



**STABLE  
SCHEDULING  
STUDY**

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**HEALTH  
OUTCOMES  
REPORT**

# STABLE SCHEDULING STUDY

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# HEALTH OUTCOMES REPORT

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## EXECUTIVE SUMMARY

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Waiting to find out if you're going to be called in to work any given day, having to rearrange your life to fit around your work schedule, and working a different number of hours every week are stressful realities of retail work today. Even worse, the stress caused by the unstable, unpredictable schedules can interfere with retail workers' ability to get good sleep. Quality sleep is a cornerstone of health: it is essential for physical and mental well-being, cognitive skills, and even good parenting. In addition to the stress of unstable schedules that makes it difficult to maintain healthy sleep routines, retail workers may lose sleep over their finances.

The common perception is that workers in retail are just students picking up beer money, so scheduling instability is not a problem. Our data on retail workers suggest that this is often untrue. This study shows that many retail workers are working to support themselves—and that scheduling instability means that many hourly retail workers lack necessities even as basic as food.

We conducted a randomized experiment of a multi-component, store-level intervention designed to provide workers with more stable schedules. This report focuses on worker health and well-being—both the hardships facing workers before the intervention was implemented and improvements due to the intervention.

This study was conducted at Gap Inc. The experiences reported by Gap workers are not unique and mirror those reported by retail workers in other studies.<sup>1</sup> By examining multiple aspects of well-being, our findings further understanding of the challenges retail workers face as they strive to manage multiple responsibilities and earn an adequate living.

1. Henly & Lambert, 2014; Schneider & Harknett, 2016; 2019.

## Worker Experiences at Baseline (before intervention implementation)

### SLEEP, HEALTH, AND STRESS

- On nights they worked, workers slept an average of 6.2 hours.
- 47% of workers reported that their work schedule interfered with their sleep.
- 60% of workers had physical symptoms (stomachaches, headaches, etc.) unrelated to a medical condition in the past week. This type of psychosomatic symptom may be a sign of stress.

### WORK-LIFE CONFLICT

- 56% of fathers and 39% of mothers had to cancel an event or appointment in the past three months that was important to their child because of their schedule at the Gap.
- 28% of students found it difficult to coordinate their classes with their work schedules.

### FOOD INSECURITY AND FINANCIAL INSECURITY

- 51% of workers reported at least moderate food insecurity in the past month.
- 12% were late on rent or mortgage payments in the past three months.
- 26% were late on utility payments in the past three months.
- 19% delayed going to the doctor or getting prescriptions filled because of financial concerns in the past three months.

### EFFECTS OF THE INTERVENTION

- Self-rated sleep quality improved by 6-8% on average as a result of the intervention.
- Mixed evidence of a decrease in psychosomatic symptoms, stress, and financial insecurity.



As in our first report, “Stable Scheduling Increases Productivity and Sales,” we focus on average treatment effects, that is, on differences between control and treatment stores overall (Williams, Lambert, Kesavan, et al., 2018). As documented in our prior report, the intervention produced only a modest shift toward stability, and perhaps as a result, we find few average treatment effects on workers’ health and well-being.

The most robust effect of this intervention is on sleep quality, which is central to worker health and well-being. Research documents that poor sleep quality and sleep deprivation impede the ability to retain new information, and the ability for creative thinking—which means that the retail jobs many young people take to help support themselves through college may undermine their ability to learn. Recent research also documents that poor sleep quality and sleep deprivation have negative short- and long-term effects on health, including raising the risks of cancer, cardiovascular disease, strokes, and heart attacks, and obesity.<sup>2</sup> Worker sleep deprivation hurts employers as well, costing companies over \$411 billion per year in the United States.<sup>3</sup>

After the pre-pilot stage of our study, Gap rolled out two changes company-wide: elimination of on-call shifts and increased advance notice. Workers were in favor of the changes, and commented on the positive health and work-life benefits.

Our findings help inform two ongoing debates.

The first is the debate over scheduling legislation that is sweeping the country: several cities and two states have enacted or proposed scheduling legislation. This report’s findings on sleep-deprivation and poverty among retail workers will be of interest to policymakers considering such legislation.

