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# Factors Leading to Occupational Injuries and Illnesses among Hispanic Construction Workers in The United States: A Systematic Review

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## ABSTRACT

### Factors Leading to Occupational Injuries and Illnesses among Hispanic Construction Workers in The United States: A Systematic Review

By

Luis Felipe León Cubides

December 2016

#### **Background**

As the number of Hispanic migrants continues to increase in the United States, their representation in high risk jobs such as in the working industry is also on the rise. High rates of injuries and fatalities seem to disproportionately impact this minority group compared to construction workers from other racial groups. Some factors have been particularly involved in this trend without adequate addressed interventions from the U.S. government or construction employers.

#### **Objective**

The primary purpose of this study is to conduct a systematic review of research literature with regards to factors leading to occupational injuries and illnesses among Hispanic construction workers in the United States to better catalog the most common factors affecting this minority working population.

## **Methods**

A literature search of the databases Global Health, Medline and PubMed was conducted. The author sought literature describing occupational factors or hazards among Hispanic construction workers in the U.S. Inclusion criteria included free full text and full text articles, studies conducted in the past 20 years, Hispanic or Latino construction workers in the United States as primarily studied population, reported occupational factors, and publications in English and Spanish. Exclusion criteria included articles without a full text, studies conducted more than 20 years ago, studies conducted in countries other than in the U.S., systematic reviews, and letters to the editor. Full texts were then reviewed by the author for applicability to the scope of the study, rejecting articles not meeting the inclusion criteria. Sixteen articles met all the criteria and were therefore included in this review.

## **Results**

The most common reported factors or hazards were observed in seven articles including the lack of personal protective equipment (PPE) available for construction workers as well as fear of retaliation when demanding safe conditions. Other factors reported in 5 articles were the employers' unsafe demands of productivity over safety, followed by no training in safety, and inadequate safety training reported in 4 articles.

## **Conclusions**

Despite efforts by the U.S. government to reduce occupational injuries and fatalities among Hispanic construction workers, this specific minority group seems to experience unique risks while on the job. Results from this systematic review may contribute to the adoption of specific

interventions and further research aimed at reducing occupational incidents and targeting regulatory and federal and state agencies, as well as employers, to better understand workplace hazards faced by Hispanic construction workers. The sharing of this information could result in a provision of healthier and safer work environments.

FACTORS LEADING TO OCCUPATIONAL INJURIES AND ILLNESSES AMONG  
HISPANIC CONSTRUCTION WORKERS IN THE UNITED STATES: A SYSTEMATIC  
REVIEW

by

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Factors leading to occupational injuries and illnesses among Hispanic construction workers in  
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### Author's Statement Page

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Luis Felipe León Cubides

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## **Background**

According to the United States Department of Labor, 4,821 workers were killed on the job during the year 2014 the construction industry sharing the highest percentage of fatalities at 20.5% or 899 worker deaths (United States Department of Labor, 2015). Despite ongoing and stringent standards, set by the Occupational Safety and Health Administration (OSHA), to provide a safe and healthy working environment, thousands of workers experience injuries, illnesses and fatalities on a daily basis. Although construction experienced the loss of 2.8 million jobs between 2007 and 2010 due to the economic recession and tougher immigration laws, it gained more than 200,000 jobs between 2010 and 2013 (Gillula, 2015).

Hispanics accounted for a large portion of construction workers in the United States, comprising of 27.3% of employment for the construction industry in 2014, closely followed by agriculture, fishing and hunting with 23.1% of Hispanics (United States Bureau of Labor Statistics, 2015). These blue-collar occupations have been dominated by Hispanics, growing in numbers in the past 20 years, especially for construction where figures from the Center for Construction Research and Training (2014) show an incredible increase of Hispanic workers as a percentage of the construction industry from 9% in 1990 to 24% in 2010 (figure 1). Furthermore, figures from the U.S. Bureau of Labor Statistics (2016) showed that among working men, Hispanics have a higher concentration in the construction industry (19%) in comparison to Whites (13%), African-Americans (7%), or Asians (3%).

Figure 1. Hispanic workers as a percentage of construction and all industries, selected years, 1990-2010 (All employment)



Source: The Center for Construction Research and Training, 2014

This trend among construction workers is not only growing because of the demand for new homes, buildings, roads and other construction-related projects in the nation, but also because of the constant migration of Latinos to the United States who are looking for low skilled, high risk jobs, where they can be hired despite their vague experience in the field, in a country with a weak regulatory processes when hiring this type of workers. By July 1<sup>st</sup>, 2015, there were 56.6 million Hispanics in the U.S., becoming the largest minority group and comprising 17.6% of the U.S. population. In addition to this, the number of Latinos added between 2014 and 2015 accounted for 1.2 million or almost half of the total added U.S. population in these years. The

percentage of Hispanics in the nation is expected to increase by the year 2060 to 28.6% (United States Census Bureau, 2016).

It is important to note that the numbers of illegal immigrants has increased in recent years as estimates of the undocumented immigrant population made up more than 11 million in 2012, Mexico being the number one contributor of unauthorized immigrants accounting for 5.9 million or almost half of this population (Pew Research Center, 2015). These undocumented immigrants constitute a significant proportion of the U.S workforce, where in 2006, 15% of U.S. workers were foreign-born and roughly 6.3 million were undocumented (Baron, 2008). Studies indicated that the foreign-born are more likely to work in high risk industries such as construction, meatpacking and poultry processing, landscaping, and agriculture in comparison to natives, as immigrants are employed in those sectors with relatively high injury and fatality levels (Orrenius, 2009).

