Social Comparison and the Value of Performance Trajectory Information: A Field Experiment in the Workplace[*]

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Abstract

New workers often compare themselves to their high-achieving senior coworkers, but they often do so without knowing how senior workers performed in the early stages of their careers. This upward social comparison under incomplete information can have adverse effects on new workers' well-being and employee turnover. We study whether providing performance trajectory information to new workers mitigates the negative consequences of performance comparison. In a large-scale randomized control trial at a leading multinational spa chain in China, we sent workers twice-weekly messages on the performance trajectories of their high-performing senior coworkers. This information treatment reduces the attrition rate of new workers by 12%, and the effect is most pronounced for the more productive workers. The lower attrition rate is mostly driven by an improvement in new workers' stress levels and mental health due to the lowering of their beliefs about senior coworkers' past performance. Overall, this study demonstrates that showing junior workers the "*Curricula Vitae*" of senior workers mitigates social comparison costs within firms.

JEL Codes: J24, J63, M12, M50, M54

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1   Introduction

Heterogeneity in productivity is common in the workplace. An extensive body of research in economics, sociology, and social psychology has shown that salient productivity differences amongst workers have profound implications on labor market outcomes, particularly when employees compare their performance to their coworkers (Lazear, 1989; Milgrom, 1992; Nickerson and Zenger, 2008; Gartenberg and Wulf, 2017). While downward comparisons with those with worse performance can occur, upward comparisons with high performers are more prevalent and may generate strong behavioral responses (Pfeffer and Langton, 1993; Obloj and Zenger, 2017). Recent studies provide evidence that social comparison can impose substantial costs on firms, including increased turnover (Carnahan et al., 2012; Kacperczyk and Balachandran, 2017), lower effort provision (Cohn et al., 2015; Cullen and Perez-Truglia, 2018a), reduced productivity (Obloj and Zenger, 2017), lower job satisfaction (Card et al., 2012), and even unethical or uncooperative behaviors (Siegel and Hambrick, 2005; Gino and Pierce, 2009b, 2010; Edelman and Larkin, 2015).

New employees of a firm are particularly likely to have strong behavioral responses to upward social comparison because their performance typically lags behind their senior coworkers'. What exacerbates this problem is that performance comparison is often based on incomplete information. In many workplaces, while new workers are relatively well-informed about high-performing coworkers' current performance, they are less likely to know about their colleagues' past performance. Without knowing the trajectory that led high performers to where they are today, new workers may attribute the performance gap to differences in innate ability instead of experience on the job. This attribution could lead new workers to suffer from high stress and increase their attrition.

Can firms mitigate the costs of performance comparison by redesigning the information environment? To address this question, we design a 28-week randomized control trial (RCT) at a leading multinational spa chain with 160 stores and over 7,000 spa workers in its Chinese division. This company is well-suited to study our question because upward social comparison is prevalent among its workers. Spa workers share the same individual performance-based compensation scheme, occupy roles of similar responsibility, and compete for the same pools of resources and promotion. These factors have been shown to induce social comparison (Kulik and Ambrose, 1992; Suls et al., 2002). Indeed, in a survey we conducted at the company before the RCT, 71% of workers admit to often comparing their performance to their coworkers', and 58% set high-performing coworkers as their comparison targets (see Figures A1 and A2). In addition, the setting of this company is comparable to many other large firms in low-skilled industries around the world, which lends support to the external validity of our study.

In the main treatment of our RCT, all workers from 40 randomly selected stores were assigned to the

performance trajectory group. Twice every week during the treatment period, they received information about the performance trajectory of an anonymous high-performing senior coworker in their region. This treatment is designed to fill in the "big picture" for workers when they compare with their senior colleagues.

We measure the effects of the information treatment on a variety of outcomes, both at the store level and the worker level. We obtain detailed administrative records on store revenues and worker salary, performance, attendance, attrition, etc. We complement these outcome measures with surveys on beliefs and subjective well-being that span across pre-, mid-, and post-treatment periods. These consolidated datasets allow us to study the effects of performance trajectory information and test their mechanisms.

The first main result of the experiment is that performance trajectory information significantly reduces attrition among new workers by 12%. The effect is even more pronounced among high-performing new workers, whose attrition rate drops by 22.8% in contrast to a much smaller drop among low-performing workers. The attrition rate among senior workers, on the other hand, is unaffected. This result supports our hypothesis that performance trajectory information ameliorates the issue of turnover among new workers.

Zooming in on the mechanisms, our second main result is that sharing performance trajectory information significantly reduces stress levels and improves the mental health of new workers, which in turn are associated with their attrition. Moreover, we trace the reduction of new-worker stress levels as being largely due to seeing the unimposing early-stage performance of their high-performing senior coworkers. The results are consistent with our hypothesis that the availability of performance trajectory information plays a central role in reducing the mental health impact of social comparisons in the workplace.

Do these benefits arise from informing new workers about the early-stage performance of any coworkers, or are they specific to information about high-performing senior coworkers? To answer this question, we implement a parallel treatment on all workers from another 40 randomly selected stores. This treatment is similar to the performance trajectory treatment, except that the twice-weekly messages a worker receives are about the recent performance of a coworker in the same region and with similar tenure as herself. We find few treatment effects on any workplace outcomes for this group. This result indicates that performance trajectory information is uniquely effective when it is about high-performing senior workers. It also validates our premise that *upward* social comparison is the main mechanism at work.

We also consider several alternative mechanisms for the treatment effects of performance trajectory information and provide evidence against them. One possible explanation for the effects of the performance trajectory information is that it improves workers' belief of their future prospects working for the firm. To explore this possibility, we analyze survey data on workers' beliefs about their future performance and fail to find any effect. We also look at the effect of performance trajectory information on individual

labor supply and productivity, and neither is significantly affected by the treatment. Second, the trajectory information may reduce the uncertainty of future performance among workers who are generally risk-averse. We show that, based on the survey data, the effect of performance trajectory information on workers' uncertainty about their own performance predictions is small and statistically insignificant. Another alternative is that the results may be driven by worker's increasing competitiveness after viewing the trajectory information of high-performing workers. To test this possibility, we compare the post-RCT survey data on workers' competitiveness and find no evidence for this mechanism. Finally, we argue that Hawthorne effects—where workers behave differently because they are being studied—is unlikely to be a concern, because it cannot account for the difference between the two treatment groups, since any Hawthorne effects should cancel out.

This paper contributes to the burgeoning literature investigating the effects of social comparison on employee performance (Hinds and Bailey, 2003; Card et al., 2012; John et al., 2014; Kacperczyk et al., 2015; Tzabbar and Vestal, 2015; Cullen and Perez-Truglia, 2018a; Baumann et al., 2019). Two findings of this literature are particularly relevant. First, social comparison of performance and, correspondingly, pay inequality can lead workers to exhibit negative emotional reactions and behavioral responses (Pfeffer and Langton, 1993; Fehr and Schmidt, 1999; Nickerson and Zenger, 2008; Gino and Pierce, 2009a; Rebitzer and Taylor, 2011; Larkin et al., 2012). Second, the intensity of the social comparison processes is often determined by the information upon which comparisons are based (Card et al., 2012; Tzabbar and Vestal, 2015; Cullen and Perez-Truglia, 2018a) and the characteristics of the referents (Wood, 1996; Buunk and Gibbons, 2007). For example, several studies (Wheeler, 1966; Taylor and Lobel, 1989; Collins, 1996) have documented widespread evidence that workers tend to compare themselves to high-performing coworkers. We add to this literature by showing that providing workers with performance trajectory information can be a cost-effective way to mitigate the negative consequences of upward social comparison. The social comparison in our study has elements of both vertical and horizontal comparison (Gartenberg and Wulf, 2017; Kacperczyk and Balachandran, 2017; Cullen and Perez-Truglia, 2018a,b). Junior workers primarily compare themselves to their senior coworkers, who have longer tenures but occupy the same position in the company.

This study adds to a recent but rapidly growing literature on the impact of pay transparency and inequality (Card et al., 2012; Bracha et al., 2015; Mas and Pallais, 2017; Cullen and Perez-Truglia, 2018b; Dube et al., 2019; Fahn and Zanarone, 2021). An increasing fraction of jobs with performance pay has led to an increase in pay inequality (Cuñat and Guadalupe, 2009; Lemieux et al., 2009). Prior scholarship has documented the effects of pay inequality and pay transparency on employee performance using field experiments (Card et al., 2012; Cohn et al., 2014; Breza et al., 2018; Cullen and Pakzad-Hurson, 2019). Our

study advances the existing literature by introducing information about coworkers' performance trajectories as an additional instrument, effectively expanding the space of pay transparency. More importantly, while prior research has mainly focused on transparency in coworkers' or managers' current performance, we are the first to consider and highlight the importance of transparency in coworkers' performance trajectory, starting from their early tenure stages.

This paper is also related to the literature about career concerns and salary dynamics (Lazear and Rosen, 1981; Harris and Holmstrom, 1982; Rosen, 1985; Gibbons and Murphy, 1992; Dewatripont et al., 1999; Gibbons and Waldman, 1999a,b). The central idea of this largely theoretical body of work is that workers care about not only current incentives but also future prospects. We complement existing literature by combining both social comparison and career concern mechanisms into one framework and empirically disentangling the effects of social comparison from career concerns.

Lastly, this paper speaks to the growing literature on the impact of management practices on employee turnover, welfare, and productivity (Ichniowski et al., 1997; Lazear, 1999; Bloom et al., 2015; Gambardella et al., 2015; Friebel et al., 2017; Blader et al., 2020). The value of human resource management practices is well-recognized by management scholars (Huselid, 1995; Koch and McGrath, 1996; Ichniowski and Shaw, 2003). More recently, a growing trend in this field places emphasis on the adoption of "innovative" human resource management practices enabled by the increasing use of data-driven management. Hence, by demonstrating the impact of a relatively simple and cost-effective information intervention on the turnover rate, this paper complements the growing literature focusing on how compensation influences employee retention (Oyer, 2004; Oyer and Schaefer, 2005; Aldatmaz et al., 2018; Krueger and Friebel, 2018; Sandvik et al., 2021). Our paper also adds to previous studies on the impact of peer pressure and stress on workplace performance (Bhagat, 1983; Kandel and Lazear, 1992; LePine et al., 2005; Quigley et al., 2007; Mohnen et al., 2008; Bandiera et al., 2010; Kocher et al., 2012; De Jong et al., 2014; Cahlíková et al., 2020).

