

# BMJ Open Catastrophic health expenditure among industrial workers in a large-scale industry in Nepal, 2017: a cross-sectional study

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## ABSTRACT

**Objectives** The study aimed at estimating out-of-pocket (OOP) expenditure, catastrophic health expenditure (CHE) and distress financing due to hospitalisation and outpatient care among industrial workers in Eastern Nepal.

**Methods** We conducted a cross-sectional study involving industrial workers employed in a large-scale industry in Eastern Nepal. Those who were hospitalised in the last 1 year or availed outpatient care within the last 30 days were administered a structured questionnaire to estimate the cost of illness. CHE was defined as expenditure more than 20% of annual household income. Distress financing was defined as borrowing money/loan or selling assets to cope with OOP expenditure on health.

**Results** Of 1824 workers eligible for the study, 1405 (77%) were screened, of which 85 (6%) were hospitalised last year; 223 (16%) attended outpatient department last month. The median (IQR) OOP expenditure from hospitalisation and outpatient care was US\$124 (71–282) and US\$36 (19–61), respectively. Among those hospitalised, the prevalence of CHE and distress financing was found to be 13% and 42%, respectively, and due to outpatient care was 0.4% and 42%, respectively. Drugs and diagnostics account for a large share of direct costs in both public and private sectors. More than 80% sought hospitalisation and outpatient care in a private sector.

**Conclusion** Industrial workers face significant financial risks due to ill health compared with the general population. Poor utilisation and higher cost of care in public health facilities warrant strengthening of public sector through increased government spending. The labour act 2014 of Nepal should be strictly adhered.

## INTRODUCTION

Ill health can have a significant economic impact on a household which can trigger a cascade of asset depletion, indebtedness and cut down on basic necessities.<sup>1</sup> Costly healthcare also deters people from using health services, thereby prolonging or worsening health problems.<sup>2</sup> Globally, approximately 44 million households or

## Strengths and limitations of the study

- First study of its kind in a challenging environment such as that of a large-scale industry in the country.
- Validation of self-reported data on expenditures was done by verifying documents such as prescriptions, bills, drug receipts, etc.
- Study was conducted in one large industry, so the findings may not be generalisable to the entire industrial workforce in Nepal.
- We recruited only those workers who were present in the industry on the day of data collection.
- We did not look at healthcare expenditure at the household level.

more than 150 million individuals face catastrophic health expenditure (CHE), and about 25 million households or more than 100 million individuals are pushed into poverty by the need to pay for services every year.<sup>3</sup>

In most low/middle-income countries, a large proportion of the money spent on healthcare comes from the out-of-pocket (OOP) expenditure of patients or their families.<sup>4</sup> In the South Asian region, this proportion has been estimated to reach up to 60%–70% of total expenditure due to poor public spending on health.<sup>5 6</sup> Households in such countries experience financial hardship and are often pushed below the poverty line as a result of their spending on healthcare.

Industrial workers face significant health risks due to poor workplace conditions and limited access to healthcare.<sup>7</sup> The International Labour Organization (ILO) estimates 2.3 million deaths annually for reasons attributed to work, 2.0 million linked to work-related diseases and 0.3 million linked to occupational injuries around the world. Economic costs of

work-related injury and illness vary between 1.8% and 6.0% of gross domestic product (GDP).<sup>8</sup>

Nepal is a low-income country with a GDP of US\$729.53 per capita in 2016.<sup>9</sup> OOP payment is still the main way to finance healthcare which accounts for 48% of the total health expenditure.<sup>4,5</sup> CHE was experienced by 13.8% of the study population in a study in Nepal. The study measured expenditure on ill health among the general population in the last 30 days.<sup>4</sup> Another study in Nepal which analysed data from a national survey, the Nepal Living Standard Survey 2010–2011 also reported cumulative incidence of CHE to be 10.3% per month.<sup>10</sup> Gupta *et al* found that the health system in the country has become regressive over the years, as the share of the poorer households facing CHE has increased by 14% between 1995 and 1996 and 2010 and 2011.<sup>11</sup> Similarly, India, Bangladesh and other countries in the neighbourhood have also reported significant catastrophic expenditure due to ill health.<sup>12–14</sup> With the new legislation, Nepal is starting a national health insurance for its citizens. At this juncture, it is of utmost importance to explore the OOP expenditure in different population groups including the factory workers.

Occupational health is in its most preliminary form in Nepal where there are limited financial security for workers covered by employers. At present, it is estimated that nearly 12 million workers are engaged in employment in Nepal. Based on the classification of industry, 81% are engaged in agriculture sector and remaining are engaged in non-agriculture sector.<sup>15</sup> Workers in Nepal are exposed to various occupational health problems in addition to the general health hazards.<sup>16–19</sup> In the event of any illness, they have to bear the medical care costs out of their own pocket which puts strain on their households.

With limited studies found regarding factory workers, there is a dearth in the literature reporting on the OOP health expenditure among industrial workers in Nepal. Previous studies in Brazil, USA and Canada have reported high healthcare expenditure for work-related injuries only.<sup>20–22</sup> Hence, we conducted the study among industrial workers to estimate the rates (per 1000 employees/year) and OOP health expenditures of hospitalisation and outpatient department (OPD) utilisation and determine the prevalence of CHE and distress financing due to hospitalisation and OPD care.

## METHODS

### Study design

This was a cross-sectional study involving structured interviews with industrial workers employed in a large-scale industry in Eastern Nepal.

