Review

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Immigrant populations, work and health—a systematic literature review

by Emily Q Ahonen, MPH,[1] Fernando G Benavides, PhD,[1] Joan Benach, PhD [1]

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Objectives This paper summarizes the information on immigrant occupational health available from recent studies, incorporating varied study designs.

Methods A systematic search was carried out in PubMed employing terms of interest to the study and related terms supplied by the same search engine. Articles were selected through the following process: (i) reading the title and abstract, in English or Spanish, for the period 1990–2005, (ii) reading of the entire text of selected articles; (iii) making a manual search of the relevant citations in the selected articles; (iv) eliminating articles without a focus on the themes of central interest (immigration, work, and health), and (v) reading and analyzing the definitive article set. No quality criteria were used in the article selection.

Results The location of studies was not straightforward and required careful thought about the search terms. The included 48 papers were often multifaceted and difficult to categorize. They generally came from countries historically associated with immigration and described occupational risk factors, health consequences, and the social, economic, and cultural influences on worker health. They were also based on data, surveillance, training, and preventive measures that were inadequate.

Conclusions Increased migration is a reality in industrialized countries all over the world, and it has social, political, and economic consequences for migrating groups, as well as for their sending and host societies. More reliable data, targeted appropriate interventions, and enforcement of existing regulations are necessary to improve the health of immigrant workers. Furthermore, studies in sending and developing countries should be encouraged to form a more complete understanding of this complex situation.

Key terms foreign worker; labor migrant; migrant worker; occupational disease; occupational health; occupational injury; occupational safety.

Increased migration is a reality in most developed countries all over the world. Currently, international human movements are increasing in volume in all major regions, with an accompanying increase in the politicization of migration (1). This process is sometimes seen as the positive result of technological advancement and a freedom from boundaries on human movement and commerce under globalization. In addition to these possible visions of this new reality, we are becoming more aware that increased migration has social, political, and economic causes and consequences for migrating groups and their sending and host societies (1, 2).

While immigration tends to be classified officially in terms of its causes, such as labor migration, refugee movement, or family regrouping, it is currently thought that migratory movement is generally motivated by a combination of macro (large, institutional factors) and micro (networks, beliefs, and the like that exist among the migrants themselves) structural factors that interact (1). Even so, given the economic circumstances that can encourage immigration, there is an important connection to be made between migrating populations, work, and the effect that both foreign status and worker status have on the health and quality of life of these groups. It is probable that these newly arrived persons find themselves in positions of special occupational vulnerability, with high levels of precarious employment and poor work conditions.

Considering the magnitude of current human movement, we know relatively little about the links between work and health in immigrant groups. Reviews on this topic are scarce and with a limited scope. They have tended to focus on specific collectives, which are clearly useful for understanding the conditions of these groups. However, such reviews do not bring to light the commonalities that can exist across immigrant worker collectives that could direct further research and advocacy at a structural level. Other descriptive reviews are not described as such and include little information about the search process, factors that are important for locating

1 Occupational Health Research Unit, Universitat Pompeu Fabra, Barcelona, Spain.

Reprint requests to: Emily Q Ahonen, Carrer Doctor Aiguader 88, ES-08003 Barcelona, Spain. [emily.ahonen@upf.edu]

them, and an understanding of their scope. Finally, existing reviews tend to focus on the situation of immigrant collectives in one area or nation. While useful in their specificity, it is also important to maintain a broad view of a global phenomenon. Even though every location has its peculiarities, knowledge of experience in different contexts could do much to situate us within the world of immigrant workers and occupational health. This current hole in scientific knowledge leaves open the possibility of misunderstanding important health-related processes and situations and letting immigrant groups continue to work in harmful conditions.

As part of a larger study, we undertook a comprehensive literature review to determine what is known and what has been left undescribed in the world of immigration, work, and health. Although we have not highlighted areas in which we believe more study or focus is needed, in this review we have not individually critiqued the included studies, nor were quality criteria used for inclusion or exclusion purposes. Instead, we have provided a summary of the included studies and the issues they raise. Our aim was to provide a view of the situations of different migrant collectives in different contexts in order to allow readers to focus on issues with the greatest interest and to critique and apply these issues accordingly in their own context.

