Training workers and reducing the rate of accidents: A proposal inspired by the chronic care model

Entrenando trabajadores y reduciendo la tasa de accidentes: Una propuesta inspirada en el modelo de cuidados crónicos

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Abstract
The construction field has an accident rate higher than those of other industries. Due to this fact, a bibliographical study was carried out in order to put forward innovative training methodologies in occupational health and safety as a means of reducing accident rates. A single methodology that ensures successful results over others could not be identified; however different safety training methodologies were identified that have been implemented within the construction industry. Since the issue of accident rates is a chronic problem in construction, the main contribution presented by this research is the application of a chronic care model used in healthcare to the construction industry. In this application, the foreman act as the linchpin in the system; it also considers technical and motivational training for the support team, especially those who work on-site, in order to cement the new lessons and the behavioral change.

Keywords: training, safety, construction projects, accidents rate, construction workers.

Resumen
El campo de la construcción tiene una tasa de accidentes superior a la de otras industrias. Debido a esto, se realizó un estudio bibliográfico para presentar metodologías innovadoras de capacitación en Seguridad y Salud Ocupacional como medio para reducir las tasas de accidentes. No fue posible identificar una metodología que garantice resultados exitosos por sobre otras, sin embargo, se identificaron diferentes metodologías de capacitación que se han implementado en este campo dentro de la industria de la construcción. Dado que las tasas de accidentes son un problema crónico en la construcción, la principal contribución presentada por esta investigación es la aplicación del modelo de cuidados crónicos utilizado en la atención médica para ser implementado en el campo de la construcción. En esta aplicación, el capataz actúa como la pieza clave en el sistema; el cual también considera la capacitación técnica y de motivación para el equipo, especialmente aquellos que trabajan en el lugar, para consolidar los nuevos aprendizajes y el cambio de comportamiento.

Palabras clave: Capacitación, seguridad, proyectos de construcción, tasa de accidentes, trabajadores de la construcción.

Introduction

Construction is a risky activity due to the fact that it typically requires open space activities, high-altitude work, and movement across irregular layouts and machine operations. In addition, many workers have an attitude contrary to that of safety (Choudhry, Fang & Mohamed, 2007). It is, in fact, one of the industries with the highest accident rates worldwide, especially accidents related to falls (Escamilla, García & Pérez, 2016). A great reduction in productivity is

caused by the loss and injury of skilled and experienced workers, as well as the resulting interruptions of these incidents across the span of the work (Choudhry et al., 2007). This does not only have a negative impact on productivity levels but also on the workers' motivation and absenteeism (Yuan, Yi, Miao & Zhang, 2018). The construction industry in Chile has an accident rate of 4.1%, much higher than the national average of 3.4%. This figure also includes 44 out of the 221 casualties due to work related accidents in 2017 (Superintendencia de Seguridad Social, 2018), which reflects the importance of this topic. If safety were treated as a priority, a great number of on-site accidents could be prevented (Forbes & Ahmed, 2011).

Occupational health and safety training ought to help minimize the number of work accidents (Endroyo, Yuwono, Mardapi & Soenarto, 2015). It is thought to help improve the perception of risk (Rodríguez, Lucas, Martínez & Delgado, 2015) and has become a necessary element in programs or safety management systems (Aksorn & Hadikusumo, 2008) being used in countries such as Australia, China, Finland, Jordan, Malaysia, Spain and the United States (Ismail, Doostdar & Harun, 2012). Additionally, the support from company management and the workers' education and training in safety are considered two essential factors for the success of safety plans and occupational health in construction projects in Thailand (Aksorn & Hadikusumo, 2008). Unfortunately, the quality of the training can vary greatly, which affects its effectiveness in achieving attitude changes towards safety in the workers (Choudhry, 2014).

Given the importance of occupational health and safety, the Chilean Superintendencia de Seguridad Social (Superintendent of Social Safety) has encouraged the development of research and technological innovation projects in accident prevention at work and work-related diseases. This article shows the results of one such research project where the research team worked together with the Asociación Chilena de Seguridad (ACHS) in order to put forward new training methodologies in occupational health and safety as a means of reducing accident rates in construction sites. The ACHS is a private, non-profit organization that manages social security against risks of accidents at work and professional diseases. Considering the importance of training experiences, the main objective was to identify, through the literature, the most effective methodologies to reduce work accidents. Additionally, the team looked into the variables that might affect the outcomes of a training program to propose a more strategic and integral approach to this topic.

