Occupational Health of Southeast Asian Immigrants in a US City: A Comparison of Data Sources

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Objectives. This study sought to characterize occupational injury and illness cases identified through 3 different sources of data on a population of immigrant workers.

Methods. Participants were Cambodian and Lao workers living in Lowell, Mass. A household survey allowed comparisons between characteristics of work-related cases documented in workers' compensation wage replacement records and hospital records and characteristics of self-reported cases.

Results. The household survey captured types of cases missing from existing data, particularly illnesses self-reported to be associated with chemical exposures. Injuries and illnesses affecting the study population appeared to be significantly underrepresented in workers' compensation wage replacement data.

Conclusions. Community-based methods can supplement available occupational health data sources. (*Am J Public Health.* 2003;93:593–598)

The United States lacks a comprehensive occupational health surveillance system. Researchers rely on data collection systems not designed for this purpose, and these systems notoriously fail to capture most work-related illnesses and many work-related injuries, especially those affecting low-wage, immigrant, and contingent workers.[1–14] It is therefore important to characterize the types of information typically captured or missed by existing data collection systems.

In the present study, we used an original household survey to identify the types of occupational health problems self-reported by Southeast Asian immigrants in Lowell, Mass, and to describe the differences between cases reported in the survey and those found in the other information sources that were available: workers' compensation records for cases involving 5 or more lost workdays and records from one of the city's hospitals. We examined the data sets to determine differences among them that might result from the fact that the systems are designed to capture different types of information and differences that appear to result from a failure to capture the cases they are designed to document.

METHODS

Target Population

This study targeted Lowell residents of Cambodian or Lao ethnicity who worked for wages at any time between 1997 and 1999. Individuals of Cambodian and Lao descent represented an estimated one fifth of employed Lowell residents.[15–18]

Data Sources

A schematic of the data sources included—the household survey, Massachusetts workers' compensation case records from the Department of Industrial Accidents (DIA), and medical records from the largest general hospital in Lowell—is presented in Figure 1.

Household survey. Cambodian and Lao consultants identified Cambodian and Lao surnames listed in the Lowell telephone book for streets within the 3 census tracts comprising the largest numbers of Southeast Asian residents. Interviewers met face to face with participants in their homes; thus, they were able to exclude members of other ethnic groups.

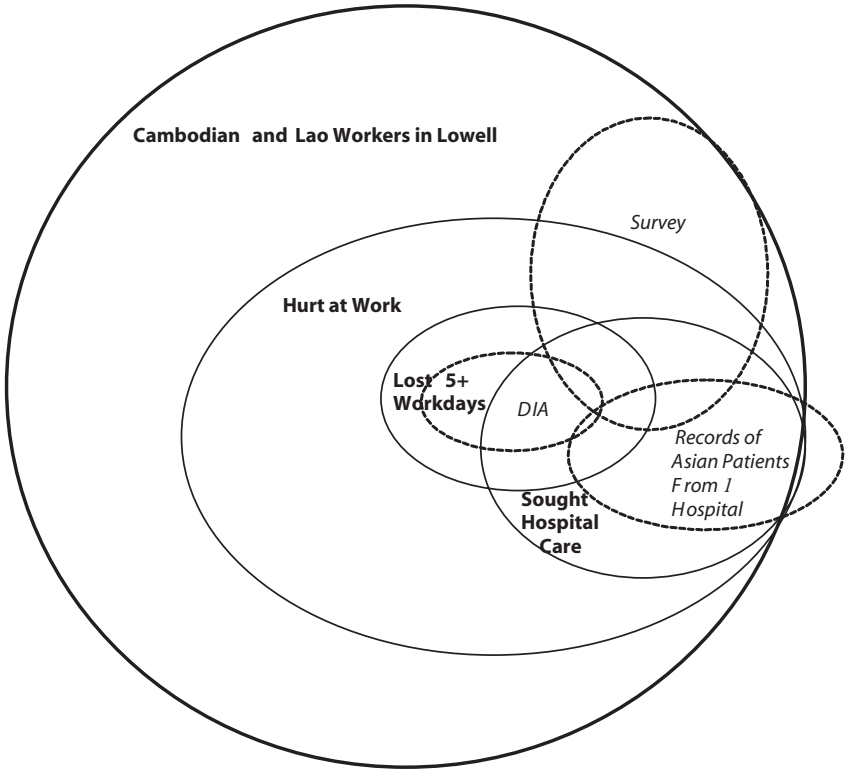
The household survey was the only active system used. We recruited respected members of the Southeast Asian community to act as interviewers, allowing interviews to be conducted, for example, with respondents who had limited English-language skills or low literacy levels and respondents who were distrustful of surveys.[19–21] Also, our participation rates were enhanced by our association with the University of Massachusetts at Lowell, which has a history of positive interactions with the local Southeast Asian community.[21] Despite previous reports of Lao women's reluctance to speak with outside interviewers,[22] few declined participation in this study.