Methods

In this review we consider "immigrant" to mean non-nationals and ethnic minority groups that include substantial numbers of recently immigrated persons. This outlook was chosen to allow us to examine the reality of immigration and work in multiple contexts. We entered the words immigrant, migrant, ethnic minority, occupational health, occupational injury, and worker into the MESH listing of key words in PubMed. From these listings, other key words were selected. Using the AND and OR functions to search electronically indexed journals listed in PubMed, we searched systematically for the period 1990–2005, limiting the search to the article title and abstract and to humans to identify potential material. Because, at that time, PubMed allowed limitation for only one language, we did not limit the language of the publications in the search, but only articles in English or Spanish were selected in that these were the languages in which the reviewers were fluent. In addition, we entered individual combinations of key words to ensure saturation of the material encountered.

The use of a first list of words related to immigration (immigrant, migrant, ethnic minority, transient, illegal migrant, labor migration, migrant worker, nomad, minority group, nationality, foreign worker), selected in a disjunctive manner (OR), and the addition (AND) of a second list of words related to health (employee health, occupational injury, industrial hygiene, industrial health, occupational safety, occupational disease, worker health, occupational health), also used in a disjunctive manner (OR), resulted in 267 articles. On the basis of the electronic abstract records, we eliminated articles that did not have immigrant populations and some occupational health factor as central issues. However, if the abstract mentioned a context that implied immigrant groups, such as an intervention in a language not native to the study site, we assumed that it dealt with an unintegrated ethnic or national group and included the study. Our selection criteria were solely theme-based, and we did not employ quality standards for inclusion. We then obtained the full text for the papers of interest, and followed up cited references that appeared applicable for the same time period, obtaining a total of 63 papers in full text. Fifteen were excluded after the entire document was read. At the end of this process, the number of included studies was 48.

Results

The nature of the articles was extremely diverse. Table 1 summarizes the designs of the studies. Researchers from the United States, Australia, Canada, and Sweden contributed 90% of the included studies. The investigators used descriptive, quantitative, qualitative, and mixed methods to study the risks workers face, the effects these risks have on worker health, and the circumstances that may contribute to causing, improving, and deteriorating the work conditions and health of immigrant workers.

Within this diversity of studies, those explicitly describing injuries in immigrant groups emerged as a substantial subcategory of research (N=10). When combined with studies describing the exposures and occupational health problems of certain collectives, they offered excellent examples with which to examine the complexity of the relationships between work and the broader social, legal and economic situation and problems of immigrant workers. As such, these issues served as the main focuses of our review.

Importance of work

Work, as a central aspect of many immigrants' experiences, was reflected by several authors as also playing a central role in their health. For example, one study of unemployment and sick leave in Sweden (3) found that more than half of the immigrant study participants considered their health to be poor, and they experienced various physical and mental health disorders. Many of

Table 1. Characteristics of the 48 included articles related to the occupational health of immigrant workers, in chronological order.

