

Consequences of Routine Work-Schedule Instability for Worker Health and Well-Being

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Abstract

Research on precarious work and its consequences overwhelmingly focuses on the economic dimension of precarity, epitomized by low wages. But the rise in precarious work also involves a major shift in its temporal dimension, such that many workers now experience routine instability in their work schedules. This temporal instability represents a fundamental and under-appreciated manifestation of the risk shift from firms to workers. A lack of suitable existing data, however, has precluded investigation of how precarious scheduling practices affect workers' health and well-being. We use an innovative approach to collect survey data from a large and strategically selected segment of the U.S. workforce: hourly workers in the service sector. These data reveal that exposure to routine instability in work schedules is associated with psychological distress, poor sleep quality, and unhappiness. Low wages are also associated with these outcomes, but unstable and unpredictable schedules are much more strongly associated. Precarious schedules affect worker well-being in part through the mediating influence of household economic insecurity, yet a much larger proportion of the association is driven by work-life conflict. The temporal dimension of work is central to the experience of precarity and an important social determinant of well-being.

Keywords

inequality, employment, time, health, precarious work, insecurity, survey methods

From the 1970s through the 2010s, the U.S. labor market experienced a pronounced risk shift from employers to employees, characterized by an increase in job insecurity as well as retrenchment in employer-provided health insurance, retirement plans, and other fringe benefits (Cappelli 1999; Kalleberg 2009; Pugh 2015). During this period, U.S. workers experienced increasingly precarious employment and higher levels of economic insecurity (Hacker 2006; Jacoby 2001). At the same time, the social safety net became a less reliable and less sufficient source of fallback support for low-wage or unemployed workers, and household resources were further stretched by a rise in single-parent families (Breen 1997). Against this backdrop, the rise

in precarious employment could have major implications for workers' health and well-being (Kalleberg 2018). The dramatic increases in the disability, morbidity, and mortality of working-class and less educated U.S. men and women (Case and Deaton 2015; Montez and Berkman 2014; Sasson 2016; Zajacova and Montez 2017), although likely

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caused by a number of factors, is suggestive of the dire possible consequences of these transformations.

This rise in precarious employment—what Kalleberg (2009:2) calls “employment that is uncertain, unpredictable, and risky from the point of view of the worker”—is widespread, but it most dramatically affects workers in low-wage occupations. Precarity is complex and multifaceted, but key dimensions include low and stagnant wages and rising uncertainty about the amount and timing of work hours employers will offer from one week to the next. A great deal of research emphasizes low wages as a marker of precarity (Kalleberg 2011; Osterman and Shulman 2011), and policy debates often center on raising the minimum wage (Card and Krueger 1995; Cengiz et al. 2017; Dube, Lester, and Reich 2010; Neumark and Wascher 2007) or augmenting low wages with social safety-net benefits like the earned income tax credit (Cooper 2017; Hoynes 2017). The temporal dimension of employment relations—related to the predictability and stability of work hours—has received far less attention in research and policy domains. Yet, there are reasons to expect the temporal dimension of precarious employment could be at least as important as wages in shaping workers’ health and well-being.

The service sector represents a strategic site for examining the consequences of the risk shift for U.S. workers. In the service sector, which employs over 10 percent of all U.S. workers and contains the single largest concentration of low-wage workers (Osterman and Shulman 2011), employers’ drive toward the “efficient husbandry” of workers’ time (Thompson 1967) has been taken to a new extreme with the widespread use of “just-in-time” scheduling practices. Many service-sector employers use a combination of human resource management strategies to closely align staffing with demand (Lambert 2008; Rubery et al. 2005). Under this system, workers receive their weekly work schedules as little as a few days in advance, their scheduled work hours and work days may change substantially week-to-week, and their shifts

may be changed, canceled, or added at the last minute (Appelbaum, Bernhardt, and Murnane 2003; Clawson and Gerstel 2015; Golden 2001). Recent estimates suggest that nearly 90 percent of hourly retail workers experience some degree of instability (Lambert, Fugiel, and Henly 2014). It is no coincidence that the retail and food service sector has been the focus of recent regulatory efforts to address unstable schedules (Wolfe, Jones, and Cooper 2018).

Although a large body of theoretical and empirical research in sociology focuses on time as a fundamental component of everyday life (Zerubavel 1981), the literature on precarious work typically does not emphasize the temporal dimension to the same degree in either defining and describing precarious work or in proposing policy remedies (Capelli 1999; Kalleberg 2011). Nevertheless, reducing the precarity of work schedules has recently emerged as a new frontier in organizing campaigns and has been the objective of “secure scheduling” legislation passed in several cities and states over the past three years. Policymaking related to scheduling often comes on the heels of successful local minimum wage campaigns. Both avenues for reducing precarity—increasing wages or stabilizing schedules—could improve the health and well-being of lower-SES U.S. workers.

Yet research on the effects of wages on health is mixed, and evidence on the effects of routine uncertainty in work schedules is limited. Data sources containing information on both work scheduling and health outcomes are rare, and workers in low-wage unstable jobs are difficult to sample. There is a real lack of data with which to understand the connection between low wages, unpredictable and unstable work schedules, and workers’ health and well-being outcomes.

To fill this gap, we use an innovative survey method to collect data from hourly retail workers in the United States. Our study, The Shift Project, is unique in collecting detailed measures on routine uncertainty in work schedules as well as measures of worker and family health, social well-being, and household

financial security for a national sample of retail workers employed at large firms that are the subject of new regulatory efforts.

Our article makes several contributions to the literature on the consequences of precarious employment. First, we show that routine uncertainty about work time is a strong predictor of worker health and well-being. Second, we show that routine uncertainty in work schedules is even more strongly predictive of worker health and well-being than hourly wages are. Third, we demonstrate that routine uncertainty about work time affects health and well-being in part through an economic pathway, but even more dramatically owing to the work-life conflict it causes. Our findings strongly suggest that the temporal dimension of precarious work is an important social determinant of health and well-being deserving of greater attention, and our estimates provide important information to guide policymaking in this domain. Finally, we demonstrate the utility of an innovative survey recruitment technique and analytic tools that can be flexibly applied in other topic areas in which data are lacking.

RISING PRECARITY

Throughout the second half of the twentieth century and into the first decades of the twenty-first, a wave of neo-liberal policymaking led to the deregulation of industries, reduction in union power, and retrenchment of the safety net (Kalleberg 2009; Snyder 2016). At the same time, firms fundamentally re-oriented, shifting from a Fordist model of living wages and stable employment to a set of employment practices tailored to short-term profit-making and shareholder value maximization (Fligstein 1990, 2001). The new firm orientation fundamentally altered employment relations in ways that afford employers maximum flexibility to nimbly respond to market demands, while requiring workers to contend with work unpredictability and instability (Capelli 1999; Kalleberg 2011; Snyder 2016). Together, these complementary transformations of the state and the

firm transferred risk from institutional actors to individuals and households (Hacker 2006; Kalleberg 2009).

In the domain of labor and employment, these social forces have led to widespread employment precarity, with workers at the bottom of the income and occupational distribution faring the worst (Fligstein and Shin 2004). Scholars suggest that this transformation of employment and rising precarity is likely to have broad consequences for social life. Exposure to precarious work has been hypothesized to spill over to negatively affect workers' own health and well-being as well as that of their families (Benach et al. 2014; Kalleberg 2009). In this way, precarious work could play an important role in the stratification process, inhibiting both intra- and inter-generational mobility.

Despite fairly broad agreement that employment has become more precarious and more polarized, how to actually conceptualize and operationalize precarious work remains unsettled (Kalleberg 2018; Vosko, MacDonald, and Campbell 2009). A variety of overlapping typologies have been proposed, but a common denominator across typologies and geographies is the inclusion of wages as a key dimension of precarious employment (Blossfield et al. 2005; Frade, Darmon, and Laparra 2004; Rodgers and Rodgers 1989; Vosko 2006). In contrast, the temporal dimension of precarious work related to routine uncertainty in work schedules has played a less central role.

However, more recent empirical and conceptual work on precarious employment in the United States focuses on two dimensions of precarity: an economic dimension and a temporal dimension. This is reflected in Kalleberg's (2011) classification that distinguishes economic compensation from non-economic aspects of work, including pace and scheduling, as well as in Kalleberg's (2018) revised typology that defines precarious work as being "limited economically" and being "uncertain" with respect to work time and work scheduling. We see a similar emphasis on these two core dimensions of precarious work in Carré and Tilly's (2018) ambitious

cross-national study of retail work, in which they emphasize the dimensions of wages and work hours.

PRECARIOUS WAGES

Of these two key dimensions of precarious work, the economic has been the overwhelming focus of attention, especially with respect to wages (Kalleberg 2011). Indeed, in their influential book on job quality and high-road labor practices, Osterman and Shulman (2011:4) remark that “everyone agrees that wages are the most important feature of work.” Vosko (2006:49) similarly notes that “income is, arguably, the most important dimension of precarious employment.”

This focus on wages is evident in the voluminous literature that clearly shows the rising precarity manifest in stagnant wages for the bottom 50 percent of the income distribution. Economic growth led to fairly equal wage growth across the income distribution following World War II through the 1970s, but the next decades saw approximately zero growth in real wages for the bottom half of earners (Duncan and Murnane 2011; Mishel, Gould, and Bivens 2015).

The focus on wages is also seen in the literature in economics and policy analysis on the minimum wage. This literature documents the declining real value of the minimum wage since the 1980s (Bárány 2016), the political economy of the regulation of wages (Bartels 2016), and, perhaps most prominently, the debate over the employment effects of minimum wage increases (Card and Krueger 1995; Cengiz et al. 2017; Dube et al. 2010; Neumark and Wascher 2007).

That wages are low and stagnant, particularly in the large sector of the economy made up of retail trade and food service (Carré and Tilly 2018; Osterman and Shulman 2011), is in and of itself a measure of the severity of the problem of precarious work. However, scholars have also examined how wages matter for employee health and well-being. Here the literature is, perhaps surprisingly, quite equivocal with respect to the importance of wages.

One set of studies uses changes to the minimum wage as a way of identifying wage effects on health and well-being. Several of these studies find positive effects of wage increases on mental health (Reeves et al. 2017) and on subjective well-being (Flavin and Shufeldt 2016; Kuroki 2018). Other work finds heterogeneous effects, with positive effects on mental health confined to women (Horn, MacLean, and Strain 2017), and, in a study of teenagers, positive effects on health among white females and negative effects for Hispanic males (Averett, Smith, and Wang 2017). Still other work finds null or even negative effects of wage increases on health (Horn et al. 2017). Outside of the minimum wage effects literature, and focusing specifically on the retail sector, Maume, Sebastian, and Bardo (2009) analyze a sample of approximately 600 retail food workers employed at Kroger and find relatively weak associations between hourly wage and sleep quality.

