Compliance inspections following severe amputation

Inspections by select characteristics of non-finger amputations, Washington 2016-2021

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DEFINITIONS

DOSH	WA Dept. of Labor & Industries Division of Occupational Safety & Health
L&I	Washington State Department of Labor and Industries
NAICS	North American Industry Classification System
OIICS	Occupational Injury and Illness Classification System
OSHA	Occupational Safety and Health Administration
SHARP	Safety and Health Assessment and Research for Prevention
WC	Workers' Compensation

KEYWORDS

SHARP; Amputation; Compliance; Inspection; Workers' compensation

EXECUTIVE SUMMARY

Limited resources prevent enforcement agencies from inspecting all worksites that experience a workplace injury, creating a need to prioritize compliance inspection activity. Workers' compensation data are a valuable source of occupational injury data that can augment employer reporting and help target workplace safety inspections, including those conducted by Washington's Division of Occupational Safety and Health (DOSH). In this study, we used Washington workers' compensation data to identify and characterize non-finger amputations from 2016 through 2021. We then linked the amputation data to cases reported in accordance with the employer reporting requirement and to DOSH compliance inspection data to determine whether some amputations – especially those likely associated with an enforceable standard – are less likely to be inspected than others. Identifying the characteristics of amputations less likely to result in an inspection can help evaluate approaches to prioritizing worksites for compliance inspections.

Key Findings:

- From 2016 through 2021, an average of 62 workers suffered a severe (non-finger) amputation each year in Washington.
- DOSH inspected 34% of severe amputations within six months post-injury, although the percent inspected varied:
    - By industry sector, from a high of 58% among manufacturing to a low of 0% among retail trade and public administration
    - By source of injury, from a high of 59% among machinery-related amputations to a low of 5% among amputations involving containers
    - By direct report to DOSH, from a high of 77% among amputations reported directly to DOSH by employers or healthcare providers to 20% among amputations not reported.
- Some industries saw little compliance inspection activity, even among machinery-related amputations.
    - While 84% of machinery-related amputations in manufacturing were inspected, only 20% of machinery-related amputations in the accommodation and food services sector were inspected.
- Two-thirds of machinery-related amputations in each industry sector could be inspected if DOSH were to complete an average of **two** additional inspections per year. *All* machinery-related amputations could be inspected if DOSH were to complete approximately **six** additional inspections per year.

Conclusion: Severe amputations occur in every industry sector, but some sectors are substantially less likely to be inspected than others, leaving workers susceptible to uncontrolled workplace hazards. Timely information gathered through SHARP's enhanced amputation surveillance system can inform inspection activity, helping to ensure that workplace hazard identification and correction efforts reach workers in all industries.

INTRODUCTION

Workers' compensation data can be a valuable source of occupational injury data. Providing insight into where, how, and how often workplace injuries are occurring, workers' compensation data can help guide injury prevention efforts. Washington workers' compensation claims data is often available within days of an injury, allowing for rapid identification and characterization of injuries. This data can augment employer reporting of injuries to help target workplace safety inspections, including those conducted by Washington's Division of Occupational Safety and Health (DOSH), the entity responsible for enforcing (and developing) workplace safety rules. DOSH often conducts a compliance inspection, following employer or hospital report of a traumatic injury, to ensure that the workplace hazards associated with the injury are eliminated. But limited resources prevent DOSH from inspecting all workplaces post-injury. In this study, we sought to summarize DOSH compliance activity among worksites that experienced an amputation, to determine whether some workplaces are less likely to be inspected than others, and to explore ways to leverage workers' compensation data to support compliance priorities.

METHODS

We identified amputations from among Washington workers' compensation claims, based on: keywords in the injury descriptions provided by the worker, employer, or healthcare provider on the form initiating a workers' compensation claim; Occupational Injury and Illness Classification Systems (OIICS) codes assigned to claims; and ICD-CM codes on hospital and medical bills and claim administrative data. We used body part to classify severity, defining severe amputations as those involving body parts other than fingers or fingertips. While less common than finger amputations, non-finger amputations have been associated with greater claim costs and lengthier work absence; detailed identification criteria and characteristics of amputations identified are provided in a separate report.[1]

We then linked the amputation claims to DOSH compliance data through employer account ID and business location ID. We used the inspection opened date to measure the number of days from injury to inspection, and limited our assessment to inspections opened within six months following the injury date. Claims were also linked to the cases reported to DOSH by employers and health providers and captured in DOSH's Hospitalization Report[2].

We summarized compliance inspections among non-finger amputations by source of injury (based on OIICS source codes assigned from the worker's description of the injury on the claim initiation form), Washington Industrial Risk Classification, and the North American Industry Classification System 2007 (NAICS) code associated with the business location.

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[1] Washington State Department of Labor and Industries. Surveillance of Amputations among Washington State workers, 2016-2021. February 2023. www.lni.wa.gov/safety-health/safety-research/files/2023/80_21_2023_AmputationSurveillance_2016_2021.pdf

[2] Employers are required to report amputations to DOSH within 24 hours (or within 8 hours if the incident resulted in an in-patient hospitalization).

