**Pandemic Babies: The Social Organization of Daily Life, Sudden Disruptions to Social Activities, and National Evidence of Disruption of Trends in U.S. Fertility Behavior**

**Abstract**

Widespread societal changes from the COVID-19 pandemic had multiple, simultaneous consequences for daily life, with high potential to change fertility-related behaviors. This circumstance presents a new challenge to theories of fertility change, simultaneously changing fertility related costs and benefits, attitudes and beliefs, and limits to individuals’ abilities for reasoned action. The pandemic coincided with advances in the tools to study U.S. national-level fertility trends. Based on the National Survey of Family Growth, the Panel Study of Income Dynamics launched new measures of fertility in the Transition into Adulthood Supplement. The NIH also supported a new, nationally representative web survey of the same topics: The American Family Health Study, which was conducted during the pandemic. Using these studies, we document pandemic-specific changes in fertility-related intentions and behaviors and stability and change in associations with predictors of these outcomes. Results reveal that the U.S. is likely to experience a sudden increase in unintended pregnancies, but they may not increase total fertility because of an equally sudden drop in sexual activity. Results also reveal that U.S. population research needs new advances in theories of fertility change and the data available to test those theories, monitor changes, and predict abrupt changes in fertility behavior.

Keywords: Fertility, Childbearing, Women, Demography, Sex, Contraception

**Introduction**

The COVID-19 pandemic, and measures taken to reduce transmission, dramatically changed the social organization of daily life worldwide. Pandemic-related restrictions went beyond social distancing to change everyday activities: work in many sectors stopped; employees with jobs that accommodated remote work abruptly began working from home; and schools at all grade levels shifted to remote instruction, sometimes disrupting education entirely. Additionally, options for recreation became limited; as large group activities were untenable, people resorted to smaller and more socially isolated activities. Home and family life changed—childcare, meal preparation, and other daily tasks often organized outside of the household suddenly returned to the home, at least more of the time.

Demographic theory links virtually all these changes in the social organization of daily life to fertility behavior, but these hypotheses were designed to predict long-term shifts spanning years or decades, not months or weeks. To apply existing theories of childbearing to the pandemic disruptions, not only do we need a theoretical framework simultaneously integrating multiple dimensions of social change, but the hypotheses must also apply to abrupt changes. To test those hypotheses we need robust population-level data about experiences and behaviors.

The family mode of social organization framework has successfully guided research on changes in family formation processes across diverse settings [1]. This broad framework considers multiple simultaneous mechanisms of changes influencing numerous dimensions of family formation, including childbearing [1,2]. Specifically, this framework predicted changes over time in the entry into marriage, childbearing, and contraception use to avert births in rural Nepal [3,4], rapidly industrializing and urbanizing Taiwan [5], and a stable but steadily changing U.S. [6,7]. A key element of this framework is that it makes no universal predictions; instead, all predictions are derived from the “starting state” of the social organization of families before the change being studied, coupled with a detailed consideration of the specific changes. Like most theories of demographic change, this framework was generally applied to slow changes that happen across years or decades. We harness this broad and flexible framework to consider the childbearing consequences of wide-ranging disruptions to social life during the COVID-19 pandemic in the U.S. in 2020 and 2021, adjusting our hypotheses for the rapid pace of change.

Particularly important for integrating the breadth of likely mechanisms linking pandemic-related changes to fertility, this framework considers the possibility of multiple mechanisms acting on behavior simultaneously. Pandemic-related disruptions had the potential to create work and income instability, alter the perceived costs and benefits of childbearing, and affect the supply of contraception, medical assistance, and fertility services, which combine to make mechanisms of the perceived costs and benefits of childbearing important to the prediction of fertility outcomes [8–10]. At the same time, new attitudes and beliefs related to childcare, health, and medicine were spread via both mass and social media—as in-person social interactions declined—to create mechanisms of change consistent with the Theory of Reasoned Action [11–14]. Other psychological factors must also be considered, especially those that limit individuals’ ability to use either cost-benefit analysis or reasoned action to guide their behavior. These factors include episodes of mental disorders (e.g., major depressive disorder, alcohol use disorder) and changes intensifying couple relationships toward either higher affection or conflict [15]. The possibility that many mechanisms of change occurred simultaneously complicates the derivation of single-direction predictions, rendering this initial investigation of pandemic-specific fertility changes in the U.S. a *starting point, not a conclusion*.

We use a new suite of U.S. fertility-focused data to test hypotheses predicting ways the pandemic influenced childbearing. The foundation of this suite of studies is the U.S. National Survey of Family Growth (NSFG). We use NSFG 2015-17 and NSFG 2017-19 public data to characterize fertility-related behaviors before the pandemic. We also use a new data resource, created by adapting a series of NSFG family and fertility measures for the U.S. Panel Study of Income Dynamics Transition into Adulthood Supplement (PSID-TAS). This harmonization occurred prior to the PSID-TAS 2017, and we use measures from 2017 and 2019. We also used the first nationally representative web survey of the U.S. population measuring the same content as NSFG, fielded in 2020-21: the American Family Health Study (AFHS). A unique data resource, AFHS is an important breakthrough in survey design for population science, and as a web survey it was ideally positioned to succeed during the pandemic. It uses measures calibrated to the pre-pandemic NSFG and PSID-TAS to assess fertility intentions, sex, contraception, pregnancy, and childbearing *during the pandemic*.

Combining these data sources, we document the extent to which childbearing behaviors and intentions during the pandemic deviate from trends underway before the pandemic. We then use multivariable models of the dimensions of childbearing behaviors and intentions that changed to test the extent to which likely predictors are associated with those changes. Our results provide an initial view of how the pandemic is associated with fertility intentions and behaviors and whether key predictors changed dramatically.

**Theoretical Framework**

Prediction of the consequences of COVID-19 on U.S. fertility behavior is complex because many factors likely influenced fertility-related intentions and behaviors simultaneously. This motivates a guiding theoretical framework linking a wide range of potential mechanisms. We create that framework in three parts:

1. Family organization of social activities
2. Theories of reasoned action
3. Limits to reasoned action

The *first part* of this framework focuses on the social organization of daily activities to organize the many simultaneous predictions. We follow a key principle of work on social organization, deriving setting-specific predictions based on conditions in the U.S. immediately before the pandemic and identifying pandemic-period changes likely to shape childbearing [1]. We use the proximate determinants of fertility framework to identify key fertility-related behaviors likely to be changed by the pandemic [16–18] and long-standing ideas about the costs and benefits of childbearing to predict the likely direction of those changes [9,19]. We also consider the potential for the diffusion of new ideas to shape childbearing behavior [20–23], drawing on the Theory of Reasoned Action [14] and its extensions that explain how individuals can hold multiple conflicting attitudes and beliefs [24,25]. Building on this, the *second part* of our framework extends from fertility-related behaviors to consider childbearing intentions. Cost-benefit models are sometimes referred to as rational choice models of behavior [26]. Rational choice models and models of reasoned action are compatible, but our framework also considers ***limits on reasoned action*** because key pandemic-specific changes had the potential to limit individuals’ abilities to act consistently with their intentions. This *third part* of the framework extends childbearing predictions to unintended pregnancies.

**The Social Organization of Daily Life: The Costs and Benefits of Childbearing**

Studies of population-scale changes have long focused on the organization of daily activities [27], including work, education, recreation, and consumption, that together point to the family organization of activities as a key window into variation and change in daily experience [28]. By the mid-1900s, this approach grew to predict family formation consequences of variations in the social organization of families [29], fueling the evolution of the family mode of social organization framework [2]. Crucial to this evolution was the recognition of a fundamental flaw in prior reasoning—*reading history sideways*—which applies ethnocentric criteria to cross-sectional differences across multiple populations to infer change over time [1][[1]](#footnote-1). In contrast, the family mode of social organization framework focuses on the local beginning state of family organization of daily life, and then builds predictions of the consequences for a specific change or variation from an assessment of that starting state [1–3]. This approach implies that *the same changes* in the social organization of daily activities can have *different consequences for family behaviors* in different populations or sub-populations [1].

