Sick Days, Snow Days, and the Labor Market Impacts of Caretaking Inequities*

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Abstract

We study how unexpected childcare disruptions impact the labor market outcomes of U.S. parents. We find in the Current Population Survey and time use data that mothers are more likely to miss work in response to increased snow or illness exposure while fathers show little change, with especially strong effects among married mothers in occupations with low time flexibility. Finally, we find that mothers in areas with higher average annual snowfall work in occupations with higher time flexibility but lower pay, suggesting that mothers may adjust their labor supply in anticipation of future possible childcare disruptions.

JEL Classification: J16, J22

Keywords: Gender Gap, Child Penalty, Labor Supply, Childcare

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1 Introduction

Mothers experience a sizable and lasting drop in earnings after the birth of their first child (Kleven et al., 2019, 2024). Recent literature has endeavored to identify the particular factors that contribute to this phenomenon. One key factor tied to this trend is childcare availability: consistent childcare and schooling allow mothers to work and earn more than they do when school and childcare are unavailable, such as during summer vacation (Price and Wasserman, 2025). In this paper, we focus on the school year itself, studying impacts of childcare disruptions experienced by nearly all parents — namely, disruptions due to weather or illness.

Using a sample of workers drawn from the Current Population Survey (CPS), we measure the impact of severe flu and snowfall seasons on parents' reported labor supply. We gather data on monthly weather patterns from the National Oceanic and Atmospheric Administration (NOAA) and data on flu-related deaths from the CDC Wide-ranging ONline Data for Epidemiologic Research (WONDER). With these two sources of exogenous variation, we find that unexpected disruptions impact all workers, but there are distinct gender differences in these effects for parents. Mothers report working fewer hours in months with worse snowfall, and both increased snowfall and illness exposure substantially raise the likelihood that mothers report having worked part-time the previous week due to childcare issues — for either source of variation, a two-standard-deviation shock is associated with a roughly 0.45 pp (10%) percent increase in the likelihood of childcare-related part-time work for mothers with children aged less than 5. We detect no such effects for fathers and find no such sex-based heterogeneity in impacts for individuals without children. Focusing on our results for snowfall, we additionally find larger effects among married mothers in occupations with lower flexibility in terms of start times.

We confirm and extend this analysis using the American Time Use Survey. Using an indicator for severe within-county weather events, we find that mothers directly substitute time away from work towards childcare, while fathers make almost no change to how they spend their time. The impact to mothers is substantial: mothers increase their time spent on childcare by 32 minutes (10.5%) and decrease their time spent working by 40 minutes (11.5%).

Finally, we use data from the CPS Annual Social and Economic Supplement to determine individuals' snow and illness exposure one year prior and investigate whether these potential childcare disruptions are associated with measurable longer-run decreases in labor supply. We obtain mainly null findings, perhaps due to mothers anticipatorily sorting into more

flexible occupations before such disruptions take place. In support of this hypothesis, we find correlative evidence that mothers in areas with higher average annual snowfall work in more flexible occupations with lower hourly wages: other things held equal, our estimates suggest that moving from a location in the bottom decile of average annual snowfall to the top decile is associated with a 10 percent increase in the gap in hourly wages between all mothers and fathers and a 30 percent increase in the wage gap between mothers and fathers of young children.

This paper's primary contribution is identifying factors that cause mothers' and fathers' career paths to diverge after parenthood. The literature has identified childcare availability as a salient factor in driving the earnings losses associated with motherhood — mothers spend more time on caretaking compared to fathers (Cubas et al., 2021; Cowan et al., 2024) and women have a higher demand for flexible work arrangements (Goldin, 2014). These gender differences decrease when more reliable school and childcare are available (Gibbs et al., 2024; Humphries et al., 2024) and are not solely due to preferences: Buzard et al. (2025) finds that school principals disproportionately call mothers, indicating that external and societal sources play a role in the gendered division of caretaking responsibilities.

Complementing Buzard et al. (2025), we focus on external disruptions that prevent children from attending school in the first place. By using the universal experiences of illness and weather disruptions, we show that mothers take on the bulk of unexpected caretaking demands, leading to short-term reductions in labor supply and potential long-term adjustments in types of occupations held. While robust childcare and schooling systems may help increase mothers' ability to work, they are not a complete solution to the gap in earnings between mothers and fathers, and additional workplace policies designed to better accommodate unanticipated childcare disruptions may be useful.

2 Data and Empirical Strategy

2.1 Current Population Survey Data

Our primary analysis sample comes from the 2000-2019 waves of the Current Population Survey.[1] The CPS has several features that makes it ideally suited for our purposes — its large sample size and time horizon enables us to both detect precise estimates and to

[1]We focus on pre-COVID years due to pandemic inducing dramatic fluctuations in both dependent (e.g. part-time work) and independent (e.g. deaths by pneumonia) variables in ways that may be difficult to interpret when pooled with less exceptional years.

study how these estimates have changed over the course of the pre-pandemic 21st century. Moreover, the survey is conducted at a *monthly* level, allowing us to leverage within-year variation in factors such as snowfall and illness propagation, and also contains precise county information for individuals living in sufficiently populous areas,[2] thereby allowing us precise measurement of exposure to our exogenous variables of interest.

The CPS also contains basic demographic and socioeconomic information that allows us to easily identify parents in the sample and derive basic measures of labor force attachment. Most important, however, is that the CPS contains a vector of questions that makes it ideal for studying the contemporaneous effects of childcare disruptions on labor supply. The CPS asks respondents whether they worked part-time (specifically, fewer than 35 hours) or were absent from work (zero hours) in the previous week, and, if so, why. Potential options include fairly typical reasons, such as slack work conditions, holidays, or the respondent only being able to find part-time work in the first place. Other reasons are more directly related to our sources of exogenous variation, such as missing work due to weather-related issues, the respondent being sick themselves, or, critically, childcare problems. These responses will form our baseline dependent variables when studying the immediate effects of childcare disruptions on labor force attachment.

We limit our CPS sample to individuals aged 20 to 45 and who are identified as either the household head or the spouse of the household head and live in a county large enough so as to not be suppressed. Since we are primarily interested on the impact of childcare disruptions on the contemporaneous labor supply of working parents, we additionally limit our sample to individuals who report being employed and to individuals surveyed in months when children are likely to be in school (i.e. September through May).[3] Table A.I presents summary statistics for the CPS data[4] in terms of hours worked the previous week as well as the frequency with which respondents report either working part-time or being absent last week for various reasons. As is well-known in the literature, mothers work fewer hours than fathers, and the data suggest that childcare problems are a notable driver of this gap — mothers are approximately 20 pp more likely to have worked part-time in the previous week

[2]To the extent that more sparsely populated areas have less public transit and longer travel distances, our focus on more populous counties may result in our underestimating the impact of weather-related disruptions on labor supply. While less population density also reduces the transmissibility of disease, our baseline measure of illness will contend with this somewhat by being a per-capita measure.

[3]We cannot observe whether individuals are unemployed specifically because of childcare-related issues. We will turn to extensive-margin labor supply impacts in Section 3.4.

[4]Descriptive statistics for the subsamples linked to either of our independent variables of interest are indistinguishable from the overall sample.

than fathers in our sample, and slightly over 3 pp (or 15%) of this gap appears to be directly attributable to childcare problems. Missing work *entirely* due to childcare problems alone appears to be a rare event. Gender differences in part-time usage and hours worked remain for individuals without children as well, though the disparities are considerably smaller in magnitude than those for parents.

2.2 American Time Use Data

We supplement our CPS analysis with a sample drawn from the 2003-2019 waves of the American Time Use Survey (ATUS). Respondents to the ATUS fill out a 24-hour time diary of how they spend their time. Each reported activity is categorized into various types of activities. For our analysis, we focus on two main types of activities: time spent working and time spent on childcare. Time spent on childcare includes both time spent on childcare as a primary activity and as a secondary activity. Mirroring our CPS analysis, we limit our sample to employed respondents. Additionally, we focus on parents by limiting to individuals who have their own child under the age of 18 in the household. ATUS also provides basic demographic and socioeconomic information which we include in the analysis. Finally, we restrict the main ATUS sample to school-days by only including time diaries from (Monday-Friday) and during school months (September-May). Table A.II presents summary statistics for our main ATUS sample. We also present statistics for parents on weekends and individuals who are not parents on weekdays as comparisons to our main sample.

2.3 Sources of Exogenous Variation

While the CPS and ATUS contain a considerable amount of useful information, they do not contain direct information about local weather conditions or the day-to-day health of respondents. We thus supplement our above samples with external measures that will be related to the likelihood that households face childcare disruptions related to weather or illness in a given week. Specifically, we gather data on snowfall and flu-related mortality at the county-year-month level.

Weather data come from the Global Summary of the Month (GSOM) data files, collected by the National Oceanic and Atmospheric Administration (NOAA). This series aggregates data from weather stations around the world to produce statistics at the station-month level, including variables related to precipitation, temperature, and so on.[5] We gather data

[5]For more documentation, refer to www.ncei.noaa.gov/data/gsom/doc/GSOM_documentation.pdf

from the universe of stations belonging to the U.S. Cooperative Network. We focus on this particular network due to its complete geographic and temporal coverage of the United States, along with it reliably possessing detailed information pertaining to snowfall. We map stations to counties by computing distances of stations from county geographic centroids using longitude and latitude coordinates. For all counties, we average data from all stations within a 50 kilometer radius of the geographic centroid to construct a county-month panel of weather statistics. The key independent variable from this data is the amount of snow a given county experienced in the previous month, which we convert from millimeters to inches for ease of interpretation. Across the United States in the 2000-2019 period, the average snowfall in a given county-month is approximately 2 inches, with a standard deviation of around 5 inches.

For exogenous variation related to illness, we use mortality data from the CDC Wide-ranging ONline Data for Epidemiologic Research (WONDER) database because county-level data on flu *cases* are not reliably available for our time period. For each county-year-month combination, we take the total number of deaths due to influenza or pneumonia[6]-related reasons before converting these numbers to deaths per 100,000 residents using Census county population estimates[7]. While death rates in a county due to influenza are certainly related to the degree of propagation of the disease in the area, they may also relate to the county's age composition and vaccination rates, since more elderly individuals are much more susceptible to pneumonia than their younger counterparts — to account for this and other relevant county-specific factors, we include county-level fixed effects in our empirical specification.

