Original Research Article

Determinants of Occupational Injury among Building Construction Employees in Southeastern Ethiopia

Abstract

Introduction: An occupational injury is the primary cause of workplace absenteeism, disability, retirement, mutilation, and mortality. Therefore, injuries in the workplace pose major public health and developmental problems especially in developing countries, which cause serious health, social, and economic costs on the labor force and their companies. The present study identified the prevalence of injury and its determinants among building construction employees in Robe town, Ethiopia.

Methods: An institutional-based cross-sectional study was conducted among building construction employees in Robe town from March 01-25/2017. A simple random sampling technique was used to select the study participants. The data was entered into Epi data 3.1 and analyzed by using SPSS version 20 software. Face to face interviews were conducted on 402 respondents using structured and pretested questionnaire. Bivariate and multivariate logistic regression analyses were performed to identify the effect of explanatory variables on injuries. **Results:** The prevalence of injury among building construction employees was reported to be 39.2% [95 % CI: (34.4, 44.2)] in the past one year. The three leading causes of injuries were falls from the same level, 38.5%, followed by injuries caused by movable or falling objects, 23.1%, and falls from elevation, 13.4%. Being male, use of personal protective equipment, health and safety training, regular supervision and job satisfaction were factors significantly associated with injury.

Conclusion: This study reported relatively higher prevalence of injury among building construction workers compared to other studies. Factors such as being male, working without using personal protective equipment, absence of health and safety trainings, lack of regular supervision and job dissatisfaction were associated with significantly higher levels of occupational injury among construction workers. Therefore,employers should focus on providingsafety training, promoting use of personal protective equipment during work, regularly supervising work, and satisfying their employees by creating good work environments and working situations to reduce the frequency of occupational injuries.

Key words: Occupational injury, building construction, employees, health and safety

1. INTRODUCTION

An occupational injury is defined as any physical damage situation sustained on an employee in association with the performance of his or her task in the workplace [1] . It is the primary cause of workplace absenteeism, disability, retirement, mutilation, and mortality [3]. Injuries in the workplace pose major public health and developmental problems which cause serious health, social, and economic costs on the labor force and their companies [2]. These costs account to four percent of the world's gross domestic product (GDP) (about 1.25 trillion USD) [3].

Occupational injuries related to construction jobs remain a big problem in the world [4]. Globally, 17 percent of all occupational deaths are in the construction sector [5,6]. According to health and safety statistics, in UK the

construction industry had the second highest percentage of self-reported illness accredited to an occupation at 3,800 cases per 100,000 working individuals [7]. Therefore, employees in the construction sector have a high total death rate, autonomous of social class, with bricklayers and manual laborers being documented as having the second highest death rate, [25]. The construction company has particular hazards to the sector alone such as working in a complex environment as both the place of work and the labor force are non-static. Construction employees work at heights and with power tools. There is a general lack of regulation compared with other sectors. There are typically multiple jobs and employers working on a single site with absence of coordination in which different activities generate dissimilar hazards. The sector is dominated by impermanent, unorganized and illiterate employees who are cheaply paid, resulting in informal employees-employer relationships and a lack of standards in terms of required expertise and training [8, 25]. These reasons have made the construction company the most hazardous of workplaces, contributing to a large number of injuries and deaths when compared with other manufacturing industries.

The construction industry is subject to high rates of work absenteeism, occupational accidents, and occupational diseases due to the presence of high rates of exposure to physical, psychosocial, mechanical, biological, chemical and ergonomic risk factors in the sector [3]. Thus, injuries and fatalities in the construction company have been associated with significant economic costs [7]. Annually, over 10 billion USD have been spent for direct and indirect occupational injury costs. More than 1.36 billion USD have also been spent for nonfatal medical expenses, [9].

The construction industry is also an emergent industry of the world, comprising 7.5% of the total work force. It contributes to major economic impacts behind the agricultural sector, due to the fact that socio-economic and infrastructure development goals are attained only by the contribution of construction sector [25] spurring on social infrastructure necessary for socio-economic development [10]. The construction industry employs a large number of people to meet the demands of fast and targeted growth [25]. Therefore, 44% of urban unorganized employees are engaged in this sector after agriculture, [6].

