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Economic Evaluation

The Cost of Managing Occupational Injuries Among Frontline Construction Workers in Ghana

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ABSTRACT

Background: The cost burden of occupational injuries has significant effects on the social well-being of workers. Although there seems to be growing evidence on the cost burden on other public health issues, little is known about occupational injuries, especially in low- to middle-income countries including Ghana. **Objective:** This study, therefore, sought to estimate the cost burden of managing occupational injuries among frontline construction workers. **Methods:** A prevalence-based cost of illness approach was used to estimate the cost burden of construction injuries. A structured questionnaire was used to collect cost-related data from 640 frontline construction workers. Descriptive statistics were used to estimate direct and indirect cost of injuries using Microsoft Excel and STATA version 14. **Results:** Overall, a worker spends an average of GHC 104.84 ($24.52) and GHC 180.89 ($42.31) as direct and indirect costs, respectively. Compared with other injuries, fracture had the highest average cost, GHS 343.33 ($80.30), and concussion and internal injury recorded the lowest cost. Also, compared with other trade specialties, carpenters had the highest average cost burden and laborers had the lowest burden. **Conclusion:** There is high direct and indirect cost for managing occupational injury among construction workers. Advocacy and awareness about workplace insurance and regulatory policies should adequately be strengthened and prioritized through periodic monitoring and evaluations.

Keywords: cost burden, indirect cost, occupational injury, frontline construction workers.

Introduction

A substantial increase in global mortality and morbidity is caused by work-related injuries. Global estimates suggest that work-related injuries account for about 11% of disability annually.[1-3] Consistently, over 350 000 people globally suffer from workplace injuries and associated fatalities, which substantially translate to several forms of disabilities and deaths.[4-6] An estimated population of more than 5 million people die each year owing to injuries, with an approximate rate of 97 per 100 000 workers.[7] The incidence of construction injuries has doubled over time, with the highest burden in developed countries. The rate in low and middle-income countries is gradually increasing owing to the growing number of construction industries. Nevertheless, there seem to be limited data sources reporting these incidences. The few existing data in Ghana suggest that 56 of the 902 occupational accidents reported in 2000 were people who died owing to injuries in construction.[8]

To reduce the burden of construction injuries, it is important not only to measure the prevalence, but also to estimate the cost burden of these injuries to the workers. Undoubtedly, a considerable amount of lives, money, and time is lost every day owing to failure to prevent injuries. These costs present a huge burden to the national health systems, organizations, and individual workers.[9] The monetary value of these losses to the global and national economy equates to the cost related to cancer and other public health problems and conditions.[10] For instance, a total of $11.5 billion, which translates to about 15% of all private industrial cost, was lost to injury fatalities in construction in the United States.[11] Several studies have shown that employers tend to lose a

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substantial number of days of absenteeism from workers owing to the time off for treating occupational-related injuries.[11,12] For example, several studies have concluded that employers in the United States, Australia, and Ireland pay higher sums of monies as compensation to workers on days off for treating occupational-related injuries.[12-14] These costs continue to leave a heavy debt toll on economies, especially those in developing countries.

Efforts to reduce the increasing cost to employers and their employees require subscription to an insurance policy. Nevertheless, studies have showed that compensation by insurers is mostly overhyped because they are not able to absorb all costs associated with the injury and so could present an additional burden to families and patients. More importantly, less than one-third of the cost associated with injuries are borne by insurance, employers, and communities, whereas the larger share is covered by the individual worker.[6] In addition, the cost associated with managing these injuries may vary according to severity of the injuries, affected body parts, trade specialization, and associated medical conditions.[2] Several evidences have showed that injuries associated with construction laborers and carpenters appear as the leading trade specialty with the highest occupational injury and disease compensation payment rate.[15,16]