2.4 Empirical Strategy

Our baseline specification studies the impact of increased exposure to snow or illness on labor supply. Specifically, we the following regression:

$$Y_{ictm} = \lambda_c + \tau_t + \gamma_m + \boldsymbol{\beta X_i} + \delta T_{ctm} + \varepsilon_{ictm}, \tag{1}$$

where Y_{ictm} is the outcome of interest (e.g., hours worked the previous week or working part-time last week due to childcare problems) for individual i in the CPS, measured in county c in year t and month m. We include fixed effects for county, year, and month to account for

[6]Pneumonia being the primary complication from influenza that actually results in fatality.

[7]We choose this scaling for ease of interpretation, as an additional death per 100,000 residents is roughly equivalent to a one-standard-deviation increase, with the mean rate per 100k being 1.67. The CDC reports when a county has zero deaths in a month but suppresses the exact count if it is between 0 and 10 — we code such cases as missing for lack of a better alternative.

geographic, annual, and seasonal trends in the dependent and treatment variables. We also include vectors of demographic characteristics $\boldsymbol{X_i}$ to account for individual factors that may relate to the dependent or independent variable, including fixed effects for race, Hispanic origin, marital status, educational attainment, and age.

The parameter of interest is δ, which captures the impact of a unit increase in the independent variable T_{ctm} (inches of snow or flu deaths per capita) in the relevant county-year-month. Identifying variation comes from county-level differences in snowfall or illness relative to trend, which may happen within counties across time, across counties within time, and combinations of the two. The identifying assumption is that, after accounting for geographic and temporal trends, changes in snowfall or mortality rates at the county level are unrelated to any other factors that may impact short-run labor supply decisions. While this baseline assumption is strong, the features of our data allow us to conduct myriad face validity and placebo tests along with robustness exercises that focus on more heavily restricted sources of identifying variation.

3 Results

3.1 Contemporaneous Effects

Figure 1 presents our main findings for the contemporaneous effects of increased snow or illness on the labor supply of respondents in the CPS. All coefficients in the figures are separate estimates of δ from Equation 1 with 95% confidence intervals. Binary outcome variables are scaled to be either 0 or 100, so that the estimates are interpretable as percentage point changes in the outcome of interest. A visual representation of the variation that gives rise to our results is also available in binned scatter plots in Figure A.I.

We find that among parents, the impacts of increased exposure to either snow or illness on labor supply load almost exclusively onto mothers. This is especially true for parents of children less than 5 years old. Increases in monthly snowfall are associated with reductions in hours worked the previous week throughout the CPS sample, but the effects are the most significant (both statistically and substantively) for mothers with a child under the age of five — an additional inch of snowfall in the county-month is associated with 0.032 (Figure 1a) fewer hours worked the previous week for such mothers. The estimates for the impacts of flu exposure on hours worked are considerably noisier and do not exhibit such clear patterns of heterogeneity.

We perform the following calculation to put the magnitude of our results into context, noting the exogenous variables are measured at the monthly level while the outcome variables ask about labor supply in the preceding week. Taking the snow coefficient for the mothers of children under age five as an example, consider the case of a county receiving a foot of snow in a given month (around two standard deviations above the mean). The impact of hours worked for the month may be approximated as $0.032 \times (12 \text{ inches}) \times (4.5 \text{ weeks}) = 1.73$ hours, which on a basis of an average of 32.3 weekly hours worked for the mothers of young children translates to around a 1 percent reduction in hours worked each month.[8]

While worse weather or more widespread illness could depress labor supply through a number of channels, our results also directly point to childcare disruptions as being a key driver in the heterogeneity of effects between mothers and fathers. When looking at the reasons given for working part-time in the previous week, the rate at which fathers report missing work due to childcare problems (Figures 1b and 1d) is essentially zero, regardless of treatment or whether the father has young children in the household. This is emphatically not the case for mothers, who consistently cite childcare problems as the reason behind working part-time — for instance, an additional inch of snow (flu death per 100k) increases the likelihood that mothers of young children[9] work part time due to childcare problems by 0.038 (0.205) percentage points, which on the base rate of approximately 5 percent constitutes increases of 0.76 (4.1) percent in any given week[10].

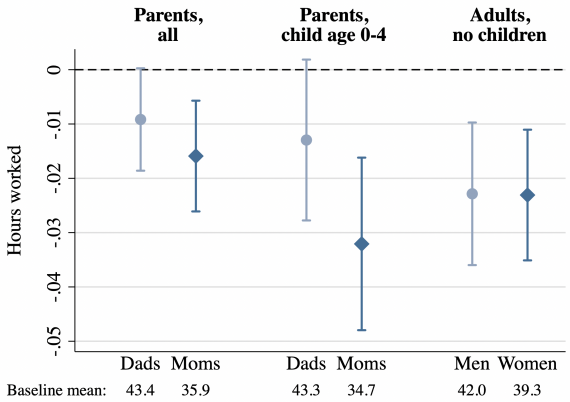
[8]Nonlinearities in the effects of snow or flu exposure and the likelihood of bimodal impacts, with the majority of parents being unaffected and a subset losing more substantial work time, may also drive our estimates down. We observe similar gendered heterogeneity patterns when looking at the impacts of snowfall on an indicator variable for having missed eight hours or more in the previous week (Figures A.IIa). An additional consideration is that parents may work *additional* hours in weeks following adverse weather events to make up for lost time, which would propel our estimates toward zero. To overcome this concern, we estimate daily-level impacts in Section 3.3.

[9]For illness, stronger impacts for mothers of young children may be explained by increased transmissibility of disease among younger children, but the larger impacts for increased snow exposure may be surprising to the extent that snow days primarily impact older children enrolled in school. We interpret these results as potentially indicating increased sensitivity of private childcare centers in response to weather events or increased difficulty in finding alternative care arrangements for younger children than for older children, who perhaps need less supervision. We also note that being the parent of a young child in our sample does not preclude one from also having older children in school. We investigate these possibilities further in Table A.III, which interacts our weather-related treatment variable by the number of children in the household aged 0 to 5, 6 to 11, and 12 to 18 for mothers in the CPS, and find that effects appear to decline monotonically with child age.

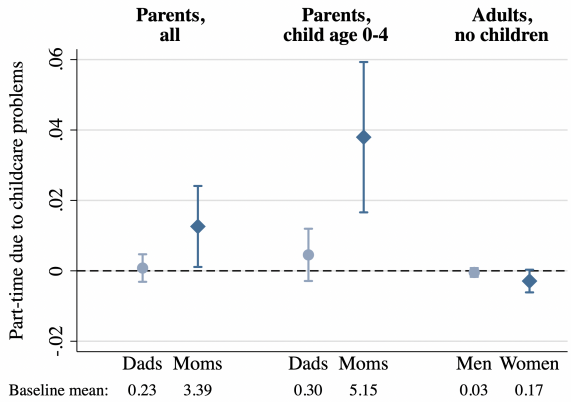
[10]One limitation of our measure of snowfall is that snow is not distributed randomly across the country—as such, a county that receives an additional inch of snowfall is more likely to be a county that possesses the necessary equipment or infrastructure to minimize the disruption caused by it. As an alternate experiment, we construct an indicator variable that captures whether a county experienced a *within-county* two-standard-deviation or higher monthly snowfall total. Results in Figure A.III exhibit a similar qualitative pattern of our baseline findings but with sensibly much larger magnitudes.

Figure 1: Baseline results

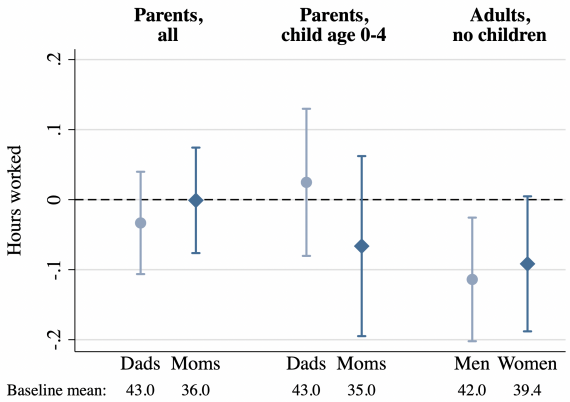
(a) Hours worked, snow exposure



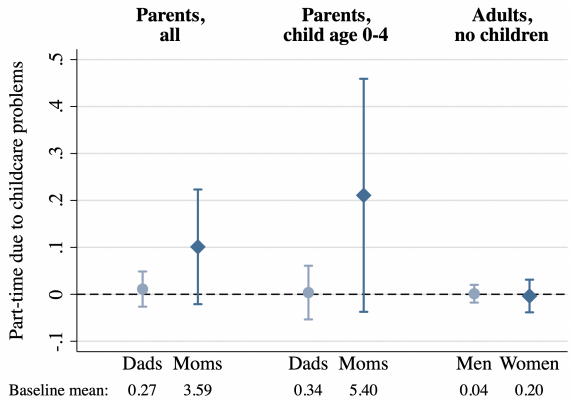
(b) Part-time due to childcare, snow exposure



(c) Hours worked, illness exposure



(d) Part-time due to childcare, illness exposure



Notes: Figures present estimates of δ from Equation 1 for indicated dependent variables and samples along with 95% confidence intervals. Parents, child age 0-4, defined as fathers or mothers with at least one own child age less than 5 present in the household. Data from 2000-2019 waves of the Current Population Survey, restricted to employed household heads and spouses of household heads age 20-45 in survey months September through May. Part-time work defined as working positive but fewer than 35 hours in previous week. Snow measured in inches of accumulation in relevant county-month. Illness measured in deaths per 100,000 residents due to flu or pneumonia-related reasons in relevant county-month. See text for details.