The effects of work-related health and safety hazards encountered by construction employees in unindustrialized countries are ten to twenty times higher than those in developed countries [2]. Ethiopia is one of the developing countries that is currently enjoying a strong growth in construction activities such as building schools, hospitals, housing complexes, shops, offices, highways, power plants, industries, bridges and other infrastructures [9]. However, all these lucrative construction activities are done by low income, illiterate, unskilled, and unorganized employees working in unsafe work environments in the absence of implementation of occupational health and safety laws [11]. Poor design of work stations and tools, absence of personal protective equipment, lack of supervision, inadequate training of workers, and unsafe working environments are the major causes of most occupational injuries especially in developing countries [12]. In addition, young age, male sex, lack of formal education, lack of experience, job dissatisfaction, smoking, chewing, excess alcohol use, sleeping problems, prolonged working hours, and non-use of personal protective equipment are essential individual factors among construction workers potentially influencing accident rates, [13, 25].

In Ethiopia, little work has been done on work-related health and safety issues, especially on building construction employees. The prevalence of work-related injuries among building construction employees in Addis Ababa city is identified to be 84.7% [3], and in Gondar town at 38.7% [13]. Even with these high prevalences, the occupational problems of construction sectors were not addressed or reduced in many parts of developing countries [6, 25]. Therefore, this study is designed to identify major factors that can determine occupational injuries among building construction employees in Robe town, southeastern Ethiopia.

2. MATERIALS AND METHODS

An institutional based cross-sectional study design was carried out from March 01-25/2017 in Robe town. Robe is the capital city of Bale Zone which is found at a distance of 430 and 180 Kilometers from Addis Ababa and Shashemene cities respectively. The town has four kebeles and thirteen building construction companies with a total of 3,979 employees during the study time.

The necessary sample size was calculated by using a single population proportion formula. Where, P= proportion of occupational injury 38.7% [13], d= 5%, Z=1.96, and a 10% non-response rate:

$$n= (Z \alpha /2)^2 * P (1-P) /d^2 = (1.96)^2 * 0.387 (1-0.387)/ (0.05)^2$$

$$n= 365$$

$$N= 365 + 10\%= 401.5 \approx 402$$

A standardized questionnaire was modified by reviewing different literature based on the study objectives [20,21,25]. Detailed information about the socio-demographic characteristics, behavioral characteristics, working environment, work history, personal history, psychological questions, awareness and practice towards safety and health in the workplace among construction employees, and occurrences of injuries in the previous one year were collected. All thirteen building construction industries found in the town were included in the study. First, the sample was proportionally allocated to each of the construction industries. Then a simple random sampling technique was employed to select the required sample from the construction sites. The employees' payroll was used as a sampling framework to pick the study participants using lottery method.

Data quality was assured with iterative translation of tools, training of data collectors and supervisors, and pre-testing of the questionnaire. Five BSc nurses and two environmental health professionals who can speak Amharic and Afaan Oromo languages were selected for data collectors and supervisors respectively. Then data collectors and supervisors were trained for two days about the questionnaire and how to administer it. The questionnaire was pre-tested on 5% of the sample before the actual data collection to check consistency; correction was taken by identifying potential problem areas. Then face to face interviews were conducted by trained data collectors after obtaining informed consent. After completing each interview data collectors checked completeness of the questionnaire. During data collection, the supervisors managed for its completeness on daily basis and feedback was given to each data collectors. The data was entered into EPI data 3.1 and exported to SPSS version 20 statistical package for analysis. Frequency distribution, mean and percentage calculations were made to describe socio-demographic characteristics and to determine the magnitude of occupational injuries. Logistic regression analysis was also performed to see the relative effects of independent variables on the dependent variable. To avoid confounding factors bivariate followed by multivariate logistic regressions analysis with 95% confidence interval (CI) was applied. First, crude odds ratios (CORs) and 95% confidence intervals (CIs) of each factor were performed by using bivariate logistic regression. Variables with P-value less than 0.25 in the bivariate analysis were selected for multivariate analysis. Finally, all variables where $p < 0.05$ in multivariate analysis were taken as being significant.

3. RESULTS

3.1 Socio-demographic characteristics

From the total sample size of 402 workers to be studied, 4 questionnaires were incomplete that made the response rate of 99%. Over three-fourths, 76.9% of the respondents, were male. The majority, 77.9%, of the participants were in the age group of 18−35 years. Regarding religion, 41.2% identified themselves as Christians. The majority, 70.6%, were married. Concerning educational level, 58% of respondents attended primary education. Around eighty percent of respondents had monthly payment of 50 - 150 USD (Table 1).