In Ghana, similar to other low- and middle-income countries, there is an increasing loss of resources to the national economy owing to occupational accidents and injuries.[17,18] The existing estimates suggest that an estimated amount of GHS 1.8 million ($420 904.95) was lost in 2012 owing to occupational accidents and injuries. Similarly, reports from the labor department showed that government paid an amount of GHS 956 326 ($223 623.52) to compensate 121 workers who had suffered from occupational-related accidents.[19] In addition, construction injuries present a huge economic burden to individual workers and organizations.[9] The injured worker is faced with several problems ranging from temporary to permanent disability to loss of income to adverse effects on quality of life of the workers, families, and friends.[11]

In an attempt to reduce this menace, it is important to understand not only the cost burden for nations and organizations, but also associated cost for managing these injuries to the individual worker. Nevertheless, there is little evidence on the cost associated with managing these injuries, particularly in the Ghanaian context. The search of literature showed that the few studies that evaluate cost burden are limited to other public health problems and issues, which include malaria[20-23] and household injuries (motorcycle injuries).[24,25] None of these studies have yet attempted to use quantitative primary data to estimate the direct and indirect cost of construction injuries. This study, therefore, sought to measure the cost burden of construction injuries among frontline construction workers in Ghana.

Methods

Study Design

A cross-sectional design with a prevalence-based cost of illness approach focusing on both the direct and indirect cost injuries was used to estimate the cost of injury management among the workers. The prevalence-based approach helped to measure the occurrence of occupational injuries among frontline construction workers and subsequently estimate the associated cost of treating such conditions. This approach is mostly used to measure costing in public health problems that seem under-reported.[26] The study was conducted in Kumasi Metropolis, which constitutes 1 of the 30 districts in the Ashanti region of Ghana. The metropolis was purposively selected for its cosmopolitan nature, heterogeneous population, and economic activities that attract building construction workers. The metropolis is the economic hub of Ghana and serves as the major transit point between the southern and northern zones of Ghana and the rest of the West African countries. The metropolis is populated with wide range of industrial activities, including both small- and large-scale construction, garages, wood-processing plants, and mining companies.[27] Kumasi Metropolis had a total population of 2.3 million as of 2013[27] and consists of 10 sub-metros, namely Asawase, Asokwa, Bantama, Kwaadaso, Manhyia, Nhysiaeso, Oforikrom, Subin, Suame, and Tafo. The age of economically active persons in the metropolis ranged from 15 years and older representing 66.5% of the population of the metropolis.

Table 1 – Sample distribution of study respondents in Kumasi Metropolis.

Sub-metro	Estimated economically active population (15-64 years) 2016	Proportion of total population	Estimated sample size
Asokwa	60 015	0.07	45.06
Bantema	111 740	0.13	83.90
Nyiaeso	58 608	0.07	44.00
Subin	76 902	0.09	57.74
Oforikrom	120 617	0.14	90.56
Asawase	129 033	0.15	96.88
Manhyia	65 373	0.08	49.08
Old Tafo	58 627	0.07	44.02
Kwaadaso	97 298	0.11	73.05
Saume	67 189	0.08	50.45
Total population of Kumasi Metropolis	865 606	1.00	635.75

Note. Estimated population of economically active persons (15-64 years) using 2015 growth rate: 2.16%.

Study Population

The population consists of all frontline building construction workers, such as carpenters, masons, brick or block layers, steel benders, and laborers, within the Kumasi Metropolis. It involved workers under structured companies and those working on their own. Both male and female workers aged between 15 and 64 years who were actively engaged in construction activities for at least a day and over a period of 12 calendar months before the study were recruited for the study.

Sampling

The sample size was estimated using the Cochran's[28,29] sample size formula. This was computed using an assumption that 50% of construction workers had occupational injuries (50% was used because there is no representative national data on construction workers who sustain injuries). The formulae used a "z value" of 1.96 or 95% confidence, a significance level of 0.05, and a degree of freedom of 0.5. The sample size estimation arrived at 384 respondents. The calculation further allowed a 10% nonresponse rate and design effects of 1.5 to arrive at 640 respondents.