## SETTING

### General setting

Nepal is a developing landlocked country in South Asia that is located at the centre of Himalaya bordering China and India. It has seven states and a population of

26.4 million with 41% living in rural areas; literacy rate is 90% and 67% among men and women, respectively. Nepal's gross domestic product (GDP) in 2016 was estimated at over \$21.14 billion. In 2010, the industrial sector accounted for 15.4% of Nepal's GDP.<sup>23</sup>

### Specific setting

In Nepal, there are five industrial corridors consisting of a conglomerate of various industries. The establishment of the Biratnagar Jute Mill led to the opening of many other industries in eastern Nepal and surrounding areas. The expansion of industries resulted in the formation of the Sunsari-Morang Industrial corridor, the country's first industrial hub. The 28 km industrial corridor comprises more than 500 small-scale, medium-scale and large-scale industries. Large-scale industry was defined as investment of more than NRs 100 million in fixed assets, medium-size industries as fixed assets between NRs 30 million and 100 million and small-size industry as investment up to NRs 30 million in fixed assets. It provides employment to around 100 000 individuals and accounts for one-third of the country's total production and business transactions.<sup>24</sup> The Reliance Spinning Mills is one of the large-scale industries in the corridor employing around 2500 workers which include manual labourers, administrative staffs, accountants, managers, executives, etc. There is no current provision of routine health screening for its employees. In the event of any illness, the workers would visit the health facility nearby, public or private, and pay for the medical services out of their own pocket.

The new Labour Act 2017 that has just been enacted is the only the legal document that covered safety and health provisions of workers in industrial sector confined to the industries employing 10 or more workers. The Act includes the provision of medical check-up for the workers at least once a year in hazardous establishments. Besides, there are other structural and environmental measures under the act to provide a healthy work atmosphere. However, the implementation of these measures is dismal.<sup>25</sup>

### STUDY POPULATION AND STUDY PERIOD

The study population included all the industrial workers currently employed as of 1 July 2016 in the Reliance Spinning Mills industry of the Sunsari-Morang Industrial Corridor in Eastern Nepal. Staffs from the industry management and administration division were excluded from the study. The study was carried out during June–October 2017.

### Sample size calculation

Assuming the prevalence of catastrophic OOP expenditure in the study setting to be 12%<sup>12</sup> with significance level set at 5%, absolute precision of 4% and a finite population correction, the sample size was calculated to be 280. In order to collect information from 280 individuals who had sought OPD care or hospitalisation due to

any ailment within a fixed reference period, we decided to screen all the employees in the industry.

## DATA COLLECTION

The employee register was obtained from the management. All those who were eligible for the study and currently employed in the industry were identified and self-administered a brief screening questionnaire in local language. Workers not found to be present on the day of the survey were traced back to their residences. We excluded those who could not be tracked after two attempts. If the response to any of the two questions, whether hospitalised within the last year or received OPD care within the last 30 days of the survey, is 'yes', they were asked to appear for a face-to-face interview on another date using a structured questionnaire. Prior to conducting the interview, consent was taken, study was explained and, once they agreed, the participants were asked to bring documents related to their hospitalisation/OPD care such as bills, reports, receipts, prescriptions, etc, if available.

Five postgraduate students from B.P. Koirala Institute of Health Sciences, Dharan, Nepal, were trained to conduct the interviews. The investigators were trained for 2 days about the study protocol, data collection process and interviewing skills. The principal investigator also accompanied the interviewers and checked the completeness of the questionnaires at the end of each day.

The OOP expenditure on health for each episode of hospitalisation (in the last 365 days) or OPD care (in the last 30 days) was estimated by asking the respondents about their expenses on medical, otherwise known as direct costs (consultation, diagnosis, surgery, drugs, bed, other medical supplies), and non-medical items, otherwise known as indirect costs (transportation, lodging/boarding, loss of wages, food, etc), separately.

## Patient and public involvement

In Nepal, the main form of healthcare expenditure is OOP expenditure. The government of Nepal is in the preliminary phase of implementing health insurance in different provinces of the country. Hence, the research question and outcome measures were developed to assess the OOP health expenditure, CHE and distress financing among industrial workers employed in a large-scale industry in eastern Nepal. Additionally, industrial workers face significant health risks due to poor workplace conditions and limited access to healthcare. ILO estimates 2.3 million deaths annually for reasons attributed to work, 2.0 million linked to work-related diseases and 0.3 million linked to occupational injuries around the world. Economic costs of work-related injury and illness vary between 1.8% and 6.0% of GDP. Despite being the vulnerable population, there has not been any study among industrial workers to assess the healthcare expenditure.

We involved all the industrial workers currently employed as of 1 July 2016 in the Reliance Spinning

Mills industry of the Sunsari-Morang Industrial Corridor in Eastern Nepal. Staffs from the industry management and administration division were excluded from the study. The employee register was obtained from the management. All those who were eligible for the study and currently employed in the industry were identified and self-administered a brief screening questionnaire in local language. Workers not found to be present on the day of the survey were traced back to their residences. We excluded those who could not be tracked after two attempts. If the response to any of the two questions, whether hospitalised within the last year or received OPD care within the last 30 days of survey, is 'yes', they were asked to appear for a face-to-face interview on another date using a structured questionnaire.

A copy along with the explanation of the result will be presented to the management and the health personnel of the industry. Similarly, the results will be presented and explained to all the section managers who will further disseminate the research findings to the study participants.

## OPERATIONAL DEFINITIONS

### Catastrophic health expenditure

CHE is defined as any OOP expenditure on treatment (per episode of hospitalisation or OPD care) more than 20% of the annual household income.<sup>26-28</sup> Monthly income (self-reported) from all sources in the family was captured using a questionnaire and multiplied by 12 to get the annual household income. OOP expenditure (both direct and indirect) was calculated for each episode of hospitalisation or outpatient visit.

If  $(\text{OOP expenditure}/\text{annual household income}) \times 100$  was  $>20\%$ , catastrophic expenditure was said to have incurred.

### Distress financing

Distress financing is defined as borrowing money from relatives/friends, taking out loans from banks/other lenders or selling assets to cope with OOP expenditure on medical treatment due to any illness.<sup>29</sup>

### Loss of wage

Loss of wage was calculated by multiplying the number of days lost due to the illness with the amount of daily wage.