This characteristic of the framework makes it useful for investigating family-related behaviors and consequences of similar pandemic-specific disruptions across varying populations and sub-populations. Pandemic-specific disruptions shaped the social organization of multiple aspects of daily life, primarily changing nonfamily activities either by temporarily suspending them or by forcing them to be reorganized within the home. These changes are likely to be associated with multiple changes in family behaviors, with different consequence across varying social contexts. We focus on a single family behavior (childbearing) in a single country (the U.S.). Notably, however, the U.S. is characterized by important sub-populations known to vary in their family behaviors, including childbearing [30].

**Family organization and childbearing behavior**

To predict the consequences of sudden disruptions to nonfamily activities, we review evidence of how the pre-disruption organization of those activities in the U.S. was linked to family formation processes, especially childbearing. Then, we derive predictions of the consequences of the pandemic disruptions in work, education, and recreation (nonfamily activities) on childbearing relative to the “starting state” before the pandemic.

***Education.*** Pandemic disruptions to college, vocational, and professional education have strong potential to disrupt young people’s transition to adulthood, with possible consequences for fertility. Educational attainment, especially enrollment in education in early adulthood, slows family formation, including first births, worldwide [4–6,31]. Though the long-term expansion of nonfamily education has been a key driver of overall fertility decline [32,33], in low-fertility settings the relationship between education and fertility is more complex. Improved educational and career opportunities for women, and longer periods of educational enrollment, have been associated with postponed family formation in the U.S. and other low-fertility countries, resulting in age-differentiated fertility behavior by education [34–36]. However, the negative relationship between women’s increased opportunities—both educational and work—and *completed* fertility has been steadily eroding in low-fertility contexts [37–39]. This trend reversal also indicates increased gender egalitarianism, which balances women’s educational and work aspirations, as well as men’s responsibilities and contributions in the domestic sphere [40–42].

The abrupt and prolonged disruptions to young women and children’s educational trajectories by COVID-19 added uncertainty to daily life, which may shape the way young women and couples think about future family formation behavior [43]. Women all experienced increased uncertainty during the pandemic, but women who did not complete their education likely experienced even greater increases in uncertainty about education and work that may reduce their intentions to have children, at least in the short term. Growing evidence suggests that uncertainty plays a powerful role in family formation and reproductive health behaviors [43–45]. Furthermore, families with school-aged children faced a substantial increase in childcare responsibilities due to school closures and remote learning, which also could have influenced fertility intentions.

***Work****.* Microeconomic theories of family formation processes, sometimes referred to as “demand” or rational-choice theories, focus on the costs and benefits of childrearing [9,31,46–50]. In *Foundations of Social Theory*, Coleman [26] explains that nonfamily organizations remove activities of production, education, food preparation, and care of family members from the home and family, thereby reducing positive externalities from childrearing, and raising the costs and reducing the benefits of children. According to this theory, self-interest maximizing individuals alter preferences and behaviors related to childbearing as circumstances around them change[[2]](#footnote-2). Therefore, pandemic-specific changes that altered the costs and benefits of childbearing might be expected to alter childbearing-related preferences and behaviors.

One way temporary job loss may minimize the costs of childrearing is by reducing the role conflict between work for pay and care of young children [26,39,53]. This could lead to a higher percentage of the population intending to have a child and a lower percentage of those who are sexually active using contraception to prevent pregnancies. Together, these changes could lead to increased pregnancy and childbearing. However, the opposite may also occur:

1. Job loss reduces income to cover the financial costs of childrearing;
2. Those who kept their job, but experienced a change from work outside the home to work from home, may have experienced greater role conflict with care of young children;
3. Nonfamily childcare closures may have also exacerbated the role conflict between work and care of young children;
4. Changes in children’s schooling to remote instruction may have also increased the costs of childcare and the role conflict between childrearing and other activities – mothers of young children were more likely to exit the labor force during the pandemic [54].

Together, these changes increase the perceived costs—finances and time—and reduce the perceived benefits of childrearing. Pandemic reorganization of work to the home and job loss may combine to lower intentions to have a child, increase contraceptive use among the sexually active, and reduce childbearing. Because changes in work may influence childbearing in opposing directions, potentially specific to sub-populations, the association between work and specific dimensions of childbearing may also change during the pandemic.

***Recreation and leisure time****.* The pandemic also produced widespread reorganization of nonfamily recreational activities, primarily through suspending larger group interactions at events and public venues (e.g., bars, restaurants, museums, concerts). These interruptions reduced social interactions, with potential consequences for courtship processes—meeting potential partners, dating, and transitioning to sexual, coresidential, and marital relationships. Following cost-benefit reasoning, this change increased the “costs” (time, effort, potential exposure to infection) of forming relationships, lowering access to intercourse, and reducing the likelihood of pregnancy.

***Courtship and marriage****.* Interruptions in processes that lead to coresidential sexual relationships are particularly likely to reduce childbearing. Coresidential relationships create more consistent exposure to sex, and cohabiting and marital relationship increase shared commitments between partners that many people find appealing for childrearing. In general, cohabitors have higher fertility intentions and pregnancy rates than single people [55], married people have higher fertility intentions and pregnancy rates than cohabiting people, and pregnancy is a common motivator for couples to transition from cohabitation to marriage [56–59]. In addition to the disruptions to courtship, the pandemic produced delays in transitions to coresidential relationships by limiting the availability of home moves and marriage ceremonies (in our section on “limits to reasoned action” we comment on limits to *exiting* coresidential relationships). Note also that the U.S. is a low-fertility setting, so that independent of these other family formation processes, having children generally has a strong, negative influence on intentions to have more children.

**Race and ethnicity in the U.S.**

The U.S. population is characterized by substantial differences across racial and ethnic sub-groups, including variation in pre-pandemic family organization, family behaviors, and pandemic-specific effects on daily activities [60]. The white population of the U.S. tends to be wealthier and more privileged than Black and Latino populations, especially in urban areas. This wealth and privilege translates into many pandemic-specific advantages for the urban white population, including ownership of larger homes better able to accommodate the reorganization of daily activities, jobs with greater flexibility that could be worked remotely, and more resources to purchase home delivery of goods and services. By contrast, Black and Hispanic workers were more highly dependent on jobs deemed “essential”, forcing them into situations that increased their exposure risk to COVID-19 [61,62]. One key consequence was higher COVID-19 death rates among Black and Hispanic Americans than among white Americans [61–63].

Coinciding with the COVID-19 pandemic, George Floyd’s death fueled widespread protests related to racial discrimination and social justice in the U.S. [64,65]. This heightened attention to the pervasive U.S. inequalities by race and ethnicity had the potential to contribute to differences in psychological stress, uncertainty, and behavior.

Fertility behavior varies by race in the U.S. Immediately before the pandemic in 2019, Hispanic women had the highest total fertility rate, followed by Black women and non-Hispanic white women [66]. Among Black women, higher overall fertility is concentrated among those with less educational attainment [67]. There are also racial differences in union formation and unintended childbearing, with Black women marrying at lower rates than white women and both Hispanic and Black women having higher levels of unwanted or mistimed births [55,68]. Black women are more likely than white and Hispanic women to have children by more than one partner; furthermore, being unmarried and initiating childbearing earlier in the life course were positively correlated with multi-partnered fertility [69]. Because Black and Hispanic women were likely to experience different consequences of the pandemic than white women, it is possible that the childbearing intentions and behaviors of these groups also changed differently.