The remainder of this paper is organized as follows. Section 2 develops a theoretical framework and derives testable hypotheses to guide the empirical analysis. Section 3 describes our context and lays out the experimental design, data, and econometric framework. Section 4 presents the results. Section 5 provides suggestive evidence for the main mechanism and discusses potential alternate explanations. Section 6 concludes. All figures and tables are available in the Online Appendix.

2   Theoretical Framework and Hypotheses

This section presents a theoretical framework for understanding the effects of performance information and two potential underlying mechanisms, social comparison, and career concern.

Consider a model with three periods, $t \in \{0, 1, 2\}$, and two cohorts, senior workers and new workers. The starting time s of senior workers is the beginning of period 0, and new workers' starting time is $s = 1$. Worker i's performance in period t, which we assume is also her salary, depends on her tenure at the firm $(t - s_i)$ and her innate ability a_i:

$$f_{it} = a_i + r_i \times (t - s_i). \tag{1}$$

The returns to experience r_i captures situational factors that affect worker i's performance progress. We assume that efforts are determined exogenously, so we omit them from the performance function.

Each worker privately knows her own innate ability a_i from the very beginning but does not know r_i. After working at the firm for a period, each worker observes some of her coworkers' performance in that period as well as her own performance. New workers do not observe senior workers' performance in period 0. Crucially, these assumptions capture the incomplete information among coworkers in many workplaces. New workers are usually assigned to teams where the majority of teammates are more senior to them. While new workers may be well-informed about their teammates' current performance, they often do not observe senior coworkers' past performance.

We analyze the effects of providing information about coworkers' performance at the beginning of period 2. At that point, a new worker i's expected payoff from continuing to work for the firm is

$$u_i = a_i + \mathbb{E}_i(r_i) \times 1 - \lambda \sum_{j \in H} \mathbb{E}_i(a_j). \tag{2}$$

She stays at the firm if and only if her expected payoff is higher than her outside option $\bar{u}_i$. The expected payoff consists of two components. The first two terms in the equation represent her expected salary in period 2. New workers, having only worked for one period, are uncertain about the returns to experience r_i. This uncertainty allows performance information to affect new workers' behavior through the career concern channel. The third term represents the mental cost associated with upward social comparison, where parameter λ is the intensity of social comparison, and H is the group of coworkers that i compares herself to. The more i thinks that workers in group H have higher innate abilities, the more mental cost she incurs. In our pre-RCT survey, most workers say that they compare themselves to coworkers with the highest performance. Since most high-performers are senior, we assume that H is a group of high-performing senior workers. Because new workers only joined the firm in period 1, they are uncertain about senior workers' period 0 performance. Moreover, we assume that worker i suffers from projection bias—she believes that the period 0 performance of group H workers must be close to their period 1 performance. This bias leads her to overestimate group H workers' period 0 performance.

With these assumptions, we first analyze the effects of informing new workers about the performance

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trajectories of group H workers. The direct effect of this information is to correct new workers' overestimates of group H workers' period 0 performance, which equals their innate ability. This belief change reduces the mental health toll that upward social comparison inflicts on the new workers. Another potential indirect effect works through the career concern channel. After learning that group H workers' innate abilities are not as high as she initially thought, new worker i now believes that experience plays a larger role in their high performance in period 1. In other words, the performance trajectory information increases new workers' beliefs about group H workers' returns to experience r. If new workers perceive a positive correlation between their own r_i and those of group H workers, then performance trajectory information will increase new workers' expectations about their own period 2 salaries. Both the social comparison effect and the career concern effect increase new workers' expected payoffs and hence lower their attrition rate. The above analysis is summarized in the following hypothesis.

Hypothesis 1. (Effects of Performance Trajectory Information on New Workers)

a (*Turnover*) Performance trajectory information lowers the attrition rate of new workers.

b (*Beliefs*) Performance trajectory information lowers new workers' beliefs about the early-stage performance of senior coworkers.

c (*Social comparison*) Performance trajectory information improves new workers' stress and mental health conditions.

d (*Career concern*) If new workers believe that their returns to experience are positively correlated with those of their high-performing senior coworkers, then performance trajectory information increases new workers' expectations about their future performance.

What are the effects of informing new workers about the period 1 performance of fellow new workers? First, because new workers only incur mental costs from comparison with high-performing senior workers, this peer performance information does not affect the social comparison term of their expected payoffs. Second, since experience does not play a role in new workers' period 1 performance, peer performance information does not affect beliefs about returns to experience. Taken together, peer performance information does not affect new workers' expected payoffs and attrition rate.

Hypothesis 2. (Effects of Peer Performance Information on New Workers) Peer performance information does not affect the attrition rate of new workers.

At the beginning of period 2, a senior worker i's expected payoff from continuing to work for the firm is

$$u_i = a_i + r_i \times 2 - \lambda \sum_{j \in H} \mathbb{E}_i(a_j). \tag{3}$$

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Because a senior worker has worked for two periods by then, she has learned about her returns to experience $r_i = f_{i1} - f_{i0}$. Therefore, performance information can no longer affect her expected payoffs through the career concern channel. Moreover, since she observed the period 0 performance of some senior coworkers, she has approximately correct beliefs about the innate abilities of group H workers. As a result, her mental toll from the social comparison should also not be systematically affected by performance information.

Hypothesis 3. (Effects of Performance Information on Senior Workers) Performance trajectory information and peer performance information do not affect the attrition rate of senior workers.

3 Research Design

3.1 The Firm

The company with whom we partnered for this study is the largest multinational spa chain headquartered in China. As an early pioneer in franchised massage services, the firm operates more than 500 stores worldwide in North America, Europe, and East Asia. The company offers a wide range of spa and therapeutic massage services[1] and serves more than five million customers annually. Figure A3 displays photos of the company's spa stores and employees.

Our study focuses on 160 stores dispersed geographically across China. Importantly for our experimental design, stores operate independently of each other and there is little communication between geographically separate sites. At the time of the experiment, each store employed 42 workers on average. The company has five layers of personnel: senior executives, regional managers, store managers, middle managers, and workers. Each store consists of one store manager, multiple middle managers, and roughly three types of workers, with two-thirds of the workers being spa workers.[2] Figure A4 demonstrates the organizational structure within a store.

Spa workers are tasked with providing therapeutic massage services, maintaining client relationships, and selling pre-paid store gift cards or personalized service packages.[3] Employees typically work six shifts a week, scheduled in advance by the store managers. The spa worker compensation scheme is comprised of a piece rate plus task bonuses and sales commissions. On average, an experienced spa worker's monthly compensation is around ¥10,000 ($1,600), which is quite high among service sector employees. Task bonuses and sales commissions are linear functions of the number of returning customers and sales vol-

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[1]Therapeutic massage incorporates a variety of advanced modalities that enhance the body's natural restorative functioning. Examples of services include hot stone massage, back oil massage, complete massage, and deep tissue massage.

[2]The remainder of the workers are mainly assistant spa workers or professional sales associates.

[3]The personalized service package is tailored to each customer's needs. For instance, a customer suffering from back pain would prefer a specialized back massage to a standard service.

ume, with small adjustments for attendance.[4] While workers sometimes help each other out, individual productivity depends mostly on personal efforts.

Middle managers each manage a team of 10 to 20 workers and are usually promoted from the pool of spa workers within the store. Workers need to perform well to be in the eligible pool of workers for promotion consideration. Similar to many other workplaces, teams typically consist of workers at very different tenure stages, from rookies to highly experienced workers. Managers hold regular group meetings, during which workers share massage and sales techniques amongst each other and report work progress. As a consequence, most workers are only familiar with the current performance of coworkers on their team.

This firm is comparable to other large firms around the world in two key aspects. First, as is common for low-skill jobs in the United States and Europe, attrition is high, at an annual rate above 100% in the pre-RCT period. Job tenure is 1.22 years on average. Second, turnover is particularly high for new hires: the monthly attrition rate is above 20% in the first six months. According to our interviews with managers, workers who stay for over six months are considered senior workers and are relatively stable. This is highly consistent with the turnover patterns in multiple low-skilled industries documented in the previous literature.[5] During our interviews with the senior management team and fifteen store managers, firm executives expressed concern with the excessively high turnover rates, especially among new workers. While some employee turnover is healthy and efficient (Siebert and Zubanov, 2009), high levels of turnover can result in substantial costs for the firm (Friebel et al., 2021), which can be due to short staffing, increased need for recruitment and onboarding efforts, and reduction in team morale after a departure is announced (Kuhn and Yu, 2021),[6] all of which help to motivate our study.

3.2 The Experiment

We conducted a 28-week RCT at 160 stores of the spa chain with over 7,000 spa workers from June 22 to December 31, 2019. The design was registered before the experiment began.[7] The 160 stores were assigned into three groups: the performance trajectory group (T1, 40 stores), the peer performance group (T2, 40 stores), and the control group (80 stores). Twice every week, spa workers in the treated stores were sent

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[4]Spa worker performance is mainly driven by her sales techniques and ability to retain customers. One key measure of worker productivity in the spa industry is customer picks. Suppose that, when a customer visits a store for the first time, the store randomly assigns a worker to the customer. Depending on the customer's satisfaction with the service rendered, she may request a specific service worker during her next visit. Workers who get picked by customers receive a bonus. This variable measures each worker's ability to retain customers. Workers who achieve high sales records typically have high customer picks.

[5]Previous work has shown that the bulk of employee turnover occurs during the first six months in the low-skilled industries. Some examples are call centers (Bloom et al., 2015; Burks et al., 2015) and service sector industries, such as food and beverage (De Stefano et al., 2019), retail (Ton and Huckman, 2008; Siebert and Zubanov, 2009; Friebel et al., 2017, 2019, 2021; Kuhn and Yu, 2021), sales (Sandvik et al., 2020, 2021), and service (Lazear et al., 2015, 2016).