Overall, wages are not as consistently predictive of lower-SES workers’ health and well-being as might be expected. But, wages are only one dimension of job quality valued by workers. Research shows that workers also place a premium on schedule predictability, which can be quantified in terms of wage trade-offs. One experimental study found that workers would take a 20 percent cut to wages in exchange for a job that provides one week of advance notice of work schedules (Mas and Pallais 2017). Along similar lines, using observational data from the Survey of Household Economic Decision-Making, the Federal Reserve (2018) found that half of workers would prefer a stable job over a variable one that paid “somewhat more,” and 40 percent of workers would take the stable job over a variable one that paid “a lot more.” These results are echoed in interviews with hourly workers who said “they would trade higher pay in positions with irregular schedules and short duration for lower paid positions with regular schedules” (Halpin and Smith 2017:352).

The economic dimension of precarious work has attracted the weight of attention in the scholarly literature. Wages matter in and

of themselves. However, taken together, studies of the effects of wages on well-being, as well as workers' willingness to trade wages for stability, point to the need to consider other dimensions of precarious work, in particular the temporal.

PRECARIOUS SCHEDULES

A rich theoretical literature has established the centrality of time—clock time, schedules, and “social” time—to the rhythm and patterns of everyday life and to well-being (Adam 1990; Zerubavel 1981). An appreciation of the temporal dimension of work is also evident in recent research in sociology and industrial relations that highlights work schedules as a source of inequality and disadvantage (Clawson and Gerstel 2015; Fuchs Epstein and Kalleberg 2001; Rubery et al. 2005). The literature on precarity has also begun to note the importance of work time in the experience of precarious work (Snyder 2016).

The shift to the industrial economy began an era in which many workers “clock in” and “clock out” and are paid for their time rather than for their output (Kalleberg 2009; Thompson 1967). When “time is currency,” as it is for workers paid by the hour, the regularity of schedules takes on heightened importance. In his seminal book *Hidden Rhythms*, Zerubavel (1981:8) described work time as usually taking place “at certain normatively prescribed standard hours” and extolled the benefits of regular and rigidly-patterned work time for allowing workers some protected time and the ability to plan. By the 2010s, however, regular and predictable work schedules had become increasingly rare (Lambert et al. 2014). Irregularity of work time is now common, and fewer workers are able to consistently protect their non-work time from the creeping demands of work (Lambert 2008; Rubery et al. 2005).

Work time constitutes a major portion of everyday life and thus has the potential to shape health and well-being. Basic health-related behaviors, such as diet, exercise, and sleep, require some semblance of control over

one's time and the ability to plan (Allen and Armstrong 2006; Fenwick and Tausig 2001, 2004; Zerubavel 1981). When predictability and control over work time are lacking, economic resources can sometimes buffer against ill effects—for example, outsourcing of domestic tasks can reduce role strain—and research shows that resources spent on time-saving services increase happiness (Whillans et al. 2017). Time is also central to quality of life and subjective well-being (Mogilner, Whillans, and Norton 2018).

The relationship between work time and health has received empirical attention with respect to non-standard work hours that encompass evenings, nights, early mornings, and weekends (Presser 1999). These non-standard work schedules interfere with circadian rhythms and are negatively associated with sleep quality (Costa 2003; Maume et al. 2009; Vogel et al. 2012; Wight, Raley, and Bianchi 2008). Non-standard work schedules are also associated with stress (Bara and Arber 2009), anxiety and irritability (Costa 2003), and reports of worse self-rated health and mental health (Cho 2017; Costa 2003; Fenwick and Tausig 2001, 2004; Knutsson 2003; Presser 2003; Rajaratnam and Arendt 2001).

Substantial scholarship has also focused on work time among professional white-collar workers and their struggles to balance work and care commitments (Galinsky, Sakai, and Wigton 2011; Schulte 2014). This work finds that professional workers often lack the necessary autonomy and control to shape their own work schedules (Kelly and Moen 2007; Kelly, Moen, and Tranby 2011), and this lack of schedule control has negative effects on health and well-being (Ala-Mursula et al. 2002; Marmot et al. 1997). Workplace experiments provide strong evidence that increasing control over work time causes reductions in work-family conflict, as well as reductions in stress and psychological distress and improvements in sleep, among other outcomes (Kelly et al. 2014; Moen et al. 2016; Olson et al. 2015). However, especially among white-collar workers, increased schedule control may lead to role-blurring by

allowing, and even obligating, workers to “take work home” (MacEachen, Polzer, and Clarke 2008; Schieman and Young 2010).

The cases of non-standard work shifts among low-income workers and schedule control among high-SES workers support the idea that work time is an important contributor to workers’ health and well-being. But, neither of these cases captures the temporal precarity of unstable and unpredictable work time, a “routine uncertainty” that is common among service-sector workers.

ROUTINE UNCERTAINTY IN WORK TIME

In the modern service sector, long-standing employer interests in maximizing control of labor and offloading risk onto workers have taken a new form with just-in-time scheduling practices (Lambert 2008; Rubery et al. 2005; Thompson 1967). Under this system, workers receive their weekly work schedules as little as a few days in advance, their scheduled work hours and work days may change substantially week-to-week, and they may be asked to work on-call or have their shifts changed, canceled, or added at the last minute (Appelbaum et al. 2003; Clawson and Gerstel 2015; Golden 2001; Halpin 2015). Workers are often required or assumed to have total open availability, and schedules are created without consideration of employee preferences and without employee input. Many employees, for example, are expected to work “clopening” shifts, in which they close the establishment late at night only to return a few hours later to reopen it (Kantor 2014).

These practices allow employers to effectively transfer financial risk to their employees. Rather than commit to a set of stable employee schedules, employers now seek to maintain as lean staffing as possible, and they do so by scheduling workers for minimal regular hours, adding shifts at the last minute, asking workers to leave shifts early, and requiring on-call shifts (Houseman 2001; Lambert 2008). In turn, employees encounter substantial uncertainty about when and how much they will work

(Carrillo et al. 2017; Henly, Shaefer, and Waxman 2006). Unstable and unpredictable work schedules are now common in the service sector (Appelbaum et al. 2003; Enchautegui, Johnson, and Gelatt 2015; Golden 2001) and can be found among low-wage workers in other industries as well, such as health care (Clawson and Gerstel 2015). Recent estimates show that 87 percent of early-career retail workers reported instability in their work hours from week to week over the past month. Of those retail workers who reported unstable work hours, the fluctuations were substantial, averaging almost 50 percent of their usual weekly hours (Lambert et al. 2014).

From the employee perspective, this should not be mistaken for the “desirable flexibility” sought by many white-collar professionals (Galinsky et al. 2011). Instead, these scheduling practices are typically experienced as “undesirable instability” by low-wage hourly workers (Halpin 2015; Henly et al. 2006). Very little research, however, examines how exposure to these practices might spill over to affect workers’ health and well-being.

WHY ROUTINE UNCERTAINTY IN WORK TIME MIGHT AFFECT WELL-BEING

Although little prior research directly examines the relationship between schedule unpredictability and instability and health and well-being for service-sector workers, theory and prior research provide ample reason to expect that unpredictable and on-call scheduling for hourly employees will have a range of negative effects. In particular, we expect unstable and unpredictable work schedules could negatively affect health and well-being by increasing household economic insecurity and by increasing work-life conflict.

Household Economic Insecurity

First, unpredictable and unstable work schedules capture a distinct dimension of precarious work, separate from economic factors

such as wages, yet these temporal aspects of job quality might matter for well-being primarily because of their negative consequences for household economic security. Variable hours may, mechanically, lead to income volatility, especially if that variability makes it difficult for workers to hold secondary jobs that might otherwise be used to smooth earnings. Last-minute changes to work schedules may make it difficult for workers to actually make the shifts they are scheduled for, increasing income volatility and household material hardship. To smooth consumption in light of volatile earnings, workers may need to rely on credit products, including high-cost sources of credit such as payday loans and pawn shops.

Prior research shows that schedule instability leads to economic insecurity (Ben-Ishai 2015; Golden 2015; Haley-Lock 2011; Luce, Hammond, and Sipe 2014; Zeytinoglu et al. 2004). In a 2013 survey of workers with low to moderate income, among those who reported income volatility, having an irregular work schedule was the most common reason given (Federal Reserve Board 2014). Similarly, in a financial diary study of 235 households, negative income shocks were common, and a drop in work hours was one of the main culprits (Morduch and Schneider 2014). Furthermore, prior research indicates that income volatility negatively affects sleep and food sufficiency (Leete and Bania 2010; Wight et al. 2008).

Work-Life Conflict

Second, unstable and unpredictable work schedules could affect health and well-being through non-economic pathways, by making it difficult for workers to balance the demands of employment and personal life (Ben-Ishai 2015; Golden 2015; Haley-Lock 2011; Luce et al. 2014; Morsy and Rothstein 2015; Zeytinoglu et al. 2004). Work-life conflict may be an intervening mechanism in the relationship between unpredictable and unstable work schedules and health outcomes.

The work-life conflict model identifies underlying time and strain-based conflicts

that result from competing and conflicting demands of work and life. Time conflict results when work is scheduled at times that directly interfere with family responsibilities, whereas strain-based conflicts stem from the stress that schedules cause and can spill over to affect family life (Greenhaus and Beutell 1985). These conflicts are prevalent in the workforce, with about half of workers reporting that work “sometimes” or “frequently” interferes with their family life (Schieman, Milkie, and Glavin 2009).

Work schedules have important influences on work-life conflict. Data from the General Social Survey in the 2000s show that working non-standard hours, or an irregular or on-call schedule, is a strong predictor of work-life conflict (Golden 2015). Further evidence linking unpredictable schedules to perceptions of work-life conflict comes from a study of 21 stores of a single women’s apparel company in the Midwest. In this study, Henly and Lambert (2014a) report that workers who were exposed to limited advance notice, last-minute schedule changes, and variability in days of the week worked reported higher levels of general work-life conflict. However, an examination of the health implications of this work-family conflict was beyond the scope of the study.

A separate, strong evidence base links work-life conflict to worse health and well-being (Kelly and Moen 2007). A recent study also provides evidence that work-life conflict plays a mediating role in the relationship between working non-standard schedules and worse mental health for workers (Cho 2017). The study does not address the influence of advance notice, variable timing and number of work hours, being on-call, or canceled shifts, which may have similar effects on time-based conflict and on health.