Businesses themselves are also becoming increasingly interested in shifting to more stable scheduling because of new information that doing so can increase both sales and labor productivity.<sup>4</sup> This report adds an important dimension to the business case for more stable schedules. Recently, Walmart implemented two components of stable scheduling: core scheduling and tech-enabled shift swapping.<sup>5</sup> This move, which will impact more than one million workers across the country, shows that businesses are realizing that stable scheduling is in fact a better business model.

The high rates of food insecurity, and long-term negative health effects of sleep deprivation highlight that a move to more stable scheduling is not just about profits; it’s about corporate social responsibility. Stable scheduling is an ethical issue that also has concrete business benefits: it’s a win-win.

2. Cappuccio, Cooper, D’Elia, Strazzullo, & Miller, 2011; Chaput et al., 2010; Fernandez-Mendoza et al., 2012; Haus & Smolensky, 2013.
3. RAND Corporation, 2016.
4. Ton, 2014; Williams et al., 2018.
5. Nassauer, 2018.

# Reducing Variability in Scheduling Shift Work

## The Status Quo

## The Intervention

## Some of the Outcomes



Research conducted by the UC Hastings Center for WorkLife Law, The University of Chicago, and The University of North Carolina and funded by Evidence for Action, a National Program of the Robert Wood Johnson Foundation.

## INTRODUCTION

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Schedule instability hurts workers, costs the public, and drives down profits for businesses. Our first report focused on the effects of improving schedule stability on business outcomes (Williams et al., 2018). This report focuses on effects on worker health and well-being.

The rise of the gig economy may have led people to believe that workers prefer flexibility in their work schedules. However, for hourly workers, like those in retail, too much flexibility paired with too little input can more accurately be called instability. Unpredictable, unstable scheduling practices are widespread. One in six workers in the US worked a variable schedule because of their employer in 2017 (Federal Reserve, 2018). This number is doubled for workers in retail (Federal Reserve, 2018). One in ten workers in the US receives their work schedule less than a week in advance (Federal Reserve, 2018). Operations researchers have found that matching labor to store traffic is a key driver of profitability for retailers (Perdikaki, Kesavan, & Swaminathan, 2012). But recent evidence shows that staffing too tightly to traffic fluctuations can result in understaffing, leading to poor customer service, phantom stock-outs, and missed sales (Mani, Kesavan, & Swaminathan, 2014; Ton, 2014). This type of scheduling can also undermine worker well-being (Henly & Lambert, 2014).

Unpredictable and unstable scheduling practices are associated with health and well-being outcomes for workers. Unstable and unpredictable schedules have been negatively linked to happiness, psychological well-being, and sleep quality (Schneider & Harknett, 2016; 2019). Parents who work these types of non-standard schedules are at heightened risk of experiencing poor family functioning, depressive

symptoms, and problems parenting (Strazdins, Clements, Korda, Broom, & D'Souza, 2006).

Unpredictable and unstable schedules are also bad for work-life balance. Workers with unstable, unpredictable schedules have to deal with the stress of continually struggling to balance their work and personal lives (Ben-Ishai, 2015; Golden, 2015; Morsy & Rothstein, 2015; Zeytinoglu, Lillevik, Seaton, & Moruz, 2004). Unpredictable schedules, last-minute scheduling changes, and schedule inconsistency have all been linked to higher work-life conflict (Henly & Lambert, 2014). Data from the General Social Survey indicate the same: irregular and on-call schedules are linked to work-family conflict (Golden, 2015).

The negative effects of unpredictable, unstable schedules are pervasive and can impact workers' health in indirect ways as well. For example, the work-family conflict that can result from non-standard schedules plays a part in worsening physical and mental health (Cho, 2018). Similarly, the effects of stress also undermine worker well-being: across the US, half of workers report missing time at work due to work-related stress, 61% report becoming sick from workplace stress, and 7% have ended up hospitalized due to workplace stress (Business Wire, 2014).

## WORK SCHEDULES AND SLEEP QUALITY

One of the most direct health effects of unstable scheduling concerns sleep: non-standard work schedules like retail workers often face are linked to disruptions in workers' circadian rhythms and lower sleep quality (Vogel et al., 2012; Wight, Raley, & Bianchi, 2008). Sleep schedules are governed by both our circadian rhythm (our internal clocks) and the neurotransmitter adenosine, which is responsible for making us feel sleepy (Walker, 2017). When these processes are out of sync, we can't fall asleep, even if our work schedules dictate that this is the time to sleep. Sleep is a crucial factor in worker health: a Gallup study found a relationship between sleep and well-being. In that study, 40% of the sample reported getting less than seven hours of sleep per night, which is the number recommended for good health (McCarthy & Brown, 2015).