**Theories of Reasoned Action: Attitudes, Beliefs, and Childbearing Intentions**

The pandemic reduced opportunities for large social gatherings, including both family-organized gatherings (e.g., weddings and funerals) and nonfamily-organized gatherings revolving around entertainment or religious practice. But in a setting like the U.S., the pandemic did not interrupt mass media or social media. Americans came to rely on the internet and digital media more than ever during the pandemic [70]. This means the mechanisms for diffusion of new ideas, including COVID-19 misinformation [71], remained available, and amplified relative to direct social interaction, among the U.S. population during the pandemic. Note too that U.S. differences by religiosity have also been substantial, with the highly religious much more likely to intend to have more children. This includes forms of religiosity that *are not* attendance at religious services, so these religiosity differences may not have been interrupted by pandemic social restrictions.

**Attitudes and beliefs**

Diffusion perspectives on fertility emphasize that the spread of new ideas about sex, contraception, and childbearing can produce changes in population-scale childbearing behaviors, even when the perceived costs and benefits of childbearing have not changed [20,21]. Although this perspective was formulated long before social media use, it does focus on patterns of social interaction that have the potential to change patterns of communication [72]. Potential mechanisms likely to produce this kind of change include exposure to education, religion, mass media, migration, and travel [1,20,29,73–75]. These exposures shape people’s social interactions, providing opportunities for new ideas to spread within and between populations [3]. These mechanisms of diffusion operate through social networks that guide this informal spread of information or gossip [76]. When the pandemic hit, most Americans were already connected via the internet, cellular data networks, and social media [77]. Not only were digital means of social contact not disrupted by the pandemic, they became a primary way for people to socialize.

Founded on investigation of links between human psychology and behavior, the Theory of Reasoned Action (TRA) has become one of the most influential frameworks for understanding the importance of attitudes, intentions, and beliefs in predicting behaviors [11–14]. The Theory of Planned Behavior (TBP) extends the TRA to consider how people’s perceived control over certain behaviors further shapes intentions and the behavior itself [78,79]. The clearest fertility prediction from these frameworks is that individual women’s childbearing intentions will, in part, shape their childbearing behaviors. This prediction has motivated continuous monitoring of population-level childbearing intentions [80,81]. Following the TRA and TPB, we investigate pandemic-specific changes in childbearing intentions, and sexual and contraceptive behavior.

Across decades of research, different attitudes and beliefs have been linked to changes in childbearing intentions and behavior. These include attitudes about contraception [82], higher consumption aspirations [29], smaller family size preferences [74,83], ideas and expectations about educational attainment and careers [6], and secular and individualistic attitudes and preferences [47,84,85]. Predicting the connections between attitudes/beliefs and fertility intentions/behaviors is complicated because individuals generally hold many different attitudes and beliefs. Not only can multiple different attitudes be simultaneously relevant to childbearing, but individuals can simultaneously hold *opposing* attitudes that are predictive of their childbearing behaviors [24,25].

The COVID-19 pandemic may have produced the diffusion of many new ideas, but we illustrate the complication of two ideas with potentially conflicting consequences. First, the pandemic appears to have produced a new high volume of messaging about the burden of childrearing, especially rearing young and school-aged children as parents were forced to increase their effort relative to daycares or schools [86,87]. The increased spread of this idea was likely to *reduce childbearing intentions*. However, the combination of COVID-19 and a divisive political season yielded a high volume of messaging about lack of trust in science and medicine, including the COVID-19 vaccine [88]. Among other consequences, this ideational diffusion was *likely to reduce contraceptive use*, especially methods requiring medical action. The potential simultaneous diffusion of attitudes reducing fertility intentions but also reducing use of contraception points toward the possibility of opposing influences on pregnancy and childbearing.

**Limits on Reasoned Action: Supply of Contraception, Relationship Dynamics, and Mental Disorders**

Although rational choice and reasoned action perspectives have been combined using the family mode of organizations framework before [3,6], the pandemic drew attention to mechanisms shaping childbearing—especially in the short-term—that rarely receive careful attention. These are mechanisms that create *limits on reasoned action*. We discuss three such mechanisms: constraints on contraceptive supplies, intensification of partner relationships (both positive and negative), and mental disorders. The most likely outcome of these limits on reasoned action is a mismatch between childbearing intentions and childbearing behaviors, leading to unintended pregnancies.

**The supply of contraception**

Pandemic-motivated reorganization of health care delivery, coupled with global supply chain interruptions, reduced the supply of contraceptives to people who were sexually active but did not intend to have pregnancies. Temporary suspensions on non-essential medical procedures interrupted the supply of common sterilization services, such as vasectomies and laparotomies. The shift to telehealth services and reduction of in-person clinical care also reduced access to some long-acting contraceptive procedures such as IUD insertions, contraceptive implants, and Depo-Provera injections. In some locations, supply chain interruptions may have also reduced access to temporary methods commonly obtained at pharmacies, including oral contraceptive pills, condoms, spermicides, and emergency contraception. Beyond these interruptions from suppliers, individuals’ concerns about (or restrictions from) going to public places such as medical service providers or pharmacies also limited their ability to obtain these contraceptive methods. Together, these changes affecting the supply of contraception may reduce contraceptive use among the sexually active, increasing unintended childbearing. There is also reason to believe these mechanisms may have been especially powerful among low income women [10].

**New relationship dynamics**

Though fertility research has always identified the intimate relationships between men and women as fundamental to childbearing [16,74], the emotional dimensions of social behaviors are rarely investigated in social research on population dynamics [89]. It is clear from research on intimate partner relationships that relationships are multidimensional and that individuals sometimes report both positive and negative aspects of their relationships simultaneously [90,91] (U.S. example). But even when individual hold conflicting emotions, these emotions have the potential to be powerful influences on behavior [89]. The pandemic-induced reorganization of social life away from nonfamily settings and into the home had high potential to evoke emotional responses between intimate partners, responses likely to shape fertility [15].

On the positive side, it is possible that the increased time together, often in small spaces and working to accomplish multiple goals simultaneously, increased affection between intimate partners. Some recent research indicates that being in the home with young children may reduce social isolation, leading to more positive feelings [92]. The same may be true for love and affection between intimate partners, and recent longitudinal research demonstrates that married couples’ levels of affection have associations with subsequent fertility behaviors, independent of factors associated with the costs and benefits of children and attitude/beliefs [93,94]. Although some demographic theory on fertility decline has predicted that greater couple-level affection will reduce childbearing [74], it is also possible that in low-fertility settings like the U.S., increased affection will produce higher intentions to have children, more sexual intercourse, or less contraceptive use among the sexually active.

On the negative side, it is possible that pandemic-related changes forced couples to spend more time together even if they were in unhealthy relationships. For couples who would have otherwise divorced or separated (including seeking temporary shelters from an abusive partner), the pandemic may have made moving or finding alternative housing more difficult. Such circumstances would have high potential to intensify negative relationships. In particular, physical violence between intimate partners is widely considered the most severe dimension of negative relationships. Social inequalities and power imbalances are exploited and reproduced through sexual violence and forced intercourse, making these among the worst forms of intimate partner violence [95,96]. Before the pandemic, the U.S. had a high prevalence of forced intercourse, with 25% of women reporting they had ever been forced to have intercourse by age 49 [96]. The pandemic has the potential to *increase* this level of forced intercourse, with clear implications for childbearing: forced intercourse rarely involves effective contraception, thus increasing the probability of unintended pregnancy [97].