Our results also pass several face validity and placebo tests. For instance, we find that increased snowfall makes all CPS respondents more likely to miss work due to weather-related problems with limited heterogeneity by sex (Figure A.IIb), and the effects of increased flu mortality on missing work due to one's own illness follow a qualitatively similar pattern (Figure A.IId). Moreover, the effects of our treatments on the labor supply of CPS respondents *without children* show either negligible heterogeneity by sex or larger effects for men, such that an alternative empirical approach that estimated impacts on mothers by "differencing out" the effects for men and women without children would either maintain or increase our baseline point estimates.[11]

We consider additional placebo tests in Table A.IV, where we estimate Equation 1 for the outcome variables of *usual* (as opposed to actual) weekly hours worked and an indicator for the respondent being *absent* from work (that is, missing work entirely) in the previous week due to childcare problems. Significant associations between our treatment variables and usual weekly hours would raise concerns that our baseline estimates are in fact either detecting a spurious relationship or are contaminated by omitted variable bias, while the near-zero frequency of absence from work due to childcare problems observed in Table A.I suggests that we should anticipate null effects for this outcome variable as well. Reassuringly, we obtain nearly exclusively insignificant (either statistically or substantively) estimates for both placebo outcome variables, and we also sensibly find that increased snow is not strongly associated with missing work due to illness, nor is flu exposure associated with missing work due to weather.

An exception to these placebo null findings is the impact of flu exposure to usual hours worked, which exhibits a negative and noisy association. This finding, along with the noisier baseline estimates of flu exposure on maternal labor supply, guides our decision to direct our focus to the weather-related results going forward. We consider more stringent specifications for the weather-related disruptions in Table A.V, where we include either year-by-month or state-by-year fixed effects in our estimating equation, thereby substantially limiting our identifying variation to within-month-cross-county or cross-month-within-county differences

[11] We also note that we would not necessarily expect the impacts of increased exposure to snow or illness on hours worked for individuals without children to be zero, since they, too, may be influenced by weather or sickness-related disruptions. Indeed, in some cases the estimated magnitudes are *larger* for individuals without children, potentially pointing to their labor supply being slightly more elastic in response to inconveniences than parents. Flu exposure in particular may increase demands for informal care for elderly parents — while these obligations, too, tend to be gendered in nature (Mommaerts, 2025), there is less reason to expect that this heterogeneity would be stronger for parents than childless individuals.

in treatment. Even with this limited source of identifying variation, we find similar results to our baseline estimates.

3.2 Heterogeneity

We next investigate heterogeneity in the impacts of weather-related childcare disruptions on labor supply over household structure and maternal characteristics. The results of these analyses are presented in Figure 2. For all analyses, we focus on mothers with at least one child under the age of five, as this was the subgroup for whom we identified the largest impacts on Section 3.1.

First, contemporaneous impacts of increased snow on labor supply appear to be concentrated among married mothers. These findings are consistent with several possible explanations, such as the opportunity cost of taking time off work being lower when there are multiple earners in the household. In order to distinguish this story from one of married women taking time off work more specifically because they earn less than their spouses, we stratify married women over whether they had higher wage income[12] than their spouses in the previous year. We find no clear pattern of heterogeneity, suggesting that the impacts we find among married women may be more gendered in nature as opposed to arising from economic comparative advantage.

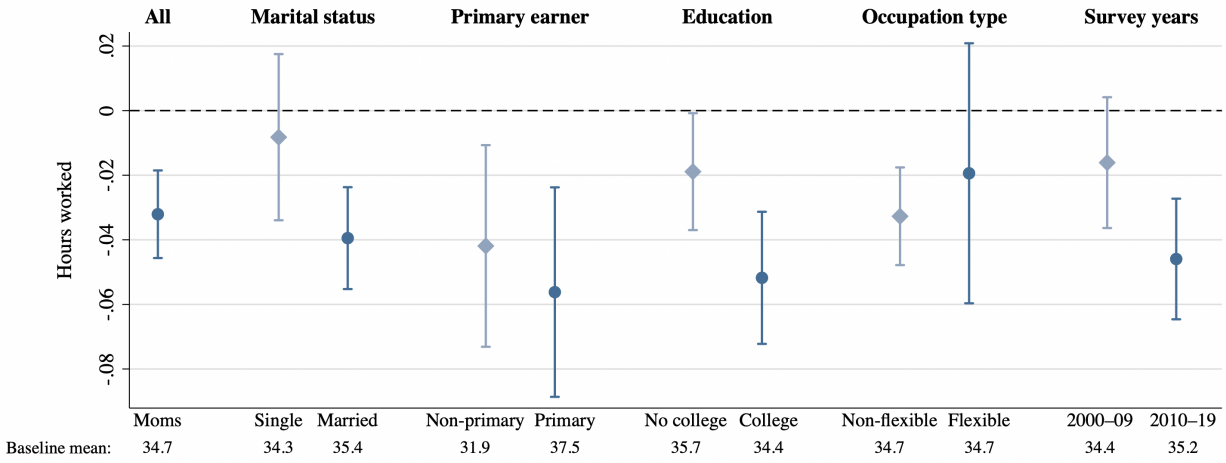
Next, we consider whether impacts differ by maternal human capital or occupational characteristics. We find no consistent patterns of heterogeneity when looking at the impacts of snow exposure on college graduates vs. non-graduates. We then construct a measure of occupational flexibility using the 2001 and 2004 CPS Work Schedules Supplements, which asks respondents a vector of questions regarding their work schedules, such as regularity, flexibility, and whether they work from home. We compute a simple measure of flexibility by calculating the share of respondents in a given occupation who report having the ability to vary when they begin and end the work day. We categorize an occupation as "flexible" if the share of respondents who report having such flexibility is 0.5 or greater.[13] We find patterns that indicate, albeit noisily, that the impacts of potential childcare disruptions are greater for mothers working in occupations that have less flexibility in their working hours.

[12] Available for respondents of the CPS Annual Social and Economic Supplement, administered in March.

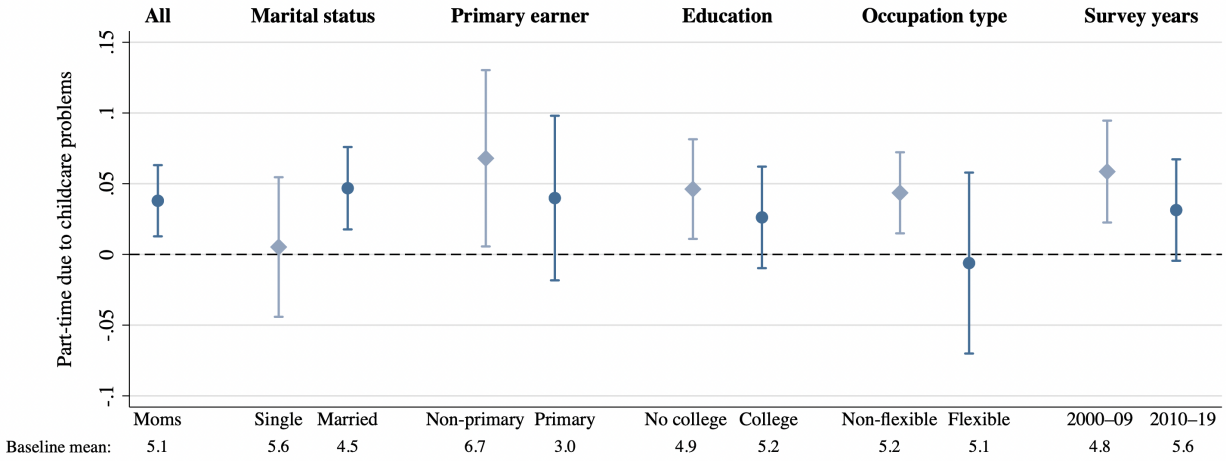
[13] Distributionally, this corresponds to being in approximately the top quintile in terms of flexibility across occupations. We require occupations to have at least 10 respondents working in them to be included in our measure. We present the 10 least- and most-flexible occupations in Table A.VI to demonstrate the face validity of our measure: the least flexible occupations tend to be various types of machine operators, while salesmen, authors, and clergy are placed among the most flexible occupations.

Figure 2: Heterogeneity among mothers for impact of additional inch of snowfall

(a) Hours worked for mothers, snow exposure



(b) Part-time due to childcare for mothers, snow exposure



Notes: Figure presents estimates of δ for indicated subgroups of mothers of children age less than 5 in the CPS along with 95% confidence intervals. Data from 2000-2019 waves of the Current Population Survey, restricted to survey months September through May. Part-time work defined as working positive but fewer than 35 hours in previous week. Primary earner status defined for married mothers as having the highest wage/salary income among household members in the previous year. Snow measured in inches of accumulation in relevant county-month. Flexible occupation defined as occupations for which at least 50% of individuals in CPS work schedules supplement reported having flexible start times. See text for details.

As a final heterogeneity exercise, we test whether our impacts have changed over the course of the 21st century by separately estimating impacts in the 2000-2009 and the 2010-2019 window. We do not observe any clear or consistent patterns of heterogeneity across these two time periods, which provides some evidence that the gendered impacts we find are persistent and unlikely to go away on their own accord.

3.3 American Time Use Survey

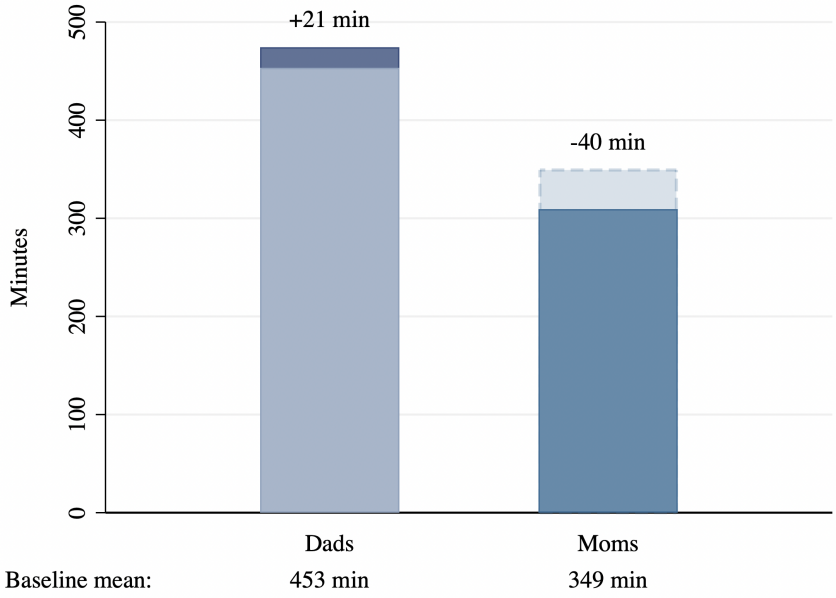
We have shown that increased snow exposure leads to mothers working less. To investigate time allocations more precisely than is possible in our CPS sample, we directly measure where mothers shift their time on any given day in response to extreme weather shocks to their local area. Using our sample from the ATUS, we build county-level indicators for a two-standard-deviation increase in snowfall above the county mean. We then estimate Equation 1, replacing the continuous measure of snowfall with this indicator for extreme weather. Due to the smaller sample size in the ATUS, we also use state fixed effects in place of county fixed effects. Figure 3 presents our main findings for the impact of severe within-county weather on parental time use.