RESULTS

A total of 372 non-finger amputations were identified among claims for injuries in 2016-2021. Fourteen percent of non-finger amputations were associated with a DOSH compliance inspection opened within 1 day of injury, 21% within 7 days after injury, and 27% within 30 days after injury (Figure 1). In total, 128 non-finger amputations (34%) were associated with an inspection opened within six months following injury.

The number of non-finger amputations peaked in 2018 at 71, then declined each year thereafter to a low of 54 in 2021 (Figure 2). During the first four years of the study period, the annual percent of non-finger amputations associated with a DOSH compliance inspection within six months following injury ranged from 32% to 37%. The greatest year-over-year change occurred between 2020 and 2021, when the percent of amputations inspected increased from a low of 31% to a six-year high of 41%.

The percent of non-finger amputations inspected within six months post-injury differed across several characteristics (Table 1). Amputations involving upper extremities were more likely to be inspected than lower extremities (38% vs. 29%). Machinery was the leading source of injury among non-finger amputations (n=101) and the source of injury with the highest inspection rate, with nearly 60% of machinery-related non-finger amputations associated with an inspection. Less than 10% of severe amputations caused by persons, plants, animals, and minerals (n=38) and containers (n=20) were inspected.

By risk class, the greatest number of non-finger amputations occurred among miscellaneous services (n=50), although it also saw among the lowest percent of amputations inspected (8%). The two risk classes with the highest percent of amputations associated with an inspection were 1) utilities and communication and 2) food processing and manufacturing, where nearly two-thirds of non-finger amputations were inspected.

Among the most striking differences in inspection rates was between cases reported to DOSH by an employer or health care provider and those not reported: 77% of reported amputations were inspected compared with 20% of amputations not reported (see Table 5 in the Appendix for the percent of employer-reported amputations source of injury and industry).

Figure 1. Cumulative percent of non-finger amputations associated with a DOSH compliance inspection, by timing of inspection, 2016-2021.

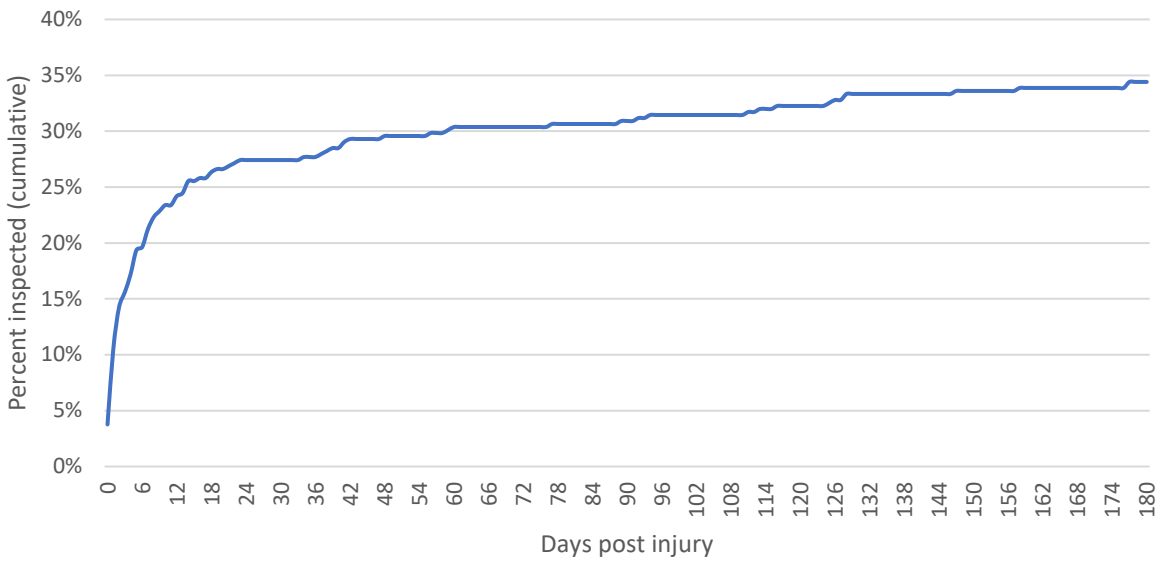


Figure 2. Non-finger amputations and percent associated with DOSH compliance inspection within six months post-injury, by year of injury.