Sleep deprivation has important health implications for workers. Sleep deprivation is associated with a weakened immune system, which means that workers will get sick more often (and have to take sick days, or come to work sick) (Prather, Janicki-Deverts, Hall, & Cohen, 2015). Routine sleep deprivation is associated with an increased risk of developing cancer, a 45% increased risk of coronary heart disease, and a 200% increased risk of heart attack or stroke for adults over 45 (Cappuccio et al., 2011; Fernandez-Mendoza et al., 2012; Haus & Smolensky, 2013). Nighttime shifts, which some retail workers regularly work, have been linked to cancer (Megdal, Kroenke, Laden, Pukkala, & Schernhammer, 2005). One study in Quebec found that sleep deprivation had a bigger impact on obesity than lack of exercise or high lipid intake (Chaput et al., 2010). Sleep deprivation

has also been linked to increased risk of diabetes and increased levels of cortisol, the stress hormone (Copinschi, 2005). The negative health effects of sleep deprivation have important implications for business. 18% of workers had health insurance through Gap, according to employee survey data. This means that if workers experience health problems related to scheduling instability at Gap, the company and coworkers in the plan may end up paying more.

Sleep deprivation also has negative repercussions for businesses. In the US, a study of four large companies found that sleep deprivation cost \$2000/year per worker, and up to \$3500/year for the most sleep-deprived workers, resulting in a net capital loss of over \$50 million per year (Rosekind et al., 2010). Across the US, sleep deprivation costs companies over \$41 billion per year (RAND Corporation, 2016). When workers are sleep deprived, they generate fewer and less accurate solutions to work problems, are less productive, and are less motivated (Webb & Levy, 1984). Sleep-deprived workers are more likely to slack off so that their coworkers have to work harder to make up for it (Hoksema-van Orden, Gaillard, & Buunk, 1998). When supervisors are sleep-deprived, they act in a more abrasive manner towards workers, which leads to workers being less engaged (Barnes, Lucianetti, Bhave, & Christian, 2015).

Instability in number of hours available to retail workers is also an economic problem: when hours vary, so do earnings. Scheduling instability and inadequate hours can be linked to financial insecurity (Ben-Ishai, 2015; Golden, 2015; Finnigan, 2018; Morduch and Schneider, 2017; Zeytinoglu et al., 2004). The insecurity caused by fluctuations in income has far-reaching consequences, from sleep disturbances and food insecurity to health



outcomes (Goh, Pfeffer, & Zenios, 2015; Halliday, 2007; Leete & Bania, 2010; Wight, Raley, & Bianchi, 2008). Schedule instability, and the accompanying income instability, is a major problem for workers in the US. Three in ten adults in the US have varying monthly household income, and one in ten experiences financial hardship due to income instability (Federal Reserve, 2018).

The health and well-being impacts of unstable, unpredictable schedules are clear. Across a multitude of studies, four dimensions of scheduling have repeatedly been linked to worker health and well-being: schedule consistency, predictability, adequacy, and control. The intervention sought to improve these four dimensions of retail workers' schedules.

## THE INTERVENTION

We conducted the first randomized controlled experiment of a multi-component intervention to increase schedule stability for hourly retail workers (Williams et al., 2018). In our initial report, we found the intervention increased scheduling consistency, predictability, and worker input, leading to positive business outcomes. There was a 7% increase in median sales in treatment stores, resulting in a \$2.9 million increase in revenue over a 35-week period. Labor productivity increased by 5%. We also examined sources of instability, finding that fluctuations in customer demand only account for 30% of variation in staffing hours.

This report adds to a growing literature on the implications of the stable scheduling intervention by examining outcomes associated with the health and well-being of workers.