Whether documented or not, almost half of this minority group come from Mexico and other Spanish-speaking countries (United States Census Bureau, 2016), and face numerous challenges in the workforce. These are, including but not limited to: a different cultural environment and a limited or absent knowledge of the English language with poor literacy levels, posing a significant risk when trying to communicate to employers or to other workers, when attending training provided only in English, or when trying to read safety materials available in a language they cannot comprehend (Brunette, M., 2004 & Brunette, M., 2005 ). Farooqui, Ahmed and Saleem (2007) included the difference in language and culture as possible reasons for excessive occupational injuries among Hispanic construction workers. They also discussed that Latinos are more prone to staying in high risk jobs than U.S. born workers because they fear losing their jobs if they do not do what their employers instructed them to do. A similar

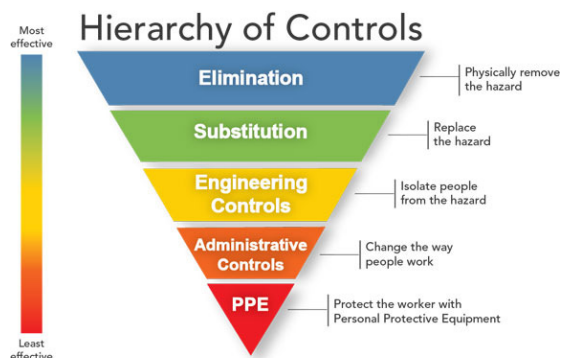
conclusion was provided by Orrenius and Zavodny (2009), where the likelihood of experiencing injuries and fatalities is more common among Hispanic immigrants than in natives, as they hold more dangerous occupations. This particular study also indicated an inverse relationship between the ability to speak and understand a language and the type of occupation in which they work. Therefore, immigrants in the U.S. who do not speak English fluently tend to work in high risk jobs, and those who do speak English fluently work in safer jobs.

Construction workers are exposed to numerous hazards in the workplace and therefore face an increased chance of experiencing injuries, illnesses and disabilities. In this manner, occupational health plays a pivotal role on health and safety of workers by focusing on primary prevention of hazards (World Health Organization, 2016). Health hazards in the construction industry could be classified as follows: 1) Chemical: including vapors, fumes, dusts, gases, mists, and fibers. 2) Physical: including noise, inadequate postures, repetitive motion, radiation, and temperature. 3) Biological: including bloodborne pathogens, poisonous animals and plants, fungi, and bacteria (OSHA, 2012). Some public health and industrial hygienists rely on environmental and personal air monitoring devices in construction sites for detecting the presence of hazards from the environment such as: sampling tubes and passive badge samplers in cases of exposure to carbon monoxide and chlorine, filter cassettes and instant swab wipes when exposed to lead and asbestos, sound level meters and personal dosimeters when exposed to noise, film badge dosimeters and Geiger counters when exposed to radiation, and using thermometers and wet bulb globe temperature devices when exposed to heat/humidity and cold conditions (OSHA, 2012). Certain occupations in the construction industry show an increase in the exposure to specific hazards. For example, insulation workers are exposed to synthetic fibers and asbestos. Carpenters are exposed to repetitive motion, noise and inadequate postures. Painters are

exposed to chemicals in the form of solvent vapors and paint additives. Electricians may be exposed to solder fumes, heavy loads and inadequate postures (Brunette, M., 2004). Safety programs have been developed to reduce or eliminate deleterious outcomes when workers are exposed to physical, chemical and biological hazards, although it has been challenging to completely recognize all hazards in the construction industry. Albert, A., Hallowell, M.R., & Kleiner, B.M., (2014), found that only 66% to 89% of the hazards in construction have been recognized, which represents deficient safety programs when attempting to manage safety risks.

Safety procedures must be followed by workers at all times while at the construction site by following the Hierarchy of Controls (figure 2), from least effective to most effective: the wearing of personal protective equipment including approved respirators, hearing protection, safety goggles, hard hat, and work suits; implementing administrative and engineering controls, by taking breaks when workers are exposed to extreme temperatures and conducting dust suppression when using mechanical ventilation; replacing and physically removing the hazard, by selecting a less toxic chemical or subcontracting jobs to more trained people, such as when managing asbestos (The National Institute for Occupational Safety and Health, NIOSH, 2016). The implementation of these controls lead to safer working environments and thus, a reduced risk of injuries and illnesses.

Figure 2. Hierarchy of Controls



Source: The National Institute for Occupational Safety and Health

OSHA's standards aim to protect workers and prevent occupational injuries, including specific construction training requirements to be provided to employees in certain topics such as: emergency action plans, occupational noise exposure, ionizing radiation, gases, vapors, fumes and mists, ventilation, hazard communication, chemical handling, personal protective equipment, and other standards. Likewise, a proficiency assessment, as well as a course certificate, should be provided to each worker completing the training course (Occupational Safety and Health Administration, 2015). However, because of language limitations among Latino workers, any effort to properly train employees in a language other than their native one, invalidate the nature of these efforts. It is the employer's responsibility to close a communication gap during training by providing safety materials and communicating to their employees in a language that employees fully understand.