This article presents the main outcomes of this research, identifying the most effective training methodologies and their main features, as well as proposing an integral model to address the issue of accident rates. This model applies elements from healthcare to the context of construction work. This may be truly valuable to agencies responsible for promoting safety and health as well as construction companies, field specialists, and others. Just as in health projects, it is important to realize that the positive outcome of any intervention will depend on an actual and participative diagnosis of what is needed, and an accurate definition of the learners' characteristics, regardless of the investment of the best resources needed for its application and execution.

The following pages in this article will introduce the work methodology carried out in this project, as well as the theoretical framework supporting the main topics studied. Later, the health model adapted for this study, as well as discussion and conclusion sections, will be presented.

Methodology

The methodological design included a review of the literature followed by an analysis that led to the presentation of an integrated model addressing the issue of accident rates to be applied in Chilean construction projects.

The review of the literature provided the necessary information to carry out the analysis of training methodologies sought for this project. Database searches in Web of Science, Engineering Village, PubMed and Science Direct yielded different sources such as academic articles, reviews and reports from several institutions. The articles included were those that showed research results related to adult training programs, construction training and prevention training in work accidents and professional medical conditions in the same field. These documents were assessed regarding their relevance, ruling out those considered only slightly related or only slightly important. Articles which showed up in more than one database were also ruled out.

All the selected articles were reviewed by one of the researchers or the assistants in the research team; they then selected the main topics in the articles or technical documents with the purpose of classifying them for further analysis. The analysis performed was of the qualitative type, which involved a study and a summary of the main results from the review as well as all results relevant to answering the research question posed by the study.

Based on this analysis, a plan was proposed in order to address the high rate of accidents at construction sites from a training perspective. The unique features of the issue, including its frequency and participants, were compared to experiences in other fields and industries such as healthcare. The findings allowed the team to develop an integrated model to address the problem of accident rates through training in safety issues, adopting elements unique to healthcare and applying them to the context of construction. In order to confirm the relevance of the project and to accommodate the specific needs of the industry, several meetings were held throughout the research process; these meetings between the research team and the ACHS served the purpose of validating the findings from the research.

Results

Safety training and occupational health in construction

The vast majority of construction safety training uses a traditional approach where the instructor is the center of the training process. Examples of this can be found in OSHA (Occupational Safety and Health Administration) documentation describing the way this type of training should be performed. Step-by-step procedures are provided for specific types of training, using the methodology of face-to-face classes with the construction workers (OTIEC, 2015). Some authors point out that construction workers prefer a more participative approach; they would rather work with qualified trainers in a practical way and apply this training to their specific work environment (Kaskutas et al., 2010).

Studies that look to improve the training curriculum in the carpenter trade, especially in relation to fall prevention, show the need to incorporate new training methods such as learning in actual unfinished houses, experimental learning, transferring basic principles acquired in a classroom to the shop environment, and focusing on the solution of actual problems (Kaskutas, Dale, Lipscomb & Evanoff, 2013; Kaskutas et al., 2010). Endroyo et al., instead, recommend using a combination of contextual learning/teaching, cooperative learning, and skill-based learning/training in the field of occupational health and safety (Endroyo et al., 2015).

Virtual reality (VR) is being applied in training and education in construction engineering. They include technologies such as immersive virtual reality, 3D games, and augmented reality among others, bringing benefits to several areas including architecture design, safety and health in construction, operation of equipment and structural analysis (Wang, Wu, Wang, Chi, & Wang, 2018). VR appears to be a useful methodology for training workers regarding safety issues (Froehlich & Azhar, 2016; Zhao & Lucas, 2015), as it allows them the opportunity to approach real life work experiences and see the result of the decisions they make (Goulding, Nadim, Petridis & Alshawi, 2012). Sacks et al. were able to accomplish better results with VR than with traditional training systems that included classroom presentations, especially with tasks related to concrete pouring (Sacks, Perlman, & Barak, 2013). Real-time systems have also been developed using 3D viewing in order to train new workers in the field of safety and construction dangers; these systems have been deemed effective because they facilitate the proactive identification of risks and provide relevant feedback (Li, Lu, Chan, & Skitmore, 2015). Other systems have used mixed reality where virtual and actual objects are combined (Bosché, Abdel-Wahab & Carozza, 2008). Video games and 4D viewing technology (incorporating physical effects) were used to conduct safety assessments that were much more effective than those obtained with traditional methods; however, this system is better suited for experienced workers rather than newcomers (Li, Chan & Skitmore, 2012). Virtual reality and augmented reality technologies afford new opportunities for training and educating novices or students with higher level of cognition and lower perception of risks (Xiao, Wen, Chi, Wang, & Chan, 2018). The main disadvantages of these methods are the cost for developing the training material, including virtual construction sites, limited hands-on experience with VR technology, and low learning or memory curving (Sacks et al., 2013; Xiao et al., 2018).