### Ethnic group of Nepal

The ethnic group of Nepal consists of Bhramin/Chettri, Dalit, Janjati and Madhesi. These groups fit under two banners: Indo-Aryans (Brahmin/Chettri, Madhesi) and Tibeto-Burman (Janjati). Dalits are marginalised and underprivileged ethnic group which were considered untouchable. However, the new Constitution 2015 of the government of Nepal has clearly stated that the Dalits shall have the right to participate in all the bodies of the state on the basis of the principle of proportion inclusion.<sup>30 31</sup>

## Housing

If everything (roof, floor and walls) is concrete, it is pucca house; if one of the parts (roof, floor and walls) is not concrete, it is semi-pucca house; and if nothing is concrete, it is kachha house.

## Analysis and statistics

Data were double-entered into Epi-Data Entry V.3.1 (Epi-Data Association, Odense, Denmark) and imported into STATA V.12.0 for analysis (StataCorp LP, USA). Rates of hospitalisation and OPD service utilisation were summarised in the form of numbers per 1000 employees/year. The key outcome of the study was cost of hospitalisation and OPD care which was expressed in terms of median (IQR). Other outcomes such as prevalence of CHE and distress financing due to hospitalisation and OPD care were presented as percentages. Krusal-Wallis test was done to compare median OOP expenditure across income quartiles and type of health facility (public and private). US\$1=NRs 103.68 was used as conversion rate on 9 December 2017 to calculate the various costs.<sup>32</sup> Logistic regression was carried out to identify the social and treatment-related factors associated with distress financing and CHE due to hospitalisation after adjusting for potential confounders.

## Ethical approval

Ethical approval for the study was sought. Administrative approval was taken from the manager of the Reliance Spinning Mills industry for the conduct of this study.

Written informed consent was taken from all workers prior to their participation in the interview.

## RESULTS

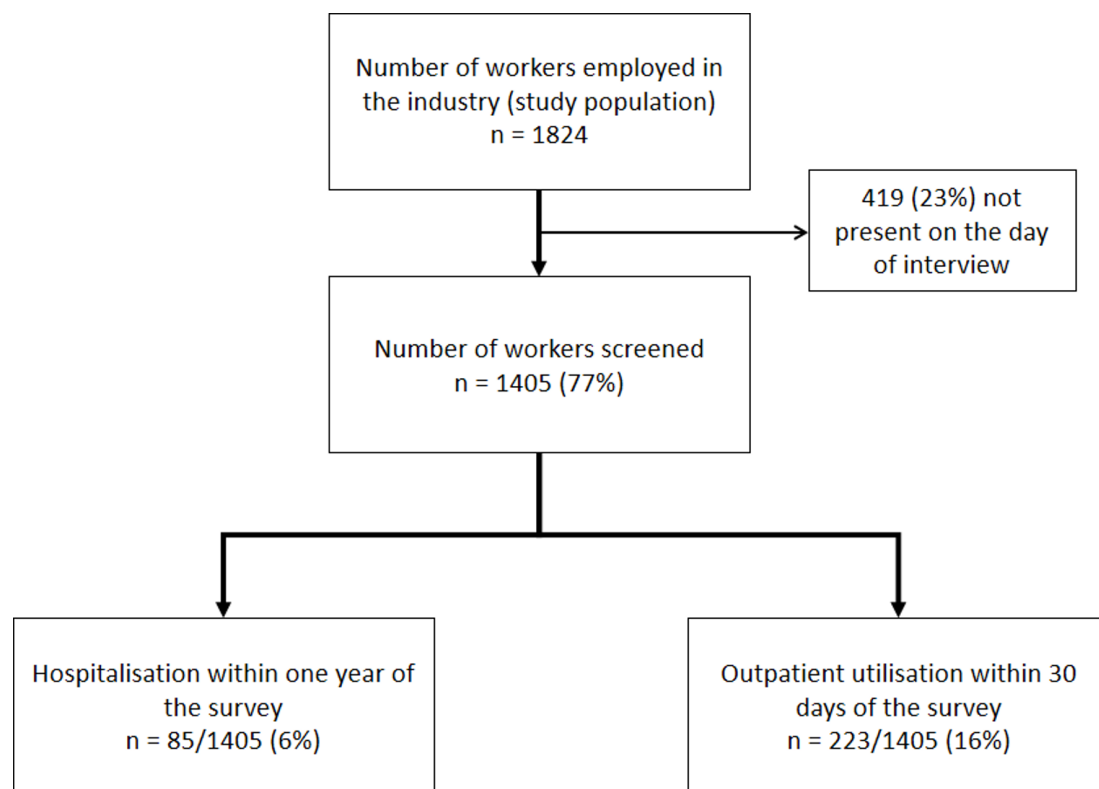
### Sociodemographic and medical care-related characteristics of the study participants

Among 1824 workers eligible for the study, that is, currently employed in the industry, 1405 (77%) were included in the study as the remaining workers were not present on the day of the interview and could not be traced thereafter (figure 1).

Among the workers screened, 1096 (78%) were men. The median age and IQR was 32 (24–40) years. A total of 85 (6%) reported having hospitalised within 1 year before the survey and 223 (16%) used OPD services within 1 month of the survey.

Among those who were hospitalised, more than half (45, 53%) were from the rural areas; majority belonged to the Janjati ethnic group (39, 46%), educated up to secondary school (49, 58%); were married (70, 82); lived in a semi-pucca/kachha house (73, 86%); and stayed >1 km away from the nearest health facility (57, 67%). Similar sociodemographic profile was also seen among those who received OPD care (table 1).

More than half (58%) of the workers were permanent employees and only about one-third had been working for more than 5 years. More than 80% sought hospitalisation and OPD care in a private sector. A large majority



**Figure 1** Flow of participants screened for hospitalisation in the last year or outpatient visit in the last 30 days among workers in a large industry in Nepal, 2017.

