

DISCUSSION PAPER SERIES

IZA DP No. 14046

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ABSTRACT

Teenage Mother's Health across Different Life Stages*

Many women who give birth during their teenage years face lifetime disadvantages in health, social and economic domains. To develop effective policies to support these teenage mothers, it is important to understand how the disadvantage evolves over time to target the timing of any interventions. This paper focuses on health outcomes and seeks to determine the role of teenage motherhood and the likely channels through which teenage motherhood may contribute to health disparities across different life stages between teenage mothers and other women. Using household panel survey data and fixed-effects regressions that control for the effects of prior disadvantage, we show that teenage motherhood is negatively associated with all domains of health and that impacts worsen in later life stages. Potential mediators, including health behaviours, family, social support, education and economic factors are investigated and these partly explain mental health outcomes, reducing the direct impact of teenage motherhood, but not physical health. The strongest pathways are through social support, family and economic outcomes. Our results suggest boosting social support and addressing economic disadvantage may improve mental health outcomes for teenage mothers.

JEL Classification: I14, I31, J13

Keywords: teenage motherhood, mental health, physical health, longitudinal analysis

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1. Introduction

Many women who give birth during their teenage years face lifetime disadvantages in health, social and economic domains. To develop effective policies to support these teenage mothers, it is important to identify how these disadvantages evolve across different life stages to ensure optimal timing of any interventions. This paper focuses on health outcomes and seeks to understand the role of teenage motherhood and the likely channels through which teenage motherhood may contribute to health disparities between teenage mothers and other women.

We use the Household, Income and Labour Dynamics in Australia (HILDA) survey, which is one of the few surveys that include the 36-item Short Form Health Survey (SF-36) in each wave, allowing us to follow the development of respondents' health status in detail for many years starting at different ages. This allows us to obtain an overview of the health of teenage mothers across all life stages and across different health domains. Some teenage mothers are observed before their first childbirth, which informs us about their health before motherhood relative to other youth who did not become a teenage mother. This helps us deal with the self-selection issue, an inherent challenge in estimating the impact of teenage motherhood.¹ Using the information from these observations, we account for pre-birth health differences using the longitudinal data in panel regression approaches. By investigating the lifetime disparity in overall health outcomes and across specific health domains, we seek to understand the underlying causes as well as the extent of health disparities (i.e. are these with regard to all aspects of health or are disparities prevalent for certain aspects of health only).

We contribute to a small literature that investigates the consequences of teenage motherhood on health and health behaviours. Overall, the evidence has been somewhat mixed. With regard to health behaviours, most studies have shown teenage motherhood leads to unhealthy behaviours (Webbink, Martin and Visscher, 2008; Güneş and Tsaneva, 2020) but positive effects of teenage motherhood in terms of avoiding risky behaviours have also been found (Fletcher, 2012). With regard to health consequences, a handful of studies (Ermisch, 2003; Henretta et al. 2008; Patel and Sen, 2012; Aitken et al. 2016) show a strong association between teenage motherhood and long-term health, after controlling for a rich set of background information. At the same time, Güneş (2016) who utilises a small sample of sibling and twin data shows a more nuanced picture. When controlling for family fixed effects, the health estimates of teenage motherhood are negative but not statistically significant. However, in specifications where effects are distinguished by age, the author finds statistically significant effects for younger age groups but not for the oldest age group, which seems to suggest that differences in health between teenage mothers and their siblings dissipate at older ages. While the nuanced finding by Güneş (2016) could be related to small sample size, the stronger effects for younger age groups resonate with observations that teenage mothers face immediate poor

¹Many estimates are based on rich cross-sectional data, or use Instrumental Variable (IV) techniques or family fixed effects to control for selection, with each method having its merits and limitations. For example, family fixed-effects approaches mitigate some of the selection issues (environment, genetic disposition), but siblings may be treated differently due to family dynamics, and siblings (and particularly twins) may respond to each other's outcomes or they may be indirectly affected by the response of their parents.

health. A psychosocial paper, examining postpartum depression for US teenage mothers, finds that they are two to three times more likely to experience postpartum depression than non-teenage mothers (McGuinness et al. 2013).² Another explanation for Güneş' findings is provided through results in Aitken et al. (2016) which suggest that long-term health effects of young motherhood have increased for more recent birth cohorts.

We extend the literature on health impacts arising from teenage motherhood in two important ways. First, we provide the first systematic mapping of teenage mothers' health over the life stages, and compare this with health outcomes for older mothers and childless women. We adopt a novel analytical method involving a lifetime perspective on health, which views health disparity at one point in time as the result of an accumulation of negative experiences and stressors up to that point. Our economic framework is based on the well-established theoretical framework of the health production function (Grossman, 1972).³ By looking at the disparity across different life stages, we shed light on how the impact of teenage motherhood varies over their lifetime and we investigate the role of possible mediators. This improved understanding will be a first step to uncover the potential pathways of evolving health impacts arising from teenage motherhood.

Second, we complement the above with further approaches to control as much as feasible for self-selection. Using longitudinal data, including the pre-teenage motherhood observations that are available for the more recent birth cohorts of women, allows us to account better for unobserved heterogeneity. We extract the patterns of women's health over a lifetime from a large collection of overlapping 15-year time windows, and with the inclusion of fixed effects, we can control for differences in health levels between teenage mothers and other women at the start of the observation window. We model the subsequent changes in health outcomes as a function of pre-existing characteristics and teenage motherhood, allowing all these factors to have different impacts over time.

We show that teenage motherhood is negatively associated with health and that the impacts worsen over time. Our results are robust to alternative specifications and an alternative definition of 'teenage mother' (using a slightly higher age for the arbitrary cut-off point to be considered a 'young' mother). We find that potential mediators, including health behaviours, family, social support, education and economic factors, partly explain the impact of teenage motherhood for mental health but not physical health. The strongest pathways for mental health are through social support, family and economic outcomes.

The paper first describes the data, its key variables and the sample of analysis in Section 2. Section 3 presents a descriptive analysis of women's health. Section 4 describes the econometric approaches, and results, together with a number of robustness checks, are presented in Section 5. An investigation of the role of potential mediators in the poorer health outcomes for teenage mothers follows in Section 6, and Section 7 concludes.

² The symptoms of postpartum depression are similar to a major depressive episode.

³ Grossman (1972) considers health as human capital where individuals receive an initial endowment which depreciates with age but can increase with investments. Maynard (1983) and Muurinen and Le Grand (1985) discuss how this framework can be used to explain the occurrence of health inequalities across different groups.

2. HILDA Data

We use the first 15 waves (years 2001–2015) of the HILDA survey, which is a representative sample from the general Australian population. In this section, we first define key variables, followed by a description of our sample of analysis.

2.1 Key Variables

Teenage motherhood

We identify teenage motherhood by using the age of all children as reported for each woman and their own reported age to derive ‘age at first birth’. A teenage mother is defined as someone who had their first child at the age of 19 or prior.⁴ All children are included, independent of whether they are living with their mother. While step or foster children can be distinguished from a woman’s biological children, and are therefore excluded when defining teenage motherhood, adopted children have to be included as they cannot be distinguished from the biological children.

Health measures

We utilise eight detailed health measures derived from the SF–36 component: mental health, general health, physical functioning, role of limitations due to physical health (role physical), bodily pain, vitality, social functioning, and role of limitations due to emotional problems (role emotional). Each has a scale of 0 to 100 with lower scores representing worse health. Factor analysis of the eight scores has consistently identified two factors interpreted as ‘physical’ and ‘mental’ dimensions of health status (Ware, Kosinski and Keller 1994). The mental health dimension, Mental Component Summary scale (MCS), puts higher weights on the four domains of mental health, vitality, role emotional and social functioning, whereas, the physical health component summary scale (PCS) puts higher weights on the four domains of general health, physical functioning, role physical and bodily pain. Following Ware, Kosinski and Keller (1994), we derive the MCS and PCS measures using factor analysis of the eight domains, both are standardised to have a mean of 50 and standard deviation of 10.

2.2 Sample of Analysis

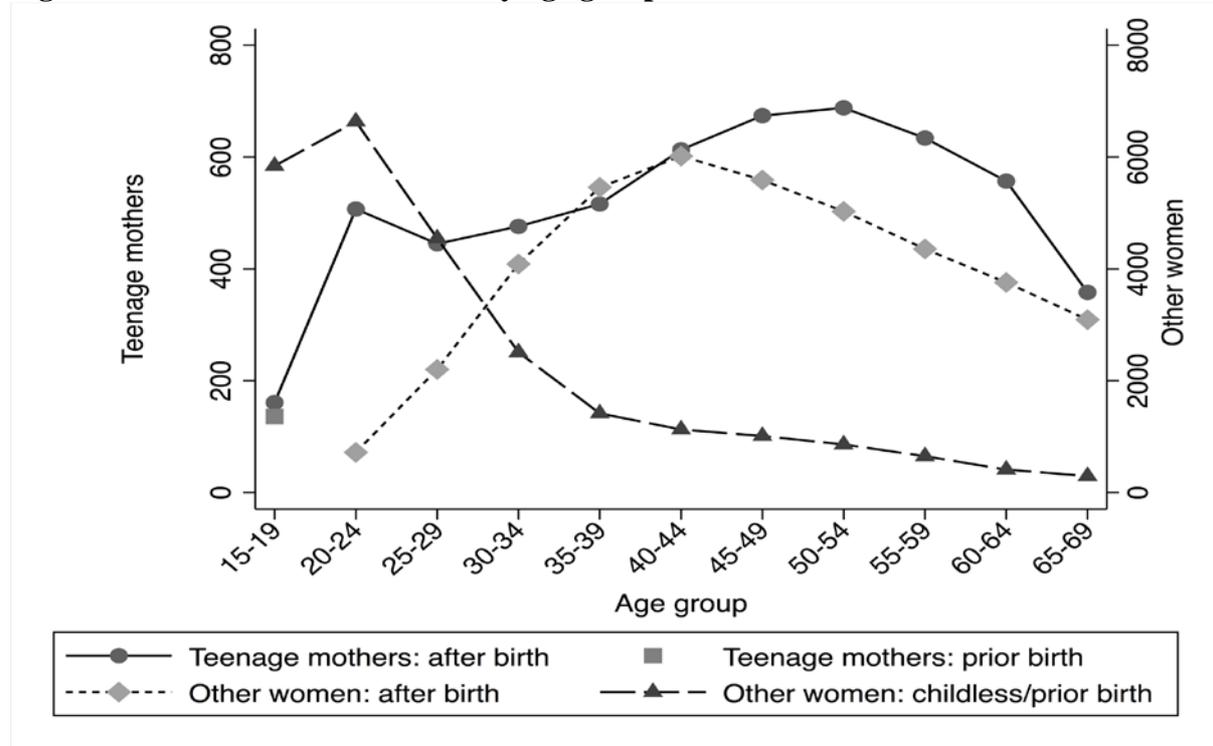
We exclude those with a derived age at first birth of less than 15 to reduce the impact of measurement error. We also exclude women who we do not observe up to at least age 19 and women who are aged 70 or over. Finally, we exclude observations with missing values for key variables. Our sample of analysis includes 916 teenage mothers and 9,422 other women, who had their first child at age 20 or over or who had no children.

Figure 1 shows the number of observations of teenage mothers and other women for each age category in our sample of analysis. The first age group, 15-19 is used to examine the differences in the outcomes prior to the occurrence of teenage motherhood. Therefore, we include observations of identified teenage mothers aged 15-19 before they had given birth, separately from those aged 15-19 who had given birth already. The number of observations on these two teenage groups is relatively small (at about 150 and 170, respectively). For other women we

⁴ In a sensitivity check, we repeat the analyses for early motherhood, defined as women who had their first child at age 21 or prior.

also distinguish before and after birth. A small number of women remains childless: at age 65-69, 306 women are childless out of 3,279 women.

