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Occupation and Industry Data Quality Among Select Notifiable Conditions in Washington State

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ABSTRACT

Context: Occupation and industry are basic data elements that, when collected during public health investigations, can be key to understanding patterns of disease transmission and developing effective prevention measures.

Objective: To assess the completeness and quality of occupation and industry data among select notifiable conditions in Washington and discuss potential improvements to current data collection efforts.

Design: We evaluated occupation and industry data, collected by local health departments during routine case investigations, for 11 notifiable conditions, selected for inclusion based on an established or plausible link to occupational exposure.

Setting and Participants: Confirmed cases of select notifiable conditions among Washington residents aged 16 to 64 years, for years 2019-2021.

Main Outcome Measures: We calculated the percentage of cases among working-age adults reported as employed, the percentage with occupation and industry data collected, and the percentage assigned standard occupation and industry codes. We identified the most common responses for occupation and industry and challenges of assigning codes to those responses.

Results: Among the 11 conditions evaluated, one-third of cases aged 16 to 64 years were reported as employed. Among the cases reported as employed, 91.5% reported occupation data and 30.5% reported industry data. "Self-employed" was among the top responses for occupation, a response that does not describe a specific job and could not be assigned an occupation code. In the absence of additional information, 4 of the most common responses for industry could not be coded: "health care," "technology," "tech," and "food."

Conclusion: Routine collection of informative occupation and industry data among working-age adults is largely absent from case investigations in Washington. Methods of data collection that improve quality while minimizing the burden of collection should be pursued. Suggestions for improving data quality are discussed.

KEY WORDS: data collection, data quality, occupational health, public health surveillance

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Public health authorities monitor diseases and conditions of public health concern to control sources of infection and to provide information to health care providers, policy makers, and the public, with the ultimate goal of preventing disease transmission or occurrence. In Washington, health care providers and facilities, laboratories, and veterinarians must report suspected or confirmed cases of select conditions* to local health jurisdictions, which may conduct a case investigation to collect additional information including demographics of the individual infected and factors involved in disease transmission. The Washington State Department of Health maintains the data collected for these notifiable conditions,

*The complete list of notifiable conditions, as defined by Washington Administrative Code 246-101, can be found on the Washington State Department of Heath public Web site: https://doh.wa.gov/public-health-healthcare-providers/notifiable-conditions/list-notifiable-conditions.

which serve as the primary source of public health surveillance data for many of the conditions.

The relationship between work and disease is multifaceted. Occupational exposures place groups of workers at an increased risk of acquiring certain diseases or conditions, for example, black lung disease among coal miners, hearing loss among workers in loud manufacturing facilities, and heat-related illness among outdoor workers.[1-3] Work settings may facilitate disease transmission from an infected worker to coworkers or others such as patients, day care attendees, and restaurant patrons. Employer-provided benefits such as paid leave and health insurance can mitigate disease transmission and health outcomes.[4,5] Work also intersects with race and ethnicity around issues of health equity.[6] For example, low-wage, high-hazard health care positions are disproportionately held by Black women[7]; Black and Hispanic workers are more likely to be employed in jobs with an elevated risk of work-related asthma and occupational pesticide poisoning.[8]

Collecting data on employment as part of case investigations can provide valuable information on sources of infection, populations at risk, and effectiveness of prevention measures. Most case reporting forms include multiple data elements related to employment. Worksite name and location among infected workers allow public health authorities to mount a rapid response to control workplace outbreaks. Occupation (job) and industry (type of business) of infected workers are critical for understanding disease burden and transmission, developing prevention strategies both for workers and for the general public, and informing public health policy. The distribution of disease by occupation and industry is basic public health surveillance data that provide government health agencies, policy makers, and researchers with the information needed to set priorities and allocate resources with the ultimate goal of preventing disease.

The COVID-19 pandemic highlighted the importance of work data and also the challenges of collecting and translating the data to standardized codes usable for analysis.[9,10] While jurisdictions successfully identified outbreaks at various worksites, including meatpacking and correctional facilities,[11,12] little timely information was available on the distribution of cases or risk of infection across the workforce. Public officials, health care administrators, and others raised questions throughout the pandemic that often went unanswered: What was the risk of contracting COVID-19 among workers in long-term care facilities, grocery stores, or package delivery services? Were case numbers among nurses so high that they threatened hospital staffing levels? Which workers bore the greatest burden of disease, and what types of workplaces were in greatest need of improved prevention measures? Answering these questions and others require data on occupation and industry among cases.