Table 1: Socio-demographic characteristics of respondents

Variables	Frequency (%) (n = 398)
Sex	
Male	306 (76.9)
Female	92 (23.1)
Age (in years)	
< 18	10 (2.5)
18-35	310 (77.9)
>35	78 (19.8)
Marital status	
Married	281(70.6)
Single	107 (26.9)
Divorced/ Widowed	10 (2.5)
Religion	
Christian	164 (41.2)
Muslim	225(35.8)
Others	9 (2.3)
Educational level	
Illiterate	78 (19.8)
Primary(1-8)	231 (58)
Secondary and above	89 (22.2)
Monthly Salary (in USD)	
50-150	318 (79.9)
>150	80 (20.1)

3.2 Workplace and behavioral characteristics

Three-fourths, 74.9%, of the employees were temporary workers. One-fourth, 25.6%, was involved on masonry work. The majority, 71.9%, had worked above 8 hrs per day. Regarding vocational training, 83.7%, didn't attend any kind of workplace health and safety training. Over half, 52.8%, served for <= 2 years. The majority, 79.4%, revealed that workplace supervision had never occurred in the past 12 months. More than eighty five percent hadn't used personal

protective equipment during the work. The majority, 70.4%, 76.6%, and 83.7% of participants didn't chew chat, drink alcohol and smoke cigarette respectively (Table 2).

Table 2: Workplace and behavioral characteristics of respondents

Variables	Frequency (%) (n = 398)
Employment pattern	
Permanent	100 (25.1)
Temporary	298 (74.9)
Job category	
Excavators	74 (18.6)
Masons	102 (25.6)
Welders/electricians	46 (11.6)
Plasterers	87 (21.8)
Carpenters	59 (14.8)
Machine Operators	19 (4.8)
Painters	11 (2.8)
Work experience	
<= 2year	210 (52.8)
> 2 years	188 (47.2)
Work hours per day	
=<8 hours	112 (28.1)
>8 hours	286 (71.9)
Health and safety training	
Yes	65 (16.3)
No	333 (83.7)
Use PPE during work	
Yes	57 (14.3)
No	341 (85.7)
Workplace supervision	
Yes	82 (20.6)
No	316 (79.4)
Chew khat	
Yes	118 (29.6)
No	280 (70.4)
Drink alcohol	

Yes	93 (23.4)
No	305 (76.6)
Smoke cigarette	
Yes	65 (16.3)
No	333 (83.7)
Job satisfaction	
Yes	102 (25.6)
No	296 (74.4)
Lack of sleep	
Yes	144 (36.2)
No	254 (63.8)

Regarding the day of injury, Monday was the most frequent day of injury,24.7%, followed by Friday,17.3%, while the majority of the employees 31.9% didn't remember the exact day of injury (Figure 1).