[6]According to Kuhn and Yu (2021)'s calculations, the turnover of a single employee reduces profits by an amount that represents 9.4 days of per-employee net sales, or 1.1% of a worker's net sales over a 2.3-year career.

[7]The RCT registry number is AEARCTR-0004281. The experiment has been waived by Stanford IRB for approval.

information on the performance statistics of an anonymous coworker through the firm's workforce management mobile application (app). Workers in the performance trajectory group (T1) received information on the performance trajectories of high-performing senior workers. In the peer performance group (T2), workers received information on the current performance of coworkers with similar tenure. For the control group stores, we did not add to or change any of the preexisting management practices throughout the experiment. We describe the details of the experiment below.

Treatment and Experiment Implementation. Twice every week during the treatment period, we show each worker in the performance trajectory group (T1) the performance trajectory of an anonymous high-performing senior worker in her region. All T1 workers in a given region receive the same message every time. The message contains the year and month during which the anonymous senior worker joined the firm, the region of her store, and her performance statistics (including customer picks[8] and sales[9]) in month 1, month 3, month 6, and month 12 of her tenure at the firm as well as in the month before the information is sent. The high-performing senior workers whose performance information will be sent out in a given month are selected before the month starts. Specifically, for each region and before the start of each month, we first randomly draw a sample of 15 workers who have worked in the firm for more than 12 months. Then, we select 8 workers from this sample, oversampling those with high current performance and excluding those with incomplete or implausible performance statistics. These 8 workers constitute the group of high-performing senior workers whose performance trajectory information will be sent out for this region during the following 4-week period. See Figure 2 for an illustration.

In the peer performance group (T2), based on one's tenure, we divide workers from the same region into four cohorts: those whose tenure is shorter than 3 months, between 3 and 6 months, between 6 and 12 months, and over one year. Twice every week, we randomly select a worker from each region-cohort group and anonymously show her customer picks and sales in the previous month to workers from the same region-cohort group.[10] See Figure 3 for an illustration.

In both treatments, information is delivered to workers' cell phones through the company's workforce management app. Table 1 shows sample messages received by a worker from treated stores. During the 28-week treatment period, each worker in treated stores received performance statistics of up to 56 coworkers. Workers in the control group do not receive information on performance statistics. From the pre-RCT to the post-RCT period, employees from all stores received routine notice, information, and survey questions

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[8]As explained previously, customer pick measures a worker's ability to retain customers. If a customer is satisfied with the service rendered, she may request a specific service worker during her next visit and workers who get picked by customers receive an extra bonus.

[9]Sales record is another important measure of individual productivity. Individual sales records are calculated by the sum of prepaid card sales and personalized service package sales.

[10]The selection excludes workers with implausibly high or low performances, but otherwise does not over- or under-sample based on observables.

from the firm as usual.

At the beginning of each month, we obtain the previous month's performance statistics from the firm's human resource (HR) department and use them to update our panel of workers' performance from 2017 to 2019. The performance statistics we use in our information treatments are generated from this panel dataset, so they are real and up-to-date. Remember that the performance information we sent out is anonymous, so it is very unlikely that a worker recognizes the identity of the worker referred to in a message. Guessing would also be difficult given the large number of workers in a region. In fact, we learned through interviews that workers rarely remember exact performance statistics, even those of themselves.

Randomization. We use 23 months of spa stores' pre-treatment data from July 2017 to May 2019 to generate the randomization plan. We use stratified randomization methods stratifying on attrition rate (the main dependent variable), store revenue, and store size. The 160 stores were randomized into three RCT arms, with each treatment group containing 40 stores. Table 2 shows that the three groups are balanced over all the pre-specified observables. In each row of columns 1-4, we regress the pre-RCT observables on the two treatment dummies. Column 1 shows the means in the control group stores. Columns 2 and 3 report the differences between each treatment group and the control. Column 4 shows the p-values for the F-statistic of the joint significance of the two treatment dummies. Neither of the dummies is statistically significant. Columns 5 and 6 compare the treated stores to the control stores, and again, none of the coefficients are statistically significant.

RCT Validity. There are two immediate concerns for a field experiment like ours. First, it is crucial that employees from the treated stores are aware of the information. If a worker is assigned to a treatment group but is unable to see most of our messages, then the experiment would have compliance issues, and the estimate would thus make a lower bound for the real treatment effect. We do not think this is of concern, as store personnel from both the treatment and control groups are required to use the workforce management app at work. Spa workers need to frequently double-check their daily performance statistics that are tied to their compensation. Since unread messages are displayed when workers open the app, we can ensure that full compliance is achieved with regard to viewing the information.

Another worry is that workers might feel they are being "watched" by the firm when they receive a message. The Hawthorne effect is unlikely to drive the results. First, none of the workers or managers were informed of the RCT. Second, the firm frequently uses the information system to make announcements and to send high-frequency survey questions or holiday greetings. Our treatment information looks no different from regular messages sent by corporate. The treatment intervention is thus a minimal nudge and workers are unlikely to pay special attention to our messages. Furthermore, Hawthorne effects cannot explain differences between the two treatment groups. Since the two groups of employees receive infor-

mation at the same frequency, any Hawthorne effects should cancel out.

Data and Measurement. We leverage the personnel and accounting data from the firm and primary survey data to evaluate the effects of trajectory and peer performance information. Our analysis uses six sources of data. First, we have monthly data on attrition of individual spa workers from June 2019 to December 2019. We construct a worker-month panel: attrition is coded as 1 if an employee leaves during a given month and 0 otherwise. The second administrative data set that we use is monthly data on performance measures at both the individual level and the store level from June 2019 to December 2019. At the individual level, spa workers have four major labor supply and performance measures: the number of days of attendance, customer picks, sales, and compensation. In the spa industry, service workers are usually randomly assigned to new clients. A task is counted as a customer pick when the client is satisfied with the rendered service and picks a specific spa worker for future visits. Customer pick is thus a good measure of a worker's ability to retain customers. Individual sales are calculated by adding up pre-paid card sales and service packages sales. Since the compensation scheme is piece rate plus task bonuses and sales commissions, monthly compensation could be perceived as a measure of one's overall productivity. At the store level, performance is measured by store revenues. Third, data on individual employee demographics (e.g. age, gender, ethnicity, marital status, years of schooling, prior work experience) and stores' administrative information (e.g. the number of employees, store size, years of history, revenue, turnover, and location) were collected for July 2017 to December 2019. Fourth, we record the detailed implementation data of every piece of information sent to the treatment group workers, including the timing, performance statistics, and recipient of every message.

Fifth, we collect high-frequency employee survey data before, during, and after the RCT using the firm's workforce management app. Survey data covers four dimensions: job satisfaction, evaluation of managers, stress levels, and mental health.[11] For job satisfaction, questions include overall job satisfaction, trust, sense of belonging, whether an employee would like to recommend the company as a place of work, and willingness to stay. Manager evaluation questions include the employee-reported level of managerial care, manager problem-solving skills, whether employees are willing to turn to their managers for help, how easy it is to ask for a leave of absence, and employee-perceived fairness. For mental health questions, we refer to the Warwick-Edinburgh Mental Wellbeing Scales[12] and cover ten different dimensions of mental health measures such as optimism, exhaustion, and curiosity. All the survey questions above are measured on a scale of 1 to 5. In line with Ichniowski and Shaw (2008), the surveys cover multiple types

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[11]We conducted multiple testing before the experiment to check if workers were afraid of expressing themselves and find no such evidence. In survey questions collecting workers' thoughts and critiques about their managers, we received thousands of very detailed comments, some of which were even harsh. When we presented these comments to the firm's Chairman, CEO, and regional managers, they were amazed at the accuracy and authenticity of the responses.

[12]A brief introduction to the Warwick-Edinburgh Mental Well-being Scales is available on the Warwick Medical School's page.

of respondents: spa workers, middle managers, and store managers. Table A1 shows a representative list of sample survey questions used in this study.

Finally, we collect data on spa workers' self-reported beliefs about performance, uncertainty, and patterns of social comparison using the app from June 2019 to January 2020 (see Table A2 for a sample). In addition to these data, we interviewed over one hundred spa workers, middle managers, and store managers from 2018 to 2020 and took detailed notes to understand the mechanisms.

Econometric Framework. To analyze the effect of sharing performance trajectory and peer performance information on employee performance, we estimate the following equation:

$$Y_{ijt} = \beta_1 \times T_{1i} + \beta_2 \times T_{2i} + \tau_t + \gamma_j + \epsilon_{ijt}, \tag{4}$$

where Y_{ijt} is the post-treatment outcome (e.g., attrition, productivity, job satisfaction) of individual i from store j in month t; T_{1i} and T_{2i} are the two treatment dummies; τ_t is month fixed effects; γ_j is region fixed effects, and ϵ_{ijt} is the idiosyncratic error term clustered at the store level. We also control for both individual-level and store-level characteristics.

To estimate the heterogeneous treatment effects, we interact the above-median dummies of several pre-specified variables with treatment indicators and estimate the equation:

$$Y_{ijt} = \beta_1 \times T_{1i} + \beta_2 \times T_{2i} + \beta_3 \times R_i + \beta_4 \times T_{1i} \times R_i + \beta_5 \times T_{2i} \times R_i + \tau_t + \gamma_i + \epsilon_{it}, \tag{5}$$

where R_i is an indicator of the above-median baseline value of each pre-specified variable. The equation notation is otherwise analogous to that of equation 4. In this equation, $\beta_1 + \beta_4$ and $\beta_2 + \beta_5$ are the effects of the two treatment dummy indicators on spa workers with an above-median baseline value of the pre-specified variable, β_1 and β_2 are the estimated treatment effects on those with a below-median baseline value, and β_4 and β_5 are the differences between the two treatment effects. In the heterogeneous analysis section, we report β_1, β_2, $\beta_1 + \beta_4$, and $\beta_2 + \beta_5$.