**Table 1** Sociodemographic, occupational characteristics and healthcare utilisation of the industrial workers who were hospitalised or availed OPD care employed in a large-scale industry in Eastern Nepal, 2016

Variable	Hospitalisation n (%)	OPD utilisation n (%)
Total	85 (100)	223 (100)
Age group (in years)		
<20 years	03(3)	10 (4)
20–40 years	67(79)	152(68)
>40 years	15(18)	61(28)
Sex		
Male	58(68)	165(74)
Female	27(32)	58(26)
Residence		
Rural	45 (53)	119 (53)
Semiurban	16 (19)	33 (15)
Urban	24 (28)	71 (32)
Ethnicity		
Brahman/Chettri	20 (24)	69 (31)
Terai/Madhesi	23 (27)	68 (31)
Dalit	3 (4)	6 (3)
Janjati	39 (46)	80 (36)
Education		
Up to primary	23 (27)	48 (22)
Up to secondary	49 (58)	122 (55)
Higher secondary and above	13 (15)	53 (24)
Marital status		
Single	15 (18)	48 (22)
Married	70 (82)	175 (79)
Type of house		
Kachha	36 (42)	95 (42)
Semi-pucca	37 (44)	71 (44)
Pucca	12 (14)	56 (14)
Not recorded	0 (0)	1 (0)
Number of family members		
<5	39 (46)	102 (46)
≥5	46 (54)	121 (54)
Annual household income (US\$)		
First Q (<1737)	25 (29)	76 (34)
Second Q (1737–2895)	25 (29)	79 (35)
Type of employee		
Temporary	36 (42)	92 (41)
Permanent	49 (58)	130 (58)

Continued

**Table 1** Continued

Variable	Hospitalisation n (%)	OPD utilisation n (%)
Not recorded	(0)	1 (0)
Duration of work		
<5 years	57 (67)	142 (64)
≥5 years	28 (33)	81 (36)
Hours in a week		
≤60 hours	72 (85)	183 (82)
60–80 hours	13 (15)	40 (18)
Type of health care facility		
Public	17 (20)	39 (18)
Private	68 (80)	184 (83)
Type of health care provider		
Unregistered practitioner	4 (5)	40 (18)
Registered practitioner	81 (95)	183 (82)
Type of health care		
Allopathy	84 (99)	222 (100)
Homeopathy	1 (1)	1 (0)
Type of ailment		
Surgical	22 (26)	21 (9)
Medical	43 (51)	179 (80)
Traumatic injury	20 (24)	23 (10)

OPD, outpatient department; Q, quartile.

(95% for hospitalisation and 82% for outpatient care) received care from registered practitioners (table 1).

Table 2 shows the health problems reported by the workers for which they were hospitalised or availed OPD care. The disease categories are coded as per the International Classification of Diseases, Tenth Revision, Clinical Modification rules and presented in online supplementary appendices 1 and 2.

### A large-scale industry in Nepal, 2016

#### Hospitalisation rate

Hospitalisation rate was 61 per 1000 employees/year whereas OPD utilisation rate was 159 per 1000 employees/month (data not tabulated).

#### OOP expenditure on hospitalisation

The median (IQR) OOP expenditure per episode of hospitalisation was US\$124 (71–282), and was higher when care was sought in a public sector (US\$145, IQR: 72–195) compared with a private facility (US\$124, IQR: 71–333), though not significant ( $p=0.9$ ). The cost of hospitalisation was significantly higher among the poorest quartile (US\$187 IQR: 118–663) compared with others ( $p=0.02$ ).

**Table 2** Classification of ailments reported by industrial workers in a large-scale industry in Nepal, 2016

Type of ailment	Hospitalisation n (%)	Outpatient care n (%)
Total	85 (100)	223 (100)
Fever/cold/headache	09 (11)	39 (17)
Injuries	22 (26)	29 (13)
Surgical conditions	18 (21)	18 (8)
Respiratory diseases	6 (7)	06 (3)
Musculoskeletal	4 (5)	24 (11)
Gastrointestinal	10 (12)	12 (5)
Vector borne	3 (4)	01 (0)
Others	13 (15)	24 (11)
Dermatological	–	08 (4)
Eye and ENT problems	–	15 (7)
Orthopaedic	–	21 (9)
Chronic diseases	–	26 (12)

ENT, ear, nose, throat.

Direct cost due to hospitalisation was US\$72 (39–201) whereas indirect cost was US\$43 (43–282). Loss due to income/wage was estimated at US\$58 (25–116); median cost on drugs and diagnostics was US\$29 (14–77) and US\$29 (14–57), respectively. Cost of hospitalisation due to any surgical condition was significantly higher with US\$203 (154–618) followed by trauma with US\$135 (65–364) (tables 3 and 4).

#### OOP expenditure on OPD care

The median (IQR) OOP expenditure per episode of OPD visit was US\$36 (19–61), which was similar in both private (US\$36, IQR: 19–64) and public (US\$34, IQR:

**Table 3** Median cost (IQR) due to hospitalisation and outpatient care among industrial workers in a large-scale industry in Eastern Nepal, 2016

Costs	Hospitalisation Median (IQR)	OPD visit Median (IQR)
Total cost	124 (71–282)	36 (19–61)
Direct cost	72 (39–201)	26 (14–43)
Consultation	1 (1–5)	1 (0–4)
Diagnostics	29 (14–57)	10 (0–22)
Drugs	29 (14–77)	12 (7–22)
Surgery	0 (0–48)	0 (0–0)
Indirect cost	43 (43–282)	4 (2–14)
Travel	10 (4–19)	1 (0–3)
Food, accommodation and others	24 (13–48)	2 (0–6)
Loss due to income/wage	58 (25–116)	12 (0–29)

Cost estimates are expressed in US\$.  
OPD, outpatient department; Q, quartile.

