Barriers to Organizational Performance: Experimental Evidence of the Importance of Relational Contracts

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Abstract

Firms often fail to adopt organizational practices that improve their performance. Existing research suggests several reasons why this may occur: managers do not perceive a problem, do not understand what to do, are not motivated to act, or have difficulty in building relational contracts with workers. We conducted a large-scale field experiment on 12,761 small and medium enterprises to study how these four factors influence the adoption of workplace safety. We found that only the relational treatment, which emphasized mutual effort by managers and workers, was effective: it reduced the rate and severity of accidents and increased the types of safety training nudged by our treatment. The results are substantial and long-lasting, and stronger when treatment dosage is higher. The effect was enhanced when combined with the manager motivational and understanding treatments, but not the perception treatment. This study provides evidence of the primal importance of relational contracts and suggests that the effects of manager motivation and understanding are insufficient without relational contracts in place for workforce safety practices. (167 words)

Keywords: Relational contracts; Organizational practices; Field experiment; Workplace safety.

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1. INTRODUCTION

Scholars in strategy and economics have long grappled with a central question: why organizational practices and capabilities that improve firm performance do not diffuse more widely (Argyres, 2021; Bartelsman and Doms, 2000; Bloom and Reenen, 2007; Hsieh and Klenow, 2009; Naumovska, Gaba, and Greve, 2021; Syverson, 2011). As a way to organize the search for answers, scholars have proposed a taxonomy of key barriers that impede firms' adoption of performance enhancing practices (Gibbons and Henderson, 2012a): managers do not perceive that their performance is lacking, lack an understanding of what needs to be done, lack the motivation to adopt the required practices, or they have difficulty in building the relational contracts between managers and workers necessary to implement the practices.

Research from an organizational economics perspective (see Gibbons and Henderson, 2012b, 2012a; Gibbons *et al.*, 2021; Helper and Henderson, 2014, Levin, 2003; Macleod and Malcomson, 1989) highlights that, while all these barriers are important, the challenges involved with relational contracts may be particularly difficult. Managerial practices and capabilities frequently rely on hard-to-build, subtle informal agreements that regulate what to do, when and how to do it, who does it, etc. These agreements, known as *relational contracts*, are so deeply rooted in the parties' circumstances that they rely on the expected future value of the relationship for the parties to adhere to the agreement rather than formal enforcement levers. However, their informal nature means that often they are difficult to build because of problems of clarity—where the parties do not understand what each party is supposed to do—and credibility—where the parties do not believe that the other party will do what it says it will do (Gibbons *et al.*, 2021; Gibbons and Henderson, 2012b). These problems can undermine firm performance as the parties defect from cooperation in building and implementing organizational practices (Helper and

Henderson, 2014).

This study addresses two gaps in the literature. First, research has yet to systematically investigate the *relative importance of problems with relational contracts, perception, understanding, and motivation* for improving organizational performance. These have been documented and studied in isolation, but no research that we are aware of has examined them all together. Filling this lacuna is important for firm strategy and for public policy that relies on firm's adoption of practices.

Second, while recent studies have called for research on how firms can construct effective relational contracts to improve performance (de Figueiredo and Silverman, 2017; Gil and Zanarone, 2018; Macchiavello and Morjaria, 2023), and theoretical and empirical progress has already been made (for theory see, Andrews and Barron, 2016; Chassang, 2010; Gibbons and Henderson, 2012a; for empirics, see Macchiavello and Morjaria, 2023) there is very little empirical evidence of *how firms build and refine relational contracts within firms*, as opposed to between firm evidence (Argyres, 2021; Macchiavello and Morjaria, 2023). Research thus far has relied on case studies to provide evidence of how relational contracts can increase employee productivity and loyalty (Gibbons and Henderson, 2012a), ethnography and surveys to uncover shading of performance by workers to punish managers (Akerlof *et al.*, 2020), and lab experiments that indicate that when the initial agreement establishes principles rather than rules, the parties more successful in adapting to changes (Gibbons *et al.*, 2021). Research has yet to empirically examine building relational contracts within firms using large sample data (Macchiavello and Morjaria, 2023).[2]

[2] The lack of research in this area is partly because the informal, undocumented nature of relational contracts makes it difficult to observe and study (Gil and Zanarone, 2018). Studies on relational contracts between firms primarily rely on patterns consistent with theoretical predictions as evidence that relational contracts are in place (Gil and Zanarone, 2018). Within firms, not only is the data on relational contracts rarely observable, but it is also frequently

In this study, we take a step towards enhancing our understanding of how firms can improve organizational performance by using a large-scale field experiment on workplace safety. Accidents in the workplace are costly and can significantly impact firms' financial performance (Cohn and Wardlaw, 2016; Gowrisankaran *et al.*, 2015; Gray, 1987; Pagell *et al.*, 2014; Viscusi and Aldy, 2003; Yakovlev and Sobel, 2010). Many firms fail to adopt safety practices that reduce accident rates (Pouliakas and Theodossiou, 2013; da Silva and Amaral, 2019). Our randomized experiment enables us to exogenously vary perception, motivation, understanding, and relational contracts to identify their effects on workforce safety performance and the adoption of workforce safety practices.

For the field experiment, we collaborated with the "Asociación Chilena de Seguridad" (ACHS), the largest occupational safety and health (OSH) services organization in Chile whose affiliated firms correspond to 40% of all Chilean workers. We ran a large-scale randomized control trial in the context of the ACHS' small and medium enterprise (SME) community prevention program. ACHS personnel visit roughly 1/12 of its 31,500 affiliated SME firms in this program each month. On each visit, the ACHS collected firm information and sent a lengthy, customized but not-easy-to-understand[3] report, that includes an assessment of safety conditions and a non-mandatory prevention plan tailored to the firm. We conducted a double-randomization of the firms visited each month for five consecutive months starting in March of 2013 and delivered the treatments the month after the visit. In total, the sample consisted of 12,761 firms.

The firms were randomly assigned to four treatment groups. First, firm managers were

unavailable for scholars (Gil and Zanarone, 2017). Moreover, even when internal data can be used to investigate the performance consequences, it is usually difficult to distinguish causation from correlation because of the lack of plausible sources of exogenous variation (Gibbons *et al.*, 2021).

[3] The reports typically are relatively complex and hard to follow, namely a document with 30 to 40 pages written in a legalistic style that makes it hard to understand, particularly for busy SME owners or managers.

assigned to receive one of three different types of information provided by email: (1) to address perception, we provided a graph that compares the firm's safety performance relative to the average firm in their sector (Perception treatment group), (2) to address motivation, we provided information that translates the firm's accident record into monetary costs (Motivation treatment group), and (3) to address understanding what needs to be done, we provided a summary of the the ACHS inspection report and prevention plan that the SME received after the visit, and we organized the summary as a checklist to facilitate the implementation of prevention measures (Understanding treatment group). Second, orthogonal to the email treatments, a fraction of firms were also randomly selected to receive 20 printed pamphlets *for managers to give to workers that frame safety as "everybody's work,"* indicate the specific risks identified by ACHS, and point at ACHS resources for prevention and training (Relational treatment group). We expect that managers providing workers with pamphlets framing safety as "everybody's work" and highlighting resources for safety will help build a relational contract by increasing relational clarity on what each party is supposed to do and increasing the credibility that managers will support (and not punish) workers for undertaking safety measures that can be costly to the firm, such as training.

The results indicate that of the four randomized treatments, only the relational treatment significantly reduces accident rates and accident severity. We found no evidence that the perception, motivation, and understanding of treatments alone significantly reduce accident rates, accident severity, nor increase safety training. In contrast, the relational treatment leads to a long-lasting reduction in the number and severity of accidents. We observe consistent decreases in the cumulative accident rates six, 12, and 15 months after the treatment. In these three intervals, there is a 15 percent reduction in accidents per worker per year compared to the control

group. These results are robust to the inclusion of controls and different specifications.

We find evidence of a change in the cooperative behavior nudged by the relational treatment. There is an immediate and substantial effect of prevention training classes (the main prevention practice in our setting) and these tend to focus on training classes that tackle the risks mentioned in the pamphlet. We only find weak evidence that the relational treatment increased the firms' use of generic training programs. Our analyses indicate that a sizeable part, but not all, of the decrease in the number of accidents is due to training.

We examine interactions of the relational with the perception, motivation, and understanding treatments. We find that the impact of the relational treatment on accidents is stronger when the managers also receive the motivation treatment that contains information on the costs of accidents (i.e., payoffs to cooperating). It is also stronger when the managers receive the understanding treatment with the summarized information and checklist on how to implement safety procedures (i.e., manager clarity). The interaction with perception was non-significant. The results suggest that the effectiveness of manager motivation and understanding are contingent on building relational contracts with workers.

Finally, to investigate whether the relational treatment is indeed capturing relational contracting, we explore clarity and credibility factors that the literature suggests affect building relational contracts and find a pattern of results consistent with theory. Specifically, for credibility that parties will cooperate in the exchange, we examined the conditions under which the expected future value of the relationship is greater. We find support that the effects of the relational treatment are more salient when the firm and workers have greater payoffs to cooperating: when workers face more severe workplace risks, when worker turnover is low, worker compensation is higher, and labor market competition—measured as the number of firms

in region-industry cells—is lower. For clarity, consistent with relational contracting theory, the effects of the relational treatment are stronger when managers had previously provided information to help workers understand what to do for safety.

Overall, our results indicate the primal importance of relational contracts. We find evidence that relational contracts are critical roadblocks to achieving workplace safety practices. The results suggest that the effects of manager motivation and understanding are insufficient without relational contracts in place for workforce safety practices. Our type of intervention could be adopted by many firms, in managerial practice areas other than safety, and by policy makers, which tend to intervene with one recipient exclusively, either managers or workers, but not both at the same time.

2. THEORETICAL BACKGROUND

In this section, we discuss how problems of perception, lack of understanding, lack of motivation, and difficulty in building relational contracts can affect the implementation of organizational practices to improve performance. We recognize that there may be other factors that also affect it, such as firm resources. We follow the framework laid out by Gibbons and Henderson (2012b) for tractability and, where possible, control for alternative explanations.

2.1 Perception

The first problem is perception: managers "do not know they are behind" (Gibbons and Henderson, 2012a: 682). Managers may be unaware that other firms are using different practices and that these different practices can significantly affect their productivity (Henderson and Clark, 1990; Tripsas and Gavetti, 2017). This problem may be driven by cognitive frames and how information is processed within the firm. Managers can become rooted in their perception of how things work, failing to perceive that there may be better alternatives or that they are lagging

behind competitors (Helper and Henderson, 2014; Kaplan, 2011; Kaplan, Murray, and Henderson, 2003; Tripsas and Gavetti, 2017). Perception problems can also be the result of a lack of information: Bloom et al (2014) show that managers are very inaccurate in self-diagnosing their organizational practices, indicating that "there is much ignorance in simply knowing how well managed a firm is" (p. 869). As a result, managers will not change practices if they fail to recognize the need to improve them (Taylor, 2010).

Firms, in order to solve this problem, may rely on the public comparisons of firms' performance in those dimensions that are provided by public rankings, ratings, expert critics, and certification schemes (Sharkey, Kovacs, and Hsu, 2023). For example, (Chatterji and Toffel, 2010) shows that after the release of corporate environmental ratings, firms react by improving their environmental performance, especially those that are lagging in the ratings.

2.2 Understanding

While managers might perceive a problem—"they know they are behind"— they may not be able to address it because they do not know how to do so—a problem of understanding (Helper and Henderson, 2014). This may be due to tacitness, complexity, or lack of managerial capacity. For tacitness, a long stream of literature shows that capabilities and routines rely upon tacit knowledge, that is hard to codify and thus transmit (Argote and Miron-Spektor, 2011; Cohen and Bacdayan, 1994; Grant, 1996). This is reflected in empirical research demonstrating the importance of individuals in transferring knowledge and best practices between organizations (Tushman and Scanlan, 1981; Zhao and Anand, 2009; Zobel, Falcke, and Comello, 2023), serving as conduits of knowledge (Levitt and March, 1988), as well as the importance of common ownership/organization to foster transmission of knowledge and practices (Atalay, Hortaçsu, and Syverson, 2014; Darr, Argote, and Epple, 1995).

Regarding complexity, a rich literature on firm capabilities has long held that activities that are interrelated and filled with subtleties are challenging for firms to understand and duplicate (Barney, 1986; Blau and Scott, 2003; Teece, 2007). Tasks are embedded in routines or bundled in sets of interacting activities, making the knowledge fundamental to implementing the practices difficult to transfer (Rivkin, 2000; Zollo and Winter, 2002).

Finally, firms may have difficulty in understanding what to do because they lack the managerial attention and capacity to decipher and unpack the practices needed. This is particularly the case for small and medium firms because they tend to busy (Walker et al, 2007)—for example, they face difficulties to delegate or outsource time-consuming, routine activities which limits their managerial capacity (Anderson and McKenzie, 2022)—which limits their attention and capacity to adopt performance improving practices (Beaman et al, 2014). These attention and cognitive limitations of SME managers is reflected in the fact that substantial consulting often is required to SMEs managers so that their firm adopt a performance improving management practices (Bruhn, Karlan, and Schoar, 2018; McKenzie, 2021).

2.3 Motivation

Managers may lack the motivation to implement organizational practices (Helper and Henderson, 2014). Frequently, motivation problems arise because the industry has weak selection pressures which reduces the incentives of managers to adopt practices (Bartling, Fehr, and Schmidt, 2012; Bloom and Reenen, 2007; Syverson, 2004, 2011). Strong selection pressures force firms to adopt competitive practices to maintain their position and, in more extreme cases, to survive.