Another educational technology, gamification may also find a place in the construction field. Gamification may be especially useful in safety training, which demands constant reinforcement. Incorporating safety updates and exercises within gaming scenarios, in which participants may gain or lose ground following safe or unsafe work practices, is a means to encourage the process (Smith & Howard, 2015). In order for this methodology to be successful, the reasons to implement gamification in work risk prevention processes need to be carefully evaluated (Bello & Muñoz, 2015).

Other authors mention participative videos in which workers are both the creators and the subjects of the videos; this is a good methodology to communicate what has been learned in the field of occupational safety and health in the construction field. The research indicates that workers prefer visual ways to learn about occupational safety and

health since they are used to learning from watching others and because procedures that are hard to explain can often be much more easily demonstrated (Lingard, Pink, Harley, & Edirisinghe, 2015).

Studies have been developed in order to assess the effectiveness of risk prevention in construction through e-learning programs. A study carried out in Taiwan, with different educational interventions, shows the effectiveness of e-learning training in order to prevent falls. This study considers the average rate of passing participants, level of satisfaction with the course, and the total number of unsafe behaviors. The conclusion is that e-learning improves the effectiveness of the training, increases safety in the field of construction, allows the training material to be used independently, and establishes a positive connection with the effectiveness of educational training in construction safety (Ho & Dzeng, 2010).

Another training strategy is simulation. For example, simulators for construction team management allow training in realistic project scenarios increasing the workers' motivation (Bosché et al., 2008). Other safety training experiences have included problem-solving and role-playing activities in order to empower the workers within the context of unsafe work practices (Kaskutas et al., 2010).

Although the previously mentioned studies identify some of the essential aspects of occupational safety and health training, no solid evidence has been found yet to determine which training methodology is more effective than the rest. Having established that, the evidence indicates that it is possible to achieve better results by using participative, motivational and innovative methodologies that include the opinion and choice of the participants.

To have a successful safety training program it is important to have a strong and vertical commitment to safety from both high management and the owner. The owner or client's presence and management's commitment to safety should be clear from the very beginning of the project, promoting a culture of safety aimed at its continuous improvement, and one that is not punitive, but positive and based on incentives (Flynn, Cunningham, Chapman & Franco, 2015). It has also been demonstrated that when high management consistently supports safety in the workplace, it can motivate and encourage workers to join as a team, one aimed at reaching measurable goals in which each and all participants become protagonists in achieving a greater level of safety in the company (Aksorn & Hadikusumo, 2008), where each worker will be applying on site what they learn in the training program.

A proposal inspired by the healthcare chronic care model to face accident rates

The construction sector has some of the highest accident and fatality rates nationwide, despite all efforts to reduce them. In this regard, it could be considered that with respect to occupational health and safety, the construction sector has a problem like that of a chronic disease. This opens the possibility of applying an approach like that of the Chronic Care Model (CCM), which has yielded positive results in improving the quality of life in patients with chronic disease.

Non-communicable diseases, also known as chronic diseases, largely affect low and medium income countries worldwide where they account for almost 75% of deaths (WHO, 2015). Over time, and with the goal of promoting actions that allow the prevention and control of these diseases, high impact strategies have been identified that may be applied through a primary care focus to encourage early detection and opportune treatment. One such strategy is Edgar Wagner's Chronic Care Model established in 1990, considered a guideline to improve the quality of care for patients with chronic diseases in primary care. This model is based on scientific evidence, it works with active and educated patients and it prepares proactive healthcare teams, resulting in more productive and satisfactory interactions with patients suffering from chronic disease (Barceló; Epping; Orduñez; Luciani, 2013). There is vast evidence of the improvement this model creates in the quality of care and results obtained by patients (Coleman, Austin, Brach & Wagner, 2009; Davy et al., 2015; Findley, 2014).