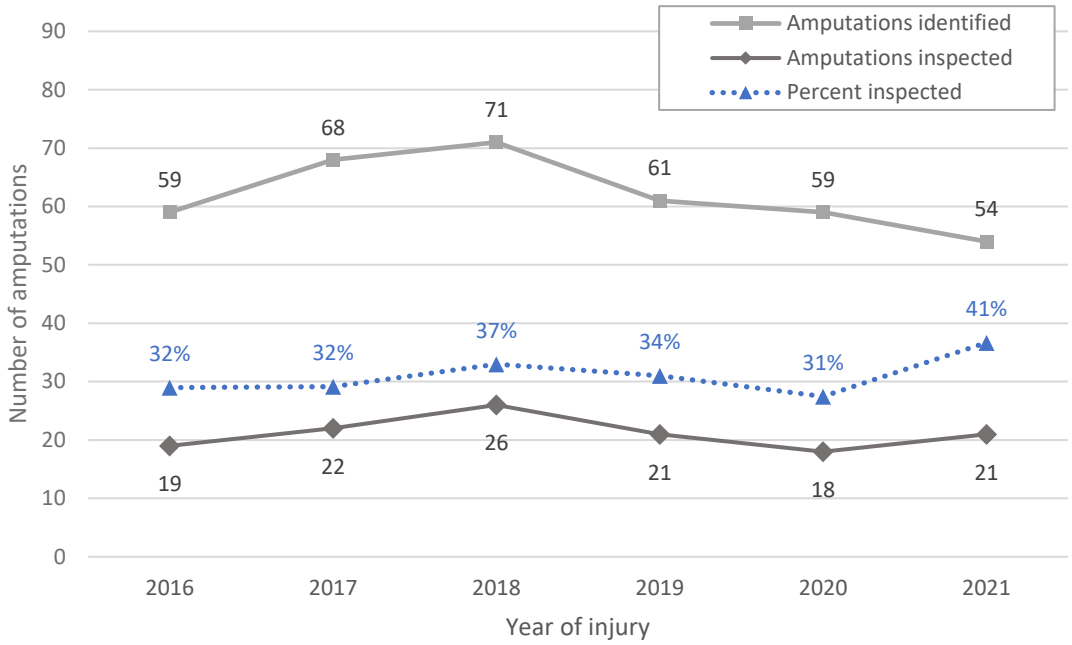
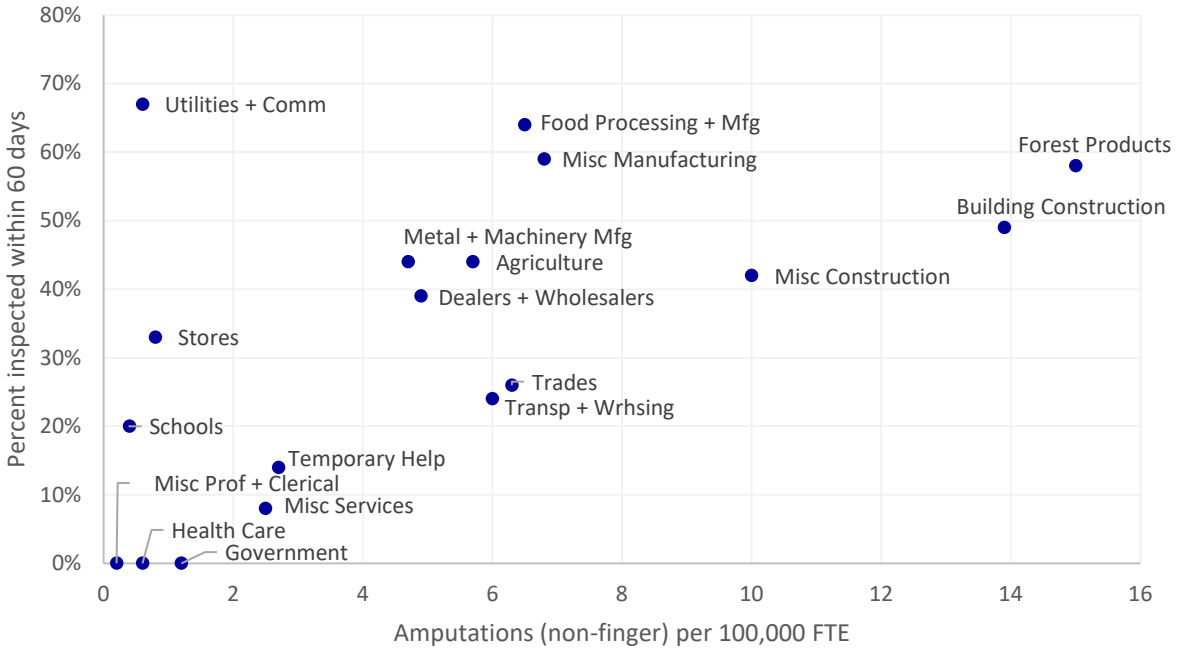


Table 1. Compliance inspections of non-finger amputations by select characteristics, 2016-2021.