Motivation problems for practice adoption also may arise because adopting a performance-enhancing practice can, on the one hand, involve upfront costs (installation,

finetuning, retraining workers, etc.) and on the other, disrupt normal operations and thus create an opportunity cost—lost returns from keeping things as they are (Holmes, Levine, and Schmitz Jr, 2012). For example, (Gant, Ichniowski, and Shaw, 2002) shows how "high-performance work practices" (see Ichniowski, Shaw, and Prennushi, 1997), although better in the long run, might not be adopted because the "disruptive overhaul in the entire network of interactions among all workers at the plant" that they require (Gant *et al.*, 2002: 289). In a field experiment in Pakistan, Atkin *et al.*, (2017) shows that, despite its clear benefits, most firms fail to adopt a new production technology because it slows workers down initially, and given the heavy use of piece rate incentives, workers resist adoption in various ways (including misinformation to managers) out of fear of compensation reduction. Moreover, behavioral tendencies to engage in hyperbolic discounting and caring more about losses than gains (Thaler and Sunstein, 2008) bias decisions against adopting practices with upfront costs and (uncertain) benefits in the future.

2.4 Relational Contract

Many organizational practices are detail-rich and context-specific, and thus, difficult to specify or define ex-ante or verify ex-post; further, their successful implementation requires cooperation between managers and workers. Thus, the implementation of these practices requires a relational contract between managers and workers (Gibbons and Henderson, 2012c); the problem is that managers may have difficulty building it.

Within firms, relational contracts generally describe how managers and employees should act and how they will be rewarded (Baker, Gibbons, and Murphy, 2002; Blader, Gartenberg, and Prat, 2020). Relational contracts are characterized by two key features: 1) they are informal understandings that a court cannot enforce, and 2) they are equilibria of repeated interaction between parties (Gibbons *et al.*, 2021). Relational contracts arise because there is

enough uncertainty that it makes it difficult to specify all contingencies, and therefore, any formal contract would be incomplete (de Figueiredo and Silverman, 2017; Milgrom and Roberts, 1992). The informal nature implies that for relational contract to be sustained, it must be self-enforcing so that the future value of the relationship for each party is greater than the value of reneging (Baker *et al.*, 2002).

Extant work models relational contracts as outcomes of repeated games. For the equilibrium to be reached, each party's strategy in the repeated game is its best response to the other party's strategy (Gibbons *et al.*, 2021). Repeated interactions in response to uncertain events leads, through different dynamics (such as learning, path-dependency, asymmetric bargaining power, organizational structure), to firms achieve different relational equilibria (Chassang, 2010; Halac, 2012; Li, Matouschek, and Powell, 2017; Baker et al, 2002). These theoretical models are consistent with empirical evidence in the heterogeneous ability of firms, absent the perception, understanding and motivation barriers, to implement performance organizational practices (Blader *et al.*, 2020; Helper and Henderson, 2014).

Building and sustaining relational contracts is difficult because often there are problems of credibility and clarity (Gibbons and Henderson, 2012b). The credibility problem concerns whether each party believes the other party will keep their promises (Gibbons and Henderson, 2012b). To achieve the equilibrium, it must be in each party's interest to keep their promises, given their expectation about the other party's behavior (Gibbons *et al.*, 2021; Herz, Schmutzler, and Volk, 2019). Prior research has explored which conditions might affect the credibility condition: it has been shown that trust coming from the extent of prior relationships increases the likelihood that the relational contract will be formed and sustained (Brahm and Tarziján, 2016; de Figueiredo and Silverman, 2017; Gil and Marion, 2013); in contrast, higher competition (e.g.,

a higher number suppliers and buyers) reduces the robustness of relational contracts because parties have an increased temptation to defect (Macchiavello and Morjaria, 2021).

Clarity problems arise because of the informal nature of the relationship, where it may be difficult for the parties to communicate to each other the expectations (Gibbons *et al.*, 2021). Consequently, the parties may not have a shared understanding of the promises made. Clarity includes task knowledge of the particular actions to complete the task and also relational knowledge about each party's payoffs to cooperating, their ability and incentive to defect, and the possible punishment actions and payoffs (Gibbons and Henderson, 2012b). Quantitative evidence on clarity has been absent so far (Macchiavello and Morjaria, 2023).

3. BARRIERS TO ADOPTING WORKPLACE SAFETY

There is substantial research in the workplace safety literature on adopting workplace safety practices. da Silva and Amaral (2019) thoroughly review workplace safety practice barriers, which we summarize and then describe how they relate to perception, understanding, motivation and relational contracting problems in Table 1. The barriers span all four factors, suggesting that workplace safety is a relevant context to compare the importance of the four barriers.

[Insert Table 1 around here]

Below, we describe how perception, understanding, motivation, and relational contracting problems hinder workplace safety practices. Foreshadowing our experimental treatment, we group these based on the notion in existing research that the first three factors are related more clearly to managers (one-sided), whereas the last is relational, between managers and workers (two-sided). As the first three factors are relatively intuitive compared to the last factor, we focus more of our theoretical development on delving deeper into safety as a relational contract.

3.1 Managerial Failures

Perception. Managers may not be aware of the firm's relative accident level and instead believe accidents are just "normal" and that all firms in their industry face similar safety problems. Often, there are large differences in managers' awareness of issues related to safety (Yoon *et al.*, 2013). The formal existence of safety procedures creates a false perception of safety—in and of itself, it does not reduce injuries nor ensure the safety of workers (Gallagher, Underhill, and Rimmer, 2003; Gardner, 2000; Gholami *et al.*, 2015; Robson *et al.*, 2007). Delays in perceiving the returns to safety practices further undermine the adoption and implementation of workplace safety practices (Yoon *et al.*, 2013). In such cases, information about the competitive performance of the firm relative to its peers can help managers recognize that the firm's performance can be improved (Sinelnikov, Inouye, and Kerper, 2015). This may lead managers to alter practices to improve performance.

Understanding. Often, managers find what constitutes safety ambiguous because the actions are interwoven in operations and routines carried out by multiple parties. Tracking safety practices and their performance are often process- or activity-specific and requires collecting complex data across all levels (Sinelnikov *et al.*, 2015). Firms accrue an implicit element of workforce safety practices based on their operations and historical experiences. Sinelnikov *et al.* (2015) observe that indicators for safety frequently are ineffective or unable to assess critical incidents accurately over time, and firms struggle to understand how to turn data on safety into action. Understanding what is needed often entails adaptation to the firm's existing operations with a tacit insight on implementation.

Experts in workforce safety practices can recognize defective areas in the firm safety and provide easy-to-digest remedies. By informing managers of the latest knowledge and indicators of safety practices, including their implementation and results in other firms, experts enhance

managers understanding of how to improve operations (Sinelnikov *et al.*, 2015). While many features of knowledge may be tacit, their expertise enables the identification of steps that firms can take based on their existing operations to improve safety.

Motivation. The high costs of safety practices are a significant barrier to implementing them as it reduce managers' motivation (Santos, Mendes, and Barbosa, 2011; da Silva and Amaral, 2019). Implementing workplace safety requires changes to organizational practices and organizational culture (Santos *et al.*, 2011), which managers tend to be reluctant to alter. Safety practices can increase management complexity and reduce its efficiency (Zeng, Shi, and Lou, 2007). It may also conflict with organizational culture, be poorly received by workers, and increase management costs (Zeng *et al.*, 2007).

Consequently, managers may not be motivated to implement safety practices if they do not understand the benefits of implementing the changes needed to improve safety. Managers must understand how accidents and safety failures can be costly to the firm's bottom line to be motivated to implement workplace safety practices (Sinelnikov *et al.*, 2015). Often, the costs of accidents and injuries are hidden or come in the form of insurance, which may make it difficult to understand the link between prior accidents and the insurance price. Further, a big share of the cost of unsafe workplaces comes in the form of compensating wage differential—higher wages that compensate workers for higher risks (Lavetti, 2020; Viscusi and Aldy, 2003)— which are defined through negotiations in the labour market and thus managers may fail to properly assess their size. Information on these costs can increase managers' motivation to implement safety practices.

3.2 Relational Failures

Workplace safety entails a range of organizational practices that hinge on manager-worker

cooperation (Battaglia, Passetti, and Frey, 2015; Mohammadfam *et al.*, 2016; da Silva and Amaral, 2019; He et al, 2021). For the organizational practices to be achieved 1) firms must invest in safety, including purchasing high-quality PPE, updating and maintaining equipment, sending workers to training, hiring safety experts, designing safe workflow procedures, etc., and 2) workers must comply with safety guidelines such as wearing PPE, attending and implementing the training received, and engaging in organizational citizenship behaviors to prevent accidents and intervene to help colleagues when an incident arises—that is, consummate voluntary effort at the heart of the behavioral safety approach (Wirth and Sigurdsson, 2008).

However, the managers and workers may defect from cooperating for safety practices. It is not always clear what constitutes defection, and often, it is difficult to distinguish when the worker or the firm could have prevented an accident. Providing high-quality PPE, enabling workers to take time for training, and supporting safety procedures can be financially and operationally burdensome for firms (da Silva and Amaral, 2019). A lack of managerial commitment impedes successful safety practice implementation (Ghahramani, 2016). Firms might opt for cost-saving but riskier alternatives like lower-quality PPE, delayed training approvals, and prioritizing production speed over comprehensive planning and safe procedures. They can also defect more explicitly by not investing in safety, withholding information from workers, and not rewarding workers for safety practices.

Workers may defect and respond to safety practices with hostility (Zeng *et al.*, 2007). They may defect from safety practices by forgoing uncomfortable PPE, bypassing safety procedures to save time or effort, not implementing new training practices to avoid altering routines, or not complying when practices conflict with their interests.

If the firm defects, workers can punish the firm by refusing to work or quitting, sabotaging

operations, delaying operations, or reducing effort (Akerlof *et al.*, 2020; Gibbons and Henderson, 2012a). Conversely, the firm can punish worker defection by firing workers, imposing financial and social sanctions, or cutting future safety investments.

Table 2 outlines the cooperation and defection actions/behavior for each party. These actions are subtle, riddled with context-specific details, and thus are not contractible (and if they were, are likely not enforceable).

[Insert Table 2 around here]

We employ a trust game in the spirit of the framework used by Gibbons and Henderson (2012a). Trust in relational contracting is calculative where the parties cooperate if the discounted future value of cooperation is above the present value of defection (Williamson, 1996; Argyres et al, 2019). In this game, the firm moves first and then workers decide whether to comply with safety guidelines and adjust their efforts. The firm may resist investing in safety if it doubts worker compliance. This game aptly fits workplace safety because the firm has the resources and primary responsibility to act in terms of providing a safe workplace. This is reflected in workplace safety regulations across countries.

One can specify "qualitative" payoffs for the firm and the workers for the three cases in this game: i) firm defects (P) – worker defects (P'), ii) firm cooperates (D) – worker defects (D'), and iii) firm cooperates (C) – worker cooperates (C'). In many cases, and for many workers, it is plausible that D' > C' > P': the worker prefers the firm to invest in PPE and equipment and implement safety practices without investing effort in organizational citizenship behavior, namely, complying fully, helping colleagues, and reciprocating with extra effort. Hence, the firm might be hesitant to act due to potential workers' shirking. The firm can be better off with the cooperative equilibrium (C > P > D) because its investment can be offset by productivity gains

(from the worker's reciprocal effort and "safe-means" productivity).

In this situation, repeated interactions and conditional strategies can promote cooperation. If the firm and worker are in a repeated relationship with discount rate r, and they play trigger strategies, then the condition for the worker cooperating (and thus, the firm) is:

$$r < (C' - P') / (D' - C') \quad (1)$$

Credibility is increased by circumstances and actions that make this condition more likely to be fulfilled, and clarity can be solved by establishing common knowledge between managers and workers about actions, their interpretations, and payoffs, and thus, reducing the uncertainty around condition (1). In our context, an action by managers that signifies their intent to cooperate, for example, laying out a pathway for mutual cooperation that provides resources and actionable steps, can be a move towards building credibility and clarity to develop the relational contract.

4. CONTEXT

4.1 Workplace safety in Chile

In Chile, worker safety and accident compensation is under the responsibility of the "mutuales de seguridad", private, non-profit institutions as determined by Ley # 16.744, in 1968. There are three institutions: IST (Instituto de Seguridad del Trabajo), ACHS (Asociación Chilena de Seguridad) y la Mutual de Seguridad CChC (Camera Chilena de la Construcción). These institutions cover nearly 85 percent of workers, with ACHS accounting for half of the market. A state-owned organization, Instituto de Seguridad Laboral (ISL), serves the remaining 15 percent. Employers, barring those with poor safety records (which are locked into their current institution for three years), can select any institution once a year.

The Chilean system is "integrated." These organizations provide all the services required in

an occupational safety and health (OSH) system: prevention (e.g., training), and in case of accidents, medical treatment and monetary compensation.[4] Workers benefits are fairly generous.[5] The system covers accidents that occur at work and commuting to work. It operates as an insurance system, funded by firms through a monthly premium, calculated as a percentage of the taxable wage bill. The insurance rate varies from 0.95 to a maximum of 6.8 percent. Firms pay a base contribution of 0.95 percent of the monthly taxable wage bill; an additional 0 to 3.4 percent based on industrial sector, and 0 to 2.4 according to the firms' accident record, adjusted every two years.

Legally, "mutuales" must allocate at least 12 percent of total revenues to prevention activities, the most important being, by far, OSH training. These services are free for affiliated firms. ACHS provides a wide range of training courses, from primers about safety to training on sector-specific issues (e.g., proper use of pesticides), and 90 percent are delivered on-site.

Chilean firms receive regular information on their accident level from their mutual, and the information is generally available to workers and managers. Since premiums are updated every two years, at a minimum, firms update their information on accident levels every two years. By law, firms must disclose risk levels to workers and establish safety committees (in large firms) or appoint safety representatives (in small firms) to disseminate safety information and represent workers. "Mutuales" monitor (but do not enforce) these two requirements.

4.2 Operation of the SME community program

In 2012, the ACHS began its "SME community" program to deliver prevention strategies for

[4] However, they are not the inspecting agent as this responsibility is under the purview of the Ministry of Labor.
[5] Sick leave is available for a maximum period of 52 weeks, renewable for another full year if needed. It covers 100 percent of wage earnings of the last three months. In case of a fully debilitating accident, the pension covers 100 percent of the worker's previous salary if the worker cannot work, and a lower percentage if his work capacity has been lowered by 40 to 100 percent. Medical costs are fully covered by the system and treatment is provided in facilities which are owned by the organizations and that enjoy a high reputation.

approximately 31,500 SMEs. Firms are classified twice a year as an SME, in January and July, when the average number of employees in the previous 12 months was lower than 50.[6] Firms receive visits from an ACHS expert, with the number of visits to a firm predefined according to the firm's initial safety performance.[7] The ACHS expert engages with managers and then diagnoses the firm's safety practices, aided by an IT tool. By the time of our experiment in March 2013, the program was functioning smoothly and SMEs had received at least one visit.