Figure 1: Number of observations by age group



3. Descriptive statistics

This section presents the patterns of health for teenage mothers, older mothers and childless women, followed by the patterns of possible mediators for observed health disparity patterns, including health behaviours, and economic and social profiles.

3.1 Health profiles

We graphically present health measures by age category for teenage mothers and other women, and the statistics are presented separately before and after first birth. Starting with mental health, Figure 2 presents mean MCS scores across age groups. Compared to other women, teenage mothers have a slightly lower level of mental health initially, which drops further after childbirth, and they experience a steeper decline in mental health in their twenties than other women. They only recover from this from age 35 onwards. Other women’s mental health deteriorates slightly during teenage years and young adulthood, but improves thereafter, and is always at a higher level than for teenage mothers. Overall, the gap in mental health between teenage mothers and the other two groups of women is quite pronounced while the difference between older mothers and childless women is relatively small, suggesting that health effects arising from teenage motherhood are markedly different from the health effects arising from motherhood at an older age.

Figure 2: Mental health- MCS score by age group and teenage motherhood

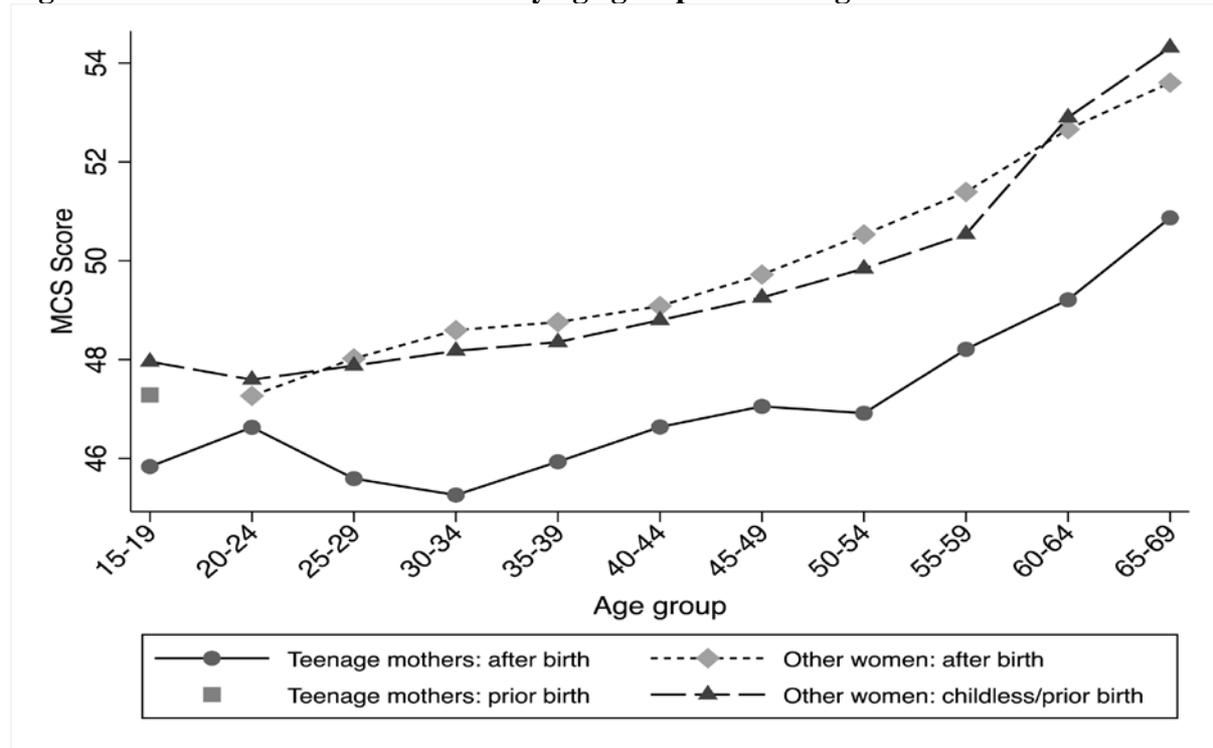
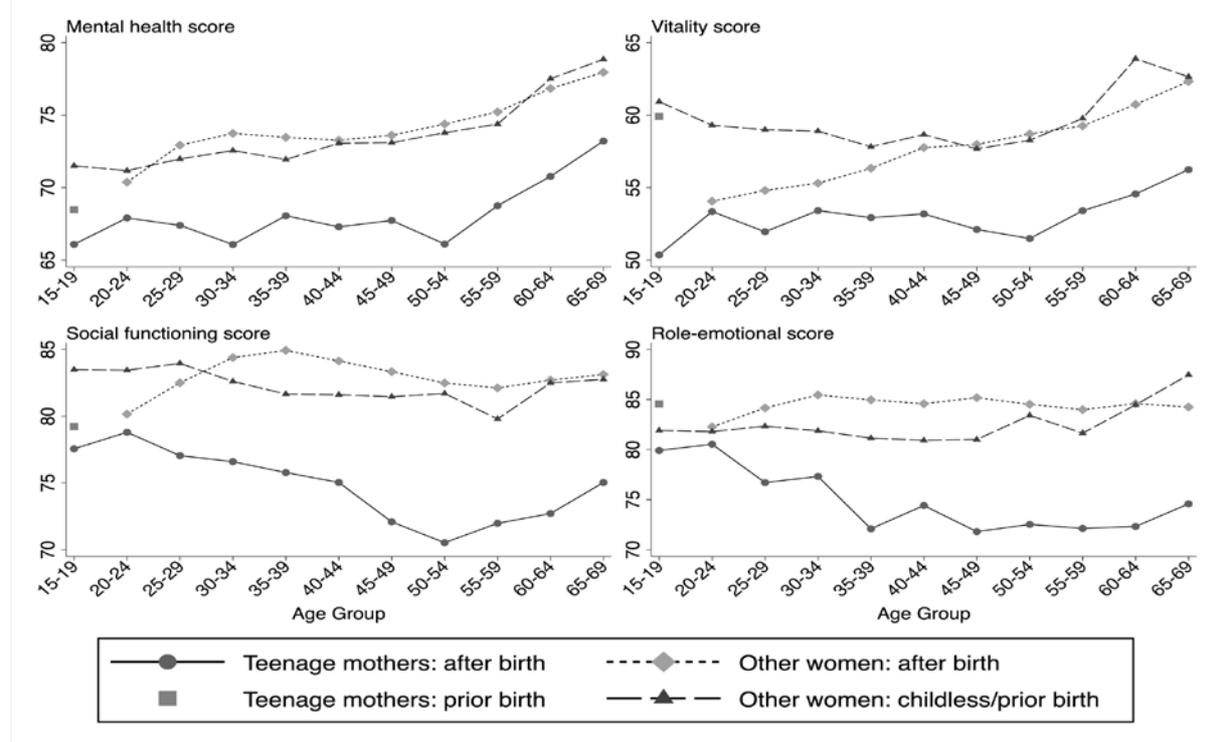


Figure 3 shows the evolution of the four mental health domains. Teenage mothers score lower on ‘social functioning’ and ‘mental health’ initially and there is only a small further decline following the first birth. By contrast, the extent of the decline at first birth is particularly strong for ‘role emotional’ and for ‘vitality’ where teenage mothers show similar outcomes to other women prior to birth, but experience a large decline after birth. Vitality is a domain where other women also experience a large drop after having children; however, they recover and catch up with childless women by age 45-49, whereas teenage mothers do not catch up. The gap in mental health is partly closed by the time the women are in their sixties. For all mental health aspects, the gap at older ages is wider than it was prior to teenage motherhood.

Figure 3: Four domains of mental health by age group and teenage motherhood



Turning to physical health, Figure 4 shows that a small disparity already exists prior to teenage motherhood, and the gap widens thereafter. In contrast, women who have their first child between age 20 and 30 have worse health than childless women, but once they are over age 30, the health disparity between these two groups is very small. Broadly similar patterns are found for the separate domains of physical health, as shown in Figure 5. The bodily pain score and role physical score deteriorate the most after becoming a teenage mother, and are similar to those of other women before birth, while general health score and physical functioning score are worse for teenage mothers even before birth and do not change much after birth.

Figure 4: Physical health- PCS score by age group and teenage motherhood

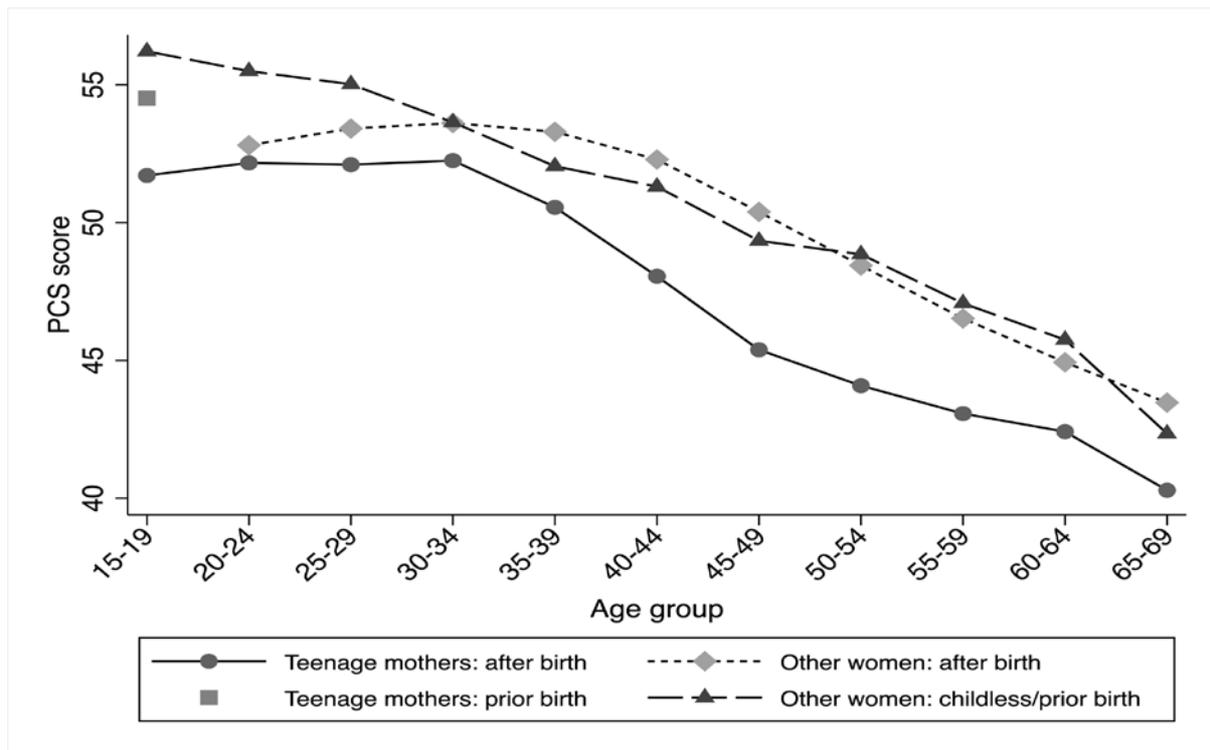
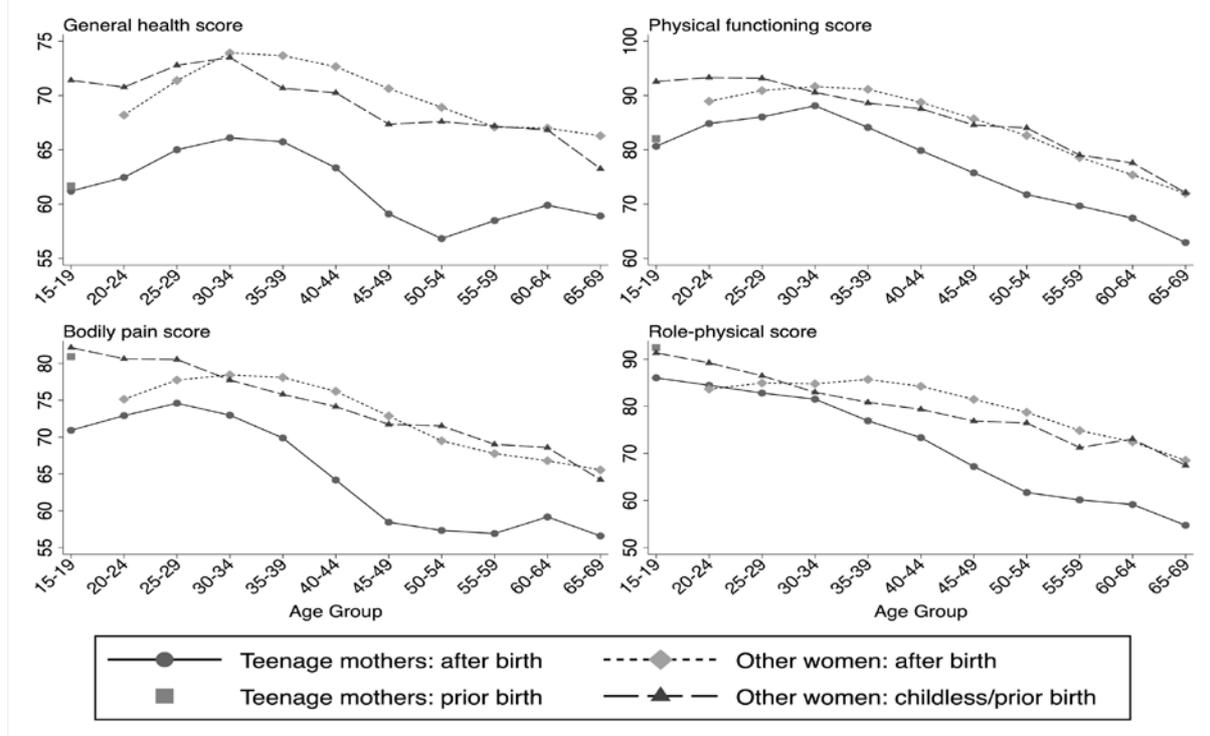