In summary, although we lack empirical evidence of the association between routine schedule instability and worker health and well-being, prior research provides two well-specified pathways by which unstable and unpredictable schedules could affect health and well-being.

THE POLICY CONTEXT: REGULATING PRECARIOUS WORK

Despite clear evidence that many Americans are exposed to precarious work, the federal government has taken only limited steps to address the precarity evident in low wages and unstable and unpredictable work schedules. However, cities and states around the country have embraced a kind of new federalism, passing legislation that seeks to “raise the floor” in terms of job quality (Bernhardt 2012), with cities such as San Francisco (Reich, Jacobs, and Deitz 2014) and states such as California (Milkman and Appelbaum 2013) at the vanguard.

States and localities have passed laws to regulate paid family leave (Milkman and Applebaum 2013) and paid sick time (Colla et al. 2014), but most legislative attention focuses on the minimum wage (Tilly 2005). As of 2018, 30 states, 32 cities, and six counties had passed minimum wages in excess of the federal rate of \$7.25, ranging from \$15 in San Francisco to \$7.50 in New Mexico (IRLE 2018). These laws can be seen as addressing the economic dimension of precarious work by mandating higher wages for low-wage workers. The benefits of such laws are overwhelmingly concentrated in the service sector. Two-thirds of minimum wage workers are employed in service occupations and nearly three-quarters in the retail trade or leisure and hospitality industries (BLS 2018).

Recently, a coalition of workers, organizers, and unions have advanced a legislative agenda related to the temporal dimension of precarious work. This policymaking is focused on unstable and unpredictable work hours (Figart 2017). Under the mantle of “fair scheduling” and “secure scheduling,” this coalition has successfully pressed for the passage of laws to regulate scheduling practices in San Francisco, CA; Emeryville, CA; Seattle, WA; New York, NY; and the state of Oregon (Wolfe et al. 2018).

Whereas minimum wage laws effectively focus on workers in the retail and food service sectors, these scheduling laws explicitly apply only to those workers. The specific coverage

rules vary somewhat, but these laws only cover workers employed by firms that are in the retail, food service, and full-service restaurant industries (SMC 14.22; Senate Bill 828; NYC Administrative Code, Title 20, Chapter 12; SF Police Code Article 33F and 33G). Furthermore, these ordinances are written to apply only to large firms. Thus, the worker population of policy interest is retail and food service employees working for large firms.¹

The scheduling ordinances passed to date also have a common set of provisions. First, the laws generally require advanced notice of work schedules, and in cases where shift timing is changed with less notice, employees are owed “predictability pay.” However, there is variation in the amount of required notice, with some ordinances requiring two weeks (Seattle, San Francisco, Emeryville, and New York City for fast food), others requiring one week of notice (Oregon), and another requiring just 72 hours (New York City for retail). Second, several of the ordinances specifically regulate on-call shifts. For instance, in Seattle, employees who are not “called-in” are owed partial pay, and in New York City, such shifts are simply outlawed for retail workers. The other ordinances, however, do not specifically regulate on-call shifts. Third, there is variation in the rules around consecutive closing then opening shifts, or “clopenings.” In New York City, fast food workers must give written consent and receive an extra \$100 for any two shifts that are separated by less than 11 hours. Oregon and Seattle have a similar rule, although the rest period is shorter (10 hours) and the compensation lower. San Francisco has no such rules. Fourth, several of these laws include “access to hours” provisions that are designed to make more work hours available to part-time employees, as well as “right to request” provisions that protect workers from retaliation should they request input into their work schedules. These two provisions do not directly regulate unstable and unpredictable scheduling practices, but the existing literature on managerial practices and scheduling suggests they could induce more regularity in schedules and more schedule control. Other laws, again broadly

similar but with important distinctions in terms of provisions, have been proposed and considered in Washington, DC; Philadelphia, PA; and the state of Connecticut (Anzilotti 2018; Reyes 2018).

However, little evidence demonstrates that these specific scheduling exposures are associated with worker health and well-being. Similarly, while there is variation in the provisions regarding advanced notice and on-call work, there is a pronounced lack of evidence to inform best practices around the amount of advanced notice to require or the case for regulating on-call work and clopening shifts specifically. We also have little information on how the effects of these measures to regulate the temporal dimension of precarious work would compare to the effects of wage increases.

HYPOTHESIZED EFFECTS OF UNSTABLE SCHEDULES ON WELL-BEING

Between the two key dimensions of precarious work—the economic dimension (wages) and the temporal (unstable work schedules)—the sheer weight of scholarly attention would suggest that wages are by far the more important determinant of employee health and well-being. Yet, the literature is surprisingly mixed on the actual empirical associations. In contrast, although theory and a small body of existing research suggest that routine uncertainty in work schedules might affect employee health and well-being, data limitations have precluded empirical tests of the association.

Our study focuses on three outcome measures that have been emphasized in prior research because they are expected to be sensitive to work conditions and represent overarching indicators of health and well-being: sleep quality, psychological distress, and happiness. We test the following hypotheses relating precarious employment to these outcomes:

Hypothesis 1: Routine uncertainty in work schedules interferes with sleep and increases psychological distress and unhappiness.

Hypothesis 2: Prior research has not made head-to-head comparisons of the relative importance of wages and schedules for worker health and well-being. We hypothesize that schedules will be as strongly related to health and well-being as wages.

Hypothesis 3: The effects of routine uncertainty in work schedules on sleep, psychological distress, and happiness will operate, in part, through an economic pathway by affecting household economic insecurity, and, in part, through a temporal pathway by affecting work-life conflict.

LIMITATIONS OF EXISTING DATA

To date, it has proven difficult to test these hypotheses, and especially difficult to do so for the policy-relevant population of employees of large retail and food service firms, because there is a pronounced lack of available data. Existing data have three interrelated limitations: (1) few datasets include measures of scheduling practices, (2) datasets that include measures of scheduling practices rarely include measures of health and well-being, and (3) existing data cannot be used to describe scheduling practices at the large retail firms at the center of policy debate and organizing activity.

One important exception is the 2011 to 2015 waves of the National Longitudinal Survey of Youth-1997 (NLSY97). In these three waves, the NLSY97 contained items that gauged the amount of advance notice of schedules that respondents received at work, the degree of control respondents had over their schedules, and the week-to-week variability in respondents' work hours. The NLSY97 also contains useful measures of adult health and well-being.

However, the NLSY97 is limited in some important respects. First, by design, it captures a specific cohort of workers, all of whom were born between 1975 and 1982 and were age 29 to 41 in 2011 to 2015. That age restriction excludes more than two-thirds of the retail and food service workforce: the 25 percent of workers under age 29 and the 43

percent over age 41 (author's calculations from the American Community Survey [ACS]). Second, because the NLSY97 is designed to be nationally representative of that age cohort, the sample size of hourly workers in the retail industry is limited, with 1,564 total observations on 1,037 unique respondents working in retail in 2011, 2013, or 2015. Third, although the NLSY97 contains some of the most detailed scheduling measures available to date, these remain quite limited. For example, no questions capture on-call scheduling, clopening, or canceled shifts. Yet, these practices constitute precarious schedules and routine uncertainty and are central components of recent policymaking. Finally, although policy attention and organizing is focused on regulating large chain retailers, the NLSY97 contains no data that can be used to describe scheduling practices at these companies. The names of employers are not available, and if they were, the sampling design ensures we would lack any substantial number of cases within particular employers.²

In summary, there is an acute lack of data that contain measures of scheduling and outcomes of interest for sufficiently large samples of retail workers. A significant challenge in collecting this data is the effective recruitment of large samples of retail workers at reasonable cost.

SURVEY METHODOLOGY

The Shift Project used an innovative method of collecting web-based surveys from a large population of service-sector workers. Our article analyzes survey data from this study collected from 27,792 retail and food service workers employed at 80 large companies across the country.

Survey respondents were recruited using targeted advertisements on Facebook. Our innovation is to use the unique targeting capabilities at the heart of Facebook's business model to sample and recruit respondents from a specific population of substantial scholarly and policy interest: hourly workers employed by large firms in the retail sector. Facebook

compiles detailed data on its users through a combination of user self-reports, user activity, and third-party vendors. Facebook then offers advertisers the opportunity to use this data at the group level to target advertisements to particular populations of interest. We took advantage of this infrastructure to target survey recruitment messages to active users on Facebook who resided in the United States, were over age 18 and under age 65, and were employed by one of 80 large retail or food service companies.

Our survey recruitment and data collection approach yielded a strategically-targeted, non-probability sample. Although the use of non-probability internet samples is well-established in experimental psychology (Birnbaum 2004; Skitka and Sargis 2006), survey methodologists have raised reasonable concerns about inferences drawn from non-probability samples in observational research (Groves 2011; Smith 2013). Nevertheless, traditional probability sample surveys are facing steeply declining response rates (Keeter et al. 2017), and an emerging body of work demonstrates that non-probability samples drawn from non-traditional platforms, in combination with statistical adjustment, can yield similar distributions of outcomes and estimates of relationships as probability-based samples. This work draws data from Xbox users (Wang et al. 2015), Mechanical Turk (Goel, Obeng, and Rothschild 2017; Mullinix et al. 2015), and Pollfish (Goel et al. 2017). Yet, of all these platforms, Facebook is the most commonly and widely used by the public (Perrin 2015).

Using Facebook as our sampling frame is novel and departs from conventional survey sampling frames such as address-based samples or random digit dialing. Earlier research notes selection into Facebook activity (Couper 2011), but recent estimates show that approximately 81 percent of Americans age 18 to 50 are active on Facebook (Greenwood, Perrin, and Duggan 2016). Thus, the sampling frame is now on par with coverage of telephone-based methods (Christian et al. 2010). Furthermore, Facebook use is not especially stratified by demographic characteristics (Greenwood et al. 2016).

There is some recent precedent for using Facebook as a recruitment tool for academic research. Bhutta (2012) used Facebook to recruit Catholic respondents to a survey through Facebook's Catholic affinity groups and chain referrals. In an approach more akin to ours, Zhang and colleagues (2017) compared respondents drawn from Facebook and the ACS in terms of veteran status, homeownership, and nativity and found a high degree of similarity.

Fielding the Survey

We purchased advertisements on the Facebook platform that then appeared in the Desktop Newsfeed, Mobile Newsfeed, and Instagram accounts of our target sample. Each advertisement was made up of four main elements. The top banner of the advertisement displayed the text "UC Berkeley Work and Family Study." This text was hyperlinked to our official Facebook study page. Below the banner, we included the text of our advertisement. The center of the advertisement contained a picture designed to resemble workers at the targeted employer workplace. Finally, below the picture, we included a headline that read "Chance to win an iPad!" A sample advertisement is shown as Appendix Figure 1 in the online supplement.