Although injuries in the construction field rise and fall irregularly in percentage, the number of non-fatal injuries and illness among Latino construction workers increased from 17,715 in 1992 to 33,930 in 2006 2007 (Dong, X. S., Wang, X., & Daw, C., 2010). In contrast, rates of non-fatal injuries and illnesses steadily declined from 326.8 per 100,000 full time



equivalent workers between 1992 and 2002, to 206.5 per 100,000 full time equivalent workers between 2003 and 2007 (The Center for Construction Research and Training, 2013). Although the construction industry constituted only 8.9% of the U.S. workforce during 2014, it shared 19% of the nation's work-related deaths (U.S. Bureau of Labor Statistics, 2015). These numbers illustrate the unequal hazards Latinos face in the construction workplace, and therefore, demonstrate a need for specific research and interventions aimed at reducing the ongoing number of fatalities, injuries and illnesses among this minority group. Data from the Centers for Disease Control and Prevention (2008), highlighted work-related injury deaths among Hispanic workers during 1992-2006 totaled 11,303, approximately 13% of all U.S. work-related injury. The annual work-related injury fatality rate for Latino workers during this period exceeded the rate for all U.S. workers, with the exception of 1995. Work-related injury fatality rates in 2006 was the highest for Hispanic workers at 5.0 per 100,000, followed by 4.0 for non-Hispanic white workers, and 3.7 among non-Hispanic black workers.

Some studies have discussed approaches for reducing the disproportionate number of injuries and fatalities among Latino construction workers. The first and most important challenge as described by Brunette (2004) is determining exactly where Latinos are working, their occupational conditions, and the true representation and magnitude of their injuries. With little research in the U.S. in regards to this specific topic, in addition to the underreporting of injuries among this group of workers, addressing this public health problem becomes a challenge by itself. Moreover, underreporting frequently occurs among workers with insecure immigration status and limited permission to work. Dong et al., (2011) analyzed data from 1992 to 2006 in relation to fatalities, illnesses and injuries in construction workers. Findings suggested small construction establishments were less likely than large establishments to report work-related

injuries, and this under-reporting is more severe for Latino workers than for White workers. The authors estimated that only 8-16% of injuries among Latino construction workers were reported compared to 21-25% among white non-Hispanic workers. A similar finding is described in the “Worker Health Chartbook” explaining that some segments of the labor force, including temporary and immigrant workers, are not a focus of ongoing surveillance and research programs; therefore allowing underreporting of injuries among these group of workers (NIOSH, 2004).

## **Objective**

Hispanic construction workers comprise a large proportion of workers in the United States. They face numerous occupational challenges and high risks for being injured on the job, more than any other race. Taking into account that numbers of Hispanic immigrants keep rising and that injuries and fatalities among Latino construction workers have kept a steady pattern, this study aims at conducting a systematic review of the literature describing factors leading to injuries and illnesses as reported by Hispanic construction workers in the United States. Ultimately, a more concise catalogue of common factors affecting this minority group would assist future researches in understanding and improving the health and safety of Hispanic workers.

Systematic reviews follow a strict process to find all the research conducted on a specific topic and offer a relevant summary of evidence, describing and critically evaluating it in the context of what is already known (Liberati, A., Altman, D.G., Tetzlaff, J., Mulrow, C., Gøtzsche, P.C., et al., 2009). By conducting this systematic review, this author and graduate student aimed to provide a synthesis of studies examining Hispanic construction workers' experiences of factors or hazards that negatively impact their safety and health. Although the underreporting of injuries within this minority group may influence the generalizability, it can be utilized in public health to provide an in-depth understanding of occupational perspectives from this minority working group to create better policies and promote socio-cultural understandings towards a safer working environment.

## Methods

Objective, methods, inclusion/exclusion criteria and other details of this systematic review were identified and documented in advanced in a protocol already reviewed and approved by the National Institute for Health Research and the Centre for Reviews and Dissemination, University of York, publication number 42016043256, available at:

[http://www.crd.york.ac.uk/PROSPERO/display\\_record.asp?ID=CRD42016043256](http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42016043256) .

This systematic review started by framing the following question: Which are the most common factors leading to occupational injuries and illnesses as reported by Hispanic construction workers in the United States? The terms Hispanic and Latino were interchangeably used during this study. A literature search was performed during October 2016 via Georgia State University library in databases Global Health, Medline and PubMed. Primary outcomes for this study were the factors which could result in occupational injuries and illnesses among Hispanic construction workers.

Key search words based on the research question for the systematic review were screened in including published literature between October 01, 2006 and October 15, 2016, as follows:

- Hispanic construction workers
- Hispanics AND occupational injury
- Hispanics AND occupational illness

The inclusion criteria for this study included: free full text and full text articles; studies conducted in the past 20 years; Hispanic or Latino construction workers in the United States as primarily studied population; reported occupational factors; and publications in English and Spanish. Exclusion criteria included: articles without a full text; studies conducted more than 20