In Washington, occupation and industry data elements were included in the COVID-19 case reporting form and investigation tool, but data quality issues hampered their use for public health surveillance and response. Challenges included unfamiliarity of the concepts of (and differences between) occupation and industry both among individuals being interviewed and among the case investigators; isolating relevant data elements from lengthy free-text responses; and missing data for a substantial portion of working-age adults. The pandemic's strain on public health resources likely accounts for some of the observed data quality issues. However, quality issues related to work data likely extend to diseases and conditions beyond COVID-19.

Collecting accurate work information that allows for the classification of occupation and industry remains a crucial surveillance activity for many diseases and conditions as work processes, social practices, environmental conditions, and disease control efforts change over time, potentially altering patterns of disease transmission and prevention strategies. The aim of this study was to assess the completeness and quality of occupation and industry data collected among select notifiable conditions in Washington and to determine what improvements to current data collection efforts are needed in order to provide informative, actionable public health surveillance data.

Methods

We evaluated work-related data collected during public health case investigations for 11 notifiable conditions. The conditions, representing various routes of transmission, were selected on the basis of an established or plausible link to occupational exposure and frequency of reported cases (omitting rare conditions with <10 cases reported over multiple years). The conditions selected are not an exhaustive list of infections or conditions associated with workplace transmission or exposure; they were selected as an initial assessment of occupation and industry data quality and completeness. For each condition, a brief description of known or suspected worker groups at an increased risk of infection follows.

Risks of occupationally acquired infection by select condition:

Arboviral diseases[†]: Generally transmitted via insect bites, occupations considered at a greater

[†]Diseases reportable as "arboviral diseases" include Eastern/Western equine encephalitis, chikungunya, dengue, Japanese

risk of infection are those that involve outdoor work during periods of high insect activity, including farm and forestry workers, landscapers/groundskeepers, construction workers, and summer camp workers.[13]

Coccidioidomycosis: Transmitted via inhalation of fungal spores released into the air by disturbing the soil, outbreaks of coccidioidomycosis have been identified among workers digging, trenching, or excavating areas where the *Coccidioides* spp fungus lives, including archeologists, construction workers, agricultural workers, and wildland firefighters.[14] However, simply working outdoors in dusty conditions is sufficient for disease transmission, as illustrated by an outbreak among a film crew operating outdoors on location.[15]

Legionellosis: Building water and HVAC (heating, ventilation, and air-conditioning) systems can become infected with the bacterium that, when inhaled, can cause the pneumonia legionellosis. While outbreaks are been identified at hotels, hospitals, long-term care facilities,[16] and car manufacturing facilities,[17] anyone working in a building with a poorly maintained HVAC system may be at risk of infection.

Measles: Health care workers are considered at an increased risk of measles infection, transmitted through droplets or aerosolized particles emitted from an infected person's breath, cough, or sneeze.[18] In addition, childcare workers, teachers and school employees, and environmental services workers are theorized to be at an increased risk, although currently we lack the public health surveillance data needed to estimate the risk.[19]

Pertussis: Transmitted person to person through infected droplets produced by coughing, sneezing, or talking, outbreaks of pertussis have been identified at various workplaces including hospitals, jails, and an oil refinery.[20-22]

Campylobacteriosis: Infection usually occurs through ingestion of undercooked chicken or other contaminated food or water or contact with feces from farm animal and/or pets. Campylobacteriosis has been documented among poultry processing workers, farm workers, and veterinary workers,[23] as well as workers in health care and residential facilities.[24,25]

Giardiasis: Generally transmitted through ingestion of contaminated lake, river, or stream water, giardiasis is often associated with water recreational activities. Contact with soiled diapers is also a risk factor,[26] placing childcare workers at an increased risk of infection.