**Mental disorders**

Most population research on mental health in the U.S. focuses on very brief measures of mood or mental health screening, not more lengthy or detailed assessments of the various impairments that are necessary to cross the more severe threshold to the level of mental disorders [98]. High-quality research on the population prevalence of mental disorders documents many factors associated with systematic variations in mental disorder experience [99]. Among those, potentially traumatic experiences loom as a powerful common cause of mental disorder onset, especially for high-prevalence mental disorders such as generalized anxiety disorder, major depressive disorder, and alcohol use disorder [100,101]. Some of the most common potentially traumatic experiences likely increased during the pandemic, including the death of a loved one, the loss of work, and sexual assault. This increase in potentially traumatic experiences is expected to produce an increase in mental disorders. Early evidence on COVID-19’s mental health toll shows a persistent rise in depressive symptoms among U.S. adults since the pandemic onset [102,103], which also appear to be associated with fertility intentions [15]. Because severe mental disorders impair social interaction, cognition, or behavior—and possibly all three—a higher population prevalence of mental disorders is also expected to produce a higher prevalence of unintended pregnancies, most likely from sex without contraceptive use.

**Data and Methods**

We compare measures from five probability-based samples of the national population of the U.S. to establish short-term trends just before the pandemic and estimate changes during the pandemic. We use measures from the U.S. National Survey of Family Growth (NSFG) 2015-2017 and 2017-2019 data releases, the U.S. Panel Study of Income Dynamics Transition into Adulthood Supplement (PSID-TAS) in 2017 and 2019, and the first national sample replicate of the new U.S. American Family Health Study (AFHS), which was measured during the pandemic in 2020-2021. We focus on measures of childbearing outcomes and related behaviors that were collected using the same wording and response categories in all five sources.

First, our analyses focus on trends across time in pregnancies, live births, sex (including forced intercourse), contraceptive use, and intentions to have children, specifically to document how behaviors and intentions during the pandemic deviate from trends directly preceding the pandemic. Second, our analyses estimate associations between key predictors of these outcomes (work, education, marriage/cohabitation, race/ethnicity, and religiosity) and these outcomes leading up to and during the pandemic. These analyses illuminate the extent to which changes in associations between these predictors and childbearing processes occurred during the pandemic.

**Data**

**NSFG 2015-2017 and 2017-2019**

The NSFG 2015-2017 data collection took place from September 2015 to September 2017, and the 2017-2019 data collection took place from September 2017 to September 2019 [104]. Interviews were conducted face-to-face by professional interviewers in a probability-based, nationally representative, area-clustered sample. The 10,094 respondents in the 2015-2017 data collection that included males and females age 15-49 was restricted to females for our analyses and to age 18-49 (n=5,014) for comparisons to AFHS data, and age 18-28 (n=1,874) to be comparable to the PSID-TAS data. The 2017-2019 NSFG collected data from 11,347 male and female respondents. We again restricted to females age 18-49 (n=5,559), and females age 18-28 (n=2006) for our analyses. Weights constructed to account for the complex nature of the NSFG sample design along with stratum and cluster codes that described the complex sample design for variance estimation purposes were taken into account for this analysis.

For decades the NSFG has served as a “gold standard” for measuring fertility and related behaviors in the U.S., but it is also characterized by three important weaknesses. First, it is limited to a cross-sectional design and has no longitudinal components. This design is sufficient to measure trends but a severe constraint on the assessment of changes in fertility dynamics, which was a key motivation for harmonizing the PSID-TAS longitudinal measures to cover key domains of family and fertility change.

Second, it has recently continued to operate in a face-to-face-only mode, preventing NSFG from using modes that adapt to either respondents’ preferences or setting-specific circumstances. The AFHS used a mixed-mode approach, primarily collecting data via the web but also providing respondents with a mail option, to overcome this limitation and provide measures during the pandemic. Note that PSID-TAS 2019[[3]](#footnote-3) also used a mixed-mode approach, primarily using web but also providing a phone option, helping us to ensure that mode changes do not produce the observed differences in pre-pandemic and pandemic behaviors and intentions.

Third, the NSFG is limited in measures of factors likely to produce change and variation in fertility behaviors and intentions. Because of the high emphasis on cross-sectional monitoring of trends in fertility behaviors, limited content is devoted to potential predictors of those behaviors (e.g., couple dynamics, mental health), and the emphasis on continuity over time greatly limits innovation in measurement. This is a well-known limitation of surveys designed to monitor fertility trends rather than investigate the causes and consequences of those trends [105]. Here we work within those constraints to provide hypothesis tests exactly comparable across time and data sources.

**PSID-TAS 2017 and 2019**

The 2017 Panel Study of Income Dynamics Transition into Adulthood Supplement (PSID-TAS) collected survey responses from 2,526 males and females aged 18-28. Data were collected by telephone over eight months, from October 2017 to June 2018. The 2019 PSID-TAS introduced a web option for data collection in addition to telephone and collected interviews from 2,595 males and females between November 2019 and July 2020. Estimates in this analysis focus on a subset of 1,317 females from PSID-TAS 2017 and 1,352 females from PSID-TAS 2019, and incorporate the cross-sectional weight that accounts for the original PSID selection probability, non-response, differential eligibility, and calibration to known features of the population of interest [106,107].

**AFHS 2020-2021**

The fieldwork for the first national sample replicate of AFHS took place between April 2020 and June 2021. The AFHS uses a mixed-mode web/mail protocol to screen a random address-based probability sample of U.S. households to identify eligible household members between the ages of 18 and 49 (the current NSFG target population, excluding children who are between the ages of 15 and 17). One randomly selected eligible respondent within each household is invited to complete the study, which replicates the content of the NSFG. Both the screening questionnaire and the survey are designed to be completed online, but can also be completed by returning paper questionnaires through the mail. Estimates in this analysis focus on 576 females aged 18-49 to match the NSFG and 181 females aged 18-28 to match the PSID-TAS who were measured in this first sample replicate. These estimates incorporate the final survey weights for the first sample replicate, in addition to bootstrap replicate weights that correctly reflect the stratified sample design and account for all nonresponse adjustments and calibration adjustments applied to the sampling weights. Particularly important, no area cluster sampling was necessary for the AFHS, introducing cost and statistical efficiency relative to face-to-face approaches. One consequence of this efficiency is the ability to achieve reliable estimates with many fewer interviews.

**Measures**

**Fertility trend measures**

***Pregnancies and live births.***Our measure of pregnancy in the past 12 months is derived using information from the NSFG and AFHS questionnaires; detailed pregnancy timing data is not available for PSID-TAS. First, we compared the month/year of the interview to the month/year the most recent pregnancy ended; if the pregnancy ended within 12 months of the interview date they were identified as pregnant within the past 12 months. Second, we used a calculated variable indicating the respondent is currently pregnant at the time of the interview. If either condition was met we consider the respondent as pregnant in the past 12 months[[4]](#footnote-4).

Our measure of ever having a live birth is derived from the pregnancy history section of the NSFG and AFHS questionnaires. If the respondent indicates at least one pregnancy resulting in a live birth, she is coded as ever having a baby. For PSID-TAS, there is a single question for the respondent to report their number of "(biological,) adopted, or stepchildren" which captures a broader definition of parity than what is captured in NSFG and AFHS. For more detail and exact question wording see Appendix Table A4.

***Sexual activity.***Sex in the past 12 months is derived from two separate questions about number of male sexual partners in the past 12 months for NSFG and AFHS. For NSFG, one was asked by the interviewer and the other was asked in the ACASI[[5]](#footnote-5) section. If one or more partners were reported in either question, that case was coded as having sex in the past 12 months. This timing information was not available for PSID-TAS.

***Contraceptive use among the sexually active.***Contraceptive use of any kind in the past 12 months is determined using a web-based event history calendar for AFHS and on a paper calendar for NSFG [108]. If any contraceptive use was reported in the past 12 months, the respondent was coded as having used contraception in the past 12 months. See Appendix Table A4 for the list of contraceptives. This timing information was not captured in PSID-TAS.