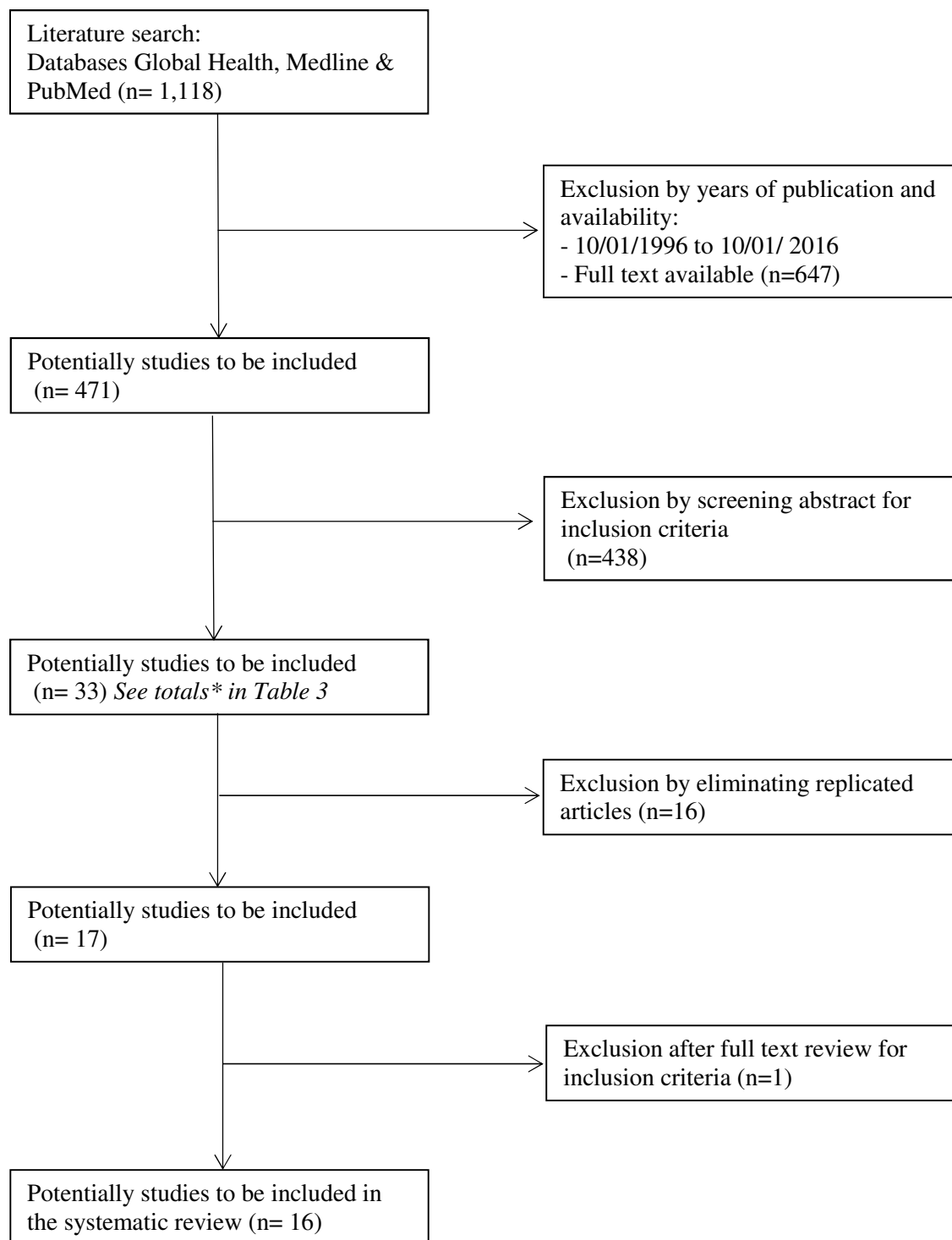
years ago, (1995 and older); studies conducted in countries other than in the U.S.; systematic reviews; letters to the editor. Full texts were then reviewed by the author for applicability to the scope of the study, rejecting articles not meeting the inclusion criteria.

The search of Global Health, Medline and PubMed databases provided 1,118 studies. Among these citations, 647 were rejected due to ineligibility with years and full text availability. After reviewing the abstracts for inclusion criteria, 438 citations were eliminated not meeting criteria. There were 16 articles discarded as duplicates. One publication was then eliminated after full text review showed that inclusion criteria were not met. 16 studies met inclusion criteria and were therefore included in the systematic review.

The flowchart below (figure 3) illustrates the number of publications searched, assessed for eligibility and included in this study.

Literature search and data collection were conducted by one graduate student during October 2016 and November, 2016, where abstracts were assessed for inclusion and exclusion criteria and relevance within the studied topic. A full text reading was then performed for further description of the primary outcome for the systematic review. No funding was provided to the author for this study.

Figure 3. Flowchart of study selection



## Results

After reviewing 447 available databases at the Georgia State University library, three were chosen as they were identified as the most relevant for conducting a public health systematic review for the topic of this study, as follows: Global Health, Medline and Global Health. A total of 16 articles were selected for the systematic review out of an initial identification of 1,118 possible citations from reviewed databases during the first and second week of October 2016.

Global Health is the only specialized indexing, bibliographic and abstracting database in the public health field and the practice of biomedicine and life sciences. Keyword search in Global Health provided 44 citations. After excluding articles by selecting free full text and full text, as well as years of publication including 10/01/1996 to 10/01/2016 (exclusion #1), 20 articles remained to be reviewed. After title and abstract reviewing process for meeting the other inclusion criteria and relevance to the studied topic (exclusion #2), such as the United States as a primary setting and Hispanic construction workers as studied participants, two articles were included. The Medical Literature Analysis and Retrieval System, or Medline is a database covering bibliographic information of medicine, dentistry, biochemistry, and health care. Keyword search by using Medline retrieved 800 citations. After excluding articles by selecting free full text and full text, as well as years of publication including 10/01/1996 to 10/01/2016 (exclusion #1), 212 articles remained to be reviewed. After title and abstract reviewing process for meeting the other inclusion criteria and relevance to the studied topic (exclusion #2), 3 articles were finally identified. PubMed is maintained by the National Center for Biotechnology Information, containing references on biomedical topics and life sciences. Keyword search by using PubMed showed 274 citations. After excluding articles by selecting free full text and full

text, as well as years of publication including 10/01/1996 to 10/01/2016 (exclusion #1), 253 articles remained to be reviewed. After title and abstract reviewing process for meeting the other inclusion criteria and relevance to the studied topic (exclusion #2), 28 articles were identified in the systematic review, for a total combined among all three databases of 33 articles (Table 1). After adjusting for replicated articles, 17 articles were then fully read. Only 1 article was rejected after the full text reading due to non-compliance with inclusion criteria, yielding a total of 16 studies included in this study.

