

CHRONIC AND METABOLIC DISEASES IN CONSTRUCTION WORKERS: A SYSTEMATIC REVIEW AND ITS PRODUCTIVITY IMPLICATION

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Abstract

Given the global construction industry's pressing need for improved productivity in the face of growing competitive challenges, this paper examines some of the factors influencing productivity, focusing on the health of construction workers. Recognizing workers as central to project success, this paper addresses the obscure knowledge among construction workers regarding chronic and metabolic diseases, underscoring the necessity for enhanced awareness and educational interventions to mitigate the risks associated with these health conditions. A systematic literature review serves as the foundation for this investigation, aiming to catalogue the prevalence of specific health issues among construction workers globally in the last fifteen years. This approach seeks to broaden the understanding of health impacts in different contexts and suggest actionable strategies for improving worker health and, industry productivity. The paper aims to stimulate further research and action through this global perspective, highlighting the critical need for a healthier, more robust construction workforce.

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Keywords: chronic diseases, construction workers, metabolic diseases, productivity, workers health.

1. Introduction

Construction productivity is a significant determinant of success in the projects carried out in the industry [1]. Despite this, the sector presents important problems concerning productivity. Many countries acknowledged that the construction industry falls behind the other industrial sectors [2]. Even though the construction sector is one of the largest in the world economy, its labor-productivity growth averaged 1 percent a year over the past two decades, compared with 2.8 percent of the total world economy [3]. There are many reasons for this problem, as there are numerous factors that affect productivity, such as labor and experience, leadership and efficiency in site management, tool and equipment issues, poor labor motivation, project management incompetency, and artisans' issues, among others [4]. Given the concern of improving the productivity levels of the construction sector, it is necessary to face the problem from all possible perspectives. Burton et al [5] found that health conditions and lifestyle risk factors are associated with workplace productivity loss, given relevance to the value of maintaining a healthy population. It is essential to highlight that by improving the health status of employees (and their families) and directly targeting specific ineffective and inefficient medical practices and delivery methods, the employer and employee can improve health and produce savings [6].

It is estimated that 41 million people die in the world due to Non-Communicable Diseases (NCD), focusing on cardiovascular diseases (44%), cancer (22%), chronic respiratory disease (9%), and diabetes (4%) [7]. NCDs are a group of chronic conditions that do not result from an infectious process and are not directly transmissible from person to person. NCDs are characterized by their long duration and generally slow progression. They include various conditions primarily influenced by genetic, physiological, environmental, and behavioral factors. Key types of NCDs encompass cardiovascular diseases (hypertension and strokes), cancers, chronic respiratory diseases (such as chronic obstructed pulmonary disease and asthma), and diabetes [8]. Metabolic diseases are a subset of NCDs that involve disorders of the metabolic process, which is the body's means of converting food into energy. These

diseases disrupt normal metabolism and life-sustaining chemical reactions in organisms, leading to an excess or shortage of essential substances required for health. Common metabolic diseases include diabetes mellitus, obesity, dyslipidemia, hypertension, and more [9]. These conditions have an impact on the workers' performance. As chronic diseases rise, employees become sicker and less productive [10]. For example, it was found that diabetes affects patients, employers, and society by reducing employment and contributing to work loss through absenteeism and health-related work limitations in the workplace [11]. Also, according to a study carried out in mining, work absenteeism increases in people with obesity, especially severe and morbid, given the comorbidities that accompany them [12]. These conditions create a significant economic burden, costing employers heavily as they provide medical benefits for employees and absorb the costs of sickness absence and long- and short-term disability claims [13]. However, employers, employees, and family members are unaware of the significant impact of health behaviours in improving health and preventing and even reversing chronic disease [6]. The above shows the relevance of the worker's health to the business results. Health positively and statistically significantly affects economic growth. Focusing on the construction sector, its workers worldwide have unhealthy lifestyles with high alcohol and tobacco consumption, high prevalence of NCD, overweight, and obesity [14]. This unhealthy lifestyle is related to decreased productivity since absenteeism increases due to health problems and reduced efficiency during working hours [15].

Given the increase and importance of NCDs in the world and their impact on the productivity of the workforce, it is important to know if there has been a concern in the construction sector to know if their workers suffer from these diseases to what degree and how to help prevent or cope with them. In this context, the main objective of this article is to present a literature review on the study of NCD in construction workers. In the following sections of this article, we present the research methodology and the main results obtained. Subsequently, suggestions are given on the research areas that should be developed in this field, to finalize the article's conclusions.