The study used a multistage (2-stage) sampling to recruit respondents. The first stage of the sampling purposively selected all 10 sub-metros (Asawase, Asokwa, Bantama, Kwaadaso, Manhyia, Nhysiaeso, Oforikrom, Subin, Suame, and Tafo). The second stage of sampling used a simple random sampling to recruit participants. The number of respondents selected from

Table 2 – Background characteristics of frontline building construction workers in Ghana.

Characteristics	$n = 637$	%
Age group		
15-24 years	143	22.45
25-34 years	298	46.78
35-44 years	136	21.35
45+ year	60	9.42
Mean (SD)	31.43 (8.85)	
Sex		
Male	569	89.32
Female	63	9.89
Missing[‡]	5	0.78
Marital status		
Single	262	41.13
Married	375	58.87
Educational level		
No formal education	143	22.45
Basic education[*]	341	53.33
High school	137	21.51
Tertiary[†]	16	2.51
Working experience (years)		
1-4	304	47.72
5-9	143	22.45
10-20	157	24.65
21+	33	5.18
Mean ± SD	7.57 ± 7.40	
Work structure		
Daily paid worker (by day work)	283	44.43
Temporal worker	242	37.99
Permanent worker	111	17.58
Monthly income		
360-499	19	2.98
500-999	389	61.07
1000-1499	204	32.03
More than 1500	25	3.92
Average income ± SD (USD)	954.86 ± 311.89; (223.33 ± 72.95)	
Median (USD)	960 (224.52)	
Average wage ± SD income per artisan group GHS (USD)	*Median income per artisan group* GHS (USD)	
Mason	60 ± 22.78 (14.03 ± 5.33)	50 (11.69)
Laborer	33.70 ± 6.30 (7.88 ± 1.47)	30 (7.02)
Carpenter	52.86 ± 12.98 (12.36 ± 3.04)	60 (14.03)
Steel bender	46.31 ± 10.84 (10.83 ± 2.54)	50 (11.69)
Average wage all artisans ± SD (USD)	40.65 ± 13.07 (9.51 ± 3.06)	
Trade specialization		
Mason	176	27.63
Laborer	358	56.20
Carpenter	70	10.99
Steel bender	33	5.18

[*] Basic education: Nine-year training from primary one to completion of junior high school and middle school.
[†] Tertiary education: includes university and polytechnics.
[‡] Missing responses.

each sub-metro was estimated using a probability proportion to the size of the economically active population (see Table 1). The research team visited the communities in the sub-metros where the households were selected randomly from the communities. Starting from the first house in each community, all the prospective respondents approached at the households were made to pick from a folded card with a "yes" and "no" inscription. Those who picked "yes" and consented to participate were enrolled as respondents. This approach was repeated in each sub-metro until the 635 respondents were reached. In all, less than 10% of prospective respondents answered "no." In households where there were more than 1 eligible respondent, the research team enrolled at most 2 respondents. Again, in instances where none of the construction workers met the inclusion criteria, the research team moved to the next household. In instances where the construction worker was not readily available to be interviewed, a later appointment was scheduled for the interview.

Table 3 – Total, average, and median cost per injury type experienced by frontline building construction workers in Ghana.

Type of injury	N = 355	%	Total cost—GHS (USD)	Average cost—GHS (USD)	Median cost – GHS (USD)
Fracture	24	6.78	8240 (1927.21)	343.33 (80.30)	200.00 (46.78)
Open wound	132	37.29	12 653 (2959.35)	112.97 (26.42)	25.00 (5.85)
Dislocation and sprains	28	10.45	7955 (1860.56)	215.00 (50.29)	40.00 (9.36)
Superficial (on surface) injury	63	15.25	7965 (1862.90)	156.18 (36.53)	50.00 (11.70)
Concussion and internal injury	54	15.25	1034 (241.84)	20.68 (4.84)	10.00 (2.34)
Amputation and deformity	30	8.47	4450 (1040.79)	234.21 (54.78)	120.00 (26.07)
Other unspecified injuries	23	6.50	7034 (1645)	319.73 (74.78)	350.00 (81.86)

Note. USD: US dollar rate at 2016 market price 1 USD = GHS4.2756.
GHS indicates Ghana cedis.