Table 1. Summary of the distribution of citations among databases by using specific keywords and exclusion criteria

<b>Keywords</b>	<b>Global Health</b>	<b>PubMed</b>	<b>Medline</b>	<b>Total</b>
Hispanic Construction Workers	10	66	18	94
After exclusion #1	9	60	6	75
After exclusion #2	2	16	1	<b>19*</b>
Hispanics AND Occupational Injury	26	160	349	535
After exclusion #1	7	150	95	252
After exclusion #2	0	11	1	<b>12*</b>
Hispanic and Occupational Illness	8	48	433	489
After exclusion #1	4	43	111	158
After exclusion #2	0	1	1	<b>2*</b>

\*See flowchart of study selection (figure 3)

A quality assessment was conducted for the 16 articles utilized in the systematic review, including: a clearly stated purpose, relevant background/literature reviewed, applicability of the study to the research question, sample described in detail, results reported in statistical significance, and conclusions appropriate to study methods and results (Table 2).



Table 2. Quality assessment for screened and included articles

Author (year)	Clearly stated purpose?	Relevant background /literature reviewed?	Does the study apply to the research question?	Sample described in detail?	Results reported in statistical significance?	Conclusions appropriate to study methods and results?
Anderson (2000)	Yes	Yes	Yes	Yes	N.A. <sup>†</sup>	Yes
O'Connor (2005)	Yes	Yes	Yes	Yes	N.A. <sup>†</sup>	Yes
Robertson (2007)	Yes	Yes	Yes	Yes	N.A. <sup>†</sup>	Yes
McGlothlin (2009)	Yes	Yes	Yes	Yes	N.A. <sup>†</sup>	Yes
Menzel (2010)	Yes	Yes	Yes	Yes	N.A. <sup>†</sup>	Yes
Roelofs (2011)	Yes	Yes	Yes	Yes	N.A. <sup>†</sup>	Yes
Rabito (2011)	Yes	Yes	Yes	Yes	Yes	Yes
Arcury (2012)	Yes	Yes	Yes	Yes	N.A. <sup>†</sup>	Yes
DeSouza (2012)	Yes	Yes	Yes	Yes	N.A. <sup>†</sup>	Yes
Grzywacz (2012)	Yes	Yes	Yes	Yes	Yes	Yes
Arcury (2014)	Yes	Yes	Yes	Yes	N.A. <sup>†</sup>	Yes
Arcury (2015)	Yes	Yes	Yes	Yes	N.A. <sup>†</sup>	Yes
Marin (2015)	Yes	Yes	Yes	Yes	N.A. <sup>†</sup>	Yes
Teran (2015)	Yes	Yes	Yes	Yes	N.A. <sup>†</sup>	Yes
Hallowell (2016)	Yes	Yes	Yes	Yes	N.A. <sup>†</sup>	Yes
Diaz Fuentes (2016)	Yes	Yes	Yes	Yes	N.A. <sup>†</sup>	Yes

<sup>†</sup>N.A. Not applicable

Quality assessment of questions for 16 included studies was conducted, showing that 100% of the articles met these criteria for 5 questions, except for the question assessing results

reported in statistical significance, where only 2 articles (13%) were quantitative in nature and reporting results including confidence intervals and *P*-values. The remaining 14 articles were qualitative; therefore, no results were reported in statistical significance.

Studies were limited to settings in the United States, where most of them were conducted in North Carolina (n=5), followed by Louisiana (n=3) and Massachusetts (n=2). There were 2 studies conducted in Colorado; one of those studies was also conducted at the same time in Minnesota. Remaining studies were conducted in the District of Columbia (n=1), Nevada (n=1), Washington (n=1), and another one conducted in both California and Pennsylvania (n=1). In regards to time, six studies (38%) were conducted between 2000 and 2010, and ten studies (62%) took place between 2011 and 2016. All the studies but two addressed occupational injuries (Robertson, C., Kerr, M., Garcia, C., & Halterman, E., 2007 & Rabito, F. A., Perry, S., Salinas, O., Hembling, J., Schmidt, N., Parsons, P. J., & Kissinger, P., 2011). The study conducted by Rabito (2011) focused on the lack of facemask use among Hispanic workers exposed to lead and their toxic effects when high levels are present in the blood; Robertson (2007) explored hearing protection practices among Latino construction workers to develop a theory-based intervention for these employees. There was one study conducted utilizing only youthful ( $\leq 21$  years old) Hispanic construction workers as participants (O'Connor, T., Loomis, D., Runyan, C., dal Santo, J. A., & Schulman, M., 2005). As for the type of study, three were prospective (19%), and the other 13 were cross sectional studies (81%). Methods for collecting data included focus groups (38%); questionnaires (38%); and interviews (19%). Other methods included chart reviews, phone calls, tests, blood samples, interactive voice responses, daily logs, and photovoice.

The most common factors or hazards found in the articles as reported by the Hispanic construction workers were: lack of PPE available for construction workers (n=7), as well as fear

of retaliation when demanding safe conditions (n=7); employers' unsafe demands of productivity over safety (n=5); these are followed by: no training in safety (n=4), inadequate safety training (n=4) and need for the job (n=4); not wearing PPE (n=3), workers' risk underestimation (n=3), language barrier when communicating with other non-Hispanic workers or supervisors (n=3), lack of understanding of the Workers' Comp system (n=3), no safety programs for employees (n=3), and exploitation based on ethnicity or migratory status (n=3). Afraid of losing job if asking for PPE (n=2), macho risk behavior (n=2), negative supervisor pressure (n=2), intimidation (n=2), precarious employment (n=2), and life stress as a distractor (n=2). Other factors mentioned only once within the studies included: the provision of safety training only in English, long working hours, unclear safety roles and responsibilities, overconfidence, no safety enforcement, injury underreporting, fear of losing their job, and no healthcare coverage by the employer.