Notably, mothers spend more time on childcare and less time working than fathers on average, even before severe disruptions. Weather-related disruptions exacerbate this disparity. In response to a two-standard-deviation increase in monthly snowfall from the county mean, mothers report significantly increasing their time spent on childcare by 32 minutes, a 10.5% increase from the baseline mean. At the same time, mothers significantly decrease their time spent working by 40 minutes, an 11.5% decrease from the baseline mean. This almost exact substitution of time points to mothers reducing time at work because of weather specifically due to childcare needs, rather than other weather-related issues. Fathers, by comparison, slightly increase their time spent working and decrease their time spent on childcare, although neither of these findings are significant.

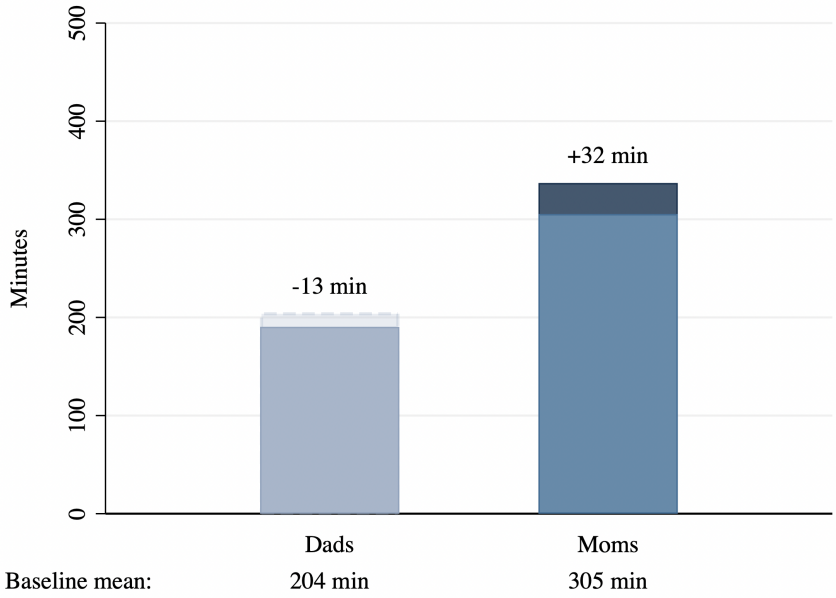
These differences are driven by disruptions to days when children are typically in childcare or school, and only exist for individuals with children: Figure A.IV shows no significant difference between mothers and fathers of the impact of severe disruptions on weekends. Additionally, there are no gender differences across individuals who do not have children. Taken together, these results confirm our findings in the CPS and show that childcare is the main driver behind the gendered responses to snow-related disruptions, and that the resulting burden can be substantial.

Figure 3: Impact of 2-SD snowfall on parental time use

(a) Daily minutes spent working



(b) Daily minutes spent on childcare



Notes: Figure presents estimates of parental time spent on work and childcare overall and the change in response to a within-county 2 standard deviation increase in monthly snowfall. Data from 2003-2019 waves of the American Time Use Survey, restricted to employed parents with own child in household. Childcare minutes include all time spent on both primary childcare (activity category 3) and secondary childcare (*SCC_ALL*); work minutes include all work-related activities (activity category 5); see text for details.

3.4 Broader Labor Market Impacts

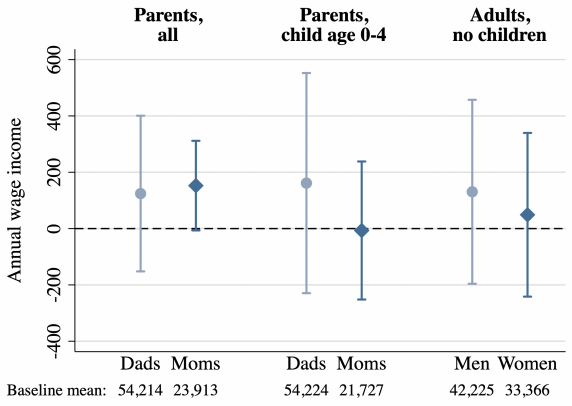
Our results above demonstrate that increased exposure to adverse weather or illness generates childcare disruptions that negatively impact the contemporaneous labor supply of mothers. Are these contemporaneous effects associated with longer-run impacts in labor supply and employment? To probe this question, we evaluate one-year-out impacts of increased exposure to the same sources of exogenous variation using CPS Annual Social and Economic Supplement (ASEC) data. This supplement, conducted yearly in March, asks additional questions that enable us to determine previous-year exposure to snow or illness and so estimate the downstream labor market impacts of potential childcare disruptions.

In particular, the ASEC asks respondents whether the respondent moved across counties in the previous year. We limit our sample as before to household heads and their spouses aged 20 to 45 and then restrict our sample further to individuals who made no such move so that their current county of residence identifies their county from one year ago. We then regress labor market outcomes that are less likely to immediately respond to childcare disruptions — including wage income in the previous year, employment status, usual hours worked weekly, and hourly wage — on the county's exposure to snow in the *previous year*, which we define as total *feet* of snowfall in the previous calendar year's school year. Conceptually, these tests are intended to focus less on the immediate impacts of childcare disruption and more on whether potential childcare disruptions in the past have measurable impacts on labor market outcomes in the present.

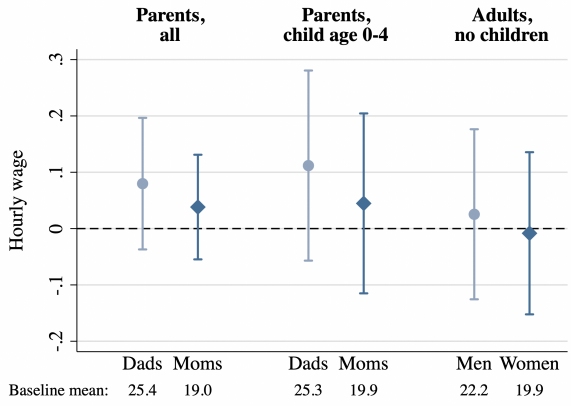
The results of this exercise are presented in Figure 4, with the headline finding being that we do not detect any statistically or substantively significant impacts of potential childcare disruptions on labor market outcomes one year after they happen. Virtually all estimated impacts for previous-year snowfall are either statistically insignificant or do not exhibit meaningful heterogeneity by sex, and even the few coefficients we estimate with some statistical significance are small in magnitude and typically rule out large effect sizes in either direction. For instance, the positive coefficient for mothers in Figure 4d indicates that an additional foot of snow (roughly 0.5 SD) in the previous year raises the usual weekly time spent working among mothers by approximately five minutes.

Figure 4: (Lack of) Downstream labor market impacts of snowfall

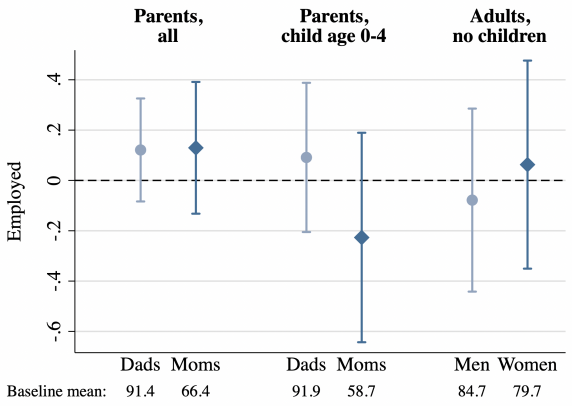
(a) Annual wage income



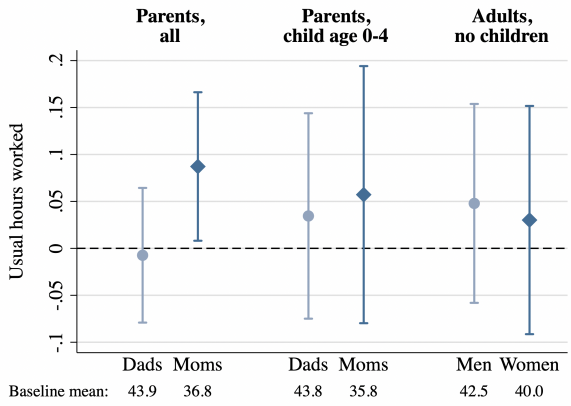
(b) Hourly wage



(c) Employed



(d) Usual weekly hours



Notes: Figures present estimates of δ from Equation 1 for indicated dependent variables and samples along with 95% confidence intervals. Parents, child age 0-4, defined as fathers or mothers with at least one own child age less than 5 present in the household. Data from 2000-2019 waves of the Current Population Survey ASEC Supplement, restricted to employed household heads and spouses of household heads age 20-45. Snow measured in feet of accumulation in relevant county in the previous September-May period. See text for details.

One potential reason for why high snowfall levels in preceding years may not manifest in contemporaneous labor market impacts is that parents in snowier areas, anticipating potential future childcare disruptions, could adjust their labor supply or the types of jobs they work in anticipation of these disruptions. As a final exercise, we explore whether living in areas with higher average annual snowfall is associated with labor supply adjustments along either the extensive or intensive margin. Specifically, we take our baseline CPS sample and estimate:

$$Y_{ictm} = \lambda_{s(c)} + \tau_t + \gamma_m + \boldsymbol{\beta}_1 \boldsymbol{X_i} + \boldsymbol{\beta}_2 \boldsymbol{X_{ct}} + \delta T_c + \varepsilon_{ictm}, \tag{2}$$

where year and month fixed effects τ_t and γ_m are defined as before, along with individual-level controls $\boldsymbol{X_i}$. However, $\lambda_{s(c)}$ now represent state-level fixed effects, and the main independent variable of interest, T_c, now corresponds to average annual snowfall (in feet) at the county level.