Author	Country studied	Type of study	Group studied
Mobed et al, 1992 (30)	United States	Review	Agricultural workers
Wilk, 1993 (28)	United States	Review	Agricultural workers
Grimsley & Adams-Mount, 1994 (37)	United States	Cases report	Construction workers
Corvalan, 1994 (19)	Australia	Original, quantitative	Any
Lantz et al, 1994 (29)	United States	Original, qualitative	Agricultural workers
Bollini & Siem, 1995 (22)	multi-location	Review	Any
Elkeles & Seifert, 1996 (4)	Germany	Original, quantitative	Any
Jackson, 1996 (6)	Australia	Original, qualitative	Nurses
Phoon, 1997 (34)	Australia	Review	Any
Wu et al, 1997 (10)	Taiwan	Original, quantitative	Any
Rosmond et al, 1998 (9)	Sweden	Original, quantitative	Any
Gannagé, 1999 (31)	Canada	Original, qualitative	Garment workers
Dembe, 1999 (50)	United States, some European data	Review	Any
Peek-Asa et al, 1999 (18)	United States	Original, quantitative	Retail workers
Sass, 2000 (49) [a]	Taiwan	Review	Any
Cho & Hummer, 2001 (46)	United States	Original, quantitative	Asian and Pacific Islanders
Faucett et al, 2001 (33)	United States	Mixed method	Agricultural workers
Dembe, 2001 (45)	United States	Review	Any
Quandt et al, 2001 (40)	United States	Original, qualitative intervention	Agricultural workers
Arcury et al, 2002 (27)	United States	Original, quantitative	Agricultural workers
Walter et al, 2002 (7)	United States	Original, qualitative	Day laborers
Malievskaya et al, 2002 (36)	United States	Original, quantitative, diagnosis	Day laborers
Pransky et al, 2002 (21)	United States	Original, quantitative	Urban, nonagricultural workers
Earle-Richardson et al, 2002 (44)	United States	Original, quantitative	Agricultural workers
Azaroff et al, 2003 (43)	United States	Original, quantitative	Cambodian and Lao workers
Arcury et al, 2003 (35)	United States	Original, qualitative	Tobacco farm employers
Griffin & Solskone, 2003 (5)	Israel	Original, quantitative	Agricultural workers
Facey, 2003 (8)	Canada	Original, qualitative	Taxi drivers
Oh & Shin, 2003 (15)	United States	Original, quantitative	Any
Nuwayhid et al, 2003 (11)	Lebanon	Original, quantitative	Any
Azaroff et al, 2004 (23)	United States	Original, quantitative	Any
Kalaroa, 2004 (39)	United States	Review	Not applicable
Pun et al, 2004 (41)	United States	Intervention	Garment workers
Burgel et al, 2004 (32)	United States	Original, quantitative	Garment workers
Azaroff et al, 2004 (48)	United States	Review	Cambodian & Lao workers
Akhavan et al, 2004 (3)	Sweden	Mixed method	Unemployed
Loh & Richardson, 2004 (16)	United States	Original, quantitative	Any
Richardson et al, 2004 (14)	United States	Original, quantitative	Any
Carangan et al, 2004 (12)	Singapore	Original, quantitative	Any
Brunette, 2004 (42)	United States	Review	Construction workers
Dong & Platner, 2004 (17)	United States	Original, quantitative	Construction workers
Capacci et al, 2005 (25)	Italy	Review	Any
Strong & Zimmerman, 2005 (13)	United States	Original, quantitative	Any
Shipp et al, 2005 (38)	United States	Original, quantitative	Agricultural workers
McCauley, 2005 (24)	United States	Review	Any
Ponce et al, 2005 (47)	United States	Original, quantitative	Any
O'Connor et al, 2005 (26)	United States	Original, quantitative	Construction workers
Cooper et al, 2005 (20)	United States	Original, quantitative	Agricultural workers

[a] Canada.

the participants actually attributed their poor health to their unemployment status. Similarly, a study of workers in Germany (4) found that unemployed foreigners suffered from more long-term or chronic health problems and reported lower satisfaction with their health than did unemployed Germans. This relationship remained after adjustment for age, gender, and education.

Despite the central importance of being employed, immigrant workers are acutely aware of the ways in which work may affect their health. Researchers in Israel (5) found a positive association between psychological distress among immigrant Thai workers and exposure to pesticides. Jackson (6) described the experiences of a group of immigrant nurses in Australia. The women, in reporting general feelings of displacement, loneliness and stress, described having these same feelings regarding their place at work. In another case, day laborers in San Francisco were conscious that competition and their undocumented status made them almost expendable; without training or safety equipment, and

with a ready supply of replacement workers, employers did not involve themselves in promoting work safety (7). Visible minority taxi drivers in Toronto described making decisions between protecting their health at work and the financial security of choosing a less healthy practice (8). Finally, a Swedish study illustrated this same dilemma. The researchers found that nonoptimal work environments were related to a low degree of life satisfaction among both Swedish and immigrant workers, but that employed immigrants' psychiatric health was less affected by less-than-ideal work conditions than that of native Swedes (9).

Occupational injuries

Ten studies (10–19) explicitly examined fatal or nonfatal injury among native and foreign workers or minority populations, and several more studied this issue in conjunction with others. The former group of studies is summarized in table 2, and results from all of the studies are discussed in our review.