Hepatitis A (acute infection): Primarily transmitted through contact with infected stool, occupations at increased risk of contracting hepatitis A include childcare workers, direct patient care providers, and workers in contact with sewage.[27]

Salmonellosis: Higher risk of infection has been found among workers with greater exposure to human or farm animal feces (or food products contaminated with infected animal feces), including health care practitioners and technical workers, personal care and service workers, food preparation and serving-related workers, and farming, fishing, and forestry workers.[25]

Shiga toxin-producing *Escherichia coli* (STEC): The bacteria that causes infection primarily resides in the intestines of cattle, placing farm workers, ranchers,[28,29] and slaughterhouse workers[30] at an increased risk of STEC infection.

Shigellosis: Infection usually occurs by ingesting contaminated food or water or through hand-to-mouth contact with surfaces or items contaminated with infected fecal matter. Infections among health care personnel, childcare workers, and food handlers are of concern because of the risk for further transmission, but outbreaks have also been documented among animal handlers who work with primates.[31]

Occupation and industry data

Case investigations were conducted by staff at local health departments, as part of their routine public health activities. Data were captured using a case report form and entered directly into a database maintained by the Washington State Department of Health, the Washington Disease Reporting System (WDRS). The set of questions related to work begins by assessing whether the case is employed, presented as "Employed: Yes, No, Unknown." When an investigator indicates that a case is employed, a free-text field for occupation is available to complete. If a response is recorded in the occupation field, free-text fields for industry (presented as "type of business") and employer are available to be completed. If no occupation is recorded, the industry and employer fields are skipped.

The National Institute for Occupational Safety and Health (NIOSH), part of the Centers for Disease Control and Prevention, developed a coding system known as the NIOSH Industry and Occupation Computerized Coding System (NIOCCS), which we used

encephalitis, St Louis encephalitis, La Crosse encephalitis, Powassan, California serogroup, and Zika. West Nile virus disease and yellow fever are reported separately and not grouped as "arboviral diseases."

TABLE 1

Occupation and Industry Data Among Cases Aged 16 to 64 Years for Select Notifiable Conditions, Washington 2019-2021[a]

Notifiable Condition	Total Cases	Reported as Employed (% of Total)	Data Reported in the Occupation Free-Text Field (% of Employed)	Data Reported in the Industry Free-Text Field (% of Employed)	Data Reported in the Employer Free-Text Field (% of Employed)
Measles	19	12 (63.2)	11 (91.7)	0 (0)	1 (8.3)
Shiga toxin-producing *Escherichia coli*	376	200 (53.2)	196 (98.0)	65 (32.5)	97 (48.5)
Salmonellosis	956	486 (50.8)	456 (93.8)	136 (28.0)	179 (36.8)
Arboviral diseases	20	9 (45.0)	9 (100)	2 (22.2)	3 (33.3)
Legionella	122	54 (44.3)	47 (87.0)	20 (37.0)	21 (38.9)
Shigellosis	402	150 (37.3)	140 (93.3)	52 (34.7)	66 (44.0)
Giardiasis	426	133 (31.2)	117 (88.0)	47 (35.3)	56 (42.1)
Pertussis	165	43 (26.1)	37 (86.0)	9 (20.9)	14 (32.6)
Coccidioidomycosis	129	33 (25.6)	27 (81.8)	6 (18.2)	5 (15.2)
Hepatitis A, acute	406	100 (24.6)	99 (99.0)	39 (39.0)	52 (52.0)
Campylobacteriosis	1248	226 (18.1)	184 (81.4)	65 (28.8)	68 (30.1)
Total	4269	1446 (33.9)	1323 (91.5)	441 (30.5)	562 (38.9)

[a] *Data presented are n (%).*

to code the narrative text data entered in the industry and occupation fields.[32] NIOCCS utilizes machine learning to assign codes, based on pairs of industry and occupation data. Because NIOCCS evaluates both the industry and occupation data to assign a particular code, a response recorded in the occupation field may be used to identify the industry code, and a response recorded in the industry field may be used to assign the occupation code. In some cases, this results in assignment of an industry code, based on the data recorded in the occupation field, even when no data were recorded in the industry field (and vice versa). We considered reported data to be coded when NIOCCS was able to assign a standard code. Data entries flagged by NIOCCS as "insufficient information" were considered not coded.

To evaluate the type of information reported in the free-text fields for occupation and industry, we reviewed the responses and classified them into one of 7 categories: Occupation, Industry, Employer, Ownership (eg, "self-employed," "family business," "government"), Work setting (eg, "office," "works from home"), Product (eg, "food," "glass," "cleaning products"—with no indication as to whether the company grows, packs, processes, sells, or services the product listed), or Refused.

