The Transition to Fatherhood and The Health of Men

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Objective: This study examines the impact of fatherhood on diverse health behaviors and outcomes among a representative sample of Millennial men in the United States.

Background: Much research explores the consequences of parenthood for women, but we know less about health outcomes and trajectories of men who become fathers. Theoretical approaches suggest both health-enhancing changes driven by social control and a new father identity, and health-decreasing changes driven by the costs and burdens of fatherhood.

Method: The NLSY97 longitudinal survey and a battery of novel fixed effects models are used to identify the consequences of paternity on diverse health outcomes, controlling for selectivity based on unobserved characteristics and unobserved trajectories of men who become fathers and accounting for heterogeneity of effects.

Results: Becoming a father induces weight gain and a decline in self-reported health, but reduces alcohol consumption. Effects on weight and alcohol use varied across strata defined by race and education, but changes in self-reported health were consistent across sub-groups.

Conclusion: The transition to fatherhood induces changes in health outcomes and behaviors that are both positive and negative. These consequences are not transitory. Rather, they persist over men's early adulthood.

Implications: Fatherhood induces health-related changes that endure over the first years after becoming a father, and which may contribute to morbidity and mortality in late adulthood.

Keywords

Aging, Fatherhood, Health, Parents, Fixed effects, Transition to adulthood

The transition to fatherhood and the health of men.

INTRODUCTION

Becoming a parent is an important life-course transition with effects spanning many domains of life, including economic attainment, stress, relationship quality, and physical and mental wellbeing (Clausen 1986; Cowan and Cowan 1992; Nomaguchi and Milkie 2017; Umberson, Pudrovska, and Reczek 2010). These effects are generally more salient for women than men. Not only do women bear the physiological demands of carrying and nursing children, but gendered social expectations result in their bearing the greater share of parental responsibilities and rewards (Musick, Meier, and Flood 2016). Compared to fathers, mothers undertake more parental responsibilities (Doucet 2009; Hochschild 2012), report higher stress (Meier et al. 2018), experience greater financial distress (Bird 1997), and contend with employment discrimination (Correll, Benard, and Paik 2007). Given such direct consequences, a connection between parenthood and health seems more obvious for mothers than fathers. Nevertheless, the transition to parenthood may also affect men in several domains of life (Eggebeen and Knoester 2001).

This analysis examines the effect of fatherhood on health behaviors and outcomes. To date, the majority of evidence comparing health outcomes between fathers and childless men is associational (Bird 1997; Eggebeen and Knoester 2001; Evenson and Simon 2005; Keizer, Dykstra, and Poortman 2010; Mirowsky 2002; Umberson 1987). This scholarship provides valuable descriptive findings, but this evidence is only suggestive. An emergent literature uses causal inference approaches to disentangle the effect of fatherhood from unobserved correlates (Garfield et al. 2016; Kerr et al. 2011; Knoester and Eggebeen 2006; Pudrovska 2008; Ross,

Mirowsky, and Goldsteen 1990; Syrda 2017; Umberson et al. 2011; Wolfe 2009). However, the extant literature faces three important challenges.

One challenge in understanding the paternity-health nexus is that research has tended to focus on specific health outcomes at a time across varied populations and has found diverse effects, rendering it difficult to piece together a comprehensive picture. For example, consistent with the notion of a protective fatherhood effect, parenthood predicts lower morbidity and mortality (Bungum et al. 2018; Modig et al. 2017), and leads to a decline in binge drinking (Wolfe 2009). One study also finds beneficial effects of fatherhood on substance use among socioeconomically disadvantaged men (Kerr et al. 2011). In contrast, others find that fatherhood has negative effects, such as weight gain (Garfield et al. 2016; Syrda 2017; Umberson et al. 2011). Taken together, it is unclear whether findings about positive and negative effects stem from simultaneous processes or simply reflect differences across generational or socioeconomic contexts. Studies examining the effect of fatherhood on psychological well-being suggest that this life transition carries both costs and rewards, with potentially offsetting effects (Hansen 2012; Nomaguchi 2012; Nomaguchi and Milkie 2003), and it is indeed plausible that fatherhood's effects on physical health are similarly wide-ranging. However, developing a full picture of how a life transition affects physical health requires an assessment of various health indicators, as well as heterogeneities across sub-groups, within the same population (Daw, Margolis, and Wright 2017).

Another challenge lies in extrapolating findings from prior research to understand the health risks faced by new fathers in the 21st century. Broad economic and cultural transformations have changed the incidence and the meaning of fatherhood in recent decades (Goldscheider, Bernhardt, and Lappegård 2015; Marsiglio and Roy 2012). With shifting gender

attitudes, American fathers today experience greater involvement with their children (Carlson, Vanorman, and Turner 2017; Pleck 2004; Samuel 2016) and assume more childcare responsibilities than they did in the past (Goldscheider et al. 2015; Pleck and Masciadrelli 2004), even in context of persistent differences in childcare between fathers and mothers (Musick et al. 2016) and beliefs that mothers are better-suited to a caregiver role (Doucet 2009). Since the 1980s, emergent norms such as “involved fathering” have placed a growing emphasis on parents’ close involvement in children’s day-to-day lives (Hays 1996; Milkie and Denny 2014). Furthermore, younger cohorts of fathers came of age in a tumultuous economic context marked by the Great Recession and decline in fertility rates (Seltzer 2019). These economic and normative transformations may have altered the experience of fatherhood, which calls for an updated understanding of the paternity-health nexus.