Individual characteristics and outcomes from the 16 selected studies are presented in Table 3, chronological order.

Table 3. Characteristics and outcomes of articles included in the systematic review

Author	Year	Title	Type of Study	Method	Sample and Setting	Reported Factors or Hazards
Anderson	2000	Injury and Employment Patterns Among Hispanic Construction Workers	Cross Sectional	Chart reviewing and telephone follow-up	643 construction workers, Washington DC	Lack of PPE; risky physical environments; safety training in English
O'Connor	2005	Adequacy of Health and Safety Training Among Young Latino Construction Workers	Cross Sectional	Interviews	50 Latino youth construction workers, North Carolina	Inadequate safety training; low level of English communication skills; no provision of PPE
Robertson	2007	Noise and hearing protection: Latino construction workers' experiences	Cross Sectional	Semi-structured interview and focus groups	15 Latino construction workers, Minnesota and Colorado	Inadequate training on hearing loss and protection; do not care about hearing protection; risk underestimation; willing to work in unsafe conditions; PPE not used among recent immigrants as was not used in their native countries; avoid asking for hearing protection fearing losing jobs; and macho perceptions when wearing PPE
McGlothlin	2009	Safety Training Issues for Hispanic Construction Workers	Cross Sectional	Survey	42 foreign-born Hispanic construction workers, Louisiana	Lack of knowledge or safety training; low English comprehension of safety terms; workers carelessness; height/falls; and not using the proper safety equipment.
Menzel	2010	Latino Worker Perceptions of Construction Risks	Cross Sectional	Focus groups	30 Latino construction workers, Nevada	Economic pressure to work quickly; lack of appropriate equipment and safety tools; lack of or inadequate safety training and equipment use; economic competition along with other construction workers for just a few jobs; lack of sufficient skills in the chosen construction trade; exploitation; immigration status; language/communication skills; workers' compensation; and health literacy

Roelofs	2011	A qualitative investigation of Hispanic construction worker perspectives on factors impacting worksite safety and risk	Cross Sectional	Focus groups	12 Hispanic construction workers, Massachusetts	Pressure to work fast; inadequate PPE or no equipment; inability to read safety signs; inadequate safety training or not helpful; negative supervisor's pressure on workers; lack of respect for workers; atmosphere of intimidation; need for the job; fear of retaliation in opposing unsafe conditions
Rabito	2011	A longitudinal assessment of occupation, respiratory symptoms, and blood lead levels among Latino day laborers in a non-agricultural setting	Prospective Cohort	Questionnaire; field or phone surveys; blood samples	102 Latino migrant workers, Louisiana	Low PPE use and declined facemask use
Arcury	2012	Work Safety Climate and Safety Practices Among Immigrant Latino Residential Construction Workers	Cross Sectional	Questionnaires	119 Latino residential construction workers, North Carolina	Poor instructions on safety when hired; lack of praised for safe conduct; non-frequent safety meetings; low employer collaboration towards their job safety
DeSouza	2012	Novel approaches to development, delivery and evaluation of a peer-led occupational safety training for Latino day laborers	Prospective Cohort	Pre and post-tests; training; one-on-one interviews	125 Latino day laborers, Seattle	Inappropriate PPE use and lack of it; lack of occupational safety training; no workers' rights knowledge; wage theft; fear of retaliation
Grzywacz	2012	Occupational injury and work organization among immigrant Latino residential construction workers	Prospective Cohort	Interviews; Community-based, Interactive Voice Response	119 Latino construction workers, North Carolina	Long working hours; precarious employment; and unable to communicate with supervisor; injury underestimation
Arcury	2014	Occupational Safety Beliefs among Latino Residential Roofing Workers	Cross Sectional	Interviews	10 Latino construction workers, North Carolina	Lack of PPE use and training; low perception of PPE use; working for smaller companies with no risk prevention; physical demands on the job; little formal training in work safety; need for work; general life stress as a distractor; no access to the Workers' Comp system
Arcury	2015	Work safety climate, personal protection use, and injuries among Latino residential roofers	Cross Sectional	Questionnaire and daily logs	89 Latino residential roofers, North Carolina	Low perceptions of risky safety climate; low personal protection equipment use

Marin	2015	Results of a community-based survey of construction safety climate for Hispanic workers	Cross Sectional	Survey	107 Hispanic construction workers, Massachusetts	Supervisor pressure; safety over productivity; retaliation; inadequate safety training; lack of prevention equipment; unclear safety roles and responsibility definitions
Teran	2015	Promoting adoption of fall prevention measures among Latino workers and residential contractors: formative research findings	Cross Sectional	Interviews and Focus groups	31 Latino construction workers, California and Pennsylvania	Overconfidence; poor perception of individual responsibility for safety; workers' resistance to use PPE; need to work and fear of speaking up; belief that contractors prefer speed over safety; limited or non-existent safety programs; lack of fall prevention equipment; pride over safety; contractors concerned about finishing the job quickly; lack of training; lack of enforcement; inconsistent safety regulations
Hallowell	2016	Exploring fundamental causes of safety challenges faced by Hispanic construction workers in the US using photovoice	Cross Sectional	Photovoice and Focus groups	17 Hispanic workers, Colorado	Employers' pressure to complete jobs quickly; inadequate safety practices based on previous experiences in their home countries; assigned more dangerous tasks because of racism and discrimination; willing to accept high risk and dangerous tasks fearing losing their jobs; less likely to communicate with their employers, supervisors and co-workers, fearing of negative personal reactions; more likely to be distracted by family issues while at work because of their strong and broad family ties; more likely to ignore criticism because of machismo; more likely to underreport injuries for fear of losing their jobs; and less likely to ask for safety assistance when it is needed because of machismo & pride