Within days after the expert visit, the manager of the firm would receive via email a detailed "prevention plan": a lengthy, legalistic style document of approximately 30 to 40 pages, containing four parts: 1) an assessment of the compliance of the firm with the basics of safety, especially in terms of regulation; 2) an assessment of the potential emergencies that could happen in the firm (e.g., flooding, fire, etc.), 3) an assessment of the workplace risks that could lead to accidents (e.g., working at heights, working underwater, etc.), and 4) a proposed prevention plan (e.g., specific training courses). The ACHS also sent safety signs and posters to post in specific places in the firm (in case they were not in place).

Finally, as part of the SME community program, the ACHS provides a dedicated SME website containing information on prevention, risks, etc., an e-learning platform, and a call center for support. Continuous contact with the SME occurs through email campaigns, such as newsletters and course announcements, as well as check-in calls.

5. FIELD EXPERIMENT

Our experimental intervention consists of four treatments through two separate randomizations:

[6] Prior to this program, SMEs were undifferentiated (i.e. they were served in the same way as larger firms affiliated with ACHS), which led them to receive less attention because of the fixed costs of attending single firms (travel, administrative work, etc.). As a result, a large proportion of SMEs were left unattended before this program began.
[7] SMEs that were classified as having a critical condition received one visit a month; those that were classified as having a moderate or slightly critical condition received a visit every other month; the rest received a visit once a year. As with the classification into the SMEs group, this classification of firms was done every 6 months, in January and July.

three emails sent to the owners/CEOs of the SMEs addressing perception, understanding, and motivation, respectively, were randomized first; then, orthogonally, we randomized the relational treatment to owners/CEOs and workers. For ease of discussion, we refer to the owners/CEOs of these SMEs simply as "managers."

Our sample consists of all firms visited by the ACHS with the "SME community" program between March and July of 2013, namely 12,761 firms.[8] It covers a broad range of sectors, the most important of which are real estate (18%), commerce (15%), manufacturing (14%) and agriculture (13%). They are geographically dispersed, but 54% are in the central region, where most of the economic activity in Chile is concentrated. These firms hired an average of 14 workers 12 months before our experiment. During the experiment, we worked only with the head of the "SME community" program and his assistant to avoid knowledge of the experiment elsewhere in ACHS until the results were collected and analyzed.

5.1 Email treatments to managers

Perception. The first email was a treatment to the manager's perception of the firm's safety performance relative to its peers. The email contained information that compared the focal firm's accident rate in 2012 with the average accident rate of the firm's sector in 2012 (at the 2-digit ISIC level). Appendix figure A.1 provides an example; for all treatments we present the original Spanish version on the left and its English translation on the right.

Understanding. The second email provided information to address managers' understanding of what to do to improve safety. The email contained a simplified and shorter

[8] The experimental design described here differs from the one registered in the AEA registry in terms of number of firms included. The shrinking of the sample occurred mostly because we focus on the months where both emails and relational treatment were sent because of the uniformity of the design over this period. Results are similar when extending the sample to the additional months where only emails were sent. When filling the registration, the total sample was listed as 31,500 firms which actually corresponds to the population of affiliated SMEs to ACHS rather than the sample. The experiment also differs in terms of the time horizon, something we detail ahead.

version of the official document sent to the firm after the expert's visit (see Appendix figure A.2). Our document was two pages long versus 30 pages in the original. The manager had to click the link to download the document. The first page details whether the firm is compliant with each legal requirement and a percentage of total compliance (see Appendix figure A.3 for an example). The second page includes a list of the types of safety issues the firm faces in decreasing order of importance in the firm, followed by a checklist of actions to address each issue (e.g., issue-specific training to enhance tacit understanding, auditing, etc.) and the frequency with which these actions should be undertaken (see an example in Appendix figure A.4).

Motivation. The third treatment addresses motivation by making the costs of accidents salient. The email mentioned three elements (see example in Appendix Figure A.5). First, to monetize the costs of accidents faced by the firm in the last year, we provided information on how much an average SME of the focal firm's sector would save if it went from having the average level of accidents in 2012 to no accidents.[9] Second, we indicated the number of lost workdays by an average SME of the focal firm's sector in 2012. Finally, we mentioned that these lost workdays, plus other "hidden costs" of safety, could be more important than the insurance premium. We did not include an estimation of the compensating wage differential (Viscusi and Aldy, 2003) because i) even if we could have used hedonic estimates from other countries, the absence of evidence for Chile suggested caution on ethical grounds, and ii) ACHS had reservations regarding "monetizing" accidents (which is also why we had to monetize the sector's accidents, and not the firms').

[9] This was calculated in the following way. There is a minimum insurance premia that is equal to 0.95 percent of a firm's pre-tax wage bill. We calculated the accidents rate in their sector, labelled as X, and then showed that, if there were no accidents, the company would save (X - 0.95) times their wage bill.

5.2 Relational Treatment

The fourth treatment targeted the relational contract between workers and managers. For this, we had to go beyond the manager, and treat manager and workers at the same time. We sent the firm's manager a cover letter and 20 pamphlets (see examples in Appendix Figures A.6 and A.7, respectively). The cover letter provided an introductory message to the firm's manager about the importance of joint effort between workers and the firm for safety; then, the letter specified that the pamphlets had to be distributed to the workers and/or published in a visible area of the company. The relational treatment was sent by certified physical mail in the month following the visit.

Our treatment follows the textbook case of Nordstrom's relational contract with workers. As noted by (Gibbons and Henderson, 2012a: 25), "Nordstrom's employee handbook was a single sheet of paper on which was written:

Welcome to Nordstrom

We're glad to have you with our Company. Our number one goal is to provide outstanding customer service. Set both your personal and professional goals high. We have great confidence in your ability to achieve them.

Nordstrom Rules: Rule #1: Use good judgment in all situations.
There will be no additional rules.

Please feel free to ask your department manager, store manager, or division general manager any question at any time."

Instead of the slogan "Use good judgment in all situations," at the top of the pamphlet was the slogan, "Workplace safety is everybody's work." Nordstrom's handout included a goal. For our treatment, the pamphlet also focuses attention by stating that the expert visited and provided a prevention plan to the firm, focused on the main hazardous tasks/actions present in the firm (which are the list of hazardous tasks in the second page of the understanding treatment, see

Appendix Figure A.4). In the pamphlet, due to space restriction we displayed the top three elements of the second page of the understanding treatment (recall that the list of hazardous tasks in Figure A.4 in decreasing in importance). Finally, Nordstrom's handout offered support and resources for any questions. Our relational treatment invites workers to access ACHS' support and resources to lower the risks through its prevention webpage (which contains, for example, available training, advice about risky tasks, etc.), email and phone number for any questions.

Of note, the ACHS already supplied the firm with posters on safety (e.g., signals, reminders, etc.). Further, firms are legally mandated to share information about the firms' safety record and risks to workers (see first page of the understanding treatment in figure A.3); however, many firms do not comply (see the score in the last column of figure A.3). The relational treatment goes further than these legal requirements, and takes a step in building relational contracts by i) having managers share the workers the pamphlets, ii) framing safety as "everybody's work", and iii) providing clarity by describing the presence of a plan that tackles the main risks, plus actions to address these (e.g., go to the ACHS website and download leaflets about the risks and sign up for trainings).

The managers sharing the pamphlets improves the credibility that managers will support the actions in the pamphlet. By revealing that the ACHS shared a plan with the firm, the managers are transparent and signal that there is something that can done about safety. The pamphlet aligns with research that finds that proactive management steps towards safety are valued by workers and perceived as firm support for safety (Haslam *et al.*, 2016). It also clarifies the cooperative expected behaviors from workers, first, by framing safety as "everybody's work" and second, providing information on relevant training and safety practices.

5.3 Randomization procedure, treatment statistics, take-up, and power

We randomly assigned interventions to firms based on the list of SMEs that by ACHS visited monthly, which typically included 2,000 to 2,500 firms. We did this assignment every month using the list of the prior month, the first prior month being March 2013 and the last one July of 2013. Our randomization is depicted in Appendix Figure A.8.

Given that the perception and motivation treatments required prior-year firm information, we first separated firms by whether they were included in the ACHS database in 2012. For firms that are not present in the 2012 data, we randomly selected half to receive the understanding treatment and the other half to receive no treatments. For firms that are present in the 2012 data, we randomly assigned them, stratifying by region, to one of the three email treatments or the control, assigning a probability of 22 percent to each email (and thus, the control group probability was 34). We loaded the customized email data on a spreadsheet and used an automated system to send the emails via MailChimp.

Next, we stratified by the email assignment groups and randomly selected 1,000 firms per month to receive the relational treatment. Due to budget constraints, the number of treated units for the relational treatment is smaller than for the emails.[10]

Table 3 summarizes the sample sizes for each combination of treatments. Of the 12,761 firms, roughly 5,000 were assigned to receive relational treatments. A similar number was

[10] The randomization was conducted in this way for the visits executed between March and June 2013. In July 2013, ACHS asked to extend the analysis period and made some changes to the randomization because the relational treatment was no longer included (again, due to budget constraints). We continued randomizing emails through October of that year. From July 2013 until October 2013, our randomization of emails proceeded as followed (In July, the randomization of relational treatment continued as before, stratifying by e-mail group and control). We first randomly allocated firms to be in the control or to receive the understanding treatment (25 percent). In a second round, we randomly allocated all firms again to being either in the control group (50 percent), or to receive the perception or the motivation treatment (25 percent each). Thus, in that month, a firm could be simultaneously assigned to receive the understanding treatment and another one of the email treatments. We used industry as a strata instead of region. Note that using the full sample from March to October 2013 for the evaluation of the email treatments changes very little the results presented. We continue to find that none of the email treatments reduced accident rates.

assigned to receive no emails, of which approximately 2,000 received a relational treatment. Around 2,900 firms were assigned to receive the understanding treatment. We assigned closer to 2,700 and 2,500 firms for the perception and motivation treatments. Around 38 percent of all the firms assigned to an email treatment were also assigned to the relational treatment.

Measuring "Take-up" is challenging in our context. We have information on the email opening and, in some cases, the attachment click rates, but these do not guarantee that the manager read and processed the information. Table 3 shows an approximate 25 percent email opening rate across treatments: 20% for perception, 18% for motivation and 30% for understanding. While common for email interventions, it implies that low compliance inherently diminishes the statistical power of our experiment, even with our large sample size. Notably, the understanding treatment, which was the only emailed treatment with an attachment, was the most opened email. While not reported here, we tried correlating "take-up" with firms' baseline characteristics and were unable to find a relationship with anything other than size.[11]

For the relational treatment, we certified the delivery to the firm's address. Still, we cannot confirm if managers opened the packages and distributed the pamphlets to workers. We conducted a small-scale survey of a random subsample of our treated firms, reaching 297 of the attempted 560 randomly selected treated firms, and found that 44% remembered receiving the package, and 84% of the ones who remembered declared they had distributed the pamphlets. The firms that responded to our survey are generally similar to those that did not, at least regarding accidents (see first two columns of Appendix Table A.1). They are slightly larger than those who did not respond. These numbers suggest that the take-up for the relational treatment is at least

[11] Specifically, for the understanding treatment, we find no significant correlations between firm characteristics and opening rate. For the perception treatment, firms with more employees were more likely to open the email. For the motivation treatment, larger firms and those with more accidents in the past were more likely to open it.

37% (= 84% x 44%).[12]

Initial power calculations were based on an assumption of a 50 percent take-up. We can revise these with information on the actual take-up. Assuming a statistical significance of 0.05, a power of 0.8, a correlation between the baseline and the follow-up of 0.4, and no attrition, our minimum detectable effects on accidents were approximately 0.36 standard deviation for perception and motivation (0.2 take-up), 0.20 standard deviation for understanding (0.3 take-up) and 0.13 standard deviation for relational (0.4 take-up; see footnote 20). Combining all email treatments yielded a detectable effect of 0.19 standard deviation. These ranges are reasonable for experiments with firms; costly interventions should be able to affect a 0.1 to 0.3 standard deviation in outcomes. Although not initially designed to detect interactions between emails and the relational treatment, our stratification permits balanced analysis across emails. The relational treatment is orthogonal; thus, the interaction analysis is fully experimental but underpowered.

[Insert Table 3 around here]

6. DATA AND EMPIRICAL STRATEGY

Since all our take-up information is partial, the analysis will focus on an Intent-To-Treat estimation, not a treatment on the treated. Despite the panel nature of our data, we choose to run the post-level outcome by the firm against its treatment status and control for baseline values of the outcome since this has been shown to be more efficient than other ways to estimate the

[12] In Table A.1 of the appendix, we also performed two additional exercises. First, and although in an Intent-to-treat estimates this is irrelevant, we explored the determinants of distributing the pamphlets to workers (among firms that answered the survey). In column 4, we found that safer and larger firms, and firms more involved in prevention training were slightly less likely to distribute the pamphlets. Second, we validated the take-up rate of (at least) 37% using a regression analysis. In the last column, we include all firms that responded the survey and those not assigned to receive the relational treatment. In addition to the covariates used in column 2 and 4, we added a dummy of captures the assignment to the relational treatment. If we assume that responders are a random sample of those assigned to the survey (and by construction to those not assigned the relational treatment) (column 2 of the table provides evidence supportive of this assumption), we conclude that receiving the relational treatment increases the probability of sharing the pamphlets with workers by 40%.

treatment impact (McKenzie, 2012). We will discuss the difference-in-difference results as a comparison. We estimate the impact of our email treatments with the following equation:

$$Y_{jst} = \beta_1 Email_{js} + \gamma Y_{js0} + \delta_s + \varepsilon_{jst}$$

where we regress firm *j*'s dependent variable in strata s at time t (Y_{jst}) on its assignment to receive an email ($Email_{js}$). In some specifications, we further differentiate between the perception ($Perception_{js} = 1$), understanding ($Understanding_{js} = 1$), and motivation emails ($Motivation_{js} = 1$), compared to the no-email control group. As dependent variables, we use *accident rates*, *accident severity*, and *adoption of safety training*. Accidents captures outcome, and training, the main prevention tool for ACHS, captures change in behavior and adoption of safety practices. δ_s is a vector of dummies for strata, namely, month for firms non-existent in 2012, and month-region interaction for those existing in 2012. Firms non-existent in the ACHS database pre-2012 are omitted when adding these controls. We use robust standard errors.