Characteristic	Amputations n (%)	Percent inspected
Body part amputated		
Upper extremity	210 (56.5)	38%
Lower extremity	156 (41.9)	29%
Head	6 (1.6)	33%
Reported to DOSH by employer		
Reported	92 (24.7)	77%
Not reported	280 (75.3)	20%
Source of injury (OIICS division grouping)		
Machinery	101 (27.2)	59%
Structures and surfaces	53 (14.2)	19%
Parts and materials	52 (14.0)	23%
Vehicles	43 (11.6)	44%
Persons, plants, animals, and minerals	38 (10.2)	8%
Tools, instruments, and equipment	36 (9.7)	42%
Containers	20 (5.4)	5%
Furniture and fixtures	10 (2.7)	10%
Chemicals and chemical products	1 (0.3)	0%
Other sources	6 (1.6)	17%
Unknown	12 (3.2)	50%
Risk class		
Miscellaneous services	50 (13.4)	8%
Building construction	39 (10.5)	49%
Transportation and warehousing	38 (10.2)	24%
Miscellaneous construction	31 (8.3)	42%
Agriculture	27 (7.3)	44%
Metal and machinery manufacturing	27 (7.3)	44%
Trades	27 (7.3)	26%
Forest products	24 (6.5)	58%
Food processing and manufacturing	22 (5.9)	64%
Dealers and wholesalers	18 (4.8)	39%
Miscellaneous manufacturing	17 (4.6)	59%
Miscellaneous professional and clerical	11 (3.0)	0%
Government	10 (2.7)	0%
Stores	9 (2.4)	33%
Temporary help	7 (1.9)	14%
Health care	7 (1.9)	0%
Schools	5 (1.3)	20%
Utilities and communications	3 (0.8)	67%
Total	**372 (100)**	**34%**

Generally, the percent of amputations inspected increased with the rate of amputations by risk class, i.e., risk classes with higher rates of amputations also saw a larger percent of amputations inspected (Figure 3). Notable exceptions were utilities and communications, which had an amputation rate similar to both stores and health care, but an inspection rate that far exceeded inspection rates for those risk classes (and in fact, exceeded the inspection rates of all other risk classes). Building construction and miscellaneous construction had the second and third highest rates of non-finger amputations, respectively but ranked fifth and seventh in terms of the percent of amputations inspected.

Figure 3. Rate of non-finger amputations by percent inspected, by risk class, 2016-2021.



More non-finger amputations occurred among the construction sector than any other single industry sector, with construction accounting for 21.5% of all severe amputations (Table 2). While 44% of amputations in construction were inspected, three sectors had a higher inspection rate: manufacturing (58% of amputations inspected), agriculture, forestry, fishing and hunting (46%), and wholesale trade (45%).

Within each sector, the percent of amputations associated with an inspection varied by subsector. Within manufacturing, inspection rates ranged from a low of 44% of amputations in machinery manufacturing, to nearly 90% of amputations in wood product manufacturing. Transportation and warehousing had a similar range between low and high rates of inspection, although in general, lower than inspection rates among manufacturing: 13% of severe amputations in truck transportation were inspected, while 57% of severe amputations in warehousing and storage were inspected.

Table 2. Compliance inspections of non-finger amputations by industry, 2016-2021. Subsectors are presented for the five sectors with the greatest case counts.

Industry (NAICS code)	Amputations n (%)	Percent inspected
Construction (23)	**80 (21.5)**	**44%**
Specialty trade contractors (238)	58 (15.6)	50%
Construction of buildings (236)	17 (4.6)	29%
Heavy and civil engineering construction (237)	5 (1.3)	20%
Manufacturing (31-33)	**62 (16.7)**	**58%**
Fabricated metal product manufacturing (332)	13 (3.5)	54%
Wood product manufacturing (321)	9 (2.4)	89%
Food manufacturing (311)	9 (2.4)	56%
Machinery manufacturing (333)	9 (2.4)	44%
Nonmetallic mineral product manufacturing (327)	5 (1.3)	60%
Plastics and rubber products manufacturing (326)	4 (1.1)	50%
All other manufacturing subsectors	13 (3.5)	54%
Agriculture, forestry, fishing and hunting (11)	**41 (11.0)**	**46%**
Crop production (111)	20 (5.4)	50%
Support activities for agriculture and forestry (115)	10 (2.7)	50%
Forestry and logging (113)	8 (2.2)	38%
Animal production (112)	3 (0.8)	33%
Admin and support and waste management, remediation services (56)	**32 (8.6)**	**22%**
Administrative and support services (561)	29 (7.8)	21%
Waste management and remediation services (562)	3 (0.8)	33%
Transportation and warehousing (48-49)	**30 (8.1)**	**23%**
Truck transportation (484)	15 (4.0)	13%
Warehousing and storage (493)	7 (1.9)	57%
All other transportation and warehousing subsectors	8 (2.2)	13%
Wholesale trade (42)	29 (7.8)	45%
Accommodation and food services (72)	22 (5.9)	9%
Retail trade (44-45)	21 (5.6)	19%
Health care and social assistance (62)	18 (4.8)	0%
Other services (except public administration) (81)	12 (3.2)	17%
Public administration (92)	6 (1.6)	0%
Arts, entertainment, and recreation (71)	5 (1.3)	20%
All other (3 or fewer amputations within sector)	14 (3.8)	14%
Total	**372 (100)**	**34%**

Machinery was the leading cause of amputation injuries, with more than one in four non-finger amputations caused by machinery. Among machinery-related amputations, those involving agricultural and garden machinery or material handling machinery were most likely to be inspected (Table 3). Amputations involving special process machinery (most of which were food slicers or meat grinders) had among the lowest inspection rate of machinery-related amputations.