2. Methodology

This review was carried out following the methodology PRISMA checklist 2020 [16]. Publications from 2000 to 2024 indexed in the ASCE, PubMed, and Web of Science databases were retrieved using the keywords ('Cardiovascular diseases*', 'Diabetes', 'Hypertension', 'Non-communicable disease**', 'non-communicable disease*', 'Obesity', 'Unhealthy', 'cardiometabolic disease*'). Each of these articles was reviewed by the authors, taking into consideration that each study had to meet the following criteria: (1) Studies published between 2012 and 2024; (2) conducted within the construction industry; (3) documented in English, Spanish or Portuguese (4) from peer-reviewed journals; (5) addressing non-communicable and metabolic diseases such as obesity, type 2 diabetes, hypertension, and hyperlipidemia. We excluded (6) articles focused on occupational diseases, including silicosis, particulate matter-related conditions, and musculoskeletal disorders.

In the screening stage, 19 articles were eliminated because they were unrelated to the construction sector. In the eligibility stage, seven articles were eliminated because they did not have peer review. Figure 1 shows the PRISMA flow chart, showing that 17 articles were included in the qualitative analysis after the entire process. As no review is completely inclusive, the keywords were selected to cover a wide range of factors related to NCD to try to answer the research question of how the issue of NCD of construction workers has been addressed in the sector. The objective is to contribute to understanding this problem and the efforts made to support those who suffer or could suffer any of these diseases and who are part of the construction sector, identifying areas already not covered through research. The main idea was to emphasize the search for workers more than the industry, as these diseases affect the person's work and personal life.

The criteria for inclusion of the articles include focusing on construction workers' health and having been published in the last years (from 2011 to 2024). The search process results are presented in the flow diagram of Figure 1. After eliminating the duplicated articles, the titles and abstracts of the remaining publications were read to select only the ones that fulfilled the inclusion criteria. At the end of this stage, 29 articles were selected and analyzed. Table 2 presents the primary information regarding these publications. The high rate of eliminated articles was because many of the hits retrieved in the search were related to the construction industry but not the research question. For example, when using the

Pubmed database, we had many hits that included the word construction or any chronic disease but in very different contexts, such as endocrinology and oncology.

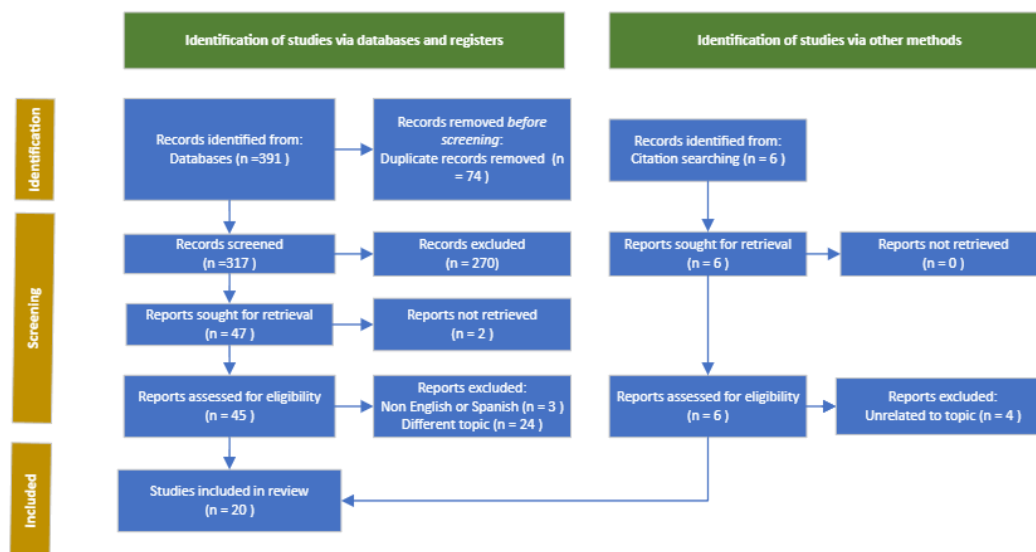


Fig. 1. The preferred reporting Items for Systemic Reviews and Meta-Analysis (PRISMA) flowchart

The selected articles were classified according to 2 topics: NCD and interventions. NCDs are research with a more exploratory approach related to the diseases included in this category. They seek to know the prevalence, causes, effects, and protection against these diseases, among other issues. They do not seek to generate a conductual change in the workers. The second topic is intervention. In the health sector, an intervention can be defined as "any activity undertaken to improve human health by preventing disease, by curing or reducing the severity or duration of an existing disease, or by restoring function lost through disease or injury" [17]. Therefore, in this category, the articles focused on improving the prevalence or effects of NCDs and evaluating the effects produced by these interventions.