21–47) health facility ( $p=0.9$ ). The cost of OPD was significantly higher among the richest quartile (US\$53, IQR: 20–74) compared with the poorest (US\$29, IQR: 16–49) ( $p=0.04$ ).

Direct cost due to OPD care was US\$26 (14–43) whereas indirect cost was US\$4 (2–14). The median expenditures on drugs and diagnostics were US\$12 (7–22) and US\$10 (0–22), respectively (tables 3 and 4).

#### Prevalence of CHE and distress financing

Among those hospitalised, the prevalence of CHE and distress financing was 13% ( $n=11$ ) and 42% ( $n=36$ ), respectively. The prevalence of CHE and distress financing due to OPD care was 0.4% ( $n=1$ ) and 42% ( $n=93$ ), respectively (data not tabulated).

#### Factors associated with distress financing and CHE due to hospitalisation

Multivariable logistic regression analysis showed that elderly age group (45 years and above), ethnicity (Dalits and janjatis) and number of days of hospitalization ( $>3$  days) were associated with distress financing and CHE, whereas distance of facility from home ( $>2$  kilometres) was also independently associated with distress financing, table 5.

Figure 2 shows that drugs, diagnostics and loss of wage account for a major share of expenditure both due to hospitalisation and outpatient care along with costs related to surgery among hospitalised patients only.

## DISCUSSION

To the best of our knowledge, this is the first study conducted in a low/middle-income setting assessing healthcare expenditure among industrial workers. These findings come from a cross-sectional study conducted on 1405 workers from a large factory located in Eastern Nepal. The key findings of the study are: (1) high rates of hospitalisation and OPD care, (2) the median total cost incurred towards hospitalisation and OPD care was US\$124 (71–282) and US\$36 (19–61), respectively, (3) poor public sector utilisation for hospitalisation and OPD care, (4) cost of hospitalisation was significantly higher in a public health facility compared with a private facility, (5) prevalence of CHE and distress financing per episode of hospitalisation was 13% and 43%, respectively, (6) costs incurred towards drugs and diagnostics were the major components of direct medical costs and (7) elderly age group, ethnicity, distance of facility from home and number of days of hospitalisation were associated with distress financing.

The high rates of hospitalisation and OPD care could be attributed to the poor general health condition, hazardous working environment, poor occupational health and safety practices, low standard of living and high burden of risk factors among industrial workers in the country.<sup>19 25 33</sup> A study by Pyakurel *et al* reported high

**Table 4** Median cost (IQR) and public sector utilisation due to hospitalisation and OPD by income quartiles, type of health facility and ailment among industrial workers in Eastern Nepal, 2016

Characteristics	Median cost (IQR) due to hospitalisation in US\$	Out-of-pocket expenditure as a proportion of annual household income in median (IQR)	Public sector utilisation for hospitalisation (%)	Median cost (IQR) due to OPD visit in US\$	Out-of-pocket OPD expenditure as a proportion of annual household income in median (IQR)	Public sector utilisation for OPD care (%)
<b>Annual household income in US\$</b>						
First Q (<1737)	187 (118–663)	14 (9–46)	36	29 (16–49)	2 (1–3)	17
Second Q (1737 – 2895)	80 (48–217)	4 (2–9)	8	39 (22–56)	2 (1–2)	20
Third Q (2896–4053)	83 (47–170)	2 (1–4)	16	34 (23–48)	1 (0.5–1.5)	23
Fourth Q (≥4054)	143 (87–285)	2 (1–6)	19	53 (20–74)	0.7 (0–1)	8
P value	0.02	<0.001	0.09	0.04	<0.001	0.3
<b>Type of health facility</b>						
Public	145 (72–195)	5 (2–11)	-	34 (21–47)	1.5 (1–2)	-
Private	124 (71–333)	4 (2–13)	-	36 (19–64)	1.4 (1–2)	-
P values	0.04	0.9	-	0.97	0.7	-
<b>Type of ailment</b>						
Surgical	203 (154–618)	10 (5–18)	27	51 (32–66)	2 (1–3)	3
Medical	83 (47–154)	3 (2–5)	23	34 (18–55)	1 (1–2)	33
Traumatic injury	135 (65–364)	6 (2–15)	5	43 (24–81)	1 (1–3)	3
P values	<0.001	<0.001	0.149	0.07	0.26	0.7
Overall	124 (71–282)	4 (2–13)	20	36 (19–61)	1.4 (0.7–2)	17

\*Kruskal-Wallis test.

Cost estimates expressed in US\$.

OPD, outpatient department; Q, quartile.

prevalence of poor dietary habits, tobacco and alcohol use and dyslipidaemia in a similar setting in Nepal.<sup>19</sup>

The median total cost incurred towards hospitalisation and OPD care was US\$124 (71–282) and US\$36 (19–61), respectively, which is somewhat lower than the estimates from another study conducted among the general population in Nepal.<sup>4</sup> There are two possible reasons for this difference. First, the previous study expressed estimates as mean expenditure which tends to inflate the estimates especially in non-normal distributions. Second, the present study was conducted among industrial workers with lower income profile compared with the general population and residing in the outskirts of the main city with inadequate health infrastructure.

Poor public sector utilisation is another worrisome factor that the government needs to address with priority. This supports the findings of the Nepal Living Standards Survey 2010–2011 which showed that 63% visit a private care facility for treatment.<sup>34</sup> However, it contradicts the findings in other studies in the region where more than half use public sector, more so by the poorest group despite having a tax-based financing system to cover public services like Nepal.<sup>27 35</sup> The recent unregulated boom in the private healthcare industry in Nepal with

minimal government spending on public sector might explain this observation. This could also be due to the specific industrial setting and the local context. The industries are usually in the outskirts of the cities where small to medium private establishments including pharmacists and other unqualified practitioners provide healthcare to the local population and access to public health facilities is poor. This might also explain poor public sector utilisation in the study.