Data Collection

Data were collected from the respondents over a 7-month period (December 2016 to June 2017) through the administration of structured questionnaires on a face-to-face basis. The questionnaire was programed into a smartphone using Open Data Kit.[30] Special training was organized for research assistants to equip them on the use of mobile apps for data collection and translating questions into local dialect. The questionnaire was pretested at Ejisu-Juaben Municipal, where respondents were randomly interviewed to check the reliability of the tools. A pictorial guide with all the major body parts labeled with numbers and their corresponding names was used to aid the research assistant to minimize data-entry errors. The categories of variables covered in the questionnaire are those identified in previous literature and theories on occupational injury. The occupational injuries were operationalized as all physical harm or damage to a person's body caused by an object. Injuries reported are aligned to the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision*.[31] Variables covered in the questionnaire are injury types (fracture, open wound, dislocation and sprains, superficial injury, concussion and internal injury, amputation and deformity, and other unspecified injuries) and individual factors (demographic, socioeconomics, and time loss from managing injuries). More importantly, variables used to estimate direct cost are associated with cost from each trade specialization (mason, laborer, steel bender, and carpenter), feeding cost, transportation cost, and medication cost.

Data Analysis

All data analyses were performed using Microsoft Excel and STATA version 14. Data were analyzed using descriptive statistics such as frequencies, mean, SDs, median, percentages, and percentiles. Direct and indirect costs were estimated according to approaches used in previous literature in road traffic injuries, birth mortality, and defects.[11,16,32] The indirect cost was particularly estimated using previous methods that estimate total cost of pain among industrial workers in The Netherlands.[33]

The direct cost was estimated by summing up all costs a worker incurred in the course of managing the injury:

- Direct cost = medication paid + laboratory + X-rays + admission cost, treatment cost (outpatient services, special consultation, emergencies, wound dressing) + transportation and feeding cost.

Indirect cost was estimated based on the assumption that every working hour that is lost owing to injury contributes to loss in productivity:

- Indirect cost = average days lost × average wage per day.
- Time value lost = summation of all the days a worker spends off work in seeking care and treatment.

The monetary estimates were all converted to US dollar, using the conversion rate of 4 Ghana cedis and 27 pesewes (4.2765) to a dollar as published by the central bank (38) December 28, 2016.

Results

The mean and median age of the respondents were 31 (31.43 ± 8.85) years and 30 years, respectively, with a range of 15 to 64 years (see Table 2). More than one-third (46.78%) of the respondents were between ages 25 and 34 years. Most respondents were male (89.32%) and were married (58.87%). More than half (53.33%) of the workers had a basic-level education, while 22% (22.45%) of the entire workers had no formal education.

The average age experience for working in the construction sector was 7.57 ± 7.40 years: 47.72% had worked for 1 to 5 years. About 44.43% of respondents worked as daily paid workers otherwise known as by-day workers, 37.99% as temporary workers, and 17.58% as permanent workers. More than half of the workers constituted laborers (56.20%) and masons (27.63%), respectively. Half of entire study population earned a monthly income of GHS 960 ($224.53), with laborers being the group with the least GHS 30 ($7.02) daily wage.

Cost Burden by Type of Occupational Injury

Overall, about 355 (57.91) of the respondents sustained at least some form of occupational injury. More than one-third, 37.29%, sustained open wounds; 15.25% each sustained superficial and concussion and internal injury; and 10.45% had dislocation and sprains (Table 3). Compared with other injury types, fracture had the highest average and median cost of injury of GHS 343.33 ($80.30) and GHS 200.00 ($46.78), respectively. (The monetary estimates 1 USD is equivalent to GHC 4.2765 [Central Bank of Ghana December 28, 2016]). Nevertheless, concussion and internal injury had the least average and median cost of GHS 20.68 ($4.84) and GHS 10.00 ($2.34), respectively (Table 3).