Among amputations involving plant and industrial powered vehicles and tractors, 86% were inspected within six months, the highest percent inspected of any source. No inspections were associated with amputations involving heating, cooling, and cleaning machinery and appliances, parts and materials – other, and water vehicles.

Table 3. Compliance inspections of non-finger amputations by source of injury, 2016-2021.

Source of injury	Amputations n (%)	Percent inspected
Machinery	**101 (27.2)**	**59%**
Agricultural and garden machinery	4 (1.1)	75%
Material handling machinery	19 (5.1)	74%
Machinery, unspecified + miscellaneous	34 (9.1)	59%
Metal, woodworking, and special material machinery	26 (7.0)	58%
Construction, logging, and mining machinery	7 (1.9)	57%
Special process machinery	10 (2.7)	40%
Heating, cooling, and cleaning machinery and appliances	1 (0.3)	0%
Parts and materials	**52 (14.0)**	**23%**
Building materials--solid elements	26 (7.0)	27%
Vehicle and mobile equipment parts	4 (1.1)	25%
Fasteners, connectors, ropes, ties	17 (4.6)	24%
Parts and materials--other	5 (1.3)	0%
Structures and surfaces	**53 (14.2)**	**19%**
Floors, walkways, ground surfaces	41 (11.0)	22%
Structures and surfaces, other	12 (3.2)	8%
Vehicles	**43 (11.6)**	**44%**
Plant and industrial powered vehicles, tractors	14 (3.8)	86%
Plant and industrial vehicle--non-powered	5 (1.3)	40%
Highway vehicle, motorized	23 (6.2)	22%
Water vehicle	1 (0.3)	0%
Tools, instruments, and equipment	**36 (9.7)**	**42%**
Hand tools – powered	20 (5.4)	60%
Hand tools – non-powered	11 (3.0)	18%
All other tools	5 (1.3)	20%
All other sources	87 (23.4)	14%
TOTAL	372 (100)	34%

Table 4 presents the number of severe amputations by sector and source of injury (machinery vs. all other injury sources). Construction ranked first in both total number of severe amputations, and number of severe amputations caused by sources other than machinery. Manufacturing had the greatest number of amputations caused by machinery.

Inspections were most common for machinery-related amputations in the manufacturing sector, where 84% of severe amputations were inspected. Among other machinery-related amputations, inspection activity was lowest in administrative and support and waste management and remediation services (29% inspected), and accommodation and food services (20% inspected), as well as information, real estate and rental and leasing, and educational services, where none of the three machinery-related amputations that occurred were inspected.

With few exceptions, industry-specific inspection rates were lower for non-machinery related amputations than for machinery-related amputations. Among non-machinery amputations, wholesale trade had the highest inspection rate, with 41% of severe amputations inspected. Inspection activity was lowest in accommodation and food services (6% of non-machinery amputations were inspected), healthcare and social assistance (0% inspected) and public administration (0% inspected).

Figure 4 presents the percent of non-finger amputations inspected, by industry and source of injury. Figure 5 presents the number of non-finger amputations inspected and not inspected, by industry and source of injury. Among machinery-related amputations, accommodation and food services had the greatest percent not inspected (80%), while construction had the greatest number not inspected (n=7). Among amputations from sources other than machinery, accommodation and food services, healthcare and social assistance and public administration had the highest rates of amputations not inspected, while construction, again, had the greatest number of amputations not inspected (n=38).

Table 4. Compliance inspections of non-finger amputations by industry and injury source: machinery vs. all other sources, 2016-2021.

Industry (NAICS code)	Total amputations n (%)	Machinery-related amputations n (%)	Percent inspected	Amputations from all other sources n (%)	Percent inspected
Construction (23)	80 (21.5)	19 (18.8)	63%	61 (22.5)	38%
Manufacturing (31-33)	62 (16.7)	31 (30.7)	84%	31 (11.4)	32%
Agriculture, forestry, fishing and hunting (11)	41 (11.0)	13 (12.9)	69%	28 (10.3)	36%
Admin and support and waste management, remediation services (56)	32 (8.6)	7 (6.9)	29%	25 (9.2)	20%
Transportation and warehousing (48-49)	30 (8.1)	2 (2.0)	50%	28 (10.3)	21%
Wholesale trade (42)	29 (7.8)	12 (11.9)	50%	17 (6.3)	41%
Accommodation and food services (72)	22 (5.9)	5 (5.0)	20%	17 (6.3)	6%
Retail trade (44-45)	21 (5.6)	6 (5.9)	33%	15 (5.5)	13%
Health care and social assistance (62)	18 (4.8)	0 (0)	-	18 (6.6)	0%
Other services (except public administration) (81)	12 (3.2)	3 (3.0)	33%	9 (3.3)	11%
Public administration (92)	6 (1.6)	0 (0)	-	6 (2.2)	0%
Arts, entertainment, and recreation (71)	5 (1.3)	0 (0)	-	5 (1.8)	20%
All other (3 or fewer amputations within sector)	14 (3.8)	3 (3.0)	0%	11 (4.1)	18%
Total	**372 (100)**	**101 (100)**	**59%**	**271 (100)**	**25%**

Figure 4. Percent of non-finger amputations inspected by industry and injury source, 2016-2021.