Another point of concern is the significantly higher cost of hospitalisation in the public sector compared with the private. One possible reason for this finding might be deficient government spending on public health services leading to poor health infrastructure. As a consequence, there is poor availability of drugs, diagnostics, health professionals and equipment in the public health facility which force patients to avail services from outside, thereby incurring more expenditure. Another reason is that possibly people prefer going to a public sector in case of a major ailment requiring hospitalisation for a prolonged period, whereas they choose a private sector for ailments of minor to moderate severity due to reasons such as long waiting times, shortages in drugs and equipment.<sup>36</sup> Improving the management of public service

**Table 5** Factors associated with distress financing due to hospitalisation among industrial workers in Nepal, 2017

Characteristics	Distress financing		CHE	
	OR (95% CI)	P values	OR (95% CI)	P values
Age group				
15–44 years	1.0		1.0	
45 years and above	1.3 (1.1 to 1.7)	0.04	1.5 (1.1 to 5.6)	0.02
Place of residence				
Rural	1.8 (0.7 to 3.1)	0.23	1.4 (0.6 to 3.8)	0.6
Urban	1.0		1.0	
Education				
Up to lower secondary	1.8 (0.8 to 3.5)	0.2	1.4 (0.3 to 6.7)	0.7
Secondary and above	1.0		1.0	
Ethnicity				
Brahmin/Chettri	1.0		1.0	
Janjatis/Dalits	3.4 (1.8 to 6.9)	0.01	2.3 (1.2 to 4.0)	0.03
Distance of facility from home				
<2 km	1.0		1.0	
More than 2 km	2.7 (1.4 to 6.7)	0.03	1.8 (0.4 to 8.6)	0.4
Type of health facility				
Public	1.5 (0.5 to 4.9)	0.4	1.4 (0.3 to 3.6)	0.7
Private	1.0		1.0	
Type of employee				
Temporary	1.3 (0.8 to 2.0)	0.2	2.0 (0.4 to 8.8)	0.4
Permanent	1.0		1.0	
Number of days of hospitalisation				
≤3 days	1.0		1.0	
More than 3 days	1.8 (1.3 to 3.0)	0.03	8.7 (2.2 to 16.7)	0.007

Binary logistic regression was conducted using ENTER method.  
CHE, catastrophic health expenditure.

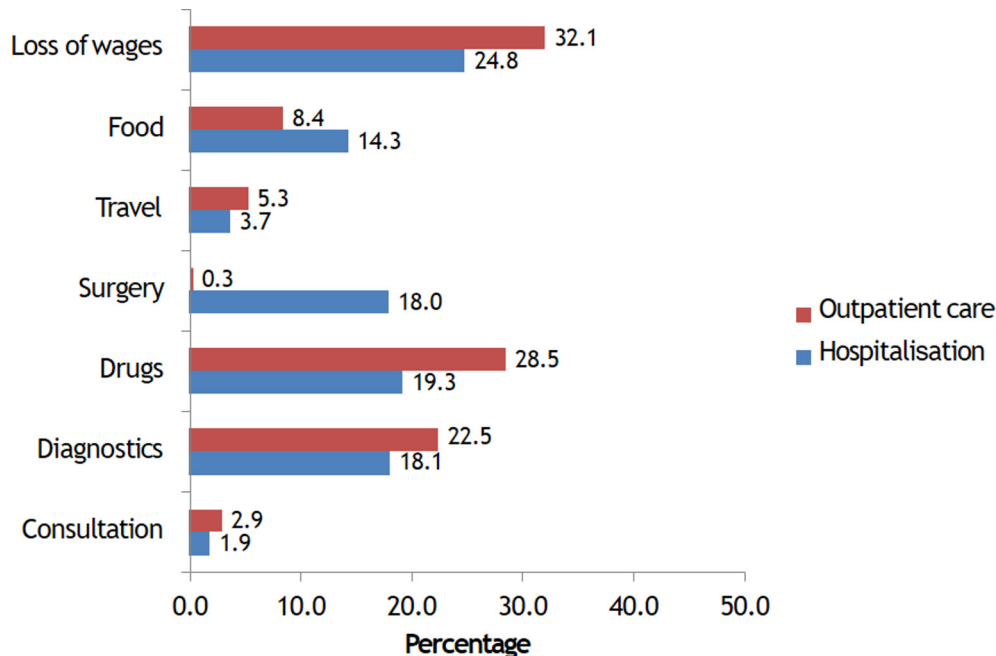
providers may encourage the utilisation of public facilities. This requires increased government spending in health infrastructure and higher budgetary allocation on health services while providing support to the poor and the marginalised to reduce OOP expenditure and catastrophic health spending in the population. Increasing access to health insurance to households will also reduce the extent of CHE. As the government of Nepal is planning a roll-out of national health insurance, we advocate the inclusion of this vulnerable population as the beneficiaries of this scheme.

The CHE due to hospitalisation in this study was similar to a recent survey done among the general population in Nepal. However, they used a 10% cut-off for defining CHE.<sup>4</sup> In an earlier nationwide study in Nepal, using the same 10% cut-off, the corresponding proportion was only 5.9% probably because of the rural setting where the study was conducted.<sup>36</sup> Analysis of the Nepal Living Standards Survey 2010–2011 showed that 13% of all households incurred catastrophic health expenses. However, this study used a cut-off of 40% of their capacity to pay.<sup>11</sup>

Defining cut-offs for CHE has always been debated. WHO recommends a cut-off level of 40% of non-food expenditure.<sup>37</sup> This study did not capture household expenditure disaggregated by food and non-food expenditure. However, in this study, we have used a threshold of 20% of annual household income in line with several other studies.<sup>26–28</sup>

A high proportion of distress financing was observed in both hospitalisation and OPD groups, which was also supported by the findings in previous studies.<sup>38–41</sup> When medical bills exceed a household's income, households may use savings, sell assets, borrow money from friends and family or take out a loan. This is especially true in households of industrial workers who struggle with their daily or monthly earnings just to fulfil the basic needs of the household without any savings. Thus, they had no or minimal disposable income or savings. Whenever they visited a health facility, even for an outpatient visit, they used to borrow money from friends/relatives, sometimes in anticipation of more healthcare expenses.