Each advertisement was targeted to users age 18 to 64 who resided in the United States, spoke English, and were employed by one of 80 large service-sector companies. We selected these 80 companies by drawing from the top 100 retailers by sales in the United States (National Retail Federation 2015). The full list of companies is included as Appendix Table 1 in the online supplement.³ These firms were strategically chosen because, given their size and business type, they are covered by local labor laws aimed at regulating work schedules.

Users who clicked on the link in our ad were redirected to an online survey hosted through the Qualtrics platform. The front page of the survey contained introductory information and a consent form. Respondents provided consent by clicking to continue to the survey instrument. Respondents who completed the

survey and provided contact information were entered in the iPad drawing.

Survey data was collected in June, September, and October 2016; March, May, and June 2017; and late August, September, and October 2017. We paused our data collection between November 2016 and February 2017, and July to early August 2017, to avoid the seasonal effects of holiday shopping and changes to family routines due to the school summer break.

In total, our advertisements were shown to Facebook users 5,024,362 times, including some users who saw our advertisements on multiple occasions. These advertisements generated 337,098 link clicks through to our survey at a total advertising and prize cost of \$160,000. Then, 60,409 respondents contributed at least some survey data. In all, 6.7 percent of ad displays led to clicks through to begin the survey, and 18 percent of those clicks led to some survey data. Overall, 1.2 percent of advertisement displays yielded survey data.

From the 60,409 responses, we eliminated 8.5 percent who reported they were not paid hourly. We also excluded almost 4 percent of respondents who failed a data quality check included in the survey, which instructed respondents to select a particular response category to demonstrate their attention. After these exclusions, the remaining sample included 53,077 respondents. Of the 53,077 respondents who began the survey, 27,792 fully completed the survey. We used multiple imputation for respondents who completed the survey but had item non-response using the *mi impute chained* commands in Stata. Our final analysis sample for a single impute was 27,792 responses. As a robustness check, we imputed missing data for respondents who broke off mid-survey and, for this larger sample, we found results consistent with those presented here.

These response rates are lower than those obtained in many probability-sample phone surveys. However, a sample such as ours would be difficult if not impossible to reach through traditional methods given the absence of an appropriate sampling frame. Nevertheless, we are attentive to issues of sample selectivity and potential bias, as described below.

Methods of Mitigating Bias

Bias on observables. Facebook use is so widespread as to diminish concerns about its use as a sampling frame. However, a second source of bias arises from non-random non-response to the recruitment advertisement. Statisticians have developed a set of post-stratification and calibration methods that are often deployed in the analysis of non-probability sample data (Goel et al. 2017; Wang et al. 2015; Zagheni and Weber 2015). This approach allows us to adjust our data to account for discrepancies in the demographic characteristics of our sample compared with characteristics of a similar target population of workers captured in high-quality probability-sample data. We describe our approach to weighting in detail in Part A of the online supplement; all our results use these weights.

Bias on unobservables. Post-stratification weighting can effectively adjust for bias in observed characteristics, including for data with much more extreme demographic bias than we observe in our data (Wang et al. 2015). However, this approach assumes that within narrowly defined cells, the sample is drawn randomly. We address potential biases in unobserved sample characteristics with two approaches. First, we use variation in “social sharing” of our advertisements as one gauge of unobserved bias. If respondents who were selected into the survey via advertisements that were shared more widely differ on a potential confounder, then testing for interactions between the extent of sharing and schedule instability in predicting our outcomes should reveal the presence of that bias. Second, rather than speculate about forms of non-specific bias, we generated hypotheses about potential, specific unobserved characteristics that might alter survey response and bias the relationship between schedule instability and health and well-being outcomes. We ran advertisements that elicited these “unobservable” characteristics in their messaging (e.g., contrasting a message referencing insufficient work hours with one referencing overwork) and examined if the relationship between schedule instability and

health and well-being varied for respondents recruited through these different channels. We provide further detail on these two approaches in Part B of the online supplement.

KEY MEASURES

We fielded an online survey containing approximately 70 questions. The survey was divided into five modules that collected information on job characteristics, household finances, demographics, workers’ health and well-being, and parenting and child well-being.

Dependent Variables

We gauged adult health and well-being with three measures. First, we used a psychological distress scale that includes five of six items from the Kessler-6 index of non-specific psychological distress (namely, how often in the past month a respondent felt sad, restless, nervous, hopeless, or that everything was an effort) and an additional item about feeling overwhelmed by difficulties. The scale of psychological distress that combines these six items has a Cronbach’s α reliability of .91. Our measure of distress is distinct from the familiar Kessler-6 measure in that our measure includes an item about feeling that “difficulties are piling up so high you could not overcome them,” and it does not include the K6 item that asks about feelings of worthlessness. We created a dichotomous measure of psychological distress that separates scores below 13 (little or no distress, on average) from those between 13 and 24 (more than a little distress, on average), which follows the recommended threshold for the Kessler-6 (Prochaska et al. 2012). The results are not affected by using the full continuous range of the scale. Second, we measure self-rated sleep quality as very good, good, fair, or poor and create a dichotomous variable contrasting very good or good sleep with fair or poor sleep. Finally, we gauge happiness by asking respondents, “taken all together, how would you say things are these days? Would you say you are, (1) very happy, (2) pretty happy, or (3) not too happy.” We recode responses into a dichotomous variable

contrasting very or pretty happy with not too happy.

Independent Variables

Routine uncertainty in work schedules. We measured the instability of respondents' schedules with a set of items that have been carefully developed and tested by the Employment Instability Network (Henly and Lambert 2014b). First, we asked respondents to classify their usual schedule as a regular day shift, a regular evening shift, a regular night shift, a variable schedule, a rotating shift, or some other arrangement. Second, we asked respondents for the amount of advance notice they are given of their schedule, differentiating zero to two days of notice, three to six days, one to two weeks, or two weeks or more. Third, we calculated a measure of hours volatility by asking respondents to report the most and the fewest weekly hours they worked over the past four weeks and taking the difference in hours divided by the maximum weekly hours. Fourth, we asked respondents if "in the last month, was one of your scheduled shifts canceled with less than 24 hours notice?" and we created a dichotomous indicator distinguishing respondents who had (1) from those who had not (0) experienced a cancellation. Fifth, we asked respondents if "in the last month, you worked on call?" and we created a dichotomous indicator distinguishing respondents who had (1) from those who had not (0) worked on-call. Sixth, we asked respondents if "in the past month or so, have you ever worked a closing shift and then worked the very next opening shift with less than 11 hours off in between your shifts at [EMPLOYER]?" We created a dichotomous variable indicating respondents who had (1) and had not (0) worked such a shift sequence. We included a seventh measure, of schedule control, that compares respondents who said their work schedules were (1) determined completely by the employer with no worker input, (2) determined by the employer with some worker input, and (3) determined by the worker with some employer input or entirely by the worker.

Finally, we created an eighth measure, an additive index that combines several measures of schedule instability and unpredictability. The items in this index are (1) having a variable schedule, (2) having less than two-weeks advanced notice, (3) having had a shift canceled, (4) having worked on-call, (5) having worked a clopening shift, and (6) having no input into scheduling. Just 1 percent of respondents had a score of six on the scale, so we top-code at five exposures.

Wages. We also measured respondents' hourly wages. These data are self-reports from respondents who reported being paid hourly. Respondents were first asked a screening question, "Are you paid by the hour at [EMPLOYER]?" and then, if yes, "How much are you paid by the hour by [EMPLOYER]?" In related work (Schneider and Harknett 2018), we sought to validate the wage data used here by comparing wages against reports for workers in the same industries and occupations who were surveyed in the Current Population Survey (CPS) and the NLSY97. We found that mean wages in the Shift data are between those reported in the CPS and the NLSY97. We also assessed if the canonical association between job tenure and wages is similar across the CPS, NLSY97, and Shift data. Here too, we found that our estimate in the Shift data is closer to estimates in the CPS and the NLSY97 than they are to each other (Schneider and Harknett 2018).

Mediating Variables

Economic insecurity. We measured five indicators of household economic insecurity. First, we used a measure of household income volatility, similar to an item from the Federal Reserve's SHED survey, by directly asking respondents, "Would you say that week to week your household income is basically the same or goes up and down?" We treated this as a dichotomous variable.

Second, we asked respondents, "In a typical month, how difficult is it for you to cover your expenses and pay all your bills?" We asked respondents to rate it as very difficult,

somewhat difficult, or not at all difficult. We recoded responses into a dichotomous variable contrasting “very difficult” with “somewhat” or “not at all difficult.” This measure was included in the National Financial Capability Survey and has been used in studies of household financial fragility (Henager and Wilmarth 2018; Theodos et al. 2014).

Third, we created a dichotomous measure that captures whether respondents experienced material hardship in the 12 months prior to the survey. Respondents were assigned a 1 if they used a food pantry, went hungry, did not pay utilities, took an informal loan, moved in with family or friends, stayed in a shelter, or deferred needed medical care and 0 if not. Material hardship is a commonly used gauge of deprivation (Beverly 2001; Mayer and Jencks 1989), and these measures are included in the Fragile Families Study and the SIPP, among other surveys.

Fourth, we created a measure of the use of alternative financial service credit products, which we coded 1 if respondents took out a payday loan or used a pawnshop in the prior 12 months and 0 otherwise. Workers may use these alternative financial services to smooth erratic income or deal with expense shocks, yet they may lock respondents into high-cost debts that are difficult to retire and so ultimately depress well-being (Stegman 2007). Use of these products has been measured in the Detroit Area Study, the Survey of Consumer Finances, and the Federal Reserve’s SHED survey, among others.

Finally, we included a measure of respondents’ perceived financial insecurity. Following Lusardi, Schneider, and Tufano (2011), we asked respondents to rate their confidence in their ability to cope with a hypothetical \$400 expense. We coded respondents as financially fragile if they reported they “certainly could not” or “probably could not” come up with that amount of funds.

Work-life conflict. Our survey included four items capturing work-life conflict drawn from the Fragile Families and Child Well-Being study (Ciabattari 2007; Nomaguchi and Johnson 2014). Respondents were asked

to rate their agreement/the truth of four statements, each on a four-point scale: (1) “my work schedule makes it hard to be there for my family,” (2) “my shift and work schedule cause extra stress for me and my family,” (3) “where I work, it is difficult to deal with family or personal problems during working hours,” and (4) “in my work schedule, I have enough flexibility to handle family needs.” Items 1, 2, and 3 were reverse coded such that lower values signal less conflict. We combined these four items in a single scale (Cronbach’s $\alpha = .82$). This scale of work-life conflict differs from a commonly used five-item scale developed by Netemeyer, Boles, and McMurrin (1996). Unlike Netemeyer and colleagues’ (1996) items, three of four items in our work-family conflict scale directly reference work schedules, which is a good fit for our research purposes.