4 Results

4.1 Average and Heterogeneous Treatment Effects on Individual Performance

We first examine the impact of the intervention on the probability that workers leave the firm during the RCT. The dependent variable is whether a worker quits in a month. As shown in Table 3, the mean monthly attrition rate in the control group is 20.31% among new workers, compared to 9.7% among senior work-

ers in the control group. New workers refer to those who joined the firm during the previous six months, whereas senior workers refer to those with tenures above six months. The statistics are consistent with the stylized turnover pattern in low-skilled industries that new workers are much more likely to quit during the first few months.

We begin by looking at the impact of performance trajectory and peer performance information on new workers. In column 1, the overall monthly attrition rate among the new workers is 2.43 percentage points (12%) lower in the performance trajectory group, which is significant at the 5% level. The result is robust to controlling for month fixed effects and a host of individual-level and store-level characteristics controls in column 2. We fail to find any significant effect of peer performance information on attrition. Columns 3 and 4 repeat the analysis on senior workers. Interestingly, while the sample size more than doubles, neither of the two information treatments have significant effects on attrition. Table 3 provides evidence that performance trajectory information significantly reduces attrition among new workers.

In Table 4, we investigate how performance trajectory and peer performance information affect individual workers' labor supply and productivity. Columns 1 and 2 report the impact of information treatments on the monthly days of attendance, and we find null results for both new and senior workers. In columns 3 and 4, we look at whether workers from the treatment groups can retain larger numbers of customers, holding the number of total tasks fixed. We only see a fall in customer picks by 8.09 among senior workers, and the coefficient is marginally significant. Columns 5 to 8 report the effect on individual sales and compensation. Again, the magnitudes of coefficients in all these regressions are small, and we fail to find any statistical significance in our results.

Since we see a significant drop in employee attrition among new workers who have viewed the performance trajectory information, it is natural to look for any heterogeneity in this effect on new workers by their productivity. If high-performing workers are less responsive to the performance trajectory information, then the average attrition rate would not fully capture the impact on firm performance due to the loss of exceptional talent. Table 5 reports whether the treatment effects differ among low-performing and high-performing workers. Since information on new workers' baseline performance is limited, we divide new workers into above-median and below-median groups by their average monthly productivity during their first three months of tenure at the firm.[13] The first observation is that the monthly attrition rate of the low-performing workers is over 30%, which is roughly three times that of high-performing workers. This

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[13]The limit of using one's monthly average productivity is that those who stay at the firm for longer period of time might have higher performance during the later tenure stage and would thus be more likely to be treated as high-performing workers, which will bias the result. On the other hand, using the performance statistics of each individual month to differentiate high-performers from low-performers would introduce significant measurement errors especially among new workers. We thus choose the three-month window in order to balance the potential bias and measurement errors. The results are highly consistent using alternative time windows of two or four months.

is consistent with the empirical observation that productive workers are significantly less likely to quit (Carnahan et al., 2012). Table 5 shows that performance trajectory information significantly reduces attrition, especially among high-performing workers: attrition rate drops by 2.21 percentage points, equivalent to a 22.8% decrease. The result is statistically significant at the 5% level. In contrast, trajectory information leads to a much smaller drop in attrition among the less productive workers and is not statistically significant.

In explaining the higher retention rates of high-performing new employees, we report the correlation between performance and stress levels using the pre-RCT survey data in A3. Table A3 shows that high performers suffer from significantly higher work stress.[14] Since high-performing workers may especially care about their performance, they are more prone to make performance comparisons and allow any deficiencies, perceived or otherwise, to take a toll on their mental health. Despite possessing high ability, a new worker's performance is still limited by her tenure and experience. Though an unfair comparison, performing worse than senior top performers could demoralize the new workers and lead to high stress and attrition. Thus, information on the performance trajectories of high-performing senior coworkers could be particularly useful for the new high-potential employees by lowering their stress levels and assuaging the mental toll of social comparisons. We report more heterogeneous treatment analyses along several other individual-level and store-level characteristics among both new and senior workers in Tables A4-A7.[15]

Overall, the main results indicate that showing new workers the performance trajectory of senior workers leads to a fall in attrition rates. The effects are larger in magnitude among the most productive workers. This is beneficial for both treated managers and the firm, as less effort and resources are required for recruiting new workers, and better workers are retained.

4.2 Average Treatment Effects on Store Performance

Table 6 investigates how performance information influences store-level performance. Column 1 shows that store-level revenues improve by 8.9% for the stores whose workers receive the performance trajectory treatment. In comparison, we see a revenue drop by 11.1% in the peer information group. However, neither result is statistically significant. Further controlling for month fixed effects in column 2 yields largely consistent results.

While the performance trajectory information treatment is not significantly associated with higher

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[14]As shown in Table 8, better stress levels and mental health conditions are strongly and negatively correlated with the attrition rate.

[15]Among all individual-level and store-level heterogeneity characteristics, we find trajectory information to be more effective on female workers and workers from new stores. One possible explanation is that males are over-confident compared to females. Thus information helps female workers realize they are not low-performing and reduce their stress. We fail to find heterogeneous effects along all the other dimensions.

store revenue, the result does not indicate that a lower attrition rate would not have positively affected a firm's business outcome. First, worker sales records are typically very low at the beginning of their tenure. It takes time for new workers to develop their customer base and to grow into star employees who will have a more significant effect on store revenues in the long run. Second, since the proportion of new workers in a store is relatively small, the store's overall revenue change might not be able to capture the positive effect of the performance trajectory treatment adequately. Lastly, store revenue is not reflective of the costs saved by the firm's headquarters. For instance, the HR department could save extra time and resources without frequently updating their worker information database, reviewing job applications, or coordinating hiring meetings with local stores. Lower store turnovers could also raise the firm's reputation and attract high-quality job applicants to apply in the future.

5 Mechanisms

We find that performance trajectory information of senior workers substantially reduces the attrition rates of new workers. In this section, we provide additional evidence for the mechanisms and consider alternative explanations for our findings. We argue that performance trajectory information leads to a decline in the attrition of new workers via decreased stress levels and better mental health conditions. The advances in employee well-being stem from assuaging workers' upward social comparisons with coworkers.

We provide support for this interpretation using evidence from five different tests that, taken together, are consistent with our argument. In our first test, we explore the effect of the information treatment on workers' job satisfaction, evaluation of managers, stress levels, and mental health conditions. If the main mechanism is in operation, we should expect new workers to experience significantly reduced stress levels. Since senior workers are aware of the performance trajectory from their own experience, the information treatment is expected to have minimal effect. In our second test, we look at the effect of stress levels and mental health conditions on attrition. In the third test, we explore the treatment effect on each worker's self-reported belief about senior employees' performance during their early tenure stage. Fourthly, we look at how the treatments affect worker stress levels. Both tests draw on the post-RCT survey data collected in January 2020. Lastly, we exploit our implementation data on the performance statistics contained in every message received by each worker during the RCT. We assemble detailed implementation and survey data to explore the effect of performance statistics on stress. In addition to these tests, we interviewed more than one hundred workers and managers in 2018 and 2019 and thirty workers from the trajectory treatment group after the experiment to collect further qualitative evidence.

5.1 Social Comparison

Table 7 reports the effect of information on employee well-being. In the trajectory group (T1), results show that new workers report significantly lower stress and better mental health conditions, whereas trajectory information has no such effects on senior workers. This change is consistent with the implications of the social comparison mechanism. Job satisfaction and evaluations of managers do not change significantly. In the peer performance group (T2), the effect on well-being is small and statistically insignificant. The one exception is that there is a slight, marginally significant (0.081 standard deviation) increase in senior worker stress levels.

Table 8 examines the effect of stress levels and mental health conditions on individual attrition. The dependent variable is whether a worker quits in a given month, and the independent variables are individual workers' monthly average survey scores on stress levels and mental health. On average, a one standard deviation improvement in stress levels is associated with roughly a 10-13% decrease in attrition, which is significant at the 1% level for both new and senior workers. We also see significantly lower attrition among new workers who report having better mental health conditions. Along with our estimates in Table 7, this suggests that trajectory information could significantly improve new workers' stress levels and mental health conditions, and both are highly correlated with worker attrition.

We now consider whether there is evidence to support the idea that the results are driven by an assuagement in workers' upward social comparison process with coworkers. To test this idea, we make use of survey questions after the RCT in January 2020. The first question asks workers about the change in their beliefs of senior workers' performance during their early tenure stage. The second question asks workers how the treatments change the amount of stress they experience. The results are reported in Tables A8 and A9. Table A8 shows that, compared to the control group workers, workers who receive the trajectory treatment accordingly have lower beliefs about senior workers' performance at their early tenure stage. However, we see no such effect among senior workers. In Table A9, new workers in the trajectory group experience stress levels that are 0.26 standard deviations lower. Both estimates are significant at the 5% level. The survey results suggest that performance trajectory information helps new workers update their belief about coworker performance, leading to lower stress levels when they engage in upward comparisons.

To further pinpoint the channel through which performance trajectory information reduces stress, we zoom in on the content of the messages received by workers in the trajectory treatment. Recall that each message contains a senior worker's performance trajectory across her entire tenure at the firm, from the month she joins the company to the most recent month. Since workers receive two messages per week,

we calculate the average first-month performance and the average last-month performance contained in the two messages for a given week, and we study their effects on the stress levels reported the following week by workers who received those messages. Table A10 shows that lower first-month performance of senior coworkers leads new workers to report lower stress subsequently. In contrast, the effect of knowing senior coworkers' recent performance is more muted and insignificant. This result lends direct support to the specific kind of social comparison mechanism we illustrate in our model—it is not the current performance of coworkers but their innate ability that forms the basis of social comparison. Put differently, new workers feel less stressed if they know that senior coworkers started low and worked their way up to their current high performance through learning on the job.

Anecdotes from workers in the trajectory treatment during our post-RCT interviews provide further evidence that such a social mechanism is in operation, typically along the lines of "*I had poor performance during the sales campaign last summer. I was so upset with myself, I cried several times after work, and wasn't sure whether I should hold on. The information made me realize that it is alright to have such a performance during my current stage. It was not great, but definitely acceptable. I believe I can overcome the difficulty and gradually become stronger.*" According to another interviewed worker, "*senior workers have been like god since I joined the firm, and it was beyond imagination to surpass them. Now that I know many of them accomplished that step by step, they are also ordinary human beings. My current performance is still much lower than the top worker's in my store, but I have a higher tolerance for myself.*" The sentiment of worker responses, though anecdotal, corroborates the impact of sharing performance trajectory information on reshaping their upward comparison process with coworkers, as contended in the theory.