The third challenge is the selectivity of men who eventually become fathers. These men could differ in terms of unobserved characteristics such as health endowments or personality. They could also differ in terms of pre-fatherhood trajectories from those who remain childless, resulting in a spurious association between the transition to parenthood and health. A recent body of research attempts to directly address this challenge using longitudinal or sibling data (Garfield et al. 2016; Kerr et al. 2011; Knoester and Eggebeen 2006; Pudrovska 2008; Syrda 2017; Umberson et al. 2011; Wolfe 2009). While this scholarship has made important strides to account for unobserved traits that are stable over time, it leaves open the risk of spurious trajectories associated with fatherhood. For example, if men who “clean up their act” and reduce alcohol consumption early in their life-course because of factors other than fatherhood also become fathers earlier (Duncan, England, and Wilkerson 2006), a spurious association between fatherhood and alcohol use will emerge (Bruderl and Ludwig 2014; Wooldridge 2002:315–22).

Others have suggested that some major life events such as fatherhood may have transitory rather than permanent effects (Dougherty 2006; Myrskylä and Margolis 2014). A robust assessment of the effects of paternity entails both accounting for life-course trajectories starting before the transition to fatherhood as well as distinguishing enduring from transient effects.

We address these challenges by considering the association between fatherhood and a range of health indicators, including body weight, alcohol consumption, smoking, marijuana and other drugs use, and self-rated health, and assess heterogeneity of these effects across different contexts of fatherhood. Our analysis examines a cohort of American men born in the 1980s, who belong to the so-called Millennial generation and came of age in the early 21st century. In order to address unobserved selectivity of men who become fathers, we estimate a battery of novel fixed effects models for longitudinal data. While no research design short of an implausible large-scale experiment randomly allocating fatherhood to men would conclusively capture causal effects, the combination of several fixed effects models based on diverse assumptions provides plausible causal estimates. We use terms such as “results” and “consequences” when interpreting findings, but the reader should be aware that we cannot irrefutably assert causality.

BACKGROUND AND THEORY

Research on the association between fatherhood and mortality consistently suggests a protective effect of parenthood (Bungum et al. 2018; Modig et al. 2017). However, the bulk of the literature also shows that health and wellbeing are lower among parents than non-parents, especially among parents with young children living at home. While women appear to be more affected, worse physical and psychological wellbeing is also observed among fathers compared

to childless men (Bird 1997; Hansen 2012; McLanahan and Adams 1987; Nomaguchi and Milkie 2017).

The possibility of both health-enhancing and health-decreasing consequences of fatherhood is not a surprise for scholars of the family, who understand fatherhood as a “bundle” that brings both costs and rewards (Hansen 2012; Nomaguchi 2012; Nomaguchi and Milkie 2003). Becoming a father involves substantial psychological, financial, and social costs (Bird 1997; Evenson and Simon 2005; Nomaguchi and Milkie 2003). In addition to the financial burden and strain, parenting entails fatigue, sleep deprivation, and loss of personal freedom (Bird 1997; Pollmann-Schult 2014; Twenge, Campbell, and Foster 2003). Fatherhood could also carry marital and relationships costs. Even as some studies suggest that fatherhood improves relationship quality improves for a small share of men (Doss et al. 2009; Twenge et al. 2003), research generally finds that transitioning to parenthood is accompanied by an average decline in relationship quality (Bird 1997; Lawrence et al. 2008; Twenge et al. 2003) due to role conflict and restricted freedom (Twenge et al. 2003), increased burden of household labor (Keizer and Schenk 2012), and decline in shared leisure (Claxton and Perry-Jenkins 2008). Given these corollaries, stress theory predicts negative health consequences of paternity. Specifically, stress can affect weight (Dallman et al. 2003), smoking (Slopen et al. 2013), drug and alcohol addiction (Volkow et al. 2011), and immunity (Schneiderman, Ironson, and Siegel 2005). Moreover, by imposing competing demands on time, the new role could reduce opportunities for physical exercise, contributing to weight gain (Nomaguchi and Bianchi 2004; Palkovitz 2002).

At the same time, the literature indicates that the transition to fatherhood provides a source of social integration and social control, and reshapes identity. In addition to the new tie with the child, the transition could strengthen community networks, and induce a novel sense of

role-based responsibilities. These changes are likely to promote health-enhancing behaviors through internalization of social norms and role expectations, and to provide a source of meaning and purpose that is protective against self-harming behavior such as smoking, excessive drinking, and substance use (Reczek et al. 2014; Umberson 1987; Umberson and Montez 2010). For instance, a study of new Canadian parents found that men were motivated to quit smoking in order to align themselves with an identity of “competent and concerned fathers” (Bottorff et al. 2009:189). Likewise, internalizing the role expectations of paternity predicted lower rates of substance use, accompanied by improved physical and mental health, among disadvantaged American fathers (Knoester, Petts, and Eggebeen 2007). American fathers also report spending less time socializing outside their immediate community due to time and money constraints, as well as the non-child-friendly nature of many gendered social activities (Eggebeen and Knoester 2001; Palkovitz 2002; Rözer, Poortman, and Mollenhorst 2017).

Heterogeneity in the effect of fatherhood on health outcomes: The effects of becoming a father are likely shaped by the contexts embedding the transition to fatherhood (Umberson et al. 2010), and could therefore be contingent upon factors that define the salience, constraints, and expectations associated with the parental role. We therefore consider several potential sources of heterogeneity, including the following:

Education: Education is a central source of health disparities, reflecting underlying differences in financial and psychosocial resources, healthcare access, and stressors (Ross and Mirowsky 2010). Lower education is associated with fewer economic resources and higher economic uncertainty, which can be a key source of distress among parents (Bird 1997; Pollmann-Schult 2014). This could exacerbate the negative consequences of fatherhood for health among less educated men. Additionally, fatherhood could be more beneficial for the

health-related behaviors of men with lower education because it moves them away from potentially risky life trajectories. For instance, (Sampson and Laub 1990:611) argue that social bonds to “adult institutions of informal social control”, such as family, move at-risk men away from deviant pathways. Consistent with this argument, Kerr et al. (2011) found that fatherhood led to a decline in all types of non-normative behavior among at-risk men, including engagement in crime, drug use, and smoking. In sum, while some literature suggests variation across education and other measures of socioeconomic standing, the direction of such variation is very much an open question. To assess heterogeneity by educational resources, we distinguish men with a high school education or less, and those with more than a high school diploma.