This model is structured around six elements:

- **Community - resources and policies**: focused on the improvement of chronic diseases from the need of community resources, such as physical exercise programs, elderly homes, social work and self-help groups (Rubiera & Riera, 2004).
- **Health system – organization of healthcare**: requires the management and leaders to consider chronic diseases and their innovation in care to be a priority (Rubiera & Riera, 2004). If a favorable environment is created, a positive impact could be achieved regarding the quality of the service; this absolutely requires a coherent system focus and clear leadership (MINSAL, 2015).

- **Self-management support**: regular execution of educational and supportive interventions in order to improve the patient's abilities and self-confidence; this interventions are performed by the healthcare team (MINSAL, 2015).
- **Delivery system design**: medical practices must be modified, separating acute care from chronic disease control, where the team anticipates the problems, performs a constant job, maintains permanent communication and follows up on the patient (Rubiera & Riera, 2004). It is fundamental to work with healthcare professionals who recognize the importance of interdisciplinary labor in order to deliver quality care and to develop care plans together with the patient (MINSAL, 2015).
- **Clinical information systems**: a digital system with a customized record of the patient that includes his conditions and planning and that may also incorporate guidelines and protocols (Rubiera & Riera, 2004).
- **Decision support**: sets the use of clinical practice guidelines with integrated protocols into practice in which work teams must include the participation of the general physicians and specialists (Rubiera & Riera, 2004).

This model considers the participation of different actors, as can be seen in Figure 1; the figure shows the six elements in the model along with the systemic relationship among the different participants: the healthcare system, the community, the healthcare team and the educated patient (MINSAL, 2013). The relationship among the actors, their connection and the transference that occurs between them in order to achieve the expected goal is essential in the CCM. The patient, his family and the caretaker must be active in the decision-making process in order to reach this objective; therefore, they constantly need to receive information from the healthcare team (MINSAL, 2013).

It is important to realize that the CCM applies a systemic approach to the healthcare issue. The construction process can be seen as an open system that adapts to situations that take place outside the system because it has flexible boundaries that allow it to interact, influence and to be influenced by its environment (Walker, 2015).

Figure 2 shows the three main categories of participants in a typical construction project. First, Management, the group in the dotted-line box that encompasses the actors from General Management to Construction Manager; this group is considered the Manager of each project due to its leadership and decision-making role. Second, site staff which includes Site Professionals, Risk Prevention Specialist, Supervisor, Foreman and the crew. The third category is an occupational health and safety Consultant or Expert from the Mutual Insurance Association to which the construction company is affiliated (institutions such as ACHS).

Every construction project has some degree of interaction with areas outside its system through contact with the occupational health and safety experts. Among the participants, the Foreman has an important role as the person in charge of a work crew. He is the linchpin between a project's management and the on-site crew teams and should be a forefront leader with direct responsibilities in the achievement of goals, a reality not often witnessed. Taking into consideration all the aforementioned elements, it is possible to apply the CCM to the context of construction, as seen in Figure 3.

Figure 1. Chronic Care Model. Source: modified from MINSAL (2015).