We queried WDRS for confirmed cases from 2019 through 2021 among Washington residents aged 16 to 64 years and calculated the percentage of cases reported as employed, the percentage with information reported in the free-text occupation and industry fields, and the percentage of cases assigned occupation and industry codes. We identified the most common responses for occupation and industry and the codes assigned to those responses.

This public health activity is not subject to Washington State Institutional Review Board review, as the scope is limited to public health practice, and all activities are authorized and conducted by the Washington State Department of Health and the Washington State Department of Labor & Industries, both public health authorities.

Results

Data collected during case investigation

Among the 4269 confirmed cases aged 16 to 64 years, a total of 33.9% were reported as employed, although the percentage ranged from a high of 63.2% (among cases of measles) to a low of 18.1% (among cases of campylobacteriosis) (Table 1). In more than half of the select conditions, less than 38% of working age cases were reported as employed, while, in comparison, greater than 70% of working-age adults in

Washington were employed. Among the 1446 cases reported as employed, most reported data in the occupation free-text field (91.5%). Three conditions reported occupation data for more than 95% of employed cases: STEC, arboviral disease, and hepatitis A. Industry data were largely unreported; only a fraction of cases reporting occupation data also reported data in the industry free-text field (no case reported industry data only because an occupation must be entered in order to enter the industry). Among the select conditions, hepatitis A had the highest percentage of industry data reported (39.0% of cases reported as employed). The industry field was left blank for all measles cases. Collection of employer name was more common than industry but less common than occupation.

Type of information reported

Among the 1323 cases with data reported in the occupation free-text field, 81.3% of the responses described an occupation, 7.1% described an industry instead of an occupation, and 5.6% named the employer (Table 2). Of the 1075 cases with occupation data that described an occupation, 1027 (95.6%) were assigned an occupation code. Common responses that could not be coded included "tech," "food worker," "contractor," or an abbreviation (eg, "PA-C"). Among the responses that described something other than occupation, less than half were able to be assigned an occupation code based on the information provided in the occupation or industry fields.

Among the 442 cases with data reported in the industry free-text field, 360 (81.4%) described an industry, although this represented only 27.2% of cases with occupation data reported (Table 2). An industry code was assigned to 967 cases, including 544 cases with no industry data reported (assigned by the NIOCCS coder based on the information reported in the occupation free-text field).

Codes assigned to common responses

When processed by the NIOCCS coder without additional information on industry, 4 of the most common responses for occupation—"engineer," "manager," "IT," and "sales"—lacked sufficient description to assign a detailed occupation code and, instead, were assigned an "all other" catch-all code within a broader occupation classification (Table 3).

TABLE 2

Type of Information Reported in the Occupation and Industry Free-Text Fields Among Cases Aged 16 to 64 Years, With Any Data Reported in the Occupation Free-Text Field, for Select Notifiable Conditions, Washington 2019-2021[a]

Type of Information Reported in the Occupation Free-Text Field	Cases Assigned Occupation Code[b]	Cases Not Assigned Occupation Code[b]	Total Cases
Occupation	1027 (91.7)	48 (23.6)	1075 (81.3)
Industry	46 (4.1)	48 (23.6)	94 (7.1)
Employer	23 (2.1)	51 (25.1)	74 (5.6)
Work setting	15 (1.3)	16 (7.9)	31 (2.3)
Refused	1 (0.1)	28 (13.8)	29 (2.2)
Ownership	8 (0.7)	12 (5.9)	20 (1.5)
Total	1120 (100)	203 (100)	1323 (100)
Type of Information Reported in the Industry Free-Text Field	**Cases Assigned Industry Code[b]**	**Cases Not Assigned Industry Code[b]**	**Total Cases**
Blank	544 (56.3)	337 (94.7)	881 (66.6)
Industry	351 (36.3)	9 (2.5)	360 (27.2)
Employer	28 (2.9)	1 (0.3)	29 (2.2)
Product	14 (1.4)	1 (0.3)	15 (1.1)
Ownership	10 (1)	2 (0.6)	12 (0.9)
Refused	5 (0.5)	5 (1.4)	10 (0.8)
Occupation	10 (1)	0 (0)	10 (0.8)
Work setting	5 (0.5)	1 (0.3)	6 (0.5)
Total	967 (100)	356 (100)	1323 (100)