All Lao households identified were approached for participation. Every second Cambodian household listed alphabetically by surname was approached, along with a small number of others whom researchers found at home while conducting the survery in their neighborhood. Informed consent forms were read to participants in their language of choice, and participants signed the forms. Interviews were conducted during the period February through November 1999.

Participants were asked the following question in regard to a list of various health conditions: "Have you ever had this problem because of your job within the past 2 years, or since 1997?" If participants provided affirmative responses to any of the items, they were asked additional questions about the exposures they associated with the health effects experienced. (Details on survey design and development are available from the authors.)

Workers' compensation case records. Massachusetts workers' compensation covers costs of medical care required and a portion of wages lost as a result of work-related injuries or illnesses. The state collects systematic information only on partial wage replacement cases filed after workers have missed 5 or more workdays owing to occupational injury or illness. The DIA provided, for the period July 1997 through July 1999, a list of the names of all Lowell residents who had filed cases together with dates of injury.

We were unable to identify published lists of surnames associated with Cambodian or Lao ethnic identity. Therefore, Cambodian and Lao consultants identified surnames from the list of individuals who had filed for workers' compensation benefits (this method has



Note. DIA = Department of Industrial Accidents.

FIGURE 1—Illustration of data collection model: Cambodian and Lao occupational health in Lowell, Mass (not proportional or to scale).

been used in previous research to identify such populations[24]). Although Vietnamese or Chinese surnames common to Cambodians may have been included in the list of cases selected for this study, and Anglicized names may have been excluded, the numbers of such instances were likely to have been small. Cambodians constitute approximately 90% of Lowell residents of Cambodian, Vietnamese, or Chinese ethnicity[15,16]; surname Anglicization is rare; and marriages to non-Asians among these recent immigrants are still relatively uncommon. The DIA provided records pertaining to the indicated names with all personal identifiers removed.

Hospital medical records. The records we obtained from the study hospital were examined in regard to use of all inpatient and outpatient services between January 1, 1996, and May 31, 1999. (There are 2 general hospitals in Lowell. Both agreed to participate, but the second could not do so as a result of subsequent technical difficulties. No major differences in patient services or target populations are known to exist between the 2 hospitals.) We categorized service use as work related if the payment class recorded was "workers' compensation." As a means of protecting patient confidentiality, hospital cases were selected on the basis of the "Asian" race code rather than surname. This code refers to East and Southeast Asians but not South Asians.

Comparisons of Cases Identified

Definition of cases. Cases were defined as follows. In the survey, a case was defined as the set of injuries/illnesses self-reported by a person as resulting from a workplace incident or exposure. In the DIA data, a case was defined as the set of work-related injuries/illnesses filed in a report describing the conditions causing an employee to lose 5 or more workdays (reportable in Massachusetts). Finally, in the hospital data, a case was defined as the set of injuries/illnesses recorded for 1 or more hospital visits made during a single calendar month by the same person for the same cause of injury (if the hospital billed the services provided to workers' compensation insurance).

Injuries or illnesses resulting in repeated hospital visits over multiple calendar months were recorded as multiple cases in the hospital data but as a single case in the other sources. Only 3 individuals were recorded as having visited the hospital more than once within a 3-month period for the same health problems and external causes.