***Pregnancy intentions.***The indicator for future pregnancy intention was derived from responding yes to a single question, "Looking to the future, do you, yourself, want to have a/another baby at some time?" with little wording difference across NSFG, PSID-TAS, and AFHS (see Appendix Table A4).

***Forced intercourse.***Our indicator for ever being forced to have intercourse is derived from two questions. If the respondent indicates that the first time they had sex was not voluntary or if they report ever being forced to have sex, they are coded as ever forced to have intercourse (Table A4). The 2017-2019 NSFG variables about forced sex are suppressed from the public use file.

**Predictors of fertility measures**

Detailed question wording and coding for these measures is provided in Table A4. A comparison of univariate distributions (ages 18-28) is in Appendix Table A1.

***Nonfamily experiences.*** We begin with a measure to examine the gross associations with any work experience. Our ever worked indicator is derived from a broadly constructed variable in NSFG and AFHS which incorporates current and former employment, regardless of duration. For PSID-TAS, we coded ever having worked if the respondent answered yes to "Did you earn wages or salaries in 2016/2018 from working on any jobs?" Our measure of education dichotomizes information about highest grade attended and highest degree attained into those with less than four years of college and those with four or more years (controlling for ages 18-22 when many are enrolled in college).

***Family formation experience.*** For marriage, cohabitation, and previous childbearing we code a respondent as married if they report a current marriage, code cohabitation if they are not married and currently living with a partner (all others are considered not married and not cohabitating), and childbearing history is coded as described above (ever had a live birth).

***Race/Ethnicity.***Hispanicity and Black are non-mutually exclusive indicators. In the NSFG and AFHS, Hispanicity is derived from a single ethnicity question, "Are you Hispanic or Latina, or of Spanish origin?" If the respondent answered yes, we coded them as Hispanic. For PSID-TAS, race and ethnicity are captured in one multi-response question, if they ever selected [Hispanic, Latino, or Spanish] we code them as Hispanic, and if they ever selected [Black or African American] we code them as Black. We derived Black from a calculated variable from NSFG which indicates [Black], [White], or [Other], and for AFHS we derived Black from a multi-response race question, if they ever indicate Black they were coded as Black.

***Religiosity.***Work on religiosity in the U.S. demonstrates two powerful dimensions of heterogeneity in religiosity: attendance and importance [6,109]. Here we focus on the personal importance of religion to individuals. The pandemic disrupted attendance at religious services for many who find religion personally important. Our focus on personal importance provides a consistent measure across time that can be used to assess potential changes in the association between religiosity and key fertility processes. Religiosity is derived as somewhat or highly important from a single question, "(Currently), how important is religion [to you/ in your daily life]?"

***Age.***For the NSFG, age is a calculated variable based on the date of the interview and the respondent's reported birthday. For the AFHS, age is a direct question, "First, we’d like to know your age in years. How old were you at your last birthday?" For the PSID-TAS, age is a calculated variable, "The values for this variable represent the actual age of the individual reported in years on his or her most recent birthday."

**Methods**

The analyses that we present use two different approaches. One documents trends in cross-sectional estimates related to key fertility outcomes over time based on these five samples. The other assesses changes in associations of the predictors with these outcomes over time.

**Trend analyses**

We started by estimating proportions of the target population represented by each of the five probability samples with certain characteristics related to fertility behaviors: any pregnancy in the past 12 months, ever having given birth to a baby, any sexual activity in the past 12 months, use of any contraceptive method in the past 12 months (among those sexually active), desiring/wanting a future pregnancy, and ever experiencing any forced sexual intercourse. All measures are available from NSFG and AFHS, but only some of them are available in PSID-TAS. When possible, we compare to PSID-TAS by restricting the NSFG and AFHS sample age range to 18-28 for consistency. When possible (given available sample sizes), these analyses were also stratified by age categories: 18-22, 23-28, and 29+, or 18-28 vs. 29+. For a given characteristic, we supplemented these descriptive analyses with fully design-adjusted Rao-Scott tests of the association between sample (five categories) and the characteristic, to obtain an estimate of any significant changes in trends over time.

**Multivariable models**

Using the data from each of the five samples, we then fitted fully design-adjusted logistic regression models to each of the binary fertility-related outcomes, separately for different age categories when relevant/possible (again given sample sizes). These models included covariates of these outcomes identified in the theoretical framework: ever been employed, less than four years of college, currently married, currently cohabitating, ever had a child, religiosity (religion is somewhat or very important to me), Hispanic, Black, age 18-22, and age 23-28. Estimates of the associations based on each sample were represented by adjusted odds ratios and 95% confidence intervals.

We then tested the possibility of significant changes in the associations of these covariates with the fertility-related outcomes over time by fitting a single logistic regression model to a given outcome in a stacked data set, including data from each of the five samples, and testing two-way interactions between sample (five categories) and each of the covariates described above. The interactions were tested using design-adjusted Wald tests, with AFHS as the “reference” sample (to examine whether any of the associations changed significantly during the pandemic). All analyses of the interactions in these larger models fully adjusted for the complex sampling features of the five samples.

**Results**

Our presentation of results is divided into two parts.

**Trends: Pre-Pandemic to the Pandemic**

Table 1 shows a slight decline in childbearing across time, but no evidence of significant changes in these proportions over time. Any slight decline across these five years is consistent with the more general trend toward lower fertility in the U.S. [110]. However, there is no evidence that the pandemic-specific reports of pregnancy or childbearing have declined from pre-pandemic levels. Most importantly, this finding is consistent with the possibility that pregnancy and live births in the first year of the pandemic are mainly determined by fertility-related behaviors before the pandemic began. Next, we examine changes in those behaviors during the first year of the pandemic.

(Table 1, About Here)

In contrast to Table 1, Table 2 indicates a statistically significant change in fertility-related behavior during the first year of the pandemic. Based on design-adjusted Rao-Scott tests comparing associations between data source and sexual activity in the past year, we find the probability of sexual activity in the past year decreased significantly in 2020-2021 relative to prior NSFG years for women aged 18-22 and aged 29+. The biggest change is among those ages 18-22. This finding is consistent with the possibility that pandemic-related interruptions in campus-based or post-high school education, large group recreation and indoor social interactions slowed entry into romantic and sexual relationships with strong consequences for young adults. This decline in sexual activity will generally be associated with lower rates of pregnancy and childbearing in the immediate future.

(Table 2, About Here)

Table 3 contrasts strongly with Table 2, revealing a statistically significant change in fertility-related behavior during the first year of the pandemic—but with the opposite consequences for pregnancy. Based on design-adjusted Rao-Scott tests comparing associations between data source and contraceptive use among the sexually active in the past year, we find evidence that the probability of contraceptive use in the past year has decreased significantly in 2020-2021 relative to prior NSFG years. By limiting these measures of contraceptive use to women who are sexually active in the same time frame, this measure focuses on the sexual behavior most likely to generate pregnancy—sex without contraception. The proportion of women having sex without contraception increased by a full 20 percentage points (the number of sexually active women contracepting declined by 20%, Table 3). This is a significant change, consistent with the possibility that pandemic-related interruptions in pharmaceutical supply chains and medical services reduced access to contraception. This finding is also consistent with the possibility that new 2020 attitudes opposed to science, medicine, and medical services may have guided contraceptive use behavior. This decline in contraception among the sexually active will generally be associated with higher rates of pregnancy and childbearing in the immediate future.