Table 1. Characteristics and information of studies.

| Type | Diseases | Authors |
|--------------|----------------|---|
| NCD | Diabetes | Chung et al [18], Damman et al [19], Sandeep et al [20], Strickland et al [21], Thabit et al [22], Viana & Carvalho [23], Welch et al [24], López & Gonzalez [25] |
| | Obesity | Chung et al [18], Rodriguez [26], Thabit et al [22], Sandeep et al [20], Umar et al [27], Van der Berge et al [28], Viana & Carvalho [23], Welch et al [24], Yi & Chan [29], Robroek et al [30], Tonnon et al [31], Strickland et al [21], López & Gonzalez [25], de Lima Brasil et al [32] |
| | Hypertension | Chung et al [18], Rodriguez [26], Thabit et al [22], Adsul et al [33] Sandeep et al [20], Umar et al [27], Viana & Carvalho [23], Welch et al [24], López & Gonzalez [25], |
| | Hyperlipidemia | Chung et al [18], Rodriguez [26], Thabit et al [22], Welch et al [24], Yi & Chan [29] |
| | Diabetes | Salinas et al [34] Groeneveld et al [35], Groeneveld et al [36], Chung et al [37], Viestar et al [38] |
| Intervention | Obesity | Salinas et al [34], Salinas et al [39], Groeneveld et al [35], Groeneveld et al [36], Chung et al [37] |
| | Hypertension | Salinas et al [34], Salinas et al [39], Groeneveld et al [35], Groeneveld et al [36], Chung et al [37] |
| | Hyperlipidemia | Salinas et al [34], Salinas et al [39], Groeneveld et al [36], Chung et al [37] |

3. Results

Using the keywords, 391 results were obtained, but after the filtering process, 20 relevant articles met the inclusion criteria. 15 studies assessed the existence of NCDs in construction workers, and 5 studies assessed interventions related to NCD

3.1. NCDs

Diabetes was investigated in eight studies, focusing on its prevalence and workers' health concerns. Chung et al. [18] reported that among 626 construction workers, 92.2% had ideal fasting blood glucose levels, indicating a low diabetes prevalence with only 7.8% showing levels indicative of diabetes or impaired glucose tolerance. Similarly, Sandeep et al. [20] observed a very low prevalence of diabetes, with only 0.34% of workers diagnosed with the condition, despite high rates of other health issues like psychological distress and hypertension. Conversely, Viana & Carvalho [23] reported no diabetes cases among their participants, while Damman et al. [19] found a higher diabetes prevalence of 5% in their sample. Thabit et al. [22] highlighted that the unadjusted prevalence of previously undiagnosed diabetes was 1.2%, and prediabetes was 3.6%, noting age as a strong predictor of fasting plasma glucose levels. They observed a significant association of diabetes and prediabetes with Metabolic Syndrome, present in 21% of their cohort. Welch et al. [24] identified workers with high HbA1c, which is indicative of diabetes -of 1,295 elderly construction workers, 64 (4.8%) had high HbA1c levels. In López-González et al. [25], glucose assessments revealed that 2.3% of 2595 females and 4.3% of 53667 male workers had glucose levels indicative of diabetes. Strickland et al. [21] focused on health perceptions, finding that only 29.3% of 1,636 workers expressed concern about diabetes. This concern was more pronounced among obese workers, rising to 38.6%, underlining the link between obesity and heightened diabetes awareness.