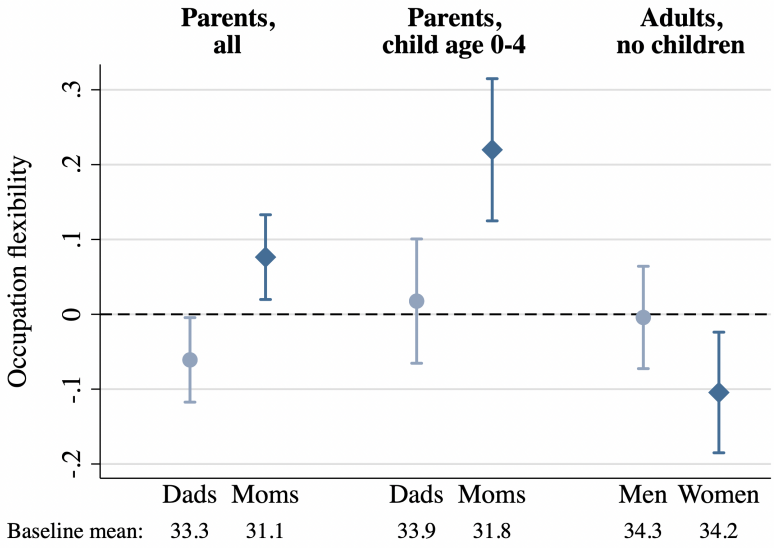
The main limitation of this specification is that, with average county snowfall as the independent variable of interest, we are no longer able to include a county fixed effect in the regression. In addition to the state-level fixed effect,[14] we attempt to address this limitation by including a rich vector of time-varying county characteristics $\boldsymbol{X_{ct}}$, including county-year level rates of poverty and unemployment, median income, two-digit sectoral employment shares (Eckert et al., 2020), and indicator variables for varying levels of rurality. Nonetheless, we emphasize that the results from this exercise are best interpreted as correlative as opposed to causal.

Turning to the results, we first find null associations between average snowfall and labor supply among mothers at the extensive margin — Figure A.V demonstrates that, among both mothers overall and mothers of young children, higher annual snowfall has no apparent influence on rates of employment or labor force participation. While the correlation between snowfall and usual weekly hours is negative and statistically significant, it is also quite small in magnitude: for mothers of young children, an additional foot of average annual snowfall ($\sim$0.5 SD) is associated with a reduction in time spent working of roughly 10 minutes per week.

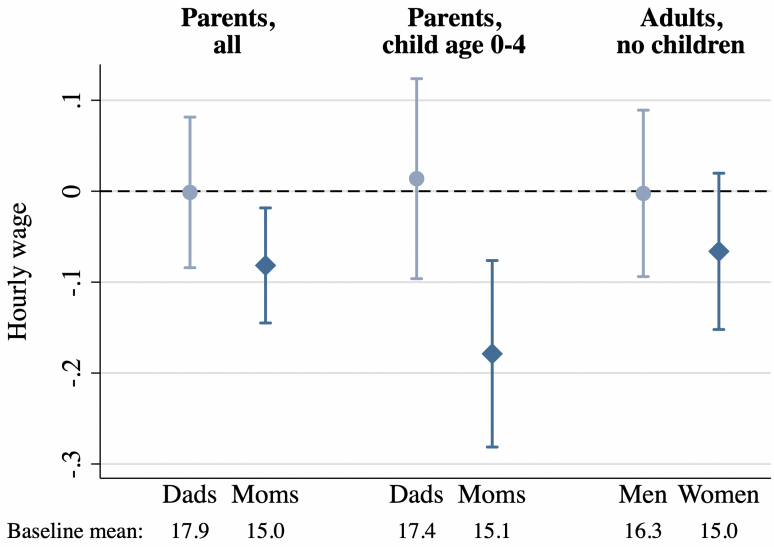
[14] The state-level fixed effects may raise concerns that we limiting the source of variation to states that have meaningful within-state elevation differences, such as California or Colorado. We obtain similar quantitative and qualitative patterns when instead including fixed effects for the nine Census Divisions, which allows us to utilize cross-state variation in snowfall while staying in reasonably demographically and socioeconomically consistent areas — see Figure A.VI.

Figure 5: Associations between job characteristics and average annual snowfall

(a) Occupation flexibility



(b) Hourly wage



Notes: Figures present estimates of δ from Equation 2 for indicated dependent variables and samples along with 95% confidence intervals. Parents, child age 0-4, defined as fathers or mothers with at least one own child age less than 5 present in the household. Data from 2000-2019 waves of the Current Population Survey, restricted to employed household heads and spouses of household heads age 20-45. Occupation flexibility defined by share of respondents in CPS work schedules supplement who report having flexible start times. Snow measured in average annual feet of accumulation in the relevant county. See text for details.

A different picture emerges when looking at the association between average snowfall and the *types* of jobs worked among working parents, presented in Figure 5. First, in Figure 5a, we observe that mothers in counties with higher average snowfall tend to work in more flexible occupations, with flexibility defined as before in Section 3.2. Notably, this association does not exist for fathers in any capacity, nor does it appear for men or women without children (indeed, the gendered pattern of heterogeneity appears to go in the opposite direction for childless individuals).

Lastly, Figure 5b suggests that this substitution into more flexible occupations may also contribute to mothers earning lower hourly wages in locations with more snowfall — again, no such association exists for fathers, and the gendered pattern of heterogeneity is considerably stronger for the parents of young children than it is for childless individuals. To contextualize these estimates, we consider a simple exercise that involves moving between counties in the bottom decile of average annual snowfall (0 feet) to the top decile (3.5 feet). Extrapolating our coefficients, such a move would be expected to increase the gap in hourly wages between mothers and fathers by approximately 29 cents, which on a baseline hourly wage gap of roughly three dollars constitutes a 10 percent increase. A similar exercise for the parents of young children yields 68 cent increase in the hourly wage gap, which on a base gap of 2.2 dollars translates to a roughly 30 percent increase.

While this exercise is correlational, we take these results together as suggestive evidence that the well-known pattern of mothers shifting to higher-flexibility but lower-paying occupations may in part be due to anticipation of potential future childcare disruptions. However, we stress that a different specification (and likely different data) would be required to probe this association through a more causal lens.

4 Discussion and Conclusion

This paper adds to the ongoing effort to unpack the determinants of the labor market penalty that mothers experience by focusing on the impacts of childcare disruptions that virtually all parents face at one point or another: sick days and snow days. By combining data from the Current Population Survey with data on snowfall and flu-related mortality, all at the county-month level, we document that increased exposure to potential childcare disruptions results in contemporaneous decreases in labor supply that are strongly concentrated among mothers. Evidence from the American Time Use Survey shows that mothers decrease time spent on work and shift this time almost entirely towards childcare in response to severe

weather shocks. Additionally, we find suggestive evidence that maternal expectations about future childcare disruptions may contribute towards their selection into more flexible and lower-paying employment, which we view as a promising avenue for further inquiry.

While reliable childcare and schooling encourage maternal labor force participation, these two systems alone are not sufficient to close the existing gender gap in the labor market. Unexpected caretaking responsibilities, which are not covered by these systems, fall disproportionately on mothers. Related policies, such as paid sick time or flexible work arrangements, ought to take these factors into consideration if they are intended to increase equity in the labor market. Given that even temporary absences are costly, with worker absenteeism leading to losses in both wages (Herrmann and Rockoff, 2012), labor productivity (Pauly et al., 2002) and potential reductions in career advancement (Chadi and Goerke, 2018), further study into how the effects of illness and especially weather-related disruptions "accumulate" over time may be worthwhile.

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A Supplementary Tables and Figures

Table A.I: Summary statistics of CPS sample

SAMPLE	All	Men, No Kids	Women, No Kids	Fathers, All	Mothers, All	Fathers, Kid < 5yo	Mothers, Kid < 5yo
VARIABLE							
Age	34.8	32.6	32.0	36.7	36.2	34.2	32.4
	(6.7)	(6.9)	(7.1)	(5.7)	(6.1)	(5.5)	(5.6)
White (%)	76.9	77.3	75.5	80.4	73.9	80.1	74.2
	(42.2)	(41.9)	(43.0)	(39.7)	(43.9)	(39.9)	(43.7)
Black (%)	12.9	12.3	13.7	9.7	16.1	9.2	15.1
	(33.5)	(32.9)	(34.4)	(29.5)	(36.7)	(28.8)	(35.8)
Hispanic (%) 21.0	18.0	13.2	26.6	22.2	26.9	21.7	
	(40.7)	(38.4)	(33.9)	(44.2)	(41.6)	(44.3)	(41.2)
College Degree (%)	40.3	41.9	53.3	35.5	36.2	39.9	43.5
	(49.0)	(49.3)	(49.9)	(47.9)	(48.0)	(49.0)	(49.6)
Hours worked last week	39.1	41.0	38.2	42.5	34.5	42.4	32.7
	(13.4)	(13.2)	(12.9)	(12.5)	(13.4)	(12.7)	(14.4)
Part-time last week (%)	18.9	14.4	20.6	10.6	29.7	11.2	32.5
	(39.1)	(35.1)	(40.4)	(30.8)	(45.7)	(31.5)	(46.8)
Due to weather	0.4	0.4	0.2	0.5	0.3	0.5	0.3
	(6.0)	(6.2)	(4.9)	(7.0)	(5.1)	(7.2)	(5.0)
Due to illness	1.4	1.2	1.7	1.1	1.7	1.1	1.7
	(11.8)	(10.7)	(13.0)	(10.4)	(13.0)	(10.4)	(12.9)
Due to childcare problems	1.1	0.0	0.2	0.2	3.4	0.3	5.1
	(10.5)	(1.9)	(4.3)	(4.9)	(18.1)	(5.6)	(22.1)
Absent from work last week (%)	2.7	2.2	2.6	2.0	4.0	2.1	6.1
	(16.3)	(14.6)	(16.0)	(14.0)	(19.5)	(14.3)	(24.0)
Due to weather	0.1	0.1	0.0	0.1	0.0	0.1	0.0
	(2.8)	(2.9)	(1.5)	(3.7)	(2.2)	(3.5)	(2.1)
Due to illness	0.5	0.4	0.5	0.4	0.7	0.4	0.7
	(7.3)	(6.5)	(7.3)	(6.5)	(8.5)	(6.2)	(8.1)
Due to childcare problems	0.0	0.0	0.0	0.0	0.1	0.0	0.2
	(1.9)	(0.6)	(0.9)	(1.2)	(3.1)	(1.4)	(4.3)
N	1886731	421013	341266	547791	576661	270649	220555

Notes: Means for each variable presented above with standard deviations included in parentheses. Data from 2000-2019 waves of the Current Population Survey in months September through May. Data restricted to employed household heads and spouses of household heads age 20-45; see text for details. Absence from work defined as working zero hours in previous week. Part-time work defined as working positive but fewer than 35 hours in previous week. Mothers and fathers with kid under 5 are defined as fathers or mothers with at least one own child age less than 5 present in the household.