Studies conducted in the United States using administrative data found that fatal occupational injuries increased among foreign workers even as they decreased among native workers (16) and that Hispanic (14, 17) and other immigrant or minority groups (18) had higher rates of occupational fatalities. In Australia, overall results for fatal occupational injuries were similar for natives and foreign workers, but the rates for foreigners were elevated in certain occupations and among newly arrived immigrants from non-English speaking countries (19).

The results concerning nonfatal injuries were less consistent. A study of traumatic occupational injuries in Singapore showed slightly elevated rates and a longer recovery time for foreign workers (12). In the United States, a survey showed that middle-school students who were migrant farm workers were twice as likely to have been injured at work than their nonmigrating, working schoolmates. This risk increased to four times among migrant high school students (20). Urban Latino immigrant workers were injured at a rate higher than that of the United States population as a whole, with much longer periods of work absence; this finding suggests more serious injuries (21). Finally, Bollini & Siem (22) reported that studies in the Netherlands, Germany, Switzerland, and France have concluded that foreign workers have a rate of occupational injuries that is about twice as high as that of native workers.

In contrast, in a longitudinal study (13) in the United States, the authors did not find differences for Hispanic ethnicity with respect to reported occupational illnesses or injuries. However, injured Hispanic men reported missing more days of work as a result of their injury than did their counterparts in the ethnic majority. This was not the case for Hispanic women (13). Oh & Shin (15) found no differences in nonfatal injury by race, but rather by level of education, work experience, and job tasks. Data from Lebanon (11) and Taiwan (10) also showed no general differences in overall injury rates. However, in Lebanon, the types of injuries differed between native and foreign workers, and stratifying for gender in Taiwan showed marked differences between Taiwanese and foreign-born women.

Table 2. Occupational injury among immigrant workers by first author.

First author	Population or comparison	Results
Nuwayhid, 2003 (11)	Work-related injuries (insurance data); Lebanese versus foreign workers	No difference in severity of injuries, Lebanese versus foreign workers, but different kinds of injuries experienced
Wu, 1997 (10)	Occupational injury (constructed cohort from legally registered migrants and labor-insured natives in same industries); Taiwanese versus foreign workers	No difference among Taiwanese versus foreign workers in general, foreign women, new arrivals and certain industries having a higher risk
Carangan, 2004 (12)	Work-related injuries (all in hospital emergency department); Singaporean versus foreign workers	Ratio of injuries for Singaporean versus foreign workers being 1:1.6, with foreign workers having longer recovery and more hospitalization
Corvalan, 1994 (19)	Fatal occupational injuries (administrative data); Australian-born versus foreign-born	Overall rates similar; elevated rates in mining and rural jobs; higher risk for <5-year residents from non-English speaking countries
Strong, 2005 (13)	Occupational illness and injury (cohort study survey data); USA majority and Black or Hispanic workers	Racial or ethnic minority workers and majority population, similar injury or illness rates, minorities missing more days of work
Richardson, 2004 (14)	Fatal occupational injuries (administrative registry data); USA majority and Black or Hispanic workers	Hispanic and Black men having higher workplace fatality rates than whites; at end of study period Hispanics surpassed Blacks
Peek-Asa, 1999 (18)	Fatal occupational injury trends in retail (administrative data); USA retail industry	Work-related deaths in retail more likely to be minority or foreign-born
Oh, 2003 (15)	Nonfatal occupational injuries (administrative survey data); USA Whites versus Blacks versus Asians	No association with race, yes with education and work experience, positions and activity
Loh, 2004 (16)	Fatal occupational injury trends (administrative registry data); USA born versus foreign born	Foreign-born fatalities higher than their proportion of workers, foreign-born fatalities increasing over the time period while native worker fatalities decreased
Dong, 2004 (17)	Occupational fatality rates in construction workers (administrative data); USA Hispanic or all other	Hispanic construction worker fatality rates higher in every year and in every age group

The results of these studies led us to questions about what may have caused the observed differences. It is often suggested that immigrant workers are concentrated in the most hazardous jobs or are assigned to the most dangerous tasks within these jobs (23). Data from the United States indicate that agriculture, construction, services, and the garment industry, all known for their heightened risk, have high concentrations of immigrant workers (24). Similar patterns have been reported in Italy and Germany, with immigrant workers concentrated in unskilled, blue-collar and industrial jobs (4, 25). Demographic studies in Australia have shown differential occupational patterns between nonnative and native groups (19). Nonetheless, some differences in injury rates have been reported to remain even within high-risk industries (16, 17, 22); this finding suggests that other factors are also at work.