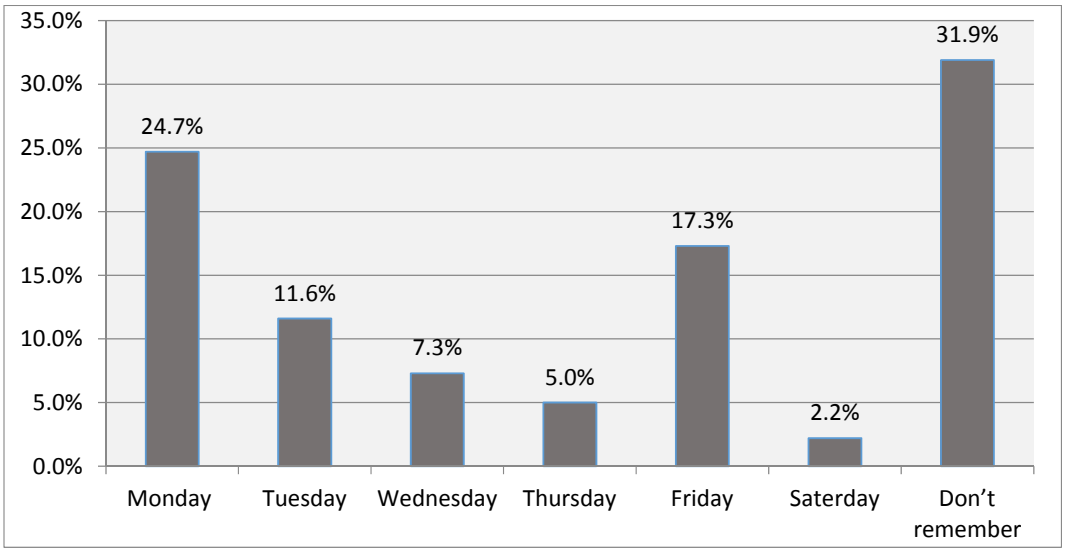

Figure 1:Day of the week when injury happened among building construction employees

3.3 Prevalence of occupational injury

The overall prevalence of injury among building construction employees was reported to be 39.2% [95 % CI: (34.4, 44.2)] in the previous one year, with37.8% of workers reporting an injury sustaining more than one injury. The three leading causes of injuries were falls from the same level, 38.5%, followed by injuries caused by movable or falling objects, 23.1%, and falls from elevation, 11.5% (Table 3).

Table 3: Distribution and causes of occupational injury among building construction employees

Variables	Frequency (%)
Occupational injuries in the last 12 months (n=398)	

Yes	156 (39.2)
No	242 (60.8)
Number of occurrence (n=156)	
Once	97 (62.2)
More than once	59 (37.8)
***Cause of injury (n=156)**	
Falling from the same level	60 (38.5)
Hurt by movable or falling object	36 (23.1)
Falling from height	21 (13.4)
Injury by sharp instrument	14 (9.0)
Splinting or splashing objects	12 (7.7)
Lifting heavy objects	15 (9.6)
Fire	4 (2.6)
Electricity	9 (5.8)
Other	2 (1.3)

**Multiple responses allowed*

In this study, the main types of injuries reported were abrasions, 33.3%, cuts, 23.7%, and fractures, 18.6%. Most work-related injuries happened on the hands of the study participants, 26.9%, followed by fingers and legs, 23.1%, 17.9% respectively. Around 11 percent of participants had multiple injuries (Table 4).

Table 4: Types of injury and affected body parts among building construction employees

Variables	**Frequency (%)**
***Types of Injury (n=156)**	
Laceration / Abrasion	52 (33.3)
Cut	37 (23.7)
Suffocation	3 (1.9)
Fracture	29 (18.6)
Dislocation	12 (7.7)
Burn	7 (4.5)
Ear injury	1(0.6)
Electrocutions	4 (2.6)
Eye injury	14 (9.0)
Poisoning	3 (1.9)
Multiple	7 (4.5)
Others	1 (0.6)
***Parts of the body affected (n=156)**	

Head	24 (15.4)
Finger	36 (23.1)
Toe	19 (12.2)
Eye	26 (16.7)
Hand	42 (26.9)
Leg	28 (17.9)
Multiple	17 (10.9)
Others	3 (1.9)

**Multiple responses allowed*

Among the total injured employees, 42.3% were hospitalized, of which 59.5% were hospitalized for more than 24 hours. Around 36.5% of them were absent from their work for more than 3 days (Table 5).

Table 5: Severity of occupational injury among building construction employees

Variables	Frequency (%)
Hospitalized (n=156)	
Yes	37 (23.7)
No	119 (76.3)
Days of hospitalization	
≤24 hours	15 (40.5)
>24 hours	22 (59.5)
Days of absent from work	
≤3 days	99 (63.5)
>3 days	57 (36.5)

3.4 Determinants of occupational injury

In this study the independent variables of injury in the multivariable analysis were sex of the employee [AOR: 0.396, 95 % CI: (0.137-0.661)], using PPE during work [AOR: 3.615, 95 % CI: (1.153-6.337)], workplace supervision [AOR: 2.072, 95 % CI: (1.561-4.946)], health and safety training [AOR: 5.078, 95 % CI: (2.818-9.148)], and job satisfaction [AOR: 1.912, 95 % CI: (1.171-3.096)]. These explanatory variables remained statistically significant after controlling the confounders (Table 6).