Figure 5: Four domains of physical health by age group and teenage motherhood

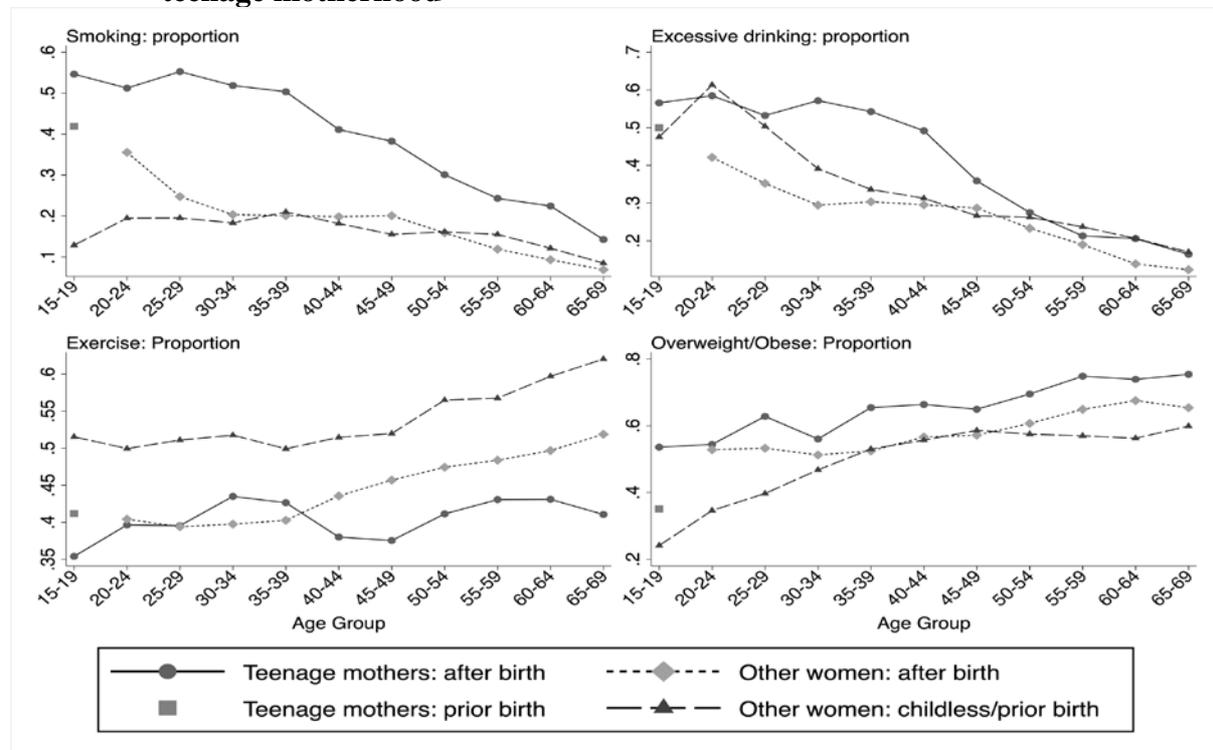


3.2 Health behaviour profiles

Figure 6 presents the proportion of women smoking, drinking excessively (drinking more than two standard drinks per day), exercising regularly (exercising three or more times per week)

and being overweight. On average, teenage mothers smoke substantially more, are more likely to drink excessively, exercise less (except at ages 20-39), and are more likely to be overweight. Although other women experience a similar increase in being overweight and a drop in exercise after having a child, they recover to a larger extent. In contrast, the gaps in behaviours for teenage mothers tend to persist. The only exception is for drinking behaviour where teenage mothers over the age of 50 behave similarly to other groups of women. Although the differences in health behaviours may not be due to teenage motherhood, but rather are co-determined by the same factors, they could, over time, lead to poorer health outcomes for teenage mothers which are potentially preventable and amenable to intervention. We test the importance of these channels for the health outcomes observed over women's lifetimes in our multivariate panel analyses.

Figure 6: Health behaviours: smoking, exercise, alcohol use and weight by age group and teenage motherhood



3.3 Economic and social profiles

Another transmission channel leading to poor health may work through the economic and social circumstances of teenage mothers. Figure 7 compares education, employment, low-income status (being in the lowest quintile of household income), and a financial hardship index. The latter is a count of seven events occurring due to a shortage of money: could not pay electricity, gas or telephone bills on time; could not pay the mortgage or rent on time; pawned or sold something; went without meals; was unable to heat home; asked for financial help from friends or family; or asked for help from welfare/community organisations.

Figure 7: Education, employment, poverty by age group and teenage motherhood

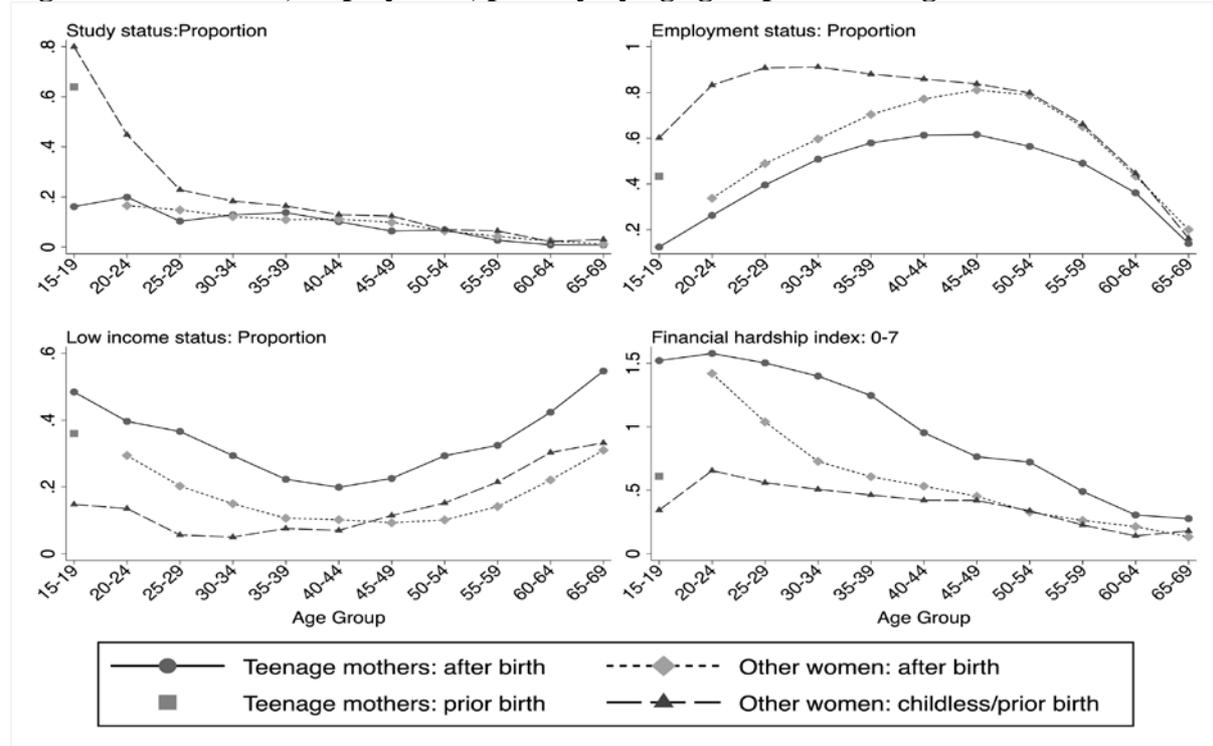


Figure 7 shows that teenage mothers are much less likely to be in education during their teenage years and twenties than other women. This already commenced prior to childbirth, but becomes particularly pronounced thereafter. Subsequently, teenage mothers have much lower participation in employment, which leads to much higher dependence on income support at all ages (not shown here). Teenage mothers are more likely to be poor and experience financial hardship. This observed financial and economic disadvantage is consistent with the findings by Hoffmann et al. (2019) for young mothers (women who had a first child between age 15 and 24).

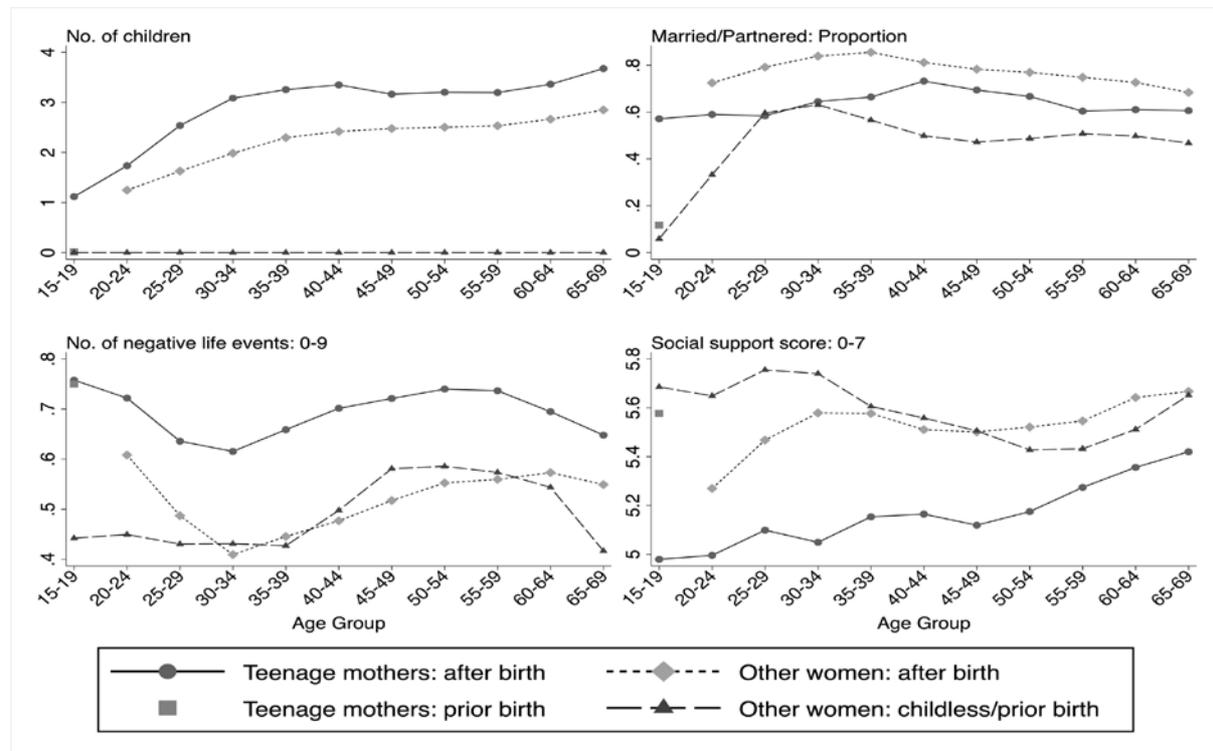
Figure 8 shows that prior to first birth, teenage mothers felt they had a similar level of social support compared to other teenagers. However, a substantial gap in perceived social support emerges after childbirth. Using mean social support scores, strong and long-lasting decreases in social support are found, with teenage mothers dropping from just under 5.6 to 5.0 (out of 7).⁵ This then increases again gradually over time, but it never reaches the same level as for other women.