## WORKER EXPERIENCES AT BASELINE

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We begin by exploring retail workers' experiences before we implemented the intervention. It is important to note that the experiences reported by workers in this study at Gap are similar to those reported in other studies on retail workers in a national women's apparel firm (Henly & Lambert, 2014) and a on large sample of service workers (Schneider & Harknett, 2016 ; 2019). However, there was a difference between Gap and other retailers: Gap worked with us to address the problem of scheduling practices and develop a multi-component intervention.

### FOOD INSECURITY AND FINANCIAL WELL-BEING

*"I'm homeless... I can't pay for childcare. I can barely feed my child on what I am getting. It's hard trying [to] be a mom and prioritize."* (Sales Associate, Survey Comment)

Unstable schedules impact financial well-being in two different ways. First, they typically offer workers only short part-time hours that do not provide enough income for workers to live on. Second, because schedules are not pinned down until the last minute, workers find it hard to work a second job to earn the extra money they need.

Although retail workers are stereotyped as students earning a little extra cash, this is often inaccurate. We found that many retail workers were struggling to come up with money for food, housing, and necessities.

The consequences of financial insecurity for retail workers were far-reaching. About half of respondents reported at least one type of food insecurity:<sup>6</sup> being unable to afford balanced meals, having to cut the size of meals or skip

meals for financial reasons, or having food not last and having no money to buy more.

Demographic groups reported significantly different rates of food insecurity: a larger proportion of men (61%) than women (47%) reported food insecurity, and a larger proportion of African-American (70%) and Hispanic (61%) workers reported food insecurity than white workers (38%).

Approximately half of workers reported difficulty covering their living expenses at the moment. Financial difficulties were more prevalent among African-American workers (58%) than white workers (44%). In the past three months, 12% of workers were late on rent or mortgage payments and about a quarter of workers were late on phone, gas, or electric bills. Almost one in five workers delayed getting prescriptions or going to the doctor because of money concerns.

Well over half (62%) of respondents reported having to put off buying something that they needed in the past three months; 44% reported having to resort to credit cards to get by, and a third had to borrow money from family or friends.

Nearly half (47%) supplemented their earnings at Gap with another job. This was not easy for many; about a quarter found it somewhat or very difficult to coordinate their work schedule with their other job. This exacerbates the negative financial effects of unstable scheduling: workers who do not get enough hours from one employer cannot take full advantage of a second part-time job to bring their incomes high enough to provide a comfortable living.

6. Items refer to food insecurity in the past month and come from the U.S. Household Food Security Survey Module: Six item Short Form, Economic Research Service, USDA, September 2012.  
[ers.usda.gov/media/8282/short2012.pdf](https://ers.usda.gov/media/8282/short2012.pdf)

Among employees who lived with a partner who worked (28% of respondents), about half reported that it was somewhat or very difficult to coordinate their schedule with their partner's job. When partners can't coordinate, it may be difficult to arrange transportation, handle child-care responsibilities, and maintain the household, further exacerbating problems with securing an adequate household income.

## SLEEP, HEALTH, AND STRESS

*“Myself and my counterpart have to completely swap our sleep schedules every two days and it really takes a toll on our lives outside of work and ability to sleep for the next day.”*

(Logistics Lead, Survey Comment)

Some workers reported that their sleep schedules were dictated by their work schedules. Survey respondents reported sleeping an average of 6.2 hours on typical days that they worked: much lower than the 7.9 hours they reported sleeping on typical days off. About a quarter reported that their sleep quality was very or fairly bad.

*“Friday we added three extra bodies to get shipment done. I had four of us come in at 3 a.m. Our little army was sleepy.”*

(Manager, Interview Comment)

Workers also reported that their work schedules interfered with their ability to prioritize their health: 47% reported that their work schedule interfered with getting enough sleep, and 42.4% reported that their work schedule interfered with exercise or sports activities.

Survey respondents felt generally healthy: only 11% rated their general health as fair or poor. However, when we asked about specific symptoms not related to a general medical

condition, like stomachaches or headaches, we got a different perspective: 60% said that they had usually or sometimes experienced those symptoms in the past week. Psychosomatic symptoms like headaches and stomachaches can be related to stress, which can in turn be caused by unpredictable and unstable schedules.

And some workers brought their health problems to work with them. Fully 80% of respondents reported that they had gone to work on a day that they were sick in the past year, which poses a significant public health risk: sick employees can expose other employees and customers to germs. A third reported going to work while sick three or more days in the past year.