Table A.II: Summary statistics of ATUS sample

	Parents, weekdays		Parents, weekends		No kids, weekdays	
	Dads	Moms	Dads	Moms	Men	Women
Age	40.3	38.4	39.9	38.5	41.7	42.9
	(6.3)	(6.0)	(6.3)	(6.1)	(6.6)	(6.7)
Married (%)	95.0	75.0	94.1	74.4	47.8	46.9
	(14.9)	(11.8)	(14.8)	(11.7)	(7.5)	(7.4)
College Degree (%)	40.1	42.3	42.4	41.6	35.8	38.7
	(6.4)	(6.7)	(6.7)	(6.6)	(5.7)	(6.1)
Black (%)	8.9	15.3	9.3	14.9	11.9	12.4
	(1.5)	(2.5)	(1.6)	(2.4)	(1.9)	(2.0)
White (%)	82.4	76.3	82.4	75.5	81.1	80.0
	(13.0)	(12.0)	(13.0)	(11.9)	(12.8)	(12.6)
Time spent on childcare (minutes)	203.7	305.3	434.0	467.7	10.7	23.3
	(32.3)	(48.2)	(68.5)	(73.8)	(1.8)	(4.0)
Time spent on work (minutes)	453.3	349.2	121.0	88.9	406.1	362.9
	(71.4)	(55.0)	(19.5)	(14.4)	(64.0)	(57.2)
N	4097	4524	4182	4522	5286	5334

Notes: Means for each variable presented above with standard deviations included in parentheses. Data from 2003-2019 waves of the American Time Use Survey in months September through May, restricted to employed individuals. Data for parents restricted to individuals with own child under the age of 18 in household. Childcare minutes include all time spent on both primary childcare (activity category 3) and secondary childcare (SCC ALL); work minutes include all work-related activities (activity category 5); see text for details.

Table A.III: Interactions with number of children of various ages

VARIABLES	(1) Hours Worked	(2) Part-Time for Childcare
Inches of Snow	0.115	-0.072
	(0.009)	(0.013)
Snow X # Children 0-5	-0.108	0.099
	(0.006)	(0.009)
Snow X # Children 6-11	-0.074	0.047
	(0.005)	(0.007)
Snow X # Children 12-18	-0.025	-0.011
	(0.005)	(0.007)

Notes: Table presents estimates of impacts of snowfall on indicated dependent variables of interest as well as interactions with number of own children in household age 0-5, 6-11, and 12-18. Robust standard errors in parentheses. Data for mothers in 2000-2019 waves of the Current Population Survey, restricted to employed household heads and spouses of household heads age 20-45 in survey months September through May. Part-time work defined as working positive but fewer than 35 hours in previous week. Snow measured in inches of accumulation in relevant county-month. See text for details.

Table A.IV: Placebo tests

Panel A: Effects of increased snow

SAMPLE	All	Men, No Kids	Women, No Kids	Fathers, All	Mothers, All	Fathers, Kid < 5yo	Mothers, Kid < 5yo
VARIABLE							
Usual hours worked weekly	-0.004	-0.004	-0.006	-0.001	-0.001	-0.007	-0.012
	(0.002)	(0.004)	(0.004)	(0.003)	(0.004)	(0.005)	(0.006)
Part-time for own sickness	-0.007	-0.006	-0.010	-0.005	-0.009	-0.003	-0.005
	(0.002)	(0.004)	(0.006)	(0.003)	(0.004)	(0.005)	(0.007)
Absent due to childcare	0.000	0.000	0.000	0.000	0.001	0.000	0.002
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.003)

Panel B: Effects of increased illness

VARIABLE							
Usual hours worked weekly	-0.027	-0.055	-0.070	-0.001	-0.017	0.020	-0.098
	(0.019)	(0.040)	(0.044)	(0.032)	(0.035)	(0.046)	(0.060)
Part time for weather	-0.006	0.003	-0.019	0.014	-0.025	0.012	-0.006
	(0.012)	(0.027)	(0.022)	(0.026)	(0.016)	(0.038)	(0.026)
Absent due to childcare	0.003	0.000	-0.006	0.003	0.008	0.001	-0.011
	(0.004)	(0.001)	(0.003)	(0.003)	(0.012)	(0.005)	(0.023)

Notes: Table presents estimates of δ from Equation 1 for indicated dependent variables and samples. Robust standard errors in parentheses. Mothers and fathers with kid under 5 defined as fathers or mothers with at least one own child age less than 5 present in the household. Data from 2000-2019 waves of the Current Population Survey, restricted to employed household heads and spouses of household heads age 20-45 in survey months September through May. Absence from work defined as working exactly zero hours in the previous week. Snow measured in inches of accumulation in relevant county-month. Illness measured in deaths per 100,000 residents due to flu or pneumonia-related reasons in relevant county-month. See text for details.

Table A.V: Robustness to alternate fixed effects structures

Panel A: Year and Month FE (Baseline)

SAMPLE	All	Men, No Kids	Women, No Kids	Fathers, All	Mothers, All	Fathers, Kid < 5yo	Mothers, Kid < 5yo
VARIABLE							
Hours worked last week	-0.018 (0.002)	-0.023 (0.005)	-0.023 (0.005)	-0.009 (0.004)	-0.016 (0.004)	-0.013 (0.006)	-0.032 (0.007)
Part-time for childcare	0.004 (0.002)	0.000 (0.001)	-0.003 (0.002)	0.001 (0.002)	0.013 (0.006)	0.005 (0.003)	0.038 (0.013)

Panel B: Year-by-Month FE

SAMPLE	All	Men, No Kids	Women, No Kids	Fathers, All	Mothers, All	Fathers, Kid < 5yo	Mothers, Kid < 5yo
VARIABLE							
Hours worked last week	-0.013 (0.002)	-0.014 (0.005)	-0.019 (0.005)	-0.005 (0.004)	-0.012 (0.004)	-0.008 (0.006)	-0.030 (0.007)
Part-time for childcare	0.004 (0.002)	0.000 (0.001)	-0.003 (0.002)	0.000 (0.002)	0.014 (0.007)	0.005 (0.003)	0.045 (0.013)

Panel C: State-by-Year and Month FE

SAMPLE	All	Men, No Kids	Women, No Kids	Fathers, All	Mothers, All	Fathers, Kid < 5yo	Mothers, Kid < 5yo
VARIABLE							
Hours worked last week	-0.019 (0.002)	-0.024 (0.005)	-0.023 (0.005)	-0.011 (0.004)	-0.016 (0.004)	-0.014 (0.006)	-0.035 (0.007)
Part-time for childcare	0.003 (0.002)	0.000 (0.001)	-0.003 (0.002)	0.001 (0.002)	0.009 (0.007)	0.005 (0.003)	0.033 (0.013)

Notes: Table presents estimates of δ from Equation 1 for indicated dependent variables, samples, and fixed effects structures. Robust standard errors in parentheses. Mothers and fathers with kid under 5 defined as fathers or mothers with at least one own child age less than 5 present in the household. Data from 2000-2019 waves of the Current Population Survey, restricted to employed household heads and spouses of household heads age 20-45 in survey months September through May. Part-time work defined as working positive but fewer than 35 hours in previous week. Snow measured in inches of accumulation in relevant county-month. Illness measured in deaths per 100,000 residents due to flu or pneumonia-related reasons in relevant county-month. See text for details.

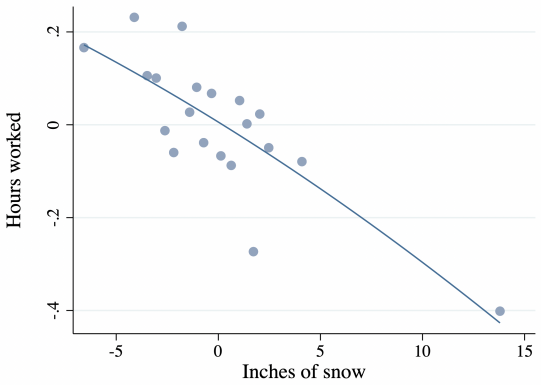
Table A.VI: Occupational flexibility rankings

Occupation	Share w/ Flexible Start Time
Least Flexible Occupations	0.00
Mining operators	0.00
Crossing guards	0.00
Crane and tower operators	0.00
Electrician apprentices	0.00
Engine and other machine assemblers	0.00
Furnace, kiln, and oven operators	0.00
Power plant operators	0.00
Mining occupations, n.e.c.	0.00
Fabricating machine operators, n.e.c	0.00
Rail-track equipment operators	0.00
Most Flexible Occupations	
Engineer Sales	1.00
Clergy	0.89
Statisticians	0.89
Models and product promoters	0.88
Massage therapists	0.86
Astronomers and Physicists	0.86
Authors	0.85
Real estate brokers	0.83
Business and Commerce Teachers	0.82
Technical Writers	0.81

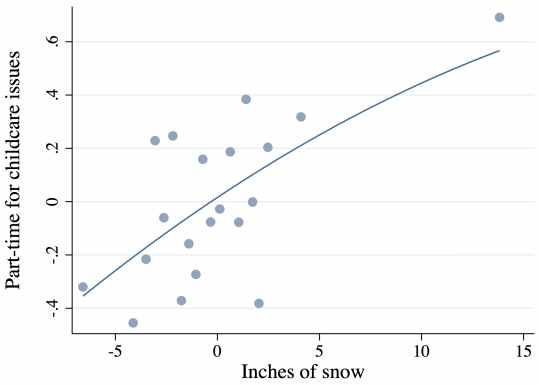
Notes: Table presents ten most/least flexible occupations, defined by share of respondents in occupation who report having flexible starting work times. Data from 2001 and 2004 waves of CPS work schedules supplement. Occupations must have at least 10 survey respondents working in them to be included in list. See text for details.