Another source of support is the presence of a partner, while additional children can be both a support and an additional stress factor. Figure 8 shows that teenage mothers have one child more than other mothers and are much more likely to live with a partner at young ages, but after age 25 they are less likely than other mothers to have a partner. The lower level of social support coincides with a likely greater need for support, given the larger number of negative life events occurring for teenage mothers compared to other women. This difference remains

⁵ The social support score is defined as the mean score across ten individual questions of perceived social support from friends and family (e.g., I seem to have a lot of friends).

large throughout all life stages.

Figure 8: Social disadvantage and social support by age group and teenage motherhood



These results are consistent with findings by Hoffmann et al. (2019) that young mothers reported poorer quality relationships with their families and friends than other mothers. However, Hoffmann et al. also find that young mothers perceived comparatively high levels of support from their parents (possibly because their parents are younger than the parents of older mothers), and young mothers were more likely to report that their support needs are met. The HILDA data have no information on support by the parents, so we cannot directly compare this result.

Similar to health behaviours, we explore the role of the outcomes discussed in this section as potential pathways to ill health.

4. Econometric Methodology

The observed differences between teenage mothers and other women across the age groups, shown in Section 3, could come from: changes in the impact of teenage motherhood across the life stages; pre-existing differences; and/or differences in the impact of teenage motherhood across birth cohorts. We aim to disentangle the impacts of teenage motherhood across the different life stages from the effects of the other factors through econometric modelling:

$$\begin{aligned}
y_{it} = & \alpha + \gamma TM_{it} + \lambda PB_{it} + \sum_{k=1}^K \varphi_k yC_{ikt} + \sum_{\substack{j=1 \\ j \neq 2}}^J (\delta_{1j} A_{ijt}) + \theta_t w_t + \sum_{j=1}^J (\delta_{2j} TM_{it} * A_{ijt}) + \\
& \sum_{j=3}^J (\delta_{3j} PB_{it} * A_{ijt}) + \sum_{j=1}^J (\beta_j X_i * A_{ijt}) + \varepsilon_{it}
\end{aligned} \tag{1}$$

where outcome variables (y_{it}) include: mental health (MCS), four domains of mental health, physical health (PCS), and four domains of physical health. Key variable, TM_{it} indicates whether woman i has given birth while she was a teenager ($TM_{it} = 1$ after giving birth). To control for the impact of having children for all mothers, we include a post-birth indicator PB_{it} . Age dummies for youngest child, yC_{ikt} , are included to control for the effects of having young children, age group dummies A_{ijt} for age effects and wave dummies w_t for time effects. The impacts of teenage motherhood and the impact of motherhood over a lifetime are represented by a series of interaction terms between age group dummies, and the teenage motherhood and post-birth dummies.

We employ three specifications: 1) pooled OLS; 2) random effects where a random individual-specific term u_i is included; 3) fixed-effects regression where α is replaced by an individual-specific constant α_i . Our preferred model is the fixed-effects specification, which controls best for unobserved heterogeneity. The other model specifications are estimated as robustness checks.

We control for the differential impact of pre-existing disadvantage across different life stages by including background characteristics (X_i) interacted with age group dummies. We include: immigration status from a non-English-speaking country or from an English-speaking country; Aboriginal or Torres Strait Islander descent; family living arrangements, distinguishing whether the individual lived with both birth parents, with either birth mother and step father or with birth father and step mother, with birth mother only, with birth father only, or another living arrangement; whether parents are divorced; information on the father's occupation, distinguishing highly skilled (managers and professionals), semi-skilled (technicians and tradespersons, community and personal services, clerical and administrative work), low-skilled (labourers, machinery operators and sales workers) and other (never employed or information is missing); mother's occupation (which includes never employed as a separate category, but is otherwise the same as father's occupation); and parental employment status: whether mother and father were employed at the age of 14, and whether father experienced unemployment while the individual was growing up.

Appendix Table A.1 presents summary statistics, which shows teenage mothers' disadvantaged background, indicating that controlling for pre-existing disadvantage is likely to be important.

5. Estimation results

Section 5.1 presents the results for the MCS and PCS measures, and Section 5.2 presents the results for the health subdomains. Sections 5.3 and 5.4 present robustness checks.

5.1 General results for mental and physical health

Table 1 presents results for mental health and Table 2 for physical health. Our preferred fixed-effects model shows that the impact of teenage motherhood on mental health, relative to the impact of becoming mother at older ages emerges from age 50 widening thereafter. Similar estimates result from the two other models, showing a slightly earlier start of the effects. Overall, these results suggest the impact on mental health due to teenage motherhood is not immediate, but develops more slowly. The coefficients on post-birth interaction terms for the fixed-effects model suggest that parenthood has a negative effect on mental health of all mothers (compared to childless women) between age 30 and 49.

For physical health, the fixed-effects model shows that teenage motherhood reduces physical health immediately and the effects deepen over time. No such effects are observed for older mothers: the effects of parenthood are positive between ages 20 and 50. The results from other models are qualitatively similar in that the effects of teenage motherhood increase over time but the impacts are smaller. These results are consistent with earlier analysis for Australia showing high disability support pension receipt amongst teenage mothers (Jeon et al., 2011).

Table 1: Estimated Impacts of Teenage Motherhood (TM) on Mental Health (MCS) across a Lifetime: (N=71,391 and number of individuals is 10,338)

| VARIABLES | FE | | OLS | | RE | |
|---------------------------------|-----------|---------|-----------|---------|-----------|---------|
| | Coeff | Se | Coeff | Se | Coeff | Se |
| TM*age 15-19 | -0.415 | (1.061) | -1.552 | (1.191) | -1.537* | (0.830) |
| TM*age 20-24 | 1.190 | (0.966) | 0.307 | (0.880) | -0.203 | (0.622) |
| TM*age 25-29 | 1.155 | (1.024) | -1.058 | (0.892) | -0.769 | (0.572) |
| TM*age 30-34 | 0.199 | (1.133) | -2.058** | (0.840) | -1.265** | (0.541) |
| TM*age 35-39 | -0.043 | (1.213) | -2.193*** | (0.828) | -1.224** | (0.521) |
| TM*age 40-44 | -0.434 | (1.268) | -1.909** | (0.778) | -1.051** | (0.492) |
| TM*age 45-49 | -1.266 | (1.317) | -1.802** | (0.799) | -1.433*** | (0.483) |
| TM*age 50-54 | -2.552* | (1.373) | -2.875*** | (0.761) | -2.302*** | (0.487) |
| TM*age 55-59 | -3.571** | (1.425) | -2.537*** | (0.799) | -2.885*** | (0.513) |
| TM*age 60-64 | -5.189*** | (1.477) | -3.000*** | (0.839) | -4.036*** | (0.558) |
| TM*age 65-69 | -4.553*** | (1.561) | -2.337** | (0.937) | -3.287*** | (0.663) |
| Post birth*age <25 | -0.572 | (0.531) | -0.821 | (0.701) | -0.170 | (0.460) |
| Post birth*age 25-29 | -0.499 | (0.400) | -0.121 | (0.548) | 0.047 | (0.342) |
| Post birth*age 30-34 | -1.373*** | (0.372) | 0.161 | (0.511) | -0.586* | (0.316) |
| Post birth*age 35-39 | -1.861*** | (0.410) | 0.185 | (0.546) | -0.906*** | (0.336) |
| Post birth*age 40-44 | -1.446*** | (0.485) | 0.241 | (0.578) | -0.375 | (0.361) |
| Post birth*age 45-49 | -1.166** | (0.562) | 0.616 | (0.608) | -0.086 | (0.387) |
| Post birth*age 50-54 | -0.542 | (0.629) | 0.808 | (0.591) | 0.489 | (0.420) |
| Post birth*age 55-59 | -0.103 | (0.722) | 0.788 | (0.759) | 0.736 | (0.477) |
| Post birth*age 60-64 | -0.277 | (0.867) | -0.340 | (0.870) | 0.437 | (0.585) |
| Post birth*age 65-69 | 0.332 | (1.037) | -0.664 | (0.897) | 0.652 | (0.711) |
| R-squared | 0.008 | | 0.049 | | | |
| Dependent variable ^a | 49.21 | (10.16) | 49.21 | (10.16) | 49.21 | (10.16) |

Notes: Other variables included in the regressions are: age youngest child dummies for ages 0-2, 3-5 and 6-15, wave dummies, age group dummies and the interactions between age group dummies and background variables (as listed in Section 4). Robust standard errors in parentheses, and significance indicated by *** p<0.01, ** p<0.05, * p<0.1. a) Mean and standard deviation (in parentheses) for the dependent variable.