Diaz Fuentes	2016	Latino Immigrant Day Laborer Perceptions of Occupational Safety and Health Information Preferences	Cross Sectional	Focus groups	48 laborers, Louisiana	Increasing sense of discrimination; eroding work opportunities; income and job insecurities; threat of replacing workers unwilling to accept work conditions; unavailable safe working conditions; threat of replacing workers; lower pay and limited employment access for women; limited or no employer coverage of healthcare costs; access to transportation and legal residency affecting access to health care; limited choice in occupational safety; lack of safety employees' programs
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## Discussion

The purpose of this study was to identify the most common factors leading to injuries and illnesses among Hispanic construction workers in the U.S. Results from the 16 articles included in this systematic review suggested that the most common factors or hazards affecting Hispanic construction workers in the U.S. are the lack of PPE available; employer's unsafe demands of productivity over safety; inadequate or no training in safety; need for the job; not wearing PPE; workers' risk underestimation; and language barrier, among others. Bridging the gap between language barriers and Hispanic workers has been somewhat unsuccessful as federal agencies may present only a partial set of safety information in Spanish or other languages.

Even though the participation of Hispanic construction workers is mainly concentrated in states such as New Mexico, Texas, California, and Arizona, per information provided by the Center for Construction Research and Training (2014), only one out of the sixteen studies was conducted in San Francisco, California, interviewing 8 Latino workers (Teran, S., Blecker, H., Scruggs, K., García-Hernández, J., & Rahke, B., 2015). This finding not only emphasizes the need for public health and occupational health research to adequately address injuries and illnesses among Hispanic construction workers, but also the need to focus on states with the highest percentage of Latino workers. In these states, more Latino workers may experience occupational incidents in high risk jobs within the construction industry. Although construction hazards to which they are exposed may not vary in nature, injury patterns might as most states have adopted OSHA-approved state plans (United States Department of Labor, 2016). These plans must be at least as effective as the federal plan, but some states including Washington, Oregon, Michigan and California have plans that include even more stringent standards or cover hazards not addressed by federal OSHA standards. California, for example, has developed



unique standards protecting workers from heat stress and to prevent explosions from combustible dust (McKnight, 2016). Moreover, OSHA-approved state plans tend to better respond to local needs, where states adopting these plans benefit from the addition of stricter enforcement to ensure worker safety.

The majority of the articles in the review did not comprise a large number of participants, which is common among qualitative studies. Therefore, this amount of studied people is far from representing the general Hispanic working population in the U.S. in terms of generalizability.

Training in safety and health regulations for construction employees in the United States is mandatory under OSHA Standards 29 CFR 1926.21. It is also required when applicable to the worker's tasks under standards: 1926.65 (hazardous waste operations and emergency response); 1926.454 (scaffolds); 1926.503 (fall protection); 1926.761 (steel erection); 1926.1060 (stairways and ladders); 1926.1207 (confined spaces), 1926.1430 (cranes and derricks). Nonetheless, results from this study show that no or inadequate safety training is provided to Hispanic construction workers by their employers. This behavior may be prevalent among small companies hiring temporary workers or laborers for a couple of days or hours, using no time in properly informing and training workers on safety and best practices in the construction industry. These workers sometimes rely on shadowing other workers' safety behaviors, which when coming from Hispanic counterparts are not adequate, or just utilizing whatever safety knowledge they have acquired from previous jobs in their native countries or the U.S.

If construction workers are exposed to hazards (chemical, radiological or mechanical) and irritants, the employer is responsible for not only providing them with appropriate PPE, but also maintaining in a sanitary and reliable condition wherever necessary.

OSHA standard 29 CFR - Part 1926.95, Subpart E describes how “...equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers” except for non-specialty safety-toe protective footwear, should be provided and replaced by the employer at no cost to the employees. Even though a hierarchy of controls (NIOSH, 2014) (figure 2) puts PPE at the bottom of the pyramid as the least effective method for protecting workers, this systematic review found that the lack of PPE available for construction workers was the most reported factor leading to unsafe working conditions at the construction site and thus, higher chances of injuries and illnesses.

Some frequently reported factors such as the fear of retaliation when demanding safe conditions, productivity over safety, lack of understanding of the Workers’ Comp system, and exploitation, are closely related to the undocumented migratory status of most Latino workers.

Undocumented construction workers are widely represented in the nation’s labor force, making up 14% of the undocumented labor force in 2012 (Passel & Cohn, 2015). Some constructions workers are scared to speak up requesting safety or training and will do whatever is necessary to keep their jobs. One of the studies in this review (Menzel & Gutierrez, 2010) explained how Latino construction laborers take risks due to the lack of legal resident status and the implication of losing their job. In the same study, Hispanic laborers and painters faced inhumane treatment and exploitation by their employers, related to threats of having an illegal status in the U.S. Disreputable incidents such as deceptions or portrayed betrayal from the employer could negatively increase fear of trusting federal agencies. The case in North Carolina on July 6, 2005 is an example. The U.S. Immigration and Customs Enforcement (ICE) distributed flyers in English and Spanish about an OSHA mandatory workplace safety meeting,

where later 48 workers, mostly Hispanics were arrested (Rathod, 2011), Therefore, Latino were discouraged from trusting information from the OSHA and other federal or state agencies.

