and C.E. Finch, eds. 1997. *Between Zeus and the Salmon: The Biodemography of Longevity.* Washington, DC: National Academy Press.

Westendorp, R.G.J. and T.B.L. Kirkwood. 1998. "Human longevity at the cost of reproductive success." *Nature* 396: 743-746.

Winkvist, A., K.M. Rasmussen, and J.P. Habicht. 1992. "A new definition of maternal depletion syndrome." *American Journal of Public Health* 82:691-694.

Wolf, D.A., V.A. Freedman, and B.J. Soldo. 1997. "The division of family labour: care for elderly parents." *The Journals of Gerontology B: Psychological Sciences and Social Sciences* 52: 102-109.

Wray, L.A. and C.S. Blaum. 2001. "Explaining the role of sex on disability: a population-based study." *Gerontologist*. 41(4):499-510.

Yount, K.M. 2004. "Maternal Resources, Proximity of Services, and the Curative Care of Boys and Girls in Minya, Egypt." *Population Studies* 58(3): 345–355.

Yount, K.M. 2005. "Women's family power and gender preferences in Minya, Egypt." *Journal of Marriage and Family* 67(2):410-428.

Yount, K.M., and E.M. Agree. 2005. Differences in disability among older women and men in Egypt and Tunisia. *Demography* 42(1):169-187.

Yount, K.M., E.M. Agree, and C. Rebellon. 2004. "Gender and use of formal care among older adults in Egypt and Tunisia." *Social Science & Medicine* 59:2479-2497.

Yount, K.M., R. Langsten, and K. Hill. 2000. The effect of gender preference on contraceptive use and fertility in rural Egypt. *Studies in Family Planning* 31(4):290-300.

Yount, K.M. and Z. Khadr. 2006. "A Biosocial Model of Medication Use among Older Women and Men in Ismailia, Egypt." *Journal of Biosocial Science* 38: 557–603.

Yount, K.M. and Z. Khadr. 2008. "Gender, Social Change, and Living Arrangements among Older Egyptians During the 1990s." *Population Research and Policy Review* 27(2):201-225.

Zeng, Y. and J.W. Vaupel. 2004. "Association of late childbearing with healthy longevity among the oldest-old in China." *Population Studies* 58(1): 37-53.

Zimmer Z., and J. Kwong. 2003. "Family Size and Support of Older Adults in Urban and Rural China: Current Effects and Future Implications." *Demography* 40(1): 23-44.

Table 1. Percent distribution of ADL difficulty count by respondent's sex

Number of ADLs with any difficulty	Males (N=457)	Females (N=499)
0	63.89	36.87
1	7.66	14.43
2	15.97	24.05
3	4.60	7.82
4	2.41	6.41
5	1.09	4.41
6	1.75	4.81
7	2.63	1.20
Total	100	100

Estimates are based on sample weights. A Kolmogorov-Smirnov test for equality indicated that the distribution of ADL difficulty counts is significantly different for men and women.

Source: Authors' calculations

Table 2. Sample characteristics, including definitions and distributions of independent variables used in the analysis, by sex

Variable	Definition	Males (N=457) 47.80%	Females (N=499) 52.20%
Parity	Number of children ever born (1-18)	6.56 (2.77)	6.78 (2.84)
Daughters	Number of daughters (0-10)	3.16 (1.82)	3.24 (1.86)
Living Daughters	Number of living daughters	2.65 (1.56)	2.52 (1.52)
Daughters who died	Number of dead daughters	0.51 (0.92)	0.72 (1.06)
Sons	Number of sons (0-12)	3.39 (1.92)	3.54 (1.93)
Living Sons	Number of living sons	2.74 (1.55)	2.60 (1.55)
Sons who died	Number of dead sons	0.65 (1.06)	0.94 (1.31)
Socio-Demographic Characteristics			
Age	Age in single years (Range: 50-96)	64.35 (9.46)	63.90 (9.97)
Currently Married	Currently married	88.40%	43.49%
Household Standard of Living	Summary of 0-17 assets and amenities	9.86 (3.26)	9.21 (3.23)
Urban Residence	Residing in urban area	52.52%	53.31%
Cognitive Capacity	Modified MMSE score (0-20)	16.61 (3.27)	14.58 (3.55)
Health Conditions			
High Blood Pressure	Reports doctor-diagnosed high blood pressure	23.85%	45.49%
Heart Disease	Reports doctor-diagnosed heart disease	5.69%	9.42%
Diabetes	Reports doctor-diagnosed diabetes	11.37%	16.43%

n=956 respondents with at least one child ever born. Means and standard errors (in parentheses) are reported for continuous variables. For dichotomous variables, proportion of respondents answering “yes” is reported.

Source: Authors’ calculations.