Moreover, sizable proportions of workers reported symptoms of psychological distress: 22% reported having trouble focusing on tasks at work or home, 18% reported difficulty taking pleasure in activities, and 20% reported feeling distant from family and friends.



## WORK-LIFE BALANCE

*“The schedule is beyond grueling - Our schedule is often 5 overnights in a row, which make it incredibly difficult to maintain a social life as well as search for a better paying job.”*

(Visuals Team Associate, Survey Comment)

Unstable schedules make it difficult for workers to plan their lives in advance. The last-minute changes and lack of worker input common in retail mean that workers often have to de-prioritize family, school, and other responsibilities in favor of their retail work schedules.

Some workers noted how far-reaching the work-family consequences of unstable scheduling are:

*“Christmas is not easy to be enjoyed after working 3-4 overnights in a row, not allowing you to plan anything with your family. Birthdays, vacations, life works around the company's calendar which changes constantly. One should not change their wedding date or plan their honeymoon around their workload calendar.”* (Assistant Manager, Survey Comment)

Among parents who had children under 18, almost a quarter said that their work schedule had interfered with their childcare arrangements in the past month. Further, 56% of men and 39% of women reported that they had to cancel an event or appointment that was important to their child because of the work schedule within the past three months. This could be because mothers have a heavier load of household labor (Bianchi, Sayer, Milkie, & Robinson, 2012): mothers are expected to be available to their children, while fathers are expected to fit childcare around their work. Parents reported that their work schedules also interfered with children's bedtime routines

(34%), hobbies/sports (24%), mealtimes (34%), school activities (25%), and extracurricular activities (25%).

About a quarter of workers reported that they provide care for an elderly, disabled, or ill adult. Women (29%) reported this at a much higher rate than men (12%). However, more of these men (23%) than women (13%) reported that their work schedule interfered with their ability to care for the adult.

Some workers commented that their schedules meant they rarely saw their children or partners. Prior research has shown that couples who handle child care through tag teaming have three to six times the national divorce rate (Rubin, 1994).

*“I worked 18 overnight shifts in one month! Not allowing me to see my child other than for dinner before I went to work again. Saw my husband when I woke up until I went to work and when I got home from work at 6am-9am.”*

(Assistant Manager, Survey Comment)

Workers reported that their work schedules interfered with family activities including spending time with children or grandchildren (20%), preparing meals for their household (36%), maintaining the home (40%), and attending family gatherings (38%). Family disruptions from non-standard hours are associated with emotional and behavioral problems among children (Strazdins et al., 2006).

*“There's always business changes... that the schedule then needs to be adjusted. So it's actually taking away work life balance even more.”* (Assistant Manager, Survey Comment)



Students often take retail jobs in order to help support their educational goals. However, unstable schedules at work may make it harder to succeed in school. Among workers who were students, 28% found it somewhat or very difficult to coordinate their work schedule with their classes; 21% reported that their work schedule makes it somewhat or very difficult to complete their program of study. The priority given to having open availability to work unstable schedules made some students feel devalued, as expressed by this student:

*“Being a college student and having to work, my managers have looked down upon me and what I list as my priorities. If I say I cannot work due to an exam I need to study for or when I try to cut down availability because I have a class, they give me a hard time... They make me feel like being a student is the worst thing to be. Going to college and working at Gap is not easy and the company does not make it easy at all.”* (Sales Associate, Survey Comment)



## DESIGN OF THE INTERVENTION

We designed an intervention to increase scheduling stability in Gap stores. To begin, interviews of Gap store managers were conducted by PI Williams and Whitney Hampton in San Francisco and co-PI Lambert and Erin Devorah Carreon in Chicago. The information obtained in these initial interviews was used to understand the ways that the schedules were unstable, and to create an intervention to increase stability. The intervention components were pretested in three San Francisco stores. The final intervention was developed in collaboration with Gap executive sponsor Eric Severson and the pretest store managers.

We sought to impact four dimensions of scheduling stability:

1. Consistency: more consistent schedules from week-to-week.
2. Predictability: making sure workers know when and how much they are working.
3. Adequacy: letting workers work more hours if they wanted.
4. Input: allow workers more autonomy in choosing when they were working and when they weren't.

