Table 2. Multiple regression model of relationship between number of hospital readmissions due to diabetes, IMD quintile and ethnicity.

Variables	Relative Risk	95% Confidence Interval	P-value
IMD quintile			
Quintile 1 (Least Deprived)	1	N.A.	
Quintile 2	1.02	0.99–1.05	0.166
Quintile 3	1.06	1.03–1.10	<0.001
Quintile 4	1.13	1.09–1.16	<0.001
Quintile 5 (Most Deprived)	1.18	1.15–1.22	<0.001
Age			
16–29 years	1	N.A.	
30–44 years	0.91	0.87–0.96	<0.001
45–64 years	0.97	0.93–1.01	0.128
65 + years	1.02	0.97–1.06	0.453
Sex			
Men	1	N.A.	
Women	0.90	0.89–0.91	<0.001
Region type			
Urban	1	N.A.	
Town	1.03	1.00–1.06	0.079
Village	1.01	0.98–1.03	0.723
Ethnicity			
White	1	N.A.	
Mixed	1.01	0.79–1.29	0.964
South Asian	0.86	0.80–0.94	0.001
Black	1.03	0.84–1.26	0.779
Asian	0.73	0.53–1.01	0.058
Others	1.16	1.02–1.33	0.026
IMD ethnicity interaction			
IMD Quintile 1: all	1	N.A.	
IMD Quintile 2:			
Mixed	1	0.71–1.39	0.981
South Asian	1.06	0.95–1.19	0.270
Black	1.11	0.87–1.42	0.383
Asian	0.96	0.59–1.57	0.111
Others	0.77	0.63–0.93	0.007
IMD Quintile 3:			
Mixed	1.17	0.86–1.58	0.313
South Asian	1.04	0.94–1.14	0.499
Black	0.92	0.73–1.14	0.432
Asian	0.80	0.49–1.32	0.387
Others	0.77	0.65–0.92	0.003
IMD Quintile 4:			
Mixed	0.92	0.69–1.23	0.582
South Asian	1.03	0.94–1.14	0.495
Black	0.92	0.74–1.13	0.411
Asian	1.29	0.85–1.95	0.230
Others	0.91	0.78–1.07	0.264

(*Continued*)

Table 2. (*Continued*)

Variables	Relative Risk	95% Confidence Interval	P-value
IMD Quintile 5:			
Mixed	0.78	0.58–1.04	0.092
South Asian	0.97	0.88–1.07	0.543
Black	0.92	0.74–1.13	0.404
Asian	1.80	1.22–2.65	0.003
Others	0.82	0.70–0.96	0.014
Admission method			
Elective	1	N.A.	
Emergency	0.85	0.84–0.86	<0.001
Likelihood ratio statistic against without random effect model (p-value)		9465.53 (<0.001)	

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called Spearhead areas), GPs obtain lower scores on the quality and outcomes framework (QOF), an indicator of quality of primary care. Practices in Spearhead areas have lower numbers of GPs per practice and higher caseloads for each GP, which may lead to lower quality of practice[28]. Poorer management of diabetes and higher prevalence of undiagnosed diabetes, combined with restricted access to medical services and poorer patterns of health-seeking behavior, is likely to lead to an increased burden on secondary care services, and our results confirm this increased service use.

Higher rates of admission we observed in some ethnicities may also be partially explained by higher prevalence. In a recent study, the age-standardized prevalence of diabetes in black British and south Asian descendants was two or three times that of white British, respectively [29]. The higher risk of inpatient admission is consistent with this difference in prevalence. There is some evidence that black and south Asian British are treated with HbA_{1c} control more intensively[30], although findings about quality of primary care in ethnic minorities are