**Figure 2** Percentage share of components of healthcare expenditure both due to hospitalisation and outpatient care in a large industry in Nepal, 2017.

Medicines and diagnostics account for a large share of the direct costs in both public and private sectors which is supported by a large body of evidence.<sup>13 27 42</sup> Thus, to increase affordability of healthcare, generic medicines should be promoted and diagnostics should be made available free or at subsidised rates in the public sector.

It was noted that industrial workers had to access healthcare services from outside and there was neither any insurance coverage nor provision of healthcare services as part of workers benefits which puts immense strain on their households. We advocate a comprehensive health benefit package from the employers supported by the government. The government of Nepal should focus its attention on this huge workforce who seem more vulnerable than the general population due to the hazards at the work place and unorganised occupational health services. Occupational Safety and Health is in its infancy in Nepal and largely guided by the Labour Act which stipulates the provision of medical facilities, compensation, factory and labour inspection mechanism. However, these legal requirements alone are not sufficient; effective implementation and strict enforcement is more important.<sup>25</sup>

Elderly age group was associated with CHE and distress financing probably due to increased cost of care as a result of multiple comorbidities. We also speculate that elderly patients might have minimal social and financial support to tide over the health crisis. Distance of facility from home was also an associated factor presumably due to increased indirect cost associated with it.

People belonging to lower caste such as Janjatis/Dalits experience CHE and distress financing probably due to poor socioeconomic status. Their lower position in the society and social exclusion also is a major barrier to accessing and utilisation of healthcare services.<sup>30 43</sup> As the

country is planning a roll-out of health insurance scheme, this calls for tailored financial protection mechanisms for this vulnerable subgroup.

Medicines and diagnostics accounted for nearly 40% and 50% of hospitalisation and outpatient care expenses. This might be due to the poor availability of free drugs and diagnostics in public health facilities forcing patients to purchase them from outside and high cost in the private health facilities. Thus, improving the affordability of drugs and diagnostics by provision of cheaper generic medicines and diagnostics at subsidised rates will significantly reduce healthcare expenditure. Loss of wage also accounts for a major share in health care expenditure which could be tackled through employee friendly initiatives such as paid sick leaves.

### Strengths and limitations of the study

There were some strengths in this study. This is the first study of its kind in a challenging environment such as that of a large-scale industry in the country. Validation of self-reported data on expenditures was done by verifying documents such as prescriptions, bills, drug receipts, etc. Double data entry and validation was done using EpiData to minimise data entry errors. The study also adhered to the Strengthening the Reporting of Observational Studies in Epidemiology guidelines in reporting the study findings.<sup>44</sup>

However, this study is not without any limitations. First, under-reporting of household income is common in surveys. This could have led to overestimating the proportion of households experiencing CHE. Second, because the study was conducted in one large industry, the findings may not be generalisable to the entire industrial workforce in Nepal. Third, we only recruited

those workers who were present in the industry on the day of data collection and those who could be traced which implies that we could be missing workers who are ill or bed-ridden and could not be present on that day. This might have resulted in a healthy-worker-effect bias leading to an underestimation of the estimates. However, it is also highly likely that in a large industry with a huge daily wage workforce, many of them might have left the job and joined another industry. Also, the period of data collection (June–July) coincided with the crop sowing season which is also the reason why most people might have left industries. Fourth, we did not look at expenditure due to any other ailments in the family members.

## CONCLUSION

Industrial workers are exposed to significant financial risks due to health ailments compared with the general population which calls for financial risk protection mechanisms. Employers or the government should consider a comprehensive health benefit package for the large industrial workforce in Nepal. Poor utilisation and higher cost of care in public health facilities compared with the private sector warrants strengthening of the public sector. With occupational health in its preliminary form and national health insurance also just being implemented, there is a need to focus in this productive group of people working in factories who have high CHE. Further research to explore the feasibility of addressing their financial risk is required.

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## REFERENCES

- Haines A, Heath I, Smith R. Joining together to combat poverty. Everybody welcome and needed. *BMJ* 2000;320:1–2.
- Wagstaff A, van Doorslaer E. Catastrophe and impoverishment in paying for health care: with applications to Vietnam 1993–1998. *Health Econ* 2003;12:921–33.
- World Health Organization. Technical Briefs for Policy-Makers on Designing Health Financing System to Reduce Catastrophic Health Expenditure. 2005.
- Saito E, Gilmour S, Rahman MM, *et al*. Catastrophic household expenditure on health in Nepal: a cross-sectional survey. *Bull World Health Organ* 2014;92:760–7.
- World Health Organization. Global Health Expenditure Database. 2014.
- Ministry of Health and Family Welfare Government of India. National Health Accounts 2014–15.
- Rockefeller Foundation. Health Vulnerabilities of Informal Workers [Internet]. 2013 <https://assets.rockefellerfoundation.org/app/uploads/20130528214745/Health-Vulnerabilities-of-Informal-Workers.pdf> (Accessed 12 Apr 2018).
- Takala J, Hämäläinen P, Saarela KL, *et al*. Global estimates of the burden of injury and illness at work in 2012. *J Occup Environ Hyg* 2014;11:326–37.
- The World Bank. GDP per capita (current US\$) [Internet] 2016 <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD> (accessed 9 Mar 2017).
- Ghimire M, Ayer R, Kondo M. Cumulative incidence, distribution, and determinants of catastrophic health expenditure in Nepal: results from the living standards survey. *Int J Equity Health* 2018;17:23.
- Gupta I, Chowdhury S. Correlates of out-of-pocket spending on health in Nepal: implications for policy. *WHO South East Asia J Public Health* 2014;3:238–46.
- van Doorslaer E, O'Donnell O, Rannan-Eliya RP, *et al*. Catastrophic payments for health care in Asia. *Health Econ* 2007;16:1159–84.
- Tripathy JP, Prasad BM, Shewade HD, *et al*. Cost of hospitalisation for non-communicable diseases in India: are we pro-poor? *Trop Med Int Health* 2016;21:1019–28.
- Khan JAM, Ahmed S, Evans TG. Catastrophic healthcare expenditure and poverty related to out-of-pocket payments for healthcare in Bangladesh—an estimation of financial risk protection of universal health coverage. *Health Policy Plan* 2017;32:1102–10.
- Food and Agricultural Organization of the United Nations. FAO in Nepal [Internet]. 2018 <http://www.fao.org/nepal/fao-in-nepal/nepal-at-a-glance/en/> (cited 2018 Apr 12).
- Singh SB, Bhatta N, Jha N, *et al*. Respiratory morbidities of jute mill workers in Nepal. *Health Renaissance* 2012;10:181–6.