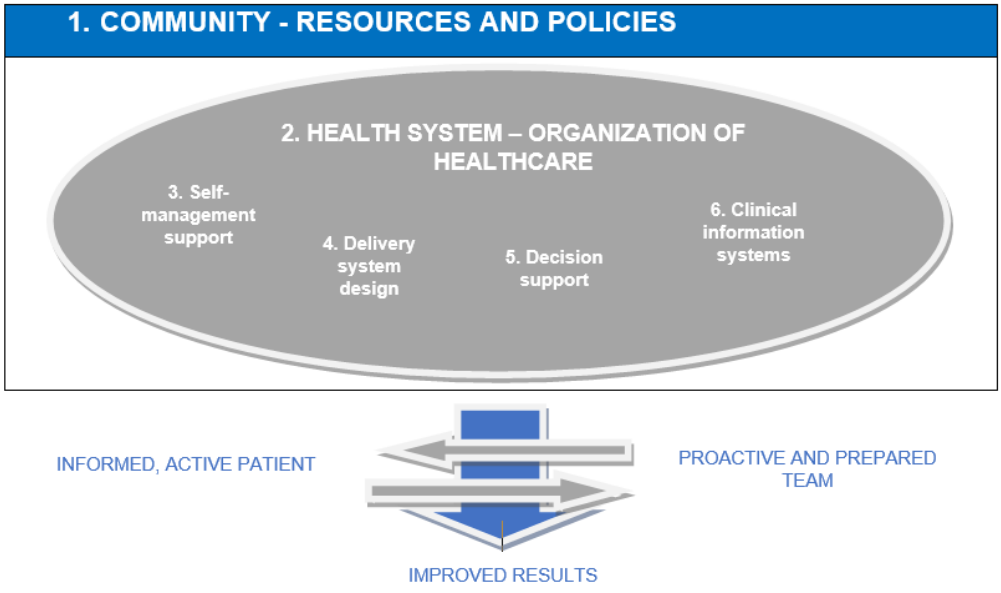
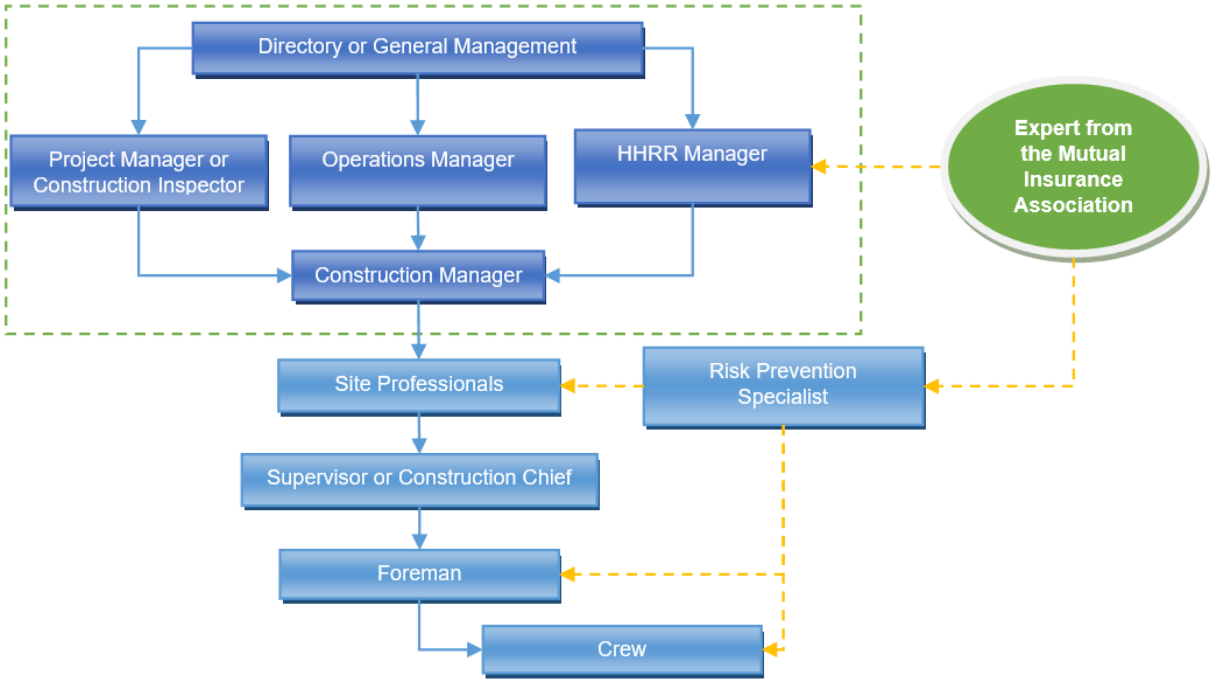