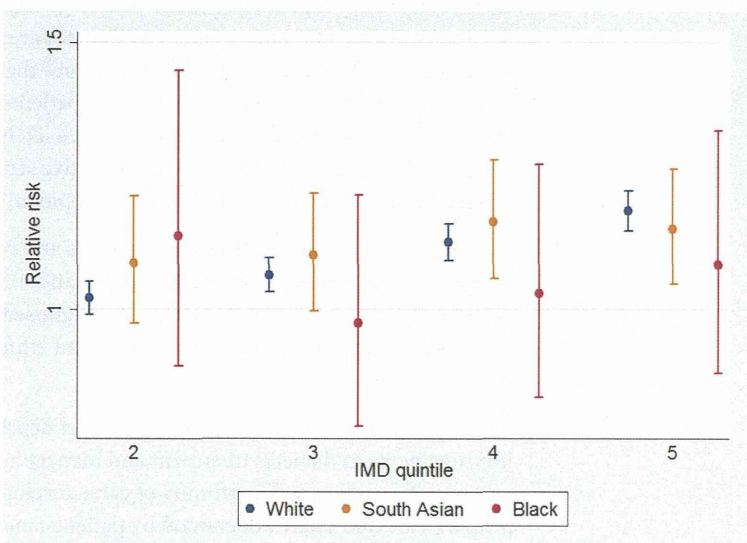

Fig 4. Sensitivity of relative risk of readmission to IMD by ethnicity.

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inconsistent[8,31]. We could not adjust for body mass index (BMI) in this analysis due to unavailability of this data in the HES data, and the high rates of admission in some ethnicities may be partly explained by racial differences in the role of this risk factor. A Canadian study has shown that south Asian and black people can develop diabetes at lower BMI thresholds than white people, though the mechanism is not understood[32]. Recent NICE guidance on assessing BMI thresholds finds that south Asian and black people may have equivalent risk in lower BMI than white people, but the guidance does not specify ethnicity-specific thresholds due to insufficient evidence[33]. The result of our study suggests that primary care in these ethnic minorities may not be sufficiently managed, though the guidance recommends multi-component interventions in ethnic minorities[33]. On the other hand, in light of this potential differential risk structure, the finding of almost no difference in readmission rates among non-white ethnicities and slightly lower risk of readmission in south Asians may mean this more intensive care in these ethnic groups may have improved diabetic condition and reduced the risk of readmission. Considering these results, first diagnosis of diabetes may be a key to address the inequality in risk of admissions. A better understanding of both prevalence and readmission pathways is necessary in these ethnicities to better understand the causes of the inequalities observed in this study.

Because this study uses a secondary data collection, it is subject to several limitations. We could not adjust for any individual confounding factors beyond age and sex, so could not adjust for the confounding effect of health background including severity of disease, occupation, employment status, educational history or whether patients have already received medical care against diabetes before hospital admission. Future research using data linking hospital admissions and primary care databases should focus on the pathway from primary to secondary care, to identify possible causes of the increased risk of diabetes-related admission in more socioeconomically deprived areas.

This study has found a strong association between socioeconomic deprivation and ethnicity and diabetes-related inpatient admission. Action needs to be urgently taken to reduce preventable hospital admissions by:

- Increasing attention on the quality of management of NCDs and their risk factors in primary care, especially in "Spearhead" areas with large deprived populations. Current attempts to improve primary care management of diabetes are focused on the quality and outcomes framework (QOF) but there is limited evidence that this is working effectively in "Spearhead" areas. Furthermore, south Asian and Black patients are more likely to be excluded from QOF measures, and these excluded patients are less likely to achieve intermediate treatment targets[34]. To avoid such problems, the incentive structure built into this program needs to be changed to better reflect the growing NCD epidemic
- Increasing community awareness of diabetes and promoting healthy behavior through mass media or education emphasizing the importance of early diagnosis, better dietary and blood-sugar monitoring amongst those already diagnosed, and more regular primary care visits. These screening, prevention and management efforts should be especially focused in highly deprived areas
- Development of innovative methods to target deprived areas and high-risk ethnic groups for improvements in diabetes treatment and management. This will include improvements in community nursing and continuity of care; development of care plans implementable in primary care and easily understood by patients; inclusion in care plans of targets to reduce inpatient admissions; and improvements in timeliness of access to outpatient care. These

methods will need to use the new coordination and funding powers of the clinical commissioning groups (CCGs) that were established in April 2013[35].

- Constructing a nationally standardized referral database which can be shared by all NHS facilities, CCGs and GPs to understand and improve referral patterns. This will require renewed commitment to information systems reform, which will be challenging given resource constraints and the limited progress of the NHS Care Records Service[36].

