Deaths and Injuries from Unintentional Falls: An Analysis of Nepal Police Records

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Abstract

Falls are a major cause of unintentional injury-related global mortality and morbidity. The actual mortality and morbidity from falls in Nepal have been overlooked and not systematically studied. This study, therefore, aims to present the national status of fall-related deaths and injuries. The study analyzed the fall incidents recorded by Nepal Police for five fiscal years (17 July 2014 to 16 July 2019). These incident recordings were in the form of narratives, and possible variables were extracted for the analysis. In five years, 4,714 people were injured or died from falls in Nepal. The average age of the fall victim was 35.6 years (SD=19.94); the mean age of the person who died from falls was slightly lower (30.9 years) than the injured person (40.4 years). The analysis showed that the fall cases were remarkably greater for males than females. This study found that Bagmati Province, where the capital city was located has the highest death and injury rates from falls, followed by Gandaki Province and Province 1. The study identified 11 different locations of falls. These findings revealed that Nepal has a considerable burden of fall deaths and injuries. However, the actual burden of fall injuries might be higher due to the under-reporting of the incidents through the Nepal Police data recording system.

Keywords

Deaths; falls; injuries; Nepal; police record

Introduction

Globally, fall is the leading cause of morbidity and the second cause of unintentional injury-related mortality (World Health Organization, 2018). Every year, 172 million people are injured, resulting in short and long-term disabilities (James et al., 2020), and 646,000 people die from fall-related injuries (World Health Organization, 2018). The total number of fall deaths doubled between 1990 and 2020 (James et al., 2020). Furthermore, fall-related injuries vary considerably from one region to another. The vast majority (80%) of fall-related deaths and disabilities happen in low-and middle-income countries (World Health Organization, 2007, 2018). The South Asia region has experienced a noticeable increment in fall injuries after 1990 and has the world's highest age-standardized fall-related death rate (James et al., 2020). The Global Burden of Disease (GBD) estimate shows that the South Asia region has 22 deaths per 100,000 population due to fall injuries. Recent epidemiology of fall injury study in Bangladesh (Wadhwaniya et al., 2017) found that injury and death rates for falls were 36.3 per 1,000 and 5 per 100,000, respectively. The survey from developed countries shows that the risk of fall injuries is higher in the aging population (65+ years of age) (World Health Organization 2007). However, the results from a pilot injury surveillance system in Pakistan showed that the youth population is also at an equally high risk of fall injuries (Bhatti et al., 2015). Most of the studies on fall injuries focus on the elderly population (Kannus et al., 1999; World Health Organization, 2007). There are limited studies on fall injuries from low-and middle-income countries. The published studies from these countries also focused on the elderly population (Sasidharan et al., 2020; Williams et al., 2015).

Nepal is a low-income country in South Asia (World Bank, 2020) and has a high morbidity (12.9 per 1,000) and mortality (16.4 per 100,000) burden from falls (Pant et al., 2020). A study conducted in 2014 estimated a whopping 16,600 deaths from falls, which constitutes 37% of Nepal's total lifetime unintentional injuries (Gupta et al., 2015). The study further showed that fall injuries are most common in the age group 25 to 54 years, as this population group solely accounts for about half of the total fall injuries in Nepal. The annual report of the Ministry of Health (2016) reported that 687,751 fall injuries were recorded in outpatient departments. Despite the significant risk of a fall injury, national-level studies on fall-related deaths and injuries are lacking. Most of the studies were based on a small sample population or were hospital-based (Gupta et al., 2015; Limbu & Poudyal, 2020; Rai et al., 2017). A country representative study can provide the national situation of fall injuries and act as evidence for highlighting the need to develop effective fall preventive measures. Therefore, there is a need for research that provides a national picture of fall injuries in Nepal.