Cost Burden of Injury Associated With Type of Facility, Services, and Sex Disparity

The study disaggregated the cost burden of injury by the type of visit to health facility, provider of services, years of work experience, and sex. Workers who were hospitalized incurred the highest average cost of GHS 620.45 ($145.11), whereas those who sought a 1-time visit to pharmaceutical shops incurred the lowest

Table 4 – Cost burden of injury: cost by facility ownership and type of service paid for at point of care by frontline building construction workers in Ghana.

Variable	n	%	Mean GHS ± SD	Mean USD ± SD	Median GHS (USD)	IQR GHS	IQR USD
Type of visit to health facility							
Visit and returned (OPD)	69	11.79	247.83 ± 161.62	57.96 ± 37.80	200 (46.78)	120-350	28.07-81.86
One-time visit pharmacy	460	78.63	31.07 ± 50.78	7.27 ± 11.88	15 (3.51)	10-30	2.34-7.02
Hospitalized	52	8.89	620.45 ± 190.87	145.11 ± 44.64	600 (140.33)	450-800	105.25-187.11
Never sought for care	4	0.68	-	-	-	-	-
Type of SDP							
Public	142	24.91	317 ± 253.87	74.14 ± 59.38	300 (70.17)	100-450	23.39-105.25
Private	428	75.09	36.66 ± 98.49	8.57 ± 23.04	15 (3.51)	10-25	2.34-5.85
Sex of worker							
Male	562	90.03	133.57 ± 197.94	31.23 ± 46.29	20 (4.68)	10-120	2.34-28.06
Female	63	9.97	33.47 ± 114.67	7.83 ± 26.81	15 (3.51)	10-20	2.34-4.68
Working experience (years)							
1-4	304	47.72	79.78 ± 183.91	18.66 ± 43.00	20 (4.68)	10-30	2.34-7.02
5-9	143	22.45	121.47 ± 178.53	28.40 ± 41.75	25 (5.85)	10-150	2.34-35.07
10-20	157	24.65	135.92 ± 220.64	31.78 ± 51.59	30 (7.01)	10-150	2.34-35.07
21+	33	5.18	86.24 ± 135.45	20.17 ± 31.67	40 (9.35)	5-140	1.17-32.74
Exact service sought							
General care	125	19.62	108.47 ± 162.12	25.37 ± 37.917	39 (9.12)	10-150	2.34-35.07
Consultant clinic	36	5.65	536.11 ± 255.40	125.39 ± 59.73	600 (140.33)	250-800	58.47-187.11
Accident and emergency	24	3.77	470.83 ± 182.33	110.12 ± 42.64	450 (105.25)	350-450	81.86-105.25
Wound dressing	19	2.98	184.17 ± 164.34	43.07 ± 38.44	120 (28.07)	40-400	9.36-93.56
Medication only	335	52.59	26.10 ± 46.92	6.10 ± 10.97	15 (3.51)	10-25	2.34-5.85
Transportation cost	85	-	16.13 ± 15.54	3.77 ± 3.64	0.80 (0.18)	15-60	3.51-14.03

Note. - indicates no record of cost. Public SDP: government hospitals, clinics, and health centers. Private SDP: private clinics, pharmacy shop, chemical shop, traditional/herbal medicines/centers. USD: US dollar rate at December 28, 2016 market price. $1.00 = 4.2765.
GHS indicates Ghana cedis; IQR, interquartile range; SDP, service delivery point.

average cost of GHS 31.07 ($7.27) (see Table 4). The cost associated with consultant clinics was highest, whereas those related to transportation to the service point were lowest (mean GHS 536.11 [$125.39] vs GHS 16.13 [$15.54]). Similarly, workers who sought care from a public facility incurred a higher cost than those seeking care from a private facility (mean GHS 317 [$74.14] vs GHS 36.66 [$8.57]). Again, male workers incurred a higher cost than female workers (mean GHS 133.57 [$31.23] vs GHS33.47 [$7.83]). In addition, workers who have worked for 10 to 20 years incurred the highest cost of treatment, whereas those who had 1 to 4 years of experience had the lowest cost of treatment or medication (mean GHS 135.92 [$31.78] vs GHS 79.78 [$18.66]).