Several authors have suggested that language ability is a possible factor, both in terms of safety training and in daily communication on the job (17, 19, 21, 26). This relationship may also work in reverse; Nuwayhid and his colleagues (11) suggested that one possibility for the nondifferential results in their study was that approximately 80% of the injured nonnative workers were Arabic speakers, like the native Lebanese to whom they were compared. Studies have also shown a higher risk for workers who are newer arrivals. Corvalan and his colleagues (19) described occupational fatality rates that approached those of native workers after five or more years of residence in Australia. They suggested that this finding may be related to the process of language acquisition. Likewise, most injuries among foreign workers in the Taiwan study (10) occurred within their first 6 months on the job.

Exposures and health problems

The studies about health problems and exposures tended to focus on specific collectives. Frequently mentioned exposures were pesticide exposure (27–30) among agricultural workers and exposure to other chemicals and fumes (23, 31). A key health problem described for agricultural workers and garment workers was musculoskeletal disorders (31–34). Other studies discussed problems as varied as green tobacco sickness (35), respiratory and airway irritation (36), lead poisoning (37), and headaches, dizziness and flu-like symptoms (23).

Prevention—safety education, training and personal protective equipment

Lack of safety training was an issue noted by several authors. In their study with nonagricultural Latino workers in Virginia, Pransky and his colleagues found that only 31% of their survey respondents reported having had any job safety training (21), numbers similar to those found in surveys of other groups (23). However, for the workers who had been injured in the last 3 years, no significant relationship was found between training and fewer injuries. The authors suggested that this finding may have been due to a lack of understanding of the training provided, as 25% of those who had been trained received it only in English (21). In another study of immigrant Latino construction workers, a higher proportion, 72%, reported receiving training, but the median length of that training was only 1 hour, and those with less English ability received less training (26). About half of the female farm workers in Texas reported having received pesticide safety training according to the worker protection standard, most of which took place in Spanish (38).

Awareness of the importance of linguistically and culturally appropriate safety training and intervention is increasing, as evidenced by the growing number of Spanish-language training aids (39, 40) and symptom measures (33) available. Pun and her colleagues (41) described an educational intervention to address musculoskeletal concerns with Mandarin-speaking garment workers. They, as well as other authors, pointed out that language is only one of the issues involved (41, 42). Safety training and personal protective equipment, though a vital part of workplace health and safety, ultimately focus on the individual worker, rather than addressing and limiting the root causes of exposures and injuries. Brunette (42) has advocated a "macro" approach to occupational safety research, one that would include the work environment and workers, but also factors external to the workplace, such as social, economic, and cultural aspects. Such an approach might be usefully extended beyond the boundaries of research to be applied in the practice of intervention.

Reporting, surveillance, health care and compensation

Accessing appropriate and accurate data was a problem that echoed in some manner in all of the studies. Data on occupational health can be obtained through official registries, but many immigrants are not included who work informally or in small businesses not obligated to report. Injuries and illnesses in vulnerable populations are probably underreported, and health problems that are work-related may not be classified as such.

One study used a household survey with immigrant workers in Massachusetts in the United States to compare self-reported cases of injury and illness with cases registered with workers' compensation and hospital records (43). They found that no data source was complete and that the household survey captured cases typically absent from existing data sources. Another study tested the possibility of monitoring migrant

agricultural workers through migrant health clinics and hospital emergency rooms (44). They concluded that such measures were potentially useful and should be further developed.

Such invisibility of the situation of immigrant workers is of profound importance, and not just to individuals. Besides the effects that work-related injuries and illnesses may have on the worker, such injuries and illnesses also have broader social effects on work, family, and community environments (45). The connection between these individual and social impacts are mediated by factors such as the type of work and the type and severity of illness or injury, sociodemographic characteristics, economic situation, the duration of illness or disability (45), the length of time of residence, documentation status, and access to care (46, 47).