Identifying the evidence of fall injuries is challenging for a country like Nepal, where there is no well-defined system for recording death and injuries from falls. A police record is the only national-level data source in Nepal. Hence, this study aims to present the national status of fall-related mortality and morbidity using a central (federal) police record system to generate a knowledge base on preventable fall injuries in Nepal.

Methods

This study utilized the available records of deaths and injuries from falls reported to Nepal Police, Nepal's national law enforcement agency, for the most recent five fiscal years (17 July 2014 to 16 July 2019). The information on deaths and injuries was recorded by the Operation and Crime Investigation Department of Nepal as part of their official investigation process. Nepal Police has developed a daily incident reporting system in all parts of the country. Once the information is recorded in the system, the data can be retrieved from Police Headquarters. The authorities regularly recorded the reported deaths and injuries narratives in the daily incident reporting system.

Initially, the data was in the form of narratives in the Nepali language. The variables (age, sex, location, district, province, reporting time, and month of occurrence) were extracted using a pattern recognition algorithm. Before extracting variables, the records were read and checked manually to identify uniform patterns and correct inconsistencies throughout the case narratives. This study used recurring linguistic patterns to define an algorithm for extracting relevant variables, such as the district of the incident, location of the fall, age and sex of the person, and the reason for the fall.

Along with 4,714 unintentional fall-related deaths and injuries, 308 cases from intentional falls (11% of the total fall-related deaths) were identified. Those intentional fall incidents were excluded in the analysis, and only unintentional deaths and injuries from falls were included in this study. The frequency distribution, deaths and injury mapping, and cross-tabulation with different variables have been used in this study.

Results

Description of deaths and injuries

It is challenging to categorize the intentional and unintentional nature of fall-related deaths and injuries. Despite the challenges, Nepal Police has mentioned the intent of the fall incidents in the narratives. The daily incident reporting system recorded 4,714 incidents of unintentional falls (52.2% deaths and 47.8% injuries) in five years (Table 1). The number of fall incidents among males outnumbered their female counterparts by a 3:1 ratio (3,579 for males compared to 1,036 for females).

The proportion of people with non-fatal fall injuries was higher for the economically active age group (20-49), as this age group comprised about 49.8% of the total (non-fatal) fall cases. The total average mean age was 35.6 years (SD=19.94). The mean age for deaths and injuries from falls slightly differ, which was 30.9 and 40.4 years, respectively. The proportion of fall deaths was the highest for people aged 40-49 years (19.4 %), followed by the 30-39 and 50-59 age groups (15.0%). Table 1 shows that notable proportion of fall incidents (11.2%) occurred to children below 10

years. Further, Table 1. displays that 13.6% of the fall incidents occurred in the population aged 60+ years.

Table 1: Deaths and Injuries from Falls by Age and Sex in Nepal from 17 July 2014 to 16 July 2019

Characteristics	Deaths N (%)		Injuries N (%)		Total N (%)	
Sex						
Female	531	(21.6%)	505	(22.4%)	1,036	(22.0%)
Male	1,876	(76.3%)	1,703	(75.6%)	3,579	(75.9%)
Not known	53	(2.2%)	46	(2.0%)	99	(2.1%)
Age Group in Years						
0-9	177	(7.2%)	349	(15.5%)	526	(11.2%)
10-19	188	(7.6%)	278	(12.3%)	466	(9.9%)
20-29	363	(14.8%)	496	(22.0%)	859	(18.2%)
30-39	368	(15.0%)	331	(14.7%)	699	(14.8%)
40-49	477	(19.4%)	295	(13.1%)	772	(16.4%)
50-59	369	(15.0%)	179	(7.9%)	548	(11.6%)
60-69	266	(10.8%)	106	(4.7%)	372	(7.9%)
70-79	141	(5.7%)	48	(2.1%)	189	(4.0%)
80-89	48	(2.0%)	21	(0.9%)	69	(1.5%)
90-99	6	(0.2%)	3	(0.1%)	9	(0.2%)
Unknown	57	(2.3%)	148	(6.6%)	205	(4.3%)
Total	2,460	(100.0%)	2,254	(100.0%)	4,714	(100.0)
Mean age (SD)*	30.9	(18.77)	40.4	(19.69)	35.6	(19.94)