Figure A.I: Binned scatter plots of residualized dependent and independent variables

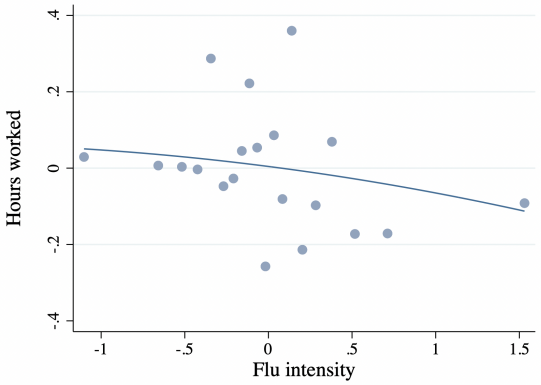
(a) Hours worked, snow exposure



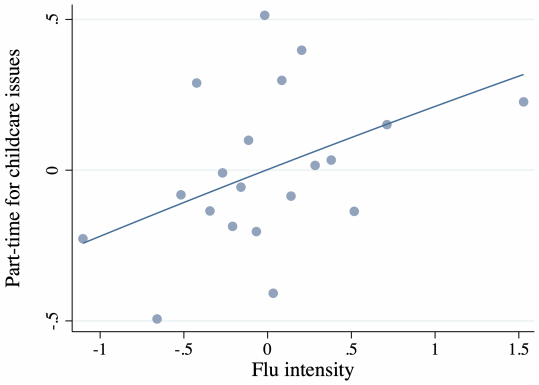
(b) Part-time for childcare, snow exposure



(c) Hours worked, illness exposure



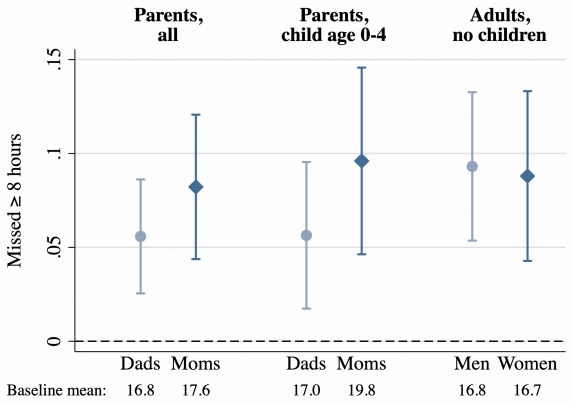
(d) Part-time for childcare, illness exposure



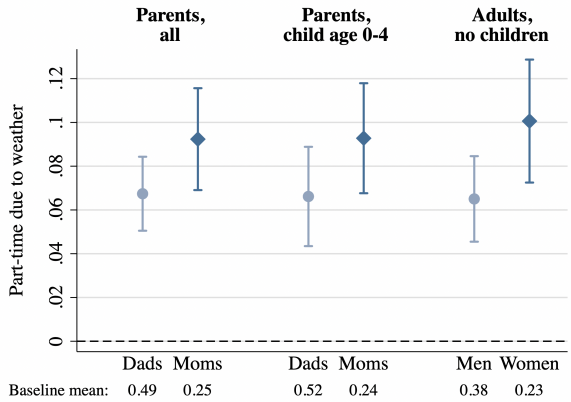
Notes: Figures present binned scatter plots of residualized dependent and independent variables with quadratic lines of best fit. Data for mothers of young children from 2000-2019 waves of the Current Population Survey, restricted to employed household heads and spouses of household heads age 20-45 in survey months September through May. Part-time work defined as working positive but fewer than 35 hours in previous week. Snow measured in inches of accumulation in relevant county-month. Illness measured in deaths per 100,000 residents due to flu or pneumonia-related reasons in relevant county-month. See text for details.

Figure A.II: Additional baseline results

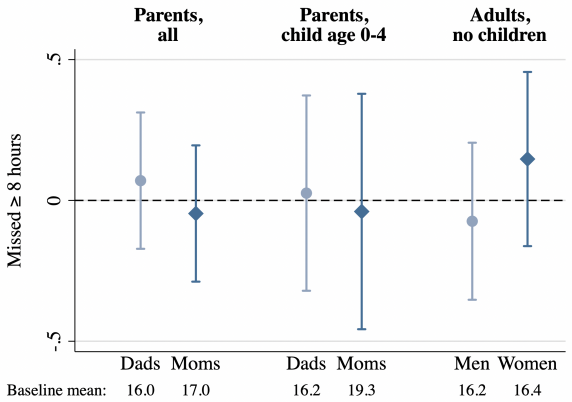
(a) Missed ≥8 hours, snow exposure



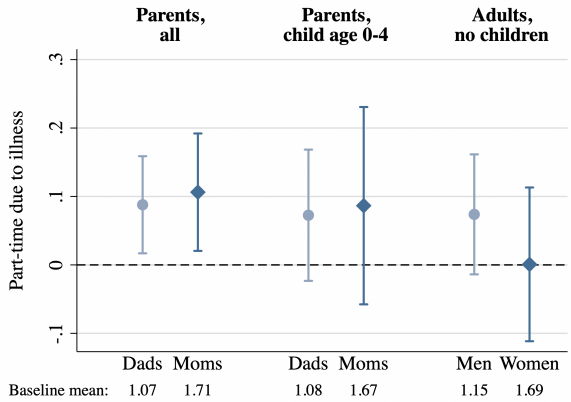
(b) Part-time for weather, snow exposure



(c) Missed ≥ 8 hours, illness exposure



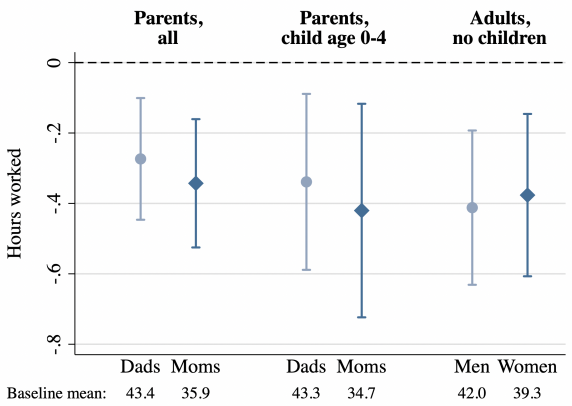
(d) Part-time for sickness, illness exposure



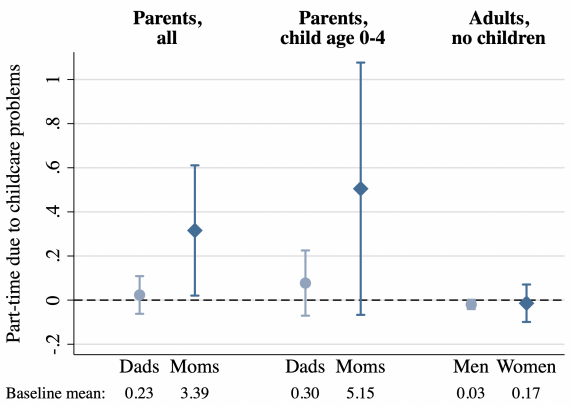
Notes: Figures present estimates of δ from Equation 1 for indicated dependent variables and samples along with 95% confidence intervals. Young fathers/mothers defined as fathers or mothers with at least one own child age less than 5 present in the household. Data from 2000-2019 waves of the Current Population Survey, restricted to employed household heads and spouses of household heads age 20-45 in survey months September through May. Part-time work defined as working positive but fewer than 35 hours in previous week. Snow measured in inches of accumulation in relevant county-month. Illness measured in deaths per 100,000 residents due to flu or pneumonia-related reasons in relevant county-month. See text for details.