Direct and Indirect Cost Incurred

The total monetary cost for the building construction workers in Kumasi was estimated at GHS 118 816.40 ($27 789.41), averaging at GHS 207.36 ($48.50) per injury expenditure (see Table 5). A direct cost of GHS 55 772.90 ($13 044.46) was estimated for the injured workers, and this represented 46% (46.94%) of the total cost. Each worker incurred an average cost of GHS 104.84 ($24.52) per injury episode; however, the median direct cost of GHS 20 ($4.68) was also incurred by a worker. Laborers incurred the least average cost of GHS 57.09 ($13.35) among the various trade groups. The average direct cost components included medical services and medication, GHS 103.58 ($24.23), and feeding for the person, including an accompanied person GHS 24.5 ($5.73) and transportation GHS 6.51 ($1.52).

The sum of indirect cost among the workers was GHS 63 043.50 ($14 744.95). A worker on average loses GHS 180.89 ($42.30) for every injury episode and also loses GHS 75.79 ($17.72) as median cost. Masons incur the highest loss of GHS 140 ($32.74) per injury episode among the trade groups.

Cost per Injury

Injury types frequently reported by frontline construction workers are shown in Table 3. Open wounds had the highest cost (GHS 12 653 [$2959.35]) followed by fractures (8240 [$1927.21]) and superficial injuries (7965 [$1862.90]). Open wounds were higher because of frequent occurrence (37.29%) among others. Fractures were, however, the most expensive (GHS 343.33 [$80.30]) injuries to care for, with concussion and internal injury being the less expensive conditions (GHS 20.68 [$4.84]) a worker could spend on average.

Time Value Lost

Most (55.99%) of the workers had taken days off work, for reasons ranging from injury occurrence (47.96%) and fatigue at work (32.65%) to attending social functions (9.69%) and a break in job engagements or contracts (6.63%), as shown in Table 5. More than half (50.17%) of this population lost an income for staying off work for an average of 5.5 days. Fifty percent of masons lost a median of 18 days at work, whiles steel benders also lost 12 days. Similarly, 50% of workers spend 15 minutes to travel to service delivery points and wait for 5 minutes before they receive treatment when they get an injury. On average, 19.51 minutes of travel time and 31.59 minutes of wait time is used to access care (Table 6).

Discussion

The study aim was to estimate the cost burden of occupational injury among frontline construction workers in Ghana. The cost burden was estimated using direct and indirect costs of occupational injury. The direct cost consists of medication cost, transportation, and feeding cost. Indirect cost addressed the average

Table 5 – Summary of direct cost and indirect cost of managing injuries among frontline building construction workers in Ghana.

Items	GHS	USD	Items	GHS	USD
Direct cost			Indirect cost		
Average cost for each trade			Average cost for each trade		
Mason	112.42	26.29	Mason	140.31	32.82
Laborer	57.09	13.35	Laborer	78.91	18.46
Carpenter	154.49	36.02	Carpenter	105.52	24.70
Steel bender	143.45	33.55	Steel bender	82.26	19.24
Feeding cost					
Total	588	137.52	-	-	-
Average ± SD	24.5 ± 24.31	5.73 ± 5.68	-	-	-
Median	7	1.64	-	-	-
IQR	6-35	1.40-8.19	-	-	-
Transportation cost					
Total	182.4	42.66	-	-	-
Average ± SD	6.51 ± 7.08	1.52 ± 1.66	-	-	-
Median	4.8	1.12	-	-	-
IQR	3.6-5.0	0.84-1.17	-	-	-
Medication cost					
Total	55002.5	12864.28	-	-	-
Average ± SD	103.58 ± 191.21	24.23 ± 44.72	-	-	-
Median	20	4.68	-	-	-
IQR	10-100	2.34-33.39	-	-	-
Total direct cost (%)	55 772.90 (46.94)	13 044.46	Total indirect cost (%)	63 043.50 (53.067)	14 744.95
Average	104.84	24.52	Average	180.89	42.31
Median	20	4.68	Median	75.79	17.73
Total injury cost					
Sum	118 816.40	27 789.41			
Average ± SD	207.36 ± 512.14	48.50 ± 119.76			
Median	49.34	11.54			