Controls

The rise in precarious employment involved declines in wages and shorter job tenure, in addition to changes in scheduling practices. These factors could plausibly confound the relationship between work schedules and our key outcomes of interest. For instance, workers who have longer tenure may be rewarded with more stable and predictable schedules and may benefit in terms of economic security and well-being through other channels as well. To address these potential sources of confounding, we controlled for hourly wage and for job tenure with a measure of length of employment with current employer (less than one year, one to two years, three to five years, or six years or more). We also adjusted for usual hours worked per week and whether respondents reported being a manager.

In addition to these aspects of work, demographic characteristics could confound any relationship between scheduling practices and our outcomes of interest. Prior research suggests women and people of color may be more likely to experience unstable and unpredictable work schedules in the service sector (Golden 2015; Pugh 2016), and there may be demographic variation on our key outcome

measures. To guard against this source of confounding, we controlled for gender, race/ethnicity (black, non-Hispanic; Hispanic; other/multiracial, non-Hispanic; versus white, non-Hispanic), educational attainment (high school diploma or less, some college, bachelor's degree or more), marital status, school enrollment, and whether respondents lived in a household with children. Finally, we included year and month fixed effects in our models to control for seasonal variation in work and well-being outcomes.

ANALYTIC MODELS

We estimate associations between our eight key measures of schedule instability (variation in weekly hours, schedule type, advanced notice, canceled shifts, on-call shifts, clopening shifts, schedule control, and the index) and our three outcome variables (psychological distress, sleep quality, and happiness). These estimates are not causal, but by design our sample has limited heterogeneity: everyone is an hourly retail worker at one of 80 large firms and we control for economic and demographic characteristics. We estimate the following model:

$$\ln\left(\frac{P_i}{1-P_i}\right) = \alpha + \beta X_i + \lambda J_i + \eta W_i + \mu + \omega \quad (1)$$

where our outcome of interest, P for individual i , is the probability of reporting (1) more than a little psychological distress, (2) very good or good sleep quality, or (3) being very or pretty happy regressed on a set of control variables, X , and a set of job scheduling characteristics, J (described above). The coefficients of interest are represented by λ and summarize the relationship between work schedules and the dependent variables. The set of individual-level controls, X_i , are respondent-level measures of race/ethnicity, age, education, household composition, marital status, usual work hours, household income, job tenure, and managerial status. These models also include a control for hourly wage, W_i . The terms μ and ω represent year and month fixed effects, which control for unobserved

period effects. Equation 1 shows the logistic regression model we estimate for our dichotomous outcomes. The results are substantively similar if we estimate the models using a linear probability model. For each outcome, we estimate eight separate models, entering the key measures of scheduling one at a time.

We test our second hypothesis by re-estimating our model above, but without the measures of work scheduling. Here, we focus on the association between hourly wage and each of our three outcome measures. As before, we include the same set of controls for workplace, household, and demographic factors. We then compare the magnitude of associations with outcomes for wages and for unstable and unpredictable work schedules. We do so first by contrasting the predicted values of our outcome measures across the observed range of values for wages and the observed range of values for the instability scale.

We also make a set of policy-relevant comparisons. We examine the full set of minimum wage increases enacted by cities, counties, and states from 2015 to 2018. The median increase was \$.75 ($p_{25} = $.35; $p_{75} = \$1.22$). However, several minimum wage increases had stepped introductions. Examining the cumulative increase in the minimum wage over a three-year period, we see a median of $2.14 ($p_{25} = $.97; $p_{75} = \$3.32$). We contrast the estimated differences in the values for each of our dependent variables from making such an increase from $7.25 against the estimated differences in each of our dependent variables from three provisions of the work scheduling ordinances: having three to six days' notice, having one to two weeks' notice, and having more than two weeks' notice versus having zero to two days' advance notice, experiencing on-call shifts versus not, and experiencing a clopening shift versus not.$$

We next assess how household economic insecurity and work-family conflict mediate any relationships between unstable and unpredictable scheduling and worker health and well-being. Here, we focus on our combined scale measure of schedule instability as the "treatment" variable (although of course recognizing that it is not randomly assigned)

and estimate its total effect on each of our three outcome measures. We then use the four-step procedure outlined by Baron and Kenny (1986) to establish if there is partial mediation of the relationship between schedule instability and each of our outcomes by each of our two mediating variables—economic insecurity and work-life conflict. Next, we estimate the proportion mediated using the assisted product method for binominal outcomes described by MacKinnon (2008). Finally, we use a bootstrap to estimate confidence intervals for each of the estimated proportions mediated.

Robustness

We first test the sensitivity of our results to including employer fixed effects. This focuses the analysis on within-employer, rather than between-employer, variation. We also test robustness to the inclusion of state fixed effects and to the inclusion of state and employer fixed effects. These results are presented in Part C of the online supplement. Second, in our main models, we present results weighted to the ACS and by employer size. To test robustness, we re-estimate each regression model using alternative weights derived from the CPS and ACS (see Part C of the online supplement). Finally, we present the results of our two tests of selection into the survey on an observed confounder, summarized in Part B of the online supplement.

RESULTS

Descriptive Results: Worker Health and Well-Being and Scheduling Experiences

We begin by presenting means for our outcome variables in Table 1. Nearly half of the service-sector workers reported “more than a little” psychological distress, on average, which is high compared to the broader U.S. population (Weissman et al. 2015). Three quarters of the workers (74 percent) reported fair or poor sleep quality. More than one quarter of workers (29 percent) reported being not too happy.

Table 1 also presents means for our mediators. Household economic insecurity is high. Over 40 percent of respondents reported week-to-week variation in income, one-quarter reported difficulty paying bills, and one-fifth used alternative credit products. Sixty-five percent of respondents reported experiencing at least one serious material hardship in the past 12 months, and over half (54 percent) reported they would probably or certainly not be able to cope with an emergency expense of \$400. For the mediation analysis, we used a scale created from these five items (Cronbach’s $\alpha = .62$). Work-life conflict is also common in the sample, with a mean score of 2.4 out of a maximum of 4.

Table 2 describes the schedules of the service-sector workers in our sample. Schedule variability and short notice are common. A plurality of workers, 37 percent, reported having variable schedules, and another 19 percent reported a rotating shift. A smaller share, 22 percent, had a regular day-time schedule, 8 percent had a regular evening schedule, and 9 percent had a regular night shift. Overall, just one-fifth worked a regular, standard-time shift, 17 percent worked a regular non-standard shift, and almost 60 percent worked some kind of variable schedule.

Workers received little advance notice of their weekly schedules. Sixteen percent received fewer than three days of notice, and 18 percent received three to six days’ notice. Thirty percent of workers received one to two weeks’ notice, and 37 percent received more than two weeks’ advance notice. Overall, 34 percent of workers had less than one week of advance notice, and 63 percent had less than two weeks.

Workers also experienced substantial variation in the total hours they worked each week over the month prior to interview. The mean percent variation was 32 percent, which implies that a worker who averaged 25 hours per week in the prior month likely worked as few as 20 hours at least one week of the month and as many as 30 hours in another week. A minority of workers, 14 percent, reported they had a work shift canceled on short notice within the past month. About twice as many

Table 1. Descriptive Statistics, Measures of Outcomes, and Mediator Variables

Psychological Distress	
More Than a Little	46%
Sleep Quality	
Very Good/Good (vs. Fair/Poor)	26%
Happiness	
Very/Pretty Happy (vs. Not Too Happy)	71%
Week-to-Week Income Volatility	
Varies (vs. Stays the Same)	43%
Difficulty Paying Bills/Expenses	
Somewhat/Not Difficult (vs. Very Difficult)	74%
Household Economic Hardships	
At Least One Hardship (vs. None)	65%
Use of Payday Loans or Pawn Shop	
Used Products (vs. Did Not)	19%
Confidence in Ability to Cope with Emergency Expense	
Certainly/Probably Able (vs. Certainly/Probably Unable)	46%
Mean Economic Insecurity Scale (range 0–1)	.40
Mean Work-Life Conflict Scale (range 1–4)	2.4
N	27,792

(26 percent) reported they work on-call shifts. A much larger share of workers, 50 percent, reported working a clopening shift. Workers had very little control over their work schedules, with half reporting no input at all and another 33 percent reporting their employer makes their schedule but they have some input. Just 15 percent had primary control over their schedule.

These various manifestations of routine work-schedule uncertainty cohere into a set of exposures for some workers. Seven percent of workers were exposed to five or six such scheduling practices, and an additional 15 percent of workers reported exposure to four such scheduling practices. Another 24 percent were exposed to three, and an additional quarter to two such practices. In contrast, only a fifth were exposed to one unstable or unpredictable work scheduling practice, and only 6 percent of workers reported no recent exposure to unstable and unpredictable scheduling practices.

Regression Results: Worker Health and Well-Being and Scheduling Practices

We now turn to our estimates of the relationship between routine work-schedule uncertainty and our three measures of worker health and well-being. After reporting these results, we examine whether these associations are mediated through the household economic insecurity pathway or the work-life conflict pathway.

Psychological distress. In the models in the first column of Table 3, we see that each of our measures of unstable and unpredictable scheduling is positively associated with psychological distress. Respondents whose hours vary more week-to-week have a higher likelihood of experiencing psychological distress, as do respondents who work variable schedules or rotating schedules compared to those working regular day shifts. Workers with fewer than

Table 2. Descriptive Statistics, Measures of Work Schedules

Week-to-Week Hours Variation	
Mean	32%
Median	27%
Schedule Type	
Variable Schedule	37%
Regular Daytime Schedule	22%
Regular Evening Schedule	8%
Regular Night Shift	9%
Rotating Schedule	19%
Other	4%
Advance Notice	
0–2 Days	16%
3–6 Days	18%
Between 1 and 2 Weeks	30%
2 Weeks or More	37%
Shift Cancelled in Last Month	
Yes	14%
Work On-Call Shifts	
Yes	26%
Cloping Shift	
Yes	50%
Schedule Control	
Decided by Employer	51%
Employer, with Employee Input	33%
Employee with Employer or Solely Employee	15%
Instability Scale	
0	6%
1	22%
2	26%
3	24%
4	15%
5 or More	7%
Hourly Wage	
Mean	\$11.60
Median	\$10.60
<i>N</i>	27,792

three days of notice and workers with just three to six days of notice fare significantly worse than those with more than two weeks of advance notice of their schedules, although we find no difference between those with one to two weeks and two weeks or more. We also find that workers exposed to canceled shifts, on-call work, and cloping shifts are significantly more likely to experience psychological

distress. Schedule control is also a key predictor of psychological distress, with workers who have no input faring substantially worse than those who have some control or even just some input. Finally, workers exposed to multiple forms of unstable and unpredictable scheduling are at highest risk of psychological distress, with an essentially monotonically increasing risk with exposure.