Table 6: Determinants of occupational injury, using multivariable logistic regression model

Variables	Injury status		OR (95% C.I)	
	Yes	No	COR, (95% C.I)	AOR, (95% C.I)
Sex of employee				
Male	141	165	1	1
Female	15	77	0.358(0.118-0.792)	0.396(0.137-0.661)

Using PPE during work				
Yes	12	45	1	1
No	144	197	4.586(2.107-9.980)	3.615(1.153-6.337)
Health and safety training				
Yes	16	49	1	1
No	140	193	4.735(2.718-8.249)	5.078(2.818-9.148)
Workplace supervision				
Yes	20	62	1	1
No	136	180	2.108(1.002-4.356)	2.072(1.561-4.946)
Job satisfaction				
Yes	13	89	1	1
No	143	153	1.758(1.224-4.961)	1.912(1.171-3.096)

AOR: Adjusted for age, marital status, work experience, monthly salary, educational level, work hours per day, smoke cigarette, drink alcohol, chew khat, lack of sleep, employment pattern and work category

4. DISCUSSION

The study results revealed that out of the total participants, 39.2% [95 % CI: (34.4, 44.2)] of employees experienced occupational injuries at least once in the past 12 months. This finding is in line with a study conducted in Ethiopia in Gondar town, 38.7 % [13] and Addis Ababa, 38.3 % [9]. However, recently higher prevalence was reported from Addis Ababa 84.7% [3]. Our study had significantly higher injury prevalence than studies done from Egypt (18.4 %) [15], India (22.9 %) [9] and China 15.0% [22]. This inconsistency in the prevalence of injuries could be due to the differences among countries in level of development, availability of occupational health and safety facilities, workplace and working conditions, employees' level of awareness to hazard control and prevention, and data collection technique.

This study showed that falling from the same level (38.5%) followed by hurt via movable or falling object (23.1%) and falling from height (13.4%) were the three leading causes of occupational injuries. This result is almost similar with the study done in northern Ethiopia, where falling from ground level and falling from height were the leading causes of injuries [13]. In Egypt accidents related to falling at ground level, struck by an object and hit by falling objects were major causes of lethal and disabling injuries among building construction employees, [15].

Abrasions, 33.3%, cuts, 23.7%, and fractures, 18.6%, were the main types of injuries reported among construction workers. Most occupational injuries happened to the hands of the study participants, followed by fingers and legs, 26.9%, 23.1%, and 17.9% respectively. These body parts are the most active and openly bare to working equipment and unprotected machines. The hands also support and balance our body during fall accidents. These findings were also agreement with a study conducted in Addis Ababa [3,10].

This study revealed that male workers experience proportionately more injuries than females. The odds of injury among females working in the construction job were 60% less compared to males [AOR: 0.396, 95% CI: (0.137-0.661)]. This finding is comparable with findings conducted in different regions [3, 11, 16]. This difference in chance of getting work-related injury based on sex might be linked with several factors which can increase the risk of injury

such as the difference in task assignment (usually males do harder tasks); work environment (males do the riskier jobs than females especially in the construction site such as working at height), and work schedule (males relatively worked longer hours per day) etc. [17].

Use of PPE showed statistically significant association with work related injury; construction workers who didn't use PPE during work were 3.6 times more likely to face injury compared to their counter parts. In this study 85.7% of the employees did not use PPE in the course of work. This may indicate that there was absence of provision of PPE from the responsible bodies lack of awareness about its significance and/or carelessness of the employees, [9, 22, 25]. In Iran carelessness of workers and the lack of using protective equipment caused fractured in more than 90% of the cases, [22]. Seven in ten construction employers felt that the worker being careless was the main cause of work-related injury. Over two thirds (69%) of construction employers felt that the main cause of occupational injury was the employee being careless, [19].