*Note: Authors' calculation using police data * Unknown cases excluded when calculating mean and SD*

Table 2 summarizes the death and injury rates per 100,000 population in Nepal. The national average rate for falls (death & injury combined) was 3.6 per 100,000 population. Among the seven provinces, the annual fall incidents rates per 100,000 population were higher in Bagmati Province, followed by Gandaki Province and Province 1. More than half of the injuries (57.6%) and 36.6 percent of the deaths were observed in Bagmati Province alone. In all provinces, except Bagmati Province, the rates were higher for deaths than injuries.

Table 2: Average Annual Fall-Related Death and Injury Rates per 100,000 Population by Province

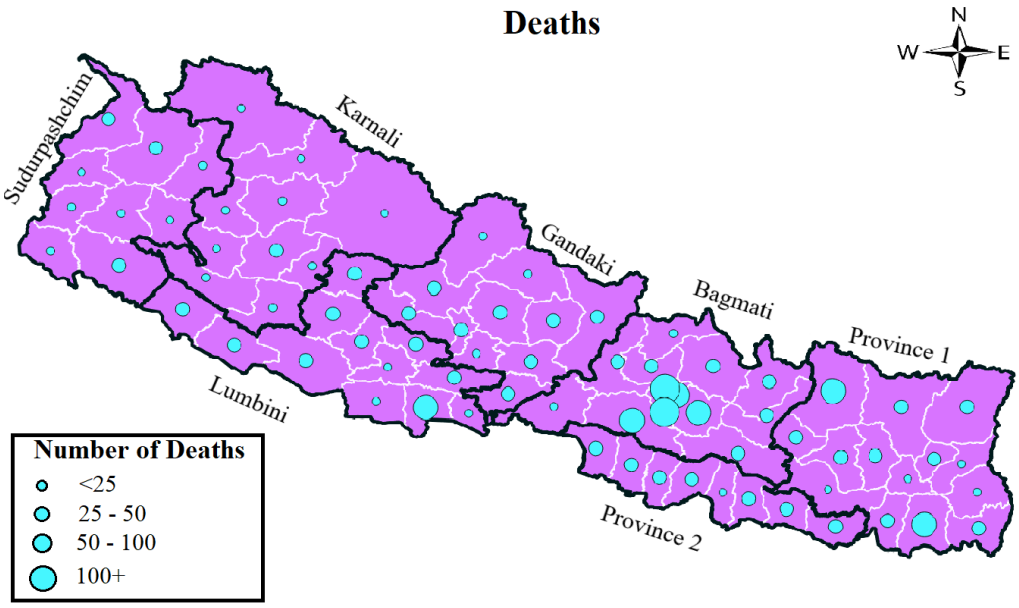
Province	Population*	Annual injury (rate per 100,000)	Annual Death (rate per 100,000)	Annual fall incidents (rate per 100,000)**
Province 1	4,534,943	46 (1.0)	96 (2.1)	142 (3.1)
Province 2	5,404,145	38 (0.7)	45 (0.8)	83 (1.5)
Bagmati Province	5,529,452	260 (4.7)	180 (3.3)	440 (8.0)
Gandaki Province	2,403,757	44 (1.8)	50 (2.1)	94 (3.9)
Lumbini Province	4,499,272	45 (1.0)	65 (1.4)	110 (2.4)
Karnali Province	1,570,418	9 (0.6)	26 (1.7)	35 (2.2)