After the pretest, Gap implemented two of the intervention components across all of their stores:

1. Two-week Advance Notice: All schedules were required to be finalized and published two weeks in advance.
2. Elimination of On-calls: Stores were no longer able to schedule "on-call" shifts that could be cancelled at the last minute.

The five additional components of the stable scheduling intervention were rolled out to stores in the treatment condition. Managers were responsible for implementing five practices

bundled together in a package called the "Stable Scheduling Study Intervention." Gap's scheduling software generated schedules as usual during the experiment, but managers in the intervention stores overrode the automatically generated schedules as necessary to implement more stable scheduling practices:

1. Tech-enabled Shift Swapping: An app allowed workers and managers to post shifts after the schedule was finalized. Workers could post shifts they did not want, and pick up other shifts to get more hours, allowing them greater input into schedule changes. Managers could use the app to help ease the burden of the elimination of on-call shifts by posting last-minute shifts or cancelling shifts that workers had posted.
2. Stable Shift Structure: Managers reduced the number of different start and end times in the store, so that shift schedules would be more consistent and predictable for workers and the entry and exit of workers more consistent and predictable for managers.
3. Core Scheduling: Workers were given more consistent days and times of work week-to-week.
4. Part-time Plus: A core team of workers were given a "soft guarantee" of 20 or more hours a week. These workers benefitted from more consistent and adequate hours, and managers had a core team they could rely on.
5. Targeted Additional Staffing: Store traffic was analyzed and stores were given additional payroll hours for times the store was understaffed. The additional hours gave managers more flexibility to give more consistent and predictable work schedules to workers.

Our experiment provided evidence that a shift toward stable schedules was associated with benefits for business and health outcomes. However, our intervention only addressed store-

level sources of instability – manager practices and worker schedule changes. During the course of the study, we also discovered that a large portion of scheduling instability is passed down from headquarters. There were three main HQ drivers of instability:

1. Shipment: Dates and numbers of units to be shipped could be changed by HQ with little notice to store managers. This led to store managers needing to add or cancel a number of shifts last-minute.
2. Promotions: In-store promotions could change frequently, sometimes multiple times a week. Store managers needed to find extra hours to schedule workers to change signs and do markdowns in the store.
3. Leadership visits: Visits from corporate managers could be scheduled with little notice, and managers felt obliged to schedule extra hours to prepare the store.

The HQ drivers of instability were not addressed in the intervention, and so they remained a source of instability throughout the experiment.

In the end, the intervention produced only a modest shift toward stability. We had an impact on consistency, predictability, and input in a few different ways. The start and end timing of shifts during the intervention was more consistent. Shifts were less likely to change, making them more predictable. Lastly, workers had more say in when they were working because of the tech-enabled shift swapping. Adequacy in hours was little changed, however, with only part-time plus associates seeing an increase in hours.





## EFFECTS OF THE INTERVENTION

We used statistical analysis to identify the effects of the intervention on health and well-being.<sup>7</sup> The clearest overall effect was on sleep. The intervention resulted in a 6-8% increase in self-rated sleep quality among workers in treatment stores. This finding was robust across a series of different models. As we discuss below, sleep quality represents a proximal outcome that is associated with a number of other, more distal health outcomes.

We found mixed evidence of an intervention effect on other indicators of health and well-being.<sup>8</sup> Physical symptoms like headaches, muscle pain, and stomachaches not related to a medical condition became less frequent – but only at a marginal level of significance. In models that control for household income, we see some evidence of a decrease in perceived stress and financial difficulties. The effects of the intervention may vary by subgroup, and a key focus of our future work is to disaggregate groups of workers to test for possible differences in the size or nature of the intervention effect. Although no overall treatment effects emerged for food insecurity or financial hardship, analyses examining subgroups such as workers in low-income households are ongoing. So far, we find that the intervention decreased stress among parents (a 15% reduction) and second-job holders (9%) and that effects on sleep are particularly strong for associates with a second job and those younger than 26.

7. Details of the methodology used for these analyses can be found in Appendix B of this report.

8. See Table 1 for full results.





## DISCUSSION

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Scheduling managers and scheduling software purveyors may be unaware how their practices disrupt sleep schedules: after all, workers can just sleep whenever they aren't scheduled to work, right?