For the relational treatment, our estimation equation is:

$$Y_{jst} = \beta_1 Relational_{js} + \gamma Y_{js0} + \delta_s + \varepsilon_{jst}$$

This equation only includes the relational treatment ($Relational_{js}$), compared to not receiving it. Strata here are the assignments to perception, understanding, and motivation treatments, interacting with the ACHS expert visit month. We use robust standard errors.

We control for the firm's initial level of safety and training by including the historical accident rate and training rate, calculated as the cumulative rates 12 months before the intervention. We also control for the firm's degree of compliance with the minimal safety provision indicated in the law. We do not control directly for t since the outcome observation month (say six months post-treatment) perfectly correlates with the treatment month included in

our strata controls.[13]

6.1 Data sources, variables, experiment statistics and balance

We collected from the ACHS data on all of their affiliated firms and every month from January 2011 to December 2014. This firm-month database contains information on the number of workers in the firm (number of workers for which the premium is paid), reported non-fatal accidents, accident rate, lost workdays, detailed information on the safety training, and characteristics of the firm (e.g., sector, SME status). Since firms received the treatment in different months, we re-center the data according to intervention date. We also obtained from ACHS each firm's degree of compliance with the minimal safety provision indicated in the law (e.g., informing workers about risks, having a safety manual, etc.) as determined by the safety experts when they visited the firm.[14]

Our primary dependent variable for safety outcomes is the *Accident Rate*, calculated as the sum of accidents divided by the average number of workers for the relevant months. We construct the cumulative accident rate for each firm over two months, six months, 12 months and 15 months after their intervention.[15] These variables are transformed into an annual rate by multiplying the ratio by six for the two-month rate, by two for the six-month, etc.; we normalize our rate with different time windows to be annual rates, and thus comparable.[16]

As a second measure of the safety outcomes, we employ *Accident Severity* based on the lost workdays as a result of accidents. The ACHS data includes the number of lost workdays for

[13] We do not include industry fixed effects in the basic specification because this was not a strata of randomization and we already control for differences in accident rates using the firm's own experience. Including industry fixed effects does not alter our results.
[14] The safety expert does not need to enforce the law; this evaluation is meant to be formative, not leading to fines or other penalties.
[15] Our experiment registration planned to study the impact on accidents and prevention for six months after the intervention. We show that the impact on accidents is consistent from six to 15 months post-intervention.
[16] Less than two percent of our sample did not continuously report to ACHS, so we do not have relevant sample attrition problems.

each firm each month. However, we cannot distinguish which accident corresponds to which lost workday. As such, it is difficult to identify a change in trends because some of the current month's lost workdays might have originated a few or several months ago (i.e., there is a high auto-correlation). We executed an algorithmic correction that assigns the lost workdays in month "t" to accidents occurring in that same month and into the two preceding months, "t-1" and "t-2"[17]. While far from ideal, this allows for an approximation of each accident severity.

To understand the effects on practices to improve safety, we calculate *Training* as the cumulative number of completed safety classes per worker at two, six, 12, and 15 months. As with accident rates, we normalized this on a per year basis.[18]

6.2 Descriptive Statistics

Table 4 contains the baseline data. There are 12,671 firms in our sample, but some observations have missing data. Firms had an average of 0.048 accidents per worker in the 12 months preceding the visit of the mutual. The firms had an average of 14 workers, although the distribution is skewed towards smaller firms. Conditioning on firms that experienced any

[17] Specifically, we first regressed the lost workdays of a month on the accidents in the previous three months (using data form 2011, after three months, coefficients were small and significant). The coefficients we obtained are 0.41 for the contemporaneous month, 0.36 for the month before and 0.23 for two months earlier. Then, we transform the series of lost workdays to reflect this. For example, if a firm reports 100 days lost in month x, we then assigned that to the current, past and two months before according to the relative contribution of each month using the number of accidents and the coefficients. For example, if a firm had one accident in each of the last three months, 41 days will be assigned to the current month, 36 days to the month before and 23 days to 2 months before. If a firm had 2 accidents in the current month but only one in the previous 2 months, 58 days (100 x (0.41 x 2/(0.41 x 2 + 0.36 + 0.23)) would be assigned to the current month while 26 days (100 x (0.36 / (0.41 x 2 + 0.36 + 0.23)) would be assigned to the month before and 16 days (100 x (0.23 / (0.41 x 2 + 0.36 + 0.23)) to 2 months prior. This implies that if no accident has occurred in a month, we will assigned zero days lost to that month. If no accidents were reported during the last three months but a positive number of days lost were, we assume that the days lost reported in month x correspond to accidents previous to that and simply do not include them in our calculation. This occurs in less than 2 percent of our cases where no accidents were reported in the 3-month period. Notice that this algorithmic allocation of lost days to months is not a rescaling of accidents. Both the numbers of days lost and the accidents are reported by firms each month. The only thing we do is match the fraction of days lost to each accident in a way that was estimated using data previous to the experiment.

[18] We do not have information regarding the number of workers trained, preventing us from using that metric. The firms affiliated with ACHS execute almost all their prevention training via ACHS because training cannot occur across "mutuales", and there are almost no other providers of safety training services in the country.

accidents, 16 workdays are lost per accident. The standard deviation for all these outcomes is large, indicating a wide distribution. Prevention actions are low, with classes completed per worker being at 0.003 in the year before our intervention. During the expert visit, around 4.5 different types of risks were identified.

The three subsequent rows offer alternative classifications of firms as "risky." Only 27 percent are considered risky on the basis of exceeding the industry average accident rate from the previous year, which is normal given the skewness of the accident rate distribution. ACHS categorizes firms into risk levels based on past accidents and their severity using colors: green (safe), yellow (medium risk), and red (highest risk), with 91.9% being low risk, 7.7% medium, and 0.4% as very risky, again demonstrating the skewed accident distribution.[19] The last row of the table indicates that several firms do not comply fully with the protocols of the ACHS: only 19 percent of firms were compliant with the legal requirements of informing workers about risks and safety. Overall, there is about 46% of aggregate compliance across all the legal requirements (not reported in table) (this corresponds to the number at the bottom-right of Figure A.3).

The next columns in Table 4 display differences between each treatment and its respective control, accounting for the randomization strata. We find a few statistically significant differences but nothing that suggests that the randomization failed since a few outcomes would differ at the 10 percent level by construction. Specifically, firms with the understanding treatment employed roughly 1.3 fewer workers than non-email recipients, and those with the relational treatment had a two percent higher compliance in worker information provisions than the control group. Although the latter is notably significant, it is small compared to the sample

[19] The median accident rate in the 12 months before the intervention is 0. The average is a bit lower than the value corresponding to the percentile 75 of the distribution. This is because 10 percent of the firms have accident rates above 0.15, which is three times as much as the average. Thus, most firms do not face a large number of accidents. However, this is not because they make necessarily large efforts in terms of prevention.

average and standard deviation. Consequently, we will control for these pre-treatment variables in regressions to confirm that random imbalances in some variables are not driving the results.

[Insert Table 4 around here]

7. RESULTS

First, we assess our treatments' impact on accident rates and severity (lost days), before examining their effect on training. We then execute some robustness tests for treatment dosage and specification, followed by an exploration of the (fully randomized) interactions of the relational treatment with the email treatments. Once the experimental impact is firmly established, we evaluate whether the relational treatment outcomes are consistent with theoretical predictions from the relational contracting literature, exploring variables that affect the credibility condition of equation (1)—severity of the workers' risks, worker rotation, competition, and wages—and (2) the clarity condition—amount of information the firm has shared with the workers concerning safety.

7.1 Impact on accidents and lost workdays

We start by presenting the impact of each emailed treatment on the cumulative accident rates over a two, six, 12 and 15-month period. All outcomes are the rate per worker per year, making each coefficient comparable across specifications. Our sample's average accident rate is about 0.048 per worker per year. In Panel A of Table 5, we show the measured impact of the relational treatment. In Panel B and C, we show the effects of the email treatments. The first four columns contain the estimation without including any controls, while the last four columns include as controls the average accident rate and the average number of workers for the 12 months before the intervention. The first panel indicates that the relational treatment generated a fall in the accident rate of the firms. For the first two months after the intervention, the impact is limited,

with a magnitude of 0.004. However, it is larger and statistically significant at six, 12 and 15 months after the intervention. The magnitudes are sizeable, ranging between 0.006 and 0.008, corresponding to 12.5 to 16.7 percent of the average before the intervention. Figure A.9 of the online appendix shows that using a difference-in-difference estimator provides similar results. Figure A.10 in the online appendix shows that the relational treatment shifts the whole distribution of firms' accident rates to the left (i.e., it is not concentrated on low, medium or high accident SMEs).

Panel B of Table 5 reveals no evidence that, as a whole, receiving an email treatment significantly decreased accidents. Panel C of Table 5 estimates the impact of the three email treatments separately and obtained the following: the coefficients for the understanding and perception treatment emails are small and not significant, this suggests that this treatment alone did not improve workplace safety practices. However, the motivation treatment unexpectedly led to more accidents. We can think of two reasons why we obtained this result. Potentially managers have a good understanding of all the costs associated to workplace safety, including compensating wage differential; and, given that the email emphasized only the insurance cost, some managers might have updated downwards the cost of accidents, and thus diminish safety prevention. Alternatively, emphasizing the financial impact of accidents may have crowded out managers' pro-sociality (Bowles and Polania-Reyes, 2012), which in turn, reduced altruistic effort prevention efforts by firms.

In Table A.2. in the online appendix, we study the robustness of the results to different specifications, including a Poisson estimation on the number of accidents, an OLS weighted by the inverse number of employees on the number of accidents, and a linear probability model weighted by the inverse number of employees on a dummy that equals one if the firm had at least

one accident. The findings remain consistent across these specifications.

In the Table A.3 of the online appendix, we study whether the impact if the relational treatment impact varies with its dosage. Considering that we distributed 20 pamphlets per firm and the pamphlet's capacity to detail only three risks, we anticipated more potent results in firms with under 20 workers and those with three or fewer risks (recall that on average firms have 4.5 risks). Table A.3. of the online appendix confirms these expectations. It is reassuring that the treatment is increasing in dosage, as expected.[20]

The first four columns of Table 6 assess the impact of treatments on the severity of accidents, as measured by the lost workdays per accident.[21] In panel A, we find that the relational treatment is significantly related to a reduction in severity at 12 and 15 months. The effect size is large: it ranges between 1.3 to 1.5 days, equivalent to around 10 percent of the mean of days lost per accident. The relational treatment reduced the severity of accidents, not only their incidence. In Panel B, we find that receiving any email treatment did not affect the severity of accidents. In Panel C we find the same when disaggregating the emails.

[Insert Tables 5 and 6 around here]

7.2 Impact on training

Changes in the accident level, if driven by adoption of practices, should be traceable to changes in the prevention level. While we do not have information on all prevention actions, we have data on training provision, the main practice that ACHS has at its disposal for firms (as an example, notice in Figure A.5 the prevalence of training in the prevention plan proposed by the

[20] We repeated this exercise with the email treatments. We do not find any change on the impact of receiving an email below or above the cutoffs of 20 workers and 3 risks.

[21] We could also used the number of days lost per worker in a similar way to the rates of the previous tables and we would document a statistically significant decrease but we would be unable to know whether this is due to fewer accidents (as we have shown before) or to each accident being less severe.

ACHS after the visit).

In the last four columns of Table 6, we study the impact of the treatments on the number of classes per 100 workers. Panel A reveals that the relational treatment has a positive and statistically significant coefficient of 0.18 to 0.2, over 50 percent of baseline classes per worker from Table 4 in months 12 and 15. Panel B and C shows no effect for the other three emails treatments on training.

We next explore if there is a stronger response for training on the risks detailed in the pamphlet of the relational treatment. This captures more cleanly whether the relational treatment changed behavior effectively. From the expert visit, we have data on the risks that the SME faces separated into 13 different risks categories which are included in the report/plan the SME receives after the visit. In our treatments, these risks are present in the first column of page two of the understanding treatment (Figure A.4), and in the three risks that were included in the pamphlet of the relational treatment (which are the top-three risks in the Figure A.4). All training classes are classified into one of these 13 different risks categories (as reflected in the last column of Figure A.4). Table 7 presents the intent-to-treat estimates on the classes per worker using only those that were included in the understanding treatment in Figure A.4 (see first four columns of Table 7), and those training classes in the categories associated to the three risks present in the pamphlet (columns 5 to 8 of Table 7). The results are marked. We find an immediate and large impact on the number of classes related to the risks prompted in the relational treatment, while a positive but smaller effect on the risk associated to the understanding treatment. Thus, our relational treatment appears to have changed prevention behavior in the specific areas mentioned to workers in the pamphlet. This suggests that our treatment generated a change in the encouraged cooperative behaviors consistent with a

relational contract forming between the managers and workers.

Imperfectly, we estimated the share of the impact of the relational treatment on accidents attributable to training. We raised the probability of training by 50 percent, which implies—using estimates of the impact of training on accidents for Chile (Brahm and Singer, 2013)[22]—a fall in accident rates of around 0.003.[23] This suggest the increase in training could explain close to half of the decline in the accident rate produced by the relational treatment. Thus, a significant portion of the effect happens through an expected channel. It also suggests that other improvements in prevention also occurred. Some examples from the prevention plan in Figure A.5 are the adoption of behavior guidelines, the purchase of adequate equipment, the redesign of protocols (e.g., associated with electric equipment) and the periodic revision of physical space, vehicles and equipment with moving parts, among others.