Race/Ethnicity: To date, there has been little examination of race-ethnic variation in the consequences of fatherhood (Eggebeen, Knoester, and McDaniel 2013), especially in population-representative quantitative research. In the United States, Black and Hispanic fathers are substantially more likely to have lower levels of education, to be unmarried, and not to co-reside with children (Carlson, VanOrman, and Pilkauskas 2013). As such, racial variation could be driven by a compositional effect in terms of these underlying attributes. In order to provide an assessment of patterns of difference we consider non-Hispanic Black, non-Hispanic White and Hispanic fathers. In ancillary analyses, we also examine effects in sub-samples defined by the intersection of race/ethnicity and education.

Age of transition into fatherhood: The life-course approach suggests that events in individuals’ lives are interrelated and affect each other depending on the age and context in which men experience them (Elder 1994; Roy 2014; Umberson et al. 2010). While the health effects of becoming a father potentially vary by the timing of parenthood, there are no universal age thresholds defining early or late transitions across social contexts and wellbeing outcomes. In

general, research suggests that transitions prior to age 20 can truncate educational and occupational opportunities (Bamishigbin, Dunkel Schetter, and Stanton 2019) and transitions 5 years before the cohort average are associated with loss of supportive social ties (Rözer et al. 2017). Likewise, younger fathers have worse health outcomes: becoming a father before age 21 is associated with poorer physical health (Mirowsky 2002; Taylor 2009) and paternity before age 23 is linked with higher depressive symptoms (Mirowsky and Ross 2002). Conversely, men who become fathers after age 25 have lower morbidity risk (Hanson, Smith, and Zimmer 2015). In longitudinal studies, weight gain is somewhat accelerated among men who have their first child earlier or later than about age 27 (Umberson et al. 2011), but other health risks appear not to be sensitive to the timing of parenthood (Garfield et al. 2016; Wolfe 2009), and an early transition into fatherhood has been found to be “rational and sound” for some men (Booth, Rustenbach, and McHale 2008). To analyze potential differences by age of transition into parenthood, we distinguish men who made the transition to fatherhood at age 21 or earlier, at ages 22-27, and after age 27. These thresholds roughly map onto the youngest and oldest 25 percent of transitions in our sample.

Marital status: While marriage appears to be beneficial for men’s health and wellbeing (Rendall et al. 2011; Waite and Gallagher 2000; Williams 2003) the consequence of fatherhood appear to vary little between married and unmarried men. When differences emerge, they suggest that the transition to fatherhood impairs health and wellbeing for single men (Hansen 2012; Umberson and Gove 1989) but has “little influence on the lives of married men” (Nomaguchi and Milkie 2003:356). However, these findings mostly refer to the late 20th century and might need to be updated if the increased demands for “involved fathering” have resulted in stronger impact of fatherhood on married Millennial men. Furthermore, while scholars have

traditionally defined partnership status based on marriage, Woo and Raley (2005) argue that this distinction might be inadequate in the context of growing cohabitation and show that, at least among women, subjective wellbeing following parental transitions declines for cohabiters, but not for married and single parents. We therefore examine the consequences of fatherhood across married, cohabiting, and unpartnered men, based on relationship status at the time of first birth. A time-varying covariate captures subsequent changes in partnership status.

Co-residential status: Given that residential fathers spend more time with children than non-resident fathers, and that culturally-prescribed role expectations apply more directly to resident parents, we can expect health effects to be stronger among co-residential fathers (Knoester and Eggebeen 2006; Umberson 1987; Umberson and Gove 1989). However, some empirical evidence suggests minimal differences between types of fathers (Eggebeen and Knoester 2001; Garfield et al. 2016; Knoester and Eggebeen 2006; Knoester et al. 2007). We examine heterogeneity by residence among biological fathers at the time of first birth. By the final survey wave, 86 percent of fathers who were resident during the transition to parenthood remained residential, whereas 50 percent of the fathers who were non-residential at the time of first birth eventually became residential fathers. We do not separately analyze non-biological fathers as they constitute only 3.5 percent of our sample.

A note on methodological challenges in the study of fatherhood effects. Capturing the effect of fatherhood is challenging for several reasons. First, men who become fathers could differ from those who do not, based on unobserved characteristics such as personality, health endowments, preferences, or family background. If panel data are available, fixed effects models can be used to account for these sources of confounding as long as the differences between fathers and non-fathers do not change over time.

However, confounding could also emerge if changes in men's health affect their probability of becoming a father, leading to reverse causality. For instance, men who quit alcohol or drug use earlier in life may be more attractive childbearing partners and thus may be more likely to become fathers. An observed association between health-related behaviors and fatherhood would then be misinterpreted as an effect of becoming a father. An additional way in which changes over time may induce confounding is that becoming a father is usually part of a broader process of transition to adulthood that involves changes in multiple domains. Different men experience this process at different ages and in heterogeneous sequences (Rindfuss 1991; Shanahan 2000). Heterogeneity in the transition to adulthood induces the risk of spuriousness if some individuals experience fatherhood and change health behaviors early in their lives, while others experience these transitions later for reasons other than an actual effect of one transition on the other. We use a battery of conventional and novel fixed effects models to address, as best as possible in context of observational data, these diverse sources of confounding.

In sum, becoming a father is likely to bring costs and rewards, which could result in both positive and negative consequences for men's health (Hansen 2012; Nomaguchi 2012; Nomaguchi and Milkie 2003). Based on prior literature, we expect the transition to fatherhood to have health-decreasing consequences such as weight gain, and health-enhancing corollaries, such as reduced smoking, drinking, and drug use. These consequences are likely shaped by the contexts embedding the transition to fatherhood, leading to heterogeneity based on the life course features of fatherhood and the socioeconomic resources of men.