Data recoding. Data from the different sources were recoded into a common system format. In the case of compensation records, recoded data were based on information included in these records if this information disagreed with the codes provided. Injuries and illnesses were recoded to Bureau of Labor Statistics injury/illness codes. Lack of specificity in the compensation and survey data precluded use of the *International Classification of Diseases, Ninth Revision* (*ICD-9*) system used in the hospital records. Causes of illness or injury were coded according to *ICD-9* external cause of injury codes (E codes). Because E codes do not specify causes of dermatitis, these data were assigned *ICD-9* diagnostic codes.

Industries were assigned standard industrial classification (SIC) codes. Employers included in the DIA records were assigned SIC codes through searches of Webster's on-line business guide or the US Occupational Safety and Health Administration's (OSHA's) on-line inspection data; if these approaches did not produce results, employers were coded according to the SIC manual. When survey respondents volunteered the names of their employers, SIC codes were assigned in a manner similar to that used for the DIA data. Most SIC codes were assigned on the basis of respondents' descriptions of their employment. Industry information was not available for hospital records.

Comparisons of case distributions. Proportional sex, age, industry, type of illness or injury, and cause of illness or injury distribu-

tions were compared among the 3 sets of data. In some of the analyses, we adjusted household survey data for potential differences in age or sex between respondents and the underlying workforce under study by multiplying the case proportion of a particular group by the group's estimated proportion in the workforce and dividing this value by the group's proportion in terms of the overall sample. If labor force data specific to the target population were unavailable, Bureau of Labor Statistics data on "Asians and others" were used to estimate labor force participation rates according to age group and sex.[18]

Case overlap among data sources. Survey cases were sought among compensation cases when respondents reported missing 5 or more workdays as a result of a work-related illness or injury. Survey cases were sought among hospital cases when respondents reported receiving treatment at the hospital for a work-related injury or illness. We were able to determine, with reasonable likelihood, the presence or absence of survey cases in the other data sets according to sex, age, injury/illness, cause of injury/illness, and incident or treatment dates.

Explaining Differences Among Data Sources

Differences among the data sources were examined for reasonable attribution to (1) differences in the types of cases targeted by the sources or (2) sampling bias. When these explanations could be reasonably excluded, differences were attributed to the systems' weaknesses in capturing the cases they target.

Designed differences. The DIA requires reports only in instances of injuries or illnesses that result in 5 or more lost workdays. The hospital seeks to document all occupational injuries and illnesses requiring medical attention. These sources rely on diagnoses of medical problems and work relatedness. The survey recorded self-reports of health problems and work relatedness regardless of lost work time or medical attention sought.

Sampling bias. All workers' compensation records meeting the selection criteria were sampled. These records excluded participants with surnames uncharacteristic of the targeted ethnic groups. Also, we used all eligible records from the study hospital. Although there is no obvious reason to expect that use of this hospital is selective, we were unable to evaluate such a possibility. A small number of selected records probably pertained to members of other Asian ethnic groups.

People were excluded from the survey if they did not reside in the 3 census tracts with the largest Southeast Asian populations, did not have telephones, had uncharacteristic surnames, or were repeatedly unavailable. Data were gathered from 160 of an estimated 11 000 Cambodian and Lao workers living in Lowell.[25] Because the survey involved a small sample, 95% confidence intervals (CIs) were calculated for some of the results. A binomial distribution was assumed for each outcome.

RESULTS

Data Collected

Survey data. One hundred sixty respondents from 57 Cambodian and 55 Lao households participated in the household survey. One hundred two (64%) reported experiencing one or more work-related symptoms, accounting for 208 cases involving 234 injuries and illnesses. Medical care was sought in 23 of these cases.

In addition to the participants, approximately 11% of Cambodian households approached declined participation. In participating Cambodian homes, at least 39 people, or one quarter of those contacted, refused participation or were unavailable. Approximately 24% of Lao households were repeatedly unavailable or, in the case of 3, declined participation. No Lao individuals in participating households refused to take part, but 5 were unavailable.