Note. - indicates no record of cost. USD: US dollar rate at 2016 market price. $1.00 = 4.2765.
GHS indicates Ghana cedis; IQR, interquartile range.

days and wages lost per day and time value lost owing to the injuries.

The cost of occupational injuries (direct and indirect) is significant to individual workers, employers, and society for several reasons. The costing can inform individuals and organizations regarding safety measures and management. More importantly, the cost can inform individuals and organizations about how to manage insurance policies. Our study showed that frontline construction workers incurred an average of GHC 104.84 ($24.52) direct cost of managing occupational injury. The direct cost for managing occupational injuries appears higher considering the Ghanaian economy. In particular, the average direct cost was about 2.3 times higher than the monthly minimum wage of the Ghanaian working population (GHC 248) in 2016. Given that the direct cost is twice higher than the monthly minimum wage, it indicates that it could have serious impact on the standard of living of construction workers. The direct cost can negatively influence the expenditure, saving, and purchasing abilities of construction workers. In addition, the average expenditure (GHS 24.5 [$5.73]) on feeding when seeking care for injury was about 50% of the daily wage (GHS 40.65 [$9.50]) of a construction worker. The huge direct cost for managing injuries can have a significant economic burden on the patients and dependents. This finding confirms earlier studies that conclude several negative impacts from injuries on the patients.[9,11] In most instances, individual patients who sustained injuries experienced several difficulties, such as loss of income and adverse effects on quality of life.[11] Our study findings recommend that employers and construction workers should ensure adequate insurance policies that can reduce the economic burden of managing occupational injuries. In addition, employers can also employ measures to reduce workplace occupational injuries for workers.

The study findings showed that injured workers spent an average of GHC 180.89 ($42.31) as indirect cost owing to the time off in managing construction-related injuries. The indirect cost was about 72.9% of monthly minimum wage in 2016 (GHC 248). In addition, the injured workers lose an average of 13.78 days owing to time off for managing the injuries. Given the increased indirect cost and associated days off for managing injuries, construction workers are more likely to experience a significant economic burden. In particular, the injured workers could experience a huge financial burden when there is limited or no insurance coverage. Consequently, the injured workers may have to rely on other sources for financial support to manage their injuries and dependent family members. The findings confirm a previous study, which suggested that injured workers are at higher risk of experiencing loss of productivity owing to days off from work.[12] The study finding recommends that employers should develop measures that could compensate injured workers for the days off from work. This can supplement any insurance benefit for injured workers to reduce the economic burden of managing injuries and dependent families.

The indirect cost of injuries was about 1.72 times higher than the direct cost of managing the injuries. This finding suggests that there is a huge gap between indirect and direct cost associated with managing occupational injuries.[34,35] This is ascribed to the fact that estimate of injury concentrates on the primary cost and mostly is limited to only the paid amount during injury episodes.

Table 6 – Time value lost by frontline building construction workers in Ghana owing to injury.