Together, sharing the trajectories of senior workers significantly improves the stress and mental health of new workers. Reading the "Curricula Vitae" of senior workers allows a new worker to understand the performance curves of experienced workers at critical tenure stages. Knowing that even the best employees may not have been that good in their own initial stages, new workers feel less stressed and have better mindsets when they engage in social comparisons among coworkers. After all, it is quite common to be less productive in the early stages of one's career.

5.2 Career Concern

An alternative mechanism for the effects of our trajectory treatment is career concern (Holmström, 1999), i.e., performance trajectory information improves new workers' beliefs about their prospects at the company. It could be that the trajectory information makes new workers more optimistic about making progress on productivity. Alternatively, frequently emphasizing performance trajectory may indicate to new workers that the company cares about and will likely invest in their personal growth.

If career concern is a main mechanism, we should expect new workers in the trajectory treatment to have higher beliefs about their own future performance. In Table A11, we examine the effects of treatments on new workers' forecasts of their own future performance. The results show that across forecast horizons, treatments have no significant effects on forecasts. This is not an artifact of measurement errors in forecasts, because forecasts are significantly associated with attrition (Table A12).

Even though new workers in the trajectory treatment do not have different expectations about their future performance, it could still be that they expect the required efforts to achieve that performance to be less. This lower expected cost of effort could be what is keeping the attrition low. If that is true, then we should see lower labor supply and productivity in the trajectory treatment. Again, this conjecture is not borne out in the data. Table 4 shows that new workers' current performance and attendance are not significantly affected by the treatments.

Taken together, we argue that new workers' career concern does not drive the effects of giving new workers information about senior workers' performance trajectory.

5.3 Other Mechanisms

We find little support for several alternative mechanisms.

Performance trajectory information reveals positive information about the firm or the industry. One possibility is that employees reacted to the trajectory information because they used it to learn about other aspects of the firm. For instance, since the firm can document and present large volumes of detailed statistics to workers, workers might infer that the firm or the industry is well-organized and resourceful and thus a good place to work for the longer term. The empirical implication of this mechanism should be consistent with the career concern model, and we do not find evidence of this mechanism.

Performance trajectory information reassures risk-averse workers. Another potential explanation for our results is that workers feel more anxious about the future when they just start working and face a significant degree of uncertainty. For example, they might have little knowledge of what their performance will look like in, say, six months, and the multiple data points contained in a trajectory message reduces the unpredictability of their future performance and reassures workers who are generally risk-averse. To explore this possibility, we look at how trajectory and peer performance information affect workers' degree of certainty of their predictions of future performance. In Table A13, we see significantly higher certainty among workers who receive peer performance information, whereas the effect on the trajectory group is much smaller and statistically insignificant.[16] The test thus shows preliminary evidence against this

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[16]One natural question to ask is why peer information decreases workers' sense of uncertainty more effectively compared to the trajectory information. Our interpretation is that workers have closer performance with those of similar tenure. Viewing the current performance of peers could give workers a more precise idea of what their performance would look like in the

explanation.

Performance trajectory information lowers risk-averse workers' belief of the variation in performance over time. An alternative argument related to risk aversion is that trajectory information makes workers realize that their performance will likely be more stable than expected, thus rendering them more willing to stay. In Table A14, we report the effect of the treatment on new workers' self-perceived performance volatility and fail to find difference across groups.

Trajectory information raises new workers' competitiveness. It could also be that, after viewing the trajectory performance of the star employees, new workers are more motivated to stay to compete with these workers. Using the post-RCT survey data, Table A14 shows that, while trajectory information has a marginally significant impact motivating the senior workers, its impact on the competitiveness of new workers is limited.

6   Conclusion

While a growing body of literature has explored the consequences of social comparison on workers' labor market outcomes within organizations, less attention has been devoted to how firms could reshape the social comparison process to improve employee turnover, productivity, and well-being using managerial practices. We highlight the role of sharing the performance trajectory information of more senior workers to provide a valuable benchmark for junior workers. To uncover the importance of performance trajectory information, we ran a large-scale 28-week field experiment at a leading multinational spa chain that randomly assigned more than 7,000 spa workers to receive coworkers' performance information. One treatment, *Performance Trajectory*, provided workers with the performance trajectories of high-performing senior workers throughout their tenure at the firm. A second treatment, *Peer Performance*, provided workers with the current performance of an anonymous worker with similar tenure.

We find that information about senior workers' performance trajectory improves the retention of new workers. This effect is mediated through the social comparison mechanism, as performance trajectory information helps new workers adjust their beliefs of senior workers' early-stage performance and alleviate their stress when they compare themselves to their coworkers. We find little support for the career concern mechanism, as information has a limited effect on new workers' outlook on their future performance, labor supply, or productivity. We find that the high-performing new workers, those with above-median

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near future. In contrast, the trajectory information of senior workers contains two additional sources of noise. First, significant selection effects apply to senior workers, as only high-performing workers tend to stay. If the new worker is a low type, it would be extremely noisy to infer his future performance based on the senior worker's trajectory. The second source of noise is time fixed effects. New workers need to tease out both from the trajectory treatment effect, which reduces their certainty about the estimate's accuracy.

productivity among all new workers, lowered their turnover likelihood by 2.21 percentage points (22.8%). By contrast, low-performing employees had limited responses to information. Apart from the attrition of new workers, we find little changes in effort, productivity, store revenues, and other on-the-job performance measures. In comparison, performance trajectory information has a limited effect on senior workers who have been through the trajectory curve during their tenure. All combined, these results highlight the importance of showing new workers the big picture of performance trajectory to improve worker well-being.

This experiment highlights an important yet understudied informational friction that exacerbates the social comparison process in the workplace. While the current performance of senior workers is more easily observable, their past performance is less known. Absent such information, it would be natural for new workers to subconsciously benchmark their performance against the current high level of coworkers with many years of experience, despite it being an unfair comparison. In their seminal work, Nickerson and Zenger (2008) theorize three ways to economize on social comparison costs within firms: pay compression, "technology choice," and corporate scope decisions, where managers divest division to restrict the scope for comparison (Feldman et al., 2018). Our experiment fits into the second category and could be understood as a simple job design decision restricting opportunities for employees to make costly comparisons. While both pay compression and corporate divestitures are complicated managerial decisions involving the coordination of numerous stakeholders, our research shows that simply providing performance trajectory information could nudge new workers into healthier social comparisons and mitigate the undesired consequence of excessive stress and turnover.

Although our estimates of the effects of performance trajectory information are obtained in a nearly ideal firm setting with large sample size, it is still important to consider whether conclusions are likely to differ in other contexts. Two features of our study are particularly relevant for external validity considerations. First, in our firm of study, the past performance of senior workers is less salient. While this feature is prevalent in many other low-skill and high-skill settings, this does not apply to a few high-skill industries. One example is the research industry, where the Curricula Vitae and performance trajectories of senior scholars are largely transparent to junior scholars. Second, early-stage performance is informative about workers' ability. If luck heavily influences how workers perform in their early stages, then new workers may not be able to figure out the innate ability of senior workers from their past performance.