In addition, other studies have described structural economic, legal, and political changes that hinder the reporting of poor work conditions, occupational injury, and illness. The authors argued that factors that discourage employees and supervisors from reporting injuries and illnesses, growing difficulty in documenting the diagnosis of work-related conditions, accessing workers' compensation coverage for medical care and partial wage replacement for occupational health problems, and more broad governmental reforms have glossed over our vision of the work conditions of immigrant workers. They point out that, in some cases, political and social changes have actually targeted immigrant workers, making them even more vulnerable (48, 49).

Factors such as immigrant status, type of job, economic situation, or tenure in the adopted country may affect immigrant workers' access to health care when they are injured or sick as a result of work. One study in a California county in the United States showed that immigrant workers were disproportionately uninsured, constituting 29% of workers but 54% of uninsured workers. This percentage declined with tenure, approaching that of uninsured naturalized immigrants born in the United States (47). Furthermore, workers face significant barriers to an access to workers' compensation care, such as administrative delays (50), denial of claims (50), lack of knowledge about the program (23), cultural and language barriers (50), and fear of reprisal (21). Such problems may be even more significant for immigrant workers (50). Although in other countries that have national health coverage such information is not as available, it has been suggested that immigrants in several European countries also face difficulties in accessing care (22). This lack of access to care is often, in turn, related to reporting and surveillance, as data from health care are often used to monitor occupational health (11, 50).

Bollini & Siem (22) suggested that it may be appropriate to view this complex web in terms of entitlements. That is, immigrants may have reduced material and social entitlements in host societies when compared with nonimmigrants. As such, their work and living conditions are poorer, as are their access to health care and social services, because of structural, linguistic, and cultural barriers. Such complicated entangling of issues requires careful and targeted study to determine relevant factors, which in turn necessitates reliable data.

Discussion

Despite their distinct health foci, populations, and settings, most of the reviewed studies highlighted the fact that immigrant workers are at high risk with respect to occupational exposures, injuries, and illnesses. Many of the authors highlighted or examined occupational injuries, probably because administrative data about injuries often exist, if incompletely. Many also reported marginalization and a lack of health and safety training in the workplace, incomplete surveillance of foreign worker populations, and difficulty accessing care and compensation when injured or ill. These factors together painted a worrisome picture for the health of immigrant workers in an increasingly mobile world job market.

Studies tend to propose similar reasons for these trends, including the relegation of immigrants to the most dangerous jobs and the most dangerous tasks within these jobs, lack of safety training, the transient nature of much of the work, fear of reprisal for demanding better work conditions or reporting an injury or illness, and linguistic and cultural complexities that may eliminate or severely minimize the existence and effectiveness of training.

It is perhaps to be expected that many of the studies come from countries with immigration as a historical presence. It is interesting, however, that, even in countries with a long history of immigration, the struggle to manage occupational health in immigrant and minority groups effectively is certainly not won. In many contexts, there is a desperate need for more complete information systems. Moreover, information-gathering and surveillance in sending and developing countries should be encouraged and aided through collaboration. Such information would further our understanding of the occupational health needs of mobile populations.

In regions in which data are already available to describe the occupational situation of immigrant workers, industry and site-specific studies, as well as qualitative information from the workers themselves, are necessary before risks can be reduced in the most vulnerable collectives. It is probably also necessary to have better data according to gender, class, and family-related aspects of

work and health. In places in which such data are not yet available, it is important to obtain them. Just because risks are undescribed does not mean they do not exist.

Several relevant methodological issues surfaced in this review. One is the necessity of appropriately defining immigrant populations, or other at-risk groups of workers, according to context. Bhopal (51, 52) has been articulate about the difficulties of naming and defining in research and health, highlighting frequent and problematic misuse of terms regarding ethnic minority and immigrant groups. Such considerations became especially important in this review because our interests lay in obtaining the literature available on a broad range of contexts and groups.