Variable	n = 593	%
Off days taken		
Yes	332	55.99
No	261	44.01
Reasons for staying off work	n = 196	
Owing to fatigue	64	32.65
Injury	94	47.96
Normal off days	6	3.06
Attend to other social issues	19	9.69
No job engagement or break in work	13	6.63
Loss of income owing to time off	n = 598	
Yes	300	50.17
No	298	49.83
Days of absence from work		
Total days absent from work	4575	
Mean	13.78	
Median	5.5	
IQR	3-14	
Total days absent by each group		
Mason	1792	
Laborer	2050	
Carpenter	536	
Steel bender	197	
Average days absent each group		
Mason	18.10	
Laborer	12.06	
Carpenter	11.91	
Steel bender	8.57	
Travel time (minutes)	n = 515	
Mean	19.51	
Median	15	
IQR	3-72	
Waiting time at point of care (minutes)	n = 450	
Mean	31.59	
Median	5	
IQR	3-480	

IQR indicates interquartile range.

In particular, the indirect cost looks beyond the physical payment and includes all other hidden costs; however, direct cost is limited to costs associated with medication and treatment. This finding confirms earlier studies estimating the cost of injuries.[6,10] In these previous findings, the indirect cost of managing injuries was twice or more than half of the direct cost incurred by a worker. The difference in the direct and indirect cost of injuries are mostly caused by the methods used to estimate the costing. Our findings recommend that future studies estimating the direct cost of injuries should include all costs associated with medication, transportation, and feeding. In addition, indirect cost should adequately address costs associated with absenteeism from work.

Moreover, the various costs associated with managing the injuries varied according to several factors, including the source of seeking care, the type of injury sustained, and the category of construction work. The highest cost burden was recorded for care in the hospital, whereas the least average cost of treatment was aligned with visiting the pharmacy and chemical shops. Traditionally, seeking care from the hospital could certainly incur a higher cost than treatment from the pharmacy and chemical shops. Contextually, the patients' population in Ghana, including injury related, would present to the pharmacy shops with minor conditions, whereas severe ones are presented to the hospitals. Recognizing that severe conditions would require serious attention, including consultant or specialist services, diagnosis, and medications, could translates to the higher cost compared with care from the pharmacy and chemical shops.

Limitations

The study had various limitations regarding the participants, scope, and data collection instruments and process. The study was limited to only construction workers, without the perspectives of policy regulators and health workers. The study recruited 640 construction workers to represent the entire construction workforce in the Kumasi Metropolis of Ghana. The cost of injuries reported by the workers may be dependent on time and severity, which was not addressed in the study instrument. This experience could possibly influence their response to the questions on cost of managing the injuries and so affect the validity of the strength of the conclusion. More importantly, the data collection instrument was self-developed by the researchers, without adapting any existing validated instruments for cost measuring. Nevertheless, the study used vigorous scientific methods in randomization, development of study tools using previous literature, pretesting of tools, ethical approval, statistical analysis, and discussion of findings with relevant literature. Also, the problem of health worker effect in the study was reduced by interviewing respondents from the household level, where both injured and healthy workers could not be missed. These measures helped to minimize the effects of limitations on the study findings.

Conclusion

The study estimated the cost burden of occupational injury among frontline construction workers in Ghana. The study findings conclude that there is a higher economic and monetary cost of occupational injury among construction workers. Injured workers incurred higher direct and indirect costs for managing occupational injuries. More importantly, the direct cost of managing occupational injuries appears higher than the monthly minimum wage in the Ghanaian economy. Our study showed that the cost of managing injuries differs by the source of seeking care, the type of injury sustained, and the category of construction work. The highest cost burden was recorded for treatment and care in the hospital, whereas the least average cost of treatment was aligned with visiting the pharmacy and chemical shops.

Implications for Policy and Future Research

- Stakeholders are encouraged to strengthen existing regulations and policies that aim to ensure standards and safety measures and subsequently reduce construction-related injuries.
- Advocacy and awareness about workplace insurance policies should be prioritized through periodic monitoring and evaluations.
- Construction employers should embark on strategies that can compensate injured workers from the days off from work. This can supplement any insurance benefit for injured workers to reduce the economic burden of managing injuries and dependent families.
- Researchers interested in economic burdens associated with occupational injuries are encouraged to include all components of costing in the estimation of direct and indirect costs.
- Researchers are encouraged to use qualitative methods to explore the subjective experiences of economic burden in managing occupational injuries.

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