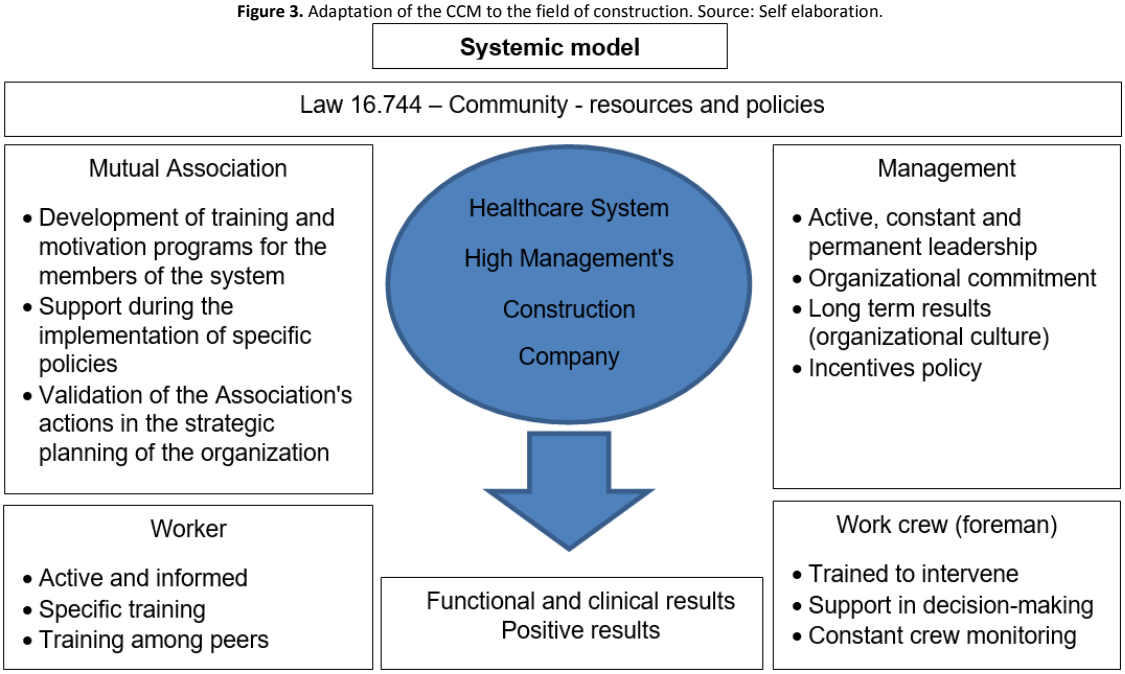
Figure 2. Actors whose decisions have an impact on the outcome of a construction project. Self elaboration.



This illustration suggests that a company's high management should have a role similar to that of the healthcare system, creating a strong relationship in terms of leadership, commitment, organizational culture and incentive policy. The central part that management plays in this system, and the effect its actions and decisions have on the different members of the company and the projects it is working on, requires a committed form of leadership in this group in order to achieve the system's final goals.

The first element of the CCM -- community, resources and policies -- could refer to the relation that the company has with a mutual insurance association. Mutual insurance associations are external groups that provide experience, support and validation of company initiatives, and also fulfill an essential role supporting specific policies and developing training and motivation programs for all participants in the system. These associations must act like leaders in order to increase awareness of the importance of occupational health and safety and all other subjects related to construction, just as with community leaders in the context of a CCM program and health issues. Prevention experts from each association should also be considered in this regard.

Figure 3. Adaptation of the CCM to the field of construction. Source: Self elaboration.



The proactive healthcare team in the CCM is represented by the construction crew, which includes the On-Site Professional, Risk Prevention Specialist and Foreman. The latter should have a relevant role in training and monitoring the workers. Further comparison with the CCM reveals the Foreman to be the equivalent of the Healthcare Professional who has direct contact with patients. For this reason, the foreman should provide his crew the support and guidance needed to care for themselves; he should give them feedback in order to correct mistakes and improve their safety and occupational health performance.

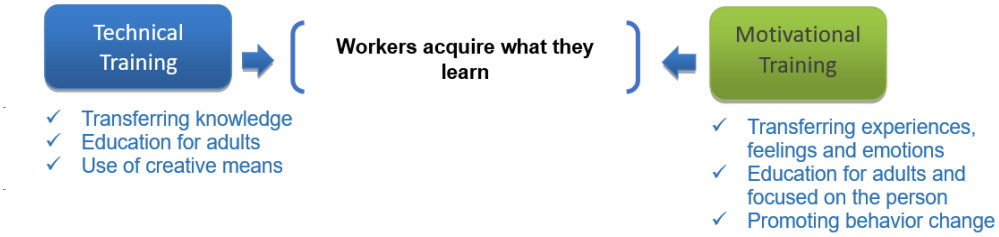
Finally, construction workers are the equivalent of patients in the CCM, for they are the ones suffering the effects of chronic diseases, namely accidents and fatalities. These workers must be informed and trained in all areas of occupational health and safety.

The CCM acknowledges that these patients require a service focused on the person and not the disease, as it is commonly done in the general healthcare model; it is therefore necessary to encourage interventions using this approach (Trehearne, Fishman & Lin, 2014). It is essential for the patient to be part of a multidisciplinary team focused on self-care and self-management (Blázqueza, Sánchez & Fuentelsaz, 2014). The same type of focus may be applied in the construction industry with the hope of obtaining similar benefits.