The UK diabetes research agenda needs to consider ways to improve research on the relationship between diabetes prevalence and socioeconomic deprivation and ethnicity. Better, more accurate measures of prevalence of diabetes are essential in order to better understand the extent of the problem in England, and to enable measures of hospital admission intensity to be standardized by disease prevalence rather than total population. These measures can be achieved by expanding the coverage and scope of the Health Survey for England, over-sampling areas with high ethnicities and deprived areas, and increasing the detail and scope of the NCD sections of this survey, and also by using the central coordinating authority of the Information Centre to identify local and regional datasets that may contain important information on regional and local variations in prevalence. Improvements in collection of ethnicity and diagnostic codes in the hospital episode statistics data are also essential.

Inequality in health outcomes as a result of NCDs is not inevitable and can be reversed. For example, IMD has no influence on survival due to heart failure and numbers of patients with a first hospital admission with heart failure reached a plateau in 1998[37]. This suggests that medical care for heart failure has been improved for people from all socioeconomic backgrounds, but for diabetes is still insufficient. Through better attention to primary care management of diabetes, at least some part of the inequity in health outcomes experienced by the most deprived members of British society can be reduced.

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Author Contributions

Analyzed the data: YN SG KS. Wrote the paper: YN SG KS.

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Saito E, Gilmour S, Rahman MM, Gautam GS, Shrestha PK, Shibuya K. Catastrophic household expenditure on health in Nepal: a cross-sectional survey. Bulletin of the World Health Organization. 2014; 92:760-767.

Catastrophic household expenditure on health in Nepal: a cross-sectional survey

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Objective To determine the incidence of – and illnesses commonly associated with – catastrophic household expenditure on health in Nepal.
Methods We did a cross-sectional population-based survey in five municipalities of Kathmandu Valley between November 2011 and January 2012. For each household surveyed, out-of-pocket spending on health in the previous 30 days that exceeded 10% of the household's total expenditure over the same period was considered to be catastrophic. We estimated the incidence and intensity of catastrophic health expenditure. We identified the illnesses most commonly associated with such expenditure using a Poisson regression model and assessed the distribution of expenditure by economic quintile of households using the concentration index.
Findings Overall, 284 of the 1997 households studied in Kathmandu, i.e. 13.8% after adjustment by sampling weight, reported catastrophic health expenditure in the 30 days before the survey. After adjusting for confounders, this expenditure was found to be associated with injuries, particularly those resulting from road traffic accidents. Catastrophic expenditure by households in the poorest quintile were associated with at least one episode of diabetes, asthma or heart disease.
Conclusion In an urban area of Nepal, catastrophic household expenditure on health was mostly associated with injuries and noncommunicable diseases such as diabetes and asthma. Throughout Nepal, interventions for the control and management of noncommunicable diseases and the prevention of road traffic accidents should be promoted. A phased introduction of health insurance should also reduce the incidence of catastrophic household expenditure.

Abstracts in عربي, 中文, Français, Русский and Español at the end of each article.

Introduction

In many developing countries, a large proportion of the money spent on health care comes from the out-of-pocket expenditure of patients or their families. In Bangladesh, India and Nepal, for example, this proportion has been estimated to be 48–69%.[1] Households in such countries can experience financial hardship and often impoverishment as a result of their spending on health care.[2–5] In the long term, financial protection against the risk of catastrophic health expenditure at household level can be achieved through tax-based health financing systems or social health insurance schemes – or a combination of both.[6] In developing countries that have inadequate public funds for health, some transitional measures such as voluntary community-based health insurance schemes may be introduced.[7] Low-income countries are increasingly either implementing essential health packages for disease treatment free of charge or providing patients – or their families – with conditional cash transfers for selected health services. Such interventions may often use up a large share of a country's public health subsidies.[8]

Nepal is a low-income country. In 2011 its gross domestic product was 620 United States dollars (US$) per capita.[9] Since 2006, certain health care services – including the drugs on a national essential drugs list – have been available free of charge at publicly funded district hospitals, health posts, sub-health posts and primary health-care centres.[10] A Safe Delivery Incentive Programme was implemented throughout Nepal in 2005. This programme has provided pregnant women with cash incentives to encourage institutional delivery and, since 2009, it has also made deliveries free of charge at government facilities and some private facilities.[11] The Nepalese government subsidizes the treatment of cancers, heart disease, kidney disease and other severe diseases up to a maximum of 50 000 Nepali rupees per patient – just over US$ 500 at the mean exchange rate for 2014.[10] Although voluntary community-based health insurance schemes are being piloted in six districts of Nepal, their coverage remains sporadic and there is no other publicly-run health insurance scheme in the country.[10]