Different studies conducted in developing countries discovered that increased educational level has been inversely related with occupational injuries. Education is more likely to increase employee's safety and health knowledge avoiding them from injuries, [18]. However, this study showed that educational level of employee didn't indicate any statistical significant association with occurrence of injury. This may be because enhancing the educational level of workers by itself alone can't decrease injury. Rather, sustained good work supervision, limiting levels of exposure down to standard requirements, applying health and safety rules and procedures, and by giving value for safety first [2, 22] are important . Researchers have shown that there is a strong association between training on health and safety issues and occupational injury rates among employees. This is because health and safety training could inspire workers to be safer and instruct them in right safety conduct. This study indicated that employees who did not having training on health and safety were five times more likely to have work-related accidents than workers who acquired training [(AOR 5.078, 95% CI (2.818-9.148)]. This result agreed with studies done in Ethiopia [1,13,8]. In China occurrence of injury among workers who didn't engage in health and safety training was 16.2 % [22]. This finding indicates the importance of providing training in prevention and control of occupational hazards and accidents. Injury prevention and safety training should contain basic construction safety, machine operation safety, high working place safety, and chemical safety [25]. According to the health and safety training requirements released in 2006 through the state administration of work safety, it is necessary that construction employees obtain at least 32 hours of vocational training before they first pledge to work in construction company and have at least eight hours of safety training annually thereafter[23-25]. The health and safety training is usually organized by the construction industry and directed by a licensed safety and health expert. Construction site is not a static place of work, where there are a number of firms present at any given time to perform work for short periods. On average, trained employees were present at construction sites for 10 months, although a systematic training program could have a better effect if measured in the long term [13,24].

Regular workplace supervision also reduced injury by 2.072 times [AOR: 2.072, 95% CI: (1.561-4.946)]. This finding agreed with other findings, [5,14, 15]. In Iran lack of supervision was identified as the leading cause of work related injury. It caused 80% of deaths and 71% of amputations, [26]. Therefore, the employer must ensure that employees are properly instructed and supervised on the safe operation of machinery, tools, equipment, process, or practices and to conduct their work in compliance with all applicable safety and health rules, [19].

Another essential finding of this study was that workers who were not satisfied with their jobs were 1.9 times more likely to be injured compared to their counterparts, [AOR=1.912, 95% CI (1.171-6.096)]. An increasing number of

studies have reflected that job satisfaction is a powerful factor in the occurrence of occupational injuries in the work environment [2,13, 14]. Job dissatisfaction may be related with work environment, leadership style, motivation and disincentives, like working for long hours without enough rest, low payment, working in hazardous jobs, unable to get health and safety services and so on. Therefore, these conditions may affect the employees to exhibit unsafe behavior by losing their motivation or concentration. This may also be due to the fact that when the employees are not satisfied with their job, they may not experience meaningfulness at work, greater work responsibility, and better use of their knowledge and skills in their job leading to declining safety in their work and increased occupational injuries. In Egypt 51.2% of the disabling injuries were caused by human factors like lack of attention, [15]. Basically, when job satisfaction is increased, on-task activities are improved, leading to greater attention to safety motivation, knowledge, and compliance. Thus, increasing employee job satisfaction could be an important factor at eliminating occupational hazards in the workplace [9].

5. LIMITATIONS OF THE STUDY

This study has the following limitations. A cross-sectional study design could result in recall bias resulting in under or over reporting of injury events, especially if they were minor injuries, since the data collected was based on self-reported practices rather than direct observation. In addition, some of the employees may not have been willing to divulge occupational problems and "negative" information which could lead to weaker associations between independent and dependent variables in this study.

6. CONCLUSION

In this study a high occurrence of injury was found among construction workers . Factors such as the male sex of the workers, employees working without using PPE, absence of health and safety trainings, lack of regular supervision and job dissatisfaction were associated with significantly higher levels of occupational injury among construction workers. Therefore, employers should focus on providing safety training, promoting use of PPE during work, regularly supervising the workplace, and satisfying their employees by creating good work environment and working situation in order to reduce occupational injuries.

CONSENT

As per international standard or university standard, Informed consent was obtained from each interviewee and they were also given the choice to refuse to participate in the study.

ETHICAL APPROVAL

As per international standard or university standard, an ethical clearance letter has been obtained from Madda Walabu University's ethical clearance committee. Support letters were obtained form construction industries' responsible persons and other concerned bodies in Oromia region, Robe town.

AVAILABILITY OF SUPPORTING DATA

Data will be available upon request.

COMPETING INTERESTS

The authors have no any competing interest.

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This study was funded by Madda Walabu University, Ethiopia.

AUTHORS' INFORMATION

AL is a lecturer at Madda Walabu University, MK is a lecturer and an academic and research coordinator at Madda Walabu University, AH is a lecturer and head of public health department at Madda Walabu University, SN is a lecturer at Madda Walabu University.

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