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Figures & Tables

Figure 1: RCT timeline

Month start   Month end

Generate a sample of 8 high-   Twice every week:
performing senior workers   Send the month 1, month 3, month 6, month 12,
for each region   and last-month performance information of a
                                      worker in the sample to all workers in the T1
                                      group of the region
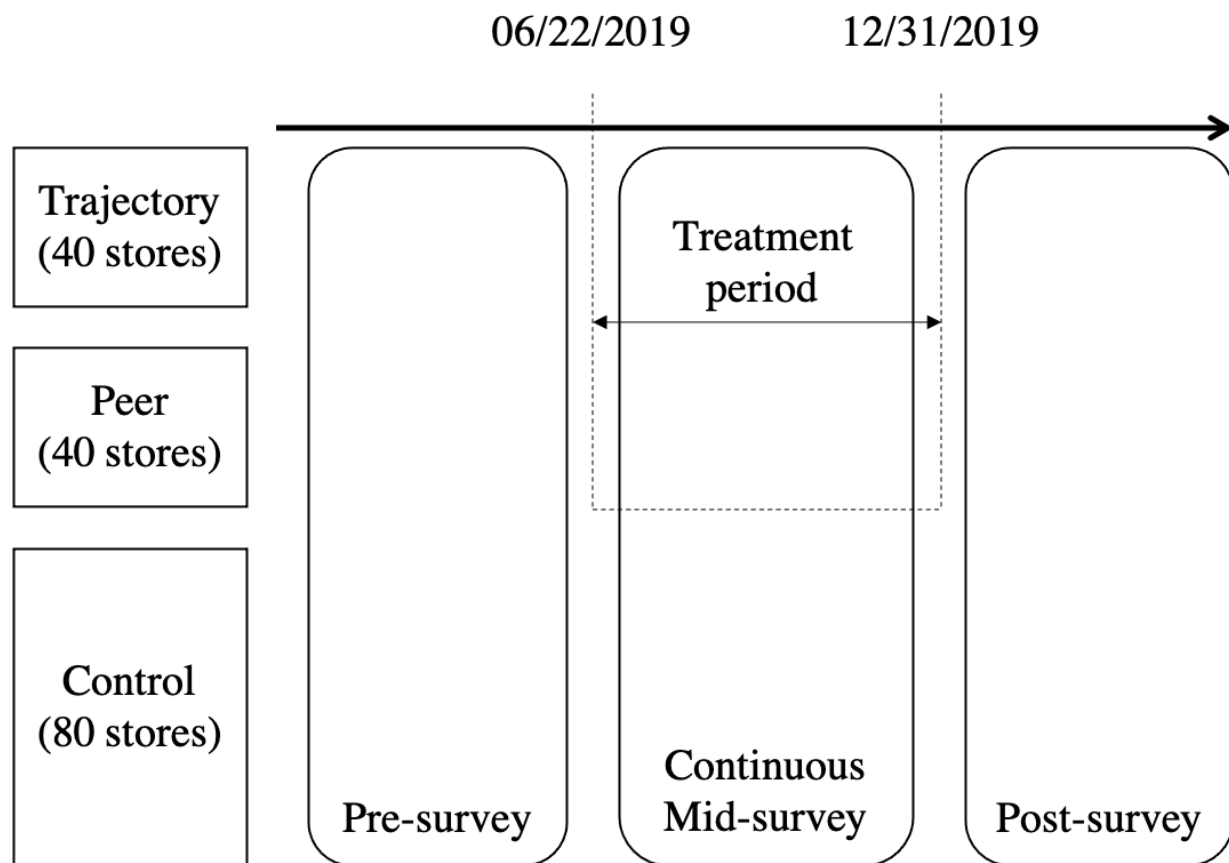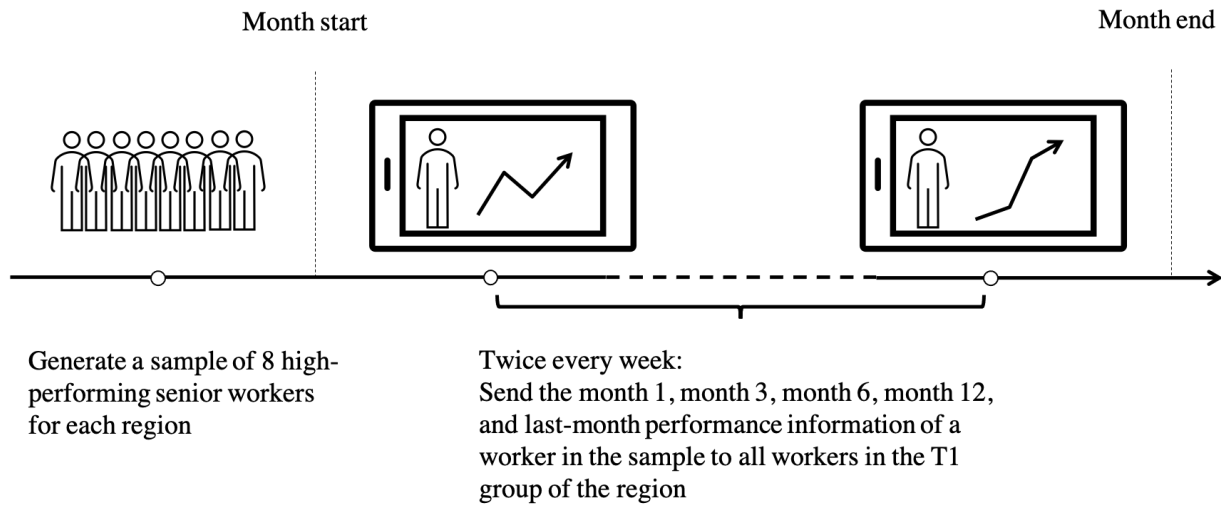
Figure 2: Performance trajectory treatment

Month start   Month end

Generate a sample of 8   Twice every week:
workers for each region-   Send the last-month performance information of
cohort   a worker in the sample to all workers in the T2
                                      group of the region-cohort
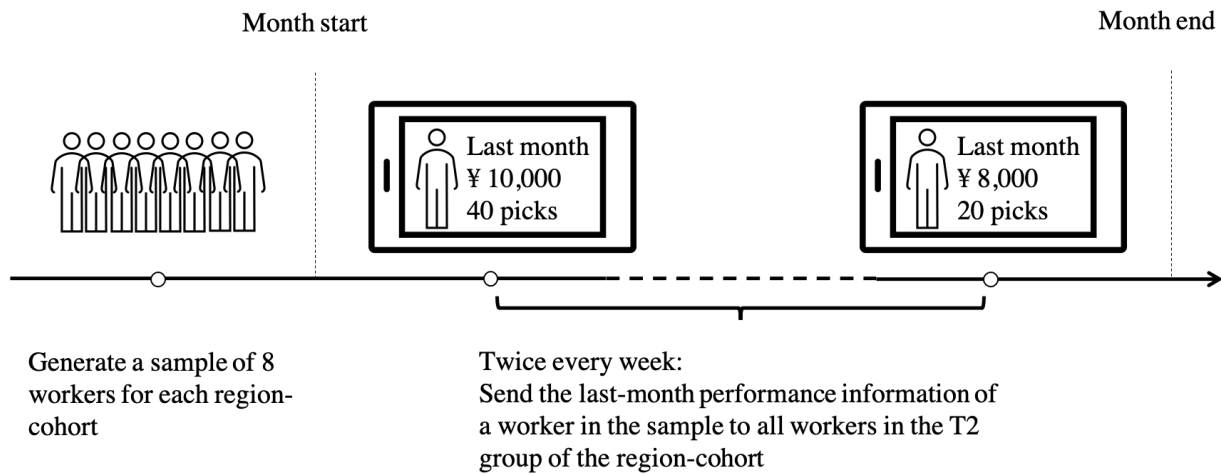
Figure 3: Peer performance treatment

Treatment Group	Sample Message
Trajectory	In order to promote mutual understanding among [the company]'s employees, today we introduce you to the performance trajectory of Xiaomei (alias). Xiaomei joined [the company] in [region] in [year and month]. In [his/her] first month at [the company], [his/her] customer pick number was [number], [his/her] sales was [number]. * In [his/her] 3rd month, [his/her] customer pick number was [number], [his/her] sales was [number]. * In [his/her] 6th month, [his/her] customer pick number was [number], [his/her] sales was [number]. * In [his/her] 12th month, [his/her] customer pick number was [number], [his/her] sales was [number]. * Last month, [his/her] customer pick number was [number], [his/her] sales was [number].
Peer	In order to promote mutual understanding among [the company]'s employees, today we introduce you to the performance of Xiaomei (alias). Xiaomei joined [the company] in [region] in [year and month]. Last month, [his/her] customer pick number was [number], [his/her] sales was [number].

Table 1: Sample messages to spa workers of the two treatment groups

Table 2: Comparing Pre-Treatment Store Means across Different Groups (N=160): Randomization Check

	Comparing All 3 Arms				Treatment vs. Control	
	Control	Trajectory	Peer	p-val	Treatment	p-val
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Store Characteristics						
Revenue in 1000 RMB	646.04***	27.75	-16.13	0.94	5.81	0.95
	(62.07)	(107.51)	(107.51)		(87.54)	
Monthly revenue (log)	13.16***	0.03	-0.05	0.84	-0.01	0.90
	(0.07)	(0.12)	(0.12)		(0.10)	
Store size (sq meters)	1141.66***	-0.29	10.03	0.99	4.87	0.96
	(62.43)	(108.13)	(108.13)		(88.01)	
Store history (years)	4.80***	-0.12	-0.09	0.99	-0.10	0.89
	(0.52)	(0.91)	(0.91)		(0.74)	
Monthly turnover	12.87***	-0.55	-0.53	0.74	-0.54	0.44
	(0.49)	(0.85)	(0.85)		(0.69)	
Location (city)	0.85***	-0.08	-0.08	0.48	-0.08	0.23
	(0.04)	(0.08)	(0.08)		(0.06)	
Panel B. Employee Characteristics						
No. of employees	41.81***	2.59	1.01	0.80	1.80	0.57
	(2.21)	(3.84)	(3.84)		(3.12)	
Age	32.58***	-0.41	0.52	-0.11	-0.26	0.38
	(0.21)	(0.36)	(0.36)		(0.30)	
No. of spa workers	27.72***	0.88	0.33	0.94	0.62	0.77
	(1.50)	(2.57)	(2.62)		(2.11)	
Share male	34.40***	2.52	0.47	0.33	1.50	0.28
	(0.98)	(1.70)	(1.70)		(1.39)	
No. of middle managers	2.23***	0.08	0.00	0.94	0.04	0.84
	(0.13)	(0.22)	(0.22)		(0.18)	
Store manager male	0.94***	0.06	0.01	0.28	0.04	0.25
	(0.02)	(0.04)	(0.04)		(0.03)	

Notes: The table compares pre-RCT store-level characteristics across the different arms. The pre-RCT period is from July 2017 to May 2019. ***p<0.01, **p<0.05, *p<0.1

Table 3: Average Treatment Effects on Attrition (Linear Probability Models)

Dependent Variable	Attrition			
Worker Type	New Workers		Senior Workers	
	(1)	(2)	(3)	(4)
Trajectory	-2.429**	-2.200**	0.917	1.009
	(1.110)	(1.114)	(0.805)	(0.700)
Peer	-0.065	-0.326	0.130	0.110
	(1.276)	(1.171)	(0.870)	(0.716)
Month fixed effects		✓		✓
Region fixed effects	✓	✓	✓	✓
Mean DV if Treatment=0	20.31	20.31	9.70	9.70
Number of observations	10171	9579	21799	18448

Notes: Columns 1-4 are linear probability models, where the dependent variable is whether an employee quits in a month. The coefficients are multiplied by 100 for readability. Observations are at the worker-month level. All columns use the experimental data during the RCT (June-December 2019). Controls are individual-level controls (entry age, gender, prior work experience, marital status) and store-level characteristics (whether the store is in a city, pre-RCT monthly revenue, pre-RCT average monthly turnover rate, number of employees, and share of female employees). Robust standard errors are clustered at the store level in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table 4: Average Treatment Effects on Individual Labor Supply and Productivity

Dependent Variables	Attendance		Customer Pick		log (sales)		log (compensation)	
Worker Type	New	Senior	New	Senior	New	Senior	New	Senior
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Trajectory	0.530	-0.359	-0.033	-0.160	0.010	0.000	-0.011	-0.024
	(0.434)	(0.345)	(1.529)	(2.997)	(0.054)	(0.046)	(0.030)	(0.025)
Peer	-0.456	-0.209	-1.083	-8.094*	-0.008	-0.073	0.009	-0.041
	(0.393)	(0.369)	(1.033)	(4.183)	(0.061)	(0.046)	(0.032)	(0.026)
Month fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Region fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Mean DV if Treatment=0	22.17	25.68	17.27	57.01	9.43	9.91	8.71	9.12
Number of observations	9573	18408	9413	17983	9568	18347	9579	18448