Obesity remains a significant health issue among construction workers, as demonstrated in 13 studies, most of which are focused on prevalence. In Hong Kong, Chung et al. [18] identified that 62% of construction workers were overweight or obese, a substantial health concern in this demographic. This pattern is echoed by Sandeep et al. [20], who found that one-third of workers were overweight, while 31% were underweight, revealing a broad spectrum of body weight issues. López-González et al. [25] documented that 20.1% of male and 19.6% of female Spanish construction workers were obese with significant abdominal obesity in 27.4% of women and 41.5% of men. Similarly, Yi & Chan [29] reported that 36.1% of construction workers in Hong Kong were moderately overweight, and 6.5% were obese. Tin et al. (2016) observed that 71.7% of construction workers were overweight or obese, with 53.1% showing central obesity, highlighting the need for targeted health interventions. Tonnon et al. [31] revealed that among 36,435 male construction workers, 15% were obese and 51% overweight, emphasizing the ongoing issue of obesity in this sector. Strickland et al. [21] observed that concerns about obesity were particularly acute among obese workers themselves, with 38.6% expressing worries about their weight. Rodríguez [26] reported that in Santander, Colombia, 46% of construction workers were overweight, and 15% were obese, with an average BMI of 26. Umar et al. [27] added that 46.7% of workers were overweight and 27% obese, correlating obesity with only 4.5 hours of sleep on average and elevated health risks. Welch et al. [24] conducted a study among 6,857 elderly construction workers and found that 43.7% were obese. Van den Berge et al. [28] found that 50.6% of workers were overweight and 17.3% obese among 29,987 workers. Viana and Carvalho [23] recorded that 52% of Brazilian workers were overweight and 18% obese, coupled with low physical activity and poor dietary habits. In the study by Brasil et al. (2016), it was found that a significant 55.9% were overweight, and 13.6% were obese.

Hypertension is a prevalent health concern among construction workers, as evidenced by numerous studies indicating varying degrees of prevalence and associated risk factors. Chung et al. [18] highlighted a significant issue with 81% of workers experiencing pre-hypertension or hypertension in Hong Kong, reflecting widespread cardiovascular challenges in this sector. Similarly, Rodríguez [26] found that 42% of Colombian construction workers showed signs of hypertension, based on clinical records, underscoring the need for comprehensive health monitoring and interventions. In the study by Umar et al. [27], it was found that the blood pressure of 43.3% of the construction workers was hypertense. The study conducted by Adsul et al. [33] identified that among migrant construction workers, 45 (3.4%) had hypertension. Van den Berge et al. [28] noted that among 29,987 workers, hypertension was notably present, particularly among those with higher body mass indices and lower physical activity levels. This finding suggests that lifestyle factors are crucial in managing and preventing hypertension in this demographic. In contrast, Welch et al. [24] reported that 26.5% of elderly construction workers had untreated hypertension, indicating that age and lack of treatment contribute to ongoing health risks. Yi & Chan [29] reported a moderate prevalence of hypertension among Hong Kong workers, while López-González et al. [25] documented that 36.1% of men and 34.6% of women among 56,262 Spanish construction workers were diagnosed with this condition. These studies collectively show the global

scale of hypertension challenges in the construction industry. While not all studies provided specific hypertension figures, many highlighted associated risk factors. Tin et al. (2016) observed that construction workers were more likely to be hypertensive than clerks/professionals, indicating occupational influences. Robroek et al. [30] linked obesity, often associated with hypertension, to a higher risk of cardiovascular-related disabilities among workers, emphasizing the interconnected nature of these health issues.

Hyperlipidemia, a key risk factor for cardiovascular diseases, is notably prevalent among construction workers. Chung et al. [18] identified significant hyperlipidemia issues, with 40.2% of workers having borderline high cholesterol levels and 16.7% exhibiting high cholesterol levels. This substantial prevalence indicates a critical health concern in this demographic. Thabit et al. [22] further underscored this, reporting that 25% of workers had elevated cholesterol levels, highlighting the widespread lipid disorders among construction workers. While Viana and Carvalho [23] did not provide specific prevalence figures, they noted that lifestyle and dietary habits significantly contribute to hyperlipidemia risk among workers. Similarly, Tonnon et al. [31] observed that obesity—a common precursor to hyperlipidemia—was prevalent, pointing to associated cardiovascular risks. Yi & Chan [29] documented broader health assessments, likely including concerns over hyperlipidemia due to noted obesity and cardiovascular risk factors.