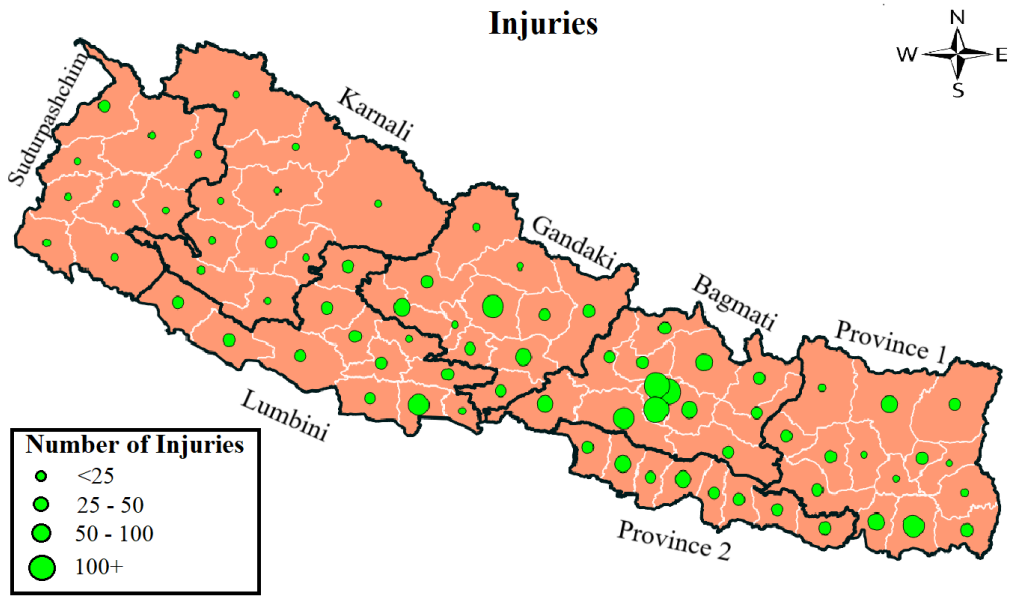
Province	Population*	Annual injury (rate per 100,000)	Annual Death (rate per 100,000)	Annual fall incidents (rate per 100,000)**
Sudurpashchim Province	2,552,517	9 (0.3)	30 (1.2)	39 (1.5)
Total (Mean)	26,494,504	451 (1.7)	492 (1.9)	943 (3.6)

*Note: Authors' calculation using police data; *Data sourced from Central Bureau of Statistics, 2018; **Annual fall incidents include both deaths and injuries*

Figure 1 shows the number of fall-related deaths and injuries by districts. Deaths and injuries from falls were distributed all over Nepal. However, the spatial analysis revealed that fall injuries were highest in the central part of the country. It displays some central and eastern districts (Kathmandu, Bhaktapur Lalitpur, Makwanpur, and Morang) comprise the most significant proportion of deaths and injuries from falls. Kathmandu district contributed to more than one-fifth of the total incidents. This finding support that a higher proportion of actual deaths and injuries from falls were recorded in Bagmati province. Both the death and injury rates from falls were low in Karnali and Sudurpaschim provinces. Fall incidents were not proportional to the population size; for example, Province 2 has the second-highest population in the country, but this province ranked 6th in recorded falls with 1.5 fall incidents per 100,000 population.

Figure 1: Reported Fall-Related Deaths and Injuries by Districts from 17 July 2014 to 16 July 2019