[a] *Data presented are n (%).*

[b] *Codes assigned to free-text responses using the National Institute for Occupational Safety and Health (NIOSH) Industry and Occupation Computerized Coding System (NIOCCS).*

TABLE 3
Most Common Responses Reported in the Occupation Free-Text Field and Corresponding Occupation Codes Assigned[a]

Reported Occupation	n (%)	Census 2018 Occupation Code Assigned	Quality of Reported Data
"Construction"	25 (1.9)	Construction laborers	Adequate
"Teacher"	20 (1.5)	Elementary and middle school teachers	Adequate
"Engineer"	15 (1.1)	Engineers, All other	More detail preferred[b]
"Self-employed"	13 (1.0)	*Insufficient information*	*Not an occupation*
"Nurse"	13 (1.0)	Registered nurses	Adequate
"Software engineer"	13 (1.0)	Software developers	Adequate
"Cashier"	12 (0.9)	Cashiers	Adequate
"Manager"	11 (0.8)	Managers, All other	More detail preferred[b]
"Food handler"	10 (0.8)	Food preparation workers	Adequate
"IT"	9 (0.7)	Computer occupations, All other	More detail preferred[b]
"RN"	9 (0.7)	Registered nurses	Adequate
"Truck driver"	8 (0.6)	Driver/Sales workers and truck drivers	Adequate
"Mechanic"	8 (0.6)	Maintenance and repair workers, General	Adequate
"CAN"	8 (0.6)	Nursing assistants	Adequate
"Sales"	8 (0.6)	Sales and related workers, All other	More detail preferred[b]
"Medical assistant"	7 (0.5)	Medical assistants	Adequate
"Caregiver"	7 (0.5)	Personal care aides	Adequate
"Paraeducator"	7 (0.5)	Teaching assistants	Adequate

[a] *The 18 responses listed accounted for 15% of the 1323 cases with occupation data reported. When processed by the National Institute for Occupational Safety and Health (NIOSH) Industry and Occupation Computerized Coding System (NIOCCS) in the absence of industry data.*

[b] *More detailed occupation response preferred to assign the most detailed code possible.*

Among the most common responses for industry were "health care," "tech," "food," and "technology" (Table 4). These responses could not be coded as reported; more specific responses are needed to assign an industry code (eg, "doctor's office" instead of "health care," "software company" instead of "tech," "restaurant" instead of "food"). An additional 4 common responses were assigned industry codes, but the data reported were too ambiguous or nonspecific to ensure that the correct code was assigned ("education," "food service," "medical," and "retail"). For example, "education" was coded as "elementary and secondary schools," although the employer data indicated that the case worked at a university (employer data are not evaluated by the NIOCCS coder). An industry reported as "medical" was coded as "general medical and surgical hospitals," but the case worked at a medical clinic. A response of "retail" was assigned to the general classification "not specified retail trade"; a more descriptive response would facilitate assignment of a more detailed code within the retail sector.

Paired occupation and industry data

Of the 1323 cases with data reported in the occupation field, less than a quarter (24.3%) described an occupation in the occupation free-text field and an industry in the industry free-text field (Table 5). The majority of cases (52.5%) described an occupation in the occupation field and left the industry field blank. Despite the missing data, the NIOCCS coder assigned an industry code to nearly two-thirds of these cases, based on the information reported in the occupation field. The lowest percentage of cases assigned either an occupation code or an industry code were the 187 cases where something other than a job description was reported in the occupation field and the industry field was left blank.