Notes: The table shows the average treatment effects on attendance and productivity. Observations are at the worker-month level. Controls are the same as in Table 3. Columns 3 and 4 also control for the total number of tasks. Robust standard errors are clustered at the store level in parentheses. ***p<0.01, **p<0.05, *p<0.1

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Table 5: Do High-performing Employees Stay? (New Workers)

Dependent Variable	Attrition	
Worker Type	Low-performing	High-performing
	(1)	(2)
Trajectory	-1.455	-2.210**
	(2.398)	(0.896)
Peer	-0.877	-0.256
	(2.359)	(1.099)
Month fixed effects	✓	✓
Region fixed effects	✓	✓
Mean DV if Treatment=0	31.97	9.70
Number of observations	3761	5818

Notes: The table reports the heterogeneous treatment effects on new worker attrition probability according to performance. Controls are the same as in Table 3. Robust standard errors are clustered at the store level in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table 6: Average Treatment Effects on Store-level Performance

Dependent Variables	log (store revenue)	log (store revenue)
	(1)	(2)
Trajectory	0.089	0.052
	(0.091)	(0.062)
Peer	-0.111	-0.040
	(0.085)	(0.051)
Month fixed effects		✓
Region fixed effects	✓	✓
Mean DV if Treatment=0	13.38	13.38
Number of observations	1120	1120

Notes: The table reports the average treatment effects of treatment on store-level performance using data from June to December 2019. Observations are at the store-month level. The dependent variable is log store revenue. Control variables include store-level characteristics and a manager change dummy. Robust standard errors are clustered at the region level in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table 7: Average Treatment Effects on Individual Survey Outcomes

Dependent Variables	Job Satisfaction		Evaluation of Managers		Low Stress		Mental Health	
Worker Type	New	Senior	New	Senior	New	Senior	New	Senior
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Trajectory	-0.040	-0.037	0.016	-0.021	0.180**	-0.004	0.172**	-0.023
	(0.067)	(0.046)	(0.076)	(0.040)	(0.079)	(0.046)	(0.075)	(0.043)
Peer	-0.104	-0.012	-0.053	-0.034	0.006	-0.081*	-0.028	-0.073
	(0.081)	(0.051)	(0.069)	(0.048)	(0.088)	(0.046)	(0.080)	(0.051)
Month fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Region fixed effects	✓	✓	✓	✓	✓	✓	✓	✓
Mean DV if Treatment=0	3.93	3.87	3.99	3.89	2.98	3.00	3.69	3.58
Number of observations	36891	69415	35519	73726	37716	73664	35951	71232

Notes: The table shows the average treatment effects on individual-level job satisfaction, evaluation of managers, pressure level, and mental health. Observations are at the worker-day level. Controls are the same as in Table 3. Robust standard errors are clustered at the store level in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table 8: The Effect of Stress and Mental Health on Attrition

Dependent Variable	Attrition			
Worker Type	New	Senior	New	Senior
	(1)	(2)	(3)	(4)
Low Stress	-2.047***	-1.240***		
	(0.499)	(0.312)		
Mental Health			-1.411***	-0.460
			(0.484)	(0.299)
Month fixed effects	✓	✓	✓	✓
Region fixed effects	✓	✓	✓	✓
Mean DV if Treatment=0	20.31	9.70	20.31	9.70
Number of observations	8149	15885	8669	16732

Notes: The table shows the effect of stress level and mental health conditions on individual-level attrition. The coefficients are multiplied by 100 for readability. Observations are at the worker-month level. Controls are the same as in Table 3. Robust standard errors are clustered at the store level in parentheses. ***p<0.01, **p<0.05, *p<0.1

Appendix: Not for publication.
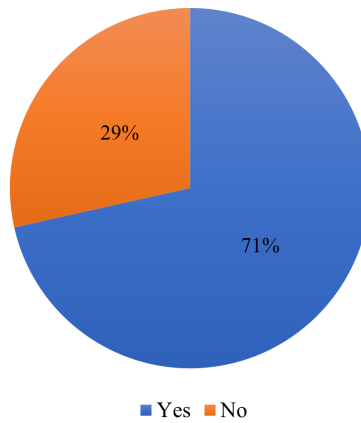
Figure A1: More than 71% of 3,470 surveyed spa workers often compare their performance to that of their coworkers.
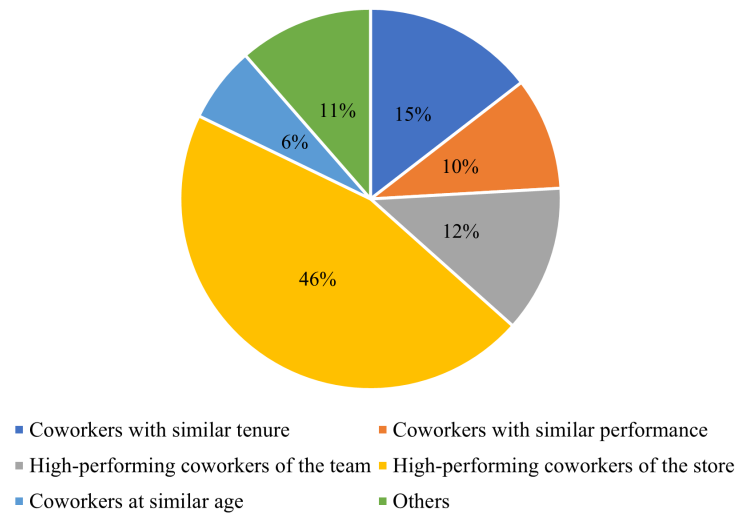
Figure A2: More than 58% of the surveyed spa workers often compare their performance to high-performing coworkers of their team or store.

(a) Store lobby

(b) Spa room

(c) Service

(d) Speech to store managers during corporate annual conference

Figure A3: The company is the largest multinational spa chain, headquartered in China, with more than 500 stores worldwide.

Figure A4: Organizational chart within a store

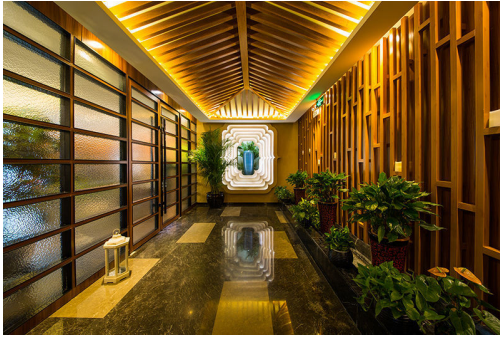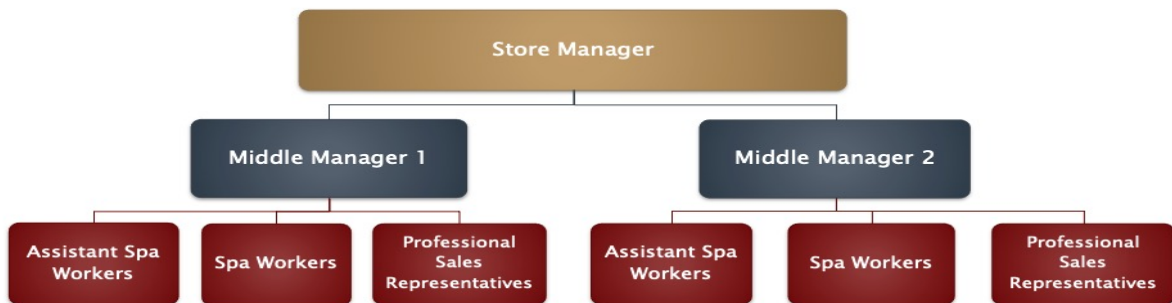| Category	Dimension	Sample Questions
Job Satisfaction	Satisfaction	How satisfied are you with your job in the company?
	Trust	How much trust do you have for the company?
	Sense of belonging	How much sense of belonging do you have for your job and the company?
	Recommendation	Have you suggested or helped family or friends get a job at the company?
	Staying	Are you willing to stay in the company for long?
Manager Evaluation	Care	Do your managers talk to/care about you?
	Problem-solving	Are managers capable of resolving problems when you need them?
	Willing to turn to	If you have troubles, how willing are you to reach out to your manager for help?
	Leave	If you ask for leave when it is really necessary, how easy is it for you to get approval from you manager?
	Fairness	How fair do you think your manager is?
Pressure	Pressure	How much pressure do you feel on the job?
Mental Health	Optimism	I've been feeling optimistic about the future
	Useful	I've been feeling useful
	Exhaustion	I've been feeling relaxed
	Energy	I've been feeling interested in other people and have energy to spare
	Problem-solving	I've been dealing with problems well
	Self-feeling	I've been feeling good about myself
	Closeness	I've been feeling close to other people
	Being loved	I've been feeling loved
	Curiosity	I've been interested in new things
	Cheerful	I've been feeling cheerful

Table A1: Survey questions on job satisfaction and well-being

Category	Sample Questions
Forecast on next month's sales	What is your forecast of your sales in July?
	How confident are you about your forecast?
Forecast on sales in three months	What is your forecast of your sales in September?
	How confident are you about your forecast?
Belief about average sales of peers in the last months	What is your estimate of the average June sales of your peers (whose start dates at the company are within two months from yours) in the same region?
	How confident are you about your estimate?
Belief about senior workers' early performance	Some workers in your region joined the company last July. What is your estimate of their average sales last September?
	How confident are you about your estimate?