[Insert Table 7 around here]

7.3 Interactions of perception, understanding and motivation with relational treatment

We examine the interaction between relational and email treatments in Table 8. This analysis is fully experimental. The results show the relational treatment is amplified when managers receive the understanding and motivation treatments. We find no interaction effect with the perception treatment. This result suggests that the effects of motivation and understanding are contingent on the presence of a relational contract with workers. These interactions can also inform the credibility and clarity analysis, as we do below.

[Insert Table 8 around here]

[22] Brahm and Singer (2013) use a representative sample of ACHS firms between 2003 and 2009, and show that having a prevention class with average level of training hours (i.e., 412 hours considering 2007 to 2009) was associated with a reduction in the number of accidents per firm by 12.3 percent in the following year.
[23] A 50 percent increase in training would translate into 6.15 percent decrease in the number of accidents per firm. The number of accidents per firm in 2012 is equal to 0.7, thus the change in number of accidents would be 0.04 (=6.15% * 0.7)), and the change in the accident rate generated by more classes would be 0.003 (=0.02/14) given that our average firm includes 14 workers.

7.4 Evidence of relational contracting: Heterogeneity due to credibility and clarity.

Having established that the relational treatment increases the encouraged training and is concentrated in firms with the higher dosage, we now assess whether our treatment follows the logic of relational contracting. This section also speaks to the conditions that help build a relational contract within firms, answering recent calls in the literature (Argyres, 2021; Gibbons *et al.*, 2021; Macchiavello and Morjaria, 2023).

We first explore four variables impacting the *credibility* condition (1) and, thus, the probability of worker cooperation in the relational contract. (Then we explore the variable we use to explore clarity.) Although the analysis has lower power and interactions are not randomized, the results are highly suggestive.

First, we explore the severity of the workers' risks. Some risks are more severe and salient to workers, with more dire consequences if an accident occurs (e.g., electrical hazards, biological hazards, working at height, using manual tools or those with moving parts); in contrast, other risks are less frequent and severe (e.g., office-related hazards, transportation hazards, food preparation). More severe risks affect the credibility condition (1) by increasing the benefits of cooperation for workers (payoff C') because of their reduction in expected harm (alternatively, the defection payoff D' reduces, as the expected harm increases). We classified risks into "severe" and "less severe" categories, with 69 percent of the firms having at least one severe risk. Table 9 shows that the impact of the relational treatment is concentrated in firms with severe risks.

Second, we study worker rotation in firms. Arguably, workers in firms with higher worker rotation will have a lower value of future relationships. In terms of the condition (1), worker rotation increases the r. We classified firms as high-rotation when, 12 months before the

intervention, they had less than 95% of their workers continuing to the next month. This corresponds to 48 percent of the firms in the sample. Table 9 demonstrates that the impact of the relational treatment is concentrated in firms with low-turnover.

Third, we analyse competition. Macchiavello and Morjaria (2021) study mills and farmers relations in Rwanda and document that mills that face more competition from surrounding mills use fewer relational contracts because farmers have increased temptation to defect. In our case, workers with more potential employers have higher temptation to defect. In terms of condition (1), the payoff D' increases. We computed the number of firms in each cell of the region-industry grid and constructed a binary indictor set equal to 1 when the number of firms is higher than 20, the median in our data, and 0 otherwise. Table 9 shows that, as expected, the impact of the relational treatment is concentrated in firms with low competition.

Fourth, we analyse wages. Firms that pay higher wages than competitors foster more cooperation from workers because the value of continuing the relationship is higher. We created a binary indicator equal to 1 for firms whose median wage was above the median value of firms in their industry-region, and 0 otherwise. Aligned with expectations, Table 9 shows that the relational treatment effect is concentrated on firms with higher wages than their peers.

In addition to these four variables, the interaction between the motivation and the relational treatments explored in table 8 also supports the credibility condition. Cooperation by workers is governed by the condition (1); if that is fulfilled, then, by backward induction, the manager would also cooperate if C > P (i.e., payoff of cooperation is larger than payoff of defection). The motivation treatment makes P lower for a share of managers that undervalue the cost of safety by emphasizing the sizeable hidden cost of accidents, beyond simply the insurance premium. And this would increase the likelihood that, if condition (1) is met, then managers

would also cooperate.

Now we turn to the *clarity* condition: in addition to credibility, relational contracts also require that parties have a clear understanding of their possible actions and payoffs. The variable we use to explore this is the amount of information the firm has shared with the workers concerning safety. Using the data collected by the expert in the visit prior to our treatment (see Figure A.4), we created a binary indicator equal to 1 when the firm has complied with these four elements: distributing to workers internal manual on hygiene and safety, informing workers about risks, informing workers about prevention measures, and informing workers about proper work methods to avoid accidents. Approximately 20 percent of firms met these criteria. Sharing this information increases the likelihood that workers and managers mutually understand what constitutes cooperative behaviour in relation to safety. Consistent with theory, Table 9 indicates that the relational treatment effect is concentrated on firms that extensively share information with workers.

In addition to sharing information, the interaction between the understanding and the relational treatments explored in table 8 also supports the clarity condition. The understanding treatment makes clear to the manager what is it that the firm can do in order to make progress in safety. This task knowledge is likely to be shared with workers because the pamphlet indicates to workers that the firm received a plan, and thus, incentivizing workers to ask and managers to share.

[Insert Table 9 around here]

8. DISCUSSION

This research highlights the significant role relational contracts play in the adoption and implementation of organizational practices. Building on existing research (Gibbons *et al.*, 2021;

Gibbons and Henderson, 2012a; Helper and Henderson, 2014), we conducted a large-scale field experiment on 12,751 Chilean SMEs to understand how perception, motivation, understanding and relational factors affect workplace safety practices and the related safety outcomes. We find that only the relational treatment had a direct effect on reducing accident rates. The understanding and motivational treatments were contingent on the firm receiving the relational treatment. Additional analyses of factors affecting the relational clarity and credibility provide evidence that the relational treatment results are indeed driven by a relational contract being built between managers and workers. A central contribution of our study is that it provides empirical evidence that building relational contracts is of paramount importance for organizational practices that improve firm performance.

An implication of this study is that managerial motivation and understanding in and of themselves are not sufficient for implementation of organizational practices. Managers need to build relational contracts with workers in order for their motivation and understanding to matter. Thus, while perception, motivation, and understanding no doubt can hold an important role for organizational practices, our study adds to existing research the importance of understanding the informal relationships with workers that can hold organizations' performance back.

Empirical evidence on relational contracts has been accumulating (see Gil and Zanarone, 2017, 2018; Macchiavello and Morjaria, 2023 for reviews). Yet, most research has focused on the performance and maintenance of existing relational contracts and not the building of relational contracts (de Figueiredo and Silverman, 2017: 234). Moreover, "evidence on relational contracts inside the firm is still lacking" (Argyres, 2021: 524), particularly in understanding how firms build relational contracts internally. The exceptions for research on building relational contracts are de Figueiredo and Silverman (2017) who study qualitatively the formation of

between-firm relational contracts, Gibbons *et al.* (2021) who uses the lab, and Blader *et al.* (2015) and Blader, Gartenberg, and Prat (2020) which study within firm relational contracting by exploiting a quasi-experiment on changing organizational values. Our study complements existing theoretical models, case studies, and lab experiments by providing large-sample empirical evidence of the building and performance of relational contracts on successful implementation of organizational practices within firms.

We create an intervention that aims to build a relational contract between the firm/management and workers. Firms randomly assigned to the relational treatment had a significant reduction in their accident rates and severity. We show that building it is easier when credibility and clarity are already present in the relationship—either exogenously determined (competition, severeness of risks) or when endogenously affected by the firm (worker rotation, wages, sharing information).

Firms face difficulties in successfully implementing workforce safety practices (da Silva and Amaral, 2019). The prevalence of workforce accidents raise questions about how and what to communicate to organizational members for implementing the practices. Our study shows that the simple and actionable treatment of framing the safety as "everybody's work" with resources on how to improve safety was sufficient to have a sizeable and long-lasting impact on safety.

For policymakers and institutional agents, our study has practical implications on how to improve safety practices. While regulators typically target policies and information treatments one party at a time, usually managers and on some occasions workers, our study shows the profound impact of targeting the relationship between both parties.

Nonetheless, this study has several limitations. First, we examine the effects of perception, understanding, motivation, and relational contracts in the context of workplace safety

practices. While workplace safety is a context plagued with ambiguity and interdependencies in organizational routines and is well-suited for relational contracts, future research can attempt to replicate our study for different workplace practices in other contexts. Second, due to cost constraints, we are limited to one randomized treatment per theoretical construct. The design of each treatment is necessarily constrained. While less than ideal, we nonetheless provided our best efforts to be true to extant literature and reconcile it with conceivably common forms of manager interventions in practice.

9. CONCLUSION

Understanding how to build and refine relational contracts within the firm is central for firm performance. We provide experimental evidence across a large sample of SMEs on the building of relational contracts for workforce safety practices. We found that only the relational treatment, which emphasized mutual effort by managers and workers, was effective: it reduced the rate and severity of accidents and increased the types of safety training nudged by our treatment. The results are substantial and long-lasting. The effect was enhanced when combined with the randomized manager motivational and understanding treatments, but not the perception treatment. Our experiment provides large-sample empirical evidence of the importance of relational contracts in improving workplace safety.

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10. TABLES AND FIGURES

TABLE 1. Barriers to Implementing Workplace Safety Practices. (Note: 'X' denotes the most important classification; 'x' denotes a less important, but nonetheless relevant)

Barriers identified by da Silva and Amaral (2019)	**Perception**	**Understanding**	**Motivation**	**Relational contract**
Formal existence of occupational health and safety (OHS) provides a false sense of security	X			
High cost of implementation and management			X	
Lack of commitment of the company management to the questions referring to OHS			x	X
Difficulty for the workers to become involved and understand the importance of management in OHS		x		X
Problems with the integration of different standards, attributes and adherence to the company culture	X			X
Difficulty in defining the appropriate management indicators in OHS	X	x		
Complexity of changing the company policy and culture		X		X
Failures in the process of assessing the risks in OHS	X	x		
Difficulties in the functioning of the OHS control and documentation systems			X	x

TABLE 2. Cooperation and Defection for Firm/Owners and Workers

	Firm / Owners	Workers
Cooperation	i) Invest in safety (e.g. buy good quality PPE, update equipment, send workers to training, hire/contract safety experts, etc.), ii) Sharing information with workers about safety (risks at the workplace, prevention ideas/options/resources), iii) Seek productivity using safe means (e.g., planning ahead of time, proactive equipment maintenance, High performance work systems)	i) Consummate compliance with safety guidelines (e.g., wearing PPE, attending training and change behavior after it), ii) Organizational citizenship behavior which includes helping colleagues in terms of safety and as well as higher effort as a result of good working conditions.

Defection	i) Not investing in safety, ii) Withholding information to workers (eg not sharing prevention options available to workers), iii) Pushing productivity using methods that are likely to decrease workers' safety (e.g., extending work hours, cut corners, increase production line speed).	i) Not complying with safety guidelines (e.g., not using PPE), ii) Maintaining or even decreasing effort, especially using as an excuse the inadequacy of PPE, PPE being cumbersome, safety guidelines being restrictive, etc.

TABLE 3. Assignment by email information and take-up

Month of visit	Perception treatment			Motivation treatment			Understanding Treatment			No emails		Relational Treatment
	N	Opened	Rel. Treat.	N	Opened	Rel. Treat.	N	Opened	Rel. Treat.	N	Rel. Treat.	Total
March	555	126	204	563	127	207	556	190	204	1053	387	1002
April	603	136	211	613	111	215	550	176	193	1100	382	1001
May	549	142	201	557	111	204	568	130	208	1065	388	1001
June	470	98	196	479	78	199	520	161	216	942	391	1002
July	506	88	252	271	42	136	672	220	336	839	418	1007
Total	2683	590	1064	2483	469	961	2866	877	1157	4999	1966	5013

Note: N refers to the total number of firms visited. Rel. Treat refers to the number of firms who were sent the workers' package. Opened refers to the number of emails sent to firms that were opened.

TABLE 4. Summary statistics of pre-intervention firm characteristics and balance tests.

	N	Mean	Difference T-C			
		(Std. Dev.)	Perception	Motivation	Understanding	Relational
Acc. rate, 12 months bef.	12372	0.048 (0.153)	0.001 (0.004)	-0.001 (0.003)	0.000 (0.004)	0.001 (0.003)
Days lost per accident, 12 months bef.	4,043	15.951 (20.256)	-0.748 (0.784)	0.513 (0.863)	1.525* (0.909)	0.409 (0.658)
Classes per worker, 12 months bef.	12372	0.319 (3.545)	-0.017 (0.074)	-0.010 (0.071)	0.046 (0.091)	-0.060 (0.054)
N. of workers 12 months bef.	12603	14.033 (29.104)	0.620 (0.614)	0.909 (0.589)	-1.296* (0.773)	0.874 (0.536)
N. risks	12761	4.519 (3.479)	-0.032 (0.069)	-0.052 (0.069)	0.008 (0.069)	0.0027 (0.058)
More risky than ind. average	11382	0.273 (0.445)	0.001 (0.011)	-0.001 (0.011)	0.008 (0.011)	-0.005 (0.009)
Green	11612	0.919 (0.273)	-0.001 (0.007)	0.005 (0.007)	0.004 (0.007)	-0.003 (0.005)
Yellow	11612	0.077 (0.266)	-0.002 (0.007)	-0.004 (0.007)	-0.004 (0.007)	0.004 (0.005)
% of compliance worker's info	12761	0.188 (0.391)	0.004 (0.007)	-0.004 (0.007)	-0.009 (0.007)	0.017*** (0.006)

*** p<0.01, **p<0.05, *p<0.1

Note: The first column documents the number of firms for which the information is available. The second and third show the average value of the characteristic and its standard deviation in the sample. The next 3 columns report the coefficients of a regression of the pre-intervention characteristic on indicator variables for each email treatment in which strata fixed effects are also included. The last column reports the coefficient of a regression of the pre-intervention characteristic on an indicator variable for being assigned to the relational treatment, again including strata fixed effects. Robust standard errors presented in parenthesis.