3.2 Intervention

Salinas et al [39] evaluated a nutrition education intervention aimed at preventing chronic diseases in construction workers. In this study, 142 participants were divided into an experimental group (n=69) and a control group (n=73). The experimental group underwent individual lifestyle counseling, group workshops, and environmental interventions. After one year, significant improvements were observed in the total cholesterol, triglycerides, and HDL cholesterol levels. Then Salinas et al [34] evaluated a nutrition education intervention for construction workers to prevent chronic diseases. One hundred forty-two participants were randomly assigned to an experimental group (n = 69) and a control group (n = 73). The experimental group received nutrition education consisting of individual lifestyle counseling, group workshops, group counseling on healthy lifestyles, and environmental intervention. After one year, significant improvements were observed in waist circumference, total cholesterol, triglycerides, and HDL cholesterol levels. Groeneveld et al. [35] investigated the cost-effectiveness and cost-benefit of a lifestyle intervention for construction workers at risk of cardiovascular disease (CVD). The intervention, lasting 6 months, aimed to reduce CVD risk factors such as overweight, obesity, hypertension, and other related issues. The study found a significant and sustained decrease in body weight among participants. However, it also highlighted that the intervention was more expensive than usual care, costing society €145 per additional kg of body weight lost. The employer experienced a net monetary loss of €254 per employee. Despite the higher costs, the study emphasized the potential for targeted health interventions in this population to improve health outcomes and, possibly in the long run, to reduce costs related to absenteeism and healthcare use. In the study by Groeneveld et al. [36], an individually tailored lifestyle intervention among construction workers at risk for cardiovascular disease resulted in significant changes in dietary behaviors and smoking cessation after 6 months. The intervention led to a reduction in snack intake and increased fruit intake, which showed potential to mitigate cardiovascular risks among the participants. Chung et al [37] involved a pilot nutrition education program with 36 construction apprentices, focusing on increasing fruit and vegetable consumption—a critical factor in mitigating risks associated with metabolic diseases such as obesity, diabetes, and cardiovascular diseases. The intervention, comprising two 1.5-hour nutrition classes, demonstrated statistically significant improvements in dietary behavior and knowledge, which persisted over a three-month follow-up period. The study by Viester et al. [38] involved 314 male construction workers and focused on improving dietary habits and physical activity through a tailored six-month intervention. The intervention successfully reduced body weight, BMI, and waist circumference at six months, although these effects were not maintained at 12 months.

4. Discussion

The reviewed literature indicates that obesity, hypertension, and diabetes are the non-communicable diseases (NCDs) most significantly impacting productivity within the construction industry. These conditions are prevalent among construction workers and directly correlate with decreased productivity

and increased economic costs. The high prevalence of obesity among construction workers leads to various complications, including increased absenteeism, reduced mobility, higher susceptibility to workplace injuries, and other comorbid conditions like diabetes and hypertension. These issues compound, significantly reducing workplace efficiency and increasing health-related costs. Continuous and sustained health interventions focusing on diet and physical activity are necessary to mitigate these effects. As a prevalent health issue among construction workers, hypertension presents severe challenges due to its asymptomatic nature, which often leads to undetected conditions until severe health events occur. This condition is closely linked with significant productivity loss, emphasizing the necessity for regular health screenings to detect and manage hypertension early.

The impact of diabetes on productivity stems from its complications, which reduce workers' ability to perform their duties and increase absenteeism. Effective diabetes management in the construction industry is crucial and requires continuous monitoring and lifestyle adjustments, which are challenging to maintain given the industry's demands. The intersection of these health issues highlights the need for comprehensive health programs that include screening, targeted interventions, and consistent follow-ups to manage these diseases effectively. Furthermore, exploring the cost-effectiveness of such health interventions could encourage more widespread adoption by employers in the construction industry.

5. Conclusions

The findings underscore the urgent need for targeted health interventions and regular screenings within the construction industry to address the significant impacts of obesity, hypertension, and diabetes on worker productivity. Key challenges identified include sustaining the benefits of health interventions over the long term, the high costs associated with comprehensive health programs that may deter implementation despite potential long-term savings, and a need for more targeted interventions that address specific health behaviors and risks prevalent among different subgroups within the construction workforce. Future research should focus on integrated health programs that are effective in managing these conditions and cost-effective to ensure broad implementation. Collaborative efforts involving all stakeholders—healthcare providers, employers, and workers—are essential to developing and sustaining health initiatives that effectively tackle these critical NCDs. Such measures will not only improve the health and well-being of the workers but also enhance the overall productivity and economic stability of the construction industry.

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