Table 3. Schedules and Psychological Distress, Sleep Quality, and Happiness; Coefficients from Logistic Regressions

	(1)	(2)	(3)
	Psych. Distress	Good Sleep	Happy
Week-to-Week Hours Variation			
Variation	.36+	-.30*	-.07
Schedule Type			
Regular Day	ref.	ref.	ref.
Variable	.38***	-.33***	-.38***
Regular Evening	.16	-.16	-.23
Regular Night	.27+	-.50***	-.19
Rotating	.20*	-.26**	-.16+
Other	.23+	-.29*	-.29*
Advance Notice			
0–2 Days	.34***	-.35**	-.45***
3–6 Days	.15+	-.27**	-.25***
1–2 Weeks	.00	-.09	-.09
More Than 2 Weeks	ref.	ref.	ref.
Shift Cancelled in Last Month			
No	ref.	ref.	ref.
Yes	.91***	-.54***	-.79***
Work On-Call Shifts			
No	ref.	ref.	ref.
Yes	.63***	-.44***	-.45***
Clopping Shift			
No	ref.	ref.	ref.
Yes	.47***	-.41***	-.39***
Schedule Control			
Decided by Employer	.57***	-.33***	-.61***
Employer + Employee	-.03	.11	-.01
Employee	ref.	ref.	ref.
Instability Scale			
0	ref.	ref.	ref.
1	.42**	-.06	.02
2	.58***	-.25*	-.49***
3	.91***	-.51***	-.62***
4	1.37***	-.85***	-1.17***
5 or More	1.85***	-1.23***	-1.28***
Hourly Wage	-.02*	.01+	.02*
Observations	27,792	27,792	27,792

Note: This table excerpts key estimates from 27 separate regression schedule measures as a predictor. Each panel × column shown represents a separate regression. All models include controls for race, age, gender, educational attainment, marital status, school enrollment, hourly wage, household income, average weekly work hours, employment tenure, managerial status, and living with children as well as month and year fixed effects.

+*p* < .1; **p* < .05; ***p* < .01; ****p* < .001 (two-tailed tests).

Figure 1 plots the predicted share of respondents experiencing psychological distress by values of the key scheduling variables, after

adjusting for the model covariates and weighting. The relationships are statistically significant and substantively large. For instance, 65

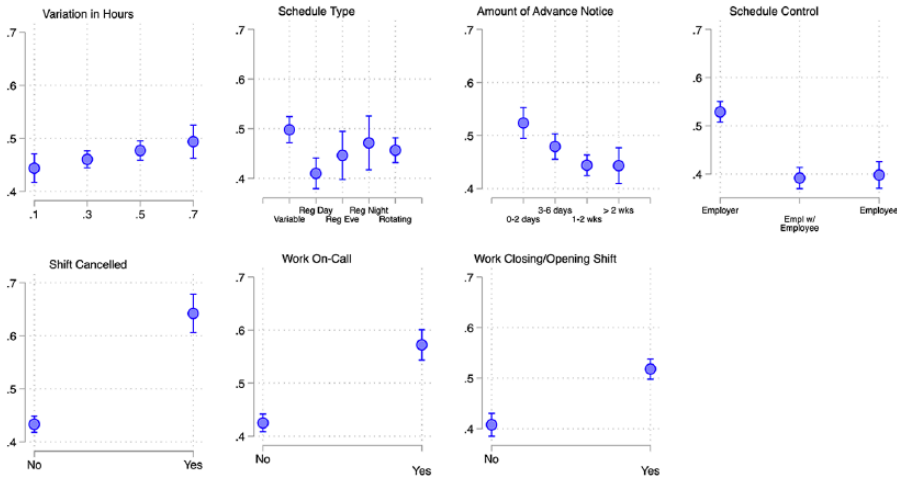


Figure 1. Predicted Probabilities of Psychological Distress by Scheduling Experiences

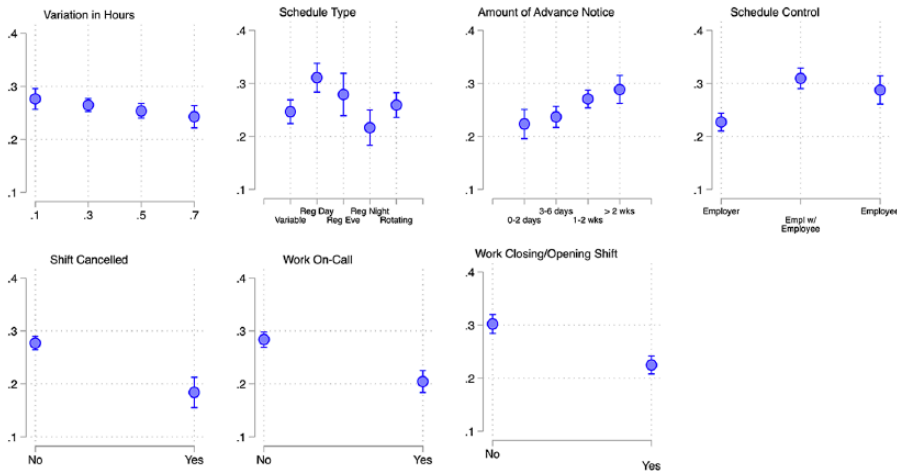


Figure 2. Predicted Probabilities of Very Good/Good Sleep Quality by Scheduling Experiences

percent of workers who have had shifts canceled reported psychological distress, compared to less than 45 percent of those who had not. We also see a large gap between those who worked on-call shifts and those who did not. The gap is even larger, at about 30 percentage points, between workers exposed to one or two forms of schedule instability and those exposed to five or more sources of instability (top left panel, Figure 4).

Sleep quality. The models in the second column (2) of Table 3 present similar estimates for the association between scheduling and sleep quality. Week-to-week variability in

work hours is negatively associated with reporting very good or good sleep quality, as is working a variable schedule as opposed to a regular day shift. Unsurprisingly, working a night shift is most strongly negatively associated with sleep quality, although working a regular evening shift is not. The distinction between having less than three days’ notice or three to six days’ notice versus at least one week of advance notice is again evident, as workers with less than one week’s notice report worse sleep. Shift cancellation and working on-call are negatively associated with sleep quality, as are working a clopening shift and having little control over one’s

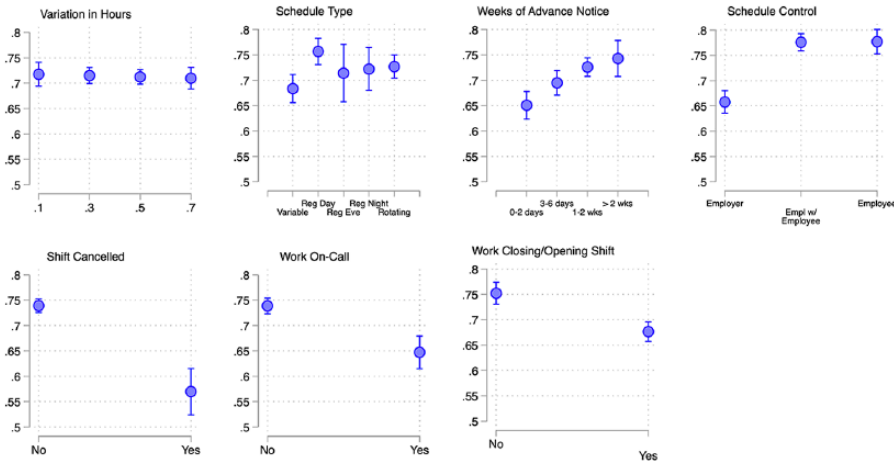


Figure 3. Predicted Probabilities of Being Very/Pretty Happy by Scheduling Experiences

schedule. Taken together, exposure to the constellation of unstable and unpredictable scheduling practices raises the risk of fair or poor sleep, particularly among the half of workers reporting exposure to three or more such practices.

Figure 2 plots predicted probabilities from these models. We find substantively significant gaps between workers with more and less hours variation, and between respondents who have unstable and unpredictable schedules versus those with more stable and predictable schedules. For instance, nearly 30 percent of respondents whose work hours varied relatively little (10 percent) week-to-week reported very good or good sleep, compared to 25 percent of respondents whose work hours varied a great deal (70 percent). We see a similarly sized gap between respondents working a regular day shift and those working a variable shift. This same 5 percentage-point gap is evident between those who receive less than one week’s notice of their work schedules and those receiving at least two weeks’ notice. There is a somewhat larger gap—about 10 percentage points—between those who have had a shift canceled versus those who have not, those who worked on-call versus not, and those who experienced a clopening versus not. The gap is even wider between respondents with few exposures to unstable and unpredictable scheduling practices (35 percent) and those with five or more

exposures (15 percent), nearly half a standard deviation (top middle panel, Figure 4).

Happiness. Finally, the models in the third column (3) of Table 3 report how scheduling practices are related to respondent reports of being very or pretty happy as opposed to not too happy. Although there is no significant relationship with week-to-week variability in work hours, the other measures of scheduling show similar patterning as for psychological distress and sleep quality. Respondents who worked a variable schedule were less likely to report being very or pretty happy compared to those who worked a regular day shift, and those with zero to two days and three to six days of advance notice were significantly less happy than those with at least one week of advance notice. We find strong relationships between happiness and exposure to canceled shifts, on-call work, clopening, limited schedule control, and multiple exposures to unstable and unpredictable scheduling practices.