DATA AND ANALYTICAL STRATEGY

Data: We use the 1997 National Longitudinal Survey of Youth (<https://www.nlsinfo.org/content/cohorts/nlsy97>), a nationally representative dataset of men and women living in the United States born between 1980 and 1984, making them the older segment of the so-called Millennial generation. The sample consists of 4,599 men, aged 12-18 at the time of the first interview in 1997. The survey was conducted annually between 1997-2011, and biennially between 2011-2015, constituting 17 rounds. In our analytical sample, we include men when they turn 17 years old who become fathers or remain childless during the period of observation. By the 2015 survey wave, respondents were 33-36 years of age. We apply NLSY97-provided custom weights appropriate for analysis of data in “any or all years”. The sample size varies slightly across outcomes because data on some outcomes are not collected in all waves, and because of question non-response.

Variables: We examine diverse health outcomes and behaviors, including body weight, self-reported health, alcohol consumption, smoking, marijuana use, and using “hard drugs” (cocaine, crack, heroin, or other substance not prescribed by a doctor used to get high or achieve an altered state). Table 1 describes the operationalization of these outcome variables. Alcohol, marijuana, and smoking were measured as days of usage in prior month. We use a dichotomous formulation because the strongly bimodal distributions (smoking, marijuana) or extreme right-skew (alcohol) render these measures unsuitable for treatment as continuous variables.

[Table 1 about here]

Analytical strategy: We estimate a battery of fixed effects models for panel data using linear regression models. The main predictor in all models is fatherhood status (1=father, 0=childless). The main analysis considers biological fathers regardless of co-residence with the child. All models include time-varying covariates to control for changes in men’s lives

potentially accounting both for fatherhood and health outcomes: men’s age and its square, education measured in years of completed schooling, and men’s partnership status. Partnership status distinguishes never married, married, cohabiter, and previously married (widowed, separated, or divorced). Controlling for changes in partnership status is particularly critical to avoid confounding because the literature has shown that marriage predicts men’s mortality, alcohol and drug consumption, and risk-taking behavior (Duncan et al. 2006; Waite and Gallagher 2000), and that cohabitation may play a distinct role from either marriage and singlehood (Mernitz and Dush 2016; Perelli-Harris et al. 2018; Woo and Raley 2005). Finally, we add year fixed effects to account for changes in the historical context.

Models: We start with a conventional individual and time fixed effects formulation, in which the outcome for individual i in time t is modeled as follows:

$$O_{it} = \beta_1 F_{it} + \beta_2 Age_{it} + \beta_3 Age_{it}^2 + \mathbf{X}_{it}'\beta_4 + A_i + \varepsilon_{it} \quad (1)$$

where O identifies the outcome of interest, F_{it} identifies fatherhood status, $\mathbf{X}_{it}$ is the vector of time-varying covariates, A_i identifies the individual fixed effect terms and ε is an idiosyncratic error term. The A_i fixed effects terms control for all (observed and unobserved) confounders that are constant over time such as men’s health endowments and personality, and yield a causal estimate under the “temporal heterogeneity” assumption that, conditional on covariates, men do not experience changes shaping their health other than fatherhood (Bruderl and Ludwig 2014). Temporal homogeneity is a strong assumption. To weaken this assumption, we retain men observed as non-fathers during the entire period of observation in the analytical sample. Non-fathers can be thought of as a control group that serves as a longitudinal counterfactual. This control group provides an estimate of the time trend in the outcome in the absence of “treatment” (fatherhood), which is differenced out from the within comparison in the treatment group. As

such, we do not need to assume that nothing relevant changes over time, but only that the time trends are parallel in the treatment and control group, also known as the “common trends” assumption (Angrist and Pischke 2009).

However, men who do not become fathers may provide a poor longitudinal counterfactual for those who do. To address this risk, we estimate a version of fixed effects models that allows for different trends in the outcome for those who become fathers and those who do not. This model is known as group-specific fixed effects model (FEGS), where the groups are men who are ever fathers and those who are never fathers.

$$O_{it} = \gamma_1 F_{it} + \gamma_2 Age_{it} + \gamma_3 Age_{it}^2 + X'_{it} \gamma_4 + A_i + \gamma_5 Age_{it} * EverF_i + \gamma_6 Age_{it}^2 * EverF_i + \varepsilon_{it} \quad (2)$$

The FEGS model includes interaction terms between an indicator identifying men who eventually become fathers ($EverF_i$) and age and its square. By adding these interaction terms, the FEGS model accounts for different age trajectories in health outcomes among those who became fathers during the period of observation and those who did not.

The FEGS model is based on the assumption that the only source of unobserved heterogeneity in trajectories over time is between men who ever and never became fathers (Ludwig and Brüderl 2018). This assumption might be too restrictive if there are diverse transitions to adulthood that affect both the timing of fatherhood and men’s health (Rindfuss 1991; Shanahan 2000). FEGS models would still be biased if individual deviations from the group-specific slopes were systematically related to the timing of fatherhood, for example, if men who gain weight earlier are also more likely to become fathers earlier in their lives. To relax the assumption, we estimate a third version of fixed effects models: fixed effects with individual-

specific slopes (FEIS) (Bruderl and Ludwig 2014; Wooldridge 2002:315–22), expressed as follows:

$$O_{it} = \delta_1 F_{it} + \delta_{2i} Age_{it} + \delta_{3i} Age_{it}^2 + X'_{it} \beta_4 + A_i + \varepsilon_{it} \quad (3)$$

FEIS allows for trends in health outcomes to vary across men and measures the effect of the treatment net of this individual-level variation pre- and post-transition to fatherhood. Specifically, the terms δ_{2i} and δ_{3i} capture the varying health trajectories across individuals. The FEIS model provides a strong test for the causal effect of fatherhood, but has barely been used in family research. The main reason is that FEIS is very demanding in terms of data, as it requires $k+1$ waves, where k is the number of individual slope parameters plus an individual-level intercept. In this case, this amounts to three additional parameters, and thus a minimum of four observations for each individual is needed. We therefore exclude individuals with fewer than 4 observations over time. As a robustness check, we restrict the sample to individuals with at least four years of observation before men become fathers to aid in the estimation of a pre-treatment trend, and obtain identical results (online supplementary material, Appendix Tables A).