That is not how sleep works. Anybody who has experienced jet-lag can tell you that even if you are in bed and want to sleep, you can't always just fall asleep at any time. When our circadian rhythms are disrupted, we cannot fall asleep, even if our work schedules suggest that this is the time to rest. As frequent travelers know, it takes time to adjust our schedules. This means that working unstable schedules can make it impossible to get a good nights' sleep, even if we have a long enough break between shifts.

As a society, we tend to value workers who power through sleep deprivation; businesses are the same. But this strategy fails to take into account the substantial costs to business from workers who are sleep-deprived.

Sleep deprivation represents another problem for students, who made up about half of survey respondents. Sleep is necessary for both learning and memory: non-REM sleep is essential for the storage and strengthening of new facts and skills, while REM sleep is essential for integration of knowledge and problem solving (Walker, 2017). When students have disrupted sleep due to their work schedules, they can't learn as effectively, which has major implications for their education and futures.

In retail stores, there are specific practices that can make it difficult for many workers to keep a regular sleep schedule. The first comes from shipping practices: when new shipments arrive, sometimes workers are required to come in extra early (at 4 AM, for example), which makes it hard to sleep on a normal schedule and also get enough sleep to function optimally. Another practice was rare in Gap stores, but is common in retail: "clopening" shifts, where a worker closes the store one night and opens the next morning. There isn't enough time in between shifts to get enough sleep, so naturally these workers experience sleep deprivation and the associated negative effects. Lastly, variable shift timing across days and weeks makes it difficult to have a consistent routine of when to work and when to rest.

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Schedule stability has a direct impact on sleep quality, which is likely to contribute to healthier workers and more viable businesses. Although this study only looked at proximal outcomes of stable scheduling, there is a substantial body of research that links sleep quality to health outcomes like well-being, diabetes, stress, and obesity (Copinschi, 2005; Chaput et al., 2010; McCarthy & Brown, 2015). There is reason to believe that the increase in sleep quality due to our intervention would have cumulative benefits for employees and businesses over a longer time period.

These findings provide further rationale for businesses and for legislative efforts to improve the stability and predictability of scheduling in retail and beyond. Although retail workers in our study reported a host of negative outcomes associated with their work schedules, we weren't able to impact all of them through the intervention. Future work should continue striving to improve scheduling stability by addressing store-level and broader corporate drivers of instability in order to have a stronger impact on health outcomes, work-family conflict, and financial security. Companies seeking ways to encourage worker engagement and productivity should consider the negative impact that unstable scheduling practices have on health and well-being. Where voluntary employer efforts are lacking, scheduling legislation may deliver similar benefits to workers and, by extension, to the customers they serve, businesses for which they work, and the communities to which they belong.



## APPENDIX A. GAP WORKER DEMOGRAPHICS

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Combining administrative data from the Gap with responses to our survey gives us a detailed picture of the workforce in stores that participated in our study. These workers were 73% female. About 33% were white, 22% were African-American, 25% were Hispanic, 13% were of Asian descent, and 7% were of another racial group. About one quarter of workers were 18-21 years old, another quarter were between 22 and 25 years old, another quarter were between 26 and 34 years old, and the last quarter were over 35 years old. About one quarter of workers had been with Gap for less than a year, and another third had been there for longer than five years. Half had a household income of \$40,000 or lower in 2014. Parents made up 18% of workers, and 54% were students.



## APPENDIX B. SURVEY ANALYSIS METHODOLOGY

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This appendix describes the methodology used in this report to estimate population statistics and treatment effects on self-reported health and well-being of Gap workers. These analyses combine data from both waves of the worker survey with company administrative records in order to correct for potential biases due to non-response.

For the purposes of these analyses, the population of interest is hourly workers in the 28 stores that participated in the Stable Scheduling Study experiment. The company provided us with two sampling frames based on personnel records from November 2015 (for wave 1 of the survey) and June 2016 (for wave 2). We combine these sampling frames with monthly store census reports to obtain basic demographic and job information for the population of eligible workers (N = 1,447).