For these relationships, the association is statistically and substantively significant. Figure 3 plots predicted values of happiness from the model estimates. There is a more than 15 percentage-point gap (a third of a standard deviation) between respondents who have had canceled shifts (56 percent) and those who have not (73 percent). Similarly, respondents who worked on-call were much less likely to be very or pretty happy (65 percent) compared

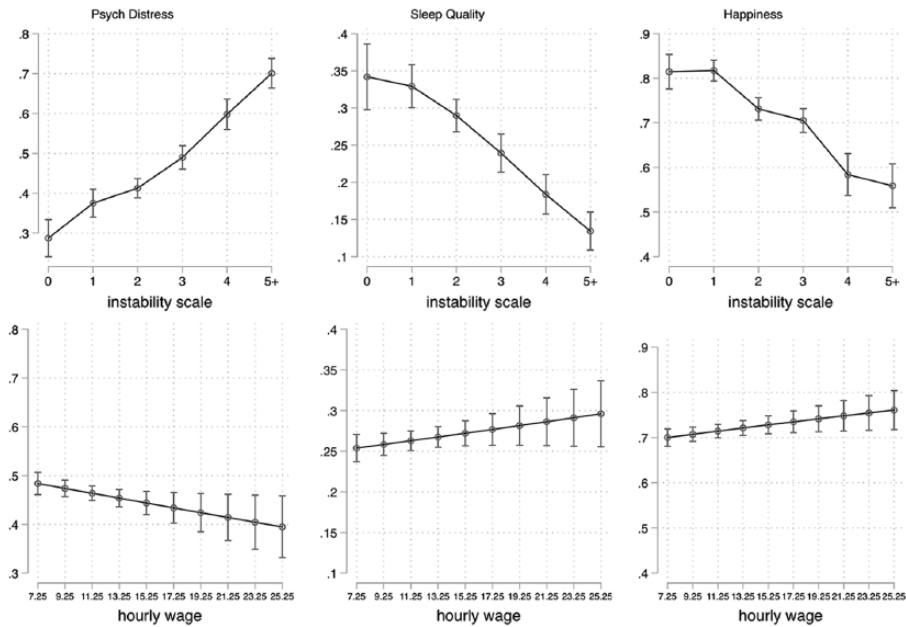


Figure 4. Predicted Probabilities of Outcomes by Scheduling Instability Scale and Hourly Wage

to those who did not (75 percent). Finally, as for the other outcomes, respondents who had few exposures to unstable and unpredictable scheduling practices fared far better than those exposed to a constellation of such practices (top right panel, Figure 4).

The Relative Roles of Time and Money: Schedule Stability and Hourly Wages

Exposure to unstable and unpredictable work scheduling practices is negatively associated with psychological well-being, sleep, and happiness. The temporal dimension of precarious work matters for health and well-being. At the bottom of Table 3, we show the associations between the key indicator of the economic dimension of precarious work, hourly wages, and our three outcome measures. For each model, hourly wages are significantly associated with our outcomes: workers who earn more are less likely to be psychologically distressed, and more likely to be happy and to report good or very good sleep quality.

However, these estimates do not tell us the relative importance of the temporal and

economic dimensions of precariousness for workers' health and well-being. In Figure 4, we explicitly make these comparisons, contrasting the magnitudes of the associations of schedule instability versus hourly wages with our outcomes by plotting predicted values for each outcome across the observed range of variation in our schedule instability scale and in hourly wages. Both wages and instability are significantly associated with each measure of well-being, but the associations are substantially larger for schedule instability. Contrasting these indicators of the two core dimensions of precarious work clearly shows the primacy of unstable and unpredictable work schedules for psychological distress, sleep, and happiness.

Another way to compare the substantive significance of these two dimensions of precarious work for well-being is to size the associations in terms of expected changes in psychological distress, sleep, and happiness that would be implied to result from policy-relevant changes to scheduling or to wages. In Table 4, we present differences in predicted probabilities for our three outcomes that our models suggest would result from increasing advance notice from zero to two days to three to six days (as

Table 4. Estimated Change in Outcomes Associated with Work Scheduling Regulations or Minimum Wage Increases

	(1) Change in Pr(Psych. Distress)	(2) Change in Pr(V./Pretty Happy)	(3) Change in Pr(V. Good/ Good Sleep)	(4) Percent of Sample Affected	(5) Total Change in Psych. Distress	(6) Total Change in Happiness	(7) Total Change in Sleep
<i>Changes in Advance Notice</i>							
0-2 Days to 3-6 Days	-.045	.044	.014	16%	-.007	.007	.002
0-2 Days to 1-2 Weeks	-.079	.075	.048	34%	-.019	.018	.014
3-6 Days to 1-2 Weeks	-.035	.031	.034				
0-2 Days to > 2 Weeks	-.081	.092	.066	64%	-.020	.028	.025
3-6 Days to > 2 Weeks	-.036	.048	.052				
1-2 Weeks to > 2 Weeks	-.001	.017	.018				
<i>On Call Shift</i>							
On-Call to No On-Call	-.148	.092	.079	26%	-.038	.024	.021
<i>Clopening Shift</i>							
Clopening to No Clopening	-.111	.075	.077	50%	-.056	.038	.039
<i>Wages</i>							
\$7.25 to \$7.50	-.001	.001	.001	1%	.000	.000	.000
\$7.25 to \$7.75	-.003	.002	.001	2%	.000	.000	.000
\$7.25 to \$8.25	-.005	.004	.002	8%	.000	.000	.000
\$7.25 to \$8.75	-.008	.005	.003	11%	-.001	.001	.000
\$7.25 to \$9.25	-.010	.007	.004	21%	-.002	.001	.001
\$7.25 to \$9.75	-.012	.009	.006	25%	-.003	.002	.001
\$7.25 to \$10.25	-.015	.011	.007	40%	-.006	.004	.003
\$7.25 to \$10.75	-.017	.012	.008	46%	-.008	.006	.004
\$7.25 to \$11.25	-.020	.014	.009	56%	-.011	.008	.005
Sample Mean (SD)	.46 (.50)	.71 (.45)	.26 (.44)				

Note: This table presents estimates of changes in predicted values of psychological distress, sleep quality, and happiness from a policy-relevant change in scheduling or wages. The estimated values are derived from 12 separate regression models, each of which includes either hourly wages or one of the three schedule measures as a predictor. Each panel x column shown represents estimates from a separate regression. All models include controls for race, age, gender, educational attainment, marital status, school enrollment, hourly wage, average weekly work hours, employment tenure, managerial status, and living with children as well as month and year fixed effects. The estimates for hourly wage do not include any controls for work hours; the models estimating scheduling effects do include a control for work hours.

mandated in New York City), to one week (as mandated in Oregon), or to two weeks (as mandated in Seattle and San Francisco). We also show the changes estimated from banning on-call shifts (as mandated for retail workers in NYC) and from eliminating clopening shifts (which are regulated in NYC for fast food workers and in Oregon and Seattle). We contrast these “effect sizes” with those our model suggests would result from increasing the minimum wage from \$7.25, where we bound the effect using the sizes of actual minimum wage increases enacted between 2015 and 2018.

Table 4 shows the substantial effects of changes to scheduling on well-being.⁴ For instance, as shown in column 1, eliminating on-call shifts would reduce psychological distress by 15 percentage points for affected workers, and requiring 72 hours of advanced notice would reduce psychological distress by 4.5 percentage points for affected workers. Wage increases also reduce distress, but the magnitudes are smaller: a \$4 increase would reduce distress by 2 percentage points.⁵ We see similar results for happiness (column 2) and sleep quality (column 3).

Even though the effect sizes for a wage increase are smaller than for scheduling changes, the total effect on the full sample might be larger if a larger share of workers would be affected by a wage increase than by a scheduling change. The fourth column of Table 4 shows the percent of workers in our sample who would be affected by each type of policy change. Sixteen percent of workers would be affected by a mandate to provide 72 hours of advance notice, a third of workers by a mandate to provide one-week advance notice, and two-thirds by a mandate to provide two weeks’ notice. One-quarter of workers would be affected by the mandate to end on-call shifts and as many as half of workers by regulations on clopening. In contrast, in our data, 46 percent of workers would receive a raise (although the amount would vary) if the minimum wage increased by \$3.50 (the 75th percentile of cumulative stepped increases), from \$7.25 to \$10.75, and 56 percent would be affected by an even larger increase to \$11.25.

Columns 5, 6, and 7 in Table 4 size the simulated effects of these policy changes for the total sample of workers by multiplying the estimated effect of a change (from columns 1, 2, and 3) by the share of the sample estimated to be affected (from column 4). Here, the effects are smaller, because the benefits are distributed across all workers. For advance notice, requiring one week of notice returns larger benefits than requiring just 72 hours, reducing distress by 2 percentage points in the sample and increasing happiness by 1.8 points and sleep quality by 1.4 points. Requiring two weeks’ notice would have larger effects for happiness and sleep, increasing them by 2.8 and 2.5 points, respectively. Eliminating on-call shifts and, especially, clopenings, would have substantial effects on the total sample, reducing distress by 3.8 and 5.6 points, increasing happiness by 2.4 and 3.8 points, and increasing sleep quality by 2.1 and 3.9 points, respectively. In contrast, although a larger share of workers would be affected by a \$4.00 wage increase, the total effect on the sample is significantly smaller, between .5 and 1 percentage point (the same as requiring 72 hours of advance notice in the case of distress and happiness).

Mediation by Economic Insecurity and Work-Family Conflict

Table 5 presents the key results from the mediation analysis. Here, we focus on the extent to which our two key hypothesized mediators—household economic insecurity and work-life conflict—account for a portion of the total effect of our scale measure of schedule instability on each of the three outcome variables. Table 5 presents the percentage of the total effect that can be accounted for by each of the two mediators for each of the three outcomes. We present the point estimate of the mediation percentage as well as the 95 percent confidence interval around the proportion.

Household economic insecurity substantially mediates the relationship between work scheduling practices and psychological distress, accounting for 42 percent of the total effect (95 percent CI: 40 percent, 44 percent).

Table 5. Mediation of Association between Schedule Instability Scale and Psychological Distress, Sleep Quality, and Happiness by Household Economic Insecurity and Work-Life Conflict; Percentage of Total Effect Mediated

	Economic Insecurity	Work-Life Conflict
Psychological Distress		
Percent Mediated	42%	76%
95% CI	[.40, .44]	[.73, .79]
Good Sleep		
Percent Mediated	45%	82%
95% CI	[.46, .51]	[.84, .91]
Happy		
Percent Mediated	37%	76%
95% CI	[.31, .35]	[.73, .80]
Observations	27,792	27,792

Note: Estimates are of the percent of the total effect of schedule instability scale on each outcome that is mediated by household economic insecurity (left) and by work-life conflict (right). All models are estimated with survey weights and on multiply-imputed data and include controls for race, age, gender, educational attainment, marital status, school enrollment, hourly wage, household income, average weekly work hours, employment tenure, managerial status, and living with children as well as month and year fixed effects.

Household economic insecurity plays a similar role in accounting for the total effect of schedule instability on sleep and happiness, explaining 45 and 37 percent of the total effect, respectively. However, even after accounting for household economic insecurity, the relationship between schedule instability and psychological distress remains negative and statistically significant. Economic instability is not the main reason why unstable and unpredictable schedules matter for workers' health and well-being.

Instead, work-life conflict explains a much larger proportion of the total effect of schedule instability on each of the three outcome measures. We are able to mediate 76 percent of the total effect of schedule instability on psychological distress (95 percent CI: 73 percent, 79 percent) as well as 82 percent of the total effect on sleep and 76 percent of the total effect on happiness.