Figure A.III: Baseline results — Effects of increased snow, 2-SD measure

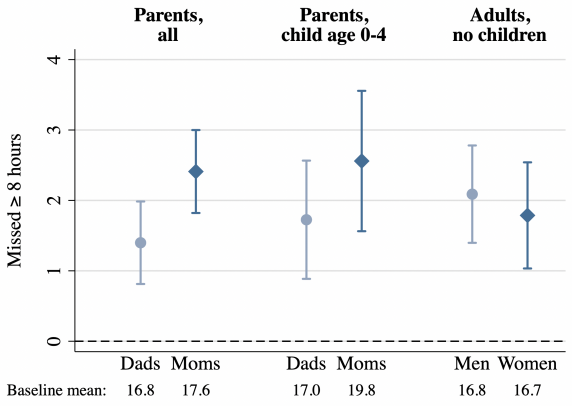
(a) Hours worked



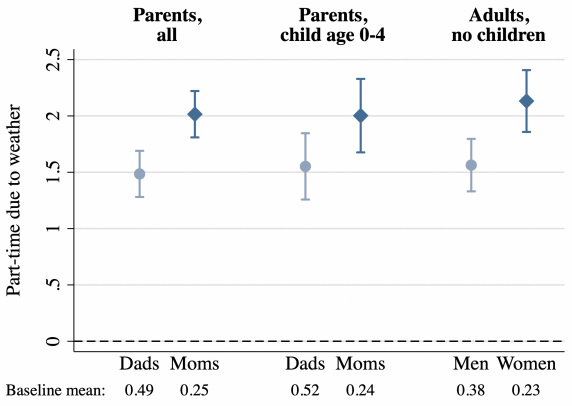
(b) Part-time for childcare problems



(c) Missed $\geq$ 8 hours



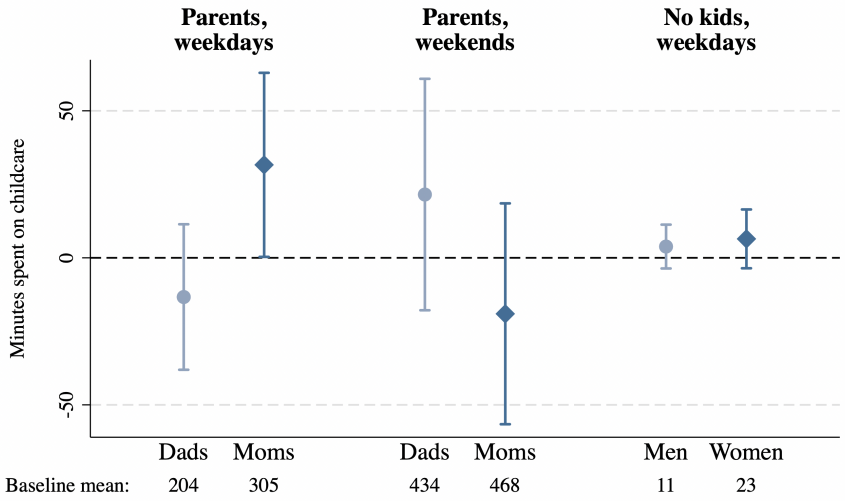
(d) Part-time for weather



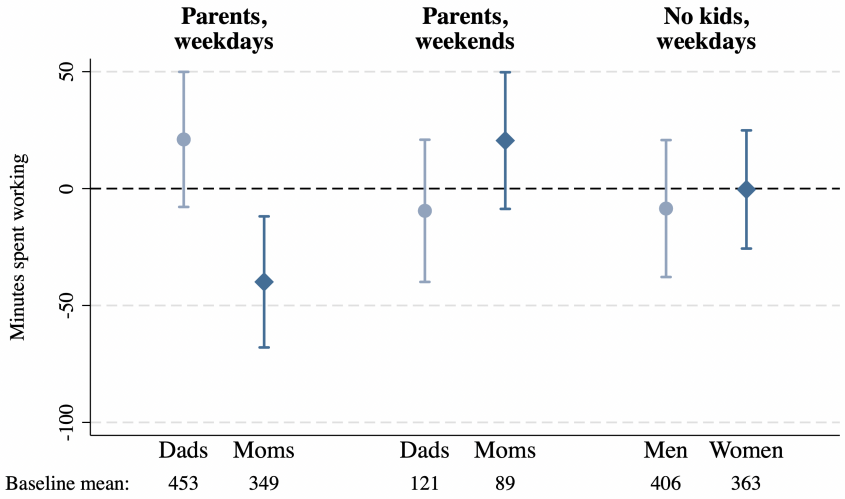
Notes: Figures present estimates of δ from Equation 1 for indicated dependent variables and samples along with 95% confidence intervals. Young fathers/mothers defined as fathers or mothers with at least one own child age less than 5 present in the household. Data from 2000-2019 waves of the Current Population Survey, restricted to employed household heads and spouses of household heads age 20-45 in survey months September through May. Part-time work defined as working positive but fewer than 35 hours in previous week. Treatment is an indicator for a within-county two-standard deviation snowfall. See text for details.

Figure A.IV: Validation comparisons for parental time use changes

(a) Impact of 2-SD snowfall on minutes spent on childcare



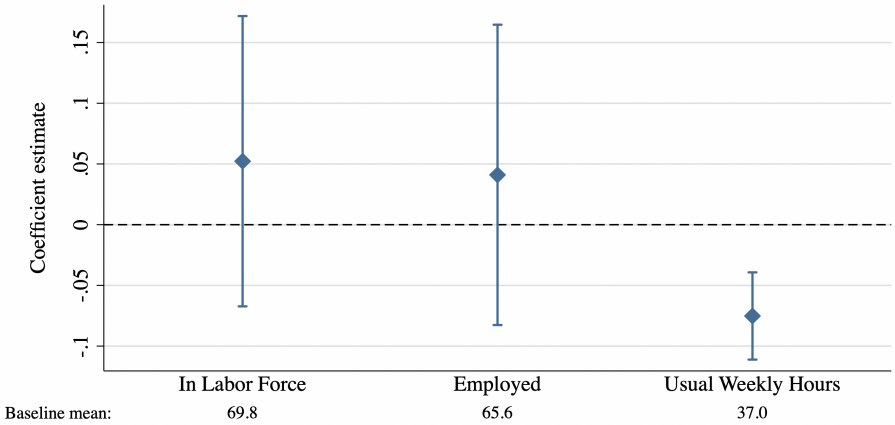
(b) Impact of 2-SD snowfall on minutes spent working



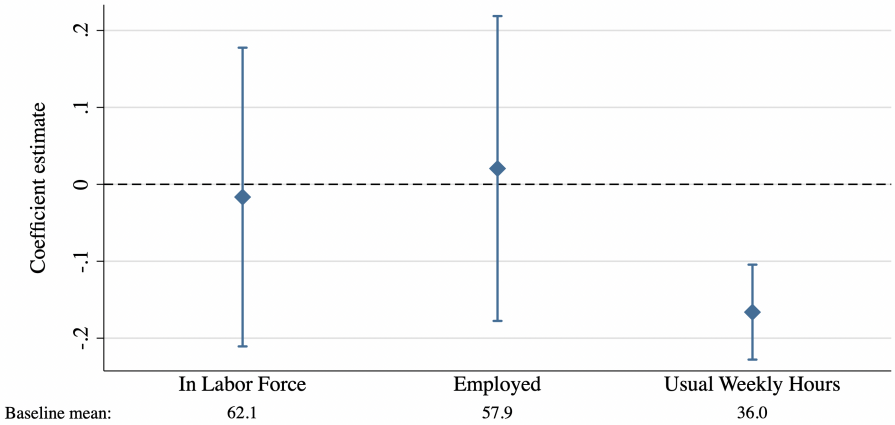
Notes: Figures present validation comparisons for the estimated change in time spent on childcare and work presented in Figure 3. Comparison groups are parents on weekends and non-parents. Estimates and confidence intervals are measured as the response to a within-county 2 standard deviation increase in monthly snowfall. Data from 2003-2019 waves of the American Time Use Survery, restricted to employed individuals. Childcare minutes include all time spent on both primary childcare (activity category 3) and secondary childcare (*SCC_ALL*); work minutes include all work-related activities (activity category 5); see text for details.

Figure A.V: Labor supply and average annual snowfall among mothers

(a) Mothers



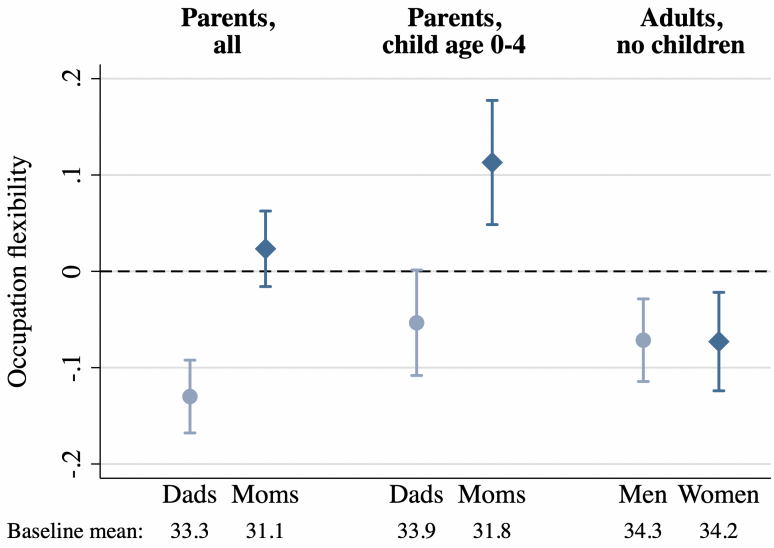
(b) Mothers, child age 0-4



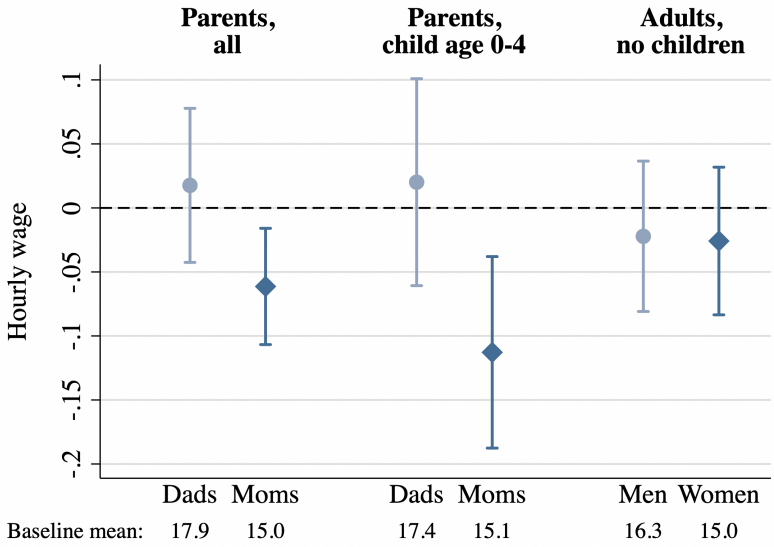
Notes: Figures present estimates of δ from Equation 2 for indicated dependent variables and samples along with 95% confidence intervals. Young mothers defined as mothers with at least one own child age less than 5 present in the household. Data from 2000-2019 waves of the Current Population Survey, restricted to employed household heads and spouses of household heads age 20-45. Snow measured in average annual feet of accumulation in the relevant county. See text for details.

Figure A.VI: Job characteristics and mean annual snowfall associations — Division FE

(a) Occupation flexibility



(b) Hourly wage



Notes: Figures present estimates of δ from Equation 2 for indicated dependent variables and samples along with 95% confidence intervals, using Census division fixed effects instead of the baseline state fixed effects. Young fathers/mothers defined as fathers or mothers with at least one own child age less than 5 present in the household. Data from 2000-2019 waves of the Current Population Survey, restricted to employed household heads and spouses of household heads age 20-45. Occupation flexibility defined by share of respondents in CPS work schedules supplement who report having flexible start times. Snow measured in average annual feet of accumulation in the relevant county. See text for details.