17. Budhathoki SS, Singh SB, Niraula SR, *et al.* Morbidity patterns among the welders of eastern Nepal: a cross-sectional study. *Ann Occup Environ Med* 2016;28:1–7.
18. Budhathoki SS, Singh SB, Sagtani RA, *et al.* Awareness of occupational hazards and use of safety measures among welders: a cross-sectional study from Eastern Nepal. *BMJ Open* 2014;4:e004646–7.
19. Pyakurel P, Karki P, Lamsal M, *et al.* Cardiovascular risk factors among industrial workers: a cross-sectional study from eastern Nepal. *J Occup Med Toxicol* 2016;11:25.
20. Lander L, Shah RK, Li Y, *et al.* Healthcare cost usage for hospitalised injuries sustained in industrial settings in the USA. *Inj Prev* 2013;19:112–8.
21. Brown JA, Shannon HS, Mustard CA, *et al.* Social and economic consequences of workplace injury: a population-based study of workers in British Columbia, Canada. *Am J Ind Med* 2007;50:633–45.
22. Santana VS, Souza LE, Pinto IC. Health care costs and the socioeconomic consequences of work injuries in Brazil: a longitudinal study. *Ind Health* 2013;51:463–71.
23. Contributors W. Nepal, The Free Encyclopedia [Internet]. <https://en.wikipedia.org/w/index.php?title=Nepal&oldid=835788286> (cited 9 Mar 2017).
24. Lamichhane B. Foreign Investment Opportunities in Nepal (PhD Thesis). Vaasan Ammattikorkeakoulu University of Applied Sciences. 2013.
25. Gautam RP, Prasain JN. Current situation of occupational safety and health in Nepal. 2011.
26. Amaya-Lara JL. Catastrophic expenditure due to out-of-pocket health payments and its determinants in Colombian households. *Int J Equity Health* 2016;15:182.
27. Tripathy JP, Jagnoor J, Prasad BM, *et al.* Cost of injury care in india: cross-sectional analysis of national sample survey 2014. *Inj Prev* 2018;24:116–22.
28. Buigut S, Ettarh R, Amendah DD. Catastrophic health expenditure and its determinants in Kenya slum communities. *Int J Equity Health* 2015;14:46.
29. Prinja S, Jagnoor J, Chauhan AS, *et al.* Economic Burden of Hospitalization Due to Injuries in North India: a cohort study. *Int J Environ Res Public Health* 2016;13:673.
30. Department For International Development and The World Bank. *Unequal citizens: gender caste and ethnic exclusion in Nepal*. Kathmandu, 2006.
31. Bennett L, Dahal DR, Caste GP. Ethnic and Regional Identity in Nepal. 2006.
32. Nepal Rastra Bank. Nepal rastra bank foreign exchange rates [Internet]. <https://www.nrb.org.np/fxmexchangerate.php> (cited 12 Apr 2018).
33. Carter WS. Introducing occupational health in an emerging economy: a Nepal experience. *Ann Occup Hyg* 2010;54:477–85.
34. Central Bureau of Statistics Government of Nepal. *Nepal living standards survey*. Kathmandu, 2011.
35. Leung GM, Tin KY, O'Donnell O. Redistribution or horizontal equity in Hong Kong's mixed public-private health system: a policy conundrum. *Health Econ* 2009;18:37–54.
36. Basu S, Andrews J, Kishore S, *et al.* Comparative performance of private and public healthcare systems in low- and middle-income countries: a systematic review. *PLoS Med* 2012;9:e1001244.
37. Musgrove P, Creese A, Preker A, *et al.* Health Systems: Improving Performance. *World Health Organization* 2000;78:1–215.
38. Joe W. Distressed financing of household out-of-pocket health care payments in India: incidence and correlates. *Health Policy Plan* 2015;30:728–41.
39. McIntyre D, Thiede M, Dahlgren G, *et al.* What are the economic consequences for households of illness and of paying for health care in low- and middle-income country contexts? *Soc Sci Med* 2006;62:858–65.
40. Peters DH, Yazbeck AS, Ramana GN V, *et al.* Better health systems for India's poor : findings, analysis, and options. 2002.
41. Russell S. Ability to pay for health care: concepts and evidence. *Health Policy Plan* 1996;11:219–37.
42. Engelgau MM, Karan A, Mahal A. The Economic impact of Non-communicable Diseases on households in India. *Global Health* 2012;8:9.
43. Devkota HR, Clarke A, Murray E, *et al.* Do experiences and perceptions about quality of care differ among social groups in Nepal? : A study of maternal healthcare experiences of women with and without disabilities, and Dalit and non-Dalit women. *PLoS One* 2017;12:e0188554.
44. von Elm E, Altman DG, Egger M, *et al.* The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *Bull World Health Organ* 2007;85:867–72.