In all, our mediation hypotheses are strongly supported. The negative associations between well-being and unstable and unpredictable work schedules are partially mediated by household economic insecurity, but work-life conflict plays the more important mediating role.

Robustness

We assess the robustness of our main regression results to four checks: (1) inclusion of employer and state fixed effects, (2) use of alternative weights, (3) using social engagement and sharing on Facebook to check for selection on unobserved confounders, and (4) consideration of possible unobserved confounders using a message test. As detailed in Parts B and C of the online supplement, the results are quite robust to these checks.

DISCUSSION

Since the 1970s, a risk shift from employers to employees has led to an increase in employment precarity for U.S. workers (Hacker 2006; Jacoby 2001), but particularly so for workers with low levels of educational attainment and human capital (Kalleberg 2009). In response to this rising precarity, research and policy mobilization have emphasized the economic dimension of precarious wages, far more than the temporal dimension of precarious schedules. Yet, this temporal dimension, a central feature in the lives of many workers, is fundamental to

their well-being. The use of just-in-time and on-call scheduling practices represents a stark manifestation of the risk shift: these scheduling practices allow employers to transfer the risk associated with uncertainty in consumer demand onto workers. Although these practices may achieve a short-term business objective of minimizing labor costs, they potentially exact a heavy toll in terms of workers' health and well-being. To date, this unmeasured cost of precarious schedules has been suspected but not put to a rigorous empirical test due to a lack of necessary data.

Using a new source of data, we estimated the associations between routine instability in work schedules and workers' health and well-being. The evidence is strong and consistent in connecting scheduling practices—including short notice of work schedules, irregular work schedules and hours, canceled shifts, and on-call shifts—to psychological distress, worse sleep quality, and unhappiness. These findings align with and extend the strong evidence linking schedule control to improved health outcomes among white-collar workers (Moen et al. 2016; Olson et al. 2015) as well as the literature on non-standard work schedules and worker well-being (Bara and Arber 2009; Costa 2003; Presser 2003).

The vast majority of prior research focuses on the economic dimension of precarious work, specifically wages. In this context, it is striking that exposure to unstable and unpredictable work schedules has substantively larger negative associations with psychological distress, sleep quality, and happiness than do wages. We size these effects in terms of enacted and proposed policies that would change scheduling practices and raise wages. Our simulations show much larger population-level benefits for changes to scheduling than to wages. All this evidence points to the central importance of the temporal dimension of precarious work and calls for a reorientation in how we think about precarious employment. Although the economic dimension of precarity is of clear importance, the temporal dimension is arguably even more important and deserves more serious and concentrated attention.

Work schedules have an inherent economic component for hourly workers, because schedules together with hourly wages determine earnings. Our mediation analysis confirms that a portion of the association between schedules and well-being is attributable to economic insecurity. However, the far more important pathway is through work-life conflict engendered by these scheduling practices. Workers who receive little advance notice and are exposed to shift cancellation, on-call shifts, and clopenings, among other practices, experience a great deal of conflict between work demands and personal life, which depresses well-being. This mediation shows that the temporal dimension of precarious work is consequential over and above any economic pathway. These results call attention to work-life conflict as an important social determinant of health, not just for the white-collar workers who have been the focus of much prior literature, but for low-wage service-sector workers as well. Our work broadens the scope of causes of this work-life conflict, pointing not just to the absence of schedule control, but to employer practices that drive routine work-schedule uncertainty.

Alongside this substantive contribution of highlighting the central role of time in the relationship between economic precarity and worker well-being, our research makes a methodological contribution in developing a flexible and accessible means to fill a gap in available survey data as well as providing tools for assessing and addressing selection bias in the resulting non-probability sample. We demonstrate that sophisticated advertisement targeting capabilities available on the social media site Facebook allow for highly targeted survey recruitment. We harness these capabilities in the service of building a large and policy-relevant database of employees at large retail and food service employers. The same basic recruitment techniques could be used to build survey samples for a wide variety of research aims. Because we rely on a non-probability sample, we are attentive to issues of potential sample selectivity. We partially address selection issues through post-stratification

weighting techniques, which are well-established and easily replicated. In addition, we develop more novel tests of bias on unobservables that could also be applicable to research relying on non-probability samples. Using these strategies, we find no evidence to suggest important selection on an unobserved confounder. Beyond the utility in this particular case, these two tests of bias could be useful in future research that uses Facebook or other social media sites as a sampling frame and recruitment channel.

In interpreting our novel and policy-relevant findings that work scheduling is strongly related to worker health and well-being, some limitations and cautions should be kept in mind. Our analyses are cross-sectional, and individuals' unobserved characteristics could lead some workers to sort into jobs with particular scheduling practices or to be subject to certain scheduling practices within jobs and to experience worse outcomes for reasons unrelated to those scheduling practices. Because we can identify employers and incorporate employer fixed effects into our models, we can address the issue of positive or negative selection into particular employers. For instance, high-road employers that offer stable schedules and better-than-average work conditions may attract the happiest and healthiest workers, whereas employers with the least desirable working conditions are likely to negatively select the least capable and healthy workers. Inclusion of employer fixed effects accounts for these differences across employers, which is one advantage of the newly-available data from the Shift Project. Nevertheless, a selection process may still influence within-employer variation in the stability and predictability of workers' schedules, if managers exercise discretion and reward or punish workers based on their performance or favoritism. This source of selection cannot be addressed in the current analysis. Therefore, when interpreting our results, we recognize that workers' unobserved characteristics may in part confound the reported relationships. Although we took steps to guard against sample selectivity and conducted numerous robustness checks, we

cannot eliminate the possibility of residual confounding.

Our research comes against the backdrop of a rapidly changing policy landscape, as many localities have increased the local minimum wage and a few now offer paid time off for sickness or parental leave. In the domain of work schedules, San Francisco, Seattle, Emeryville (CA), and New York City have all passed and implemented legislation that requires chain stores to provide two weeks' advance notice of work schedules and access to more work hours. New York State and the state of Oregon have written regulations or passed laws, and other cities and states are considering similar legislation. Our research provides concrete support for the notion that requiring 72 hours advance notice would be beneficial to workers, requiring a week of advance notice would be better still, and in some domains, two weeks' advance notice would be best of all. Our estimates also clearly support the idea that reducing on-call and clopening shifts would improve retail workers' lives, specifically improving their mental health, sleep quality, and happiness. If these provisions also reduced schedule variability, hour volatility, and shift cancellation, and increased schedule control, our estimates show that those changes too would promote well-being.

Our estimates show that these schedule effects are large compared with those of wage increases, but our estimates should not be interpreted to suggest that wage increases are immaterial to well-being. On the contrary, we find significant associations between wages and psychological distress, sleep quality, and happiness. Yet, these new findings point to a need to rethink what really matters most for job quality in the large, less-skilled sectors of the economy. The multiple dimensions of work schedules that represent the temporal dimension of precarious work are arguably at least as important, and perhaps more so, than the economic dimension as a social determinant of worker health and well-being.

The imminent changes in scheduling law and company practice provide a window into the consequences of the risk shift related to workers' time. The exogenous changes in work scheduling practices—in the direction

of discouraging and penalizing just-in-time scheduling—offer an opportunity to gauge the effects of a reduction in the risk borne by service-sector workers. Future research, capitalizing on these exogenous changes, would represent an important step forward in understanding the causal link between work schedule practices and the well-being of workers and their families. Our results add to a growing body of evidence that scheduling experiences are powerfully associated with worker well-being, and they give us reason to expect an increase in the stability and predictability of work schedules would have a range of beneficial effects.

Our study pertains to the retail and food service sector, a sizeable and policy-relevant segment of the U.S. workforce. Yet, precarious scheduling experiences are not unique to these workers. Instead, precarious schedules have become a fact of life for a broad range of industry sectors and occupations—ranging from the software sector (O’Carroll 2015), telecommunications, media, government (Rubery et al. 2005), and health care (Clawson and Gerstel 2015) to financial professionals and truck drivers (Snyder 2016). Although workers in higher paid occupations have more resources to buffer against routine uncertainty in work schedules, the connections we trace between the temporal dimensions of precarious work—above and beyond economic status—give some reason to expect health and well-being consequences of the scheduling risk shift to spread beyond the service sector. The temporal dimension of precarious employment—instability, unpredictability, and uncertainty about work schedules—deserves a place alongside the economic dimension in future research and policy-making on precarious employment and on work as a social determinant of health.

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Notes

1. In Seattle and Oregon, only firms with more than 500 employees worldwide are covered (SMC 14.22; Senate Bill 828), in San Francisco only those with more than 40 establishments (SF Police Code Article 33F and 33G), and in New York City only chain fast food restaurant and retail employers with more than one location and more than 20 employees in New York City (NYC Administrative Code, Title 20, Chapter 12) are covered.
2. Despite these limitations, it is still potentially useful to benchmark the data we use against the NLSY97 data on the scheduling variables in common. Note that the company samples are not the same in our data as in the NLSY97 and the period differs as well, with NLSY97 collection in 2011, 2013, and 2015 and our data collected in 2016 and 2017. That said, we find a high degree of similarity. In the Shift data, 50 percent of workers reported no control over scheduling, compared to 49 percent of NLSY97 workers at companies with at least 10 employees. Among Shift respondents, 64 percent reported more than one week of advanced notice, compared to 57 percent of NLSY97 respondents. Finally, we estimate 24 percent variation in work hours week-to-week in the NLSY97 against 35 percent in the Shift data.
3. The National Retail Federation (NRF) list ranks parent companies that may include more than one consumer-facing brand (e.g., Yum! Brand owns KFC

and Taco Bell). Our sample of employers includes one or more consumer-facing brands owned by 61 of the top 100 retailers, including all of the top 30 firms (excluding Apple and Amazon, which are primarily internet-based sales businesses) and all but six of the top 50 retailers. We include an additional 11 firms that do not appear on the NRF list but are among the top 50 largest restaurant chains in the United States (Nation's Restaurant News 2017).

4. In discussing Table 4 we use the terms "effect" and "effect size" informally to describe the difference in predicted probabilities at different values of key predictors. We note that we are *not* describing causal effects or effect sizes in the formal sense of effects expressed in standard deviation terms.
5. Of course, minimum wage increases could have additional effects on workers beyond the treatment group. One possibility is reductions in employment (Neumark and Wascher 2007), although the scholarly consensus shows little evidence of such effects (Dube et al. 2010). Another possibility is that wages would rise for workers already above the new minimum wage, although the evidence suggests wage compression is more likely (Schmitt 2013).

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