(Table 3, About Here)

Table 4 shows another statistically significant change during the first year of the pandemic, this time in intentions to have a/another pregnancy. Based on design-adjusted Rao-Scott tests comparing associations between data source and intentions (want) for a future pregnancy, we find that the probability of wanting another pregnancy in the future decreased significantly in 2020-2021 relative to prior years. This is true compared to either NSFG or PSID-TAS. The change among those 18-28 is larger—more than a 20 percentage point drop in the proportion of women 18-28 wanting a pregnancy at any time in the future. This is a significant change in the intentions for future pregnancies. This finding is consistent with the possibility that pandemic-related changes in social organization, changing attitudes and beliefs, and changes in factors related to limits on reasoned action reduced U.S. women’s intentions to have pregnancies. By itself, the decline in pregnancy intentions will generally be associated with lower rates of pregnancy and childbearing in the immediate future.

(Table 4, About Here)

However, in the context of a decline in contraceptive use among the sexually active, an equally large decline in intentions to become pregnant is likely to produce an increase in unintended pregnancies. Unfortunately, because current pregnancy data primarily reflects behaviors based on pre-pandemic conditions, and the measures of unintended pregnancy are limited to those who report a pregnancy, measures of unintended pregnancy from 2020-2021 also reflect pre-pandemic conditions. This first national replicate of the AFHS will not yet yield much insight into unintended pregnancies during the pandemic. Future replicates of AFHS, future waves of PSID-TAS, and future rounds of NSFG will be needed to know if unintended pregnancy does rise sharply.

One of the key behaviors linked to unintended pregnancy, and a clear limit on reasoned action, is forced intercourse. Table 5 shows another statistically significant change during the first year of the pandemic, this time in the percent of women experiencing forced intercourse among those aged 18-28. Although PSID-TAS measures consistently lower rates of forced intercourse than NSFG, the AFHS measures higher rates than either of those data sources during the pandemic. Based on design-adjusted Rao-Scott tests comparing associations between data source and experience of forced intercourse, we find evidence that the probability of being forced to have intercourse increased significantly in 2020-2021 relative to prior years. Among these young adult women, as predicted, rates of forced intercourse increased during the pandemic. This result is also consistent with the decline in contraceptive use among the sexually active—forced intercourse is a key reason for absence of effective contraceptive use [97]. By itself, like the potential increase in unintended pregnancy, the increase in forced intercourse will generally be associated with higher rates of pregnancy and childbearing in the immediate future.

(Table 5, About Here)

Note that key weakness in the interpretation of results in Table 5 will be remedied as new data become available. All of the measures in Table 5 rely on lifetime experiences of forced intercourse and are not limited to the pandemic. PSID-TAS continues to measure this outcome in 2021 and 2023, AFHS measured this outcome in 2022, and future rounds of NSFG are likely to measure this outcome. Differences across measures reflecting more pandemic experience will more clearly reveal the extent of changes during the pandemic.

**Multivariable Models**

Next, we turn to multivariable models for these fertility-related outcomes. Our primary objective is to detect changes in the predictors of these fertility outcomes. Unfortunately, we do not have measures of all of the predictors identified as relevant to pandemic-specific childbearing changes in the theoretical framework. Our models are constrained to measures available in the three data sources used. We close this paper by arguing that measurement of a broader range of predictors should be a high scientific priority.

**Models of sexual activity and contraceptive use among the sexually active**

As in Tables 2 and 3, measures of sexual activity in the past 12 months and contraceptive use in the past 12 months among those who were sexually active are limited to the NSFG and AFHS. Our multivariable models of these two outcomes are presented in Appendix Tables A2 and A3. We do not discuss the results in detail here because those models demonstrate stability of associations with predictors before and during the pandemic. It is useful to see this continuity of results across time, data sources, and modes of data collection, but the continuity reveals no dramatic changes in the predictors of these two proximate determinants of fertility.

**Pregnancy intentions**

We focus our models of pregnancy intentions on women aged 18-28 to include the PSID-TAS results and because young adult intentions have the largest potential consequences for childbearing across the life course. Table 6 presents the estimated odds ratios indicating associations of the covariates with the indicator of wanting a future pregnancy based on each of the five samples. Ever having worked increased the odds of wanting a future pregnancy consistently across time, with the association becoming significantly stronger during the pandemic. This change is unusually large. The AFHS odds ratio of more than 16 indicates an increase of 16 times in the odds of wanting a/another pregnancy among those young adults who have worked compared to those who have never worked. Because this magnitude of association is rare and the AFHS sample size is small, we investigated the association in more detail: Although only 28% of the AFHS sample 18-28 never worked, 16% of them wanted a future pregnancy and 84% did not. Among the 72% ages 18-28 who had ever worked, 45% of them wanted a future pregnancy and 55% did not[[6]](#footnote-6). Thus, we have reason to believe this large, statistically significant change during the pandemic in the association between ever working and wanting a pregnancy is correct[[7]](#footnote-7). It is also consistent with the prediction that documented changes in access to work for pay could have a powerful consequence for childbearing behavior given the high costs of childrearing in the U.S. context.

(Table 6, About Here)

A negative or non-significant association of less than four years of college education became more negative in 2017-2019 and 2020-2021, with the odds of wanting a future pregnancy being 79% lower for those with less than four years of education when adjusting for the other covariates in 2020-2021. The pandemic estimate of association is significantly different than both NSFG associations, but it is not different than the two PSID-TAS estimates of association. This change is *not* pandemic-specific. The only other association significantly different than prior estimates was the association with Black race. This association became stronger over time, increasing the odds of wanting a future pregnancy significantly in 2020-2021. This is a significant difference from both PSID-TAS estimates and from the NSFG 2015-2017 estimate, but not from the NSFG 2017-2019 estimate. Thus, this change of association is *not* pandemic specific.

None of the other associations with intentions to have a pregnancy were significantly different during 2020-2021. Being married or cohabiting had a positive association consistently over time. However, the negative association of ever having had a child on wanting a future pregnancy changed to non-significant in 2020-2021. The association of religiosity remained positive but became somewhat weaker in 2020-2021. The association of Hispanic ethnicity remained positive over time. Finally, the positive association of younger age (18-22) remained remarkably consistent over time.

**Discussion**

Predicting short-term changes in fertility is useful because a sudden increase in babies will also create sudden changes in demands for health care, schools, jobs, etc. Prediction of the future is difficult [111,112], so we combine a broad theoretical framework with nationally representative data to begin the process of understanding the consequences of COVID-19 for childbearing. Consistent with the complexity predicted by this framework, pandemic-specific changes are *complicated*. No changes in pregnancies or childbearing are observed yet (Table 1), but rates of sex declined (Table 2), rates of contraceptive use among the sexually active declined (Table 3), and rates of intending a/another pregnancy declined (Table 4). The combination of declining rates of contraceptive use and intentions to have a pregnancy are likely to produce an increase in unintended pregnancies, but data from 2020-21 was too soon to estimate this change. Declining rates of sex may mean that increased rates of unintended pregnancy among the sexually active do not have a large consequence for the total fertility rate. Consistent with the possibility of increasing unintended pregnancies, we also find an increase in forced intercourse in 2020-21 (Table 5).

Although multivariable models demonstrate that the predictors of key proximate determinants of fertility remained stable (Appendix Tables A1 and A2), the association between ever having any work experience and pregnancy intentions changed dramatically during the pandemic for young (18-28) adult women (Table 6). Note that these are lifetime intentions for another pregnancy, *not* short-term intentions for pregnancy timing. Any work experience greatly increases the odds of wanting a future pregnancy among these women. This association was evident in prior studies, but never so pronounced. This direction of association is also consistent with the positive association between high educational attainment and fertility intentions [113]. Educational attainment drives long-term income trajectories [114], but among those aged 18-28, experiences of paid work likely shape perceptions of future income. The difference between fertility intentions among those who worked and did not work grew larger, with those who worked more likely to want a future pregnancy.