Table 2: Estimated Impacts of Teenage Motherhood (TM) on Physical Health (PCS) across a Lifetime (N=71,391 and number of individuals is 10,338)

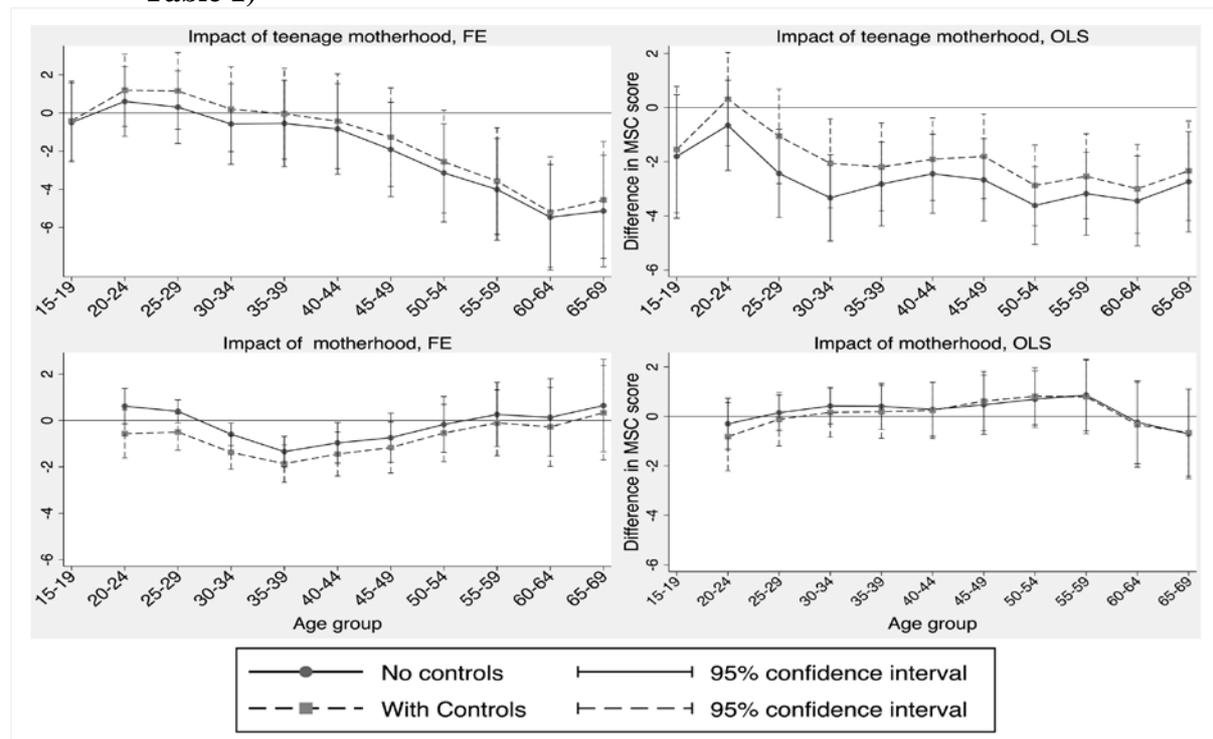
| VARIABLES | FE | | OLS | | RE | |
|---------------------------------|-----------|---------|-----------|---------|-----------|---------|
| | Coeff | Se | Coeff | Se | Coeff | Se |
| TM*age 15-19 | -2.024** | (0.859) | -1.454* | (0.759) | -1.344** | (0.685) |
| TM*age 20-24 | -2.455*** | (0.782) | 0.014 | (0.607) | -0.869* | (0.518) |
| TM*age 25-29 | -2.385*** | (0.829) | -0.745 | (0.625) | -0.842* | (0.476) |
| TM*age 30-34 | -3.136*** | (0.917) | -0.444 | (0.570) | -1.179*** | (0.452) |
| TM*age 35-39 | -3.898*** | (0.982) | -1.188* | (0.670) | -1.517*** | (0.437) |
| TM*age 40-44 | -5.084*** | (1.026) | -2.910*** | (0.700) | -2.651*** | (0.414) |
| TM*age 45-49 | -5.806*** | (1.066) | -3.780*** | (0.715) | -3.300*** | (0.408) |
| TM*age 50-54 | -5.974*** | (1.111) | -3.062*** | (0.708) | -3.425*** | (0.412) |
| TM*age 55-59 | -5.920*** | (1.153) | -2.178*** | (0.782) | -3.316*** | (0.435) |
| TM*age 60-64 | -5.422*** | (1.195) | -1.712** | (0.871) | -2.830*** | (0.472) |
| TM*age 65-69 | -5.230*** | (1.264) | -2.748*** | (1.053) | -2.714*** | (0.559) |
| Post birth*age <25 | 1.404*** | (0.430) | -3.319*** | (0.549) | -0.940** | (0.378) |
| Post birth*age 25-29 | 1.191*** | (0.324) | -2.913*** | (0.460) | -0.764*** | (0.282) |
| Post birth*age 30-34 | 1.414*** | (0.301) | -1.474*** | (0.451) | -0.201 | (0.261) |
| Post birth*age 35-39 | 1.495*** | (0.332) | -0.172 | (0.491) | 0.257 | (0.277) |
| Post birth*age 40-44 | 0.982** | (0.393) | 0.097 | (0.500) | 0.002 | (0.300) |
| Post birth*age 45-49 | 0.821* | (0.455) | 0.785 | (0.570) | 0.115 | (0.324) |
| Post birth*age 50-54 | 0.257 | (0.509) | -0.257 | (0.634) | -0.444 | (0.352) |
| Post birth*age 55-59 | 0.979* | (0.585) | -0.332 | (0.769) | 0.122 | (0.400) |
| Post birth*age 60-64 | 0.946 | (0.702) | -0.676 | (0.863) | 0.058 | (0.490) |
| Post birth*age 65-69 | 1.173 | (0.839) | 1.394 | (1.018) | 0.549 | (0.596) |
| R-squared | 0.040 | | 0.192 | | | |
| Dependent variable ^a | 51.14 | (9.567) | 51.14 | (9.567) | 51.14 | (9.567) |

Notes: See Table 1.

These patterns over a lifetime are clearly shown in Figures 9 and 10 which map the estimated impacts for teenage mothers versus other mothers, and for other mothers versus childless women. The graphs also show the impact of including the background variables (i.e. with controls versus no controls). While mental health of other mothers starts recovering from age 40 (relative to childless women), mental health of teenage mothers continues to deteriorate (see Figure 9). This contradicts a hypothesis by Aitken et al. (2016) that the larger impact on mental health experienced by younger cohorts may be due to them being closer to having given birth. Inclusion of background variables in estimation reduces the estimated impact on the pattern of mental health of mothers and teenage mothers relative to childless women.

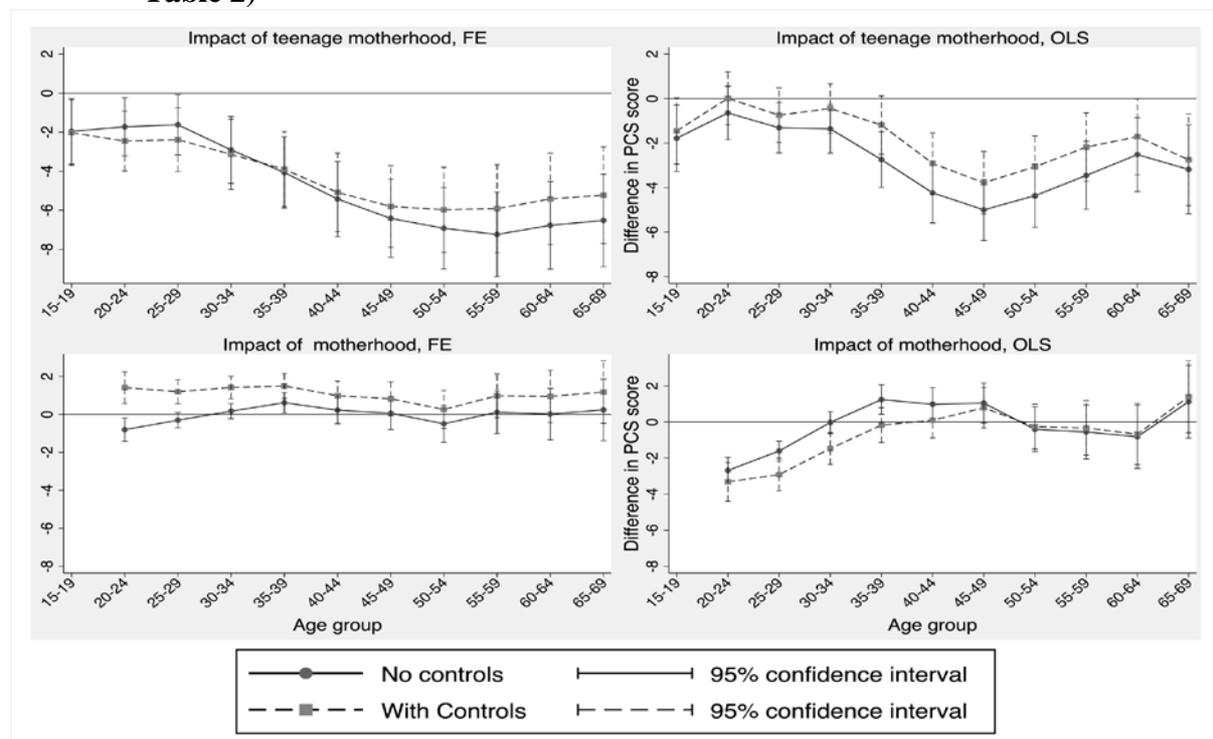
Figure 10 shows that the physical health of older mothers is not that different from the physical health of childless women, but that the physical health of teenage mothers, relative to other mothers, is poorer and worsens as teenage mothers age. From age 40, the poor physical health outcomes for teenage mothers can be partly explained by the background variables.

Figure 9: Impact of (teenage) motherhood on mental health (visual representation of Table 1)



Note: 'No controls' indicates that only age dummies and interactions with motherhood are included, whereas 'With controls' includes all variables included in Table 1. Impact of teenage motherhood is relative to other mothers whereas impact of motherhood is relative to childless women.

Figure 10: Impact of (teenage) motherhood on physical health (visual representation of Table 2)



Note: See notes of Figure 9.

5.2 Results for health subdomains

Using the fixed-effects specification, we estimate models for each of the subdomains of mental and physical health with results reported in Appendix Tables A.2 and A.3, respectively. Overall, the patterns of the impacts on the subdomains of mental health are similar to the impacts on MSC. The impacts are largest for the 'role emotional', followed by 'social functioning'. The impacts on 'mental health' and 'vitality' are much smaller and only significant for teenage mothers in their sixties. The drop in vitality for teenage mothers observed in Figure 3 is shared by other women who have recently gone through child birth. For physical health, the increasing negative impacts on the 'role physical' and on 'bodily pain' as teenage mothers age are much more pronounced than the impacts on the other two domains.

5.3 Controlling for birth cohort

The increasing impacts of teenage motherhood with age estimated thus far may (partly) reflect differences in impacts across birth cohorts. To examine this possibility, we allow for differential impacts by birth cohort. Aitken et al. (2016) distinguished three birth cohorts: 1936-1945, 1946-1955 and 1956-1965. They found that the impact is strongest for the youngest cohort and similar for the older cohorts. Based on their results, we divide our sample into three birth cohorts: born before or in 1955, born from 1956 to 1975 (our reference group), and born after 1975. We include birth cohort dummies and interact these with age, post-birth and teenage motherhood dummies. There is limited overlap in the age categories across these birth cohorts. Five age groups (15 to 24, 40 to 44 and 60 to 69) are observed in one cohort only, while the other age categories are observed in two cohorts, one of which is the reference birth cohort. The interaction terms with birth cohort dummies reflect the differential impacts relative to the impacts for the reference group.

The inclusion of birth cohorts is expected to be more important in the OLS and random-effects models, than in the fixed-effects model, as persistent cohort differences in the impact of teenage motherhood are already absorbed in the fixed effects. Interestingly, for the mental health impact, the interaction term between teenage motherhood and being born prior to 1955 is strongly significant and positive for OLS and random-effects models (see Appendix Table A.4). This suggests the negative impacts of teenage motherhood are stronger for the younger cohort, which is consistent with the finding by Aitken et al. (2016). The more muted effects for the older cohorts may be due to the fact that teenage motherhood was more common in their time (11.9% in the oldest cohort versus 9.6% and 6.7% in the middle and youngest cohorts respectively). Concerning the age pattern in effects, the impacts for both mental and physical health from the OLS and random-effects models have become substantially stronger with age and are closer to the results from the fixed-effects model, providing further support for these results.

5.4 Broadening the definition of young motherhood

As recent research has focused on the broader concept of young mother/parenthood, we investigate the sensitivity of our findings to the inclusion of women who gave birth at age 20 or 21 in our treatment group. The results (Appendix Table A.5) for mental and physical health are quite similar to the baseline results with only slightly weaker impacts observed due to including women who have their child at a slightly older age, and our main conclusions remain

unchanged.

6. Role of mediators

The long-lasting health effect found thus far is consistent with teenage motherhood being likely to have negative impacts on income, family status, education, and social support which in turn may negatively affect investments in health. To explore the mediating effects of these factors, we use the fixed-effects model in Tables 1 and 2 as a starting point and add these potential mediators to observe the impact of such inclusions on the teenage motherhood coefficients.⁶ If the impacts of teenage motherhood are reduced and the included factors are significant, these factors could be mediators for poor health.