We restrict our analyses to survey data collected during the baseline or intervention periods. For baseline data, we exclude wave 1 responses collected after 12/31/2015 or more than 30 days after the store-specific meeting date on which the intervention was announced (12/1/2015 at the earliest). These excluded cases are treated as (wave 1) non-respondents. We also exclude 23 cases with mostly missing or dubious responses (e.g. the first response option was selected for every question). These cases are treated as respondents for the purpose of calculating survey weights and response rates, but are dropped from all other analyses. This cleaning procedure yields 697 total respondents, for an overall response rate of 48%.

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We report descriptive statistics using the weighted estimates for the population of 1,447 workers. We construct wave-specific calibration weights using a logistic regression of response on demographic and employment information from the administrative data. Response models for both waves include as predictors age, gender, race, and region (Chicago or San Francisco). The wave 1 model further includes pilot store status and the mean number of senior managers in the store, whereas the wave 2 model includes a continuous measure of seniority. These models correctly predict 66% of response/non-response at wave 1 and 62% of response/non-response at wave 2. Survey weights are calculated as the inverse of the predicted probabilities from these models.

For our regression analyses, we use maximum likelihood estimation to fit a series of four multilevel models with random worker intercepts and fixed store effects. Model 1 is the simplest, including indicators for treatment condition, wave, and the interaction of treatment by wave 2 which we interpret as the average treatment effect. Each subsequent model adds parameters to control for potential omitted variable or selection bias. Model 2 adds controls for age, race, gender, full-time status, seniority, and a second job. Model 3 includes a Heckman correction for non-response hazard. Model 4 does not include a Heckman correction but adds controls for education, household income, dependent children, a cohabiting partner, a partner who works full-time, job title, and attending classes in the past 6 months.

We obtain the Heckman correction term in model 3 from a separate maximum likelihood

regression of response on the same variables used previously to generate survey weights plus an instrumental variable. For wave 1, we use an indicator for whether or not race was observed in a preceding store census as an instrument for response. Cases missing race prior to wave 1 are considerably more likely to respond than cases not missing race. For wave 2, missingness of race does not predict survey response, so we use an indicator for missing an email address in the personnel records. Workers with a non-missing email address were considerably more likely to respond in wave 2.

**TABLE 1**  
**Average treatment effects by**  
**outcome, model, and sample**

**FULL ANALYTIC SAMPLE**

	Model 1 (unconditioned)	Model 2 (reduced controls)	Model 3 (Heckman correction)	Model 4 (full controls)
<b>Quality of sleep</b> (4-point scale)	0.197* (0.082)	0.193* (0.082)	0.193* (0.082)	0.201* (0.087)
<b>Perceived stress</b> (5-point index)	-0.089 (0.071)	-0.117 (0.072)	-0.120+ (0.072)	-0.111 (0.074)
<b>Physical symptoms</b> (4-point scale)	-0.197+ (0.112)	-0.199+ (0.112)	-0.196+ (0.112)	-0.215+ (0.118)
<b>Work-family conflict</b> (5-point index)	-0.128 (0.110)	-0.074 (0.110)	-0.084 (0.109)	-0.026 (0.112)
<b>Interference with personal activities</b> (5-point index)	-0.052 (0.088)	-0.023 (0.089)	-0.027 (0.089)	0.005 (0.092)

**PART-TIME ASSOCIATE SUBSAMPLE**

	Model 1 (unconditioned)	Model 2b (reduced controls + income and BA)	Model 3b (Heckman correction)	Model 4 (full controls)
<b>Financial difficulties</b> (5-point scale)	-0.221 (0.138)	-0.313* (0.145)	-0.330* (0.145)	-0.290* (0.146)
<b>Extreme food insecurity</b> (dichotomous indicator)	-0.424 (0.573)	-0.603 (0.594)	-0.587 (0.596)	-0.761 (0.629)

Notes: Table includes coefficients (and standard errors) from maximum likelihood estimation of models described above. Models 2b and 3b add controls for income and education as well as age, race, and gender. Full analytic sample includes all non-exempt employees and participating stores that meet the criteria described above. Part-time associate subsample excludes full-time employees and two treatment stores with trained general manager for less than 25% of study period. Coefficients are expressed in the outcome metric except for extreme food insecurity, which has been transformed into log odds. Significance levels of  $p < 0.10$  and  $p < 0.05$  are denoted by + and \*, respectively.





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