The FEIS model provides a conservative test of the effect of fatherhood. In fact, by modeling individual-level trajectories pre- and post-transition to fatherhood, the FEIS model can absorb part of the effect of the treatment if the effect changes over time, inducing downward bias in the parameter estimates (Meer and West 2016). We offer the FEIS model as the most stringent test of an effect of fatherhood. Because FEIS may load the dice toward the null hypothesis, if we find an effect of fatherhood using FEIS, it is exceedingly likely that a true causal effect exists.

All the outlined models –conventional FE, FEIS, and FEIS– capture discrete changes men’s health after they become fathers. However, fatherhood could result in gradual health effects over time as fathers adjust to their new role (Rindfuss 1991), or short-term health changes

followed by a return to prior levels (Myrskylä and Margolis 2014), for example if men quit cigarettes only during the pregnancy and immediately after birth but then return to smoking. Furthermore, changes in health behaviors or outcomes could start before the transition to fatherhood, signaling reverse causality (for example, men who quit alcohol earlier may be more likely to become fathers) or anticipation effects (for example, men may decide to “take care of themselves” in preparation for fatherhood (Duncan et al. 2006). To examine changes over time in the outcomes both prior to and after the transition to fatherhood, we estimate a time-distributed fixed effects model (also known as event study), formulated as:

$$O_{it} = \sum_{p=-s}^s \beta_p F_{it}^p + \beta_2 Age_{it} + \beta_3 Age_{it}^2 + X'_{it} \beta_4 + A_i + \varepsilon_{it} \quad (4)$$

The fatherhood dummy F_{it} is replaced by a set of dummy variables F_{it}^p where p is the number of years since the transition to fatherhood if positive and the number of years to the transition to fatherhood if negative, and the maximum horizon forward and backwards from the time of becoming a father is s and $-s$ respectively (Dougherty 2006). We use the following categorical version of time from fatherhood: 7 or more years pre-fatherhood (baseline category), 5-6 years pre-fatherhood, 3-4 years pre-fatherhood, 1-2 years pre-fatherhood, year in which men became fathers, 1-2 years since fatherhood, 3-4 years since fatherhood, 5 or more years since fatherhood. If no anticipation, reverse causality, and pre-fatherhood spurious trajectories exist, the first three parameter estimates are expected to be statistically indistinguishable from zero. Similarly, if fatherhood only has a transient effect, the magnitude of the estimates would decline over time.

The four kinds of fixed effects models we use vary in assumptions about how health outcomes change with age and time since fatherhood. The conventional fixed effects model (FE) assumes that after time-invariant characteristics of men are considered, any difference in health outcomes between fathers and non-fathers is attributable to paternity. The FEES model allows

different age-based health trajectories for ever- and never-fathers, accounting for unobserved selectivity in trajectories of men who become fathers. The FEIS model is even more conservative: instead of allowing age trajectories to vary only by fatherhood status, it allows variation in age trajectories of *all* individuals in the sample. Finally, the TDFE examines changes in health prior to becoming a father, and tests whether the effect of fatherhood is temporary or permanent. By comparing results from four models we are able to evaluate the stability, robustness, and timing of the effect of fatherhood, ruling out diverse sources of confounding.

RESULTS: DOES FATHERHOOD HAVE AN EFFECT ON MEN'S HEALTH?

We begin by examining the effect of fatherhood on each of the five risk factors – body weight, alcohol, smoking, marijuana, and hard drugs – and self-rated health using our four fixed effects specifications. We next discuss potential sources of heterogeneity.

Body Weight: Figure 1 shows the estimated effects of fatherhood on weight (complete set of parameter estimates are available in online supplementary material, Appendix Table B1). A conventional fixed effects model shows a significant increase in men's body weight by about 1.5 pounds on average after they became fathers. The TDFE model indicates that there was no change in body weight prior to becoming a father, ruling out reverse causality or spurious trajectories – for example, if men who were already gaining weight were more likely to become fathers. The model also suggests that weight gain increased over time after the transition to fatherhood, although the trend is not statistically significant (and the parameter estimate associated with 1-2 years after fatherhood fails to reach significance at the conventional $p < .05$ level). Overall, this model indicates that men experienced a discrete increase in weight after becoming fathers that persisted over the years that followed this transition.

Models adding group-specific slopes (FEGS) and individual-level slopes (FEIS) show a consistent, albeit somewhat smaller, effect of becoming a father on body weight: an increase in weight by about 1 to 1.3 pounds. This effect is significantly different from zero and indistinguishable from the effect captured with a conventional fixed effects model. Given the stringent assumption of the FEGS and, particularly the FEIS model, we interpret these results as strong evidence that becoming a father induces weight gain in men.

Prior research uses the height-adjusted body mass index (BMI) to examine the effect of fatherhood on weight. While we prefer using unadjusted weight because of measurement error in self-reported height, our analysis with BMI yields similar results (online appendix Table C1). The magnitude of change in terms of BMI ranges from 0.11 to 0.17 kg/m², which is smaller compared to estimates of prior studies (Garfield et al. 2016; Syrda 2017; Umberson et al. 2011). This could suggest that paternity had a smaller impact on the weight of fathers among Millennial men compared to prior cohorts. Nevertheless, the magnitude of the effect observed in this study is nontrivial, being comparable to the weight gain after one year among smokers who quit cigarettes (Aubin et al. 2012).