Tables 3 and 4 report the results. First, we consider health behaviours: drinking, exercising, and smoking. Each of these has the expected impact on mental health, while for physical health exercising has the expected impact, smoking has no impact and drinking has the opposite effect. These unexpected impacts are perhaps related to reverse causation, people who become less healthy may reduce their unhealthy behaviours. The coefficients on teenage motherhood are slightly smaller for mental health and change very little for physical health. These results suggest that health behaviours are not important mediators for physical health.

Second, we examine the role of family by including marital instability, satisfaction with partner rating, and information on children. The results show that family factors are strongly related to mental health: high partner ratings are associated with better mental health, while having more children and unstable relationships are associated with poorer mental health. The estimated effect of teenage motherhood is reduced across age groups, indicating that family factors may mediate the mental health impact. In contrast, the relationships between family factors and physical health are less clear-cut.

Social support is next considered using the social support score and the number of negative life events. Aitken et al. (2016) mention negative life events as one of the unmeasured socioeconomic factors that might influence mental health outcomes and are experienced disproportionately by teenage mothers. Social support is the most important mediating factor for mental health, substantially reducing the estimated impact attributed to teenage motherhood. However, no such impact is observed for physical health.

Fourth, education is considered. The results suggest there is no clear relationship between health and education. The teenage motherhood coefficients for mental and physical health were not much affected.

⁶ That is, we add pathway variables Z_{it} interacted with age dummies to equation (1).

Table 3: The impact on mental health (MCS) after introducing mediators: Fixed-effects Estimators (N=71,391, individuals=10,338)

| VARIABLES | (1) Base | | (2) Health behaviours | | (3) Family | | (4) Social support+ | | (5) Education | | (6) Economic | | (7) All | |
|-----------------------------|-------------|---------|-----------------------------|---------|---------------|---------|---------------------------|---------|------------------|---------|-----------------|---------|------------|---------|
| | Coeff. | Se | Coeff. | Se | Coeff. | Se | Coeff. | Se | Coeff. | Se | Coeff. | Se | Coeff. | Se |
| TM* age 15-19 | -0.415 | (1.061) | -0.188 | (1.057) | -0.263 | (1.051) | 0.498 | (1.012) | -0.286 | (1.062) | -0.057 | (1.053) | 0.894 | (1.003) |
| TM* age 20-24 | 1.190 | (0.966) | 1.386 | (0.962) | 1.174 | (0.956) | 1.560* | (0.921) | 1.246 | (0.966) | 1.431 | (0.958) | 1.792** | (0.912) |
| TM* age 25-29 | 1.155 | (1.024) | 1.233 | (1.020) | 1.177 | (1.015) | 1.245 | (0.976) | 1.234 | (1.025) | 1.403 | (1.016) | 1.376 | (0.969) |
| TM *age 30-34 | 0.199 | (1.133) | 0.202 | (1.129) | 0.561 | (1.125) | 0.788 | (1.080) | 0.313 | (1.134) | 0.772 | (1.124) | 1.191 | (1.073) |
| TM* age 35-39 | -0.043 | (1.213) | -0.015 | (1.208) | 0.318 | (1.204) | 0.841 | (1.157) | 0.072 | (1.214) | 0.716 | (1.204) | 1.289 | (1.149) |
| TM* age 40-44 | -0.434 | (1.268) | -0.287 | (1.262) | -0.067 | (1.258) | 0.468 | (1.209) | -0.309 | (1.268) | 0.285 | (1.258) | 1.005 | (1.201) |
| TM* age 45-49 | -1.266 | (1.317) | -1.101 | (1.312) | -0.704 | (1.307) | 0.056 | (1.256) | -1.145 | (1.318) | -0.562 | (1.307) | 0.720 | (1.247) |
| TM* age 50-54 | -2.552* | (1.373) | -2.353* | (1.367) | -1.810 | (1.363) | -1.274 | (1.309) | -2.429* | (1.374) | -1.722 | (1.362) | -0.334 | (1.300) |
| TM* age 55-59 | -3.571** | (1.425) | -3.328** | (1.419) | -2.710* | (1.414) | -1.898 | (1.359) | -3.453** | (1.425) | -2.830** | (1.414) | -0.945 | (1.349) |
| TM* age 60-64 | -5.189*** | (1.477) | -4.857*** | (1.471) | -4.270*** | (1.465) | -3.304** | (1.408) | -5.074*** | (1.477) | -4.429*** | (1.465) | -2.271 | (1.397) |
| TM* age 65-69 | -4.553*** | (1.561) | -4.236*** | (1.555) | -3.691** | (1.548) | -2.604* | (1.488) | -4.439*** | (1.562) | -3.766** | (1.549) | -1.591 | (1.476) |
| No. of children ever had | | | | | -0.650*** | (0.118) | | | | | | | -0.359*** | (0.113) |
| Married | | | | | -6.544*** | (0.415) | | | | | | | -4.385*** | (0.397) |
| De facto | | | | | -6.708*** | (0.290) | | | | | | | -4.510*** | (0.279) |
| Separated | | | | | -2.371*** | (0.380) | | | | | | | -1.889*** | (0.363) |
| Divorced | | | | | -0.478 | (0.356) | | | | | | | -0.197 | (0.341) |
| Widowed | | | | | -2.053*** | (0.514) | | | | | | | -1.716*** | (0.491) |
| Married once | | | | | -0.429 | (0.385) | | | | | | | -0.371 | (0.367) |
| Married twice | | | | | -1.208* | (0.676) | | | | | | | -0.876 | (0.645) |
| Married 3 times | | | | | -2.612** | (1.278) | | | | | | | -2.380* | (1.218) |
| De facto once | | | | | -0.433* | (0.222) | | | | | | | -0.258 | (0.213) |
| De facto twice | | | | | -0.173 | (0.344) | | | | | | | 0.143 | (0.329) |
| De facto 3 times | | | | | 0.094 | (0.490) | | | | | | | 0.276 | (0.469) |
| De facto 4 times | | | | | -0.334 | (0.672) | | | | | | | -0.512 | (0.641) |
| De facto 5 times | | | | | 1.515 | (1.043) | | | | | | | 1.396 | (0.995) |
| Satisfaction rating partner | | | | | 0.934*** | (0.026) | | | | | | | 0.617*** | (0.026) |
| Drink excessively | | | -0.585*** | (0.091) | | | | | | | | | -0.477*** | (0.087) |
| Exercise | | | 1.600*** | (0.073) | | | | | | | | | 1.391*** | (0.069) |
| Smoke | | | -0.485*** | (0.132) | | | | | | | | | -0.337*** | (0.126) |
| Social support score | | | | | | | 3.325*** | (0.045) | | | | | 3.035*** | (0.045) |
| No. of negative life events | | | | | | | -0.863*** | (0.040) | | | | | -0.776*** | (0.040) |
| Bachelor or higher degree | | | | | | | | | 0.194 | (0.288) | | | -0.088 | (0.275) |
| Diploma | | | | | | | | | 0.203 | (0.349) | | | 0.250 | (0.331) |
| Certificates | | | | | | | | | -0.312 | (0.218) | | | -0.226 | (0.206) |
| Year 12 | | | | | | | | | -0.363* | (0.195) | | | -0.052 | (0.186) |
| being employed | | | | | | | | | | | 0.532*** | (0.094) | 0.688*** | (0.090) |

| VARIABLES | (1) Base | | (2) Health behaviours | | (3) Family | | (4) Social support+ | | (5) Education | | (6) Economic | | (7) All | |
|---|-------------|----|-----------------------------|----|---------------|----|---------------------------|----|------------------|----|-----------------|---------|------------|---------|
| | Coeff. | Se | Coeff. | Se | Coeff. | Se | Coeff. | Se | Coeff. | Se | Coeff. | Se | Coeff. | Se |
| 2nd Income quintile | | | | | | | | | | | 0.188 | (0.116) | 0.065 | (0.111) |
| 3rd Income quintile | | | | | | | | | | | 0.266** | (0.128) | 0.068 | (0.123) |
| 4th Income quintile | | | | | | | | | | | 0.362*** | (0.137) | 0.082 | (0.132) |
| 5th Income quintile | | | | | | | | | | | 0.435*** | (0.152) | 0.101 | (0.147) |
| Homeowner | | | | | | | | | | | -0.174 | (0.110) | -0.155 | (0.106) |
| relative socio-economic disadvantage index | | | | | | | | | | | -0.013 | (0.021) | -0.005 | (0.020) |
| Financial hardship index | | | | | | | | | | | -0.851*** | (0.041) | -0.592*** | (0.039) |
| R-squared | 0.008 | | 0.017 | | 0.032 | | 0.099 | | 0.009 | | 0.025 | | 0.121 | |

Notes: Other variables included are the same as in Table 1. Robust standard errors in parentheses, and significance indicated by *** p<0.01, ** p<0.05, * p<0.10.

Table 4: The impact on physical health (PCS) after introducing mediators: Fixed-effects Estimators (N=71,391, individuals=10,338)

| VARIABLES | (1) Base | | (2) Health behaviours | | (3) Family | | (4) Social support+ | | (5) Education | | (6) Economic | | (7) All | |
|--------------------------|-------------|---------|-----------------------------|---------|---------------|---------|---------------------------|---------|------------------|---------|-----------------|---------|------------|---------|
| | Coeff. | Se | Coeff. | Se | Coeff. | Se | Coeff. | Se | Coeff. | Se | Coeff. | Se | Coeff. | Se |
| TM* age 15-19 | -2.024** | (0.859) | -2.220*** | (0.855) | -2.043** | (0.859) | -2.041** | (0.859) | -2.044** | (0.860) | -2.103** | (0.859) | -2.269*** | (0.856) |
| TM* age 20-24 | -2.455*** | (0.782) | -2.503*** | (0.778) | -2.569*** | (0.782) | -2.462*** | (0.782) | -2.444*** | (0.782) | -2.481*** | (0.781) | -2.645*** | (0.778) |
| TM* age 25-29 | -2.385*** | (0.829) | -2.504*** | (0.825) | -2.572*** | (0.830) | -2.388*** | (0.829) | -2.378*** | (0.830) | -2.432*** | (0.828) | -2.768*** | (0.826) |
| TM* age 30-34 | -3.136*** | (0.917) | -3.328*** | (0.913) | -3.352*** | (0.920) | -3.150*** | (0.918) | -3.138*** | (0.918) | -3.178*** | (0.917) | -3.641*** | (0.915) |
| TM* age 35-39 | -3.898*** | (0.982) | -4.108*** | (0.977) | -4.121*** | (0.985) | -3.920*** | (0.982) | -3.897*** | (0.983) | -3.908*** | (0.982) | -4.384*** | (0.980) |
| TM* age 40-44 | -5.084*** | (1.026) | -5.244*** | (1.021) | -5.312*** | (1.029) | -5.106*** | (1.026) | -5.084*** | (1.027) | -5.076*** | (1.026) | -5.513*** | (1.024) |
| TM* age 45-49 | -5.806*** | (1.066) | -5.887*** | (1.061) | -6.088*** | (1.069) | -5.836*** | (1.066) | -5.807*** | (1.067) | -5.792*** | (1.066) | -6.192*** | (1.063) |
| TM* age 50-54 | -5.974*** | (1.111) | -6.049*** | (1.106) | -6.322*** | (1.114) | -6.003*** | (1.112) | -5.968*** | (1.112) | -5.939*** | (1.111) | -6.371*** | (1.109) |
| TM* age 55-59 | -5.920*** | (1.153) | -5.945*** | (1.148) | -6.277*** | (1.156) | -5.956*** | (1.154) | -5.911*** | (1.154) | -5.883*** | (1.153) | -6.282*** | (1.150) |
| TM* age 60-64 | -5.422*** | (1.195) | -5.404*** | (1.189) | -5.755*** | (1.198) | -5.462*** | (1.196) | -5.411*** | (1.196) | -5.386*** | (1.195) | -5.715*** | (1.192) |
| TM* age 65-69 | -5.230*** | (1.264) | -5.143*** | (1.257) | -5.534*** | (1.266) | -5.271*** | (1.264) | -5.220*** | (1.264) | -5.193*** | (1.263) | -5.424*** | (1.259) |
| No. of children ever had | | | | | 0.782*** | (0.096) | | | | | | | 0.855*** | (0.096) |
| Married | | | | | 0.436 | (0.339) | | | | | | | 0.477 | (0.339) |
| De facto | | | | | 0.413* | (0.237) | | | | | | | 0.465* | (0.238) |
| Separated | | | | | 1.249*** | (0.311) | | | | | | | 1.276*** | (0.310) |
| Divorced | | | | | 0.191 | (0.291) | | | | | | | 0.255 | (0.290) |
| Widowed | | | | | 0.907** | (0.421) | | | | | | | 0.928** | (0.418) |
| Married once | | | | | -0.682** | (0.315) | | | | | | | -0.542* | (0.313) |
| Married twice | | | | | -1.114** | (0.553) | | | | | | | -0.932* | (0.550) |
| Married 3 times | | | | | -0.241 | (1.045) | | | | | | | 0.160 | (1.039) |