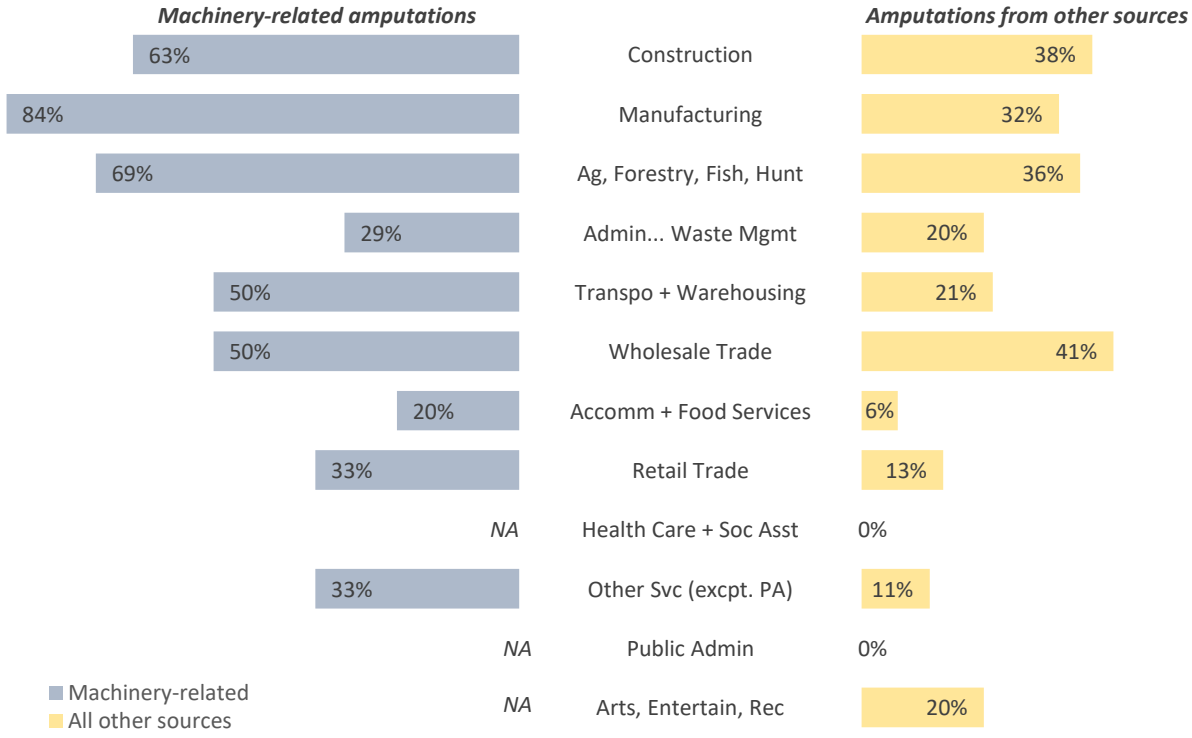
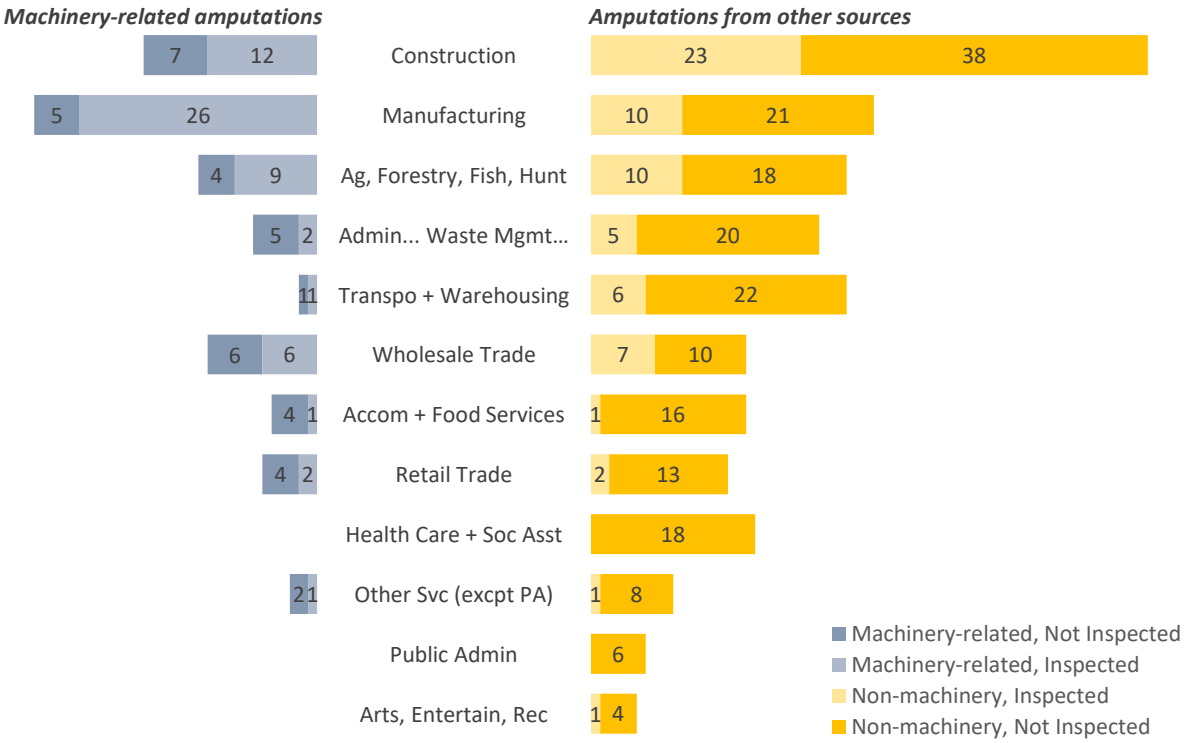