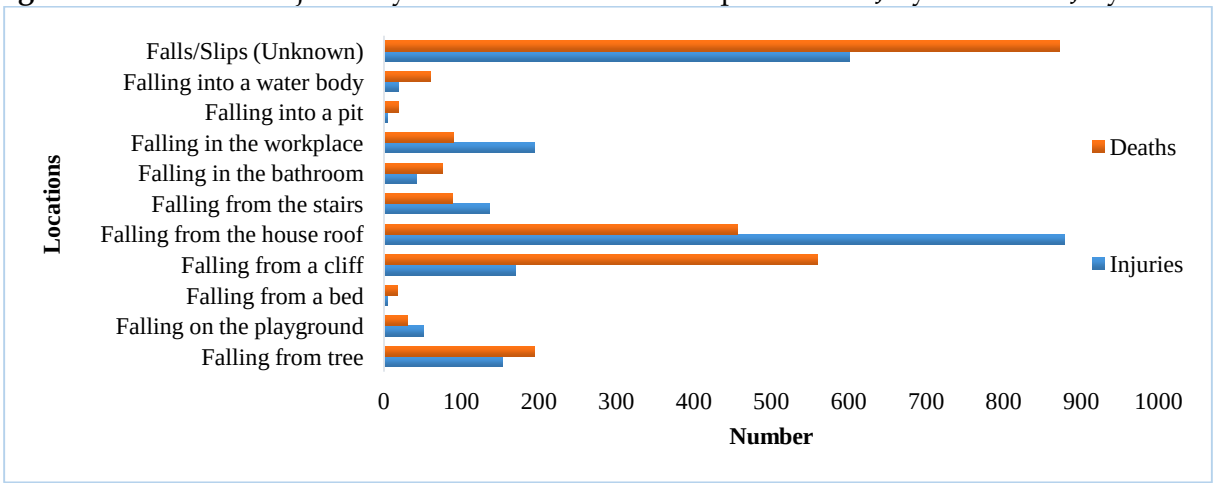


Note: The author used QGIS to plot the death and injuries on the map

Locations of falls

This study identified the 11 common locations for fall occurrence; among them- playground, bathroom, and slip-falls were the locations of falls occurring at the same level, and the remaining 8 were the falls from a height (Figure 2). The most significant proportion of fatal falls (*n*=872; 35.4%) occurred in unspecified locations and injuries occurred while falling from the house roof (*n*=879; 39.0%). Likewise, Figure 2 shows that cliffs were the second major location of fall-related deaths (*n*=560; 22.8%). Among the total deaths and injuries (combined), nearly half of the incidents of falls occurred around the victims' home environments (roof, bed, stairs, and bathroom)., The most common location of fall incidents (deaths and injuries combined) was the house roof (*n*=1,335; 28.3%). Similarly, falling at workplaces (*n*=284; 6.0%), and from trees (*n*=347; 7.4%) also appeared as frequent locations of falls.

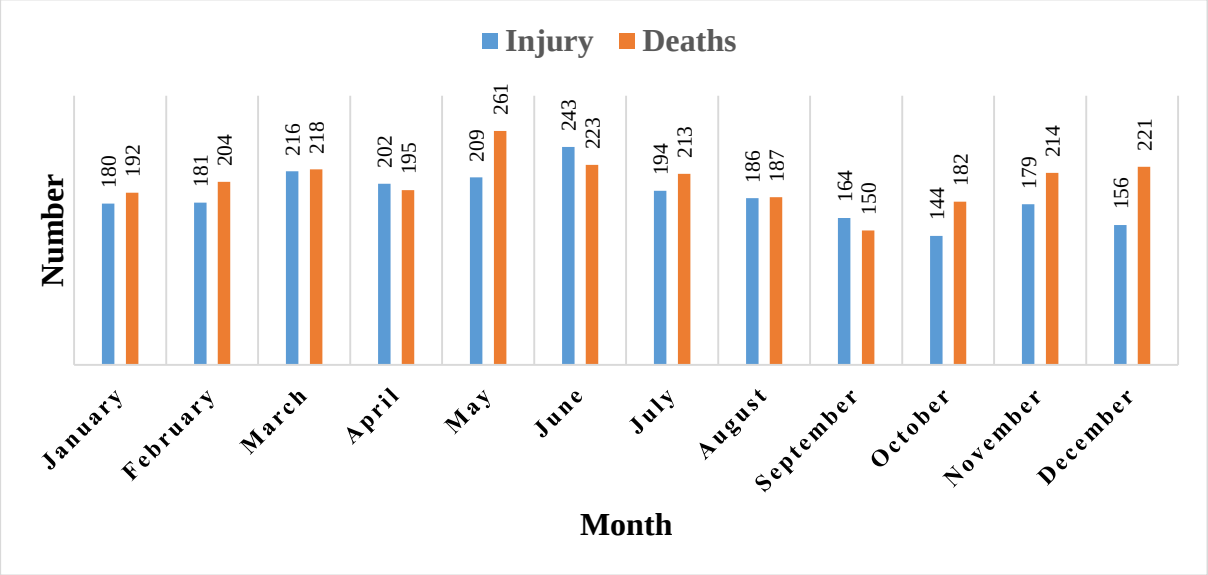
Figure 2: Deaths and Injuries by Locations of Falls in Nepal from 17 July 2014 to 16 July 2019