[Figure 1 about here]

Alcohol Consumption. Figure 2 and Table B2 in the online supplement show findings about the effect of fatherhood on alcohol use. The transition to fatherhood increased the probability of abstinence/light alcohol use (having less than 9 drinks in the last 30 days) compared to heavier drinking. On average, becoming a father increased the probability of abstinence/ light drinking by 3 percentage points. As a benchmark, in 2015, 73 percent of men in the sample were light drinkers, while the remainder were moderate to heavy drinkers. This effect would mean a substantial decline in the proportion of moderate and heavy drinkers from 27 to 24 percent.

The TDFE model shows, again, that alcohol use declined after, but not prior to, the transition to fatherhood. This decline persisted over time from the year in which the child was born up to 5 or more years after men became fathers, suggesting a long-term change in lifestyle. Furthermore, the TDFE model shows that the drop in alcohol use did not start before the transition to fatherhood, suggesting that it was the actual transition, rather than unobserved trajectories or anticipation, which drove this effect. The FEGS and FEIS models show effects of similar magnitude to the standard FE model, providing strong evidence that fatherhood indeed reduced alcohol consumption.

[Figure 2 about here]

Cigarette Smoking. Figure 3 examines the effect of becoming a father on cigarette smoking (full results available in online appendix, Table B3). It shows that the transition to fatherhood had no impact on smoking. Although the parameter estimates capturing this effect have the expected direction in all models –showing that becoming a father reduced smoking– the effects fail to reach significance, except in the FEIS model. An insignificant effect of fatherhood on smoking is consistent with prior research (Bachman et al. 1997) and suggests the difficulty of quitting smoking (Hughes, Keely, and Naud 2004).

[Figure 3 about here]

Marijuana. Figure 4 (online supplement, Table B4) examines the effect of becoming a father on marijuana use. The transition to fatherhood resulted in a drop in the probability of using marijuana in the last 30 days by approximately 3 percentage points. However, the TDFE model questions an effect of fatherhood, finding that use of marijuana began to decline several years prior to the transition to fatherhood, and declined more strongly after men became fathers. According to the TDFE, even 6 years prior to fatherhood a significant decline of marijuana

consumption by about 2 percentage points is observed. This change is too early in the life course to be attributed to anticipation of fatherhood, and suggests that men who eventually became fathers reduced their consumption of marijuana earlier in their lives for reasons other than the transition to fatherhood, suggesting the possibility of reverse causality or a spurious trajectory.

The FEGLS and FEIS models, intended to alleviate bias emerging from unobserved trajectories of men who eventually become fathers, show that the reduction in marijuana use fails to reach significance. This evidence adds to the finding of an early decline in marijuana consumption before men became fathers obtained from the TDFE estimates, leading us to conclude that becoming a father did not significantly reduce the use of marijuana. In this case, using a conventional fixed effects model would have led to an inaccurate conclusion.

[Figure 4 about here]

“Hard” drug use. Figure 5 considers the effect of fatherhood on quitting “hard” drugs such as cocaine and heroin (full results provided in online supplement, Table B5). All models show declines of about half a percentage point, which are large considering that only 4.4 percent of men used these drugs in 2015. However, these estimates are not significantly different from zero. Based on the analysis, we conclude that, as in the case of smoking and marijuana, fatherhood did not affect consumption of “hard” drugs (or that our sample size does not allow us to capture an effect given the tall data requirements of fixed effects models).

[Figure 5 about here]

Self-rated health. Finally, we examine the effect of becoming a father on self-reported health, which provides an overall subjective assessment of wellbeing with an exceptional ability to predict later mortality and morbidity (Benjamins et al. 2004; Schnittker and Bacak 2014). The

findings, reported in Figure 6 and online appendix Table B6, show that the transition to fatherhood resulted in a decline by .06 points in a 1-5 self-rated health scale, a small but significant drop. The TDFE model shows that this decline started only the year after men became fathers, with no effect prior to the transition to fatherhood. This effect persisted over at least five years after the transition to fatherhood, again suggesting a long-term change in health status associated with becoming a father. The FEGS model shows similarly negative effects as the conventional fixed effects specification. However, the FEIS model allowing for individual-specific slopes shows a smaller negative influence of fatherhood that fails to reach significance at the .05 level. Given the stringent assumptions of the FEIS model and the consistent negative estimates from other models, we conclude that the transition to fatherhood resulted in a decline in men's self-reported health. Ancillary analysis (online Appendix C2) shows that this effect was driven by a decline in men reporting excellent health after becoming fathers rather than by an increase in poor health. Alternative models using an ordinal logit formulation yield similar results.

[Figure 6 about here]

Are the effects of the transition to fatherhood heterogeneous across men? Our findings indicate that becoming a father induced weight gain, reduced alcohol consumption, and lowered self-rated health in early adulthood. These average effects pertained to all early-Millennial men. The literature however suggests that the effects may vary by economic and psychosocial resources as well as differences in the experience, salience, and constraints associated with fatherhood. We examine heterogeneity in effects by men's educational level, race and ethnicity, age of transition to fatherhood, partnership status, and co-residential status. We suggest that the results of this heterogeneity analysis be interpreted with caution: Given sample size constraints

in context of fixed effects models and variation in sample size across groups, we may fail to capture differences across groups. We therefore interpret the substantive magnitude of differences, and not just their statistical significance, as suggestive evidence.

Figure 7 offers the result of our analysis allowing variation in effects across these dimensions for the outcomes where a consistent effect was found – body weight, alcohol consumption, and self-rated health (no significant variation was found for other outcomes, full results are presented in the online supplement, Appendix D). Overall, the figure shows limited differences in the consequences of fatherhood across different types of men. However, some suggestive patterns emerge, which we discuss below.