Table A2: Survey questions on beliefs

Table A3: Stress Levels of High-performing and Low-performing Workers

Dependent Variable	Low Stress
High-performer	-0.195**
	(0.079)
Month fixed effects	✓
Region fixed effects	✓
Number of observations	6356

Notes: The table reports the correlation between performance and stress levels among new workers using pre-RCT survey data. Observations are at the worker-day level. Controls are the same as in Table 3. Robust standard errors are clustered at the store level in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table A4: Heterogeneous Treatment Effects on Attrition (New Workers)

Dependent Variable	Attrition					
Worker Type	Female	Male	Younger	Older	Less Educated	More Educated
	(1)	(2)	(3)	(4)	(5)	(6)
Trajectory	-2.911**	-0.544	-2.303	-1.785	-1.944	-2.681
	(1.340)	(1.994)	(1.523)	(1.761)	(1.458)	(1.693)
Peer	-0.512	0.114	0.631	0.340	0.566	-1.294
	(1.319)	(2.291)	(1.495)	(1.821)	(1.546)	(1.728)
Month fixed effects	✓	✓	✓	✓	✓	✓
Region fixed effects	✓	✓	✓	✓	✓	✓
Mean DV if Treatment=0	20.50	19.73	20.49	20.14	19.54	21.39
Number of observations	7152	2427	4774	4805	5428	4151

Notes: Columns 1-6 are linear probability models, where the dependent variable is whether an employee quits in a month. The coefficients are multiplied by 100 for readability. Observations are at the worker-month level. All columns use the experimental data during the RCT (June-December 2019). Controls are the same as in Table 3. Robust standard errors are clustered at the store level in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table A5: Heterogeneous Treatment Effects on Attrition (Senior Workers)

Dependent Variable	Attrition					
Worker Type	Female	Male	Younger	Older	Less Educated	More Educated
	(1)	(2)	(3)	(4)	(5)	(6)
Trajectory	0.719	1.638	0.827	1.258*	1.354	0.577
	(0.740)	(1.349)	(1.095)	(0.735)	(0.834)	(1.000)
Peer	0.200	-0.372	-0.101	0.193	-0.211	0.486
	(0.778)	(1.238)	(1.000)	(0.840)	(0.794)	(1.003)
Month fixed effects	✓	✓	✓	✓	✓	✓
Region fixed effects	✓	✓	✓	✓	✓	✓
Mean DV if Treatment=0	9.81	9.31	11.02	8.38	9.26	10.39
Number of observations	14158	4290	9284	9164	11050	7398

Notes: Columns 1-6 are linear probability models, where the dependent variable is whether an employee quits in a month. The coefficients are multiplied by 100 for readability. Observations are at the worker-month level. All columns use the experimental data during the RCT (June-December 2019). Controls are the same as in Table 3. Robust standard errors are clustered at the store level in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table A6: Heterogeneous Treatment Effects by Store-level Characteristics on Attrition (New Workers)

Dependent Variable	Attrition					
Store Type	Town	Big City	Newer	Older	Lower Turnover	Higher Turnover
	(1)	(2)	(3)	(4)	(5)	(6)
Trajectory	-0.610	-2.186*	-2.890**	-0.485	-1.538	-2.509
	(2.714)	(1.278)	(1.294)	(1.923)	(1.621)	(1.685)
Peer	1.749	-0.500	-0.085	-1.215	-1.326	0.607
	(2.617)	(1.283)	(1.659)	(1.626)	(1.563)	(1.955)
Month fixed effects	✓	✓	✓	✓	✓	✓
Region fixed effects	✓	✓	✓	✓	✓	✓
Mean DV if Treatment=0	17.05	20.72	20.40	20.21	20.18	20.41
Number of observations	1502	8077	5332	4247	4315	5264

Notes: Columns 1-6 are linear probability models, where the dependent variable is whether an employee quits in a month. The coefficients are multiplied by 100 for readability. Observations are at the worker-month level. All columns use the experimental data during the RCT (June-December 2019). Controls are the same as in Table 3. Robust standard errors are clustered at the store level in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table A7: Heterogeneous Treatment Effects by Store-level Characteristics on Attrition (Senior Workers)

Dependent Variable	Attrition					
Store Type	Town	Big City	Newer	Older	Lower Turnover	Higher Turnover
	(1)	(2)	(3)	(4)	(5)	(6)
Trajectory	0.859	0.774	0.563	0.941	1.214	-0.061
	(1.293)	(0.783)	(1.232)	(0.879)	(0.759)	(1.248)
Peer	1.324	-0.577	-0.532	0.685	0.596	0.029
	(1.244)	(0.811)	(1.286)	(0.775)	(0.892)	(1.339)
Month fixed effects	✓	✓	✓	✓	✓	✓
Region fixed effects	✓	✓	✓	✓	✓	✓
Mean DV if Treatment=0	9.34	9.76	12.30	8.16	8.74	10.94
Number of observations	3456	14992	6840	11608	10909	7539

Notes: Columns 1-6 are linear probability models, where the dependent variable is whether an employee attrites in a month. The coefficients are multiplied by 100 for readability. Observations are at the worker-month level. All columns use the experimental data during the RCT (June-December 2019). Controls are the same as in Table 3. Robust standard errors are clustered at the store level in parentheses. ***$p<0.01$, **$p<0.05$, *$p<0.1$

Table A8: Treatment Effects on Beliefs about Senior Workers' Early-career Performance

Dependent Variable	Beliefs about Senior Workers' Early-career Performance	
Worker Type	New	Senior
	(1)	(2)
Trajectory	-0.238**	0.056
	(0.079)	(0.067)
Peer	0.148	0.080
	(0.097)	(0.066)
Region fixed effects	✓	✓
Mean DV if Treatment=0	3.54	3.40
Number of observations	932	1851

Notes: The table reports the treatment effects on workers' self-reported beliefs about senior workers' early-career performance using post-RCT survey data. The survey question asks: "Compared to my estimate half a year ago, I believe the actual performance of senior workers (from the same region) in their early tenure stage is (1=much lower, 2=lower, 3=roughly the same, 4=higher, 5=much higher)." Control variables include store-level characteristics and region fixed effects. Robust standard errors are clustered at the region level in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table A9: Treatment Effects on Stress

Dependent Variable	Low Stress	
Worker Type	New	Senior
	(1)	(2)
Trajectory	0.257**	-0.130
	(0.116)	(0.095)
Peer	-0.018	-0.046
	(0.125)	(0.067)
Region fixed effects	✓	✓
Mean DV if Treatment=0	2.57	2.73
Number of observations	1022	1988

Notes: The table reports the treatment effects on workers' self-reported change in stress levels comparing themselves to the senior high-performing workers using post-RCT survey data. The survey question asks: "Compared to half a year ago, my stress level is (1=much higher, 2=higher, 3=roughly the same, 4=lower, 5=much lower)." Control variables include store-level characteristics and region fixed effects. Robust standard errors are clustered at the region level in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table A10: The Effect of Coworkers' Performance Trajectory Information on Stress of New Workers

Dependent Variable	Low Stress
Coworkers' performance in the 1st month	-0.521**
	(0.251)
Coworkers' performance in the last month	0.0886
	(0.134)
lagged (Stress Score)	0.294***
	(0.0197)
Store fixed effects	✓
Number of observations	5576

Notes: The table shows the effect of senior workers' performance trajectory information on new workers' stress levels. The performance measure is the number of customer picks (divided by 100) that a worker has in a month. Observations are at the worker-week level. Robust standard errors are clustered at the store level in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table A11: Average Treatment Effects on New Workers' Forecasts on Own Future Performance

Dependent Variables	log (forecast on next month's sales)	log (forecast on sales in three months)
	(1)	(2)
Trajectory	0.153	0.0473
	(0.0976)	(0.0766)
Peer	-0.125	-0.128
	(0.0913)	(0.0806)
log (sales)	0.419***	0.332***
	(0.0289)	(0.0241)
Month fixed effects	✓	✓
Region fixed effects	✓	✓
Number of observations	3023	3088

Notes: The table shows the average treatment effects on individual-level performance forecasts. Observations are at the worker-month level. Controls are individual characteristics (entry age, gender, prior work experience, marital status). Robust standard errors are clustered at the store level in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table A12: Effects of Individual Performance Forecasts on Attrition

Dependent Variable	Attrition	
Worker Type	New Workers	Senior Workers
log (forecast of next month's sales)	-2.13**	0.156
	(0.909)	(0.582)
log (forecast of sales in three months)	1.13	-0.902*
	(1.17)	(0.536)
log (sales)	-1.74*	-1.26***
	(1.03)	(0.343)
Month fixed effects	✓	✓
Region fixed effects	✓	✓
Number of observations	1508	4583

Notes: The table regresses attrition on workers' forecasts of future performance and current sales using data from June to December 2019. The coefficients are multiplied by 100 for readability. Observations are at the worker-month level. Controls are individual characteristics (entry age, gender, prior work experience, marital status). Robust standard errors are clustered at the store level in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table A13: The Effect of Information on the Certainty of Self-predicted Future Performance

Dependent Variable	Certainty of Predictions
Trajectory	0.024
	(0.038)
Peer	0.083**
	(0.041)
Region fixed effects	✓
Number of observations	17363

Notes: The table shows the effect of performance information on workers' certainty of their self-predicted performance in three months. The regression uses workers' forecast data on future performance from June to December 2019. Robust standard errors are clustered at the store level in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table A14: Treatment Effects on Self-perceived Performance Volatility and Competitiveness

Dependent Variables:	Perceived Volatility		Competitiveness	
Worker Type	New	Senior	New	Senior
	(1)	(2)	(3)	(4)
Trajectory	-0.026	-0.010	0.143	0.120*
	(0.063)	(0.051)	(0.088)	(0.063)
Peer	-0.036	0.092	-0.095	-0.102
	(0.043)	(0.064)	(0.090)	(0.071)
Region fixed effects	✓	✓	✓	✓
Mean DV if Treatment=0	3.52	3.31	4.00	3.76
Number of observations	984	1946	916	1751

Notes: The table reports the treatment effects on worker's self-perceived performance volatility and competitiveness using post-RCT survey data. Columns 1 and 2 ask: "Compared to half a year ago, the actual variance of individual productivity is (1=much smaller, 2=smaller, 3=roughly the same, 4=larger, 5=much larger) than what I estimated." Columns 3 and 4 ask: "Compared to half a year ago, my sense of competitiveness is (1=much smaller, 2=smaller, 3=roughly the same, 4=larger, 5=much larger)." Control variables include store-level characteristics and region fixed effects. Robust standard errors are clustered at the region level in parentheses. ***p<0.01, **p<0.05, *p<0.1