The model also requires using information systems on occupational health and safety and on-site follow-ups to make decisions based on the best evidence available. The information systems should include two types of indicators. The first should be technical, that is, occupational safety and health indicators that ideally include not only accident-related data, but incidents that have taken place during construction projects. The second type of indicator should be used for evaluating the perception of the training programs performed in the company.

Figure 4 shows a proposed training program that combines technical training aimed at transferring knowledge with motivational training aimed at transferring experiences and emotions; the combination of both will cement the new learning in the participant. These training programs need to be conducted using a combination of techniques because, even though each topic is taught using different active methodologies, these methodologies must be linked in such a way to promote the development of new learning and behavior change. Motivational training is also recommended for technical topics because, according to the CCM experience, motivation is critical to the support strategy when the objective is a behavior change in the patient.

Figure 4. Types of training proposed by the model. Source: Self elaboration.



When designing these training programs, the most appropriate methodologies must be selected depending on the reality of the organization, its objectives, the topics to be tackled and the profile of the participants who will receive the training. This is not about designing a template or a one-size-fits-all strategy because, as with people, the needs will vary depending on the project and circumstances when the when training is introduced. The context in which the program will be implemented must be carefully considered in order to achieve the expected goals.

To apply this model successfully, there needs to be a strategic plan that includes a global vision about how to implement it and what key elements must be considered. This will be a general analysis because the specificity of a strategic plan depends on the features of each organization. These are the general elements to be considered:

- **Definition of the strategic objectives in occupational health and safety**. The objective of the program needs to be defined and aligned with the organizational strategic planning. Although the final goal is to decrease accident and fatality rates in construction projects, this will be a result of having previously applied training programs according to the given guidelines, based on the analysis of the chronic care model.
- **Definition of the training program**. This activity involves the detailed definition of the training activities that will be conducted with each group of workers within a specific amount of time. These details are determined not only according to the organization's strategic objectives but also according to the current state of the construction projects. When programming training sessions, the recommendation is to define different rotations that combine technical and motivational training sessions; the combination is important because it will cement

the new knowledge in the worker. The idea of a permanent and constant “cycle” essential until the results demonstrate achievement of the organization's goals.

- **Development of a communication policy.** This activity is essential not only to advertise the program but also the proposed collaborative management approach; all members of the organization need to know what the program is about and the importance of their participation in it.
- **Implementing the program.** This activity is the execution of all the different training activities defined in the training program.
- **Monitoring the program's progress.** This activity refers to the collecting of data related to the execution of the different training activities, such as attendance percentage, number of classes, percentage of progress in the program, number of workers trained per site, percentage of participant's satisfaction and trainer evaluation, among others.
- **Evaluation of the program's results.** Once the training classes are finished, the participants need to be evaluated; they also need to report their perceptions regarding the training program and any other related data that could be considered relevant in order to improve the process.

Both General Management and Construction Managers have a crucial role in defining the strategic occupational health and safety goals for the company and each project. The Occupational Health and Safety Consultant from the Mutual Insurance Association may also participate. Once these objectives have been defined it becomes possible to develop the training program. All actors participate in this development regardless of their level of involvement. For example, it is important to collect data about the needs of the crew and their foremen; this data must then be complemented and validated by the risk prevention expert and the on-site professional; finally, this data must be cross-referenced with the project's objectives from the perspective of both the manager and the company in order to reach an agreement among all participants. In terms of the communication policy, the development and execution of the training program should have the active cooperation of everyone from management to foreman, who is the link with all the workers in the crew.

During the training execution stage, the proposed model considers the foremen and their work crew as essential in reducing accident rates. During the monitoring stage, foremen and risk prevention experts will rely on the collected data in each training session while administrators and management will keep track of these general figures. Finally, regarding the final evaluation of the training program, everyone should participate, either rating the training itself or its impact on the project in relation to the fulfillment of the company's strategic objectives.

Recommended methodologies to be used

The focus of the training program is aimed primarily at foremen and their crews and includes both motivational and technical training. While they are not the only solutions this multifaceted approach offers different options depending on the strategic objectives of each project or company and the time and financial resources available, among other factors.