Figure 5. Number of non-finger amputations by inspection status, industry and injury source, 2016-2021.



DISCUSSION

Each year, an average of 62 non-finger amputations occur in Washington. DOSH inspects approximately one-third of them, although the likelihood of an inspection varies across several characteristics. Amputations most likely to be inspected were those that were reported to DOSH by employers or health care providers, resulted from injuries involving machinery, powered hand tools, and industrial powered vehicles or tractors, and occurred in the manufacturing sector or the warehousing and storage subsector. Increased compliance attention among these amputations likely reflects national and regional emphasis programs,[3-4] as well as DOSH's increased awareness of the injuries as a result of employer reporting.

Prioritizing inspections of injuries arising from specific sources like machinery, and powered industrial trucks, is a logical approach – these sources potentially indicate an existing safety violation, in contrast with injuries arising from, for example, motor vehicle accidents. However, even among Machinery-related injuries, some sectors saw very little inspection activity (e.g., accommodation and food services).

Workers' compensation data can assist in identifying high priority cases for inspection. Data collected at the time of claim filing include injury and incident descriptions provided by the injured worker and health care provider, which are used to characterize important aspects of the injury, including type of injury (e.g., amputation), injury source (e.g., agricultural and garden machinery). These data, as well as identifying information on the employer and worksite, are often available within days of a workplace injury, potentially allowing for rapid identification of injuries that meet select criteria. Augmenting employer reported amputations with cases identified from workers' compensation data could provide a more complete picture of severe amputations.