The analysis of heterogeneity by race and education suggests that while all men are impacted by fatherhood, the mechanisms driving effects across sub-groups might vary. For example, when it comes to race and ethnicity, fatherhood increased the risk of weight gain for Hispanics more than other groups, and lowered alcohol use among Whites compared to other groups. When stratified by education, it appears that less educated men were more negatively impacted by fatherhood in terms of weight. In ancillary analyses, we further stratified the samples to observe differences across groups by race and education. These analyses find that among Black and Hispanic men, those with higher levels of education gained more weight compared to those with less education, but that this pattern was reversed for White men (online appendix Table E1). For alcohol use, we find a stronger effect among less educated Black and Hispanic fathers (online appendix Table E2), which is consistent with prior research suggesting that fatherhood could be particularly transformative for at-risk men (Kerr et al. 2011; Sampson and Laub 1990). The effect on self-rated health was similar across all racial groups (Figure 7, panel c) and as well as sub-groups defined by race-education interactions (online appendix Table

E3). Overall, our analysis of race and education suggests that the specific risk factors impacted by fatherhood varied across different population strata. Nevertheless, the net effect – as captured by self-reported health – was comparable across groups.

Stratification of the sample by other characteristics largely suggests the absence of a systematic pattern. For example, young fathers gained the most weight after transitioning to parenthood, while those who transitioned between ages 22-27 experienced the strongest effect on alcohol use. Relatively older fathers did not experience a significant change in either weight or alcohol use. Marital status at the time of parenthood transition had no bearing on subsequent weight, but lowered alcohol use among unmarried men. Finally, as observed in the analysis of race and education, self-rated health consistently declined across all sub-groups.

Co-residence –typically an indicator of greater involvement with the child – was not a substantial source of variation. This is aligned with a number of prior studies, which have also noted similarity in health outcomes by paternal co-residence (Eggebeen and Knoester 2001; Garfield et al. 2016; Knoester and Eggebeen 2006; Knoester et al. 2007). It is important to recall, however, that 50 percent of fathers who were non-resident when they transitioned into parenthood eventually became resident parents. This means that while those in the non-resident group were indeed less likely to be residential parents compared to fathers classified as resident, non-residence was not a perfect indicator for continued lack of quotidian involvement with children.

[Figure 7 about here]

CONCLUSIONS

Becoming a father had both beneficial and detrimental consequences for health among a recent cohort of men who became fathers in the early 21st century. The transition to fatherhood induced weight gain and lowered self-reported health. At the same time, becoming a father reduced the consumption of alcohol. These effects are persistent over early adulthood, suggesting that becoming a father involves lifestyle transformations over the initial years after the birth. Given the large number of men who become fathers over their life course –over 80 percent in the US in 2015 (Martinez, Daniels, and Febo-Vazquez 2018)– these effects have wide demographic implications.

We also investigated heterogeneity in the consequences of fatherhood across a number of dimensions suggested by prior literature. Although our ability to capture heterogeneity is hampered by sample size constraints, we found limited variation in magnitude of the effects across sub-groups defined by race and ethnicity, age of first birth, and marital status at first birth, which suggests that the specific risk factors impacted by fatherhood vary across contexts. Interestingly, self-reported health declined by relatively similar magnitude across all sub-groups, suggesting that becoming a father affects the health of a vast swath of American men, in spite of different positions and constraints. More detailed, especially qualitative work, will be able to shed further light on variation across specific circumstances and experiences of fatherhood.

Our research contributes to the body of literature examining the association between family bonds and health and wellbeing (Mirowsky 2002; Ross et al. 1990; Umberson 1987; Umberson and Montez 2010). Specifically, we build on a recent scholarship attempting to capture a causal effect of fatherhood on men’s health (Garfield et al. 2016; Kerr et al. 2011; Myrskylä and Margolis 2014; Nomaguchi and Milkie 2003; Pudrovska 2008; Wolfe 2009). Using novel fixed effects specifications, we account for selection based on both unobserved

characteristics and unobserved life-course trajectories of men who eventually become fathers, as well as for the possibility of reverse causality and transient effects. The combination of fixed effects formulations provides transparent and robust evidence of the consequences of fatherhood. Still, without random allocation of fatherhood status, it is impossible to conclusively claim that the associations we uncover are causal. Having examined a range of health indicators, we can comment on social processes potentially shaping the health effects of fatherhood. Consistent with the predictions of stress theory (Aneshensel 1992; Thoits 2010), we find that fatherhood results in weight gain. While identity motivations would lead men to take care of their bodies as a means of fulfilling their role-based responsibilities (Watson 2000), our findings suggest that any protective effect of father identity on weight might be superseded by constraints emerging from the novel burden of parenthood and associated stress, particularly for socioeconomically disadvantaged men. When it comes to alcohol use, the findings are consistent with both identity-based and social regulation mechanisms, as reduction in alcohol use may reflect a desire to maintain health as well as internalization of the norms associated with use of addictive substances (Umberson 1987). Finally, fatherhood worsens self-rated health, which is also consistent with stress as a plausible mechanism.

The NLSY97 dataset used for this analysis is probably the best source of longitudinal information of life trajectories among a cohort that came of age in the early 21st century. It is, however, not free of limitations. First, it is not possible with the data at hand to directly measure the mechanisms driving the health effects of fatherhood. Rather, we can only evaluate theorized mechanisms based on their consistency with our empirical findings. Second, relatively small sample sizes for some demographic sub-groups and the data demands of fixed effects models limit our ability to find significant sources of variation that have been suggested by qualitative

research (Abdill 2018; Bottorff et al. 2009; Reczek et al. 2014; Watson 2000). Furthermore, sample members are only 30-36 years old in the last wave of observation. This means that some of them would become fathers in the future, inducing right censoring. This problem appears to be minor, however: our analysis indicates that a very small proportion of men in the cohort we examined become fathers for the first time after their mid-30s (online appendix F). The youth of our sample also means that we cannot observe the effect of fatherhood as men transition into late adulthood and their children transition into adolescence (Meier et al. 2018). Although we find persistent consequences during early adulthood, only further research examining individuals as they age can investigate these effects over the remainder of the life course.