Falls by months

Figure 3 presents the number of deaths and injuries from falls by month. The deaths and injuries were distributed across all months. However, the highest number of fall incidents were recorded from May to June. The monthly distribution of deaths and injuries shows that more deaths (n=261) occurred in May and injuries (n=243) in June. In Nepal, the monsoon season starts in mid-June and ends in August. However, no such noticeable difference in the number of deaths and injuries was observed among the monsoon seasons.

Figure 3: Distribution of the Deaths and Injuries Due to Falls by Months in Nepal from 17 July 2014 to 16 July 2019



Note: Authors' calculation using police data

Discussion

This study uses nationally recorded police data on deaths and injuries from falls for five fiscal years (17 July 2014 to 16 July 2019). During data extraction, 4,714 unintentional and 308 intentional fall cases were identified; only the unintentional fall cases have been used in the analysis. To the best of my knowledge this is the first national-level study analyzing a large dataset of fall-related deaths and injuries. Numerous challenges have been encountered while parsing and extracting variables from the fall deaths and injuries narratives. Most importantly, due to the lack of linguistic consistency in the recordings, the developed algorithm could only accurately extract variables for 60% of the cases. For the remaining 40%, adjustments (i.e., re-reading and correcting typos) were made accordingly upon thoroughly going through every narrative.

The findings of this study show that falls pose a considerable threat to the population regarding preventable deaths and injuries in Nepal. The annual death and injury rate per 100,000 population by province indicated that deaths and injuries from falls were not proportional to the population

size. An interesting revelation from this study is that the number of reported deaths from falls was higher than the injuries, except in Bagmati province, indicating data from all other provinces may have severe limitations. In other words, not all non-fatal falls or injuries are reported to the police. From our day-to-day observations, it can be said that many injuries occur every day at home, work, or school from accidental falls but may not be reported to the police. One contrasting observation from this study clearly shows an under-recording of non-fatal falls. Usually, the number of major and minor injuries vastly outweigh the number of deaths caused by falls (World Health Organization, 2015); however, such a pattern was not observed in this study.

Like many other types of injuries, the male to female ratio for deaths from falls was observed to be 3.5:1 (Peden et al., 2008). This study also found a 3:1 male to female ratio for the fall incidents in Nepal. A global report published by WHO showed that females are more likely to die than to be injured from falls compared to their male counterparts (World Health Organization, 2018). However, in this study, the number of deaths for both males and females was higher than the injuries. This discrepancy was probably due to an issue related to reporting and recording incidents to the police.

The combined mean age for deaths and injuries from falls was 35.6 years (SD=19.94). The average age for injury was higher than deaths, with 40.4 years for injury and 30.9 years for deaths. Although the fall incidents were distributed across all age groups, the highest occurrence (49.4%) was in the young working-age (20-49 years) population, a finding that matched with other studies conducted in developed and developing countries (Wadhwaniya et al., 2017; World Health Organization, 2007). According to the population census of 2011, the persons aged 60 or over comprised 8.1 percent of the total population of Nepal (Adhikari, 2014), but 13.6 percent of fall-related deaths and injuries occurred to the same elderly population, which is substantial. The number of fall cases in the population aged 60 years and above could be more than reported to the police. Therefore, this study's results cannot describe the actual number of deaths and injuries from falls for the elderly population.