TABLE 5. Impact of information on cumulative accident rates, by number of months since the intervention.

	Without controls				With controls			
Months	2	6	12	15	2	6	12	15
				Panel A: Relational Treatment				
Relational	-0.004	-0.006**	-0.006**	-0.007**	-0.004	-0.007**	-0.006**	-0.008**
	(0.005)	(0.003)	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)	(0.003)
R^2	0.004	0.004	0.004	0.004	0.020	0.016	0.019	0.019
N	12,214	12,305	12,329	12,329	12,085	12,142	12,157	12,157
				Panel B: Emails to managers				
Any emails	0.001	0.004	0.003	0.004	0.000	0.004	0.003	0.004
	(0.005)	(0.003)	(0.002)	(0.003)	(0.005)	(0.003)	(0.002)	(0.003)
R^2	0.004	0.007	0.010	0.010	0.020	0.019	0.023	0.023
N	12,214	12,305	12,329	12,329	12,085	12,142	12,157	12,157
				Panel C: Emails to managers-by type				
Understanding	0.000	0.002	0.002	0.002	-0.001	0.001	0.002	0.002
	(0.007)	(0.004)	(0.003)	(0.004)	(0.007)	(0.004)	(0.004)	(0.004)
Perception	-0.006	-0.001	-0.002	-0.003	-0.006	-0.001	-0.001	-0.003
	(0.007)	(0.004)	(0.004)	(0.004)	(0.007)	(0.004)	(0.004)	(0.004)
Motivation	0.008	0.008*	0.007**	0.008**	0.008	0.007*	0.008*	0.008**
	(0.008)	(0.004)	(0.003)	(0.004)	(0.008)	(0.004)	(0.004)	(0.004)
R^2	0.005	0.007	0.010	0.010	0.020	0.019	0.024	0.024
N	12,214	12,305	12,329	12,329	12,085	12,142	12,157	12,157

Robust standard errors in parentheses. All regressions include dummies for each strata of the randomization. Controls for columns (5) to (8) also include the average accident rate and the average number of workers over the 12 months before the intervention as well as the legal rating given by the mutual during its last visit. *** p<0.01, ** p<0.05, * p<0.1

TABLE 6. Impact of information on days lost per accident and prevention actions, by number of months since the intervention.

	Days lost per accident				Classes per 100 workers			
Months	2	6	12	15	2	6	12	15
				Panel A: Relational Treatment				
Relational treatment	0.261	-1.424	-1.540**	-1.308**	0.035	0.087	0.179**	0.213**
	(1.418)	(0.947)	(0.708)	(0.661)	(0.037)	(0.057)	(0.083)	(0.101)
R^2	0.016	0.038	0.037	0.034	0.113	0.054	0.045	0.038
N	1,156	2,576	3,810	4,160	12,085	12,142	12,157	12,159
				Panel B: Emails to managers				
Any emails	-1.385	0.555	0.023	0.086	-0.018	-0.034	-0.080	-0.013
	(1.442)	(0.982)	(0.726)	(0.680)	(0.042)	(0.062)	(0.085)	(0.100)
R^2	0.122	0.057	0.046	0.042	0.182	0.065	0.053	0.049
N	1,156	2,576	3,810	4,160	12,085	12,142	12,157	12,159
				Panel C: Emails to managers, by type				
Understanding	-2.686	-0.538	-1.373	-1.218	-0.002	-0.006	0.012	0.121
	(1.762)	(1.222)	(0.847)	(0.801)	(0.064)	(0.093)	(0.121)	(0.148)
Motivation	-0.991	0.753	0.271	0.090	-0.038	0.027	0.012	-0.009
	(1.765)	(1.206)	(0.888)	(0.829)	(0.052)	(0.076)	(0.096)	(0.113)
Perception	0.165	1.002	0.827	0.921	0.027	-0.017	-0.081	-0.073
	(2.064)	(1.459)	(1.168)	(1.079)	(0.040)	(0.061)	(0.083)	(0.095)
R^2	0.124	0.058	0.047	0.043	0.298	0.192	0.132	0.110
N	1,156	2,576	3,810	4,160	12,085	12,142	12,157	12,159

Robust standard errors in parentheses. All regressions include dummies for each strata of the randomization, the average accident rate and the average number of workers over the 12 months before the intervention as well as the legal rating given by the mutual during its last visit. Columns (5) to (8) also include controls for classes taken in the 12 months before the intervention. *** p<0.01, ** p<0.05, * p<0.1

TABLE 7. Impact of information on classes per 100 workers, by type of classes

	Linked to action plan				Linked to workers' pamphlet			
Months	2	6	12	15	2	6	12	15
				Panel A: Relational treatment				
Relational treatment	0.011	0.033	0.054*	0.054	0.033***	0.065***	0.093***	0.098***
	(0.010)	(0.023)	(0.030)	(0.035)	(0.011)	(0.022)	(0.029)	(0.034)
R^2	0.006	0.006	0.008	0.008	0.006	0.007	0.008	0.008
N	12,085	12,142	12,157	12,159	12,085	12,142	12,157	12,159
				Panel B: Emails to managers				
Any emails	0.004	-0.013	-0.017	-0.014	-0.004	-0.015	-0.024	-0.025
	(0.010)	(0.023)	(0.030)	(0.036)	(0.009)	(0.022)	(0.029)	(0.034)
R^2	0.007	0.012	0.014	0.014	0.007	0.011	0.013	0.014
N	12,085	12,142	12,157	12,159	12,085	12,142	12,157	12,159

Robust standard errors in parentheses. All regressions include dummies for each strata of the randomization, the average accident rate and the average number of workers over the 12 months before the intervention as well as the legal rating given by the mutual during its last visit. Columns (5) to (8) also include controls for classes taken in the 12 months before the intervention. *** p<0.01, ** p<0.05, * p<0.1

TABLE 8. Impact of the interaction between the relational treatment and the perception, motivation and understanding treatments.

	Cumulative accident rates		
Months	6	12	15
	Panel A: By whether manager received email		
Relational	-0.002	0.000	0.000
	(0.004)	(0.004)	(0.004)
Relational*Understanding	-0.012	-0.016***	-0.021***
	(0.008)	(0.006)	(0.008)
Relational*Perception	-0.000	0.004	0.005
	(0.008)	(0.008)	(0.010)
Relational*Motivation	-0.014*	-0.018***	-0.022***
	(0.008)	(0.007)	(0.008)
R^2	0.017	0.019	0.019
N	12,142	12,157	12,157

Robust standard errors in parentheses. All regressions include dummies for each strata of the randomization. Controls also include the average accident rate and the average number of workers over the 12 months before the intervention as well as the legal rating given by the mutual during its last visit. *** p<0.01, ** p<0.05, * p<0.1

TABLE 9. Impact of relational treatment on accident rates and prevention, by characteristics the affect the credibility and the clarity of the relational contract.

	Cumulative accident rates		
Month	6	12	15
	Panel A: By credibility variables		
Relational*Severe risks	-0.008*	-0.007**	-0.009**
	(0.004)	(0.003)	(0.004)
Relational*Light risks	-0.004	-0.004	-0.005
	(0.003)	(0.002)	(0.003)
F-test	0.44	0.44	0.41
R^2	0.022	0.022	0.027
N	12,142	12,157	12,157
Relational*High turnover	0.002	0.002	0.003
	(0.004)	(0.004)	(0.005)
Relational*Low turnover	-0.016***	-0.015***	-0.018***
	(0.004)	(0.004)	(0.004)
F-test	9.95***	11.34***	11.34***
R^2	0.017	0.020	0.020
N	12,142	12,157	12,157
Relational*Many competitors	-0.002	-0.000	-0.000
	(0.005)	(0.004)	(0.005)
Relational*Few competitors	-0.016***	-0.013***	-0.012***
	(0.004)	(0.003)	(0.004)
F-test	3.54*	6.74**	6.74**
R^2	0.017	0.020	0.020
N	12,142	12,157	12,157
Relational*high wage	-0.010***	-0.007***	-0.009***
	(0.003)	(0.003)	(0.003)
Relational*low wage	-0.002	-0.004	-0.005
	(0.005)	(0.004)	(0.005)
F-test	1.08	0.01	0.01
R^2	0.018	0.022	0.022
N	11,802	11,811	11,811
	Panel B: By clarity		
Relational*Informed	-0.018**	-0.018***	-0.022***
	(0.007)	(0.006)	(0.008)
Relational*Uninf.	-0.004	-0.003	-0.004
	(0.003)	(0.003)	(0.004)
F-test	3.17*	4.72**	4.72**
R^2	0.016	0.019	0.019
N	12,142	12,157	12,157

Robust standard errors in parentheses. All regressions include dummies for each strata of the randomization. Controls also include the average accident rate and the average number of workers over the 12 months before the intervention as well as the legal rating given by the mutual during its last visit. *** p<0.01, ** p<0.05, * p<0.1

11. ONLINE APPENDIX

TABLE A.1. Correlations between firm characteristics, answering the phone survey and distributing the relational treatment

	Answering the survey		Distributing the workers' package		
	(1)	(2)	(3)	(4)	(5)
Acc. rate, 12 months bef.	0.069	0.048	-0.227	-0.257*	-0.006
	(0.155)	(0.155)	(0.148)	(0.154)	(0.006)
Classes per worker, 12 months bef.		0.443		-3.359***	-0.026
		(1.020)		(0.648)	(0.019)
N. of workers, 12 months bef.		0.001***		-0.001*	-0.000*
		(0.000)		(0.001)	(0.000)
% of compliance worker's info		-0.093		0.004	-0.004
		(0.068)		(0.007)	(0.007)
Assigned to WP					0.398***
					(0.030)
Sample	Firms called		Firms who answered		(3)-(4) +not assigned
N	560	560	297	297	7,787

Robust standard errors in parentheses. Table presents the coefficients of a linear probability regression of an indicator variable that the firm answered the survey (first 2 columns) and claimed to have distributed the pamphlets (last 3 columns) on pre-intervention characteristics. In the first two columns, the sample includes all firms that were surveyed. In the next 2 columns, the sample is restricted to firms that answered our phone survey. Finally, the last column includes firms who answered the survey and all those who were not assigned to receive the workers' package. All regressions include dummies for each strata of the randomization. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

TABLE A.2. Robustness checks on impact information on cumulative accident prevalence

	Poisson			Any accidents			Number of accidents		
	6	12	15	6	12	15	6	12	15
Panel A: Workers' package									
Relational	-0.153**	-0.139**	-0.138**	-0.017***	-0.029***	-0.033***	-0.019***	-0.041***	-0.039***
	(0.070)	(0.060)	(0.060)	(0.006)	(0.008)	(0.009)	(0.007)	(0.014)	(0.001)
R^2				0.097	0.109	0.109	0.129	0.162	0.167
N	12,157	12,157	12,142	12,159	12,157	12,142	12,159	12,157	12,142
Panel B: Emails to managers									
Any emails	0.068	0.063	0.065	0.005	0.003	0.008	0.004	0.006	0.011
	(0.066)	(0.054)	(0.054)	(0.006)	(0.008)	(0.008)	(0.007)	(0.012)	(0.001)
R^2				0.175	0.118	0.119	0.133	0.169	0.101
N	12,157	12,157	12,142	12,159	12,157	12,142	12,159	12,157	12,142
Panel C: Emails to managers, by type									
Understanding	0.016	0.023	0.024	-0.001	-0.009	-0.003	-0.003	-0.008	0.001
	(0.087)	(0.072)	(0.072)	(0.008)	(0.011)	(0.011)	(0.009)	(0.017)	(0.014)
Perception	-0.034	-0.066	-0.066	-0.006	-0.010	-0.005	-0.007	-0.022	-0.013
	(0.096)	(0.085)	(0.085)	(0.007)	(0.011)	(0.012)	(0.010)	(0.020)	(0.018)
Motivation	0.158*	0.140**	0.139**	0.017*	0.022*	0.026**	0.015	0.026	0.026*
	(0.089)	(0.068)	(0.069)	(0.009)	(0.011)	(0.013)	(0.010)	(0.016)	(0.015)
R^2				0.102	0.119	0.120	0.133	0.169	0.175
N	12,157	12,157	12,142	12,159	12,157	12,142	12,159	12,157	12,142

Robust standard errors in parentheses. All regressions include dummies for each strata of the randomization, the average accident rate and the average number of workers over the 12 months before the intervention as well as the legal rating given by the mutual during its last visit. Columns (1) to (3) regress the rounded accident rate (multiplied by 1000) in a Poisson count model, Columns(4) to (6) use a linear probability model to estimate the probability of having any accidents, weighted by the inverse of the number of workers, Columns (7) to (9) regress the number of accidents in a linear equation, weighted by the inverse of the number of workers. *** p<0.01, ** p<0.05, * p<0.1

TABLE A.3. Impact of relational treatment on accident rates and prevention, by pamphlet

characteristics

	Cumulative accident rates		
Month	6	12	15
	Panel A: By firm size		
Relational*≤ 20 workers	-0.009**	-0.008**	-0.010**
	(0.004)	(0.003)	(0.004)
Relational*> 20 workers	0.001	-0.001	-0.002
	(0.003)	(0.002)	(0.003)
F-test	4.69 **	2.52	2.52
R^2	0.017	0.019	0.019
N	12,142	12,157	12,157
	Panel B: By risks existing		
Relational*≤ 3 risks	-0.010***	-0.008**	-0.010**
	(0.004)	(0.003)	(0.004)
Relational*> 3 risks	-0.003	-0.005	-0.006
	(0.005)	(0.004)	(0.005)
F-test	1.36	0.35	0.35
R^2	0.019	0.023	0.023
N	12,142	12,157	12,157

Robust standard errors in parentheses. All regressions include dummies for each strata of the randomization. Controls also include the average accident rate and the average number of workers over the 12 months before the intervention as well as the legal rating given by the mutual during its last visit. *** p<0.01, ** p<0.05, * p<0.1