Discussion

The notifiable conditions reporting system serves as the primary data source for public health surveillance of these diseases and conditions; yet, the routine collection of occupation and industry data among working age adults is largely absent from case investigations in Washington. Census data suggest that an estimated 72% of Washington residents aged 16 to 64 years were employed in 2019-2021[33]; however, among notifiable conditions cases of the same age, the percentage documented as employed was much lower. While it is possible that the employment rate among cases of notifiable conditions is lower than the

TABLE 4
Most Common Responses Reported in the Industry Free-Text Field and Corresponding Industry Codes Assigned[a]

Reported Industry	n (%)	Census 2018 Industry Code Assigned	Quality of Data Reported
"Health care"	23 (5.2)	*Insufficient information*	More detail needed
"Restaurant"	15 (3.4)	Restaurants and other food services	Adequate
"Tech"	14 (3.2)	*Insufficient information*	More detail needed
"Education"	13 (3.0)	Elementary and secondary schools	More detail preferred[b]
"Construction"	12 (2.7)	Construction	Adequate
"School"	9 (2.0)	Elementary and secondary schools	Adequate
"Food service"	6 (1.4)	Restaurants and other food services	More detail preferred[b]
"Finance"	5 (1.1)	Nondepository credit and related activities	Adequate
"Food"	5 (1.1)	*Insufficient information*	More detail needed
"Medical"	5 (1.1)	General medical and surgical hospitals, and specialty (except psychiatric and substance abuse) hospitals	More detail preferred[b]
"Retail"	5 (1.1)	Not specified retail trade	More detail preferred[c]
"Fast food"	4 (0.9)	Restaurants and other food services	Adequate
"Hospital"	4 (0.9)	General medical and surgical hospitals, and specialty (except psychiatric and substance abuse) hospitals	Adequate
"Real estate"	4 (0.9)	Lessors of real estate, and offices of real estate agents and brokers	Adequate
"Technology"	4 (0.9)	*Insufficient information*	More detail needed

[a] *The 15 responses listed accounted for 29% of the 441 cases with industry data reported. When processed by the National Institute for Occupational Safety and Health (NIOSH) Industry and Occupation Computerized Coding System (NIOCCS) in the absence of occupation data.*

[b] *More detailed industry response preferred to ensure that the appropriate code is assigned.*

[c] *More detailed industry response preferred to assign the most detailed code possible.*

general population (ie, that unemployed individuals may be overrepresented among cases of notifiable conditions), employment data are likely missing from a substantial portion of cases of notifiable conditions. And while occupation data were collected among the majority of cases reported as employed, those cases accounted for only 31% of cases among working-age individuals. Even more striking was the lack of industry data, which were reported for only a fraction of the cases reporting occupation data. The skip pattern programmed in the reporting system that requires entry of occupation data in order to report industry may have contributed to the low response for industry data.

TABLE 5
Data Reported and Coded,[a] by Type of Occupation and Industry Data Reported, Among Cases Aged 16 to 64 Years With Data Reported in Occupation Free-Text Field, Washington 2019-2021

Type of Data Reported in the Occupation Free-Text Field	Type of Data Reported In the Industry Free-Text Field	Cases, n (%)	Cases Assigned Occupation Code	Cases Assigned Industry Code
Occupation	Industry	321 (24.3)	97%	98%
	Other[b]	60 (4.5)	100%	93%
	Blank	694 (52.5)	95%	63%
Other[c]	Industry	39 (2.9)	69%	97%
	Other[b]	22 (1.7)	59%	77%
	Blank	187 (14.1)	30%	59%

[a] *Codes assigned to free-text responses using the National Institute for Occupational Safety and Health (NIOSH) Industry and Occupation Computerized Coding System (NIOCCS).*

[b] *Includes data reported in the industry free-text field that described an employer name, product, occupation, organization, or work setting.*

[c] *Includes data reported in the occupation free-text field that described an industry, employer name, work setting, or ownership.*

Incomplete occupation and industry data among notifiable conditions are not unique to Washington. In an evaluation of campylobacteriosis and salmonellosis case data from Maryland, Ohio, and Virginia, Su et al[25] noted several issues with occupation data, namely, missing data, potential disproportionate recording of example occupations listed on the report forms, and missing industry data, which, when reported, facilitate the coding of occupation data. The National Academies highlighted the lack of work-related data among infectious disease data as a weakness in the nation's occupational health surveillance system.[34]

Local health jurisdictions are central to the public health response to notifiable conditions in Washington. Data collection and immediate infection control efforts are largely undertaken by local health jurisdictions, which are responsible for collecting basic information about cases and for restricting infected persons from specific work settings. For conditions readily transmitted person-to-person, local health jurisdictions use information related to the case's work environment to assess the potential for disease transmission, instructing infected day care, health care, and food handling workers to avoid work while contagious. Although these select categories of industries and occupations are crucial for determining next steps to control spread of the disease, the descriptions are too vague and the categories too circumscribed to provide useful information on the distribution of cases by occupation and industry.