| VARIABLES | (1) Base | | (2) Health behaviours | | (3) Family | | (4) Social support+ | | (5) Education | | (6) Economic | | (7) All | |
|---|-------------|----|-----------------------------|---------|---------------|---------|---------------------------|---------|------------------|---------|-----------------|---------|------------|---------|
| | Coeff. | Se | Coeff. | Se | Coeff. | Se | Coeff. | Se | Coeff. | Se | Coeff. | Se | Coeff. | Se |
| De facto once | | | | | -0.208 | (0.182) | | | | | | | -0.183 | (0.182) |
| De facto twice | | | | | -0.431 | (0.281) | | | | | | | -0.338 | (0.281) |
| De facto 3 times | | | | | -0.768* | (0.401) | | | | | | | -0.625 | (0.400) |
| De facto 4 times | | | | | 0.228 | (0.549) | | | | | | | 0.247 | (0.547) |
| De facto 5 times | | | | | -0.302 | (0.853) | | | | | | | -0.119 | (0.849) |
| Satisfaction rating partner | | | | | -0.110*** | (0.022) | | | | | | | -0.107*** | (0.022) |
| Drink excessively | | | 0.685*** | (0.073) | | | | | | | | | 0.610*** | (0.074) |
| Exercise | | | 1.396*** | (0.059) | | | | | | | | | 1.401*** | (0.059) |
| Smoke | | | 0.025 | (0.107) | | | | | | | | | -0.028 | (0.107) |
| Social support score | | | | | | | -0.058 | (0.038) | | | | | -0.047 | (0.038) |
| No. of negative life events | | | | | | | 0.036 | (0.034) | | | | | 0.049 | (0.034) |
| Bachelor or higher degree | | | | | | | | | 0.026 | (0.234) | | | -0.168 | (0.234) |
| Diploma | | | | | | | | | 0.102 | (0.283) | | | -0.054 | (0.282) |
| Certificates | | | | | | | | | 0.211 | (0.176) | | | 0.085 | (0.176) |
| Year 12 being employed | | | | | | | | | -0.006 | (0.158) | | | -0.216 | (0.159) |
| 2nd Income quintile | | | | | | | | | | | 0.750*** | (0.077) | 0.789*** | (0.077) |
| 3rd Income quintile | | | | | | | | | | | -0.030 | (0.095) | 0.028 | (0.095) |
| 4th Income quintile | | | | | | | | | | | -0.174* | (0.104) | -0.033 | (0.104) |
| 5th Income quintile | | | | | | | | | | | -0.150 | (0.112) | 0.047 | (0.113) |
| Homeowner | | | | | | | | | | | -0.305** | (0.124) | -0.065 | (0.126) |
| relative socio-economic disadvantage index | | | | | | | | | | | -0.110 | (0.090) | -0.053 | (0.091) |
| Financial hardship index | | | | | | | | | | | 0.022 | (0.018) | 0.017 | (0.017) |
| | | | | | | | | | | | | | -0.074** | (0.033) |
| | | | | | | | | | | | | | -0.095*** | (0.033) |
| R-squared | 0.040 | | 0.050 | | 0.044 | | 0.040 | | 0.040 | | 0.042 | | 0.056 | |

Notes: See notes of Table 3.

A final group of factors, the economic cluster, includes employment, income quintile, home ownership, relative socio-economic disadvantage index and the number of material hardship events. The latter were again more likely to occur amongst teenage mothers (e.g., Gibb et al. 2015). Economic factors are observed to have much more impact on mental health outcomes than education and seem to explain a substantial part of the teenage motherhood impacts. However, the impact on physical health is again less clear-cut, and the teenage motherhood coefficients are not affected.

When including all factors at once, the coefficients on the teenage motherhood-age interactions are much smaller and much less significant in the mental health model while the results in the physical health model are much less affected, with the coefficients in the fixed-effects model slightly increasing. This suggests that for physical health, there is hardly any evidence of the factors studied in this section being pathways to the impacts on physical health.

7. Conclusion

This paper has analysed the patterns of lifetime health outcomes of teenage mothers. Descriptive analysis reveals that, relative to other mothers and childless women, poorer health outcomes on all domains and across all life stages are observed for teenage mothers compared to other women of the same age, even before childbirth. This suggests that teenage mothers are already at a disadvantage before having children, and teenage birth is an outcome of this disadvantage, although it may also compound prior disadvantage.

Estimating the impact of teenage motherhood across different life stages is this paper's main contribution. Using fixed-effects models to better control for prior disadvantage, our results show that the negative impact on mental health of teenage birth, relative to having a first child at an older age, emerges from age 50, whereas the negative impact on physical health is immediate. Both impacts increase with age, widening the gap between teenage mothers and other mothers. These findings are in stark contrast with the finding that other mothers' health outcomes are similar to the health outcomes of childless women, highlighting the adverse effects of having a child early. Analysis of the eight domains of health reveals that the health impact is particularly strong for the role of limitations due to emotional problems and 'social functioning' (mental), and the role of limitations due to physical health and 'bodily pain' (physical).

The robustness of results to the inclusion of birth cohort indicators suggests that the increasing negative estimated impacts of teenage motherhood with age are not a product of differential effects across birth cohorts but plausibly suggest that teenage motherhood has a long-lasting effect on health, with effects becoming more pronounced in later life stages. The worsening health effects in later life stages are consistent with Grossman's health production model, where poor health may be the result of negative effects of teenage motherhood on other outcomes leading to lower investments in health and thus poorer health outcomes as the women age. Our pathway analysis reveals that observed disadvantages in social support, family and economic outcomes are likely mediators for the negative impacts on mental health. For physical health, however, we are unable to link the impacts to potential pathways. This suggests

understanding the mechanism through which physical health is impacted may not be straightforward, and/or teenage motherhood itself has a stronger direct impact on physical than mental health.

Our results provide several policy implications. First, the availability of social support is extremely important for mental health, and the lack of it appears to be a mediating factor for the negative impact of teenage motherhood on mental health. With many teenage mothers reporting a lack of social support, especially in the first years after the first child is born, this seems an area where outcomes could be improved through the design of policies aimed at providing support and advice to young mothers. An example of such an approach is the Second Chance Home Network in the US as described by Hudgins et al. (2014). In their review of interventions, Hoffman and Vidal (2017) provide recommendations regarding desirable characteristics of interventions aimed at young parents and pregnant youth. One of these states “Authorities should adopt broader approaches to address social exclusion among pregnant and parenting teenagers.” This is in line with the lack of social support observed in our data.

Second, our analyses suggest that there are strong and immediate impacts of teenage motherhood on physical health, especially in the form of bodily pain. However, we are not able to uncover the mechanisms of how teenage motherhood affects physical health. As such, no specific policy interventions can be recommended, aside from ensuring all women have easy, non-judgmental (and affordable) access to medical care at all stages of their life to facilitate prevention, early detection, and treatment of serious health issues.

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Appendix Tables

Table A.1: Summary statistics (proportions unless otherwise specified)

| | Teenage Mothers | Other Women | All Women |
|--|-----------------|-------------|-----------|
| Teenage mother status | 1.000 | 0.000 | 0.079 |
| Age | | | |
| Age 15-19 | 0.029 | 0.091 | 0.086 |
| Age 20-24 | 0.090 | 0.112 | 0.110 |
| Age 25-29 | 0.079 | 0.103 | 0.101 |
| Age 30-34 | 0.085 | 0.100 | 0.099 |
| Age 35-39 | 0.092 | 0.105 | 0.104 |
| Age 40-44 | 0.109 | 0.109 | 0.109 |
| Age 45-49 | 0.120 | 0.100 | 0.102 |
| Age 50-54 | 0.122 | 0.090 | 0.092 |
| Age 55-59 | 0.113 | 0.076 | 0.079 |
| Age 60-64 | 0.099 | 0.063 | 0.066 |
| <i>Age 65-69 (omitted category)</i> | 0.064 | 0.052 | 0.052 |
| Post birth indicator | 1.000 | 0.613 | 0.643 |
| Age of youngest child | | | |
| Youngest aged 0-2 | 0.055 | 0.051 | 0.051 |
| Youngest aged 3-5 | 0.059 | 0.050 | 0.051 |
| Youngest aged 6-15 | 0.213 | 0.167 | 0.171 |
| <i>Youngest >15/no children: (omitted category)</i> | 0.674 | 0.732 | 0.727 |
| Country of birth | | | |
| <i>Australian born (omitted category)</i> | 0.912 | 0.912 | 0.912 |
| Born in Major English-Speaking Country | 0.063 | 0.043 | 0.044 |
| Born in Non-English-Speaking Country | 0.025 | 0.046 | 0.044 |
| Indigenous indicator | 0.088 | 0.022 | 0.028 |
| Father employed at the age of 14 | 0.801 | 0.890 | 0.882 |
| Mother employed at the age of 14 | 0.426 | 0.563 | 0.552 |
| Father unemployed while respondent growing up | 0.191 | 0.120 | 0.126 |
| Father's occupation | | | |
| <i>high skill (omitted category)</i> | 0.201 | 0.385 | 0.371 |
| medium skill | 0.288 | 0.314 | 0.312 |
| low skill | 0.394 | 0.234 | 0.247 |
| other (invalid answers/don't know) | 0.117 | 0.067 | 0.071 |
| Mother's occupation | | | |
| <i>high skill (omitted category)</i> | 0.105 | 0.244 | 0.233 |
| medium skill | 0.257 | 0.323 | 0.318 |
| low skill | 0.312 | 0.239 | 0.244 |
| never in paid work | 0.238 | 0.126 | 0.135 |
| Other (invalid answers/don't know) | 0.088 | 0.068 | 0.069 |

| | Teenage Mothers | Other Women | All Women |
|--|------------------------|--------------------|------------------|
| Parent divorced/separated while growing up | 0.370 | 0.247 | 0.257 |
| Living arrangement at the age of 14 | | | |
| <i>living with both birth parents (omitted category)</i> | 0.643 | 0.797 | 0.785 |
| living with one birth parent and one step parent | 0.081 | 0.062 | 0.064 |
| living with birth father only | 0.034 | 0.017 | 0.018 |
| living with birth mother only | 0.153 | 0.105 | 0.109 |
| Other living arrangement | 0.089 | 0.018 | 0.024 |
| Number of siblings (mean) | 3.848 | 2.528 | 2.632 |
| Number of observations | 5,629 | 65,762 | 71,391 |
| Number of individuals ^a | 916 | 9489 | 10338 |

Notes: a) 67 individuals who became a teenage mother during the observation period are counted in both 'other' women and 'teenage mothers' and thus the number of individuals in 'all women' is not equal to the sum of teenage mothers and other women.