Workers' compensation data. In total, there were 1884 compensation cases involving Lowell residents. Eighty (4%) of these individuals were identified as Cambodian or Lao, approximately one fifth the number predicted from their proportion of the workforce.

Injury and body part codes consistent with textual information contained in workers' compensation documents were found in only 55% of the records. Fewer than half of the cases in electronics manufacturing and services contained illness/injury and body part codes consistent with information in the records. The most prevalent inconsistently coded injury/illness was sprains and strains. Contusions, the most frequently miscoded injury/illness classification, were coded inconsistently nearly three quarters of the time.

Twenty-four (30%) DIA case records lacked SIC codes, and 4 of these records did not include sufficient information to reassign the codes. Of the 56 case records that included SIC codes, 3 were identical to the codes that we reassigned, 31 agreed to 2 digits (industry major group), and 14 agreed to only the industrial division level. Eight categorized employers into entirely different industrial divisions than the reassigned codes.

Hospital data. Hospital records yielded 163 cases charged to workers' compensation among Asians aged 12 to 99 years, accounting for 187 hospital visits. Of the visits made by this population, 9.2% were charged to workers' compensation; however, only 1.1% of all patient visits charged to workers' compensation involved Asians.

Quantitative Comparisons and Explanations of Differences

Age and sex. After adjustment for sampling, approximately 55% (95% CI=48%, 62%) of the survey cases involved males, compared with 64% of compensation cases and 69% of hospital cases. People younger than 30 years accounted for roughly one third of both hospital cases and survey cases after adjustment for sampling (95% CI=30%, 43%); however, this group accounted for only 24% of compensation cases.

Industry. Twenty-four percent of the survey respondents were involved in the electrical and electronic equipment manufacturing industry, which employed only 4.5% of Lowell workers overall.[26] This industry classification accounted for 40% of survey cases (95% CI=33%, 47%) but only 13% of DIA cases. It is likely that some of the DIA cases involving temporary workers in electronics manufacturing were coded in the business services category.[27] However, only 6% of DIA cases were coded as business services, so this explanation cannot completely explain the discrepancy between DIA and survey data. The "eating and drinking places" and "stone, clay, glass, and concrete products" categories accounted for more than 5% of survey cases but much smaller percentages of DIA cases.

TABLE 1—Selected Illnesses and Injuries Observed in the Study Data Sets: Lowell, Mass, 1997–1999

Illness/Injury	Compensation Illnesses/Injuries (n = 102), %	Hospital Illnesses/Injuries (n = 185), %	Survey Illnesses/Injuries (n = 234), % (95% Confidence Interval)
Sprains and strains	36.0	22.0	21.0 (16.0, 26.0)
Cuts and punctures	8.8	25.0	11.0 (7.0, 15.0)
Contusions	20.0	16.0	8.5 (4.9, 12.0)
Fractures	9.8	7.6	0.4 (0.0, 1.2)
Symptoms and ill-defined conditions	2.0	1.6	29.0 (23.0, 35.0)
Dermatitis	0.0	0.0	6.4 (3.3, 9.7)

Injuries and illnesses. Because some cases involved more than 1 injury or illness, the DIA data included a total of 102 work-related injuries/illnesses, the hospital data included 185 work-related injuries/illnesses, and the survey data included 234 work-related injuries/illnesses (of which medical care was sought for only 34). In all 3 data sources, the most common health problems observed were sprains and strains; cuts, lacerations, and punctures; and contusions, crushing, and bruises (Table 1).

Different proportions of types of injuries and illnesses were expected, given the differences in information collected by the data collection systems. Sprains and strains may lead to lost work time and may be included in DIA data; cuts and lacerations often require urgent care in hospitals; and fractures should result in hospital visits and lost work time but be found rarely in a household survey.

Fifteen of the survey respondents reported dermatitis (accounting for 6% of reported work-related injuries or illnesses), but only 2 of these individuals reported seeking medical care for this condition. Thus, design differences probably explained the lack of presence of this condition in the other data sources.