The current data collection process faces several challenges. First, most local health jurisdictions are underfunded and understaffed, leading them to prioritize select public health activities over others.[35] Skipping the collection of some data elements during case investigations is one way to conserve resources needed for more immediate issues. Second, there is no process for ensuring that staff have received adequate training on how best to collect quality occupation and industry data. Indeed, most staff have received little to no training on collecting occupation and industry data, which likely contributed to the lack of codeable data. Third, the case investigation form does not include scripts or questions for the interviewers to use with respondents. Instead, interviewers attempt to fill in blanks preceded by the prompts "Occupation:____" and "Type of business or industry:____".

There are several opportunities to improve the occupation and industry data collected during case investigations. Four recommendations for improving data in the near term are to (1) train case investigators on the concepts of occupation and industry and when to probe for detail or clarity in responses; (2) provide case investigators with appropriately phrased questions to ascertain occupation and industry; (3) collect occupation and industry among cases of all working-age adults; and (4) remove the skip pattern in the investigation form that allows for the collection of industry only if occupation has been recorded. In addition, streamlining the case investigation interview tool so that work information recorded in one section is carried over into others can help ensure that the data collected throughout the interview are both complete and consistent, aligning the data reported in free-text industry and occupation fields with check boxes for health care occupations or recent visits to susceptible work settings.

Advances in computing and technology might offer improvements to occupation and industry data that are both efficient and sustainable. Enabling the NIOCCS Web-call option during the interview (allowing case investigators to view the code assigned to an individual's response at the point of data collection) provides investigators with instant feedback, identifying inadequate responses that could be improved through immediate follow-up with respondents. Likewise, an auto-fill option in the computerized version of the questionnaire might speed the process of recording the data and help improve accuracy.

Limitations

This study is subject to at least 3 limitations. First, we did not evaluate the accuracy of all codes assigned. Thus, there may be additional issues not yet identified, related to an investigator's ability to accurately and succinctly describe a case's occupation and industry, that led to the assignment of inaccurate codes or a bias in the types of industries and occupations reported. Second, the COVID-19 response consumed many public health resources and may have reduced data collection efforts among other notifiable diseases during the pandemic. Although COVID-19 activities have decreased in recent years, local health jurisdictions continue to operate with limited resources, suggesting that current data collection efforts are likely similar to the years included in the study. Finally, oversight of the data collection process lies with each individual state. Findings from Washington may not be generalizable to other states.

Conclusion

The current public health surveillance system for notifiable conditions relies on the voluntary collection of data among local health jurisdictions, whose resources are limited and which may have little apparent use for occupation and industry data collected.

Implications for Policy & Practice

- In Washington, the occupation and industry data collected for many notifiable conditions are inadequate for describing cases by fundamental work characteristics, due to large amounts of missing data.
- Among nonmissing data, ambiguous and nonspecific responses were the main challenge to translating free-text occupation and industry data to standard numerical codes. Brief, specific descriptions of occupations and industries are more likely to be assigned accurate, detailed codes.
- Improvements in occupation and industry data may be achieved by:
  - Training case investigators on the best practices for collecting work data;
  - Modifying the investigation form to provide phrases to use when asking about occupation and industry and consolidate work questions throughout the form; and
  - Utilizing technology that facilitates assignment of standard codes.

However, protecting public health is best achieved through a multipronged approach, and occupation and industry data are critical to federal agencies, universities, and others that aim to protect worker health through a multitude of activities that include educational outreach, work process evaluation, and policy development.

Occupation and industry data are fundamental for understanding the epidemiology of notifiable conditions, addressing health inequities, allocating resources, and developing effective prevention measures. Methods of data collection that improve quality while minimizing the burden of collection should be pursued.

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Erratum

Achieving Sustainable Health Equity Locally After the COVID-19 Emergency Response: Erratum

In the November/December 2023 issue of the Journal of Public Health Management & Practice (vol 29, no. 6), a necessary funding acknowledgment and disclaimer statement were not published in the initial article entitled "Achieving Sustainable Health Equity Locally After the COVID-19 Emergency Response."

They are as follows:

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