Table A.2 Separate fixed-effects estimation for the four subdomains of mental health (N=71,391, individuals=10,338)

| VARIABLES | Mental Health | | Vitality | | Role emotional | | Social functioning | |
|---------------------------------|---------------|---------|-----------|---------|----------------|---------|--------------------|---------|
| | Coeff | Se | Coeff | Se | Coeff | Se | Coeff | Se |
| TM* age 15-19 | -1.574 | (1.701) | -1.858 | (1.918) | -6.290* | (3.751) | 0.283 | (2.457) |
| TM* age 20-24 | 2.445 | (1.548) | 2.118 | (1.745) | -4.691 | (3.414) | -1.795 | (2.237) |
| TM* age 25-29 | 3.125* | (1.641) | 1.288 | (1.851) | -3.705 | (3.620) | -2.528 | (2.372) |
| TM* age 30-34 | 0.904 | (1.816) | 1.792 | (2.048) | -5.451 | (4.006) | -4.779* | (2.625) |
| TM* age 35-39 | 1.842 | (1.945) | 1.130 | (2.192) | -12.677*** | (4.289) | -6.758** | (2.810) |
| TM*age 40-44 | 0.097 | (2.032) | -0.093 | (2.291) | -12.704*** | (4.481) | -5.795** | (2.936) |
| TM*age 45-49 | -0.595 | (2.111) | -2.662 | (2.380) | -18.451*** | (4.656) | -8.964*** | (3.050) |
| TM*age 50-54 | -3.297 | (2.201) | -4.361* | (2.481) | -20.091*** | (4.853) | -11.189*** | (3.180) |
| TM*age 55-59 | -4.126* | (2.284) | -5.137** | (2.575) | -24.513*** | (5.037) | -12.965*** | (3.300) |
| TM*age 60-64 | -5.980** | (2.367) | -7.325*** | (2.669) | -30.574*** | (5.220) | -15.471*** | (3.420) |
| TM*age 65-69 | -5.496** | (2.502) | -6.598** | (2.821) | -29.548*** | (5.518) | -12.951*** | (3.615) |
| R-squared | 0.009 | | 0.014 | | 0.008 | | 0.009 | |
| Dependent variable ^a | 73.06 | (17.42) | 58.16 | (20.12) | 82.89 | (32.71) | 82.52 | (23.16) |

Notes: Other variables included are the same as in Table 1. Robust standard errors in parentheses, and significance indicated by *** p<0.01, ** p<0.05, * p<0.1.

a) Mean and standard deviation (in parentheses) shown of dependent variable.

Table A.3 Separate fixed-effects estimation for the four subdomains of physical health (N=71,391, individuals=10,338)

| VARIABLES | General health | | Physical functioning | | Role physical | | Bodily pain | |
|---------------------------------|----------------|---------|----------------------|---------|---------------|---------|-------------|---------|
| | Coeff | Se | Coeff | Se | Coeff | Se | Coeff | Se |
| TM*age 15-19 | 0.357 | (1.694) | -2.920 | (1.854) | -3.933 | (3.805) | -7.142*** | (2.357) |
| TM*age 20-24 | 2.173 | (1.542) | -2.101 | (1.687) | -6.589* | (3.464) | -6.375*** | (2.145) |
| TM*age 25-29 | 4.120** | (1.635) | 2.036 | (1.789) | -7.232** | (3.672) | -4.979** | (2.274) |
| TM*age 30-34 | 1.485 | (1.810) | 2.789 | (1.980) | -9.832** | (4.064) | -9.776*** | (2.517) |
| TM*age 35-39 | 0.836 | (1.937) | -0.993 | (2.119) | -13.980*** | (4.351) | -12.745*** | (2.695) |
| TM*age 40-44 | -0.979 | (2.024) | -2.794 | (2.214) | -15.788*** | (4.546) | -15.413*** | (2.816) |
| TM*age 45-49 | -3.807* | (2.103) | -5.309** | (2.301) | -19.795*** | (4.723) | -18.387*** | (2.925) |
| TM*age 50-54 | -5.546** | (2.192) | -7.805*** | (2.398) | -27.141*** | (4.923) | -18.122*** | (3.049) |
| TM*age 55-59 | -5.463** | (2.275) | -7.321*** | (2.489) | -29.943*** | (5.110) | -19.091*** | (3.165) |
| TM*age 60-64 | -5.511** | (2.358) | -7.465*** | (2.579) | -33.192*** | (5.296) | -18.180*** | (3.280) |
| TM*age 65-69 | -3.673 | (2.492) | -6.247** | (2.727) | -33.729*** | (5.598) | -18.097*** | (3.467) |
| R-squared | 0.026 | | 0.025 | | 0.015 | | 0.023 | |
| Dependent variable ^a | 69.90 | (20.88) | 86.24 | (20.16) | 81.38 | (34.10) | 74.27 | (23.67) |

Notes: See notes for Table A.2.

Table A.4 The impact of teenage motherhood on Mental health (MCS) and physical health (PCS) allowing for cohort effects: (N=71,391, individual=10,338)

| VARIABLES | MCS | | | PCS | | |
|----------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| | FE | OLS | RE | FE | OLS | RE |
| TM* age 15-19 | -0.414 (1.062) | -0.665 (2.246) | -0.030 (1.448) | -1.990** (0.860) | -0.109 (1.389) | 1.083 (1.195) |
| TM* age 20-24 | 1.199 (0.967) | 1.209 (2.035) | 1.274 (1.310) | -2.410*** (0.782) | 1.375 (1.266) | 1.333 (1.082) |
| TM* age 25-29 | 1.088 (1.030) | -0.318 (1.795) | 0.372 (1.129) | -2.557*** (0.834) | 0.376 (1.026) | 0.916 (0.936) |
| TM* age 30-34 | -0.580 (1.557) | -2.255** (1.135) | -1.376* (0.731) | -5.343*** (1.261) | -0.471 (0.761) | -1.241** (0.616) |
| TM* age 35-39 | -0.685 (1.561) | -2.410*** (0.902) | -1.558** (0.610) | -5.573*** (1.264) | -1.038 (0.718) | -1.336** (0.520) |
| TM* age 40-44 | -1.106 (1.596) | -1.911** (0.779) | -1.692*** (0.557) | -6.798*** (1.292) | -2.921*** (0.700) | -2.709*** (0.479) |
| TM* age 45-49 | -1.820 (1.640) | -2.172** (0.883) | -2.353*** (0.581) | -7.499*** (1.328) | -4.238*** (0.780) | -3.562*** (0.498) |
| TM* age 50-54 | -3.579** (1.700) | -4.976*** (1.082) | -4.153*** (0.671) | -7.708*** (1.376) | -4.255*** (0.968) | -3.792*** (0.569) |
| TM* age 55-59 | -4.183** (1.858) | -6.071*** (1.862) | -4.846*** (0.963) | -7.676*** (1.504) | -4.263*** (1.452) | -3.937*** (0.801) |
| TM* age 60-64 | -5.764*** (1.934) | -7.304*** (2.032) | -6.254*** (1.092) | -7.176*** (1.565) | -4.281*** (1.647) | -3.617*** (0.904) |
| TM* age 65-69 | -5.125** (1.993) | -6.647*** (2.174) | -5.700*** (1.166) | -6.985*** (1.613) | -5.316*** (1.870) | -3.591*** (0.965) |
| Born in 1976-1995 | | -0.684 (0.586) | -0.442 (0.473) | | 0.281 (0.524) | 1.951*** (0.396) |
| Born in 1955 or before | | 0.428 (1.528) | 1.348 (0.946) | | 1.063 (1.530) | -1.031 (0.800) |
| TM* born in 1976-1995 | | -0.895 (1.989) | -1.702 (1.279) | | -1.347 (1.199) | -2.654** (1.063) |
| TM* born in 1955 or before | | 4.298** (2.039) | 3.288*** (1.132) | | 2.572 (1.681) | 1.484 (0.952) |

| VARIABLES | MCS | | | PCS | | |
|------------------------------------|-------------------|-------------------|-------------------|---------------------|------------------|--------------------|
| | FE | OLS | RE | FE | OLS | RE |
| TM* age3034*born in 1976-1995 | 1.059 (1.413) | 1.340 (1.930) | 1.335 (1.333) | 3.086*** (1.144) | 1.372 (1.369) | 2.387** (1.088) |
| TM* age3539*born in 1976-1995 | 0.774 (1.738) | 2.407 (2.513) | 1.415 (1.615) | 1.705 (1.407) | 0.092 (1.987) | 0.872 (1.322) |
| TM* age4549*born in 1955 or before | -1.121 (1.360) | -1.919 (2.340) | -0.985 (1.302) | -0.178 (1.101) | 0.549 (2.010) | 0.293 (1.062) |
| TM* age5054*born in 1955 or before | 0.688 | 0.003 | 0.550 | 0.002 | -0.027 | -0.110 |
| R-squared | 0.009 | 0.050 | | 0.040 | 0.192 | |

Notes: See notes for Table A.2.

Table A.5: The estimated impact of ‘early motherhood’^a (EM) on mental health (MCS) and physical health (PCS) (N=71,325, individual=10,337)

| VARIABLES | Mental Health | | | Physical health | | |
|--------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| | FE (1) | OLS (2) | RE (3) | FE (4) | OLS (5) | RE (6) |
| EM*age 15-19 | -0.898 (0.839) | -0.400 (1.021) | -0.830 (0.714) | -1.705** (0.679) | -1.250* (0.679) | -1.622*** (0.586) |
| EM*age 20-24 | -0.479 (0.853) | 0.410 (0.968) | -0.397 (0.685) | -1.942*** (0.690) | -0.276 (0.668) | -1.120** (0.563) |
| EM*age 25-29 | -0.739 (0.721) | -0.896 (0.690) | -0.926** (0.459) | -1.594*** (0.583) | -0.200 (0.506) | -0.610 (0.380) |
| EM*age 30-34 | -1.207 (0.783) | -1.552** (0.628) | -1.037** (0.418) | -2.320*** (0.634) | -0.594 (0.480) | -1.206*** (0.349) |
| EM*age 35-39 | -1.887** (0.840) | -2.256*** (0.621) | -1.435*** (0.396) | -2.810*** (0.680) | -1.496*** (0.527) | -1.539*** (0.331) |
| EM*age 40-44 | -2.389*** (0.886) | -2.106*** (0.615) | -1.544*** (0.379) | -3.316*** (0.717) | -2.626*** (0.547) | -2.134*** (0.318) |
| EM*age 45-49 | -1.863** (0.928) | -0.626 (0.554) | -0.597 (0.370) | -4.013*** (0.750) | -3.412*** (0.545) | -2.747*** (0.312) |
| EM*age 50-54 | -2.898*** (0.976) | -1.561*** (0.556) | -1.429*** (0.374) | -4.405*** (0.789) | -3.152*** (0.541) | -2.990*** (0.316) |
| EM*age 55-59 | -4.045*** (1.016) | -1.880*** (0.561) | -2.355*** (0.389) | -5.499*** (0.822) | -3.248*** (0.603) | -3.917*** (0.329) |
| EM*age 60-64 | -4.745*** (1.058) | -2.306*** (0.574) | -2.946*** (0.418) | -5.025*** (0.856) | -2.559*** (0.626) | -3.326*** (0.353) |
| EM*age 65-69 | -4.629*** (1.114) | -2.033*** (0.639) | -2.681*** (0.474) | -5.489*** (0.901) | -2.670*** (0.700) | -3.657*** (0.400) |
| R-squared | 0.008 | 0.049 | | 0.040 | 0.195 | |

Notes: See notes of Table A.2. a) Early motherhood is defined as having first child at age 21 or younger.