The language barrier among Hispanic workers, as reported by 3 different studies in this review, makes sharing knowledge of work performance difficult and inhibits communication with the employer (de Souza et al., 2012). Employers hardly provide safety training in Spanish, so when they must operate complicated tools or machinery and handle chemicals, Latino non-bilingual workers run greater risks than other workers. The study by O'Connor (2005) expressed how higher rates of injury among Hispanic immigrants are explained by the language barrier. Workers with better English language ability received more training than workers with little or no knowledge of English, which prevents the provision of safety training and better communication for Hispanics.

There is a relatively low availability of Spanish-language training materials and safety information (Tinajero, 2005). As the author of this systematic review is fluent in both Spanish and English, he proceeded to review the OSHA website in Spanish (<https://www.osha.gov/spanish/>) comparing it to the one available in English (<https://www.osha.gov/>). The following gaps were found: most of the content in English is not available in the Spanish one; the translation of some paragraphs are grammatically incorrect and incomprehensible; some links such as the “Protecciones al Trabajador” or “The Whistleblower Protection Programs”, “Hazard Communication”, “OSHA Law and Regulations”, and most of the training documents are only available in English, among other main findings. Despite all data previously provided, in regards to the high prevalence of injuries among Hispanic construction workers, a federal agency such as OSHA could assist employers by having more available

materials and training information in a language that is familiar to Hispanic workers, which in return could be used to improve the health and wellbeing of this working group.

This study intended to identify the most common factors leading to occupational injuries and illnesses among Hispanic construction workers in the US. The systematic review was limited to a specific search strategy that focused specifically on Hispanic construction workers. Other strategies could have obtained a different set of articles that generally applied to Hispanics as a part of all workers.

## **Conclusions**

Hispanics play an important role in the labor force in of the United States. They are not only the largest minority group, but also are overrepresented in high risk jobs. Immigrant Latinos are young and in most cases, inexperienced in the construction industry. They are constantly mobilizing, looking for better working opportunities. As previously discussed, many Latino workers underestimate hazards in the construction industry and act tough to keep their “Macho” reputation, which has led to high rates of injuries and illnesses. Hispanic immigrant workers are at far greater risk of being killed or injured on the job than native-born workers. Furthermore, Hispanic construction workers are more willing to accept high risk jobs, sometimes because natives are not willing to hold such jobs, and sometimes because the need for a job blindly forces this minority group to accept hazardous workplace conditions.

The systematic review showed that chances of workplace injuries among Hispanic construction workers are due mainly to the presence of factors including: lack of PPE available, fear of retaliation when demanding safe conditions, employers’ unsafe demands of productivity over safety, inadequate or absent safety training, willing to perform high risk tasks or engaging

into unsafe conditions. Because of the need for the job, workers' risk underestimation, language barriers when communicating with other non-Hispanic workers or supervisors, and in some occasions, insecure immigration status may contribute to this issue.

Immigrant Hispanics often do not comprehend their rights in the workplace, and undocumented workers fear deportation if they complain about occupational safety. Unresolved or chronic health issues can limit Hispanics ability to maintain a productive performance on the job, especially when physically strenuous tasks are assigned to this group. Further, undocumented workers fear that a physician or clinic will report their immigration status to the U.S. Immigration and Customs Enforcement, which could divert them to seek lower quality of care or just not seek any healthcare at all. Also, Hispanic laborers have a need for working which makes them more vulnerable to accept high risks without requiring or asking for training or personal protective equipment, most frequently among small contractors.

Compliance with federal safety laws remains a great concern. Lack of stricter regulations among small firms which recruit most young Latinos construction workers, limited number of bilingual OSHA trainers and inspectors, lack of employer agreement with provision of training as required, and provision of PPE and safety equipment as mandated by current regulations, in addition to cultural and socioeconomic factors from Hispanic workers, are triggering an epidemic of occupational injuries and illnesses among both documented and undocumented Latino construction workers.

## **Recommendations**

Further research and surveillance systems are needed for occupational injuries and illnesses among Hispanic construction workers to precisely understand this problem. More

research could provide exact and more accurate numbers for federal and state databases in regards to the true representation of workplace incidents, and for future investigators aiming to reduce injuries and illnesses based on current and accurate data. Correspondingly, increasing the number of studies in the 5 or 6 states where there is a large representation of Latinos could better provide an approach to this public health problem and thus, generalizing results and extrapolating interventions to other cities in the U.S.

The government cannot just provide a handful of incomplete and poorly translated electronic sources aimed at educating a minority group, who in most cases have low literacy levels and do not have access to a computer or are not completely familiar with their use. Employers are the ones who should be educated in how to properly treat, train, and target safety among their Latino workers. To achieve this, federal agencies such as the OSHA must work on enforcing construction safety regulations and standards compliance, including small and large businesses. Also, increasing the number of bilingual inspectors and trainers, not only knowledgeable in the Spanish language but also in their culture and beliefs. Furthermore, assuring a safe and healthy work environment for all construction employees regardless of their language or background.

An urgent need for grants for research and programs utilized by public health, occupational safety and other professionals working in this area and aiming at investigating common factors and possible interventions directed at reducing the ongoing number of fatalities, injuries and illnesses among this minority group is required. Coordinated efforts by universities and the NIOSH could be used in expanding research programs addressing the health and safety risks of Latino workers in the U.S.

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