Symptoms and ill-defined conditions (headache, dizziness, nausea, flu-like symptoms, and overall sensations of ill health) were reported for more than one quarter of work-related injuries or illnesses reported in the survey and for 6 (18%) of the cases associated with medical care. Yet, this category accounted for only 1% of the injuries/illnesses observed in the hospital data and 2% of the cases observed in the DIA data. These discrepancies are difficult to attribute to differences in system design or to sampling bias.

External causes of injury. Among the most prevalent external causes in all 3 lists were overexertion and strenuous movements, cutting and piercing caused by instruments or objects, and striking against or being struck accidentally by objects or persons (Table 2). Falls accounted for several DIA and hospital cases but no survey cases. Noise exposure appeared only among survey cases. Nine percent of survey cases were attributed to exposure to substances such as solvents, dusts, and soldering fumes (*ICD-9* codes E850–E869), and 4% were assigned dermatitis diagnostic codes for dust, biological, or chemical exposure; however, these exposures accounted for no DIA cases and only 2 hospital cases.

The absence of chemical exposure cases in the DIA and hospital data is not readily explained by differences in the design of the data collection systems, because chemical exposures can result in both hospital treatment and lost workdays. This cause appeared in the survey data at a prevalence rate significantly different from zero. In several instances, insufficient information was available to code external causes for DIA and survey cases but this problem did not arise with hospital cases. Twelve percent of survey cases involved unclassifiable external causes, including long hours of work or pressure to work quickly.

Case Overlap Among Data Sources

Six survey respondents reported that they had missed 5 or more days of work owing to work-related health problems since 1997. Four identified the approximate month of the lost work time, and the other 2 had begun their jobs after the specified initiation date used with the DIA data. Only 1 respondent reported receiving workers' compensation, and this case was documented in the DIA data. The cases of the other 5 individuals, who did not report seeking workers' compensation, were not documented in the DIA data. The reported incidents included repetitive strain, solvent exposure, and being struck by a forklift.

Seven survey respondents reported that they had received treatment at the hospital participating in this study for work-related health problems since 1997. Of the 4 who provided approximate months of treatment, 3 were included in the hospital data set within 1 year of the self-reported date. The fourth matched a hospital record not coded as work related. Three respondents who did not recall a month of treatment were not found in the data set. They may have reported injuries occurring before the 1996 cutoff date of the

TABLE 2—Selected External Causes of Injury Included in the Study Data Sets: Lowell, Mass, 1997–1999

Cause	Compensation Cases (n = 80), %	Hospital Cases (n = 163), %	Survey Cases (n = 208), % (95% Confidence Interval)
Overexertion, strenuous movements	29.0	15.0	36.0 (30.0, 43.0)
Cutting and piercing instruments	3.8	24.0	9.4 (5.4, 13.0)
Struck by/against object or person	2.5	9.1	4.9 (2.0, 7.8)
Falls	14.0	2.5	0.0
Exposure to substances	0.0	1.2	13.0 (8.4, 18.0)
Noise	0.0	0.0	1.0 (0.0, 2.4)
Unclassifiable	0.0	0.0	12.0 (7.6, 16.0)
Insufficient data	13.0	0.0	6.3 (3.0, 9.6)

TABLE 3—Strengths and Limitations of the Study Data Collection Systems

Data Source Characteristic	Compensation	Hospital	Survey
Designed to capture all eligible cases among target population	Yes	No	No
Specific to defined ethnic groups	Yes	No	Yes
Information on industry	Yes	No	Yes
Information on employer	Yes	No	No
Information on cause of injury	Yes	Limited	Yes
Clinical validation of diagnosis and association with work	Yes	Yes	No
Coded by trained professionals	No	Yes	No
Largely independent of employer practice	No	Yes	Yes
Active case seeking	No	No	Yes
Information on work hours and conditions[a]	No	No	Yes
Information on workers' knowledge[a]	No	No	Yes

[a]These data are described in a separate article by the authors (in press).

hospital data; but because these injuries were severe it seems unlikely that all 3 miscalculated the accident date by more than 1 year.