In a preliminary search, it became obvious that we would also need to employ other terms. Words such as ethnic minority, minority group, foreigner, and migrant were often used to refer to nonnative populations. Furthermore, in some situations, the reverse occurred; the names used for ethnic minorities or nationality groups became synonymous with immigrant to indicate foreign status. Thus we pursued an interactive search style, wherein the search methodology was modified by its own process. The preliminary search helped to decide which data to continue to seek, and the methodological decisions were theoretically informed and shaped by our research interests (53). As we have attempted to make clear, the emphasis was placed less on the term immigrant and more on the significance of that word in context and in terms of occupational health. More recently arrived persons will be more vulnerable, but some groups remain marginalized although time has elapsed since their arrival.

We are conscious, as Akhavan and her colleagues have pointed out (3), that identifying or monitoring minority groups can lend itself easily to stigmatization if not properly handled. The usefulness of terms such as immigrant or foreign worker is their capacity as descriptors of power imbalances, social stratification, and the lesser power that minority groups often have in societies (3). As we have seen, immigrant status can be a source of important occupational health inequalities.

Another issue of methodological interest is the challenge of incorporating studies that vary greatly in design, methods, and quality into the same review. Such techniques are increasingly recognized as an appropriate way to gain a multifaceted understanding of a phenomenon or situation; likewise methodology for such reviews is also developing (53–55). The weaknesses of one study design tend to be the strengths of others, and we therefore included no study design filters in our search. This deliberate mixing of data derived from different study methods can be compared with the qualitative research technique of triangulation (56). Inclusion and exclusion criteria in terms of study quality are debated with regard to quantitative review studies, and the review of both quantitative and qualitative studies further complicates this issue (57). We imposed no quality criteria for inclusion. Topics as complex as the occupational health of vulnerable populations, for whom work, individual, environmental, social, and economic forces coincide to produce health effects, require equally nuanced research methods. We believe that a wide range of methods and techniques must be employed before the occupational health of immigrant groups can be truly understood.

This study had several limitations. We used PubMed as our main source of article identification because it is widely used at the international level, it encompasses several other relevant databases, and its use is free of charge. Nevertheless we recognize that it is not without its limitations, including publication bias and relevant studies in other disciplines that it does not index. However, its extremely wide use means that the articles indexed are likely to be seen by other researchers and health care providers, and a review of the information it provides is also useful in that respect. Although we have almost certainly missed relevant studies indexed elsewhere, both numbers and narratives provided by quantitative and qualitative research help us to form an idea of the occupational health concerns of immigrant workers and the areas in which more knowledge is necessary.

Another possible limitation is the selection of English and Spanish articles for review. As previously described, we did not limit the search to English or Spanish articles, but rather selected them in the review of abstracts. Six articles (58–63) were excluded for reasons of language: three in Italian, one in German, one in French, and one in Japanese.

Our nonuse of quality criteria can also be viewed as a limitation of the conclusions drawn from this review. It is indeed possible that studies that do not meet certain quality standards may contribute results that confuse an existing body of evidence. Nonetheless, the evidence presented is relatively limited and extremely varied. We leave the readers to critique the studies and methods relative to their context and interests. This approach serves the dual purpose of helping us to understand realities and directing us to advocate better and more complete information and studies.

In conclusion, this review serves to consolidate the evidence from recent research about the occupational health of migrant populations and suggest areas in which more research and action are needed, particularly in the areas of data collection, surveillance, and safety interventions. Complex and dynamic movement of the human population requires more agile and adaptable methods of information gathering. It is also important, as a reminder, that, for some workers, occupational health risks continue to be a very real concern, despite

important advances in occupational health for the general population.

This information is perhaps both alarming and reassuring. What it may indicate is a failure to implement successful strategies in more complex occupational settings. We should take such failures seriously, as they involve the health and lives of people who live and work in our neighborhoods, societies, and economies. On a more optimistic note, in the same way that tightened safety measures have improved the lot of many workers, targeted interventions with at-risk collectives could begin to correct this imbalance. We should also continue to think about the larger social and economic structures that contribute to the disadvantages of immigrant and minority collectives. We cannot allow some workers to work at heightened health risk. And, after all, an improvement in the health of immigrant workers is an improvement in the health of all workers.

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