FIGURE A.1. Example of email for perception intervention

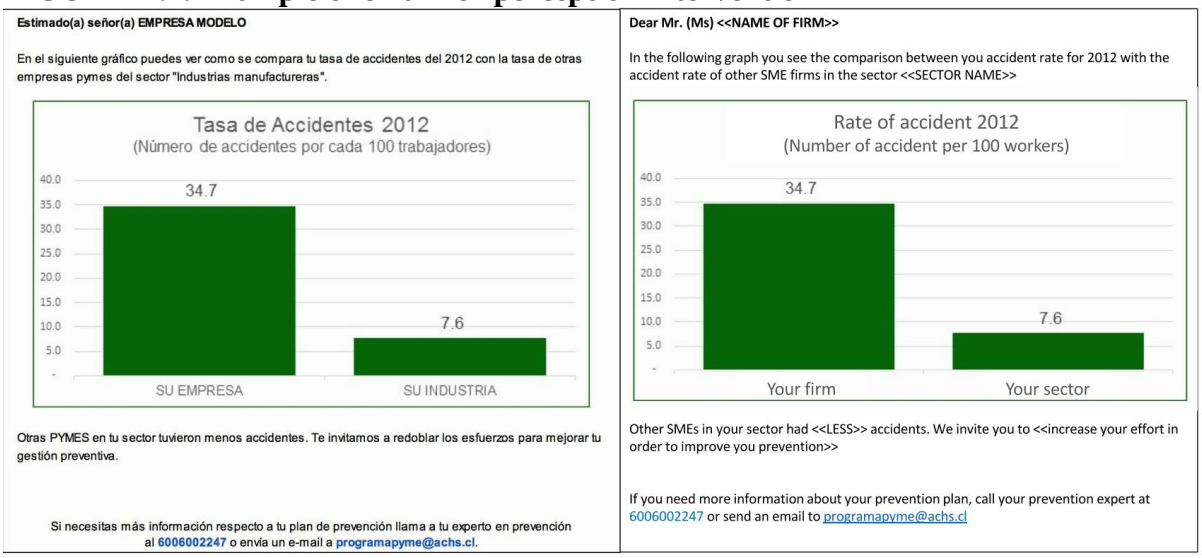
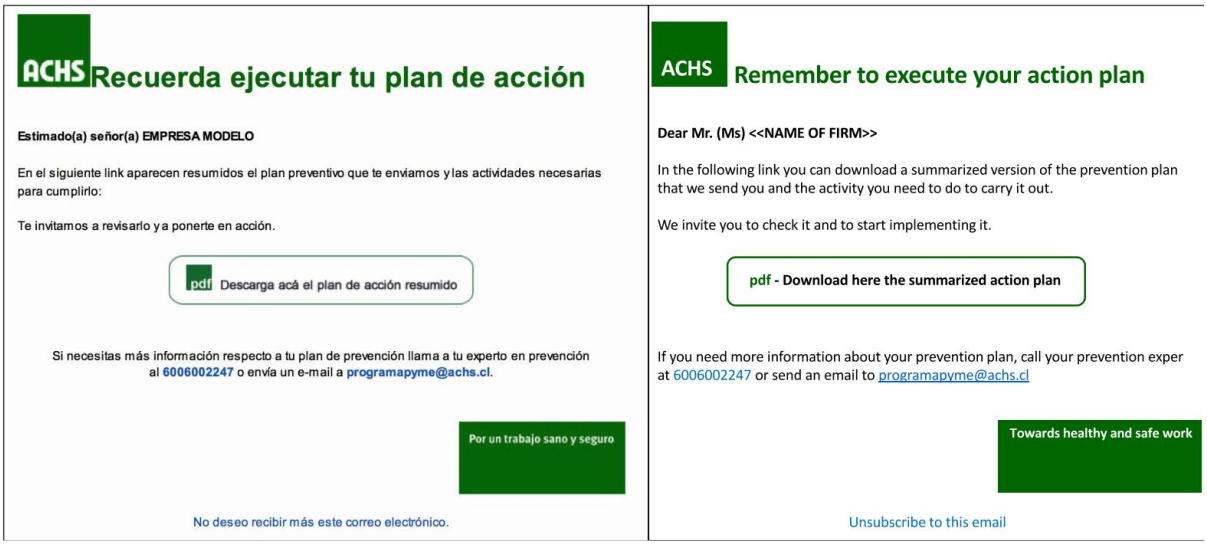


FIGURE A.2. Example of email sent in the motivation treatment.



ACHS Recuerda ejecutar tu plan de acción

Estimado(a) señor(a) EMPRESA MODELO

En el siguiente link aparecen resumidos el plan preventivo que te enviamos y las actividades necesarias para cumplirlo:

Te invitamos a revisarlo y a ponerte en acción.

pdf Descarga acá el plan de acción resumido

Si necesitas más información respecto a tu plan de prevención llama a tu experto en prevención al 6006002247 o envía un e-mail a programapyme@achs.cl.

Por un trabajo sano y seguro

No deseo recibir más este correo electrónico.

ACHS Remember to execute your action plan

Dear Mr. (Ms) <<NAME OF FIRM>>

In the following link you can download a summarized version of the prevention plan that we send you and the activity you need to do to carry it out.

We invite you to check it and to start implementing it.

pdf - Download here the summarized action plan

If you need more information about your prevention plan, call your prevention exper at 6006002247 or send an email to programapyme@achs.cl

Towards healthy and safe work

Unsubscribe to this email

FIGURE A.3. Example of understanding treatment---first page.

ASPECTO LEGAL BÁSICO	Cumple	
	SI	NO
AUTOEVALUACIÓN DE ASPECTOS LEGALES		
La organización ha realizado una autoevaluación de condiciones y requisitos legales básicos aplicables a su actividad		x
REGLAMENTO INTERNO (HIGIENE y SEGURIDAD o DE ORDEN, HIGIENE y SEGURIDAD)		
Tiene Reglamento Interno	x	
El documento está actualizado	x	
Entregó copia a Trabajadores	x	
OBLIGACIÓN DE INFORMAR LOS RIESGOS LABORALES		
Informa sobre riesgos a que están expuestos	x	
Informa sobre medidas preventivas (o de control)	x	
Informa sobre los métodos de trabajo correcto (instrucciones)	x	
ORDEN Y LIMPIEZA		
La organización tiene implementado un programa de orden y limpieza	x	
ELEMENTOS DE PROTECCIÓN PERSONAL (EPP)		
Se proporcionan EPP adecuados al riesgo	x	
Los EPP están certificados y en buen estado	x	
Los trabajadores usan los EPP cuando están expuestos al riesgo		x
ZONAS DE PELIGRO (tableros eléctricos, partes en movimiento, zona de fumadores, etc.)		
Están correctamente señalizadas	x	
Porcentaje de Cumplimiento	**83,33%**	

BASIC LEGAL ASPECT	Compliant	
	YES	NO
SELF ASSESMENT OF LEGAL ASPECTS		
The organization has done a self-assessment of the basic legal requirements that apply to their activity		X
INTERNAL REGULATION OF HEALTH AND SAFETY		
The organization has an internal regulation	X	
The document is up to date	X	
The organization handed a copy to workers	X	
OBLIGATION OF INFORMING WORKPLACE RISKS		
The organization informs about the risks workers are exposed to	X	
The organization informs about preventive and control measures	X	
The organization informs about proper ways of executing tasks	X	
ORDER AND CLEANLINESS		
The org. has implemented a program of order an cleanliness	X	
PERSONAL PROTECTION EQUIPMENT (PPE)		
The organization provides PPE, appropriate to the risks	X	
The PPE are certified and are in good shape	X	
The workers use the PPE when exposed to risk		X
DANGER AREAS (Electric panels, moving parts, etc.)		
These areas are appropriately signalled	X	
Compliance percentage	**83.33%**	

FIGURE A.4. Example of understanding treatment---second page.

Tareas habituales	Actividad de Gestión	Frecuencia
Labores administrativas en oficina	1. Capacitación Interna: Peligros y recomendaciones para labores administrativas en oficina y similares.	Anual
	2. Revisión de oficinas administrativas y similares: Búsqueda de peligros no identificados y/o controlados.	Semestral
Labores administrativas en terreno	1. Capacitación Interna: Peligros y recomendaciones para Labores administrativas en terreno.	Semestral
Manejo de herramientas manuales	1. Capacitación Interna: Peligros y recomendaciones para labores relacionadas con manejo de herramientas.	Mensual
	2. Revisión de herramientas: Búsqueda de peligros no identificados y/o controlados.	Mensual
Manejo Manual de Cargas	Capacitación Interna: Peligros y recomendaciones para labores de Manejo Manual de Cargas.	Trimestral
	Iniciar el proceso de implementación de los requisitos establecidos en el Decreto Supremo N° 63, para esto se debe solicitar soporte al 600 600 2247	Anual
	Revisión de los lugares de trabajo para el manejo manual de cargas: Búsqueda de peligros no identificados y/o controlados.	Semestral
Operación y/o mantención de un equipo energizado	1. Definición de la secuencia lógica: Operación y/o mantención de equipo energizado.	Anual
	2. Revisión y aprobación de la secuencia lógica: Operación y/o mantención de equipo energizado.	Anual
	3. Revisión de equipos energizados, para lo cual se pueden utilizar pautas de verificación.	Trimestral
	4. Capacitación Interna: Secuencia lógica, peligros y recomendaciones para la operación y/o mantención de equipo energizado.	Mensual
Uso de herramienta o equipos con partes en movimiento	1. Definición de la secuencia lógica: Uso de herramienta o equipo con partes en movimiento. Luego de un año corresponde revisión y actualización.	Anual
	2. Revisión y aprobación de la secuencia lógica: Uso de equipo con partes en movimiento	Anual
	3. Revisión de equipos con partes en movimiento, para lo cual se pueden utilizar pautas de verificación.	Trimestral
	4. Capacitación Interna: Secuencia lógica, peligros y recomendaciones para equipos con partes en movimiento.	Mensual
Conducción de vehículos	1. Capacitación Interna: Peligros y recomendaciones del trabajador. En caso de contar la evaluación de la ruta, incluir esta información en la capacitación.	Mensual
	2. Revisión de vehículos: Ver formulario básico de revisión de vehículos livianos	Mensual
	3. Iniciar el proceso de identificación y evaluación de las rutas habituale	Anual

Recurrent tasks	Prevention activity	Frequency
Indoor administrative tasks	1. Training: "Risks and recommendations for indoor administrative tasks"	Annual
	2. Auditing of offices and similar: Search for uncontrolled or unidentified risks	Biannual
Outdoor administrative tasks	1. Training: "Risks and recommendations for outdoor administrative tasks"	Biannual
Handling of manual tools	1. Training: "Risks and recommendations tasks related to manually handling tools"	Monthly
	2. Auditing of tools: Search for uncontrolled or unidentified risks	Monthly
Manuel handling of cargo/load	1. Training: "Risks and recommendations for manual handling of cargo/load"	Quarterly
	2. Start the implementation process of the basic requirements in the government supreme decree No. 63; call 6006002247 for assistance	Annual
	3. Auditing of work areas where cargo is handled: Search for uncontrolled or unidentified risks	Biannual
Operation and/or maintenance of energized equipment	1. Definition of the logic sequence for "operating and/or maintaining energized equipment"	Annual
	2. Revision and approval of logic sequence for "operating and/or maintaining energized equipment"	Annual
	3. Auditing of energized equipment: Use the auditing guidelines	Quarterly
	4. Training: "Logic sequence, risks and recommendations for operating and/or maintaining energized equipment"	Monthly
Use of tools or equipment with moving parts	1. Definition of the logic sequence for "using tools with moving parts". After a year, revising and updating.	Annual
	2. Revision and approval of logic sequence for "using tools with moving parts"	Annual
	3. Auditing of tools with moving parts: Use the auditing guidelines	Quarterly
	4. Training: "Logic sequence, risks and recommendations for tools with moving parts"	Monthly
Driving vehicles	1. Training: Risks and recommendations for the worker. In case of having de evaluation of the route, include this in the training	Monthly
	2. Auditing vehicles: Use the basic guidelines for auditing vehicles	Monthly
	3. Start the process of identification and evaluation of frequent routes	Annual

FIGURE A.5. Example of information provided in the motivation treatment.

ACHS **Cuanto cuestan los accidentes laborales en tu sector?**

Estimado(a) señor(a) EMPRESA MODELO

Los accidentes tienen costos para las empresas pymes que están tu sector : tasa de cotización + dias perdidos. Te invitamos a revisar las estadísticas que te entregamos abajo.

Tasa de cotización
En el sector "Industrias manufactureras", la tasa de cotización promedio de las empresas pyme durante el 2012 fue de 2,86.
Si no existieran accidentes, las pymes de tu sector se podría ahorrar un 1,91 de sus remuneraciones imponibles.

Días perdidos
Los dias perdidos a causa de los accidentes laborales no ayudan a que tu empresa alcance todo su potencial. Durante el 2012, en tu sector se perdieron 6.739 dias en total, en promedio 25,82 días por empresa. En la ACHS sabemos que los dias perdidos, más otros costos "escondidos", pueden llegar a ser más importante que la tasa de cotización. Recuerda que la empresa también se beneficia al mejorar la seguridad y salud laboral.

Nota: Estas estadísticas fueron obtenidas a partir de los accidentes reportados por las empresas durante el 2012 a la ACHS.

Si necesitas más información respecto a tu plan de prevención llama a tu experto en prevención al **6006002247** o envía un e-mail a **programapyme@achs.cl**.

ACHS **How costly are workplace accidents in your sector?**

Dear Mr. (Ms) <<NAME OF FIRM>>

Workplace accidents have costs for the SMEs that are in your sector: insurance premium + lost workdays. We invite you to check the statistics that we display below.

Insurance premium
In the <<manufacturing>> sector, the average insurance premium for SMEs during 2012 was 2.86 percent.
If they were no accidents, the SMEs of your sector would be able to save 1.91 percent of their wage bill.