DISCUSSION

In this study, we investigated the data sets available for assessing the occupational health of Cambodian and Lao residents of Lowell, Mass, and conducted an original household survey. None of these data sources was complete, each being designed to capture different information and involving particular strengths and limitations (Table 3). The 3 sources provide different pictures of the occupational health of the target population.

Sensitivity and Specificity

Individuals of Cambodian and Lao ethnicity represent an estimated one fifth of the working residents of Lowell, but we found that they accounted for only 4% of the city's workers' compensation wage replacement cases. The cases of most survey respondents who were apparently eligible for partial wage replacement were not found in the compensation data.

The Lowell labor market area contains 75 establishments coded as "electronic and other electrical equipment and components, except computer equipment,"[26] and 24% of our survey respondents described such work. However, the 10 DIA cases with this code involved a total of only 8 of these establishments, and 3 such establishments reported all DIA cases involving sprain and strain injuries. In addition, it is interesting that only 3 temporary employment agencies accounted for the 5 cases from this sector, whereas the Lowell telephone directory lists more than 60 temporary agencies.

The hospital data reflect the experience of only 1 health care facility. No data were available from other area hospitals or clinics, and we were unable to determine whether these facilities handle different types of cases. The cases we observed in our hospital data probably included small numbers of individuals outside the targeted ethnic groups as well as small numbers of people residing outside Lowell.

Only 1% of hospital visits charged to workers' compensation were made by Asian patients, suggesting that the work relatedness of conditions affecting this population may be disproportionately unrecognized. However, 3 of the 4 survey participants who identified dates of hospital visits for work-related health problems were found in the hospital cases billed to workers' compensation. This finding may suggest that the hospital is likely to capture work relatedness when it is self-reported by patients.

The labor-intensive nature of the survey limited the number of participants, and they probably represented less than 2% of the target population. In comparison with the other data sources, the survey data were less likely to include people without telephones and those who had unusual work schedules. As a result, people in hazardous or low-wage positions such as day labor or under-the-table construction, fishing, or manufacturing work were probably underrepresented.

Accuracy and Depth

The health information services of the DIA and the study hospital generously and efficiently shared all relevant data. However, 14% of DIA records studied lacked the legally required first reports of injury, which contain injury/illness and other codes. DIA case records are typically completed by untrained company personnel, and we found that they frequently contained miscoding. These records provided varying amounts of descriptive information. The hospital data used in this study were coded by trained professionals, and we assumed that this information was highly accurate. These records did not include in-depth narratives.

Our survey did not solicit specific information about employers, and thus it may have produced inaccurate industrial codes. In addition, because individuals sometimes incorrectly identify health problems and their sources, and sometimes forget problems after a few weeks,[8,28,29] the survey results may not be entirely accurate in this area. Still, potentially useful information was collected about work risks that otherwise would have been unavailable. For example, dermatitis, which was reported by several of the survey respondents, may be an important and preventable occupational health issue; however, dermatitis cases frequently fail to meet criteria for inclusion in established reporting systems.

CONCLUSIONS

The data sources available to assess the occupational health of Southeast Asian workers in Lowell are limited and apparently fail to fully capture relevant hazards and health problems faced by this population. Exposures to dusts, solvents, and fumes, especially in the electronics manufacturing industry, are prevalent hazards that go largely undocumented. Chronic sensations of ill health, headache, nausea, and flulike symptoms are rarely captured, and, when they are recorded, they are

hidden in the category "symptoms and ill-defined conditions." Cases involving the study population appeared to be significantly underrepresented in workers' compensation wage replacement data. Our results suggest that household surveys can reveal otherwise undocumented occupational health issues among defined populations. ■

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Contributors

L.S. Azaroff designed the study, conducted the data analysis, wrote most of the article, and assisted in data gathering. C. Levenstein helped place the research within the broader context of work environment justice and helped formulate overall themes and questions. D.H. Wegman helped to formulate specific definitions of research questions, define the conclusions, and describe the findings clearly.

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Human Participant Protection

This research was conducted with the approval of the University of Massachusetts institutional review board. Informed consent was obtained from participants according to the board's requirements.

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