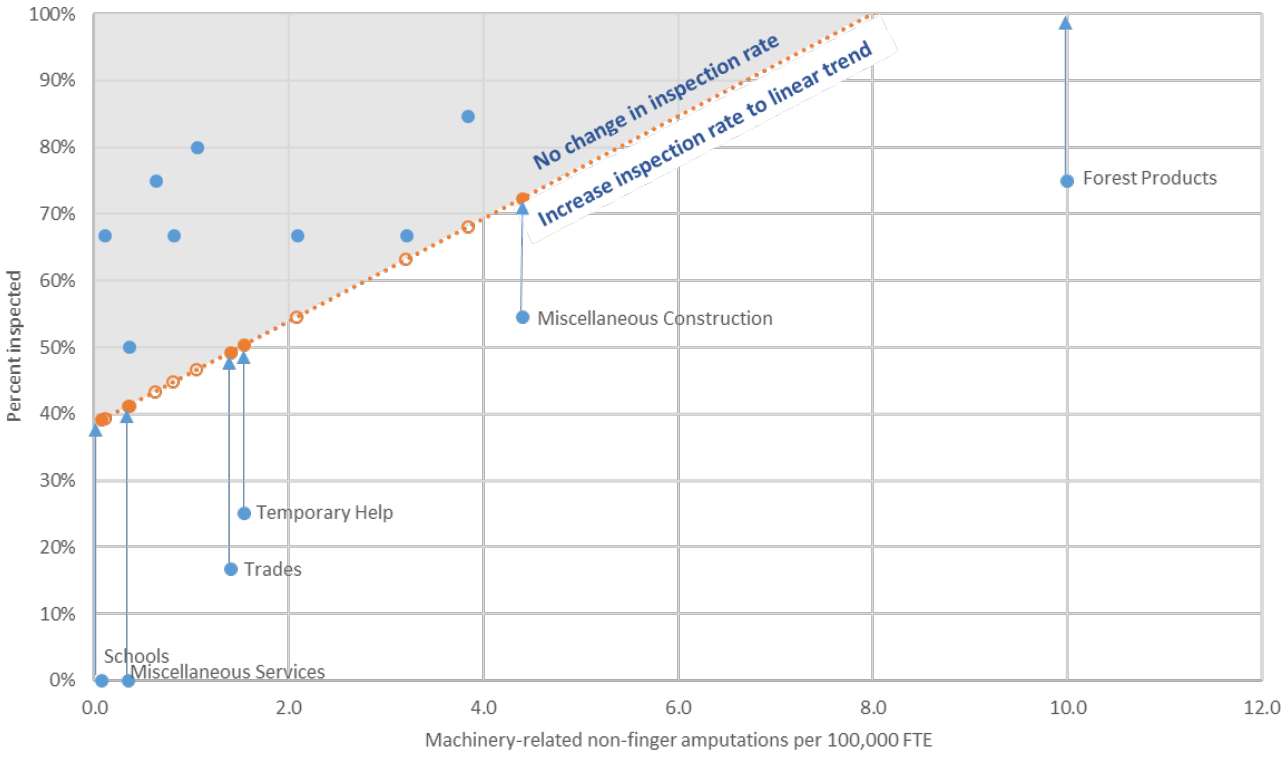
There are multiple ways to achieve greater parity in inspection activity across worksites. For example, DOSH could focus on machinery-related amputations, and set a target to inspect at least two-thirds of such amputations within each sector (with no change in the inspection rates among sectors with higher rates of inspections). This could be largely accomplished with existing resources, requiring just two additional inspections each year, yet the impact would differ substantially by sector: while no change would occur among manufacturing or agriculture, forestry, fishing, and hunting (both sectors already have inspection rates that exceed 67%), inspections among administration and support and waste management and remediation services would more than double while inspections among accommodation and food services would more than triple.

Another approach to increasing inspection activity among under-represented worksites is to set inspection rates proportional to amputation rates. Fitting a regression line using data on inspection rates and amputation rates by risk class can suggest a minimum inspection rate for each risk class, based on the risk class's amputation rate. Using the example of machinery-related amputations, the eight risk class groups that exceed the linear trend based on amputation rates would remain at the current

[3] CPL 03-00-022 National Emphasis Program on Amputations in Manufacturing Industries
[4] 21-09 (CPL 04) Local Emphasis Program for Powered Industrial Trucks

inspection rate, while six groups would see increased inspection activity (Figure 6). Among the risk class groups where inspections would increase include forest products, miscellaneous construction, temporary help, and trades. This, too, could be achieved by increasing the number of inspections by two each year.

Figure 6. Increasing inspection activity among under-represented worksites by tying risk class inspection rates to amputation rates.



Linear trend estimated by regressing risk class rates of machinery-related non-finger amputations on the percent of amputations inspected. Data for forest products was excluded as an outlier. In the proposed model, the percent inspected among forest products would increase to 100%.

Conclusion

Severe amputations occur in every industry sector. But some sectors are substantially less likely to be inspected than others, leaving workers susceptible to uncontrolled workplace hazards. Information gathered through SHARP's enhanced amputation surveillance system can be used to inform inspection activity, helping to ensure that workplace hazard identification and correction efforts reach workers in all industries.

APPENDIX

Table 5. Employer reporting of non-finger amputations by injury source and industry sector, 2016-2021.

Characteristic	Amputations	Reported to DOSH by employer	Percent reported by employer
Source of injury			
Machinery	101	41	41%
Vehicles	43	15	35%
Tools, instruments, and equipment	36	11	31%
Furniture and fixtures	10	2	20%
Structures and surfaces	53	10	19%
Parts and materials	52	6	12%
Containers	20	2	10%
Persons, plants, animals, and minerals	38	1	3%
Chemicals and chemical products	1	0	0%
Other sources	6	1	17%
Unknown	12	3	25%
Industry sector (NAICS code)			
Manufacturing (31-33)	62	26	42%
Construction (23)	80	25	31%
Wholesale trade (42)	29	9	31%
Transportation and warehousing (48-49)	30	9	30%
Admin, support, waste management, remediation svc (56)	32	7	22%
Arts, entertainment, and recreation (71)	5	1	20%
Retail trade (44-45)	21	4	19%
Other services (except public administration) (81)	12	2	17%
Agriculture, forestry, fishing and hunting (11)	41	6	15%
Information, finance, real estate, professional, mgmt svc (51-55)	9	1	11%
Health care and social assistance (62)	18	1	6%
Accommodation and food services (72)	22	1	5%
Public administration (92)	6	0	0%
Educational services (61)	3	0	0%
Mining, quarrying, and oil and gas extraction (21)	1	0	0%
Utilities (22)	1	0	0%
Total	**372**	**92**	**25%**