Our findings have, however, relevant implications for understanding the role of parenthood bonds and expectations on important sources of men's health and mortality, including "metabolic deaths", resulting from obesity-related diseases (Masters, Powers, and Link 2013; Preston, Vierboom, and Stokes 2018), and mortality due to diseases of the liver, largely attributable to alcohol abuse (Tapper and Parikh 2018). In particular, we highlight the protective role of fatherhood, likely explained by mechanisms of social regulation and social identity, in preventing alcohol-related morbidity, as well as the constraints and stress that potentially contribute to weight gain and deterioration in self-rated health, respectively. However, importantly, our estimates for weight gain are smaller compared to studies based on samples of earlier birth cohorts (Garfield et al. 2016; Syrda 2017; Umberson et al. 2011). This suggests that the effects of fatherhood on weight – while statistically significant – are not as large for early Millennial men.

Finally, while the majority of American men do become fathers, US fertility rates have been declining for nearly a decade, a trend that is expected to continue in the future (Munnell,

Chen, and Sanzenbacher 2018; Seltzer 2019). Our findings are also relevant for the long-run implications of increasing rates of childlessness for men's health. In particular, childlessness may decrease weight-related morbidity, but with the absence of social control and identity mechanisms accompanying parenthood, childless men could be at greater risk of alcohol and substance use. Given the recent rise in male mid-life mortality in the United States (Acciai and Firebaugh 2017; Woolf et al. 2018), we hope that these findings will enhance our collective capability to address health risks among men approaching midlife, both fathers and non-fathers.

Tables

Table 1. Outcome Variables

Outcomes Variables		Time horizon	Data waves
Weight	Body weight (pounds).	1997-2015	17
Low alcohol use	Dichotomous variable based on self-reported number of days R had alcohol in past 30 days indicating using alcohol on <9 days in past 30 days (Bobashev et al. 2014).	1997-2015	17
Smoking abstinence	Dichotomous variable based on self-reported number of days R smoke in past 30 days.	1997-2015	17
Marijuana abstinence	Dichotomous variable based on self-reported number of days R used marijuana in past 30 days.	1997-2011, 2015	16
Hard drugs abstinence	Dichotomous variable based on self-reported use of cocaine/ crack/ heroine/ other since date of last interview.	1998-2011, 2015	15
Self-rated health	In general, would you say your health is excellent, very good, good, fair, or poor? 1=poor, 2=fair, 3=good, 4=very good, 5=excellent.	1997-2015	17

Figures

Figure 1. FE estimates of the effect of fatherhood on body weight (pounds)

Notes: FE: Conventional individual fixed effects model, TDFE: Time-distributed fixed effects model, FEGS: Fixed effects model with group-specific slopes, FEIS: Fixed effects with individual-specific slopes. Reference category in TDFE model is 7+ years before fatherhood. Solid dots show parameter estimates. Bars show 95% confidence intervals. Complete model in Appendix Table B1. N(individuals)=4,383; N(observations)=53,779. Source: NLSY97.

Figure 2. FE estimates of effect of fatherhood on low alcohol use (<9 days past month)

Notes: FE: Conventional individual fixed effects model, TDFE: Time-distributed fixed effects model, FEFS: Fixed effects model with group-specific slopes, FEIS: Fixed effects with individual-specific slopes. Reference category in TDFE model is 7+ years before fatherhood. Solid dots show parameter estimates. Bars show 95% confidence intervals. Complete model in Appendix Table B2. N(individuals)=4,385; N(observations)=53,376. Source: NLSY97.

Figure 3. FE estimates of the effect of fatherhood on smoking abstinence

Notes: FE: Conventional individual fixed effects model, TDFE: Time-distributed fixed effects model, FEFS: Fixed effects model with group-specific slopes, FEIS: Fixed effects with individual-specific slopes. Reference category in TDFE model is 7+ years before fatherhood. Solid dots show parameter estimates. Bars show 95% confidence intervals. Complete model in Appendix Table B3. N(individuals)= 4,385; N(observations)=53,838. Source: NLSY97.

Figure 4. FE estimates of the effect of fatherhood on marijuana abstinence

Notes: FE: Conventional individual fixed effects model, TDFE: Time-distributed fixed effects model, FEFS: Fixed effects model with group-specific slopes, FEIS: Fixed effects with individual-specific slopes. Reference category in TDFE model is 7+ years before fatherhood. Solid dots show parameter estimates. Bars show 95% confidence intervals. Complete model in Appendix Table B4. N(individuals)= 4,385; N(observations)=50,464. Source: NLSY97.

Figure 5. FE estimates of the effect of fatherhood on hard" drug abstinence"

Notes: FE: Conventional individual fixed effects model, TDFE: Time-distributed fixed effects model, FEFS: Fixed effects model with group-specific slopes, FEIS: Fixed effects with individual-specific slopes. Reference category in TDFE model is 7+ years before fatherhood. Solid dots show parameter estimates. Bars show 95% confidence intervals. Complete model in Appendix Table B5. N(individuals)= 4,377; N(observations)=49,868. Source: NLSY97.

Figure 6. FE estimates of the effect of fatherhood on self-rated health

Notes: FE: Conventional individual fixed effects model, TDFE: Time-distributed fixed effects model, FEFS: Fixed effects model with group-specific slopes, FEIS: Fixed effects with individual-specific slopes. Reference category in TDFE model is 7+ years before fatherhood. Solid dots show parameter estimates. Bars show 95% confidence intervals. Complete model in Appendix Table B6. N(individuals)= 4,386; N(observations)=54,555. Source: NLSY97.

Figure 7. Heterogeneity in the Effects of Fatherhood

Note: Solid dots show parameter estimates. Bars show 83.4% confidence intervals. Analyses based on conventional fixed effects regression models. Complete models in Appendix D. Source: NLSY97.

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