Key findings from our comparisons across these nationally representative probability samples of the U.S. are also consistent with results from other studies of fertility during the pandemic. For example, a 2021 report released by the Guttmacher Institute used a national web survey (mixing probability and non-probability samples) of sexually active women aged 18-49 to document changes in childbearing intentions and declines in access to contraceptives [115]. That report shows that work experience, earnings, and race are each associated with changes to individual fertility intentions [115]. Early research on the pandemic’s impact on fertility found a strong decline in births from November 2020 to January 2021 in more than 20 countries, including the U.S. [116,117]. This is consistent with the sudden drop in sexual activity documented here. Furthermore, the pandemic is associated with greater childcare burden, elevated stress, and poorer mental health among parents [15,118,119], with a particularly strong impact on women [120].

Theories of fertility dynamics are designed to predict consequences of long-term changes to social life, not abrupt changes like those accompanying the pandemic. It is possible that in high-fertility populations, abrupt changes are less consequential. In settings with consistently low total fertility rates, the variance in lifetime childbearing will be more limited due to the decreased prevalence of high-parity births [121]. Fertility increases by even a single birth could create noticeable consequences for services of all types. Also, if the pandemic creates an abrupt increase in unintended childbearing in the U.S., this change will likely have substantial long-term, negative consequences for family, child health, and wellbeing [122,123]. Because of the concurrent decline in sexual activity, a sudden rise in unintended pregnancies may not produce a sudden rise in the birth rate. However, in the U.S. the pandemic has also coincided with a wave of stringent state laws (in some places) restricting women’s access to timely and safe abortion services [124], which may contribute to a rise in unintended childbirths from those pregnancies.

We find potential for changes in social organization of daily activities to produce quick changes in fertility, though it is too early to know if those changes are long-term. First, changes in social organization that disrupt work opportunities may change fertility intentions rapidly, particularly among young adults. Second, changes in social organization that disrupt opportunities for social interaction may rapidly change rates of intercourse. Third, changes in social organization that disrupt access to contraception and medical services may rapidly change rates of contraceptive use among the sexually active. At the same time, increased dissemination of attitudes regarding the high burden of childrearing during the pandemic may have also lowered fertility intentions. Likewise, increased skepticism toward science and medicine, fueled in part by active efforts to change attitudes, may be linked to lowered contraceptive use. The mismatch between declining contraceptive use and declining intentions to become pregnant among the sexually active also indicates the possibility that limits to reasoned action will shape pandemic childbearing in the short-term. Higher rates of forced intercourse are consistent with this possibility, but emotional decisions about sex and contraception or greater prevalence of mental disorders in the pandemic could also produce higher rates of unintended pregnancy. As with theories of slower demographic change, multiple mechanisms are likely working simultaneously [47].

The possibility that so many different mechanisms of change occurred simultaneously complicates the derivation of single-direction predictions, rendering this investigation of pandemic-specific fertility changes in the U.S. as a starting point. Unfortunately, available data for comparative models of multiple simultaneous predictors do not measure many crucial predictors of pandemic fertility. These include pandemic-specific attitudes, couple-level relationship dynamics, and mental health. This impedes our ability to adjudicate among the multiple mechanisms that may explain the observed outcomes, providing more questions than answers. This is a general problem with the absence of carefully-tested demographic theories to predict abrupt changes in fertility or even general fertility dynamics in low-fertility settings [125].

Methodologically, our results indicate that more answers are within reach. First, more data from PSID-TAS 2021 and 2023 and AFHS 2021-2022, now completed or in process, will provide a clearer picture of how long these changes will last. The observed changes may have already ended. Second, because PSID-TAS has much broader measurement than NSFG, is embedded in the PSID, and monitors the same individuals across time, it provides dynamic measures of more theoretically important predictors of fertility outcomes and can be used to advance understanding of pandemic-specific dynamics. Third, because AFHS is more efficient to field and an easier tool for introducing innovative content than NSFG, it is an important opportunity for investigating crucial understudied predictors of fertility, such as new attitudes, rising uncertainty, rapidly changing emotions, or mental health changes. Despite the differences in sample designs and modes of administration, the results demonstrate that these three studies yield consistent measurement of childbearing, determinants of childbearing, and associations between key predictors and those determinants.

The sudden observed shift in forced intercourse is consistent with the apparent mismatch between the decline in contraceptive use among the sexually active and intentions to become pregnant. These results indicate a gap in demographic theory—a lack of theoretical attention to the *limits on reasoned action*. Forced intercourse is widely understood to be the worst of bad intimate partner relationship quality [95,126]. If this extreme measure of bad relationship quality rose dramatically, less extreme relationship problems undoubtedly rose to even higher proportions. Moreover, relationship prediction is partly so complex because the same context of social organizations that may have produced a spike in bad relationship quality for some could have also produced a spike in good relationship quality for others [127]. Highly emotional positive relationships—love—may also limit reasoned action reducing consistency between contraceptive use and childbearing intentions. Both possibilities point to the urgent need to better measure and understand the connections among social organization, intimate partner relationship dynamics, limits to reasoned action, and fertility. Tools like repeated, short-term panel studies built on flexible study designs, like the AFHS, are an important resource for advancing such science.

Finally, the absence of diagnostic measures of mental disorders cripple the testing of models predicting abrupt childbearing changes. Mental disorders are highly prevalent. In the U.S. over 16% of the population meets lifetime criteria for major depressive disorder [128], about 12% meets lifetime criteria for at least one anxiety disorder [101], and around 14% meets lifetime criteria for alcohol use disorder [101]. These disorders may significantly impact behavior, cognition, and emotional regulation. Suffering from one of these disorders would impose a *limit on reasoned action*, including a limit on reasoned action regarding sex, contraception, and pregnancy. Studies have shown that the pandemic has been associated with an increase in the rates of mental disorders, violence, and binge drinking in many countries [129,130]. This may explain some of the increase in forced intercourse observed. Absence of both theory about the connections between episodes of mental disorders and fertility dynamics and the measurement to test those hypotheses impose a severe limitation on our ability to understand fertility dynamics. Constructing thoughtful measures of mental health in new studies of fertility and reproductive health should be a high scientific priority.

In one of the most scathing reviews of fertility surveys written by a demographer, Kingsley Davis wrote, “I think the WFS was misconceived. It assumed that, from the standpoint of policy, the great need was for more and better data, but actually the need was for clearer and broader thinking” (p. 834) [105]. The topic was the World Fertility Surveys (WFS), but the same critique is a threat to our application of demographic reasoning to key population policy issues that continue to appear, whether they evolve slowly or quickly. Davis closes his critique noting that the WFS was, “a survey in one moment of time, with stripped-down questions and elaborate methodology, the survey asked women about their reproductive behavior but forgot to ask them why” (p. 834 [105]. To understand and predict the rapid changes in fertility and reproductive health, like those brought on by the pandemic, we will need to continue to innovate measurements of *why* behavior changes. These measures will be most effective when built on “clearer and broader thinking”. From the complexity observed in our investigation of pandemic-specific fertility responses, we argue that this thinking will need to encompass the family organization of social activities, the cost-benefits of childbearing, reasoned action, and limits to reasoned action.