Lost workdays
The lost workdays due to workplace accidents do not help your firm reaching its full potential. During 2012, in your sector there were <<6,739>> workdays lost in total, which amount to 25.82 per SME. At ACHE we know that workdays lost, plus other "hidden" costs, can be more important than the insurance premium. Remember that your firm will benefit from improving workplace health and safety.

Note: These statistics were obtained from the accidents reported by firms during 2012 to ACHS.

If you need more information about your prevention plan, call your prevention exper at 6006002247 or send an email to programapyme@achs.cl.

FIGURE A.6. Example of letter accompanying the relational treatment

Edificio Corporativo
Av. Vicuña Mackenna 152
Providencia - Santiago
Fono: (2) 685 2000
Fax: (2) 222 3533
Email: achs@achs.cl

ACHS

Santiago, XX de XXXX de 2013

SEÑOR(A)
<< NOMBRE CONTACTO EMPRESA >>
<< NOMBRE EMPRESA >>
PRESENTE

Estimado Señor(a):

En la ACHS sabemos que el trabajo de prevención y seguridad laboral representa un esfuerzo importante para usted y sus trabajadores. También sabemos que la prevención de accidentes se logra mediante un esfuerzo conjunto entre todos los miembros de la empresa.

En este sobre usted encontrará material informativo acerca de los principales riesgos a los que está afecta su empresa y cómo prevenirlos.

Lo invitamos a que distribuya esta información entre sus trabajadores, contribuyendo al trabajo en equipo en prevención. Le recomendamos además que los folletos sean publicados en lugares visibles para recordarles permanentemente a sus trabajadores acerca de los riesgos que corren y de las posibilidades de prevención a las que tienen acceso.

Esperamos poder seguir ayudándolos en el trabajo de prevención, que es trabajo de todos. Si tiene alguna pregunta o requiere alguna información adicional no dude en contactar a su Experto en Prevención en el fono 6006002247 o e-mail programapyme@achs.cl.

Se despiden sinceramente,

Equipo PYME ACHS

Edificio Corporativo
Av. Vicuña Mackenna 152
Providencia - Santiago
Fono: (2) 685 2000
Fax: (2) 222 3533
Email: achs@achs.cl

ACHS

Santiago, XX of XXXX, 2013

Mr. (Ms.)
<< NAME OF CONTACT >>
<< NAME OF FIRM>>

Dear Mr. (Ms.):

At ACHS, we know that workplace prevention and safety is an important effort for you and your workers. We also know that the effective prevention of accidents is accomplished through a collaborative effort among all members of the firm.

In this envelope, you will find printed material that informs about the main risks that affect your firm and how to prevent them.

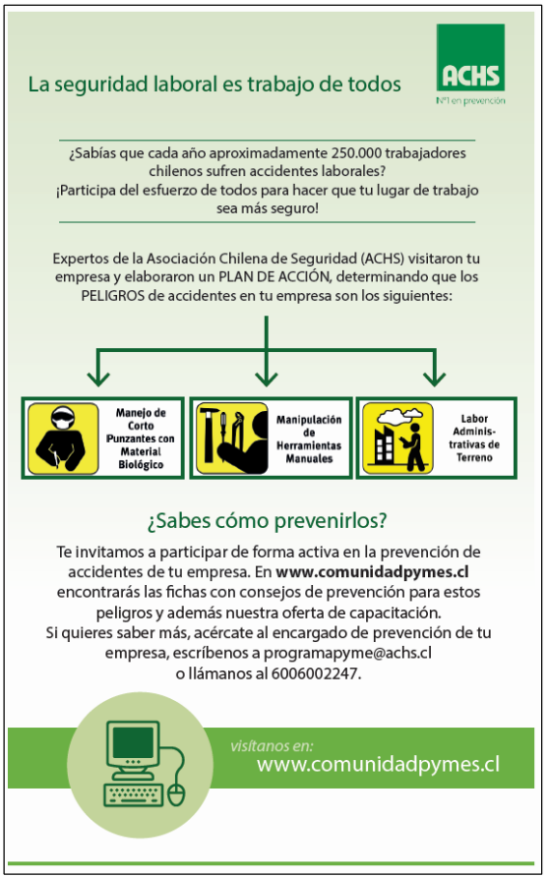
We invite you to distribute this information among your workers; this will contribute to teamwork around prevention. In addition, we recommend you that the pamphlets are published in visible areas so that workers are reminded about the risks they face and the prevention options they have access to.

We hope to keep on helping you in the prevention efforts, which is everybody's work. If you have any question or require additional information, do not hesitate in contacting your ACHS prevention expert at the phone 6006002247 or at the e-mail programapyme@achs.cl.

Yours sincerely,

Team SME ACHS

FIGURE A.7. Example of information provided in the relational treatment.



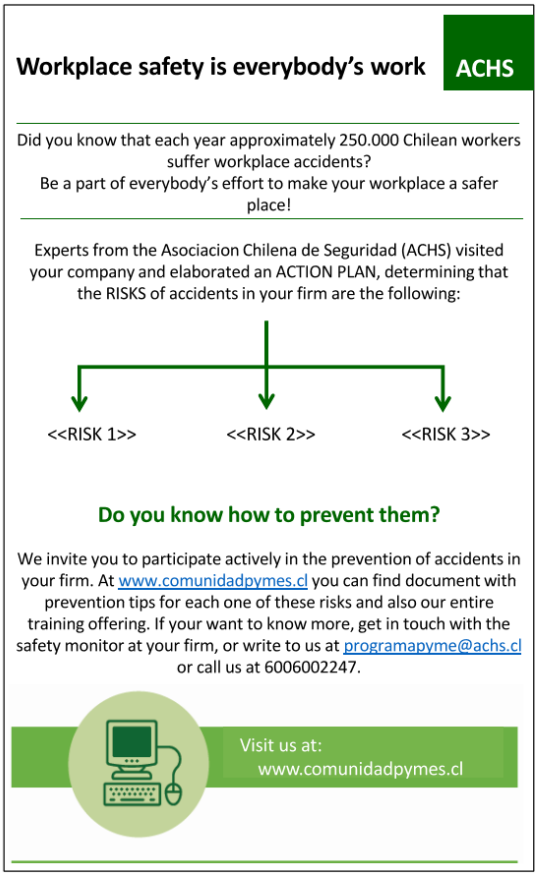


FIGURE A.8. Details of randomization procedure.

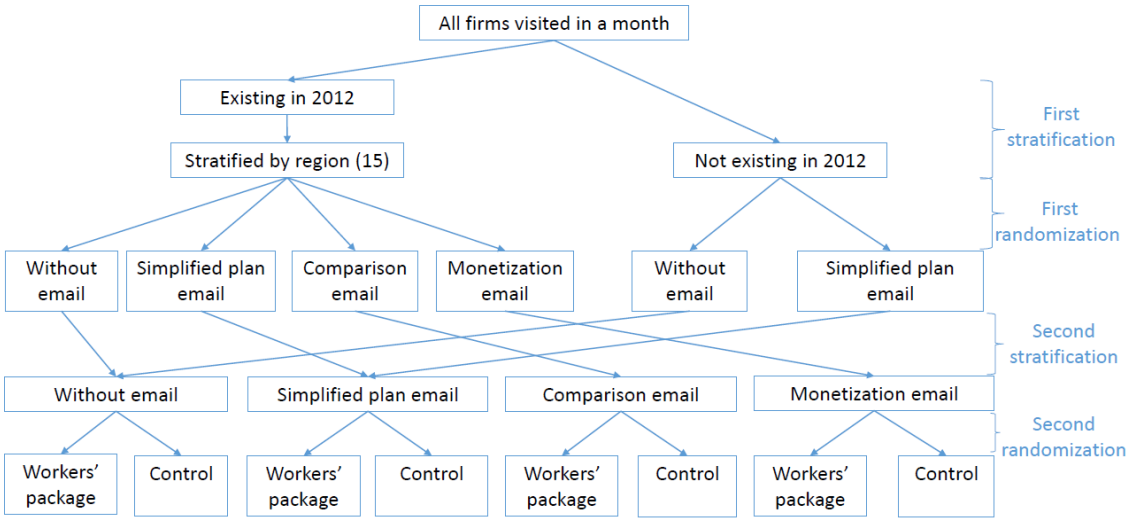
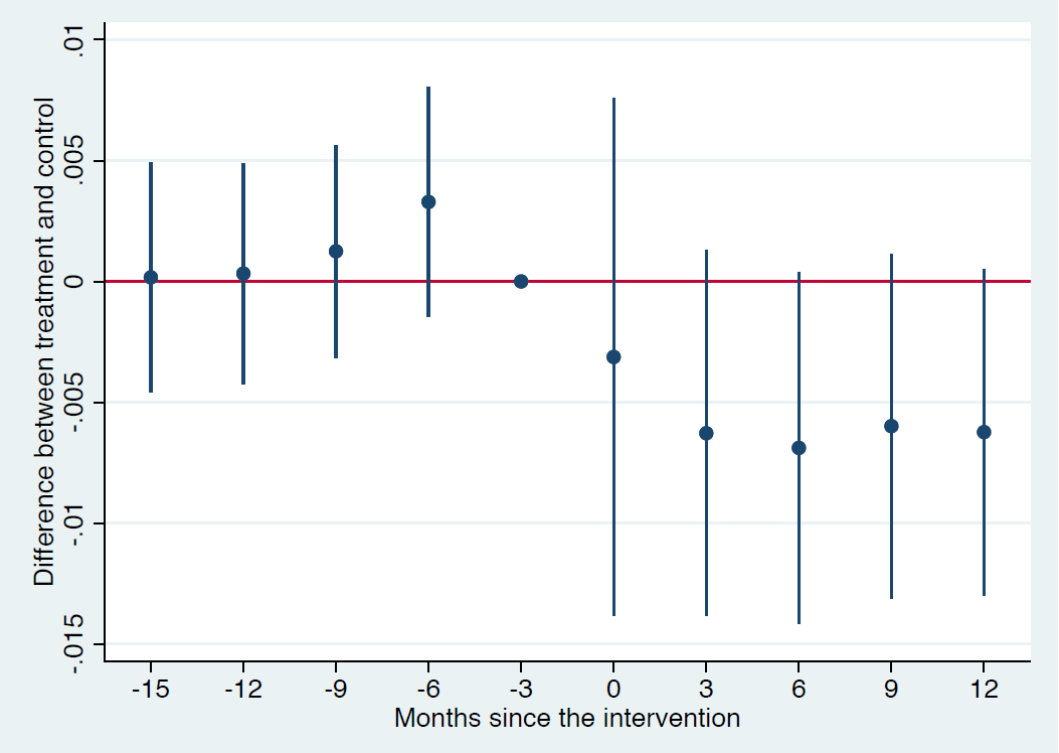
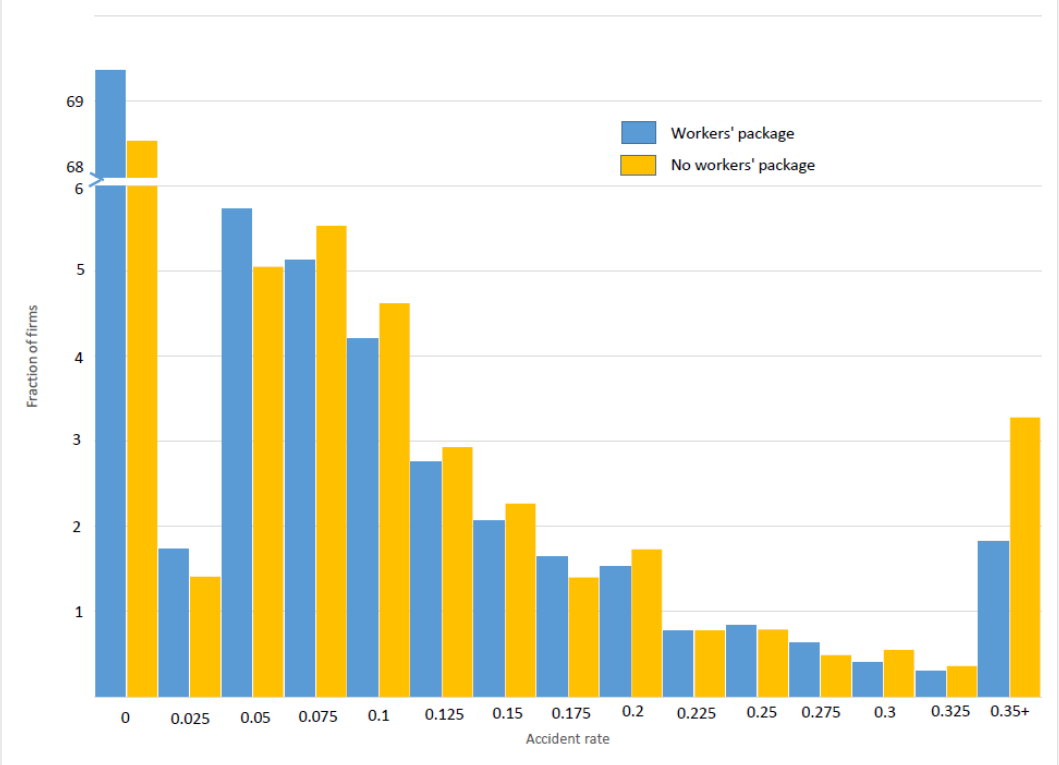


FIGURE A.9. Results of the difference-in-difference estimation



This figure presents the coefficients of a regression of the cumulative accident rate on a dummy indicating that the firm was assigned to receive the relational treatment and the observation corresponds to "x" months before or after the receipt of the package. The regression includes fixed effects by firm, fixed effects for the month-year and clusters the standard errors by firm. A simple regression on a dummy for post-WP has a coefficient of -0.004 and is significant at 10% level.

FIGURE A.10. Impact of relational treatment on accident rates distribution.



To build this figure we use the 12 months post-intervention accident data (without adding controls; simply the raw data). The vertical axis is cut since more than two-thirds of firms declare no accidents over the period. The data illustrates a leftward shift in accident rate distribution for firms receiving relational treatment compared to those that did not. Specifically, the first three pairs of bins, all below 0.05 (approximately the mean), have a higher fraction in the treatment group, while bins above 0.05 have a higher fraction of firms in the control group.