The use of active methodologies is a clear choice. Another strategy recommended in the early stages of training is collaborative learning, that is, training based on problem-solving among peers. This strategy will provide the participant with more responsibilities and a better appreciation of teamwork as part of the learning process. His work and behavior have an impact on others, hence the importance of collaborative work where success does not depend on the individual but the performance of the team. To minimize upfront costs, a construction company may start by using resources such as low-tech simulation and gamification; these technologies do not require an investment in information technology, but instead require time to plan and design the formative activities as well as prepare the trainers to apply them. *E-learning* requires more capital investment, it is fairly well developed in Chile, although not used extensively in construction industry. Applying it must take into consideration when and where the participants would have access to the internet, as this service may not be readily available at home, and computers are rarely available at construction sites for the crew to use. Finally, both high-tech gamification virtual reality uses information technologies that require the largest investment, both in development time and financial cost. However, once developed, VR programs may be reused over and over, amortizing the initial investment over time.

Discussion and conclusion

The main contribution presented by this research is the application of a behavioral change model used in the Chilean Healthcare System to reduce accident rates in the construction industry. This project presents a structured approach to train construction workers in safety issues, taking elements from healthcare and applying them to the field of

construction. The bibliographical review showed that there is no clear answer regarding which training methodologies have been more successful in occupational health and safety. It was therefore determined that the issue of accident rates should be seen with a broader and more systemic view, evaluating how similar problems have been faced in other industries. As desirable levels of safety performance are yet to be attained in the construction industry (Jeelani, Han, & Albert, 2018), it is important to look for new approaches to address this problem.

This research proposes the development of collaborative designs that consider the needs of the company as well as the needs of the workers. This is especially important since all evidence shows that people make a commitment to their training when it meets their needs. The participants are expected to internalize what they learn and show changes in behavior that allow a significant reduction in accidents at work, especially those that have fatal or crippling results.

Occupational health and safety have a direct impact on the worker and the productivity of the company (Yuan et al., 2018); that is why it is necessary to incorporate education on this topic as part of the Strategic Plan of all construction companies. This way, training proposals would coincide with the development plans of the company and contribute to their successful completion. The proposal presented here incorporates in its global design opportunities for the management to participate directly. This way a change can be expected in the way training and occupational health and safety are generally seen, from being a peripheral consideration overseen by risk prevention experts, to having a central strategic role that affects the performance of the company. This new approach could help guarantee the success of safety and occupational health plans, where workers' education and training in safety are essential to the company's achievement (Aksorn & Hadikusumo, 2008).

In addition to the strategic vision previously presented, it is important to define the cognitive and behavioral skill set required for the productive process of the organization, This will enable the company to provide its workers with the necessary tools to perform according to the real needs of the industry, where they are taught to see each other as people and not as resources, thus creating a connection based on respect and mutual support.

The training of workers must be strategically planned based on the objectives to be achieved in occupational health and safety, using an integrated view that strengthens the person's social and emotional connections, while providing the necessary technical training in the productive processes in which he participates. The training needs must show the gap between the actual situation and the expected goal. From that point on, the process, the result and the impact can be evaluated to test the effectiveness of the interventions.

The company must provide the training context, promoting a safe and healthy environment for the worker to perform the tasks demanded of him. Otherwise, despite the training provided, his behavior will be shaped by his environment. Additionally, the role of the Foreman is essential because for the CCM to be adopted effectively in the construction industry, his active and committed participation is essential as he must take on the role of a leader within the work crew on site. Although the Foreman is the link between workers and professionals, he is not entirely considered a part of the management team which usually leaves him in an intermediate position that limits his ability to act. This means it is necessary to acknowledge and value the work of the Foreman as a "first line manager", giving him not only the basic technical information required but above else the training related to management and motivation that will allow him to perform as an effective crew leader. We believe that a company that applies this methodology is strategically committed to the management of people and their safety and occupational health. Then, complementary strategies can be used for the development of these people (Holbeche, 2009). For example, to reinforce the role of the Foreman on site, strategies such as competency planning to develop the competencies required by for this role must be aligned with the strategies of the project to which it belongs and, consequently, with the company.

The CCM-derived collaborative model hereby proposed to address the issue of occupational health and safety in construction has not been validated in the field; therefore a second development stage of this project is expected to include a feasibility study of the model in a specific construction company. This trial would allow the opportunity to delve deeper into the training design, especially at the motivational training level; it would also allow the foremen and risk prevention experts to be trained in in the necessary soft skills to implement the training modules, define indicators to measure the effectiveness of the training actions performed, and evaluate pre and post application of the model. The results obtained from the application of this pilot program will help improve the model, strengthen it and, above all, validate it in the specific context of the construction industry.

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