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### Tables

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| **Table 1.** Proportion of women with pregnancies in the past 12 months and ever having given birth to a baby. (Values in parentheses are design-adjusted standard errors, and all estimates are weighted.) |
|  | **NSFG****2015-2017** | **PSID-TAS****2017** | **NSFG****2017-2019** | **PSID-TAS****2019** | **AFHS****2020-2021** |
| Pregnancy last 12 months, ages 18-49 | .15 (.01) | -- | .11 (.01) | -- | .10 (.02) |
| Ever baby, ages 18-49 | .63 (.01) | -- | .60 (.01) | -- | .57 (.02) |
| Ever baby, ages 18-28 | .31 (.02) | .27(.02) | .25 (.02) | .24 (.02) | .26 (.04) |

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| **Table 2.** Proportion of women sexually active in the past 12 months. (Values in parentheses are designed-adjusted standard errors, and all estimates are weighted.) |
|  | **NSFG** **2015-2017** | **NSFG** **2017-2019** | **AFHS** **2020-2021** |
| Ages 18-22 | .80 (.02) | .71 (.03) | .48 (.06)\*\* |
| Ages 23-28 | .85 (.02) | .84 (.01) | .78 (.05) |
| Ages 29+ | .89 (.01) | .87 (.01) | .81 (.03)\* |
| NOTE: AFHS is different from other samples at \*p < 0.05 or \*\* p < 0.01 (based on design-adjusted chi-square tests).  |

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| **Table 3.** Proportion of sexually active women using any contraceptive method in the past 12 months. (Values in parentheses are design-adjusted standard errors, and all estimates are weighted.) |
|  | **NSFG** **2015-2017** | **NSFG** **2017-2019** | **AFHS** **2020-2021** |
| Ages 18-49 | .87 (.01) | .87 (.01) | .66 (.03)\*\* |
| Ages 18-28 | .90 (.01) | .88 (.01) | .64 (.06)\*\* |
| NOTE: AFHS is different from other samples at \*\* p < 0.01 (based on design-adjusted chi-square tests). |

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| **Table 4.** Proportion of women who desire (want) any future pregnancy. (Values in parentheses are design-adjusted standard errors, and all estimates are weighted.) |
|  | **NSFG****2015-2017** | **PSID-TAS****2017** | **NSFG****2017-2019** | **PSID-TAS****2019** | **AFHS****2020-2021** |
| Ages 18-49 | .51 (.01) | -- | .48 (.01) | -- | .37 (.02)\*\* |
| Ages 18-28 | .81 (.02) | .83 (.01) | .78 (.01) | .84 (.01) | .54 (.04)\*\* |
| NOTE: AFHS is different from other samples at \*\* p < 0.01 (based on design-adjusted chi-square tests). Also, the differences between AFHS and the two NSFG samples remain statistically significant when examined among only those who were sexually active in the past 12 months (sexually active in the past 12 months is not available from PSID-TAS). |

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| **Table 5.** Proportion of women ages 18-28 who reported they were ever forced to have intercourse. (Values in parentheses are design-adjusted standard errors, and all estimates are weighted.) |
|  | **NSFG****2011-2013** | **NSFG****2015-2017** | **PSID-TAS****2017** | **PSID-TAS****2019** | **AFHS****2020-2021** |
| Percent (SE) | .16 (.01) | .17 (.01) | .11 (.01) | .07 (.01) | .26 (.05)**\*** |
| N | 2218 | 1,849 | 1,311 | 1,348 | 103 |
| Note: \* Means that the AFHS is different from the NSFG 2011-2013 at p < .05, different from NSFG 2015-2017 at p = .07, and different from PSID-TAS 2017 and 2019 at p < 0.01 (based on design-adjusted chi-square tests). The National Center for Health Statistics, CDC chose to place the NSFG 2017-2019 measures of forced intercourse into restricted use data for the first time since NSFG began measuring forced intercourse. We display the NSFG 2011-2013 estimate here to demonstrate the long-term stability in this proportion. |

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| **Table 6.** Estimates of adjusted odds ratios in logistic regression models predicting the probability of wanting a (another) pregnancy, women ages 18-28. (Odds ratios presented with 95% confidence intervals in parentheses.) |
|  | **NSFG****2015-2017** | **PSID-TAS****2017** | **NSFG****2017-2019** | **PSID-TAS****2019** | **AFHS****2020-2021** |
| **Nonfamily Activities** |  |  |  |  |  |
| Ever worked | 1.85\*(1.03,3.32) | 1.17(0.67,2.03) | 1.62(0.80,3.27) | 1.25(0.78,2.01) | 16.07\*\*(3.06,84.47) |
|  |
| < 4 years of college | 0.73(0.48,1.12) | 0.61(0.33,1.13) | 1.27(0,74,2.17) | 0.41\*\*(0.22,0.74) | 0.20\*\*(0.06,0.65) |
|  |
| **Family Formation** |  |  |  |  |  |
| Currently married | 1.43(0.97,2.12) | 1.71(0.89,3.29) | 2.55\*\*(1.54,4.23) | 1.60(0.84,3.04) | 1.95(0.41,9.27) |
|  |
| Currently cohabitating (not married) | 1.24(0.78,1.99) | 1.93\*(1.08,3.42) | 1.91\*\*(1.25,2.92) | 1.72(0.97,3.04) | 2.34(0.41,13.42) |
|  |
| Ever had a child | 0.30\*\*(0.21,0.41) | 0.37\*\*(0.23,0.60) | 0.28\*\*(0.20,0.40) | 0.30\*\*(0.19,0.49) | 1.28(0.28,5.93) |
|  |
| **Religiosity** |  |  |  |  |  |
| Religion is somewhat or very important to me | 2.33\*\*(1.57,3.44) | 3.44\*\*(2.14,5.51) | 3.40\*\*(2.59,4.48) | 2.44\*\* (1.55,3.84) | 1.31(0.46,3.68) |
| **Race/Ethnicity** |  |  |  |  |  |
| Hispanic | 1.32(0.88,1.98) | 1.21(0.66,2.24) | 1.55\* | 1.49(0.85,2.62) | 2.17(0.75,6.28) |
|  | (1.05.2.30) |
| Black | 0.85(0.54,1.33) | 0.72(0.42,1.25) | 1.48\*(1.03.2.12) | 1.09(0.64,1.88) | 5.92\*(1.06,33.12) |
|  |
| **Age Group** |  |  |  |  |  |
| 18-22 | 1.70\*\*(1.19,2.43) | 2.08\*\*(1.29,3.33) | 1.54\*(1.04,2.27) | 1.90\*\*(1.21,2.97) | 1.86(0.53,6.52) |
|  |
|  |  |  |  |  |
| -2 the log likelihood | 19,926,901 | 20,037,801 | 21,362,601 | 19,898,854 | 22,438,554 |
| N | 1874 | 1317 | 2006 | 1352 | 181 |
| Note: For PSID-TAS models “ever had a child” includes adopted and stepchildren. Predictors are significant within single sample models at \*p < 0.05 or \*\* p < 0.01. Odds ratio in red indicates a significant difference between AFHS and PSID-TAS 2019. |

1. Prior research generally argued that changes that already happened in north-western Europe were destined to happen everywhere, and that the timing of those changes was a measure of “development”, with non-European countries seen as less developed [1]. [↑](#footnote-ref-1)
2. Please note this is an important contrast to types of fertility theories that argued that the circumstances facing individuals stayed essentially the same, but as individuals become more aware of their own self-interest, they become more rational and begin to limit their fertility [51]. Such theories may have never been helpful in predicting behavior [52], but they are unlikely to be helpful in predicting short-term changes in childbearing behaviors produced by the pandemic. [↑](#footnote-ref-2)
3. PSID-TAS 2017 was primarily phone mode, but also included limited face-to-face mode. [↑](#footnote-ref-3)
4. To ensure respondent confidentiality, month of last pregnancy is suppressed for NSFG respondents, therefore the NSFG estimate includes pregnancies from the past 12-23 months. [↑](#footnote-ref-4)
5. Audio computer assisted Effects on marri. [↑](#footnote-ref-5)
6. Note that the percent of 18-28 year olds who had ever worked among those aged 18-22 was 45%. [↑](#footnote-ref-6)
7. As more data from the pandemic period become available our confidence in this finding may improve. [↑](#footnote-ref-7)