Table 3. Incidence rate ratios (IRRs) from the pooled negative binomial multivariate regression models predicting number of ADL difficulties based on total parity

	Model 1	Model 2	Model 3
Parity	1.05 (0.02)**	1.10 (0.04)*	1.05 (0.02)**
Parity*Female		0.93 (0.04)#	
Female	1.77 (0.21)***	2.89 (0.97)**	1.64 (0.20)***
Age	1.04 (0.01)***	1.04 (0.01)***	1.04 (0.01)***
Married	1.01 (0.11)	0.99 (0.11)	1.02 (0.10)
Household SES	0.95 (0.02)**	0.95 (0.2)**	0.94 (0.01)***
Urban	1.14 (0.13)	1.15 (0.13)	1.02 (0.12)
MMSE	0.94 (0.01)***	0.94 (0.01)***	0.94 (0.01)***
High Blood Pressure			1.30 (0.15)*
Heart disease			1.24 (0.09)**
Diabetes			1.40 (0.14)**

Standard errors in parentheses. *** p≤0.001; ** p≤0.01; * p≤0.05; # p≤0.1

n=956 is the sample of respondents with at least 1 child.

Source: Authors' calculations

Table 4. Incidence rate ratios (IRRs) from the pooled negative binomial multivariate regression models predicting number of ADL difficulties based on number of daughters

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Parity			1.03 (0.02)	1.03 (0.02)			
Daughters	1.06 (0.03)*	1.13 (0.05)**	1.03 (0.03)	1.09 (0.05)*			1.06 (0.02)**
Daughters*Female		0.90 (0.05)*		0.90 (0.05)*			
Living Daughters					1.07 (0.04)#	1.15 (0.07)*	
Daughters who Died					1.06 (0.05)	1.09 (0.09)	
Living Daughters*Female						0.87 (0.06)#	
Daughters who Died*Female						0.96 (0.09)	
Female	1.80 (0.21)***	2.53 (0.57)***	1.78 (0.21)***	2.50 (0.56)***	1.80 (0.22)***	2.63 (0.64)***	1.66 (0.20)***
Age	1.04 (0.01)***	1.04 (0.01)***	1.04 (0.01)***	1.04 (0.01)***	1.04 (0.01)***	1.04 (0.01)***	1.04 (0.01)***
Married	1.01 (0.12)	0.99 (0.12)	1.01 (0.11)	0.99 (0.11)	1.01 (0.12)	1.00 (0.12)	1.03 (0.11)
Household SES	0.95 (0.2)**	0.95 (0.2)**	0.95 (0.2)**	0.95 (0.2)**	0.95 (0.2)**	0.95 (0.02)**	0.94 (0.01)***
Urban	1.14 (0.13)	1.12 (0.12)	1.14 (0.13)	1.13 (0.13)	1.13 (0.12)	1.13 (0.12)	1.02 (0.12)
MMSE	0.94 (0.01)***	0.94 (0.01)***	0.94 (0.01)***	0.94 (0.01)***	0.94 (0.01)***	0.94 (0.01)***	0.94 (0.01)***
High blood pressure							1.30 (0.15)*
Heart disease							1.28 (0.09)**
Diabetes							1.39 (0.14)**
n	956	956	956	956	956	956	956

Standard errors in parentheses. *** p≤0.001; ** p≤0.01; * p≤0.05; # p≤0.1

Source: Authors' calculations

Table 5. Incidence rate ratios (IRRs) from the pooled negative binomial multivariate regression models predicting number of ADL difficulties based on number of sons

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Parity			1.06 (0.03)*	1.06 (0.03)*			
Sons	1.04 (0.02)	1.07 (0.05)	0.97 (0.03)	1.00 (0.06)			1.03 (0.02)
Sons*Female		0.95 (0.05)		0.95 (0.05)			
Living Sons					1.05 (0.03)#	1.07 (0.06)	
Sons who Died					1.01 (0.03)	1.06 (0.07)	
Living Sons*Female						0.96 (0.06)	
Sons who Died*Female						0.94 (0.07)	
Female	1.77 (0.22)***	2.10 (0.56)**	1.78 (0.21)***	2.14 (0.57)**	1.77 (0.22)***	2.06 (0.56)*	1.63 (0.21)***
Age	1.04 (0.01)***	1.04 (0.01)***	1.04 (0.01)***	1.04 (0.01)***	1.04 (0.01)***	1.04 (0.01)***	1.04 (0.01)***
Married	1.00 (0.11)	1.00 (0.11)	1.00 (0.11)	1.00 (0.11)	0.99 (0.11)	0.99 (0.11)	1.02 (0.11)
Household SES	0.95 (0.02)**	0.95 (0.02)**	0.95 (0.02)**	0.95 (0.02)**	0.95 (0.02)**	0.95 (0.02)**	0.94 (0.02)***
Urban	1.11 (0.13)	1.12 (0.13)	1.14 (0.13)	1.15 (0.13)	1.11 (0.13)	1.12 (0.13)	0.99 (0.13)
MMSE	0.94 (0.01)***	0.94 (0.01)***	0.94 (0.01)***	0.94 (0.01)***	0.94 (0.01)***	0.94 (0.01)***	0.94 (0.01)***
High blood pressure							1.30 (0.15)*
Heart disease							1.25 (0.10)*
Diabetes							1.39 (0.13)***
n	956	956	956	956	956	956	956

Standard errors in parentheses. *** $p \leq 0.001$; ** $p \leq 0.01$; * $p \leq 0.05$; # $p \leq 0.1$

Source: Authors' calculations