Deaths and injuries from falls were distributed all over the country. However, the spatial analysis revealed that fall injuries were more prevalent in the central part of the country. Kathmandu district itself contributed to more than one-fifth of the total fall incidents. This district lies in the Bagmati province, which recorded the highest number of fall-related deaths and injuries. On the other hand, Karnali and Sudurpaschim provinces had the lowest rates for injuries and deaths from falls. These findings show that fall incidents were not proportional to the population size. This observation was also seen for Province 2, which has the second-highest population in the country but ranked 6th for the incidents of falls. This finding alone is not sufficient to conclude that the risk of falls is remarkably higher in Bagmati Province. The higher number of reported deaths and injuries from falls in Bagmati province is probably due to easy accessibility to police stations and the widespread knowledge among the people regarding the importance of reporting cases to the police. Mass media coverage is another factor that contributes to a comparatively higher number of reporting in this province (Thapa & Mishra, 2003). Like the Karnali and Sudurpaschim provinces, other parts of the country may have the least resources in Nepal (Gyanwali, 2020), reflected by the small number of reporting in the region. Therefore, the findings of this study raise concerns about the lack of public reporting of fall incidents to the police and the need for a detailed study on fall injury in Nepal.

Circumstances of falls

Falls from heights were related to falling from the roof, stairs, cliffs, and trees. A comparable number of falls also occurred in the bathroom and from the bed. Most of the deaths and injuries from falls happened while carrying out daily life and workplace-related activities. Similarly, people fell from the house roof while cleaning, hanging clothes (washing/laundry) to dry, and playing. Nepal is a mountainous country, and falling from cliffs led to many people being injured or losing their lives. In this study, falls or slips were a prominent cause of deaths consistent with other studies on falling or slipping from a height (Turgut et al., 2018; Zlatar et al., 2019) or the same level (Smith, 2016).

Similarly, falling from trees and other structures, falling in the bathroom, or falls at the workplaces are the other common locations of deaths and injuries in Nepal. It was also found that work-related falls are common among labor workers involved in construction. Surprisingly, the study showed that fatal falls also occurred during short stops for natures' call (urination and toilets) while people were going on longer journeys on highways. These findings imply the need for safety measures during work and the necessity of public restrooms along the highways (National Planning Commission, 2012).

Some studies presented that more fall incidents occurred in the summer season (Gulati et al., 2012; Turgut et al., 2018). Findings of this study reinforce such a pattern, with 35.9% of the deaths and 26.1% of fall injuries occurring between May and August. However, it is presumed that the burden of fall injury to be somewhat higher, mainly due to difficulty and lack of human resources in recording such incidents.

Strength and limitations

This study contributed to generating evidence to address the problems, identified the need for further research related to fall injuries, and space for improving the quality of data in Nepal. One of the limitations of this study is that it was based on secondary data sources, which may have experienced an under-reporting issue.

Conclusion

This study provides a national-level description of deaths and injuries from falls. It is found that the economically active age group (20-49), particularly the male population, was at a higher risk of fall-related deaths and injuries. A remarkable proportion of fall injuries occurred due to falling from the house roof, bathroom, and stairs. Therefore, home-specific fall prevention measures should be developed and implemented. Similarly, workplace-related falls (deaths and injuries) demand workplace safety measures from the authorities. Nepal Police is the only national-level authority to record fall incidents; however, they register for the purpose of the case investigation process. The data analysis revealed inconsistency in the recording of the incidents. Therefore, developing a standard data recording format could be the best way to restructure the existing

database for quality information on national-level fall-related deaths and injuries. Hence, there is an opportunity to improve the quality of police data with academic collaboration.

Ethical approval

The study did not involve consultation with humans to explore the fall-related deaths and injuries and utilized secondary data recorded by Nepal Police. During the data receiving process, the approval letter for the data used in the academic research was obtained from the Police authorities.

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