Despite the treatment subsidies and pilot insurance schemes in Nepal, the incidence and main causes of catastrophic household expenditure on health have not been investigated in detail in the country. It remains unclear if the existing public subsidies that target specific diseases are providing reasonable financial protection to the general population. There have only been a few attempts to determine the effect of disease-specific medical costs on household economic status in southern Asia[5,12,13] or to determine which illnesses have the most impact on household expenditure.[14–17] We therefore estimated the incidence of – and determined the illnesses that were most commonly associated with – catastrophic household expenditure on health in an urban area of Nepal.

Methods

Study design

We used a multivariate Poisson regression model to analyse self-reported data – on illness and financial expenditure in the previous 30 days – that we collected in a population-based

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cross-sectional household survey in Kathmandu Valley. The survey covered all five municipalities in Kathmandu Valley: Bhaktapur, Kathmandu, Kirtipur, Lalitpur and Madhyapur-Thimi. We used data from the 2011 national census as the sampling frame and the corresponding census enumeration areas as the primary sampling units. We aimed to sample a total of 2000 households – by multi-stage cluster sampling – between November 2011 and January 2012. We based our choice of sample size on a cluster sampling method, the precision of the estimates required for the study[18] and an estimate of the prevalence of hypertension in the study area (8%) – assuming that hypertension in those over 20 years of age may represent a major economic burden within the study households.[19] For the first stage of the sampling, 100 enumeration areas were selected, using systematic sampling with probability proportional to the number of households in each area. For the second stage, a cluster of 20 dwellings was selected in each selected enumeration area. If a selected dwelling contained more than one household, one household in that dwelling was randomly selected. We considered an eligible respondent to be the household head or the most knowledgeable adult in a selected household. To collect data, we used a standardized questionnaire – pre-tested in 100 households in the city of Lalitpur – that included questions on household demographics, education, expenditure and durable goods, self-reported episodes of disease, care-seeking behaviour, total health-related expenditures and inpatient health expenditures, and the coping strategies that household members followed to finance health care (Appendix A; available at http://www.ghp.m.u-tokyo.ac.jp/wp-content/uploads/2014/07/Appendix-A.pdf).

We recorded morbidities that had reportedly occurred in the 30 days before the survey and any chronic conditions that had reportedly continued for more than 3 months in the 12 months before the survey. Each reported illness that had been diagnosed by an allopathic or ayurvedic doctor and the symptoms of any undiagnosed illness were coded according to a disease list that we based on the results of previous studies[12,20] and a focus group discussion conducted with health workers in Kathmandu (Appendix A). Whenever possible, interviewers cross-validated a reported diagnosis with the corresponding outpatient card or hospital discharge report. To assess the differences of disease occurrence across economic quintiles we conducted χ^2 tests.

Expenditure

The out-of-pocket expenditure on health of each study household – over the 30 days before the survey – was estimated by asking the respondents how much their households had spent, separately, on consultation or diagnosis fees, drugs, other medical supplies and hospitalization costs. The interviewers also posed separate questions on the costs of traditional healers, homeopathic treatments, ayurvedic treatments and home remedies. We also asked each respondent to give a single aggregated estimate of their household's total expenditure on health in the previous 30 days to see if – as in previous studies[21,22] – this estimate fell substantially below the sum of the respondent's corresponding separate estimates of expenditure on several aspects of health care – i.e. the disaggregated estimate. We used Wilcoxon rank sum test to compare the respondents' aggregated and disaggregated estimates. Total household expenditure was estimated from the reported consumption, in the 30 days before the survey, of purchased and home-produced goods, including foods, non-foods, housing and durable goods. This estimated expenditure and an adult-equivalent score – based on the number and ages of the members of the household – for each household were then used to identify the economic quintile to which each study household belonged.[23] Quintiles 1 and 5 represented the poorest and wealthiest households, respectively.

Comorbidity costs

Some of our study subjects had experienced concurrent episodes of two or more illnesses that were treated concurrently. Such subjects were generally only able to report the total costs of health care for the comorbidities. In these circumstances, we used a regression-based approach – similar to that used by Trogdon et al.[24] – to allocate a proportion of the jointly reported costs to each illness. More details of such cost allocation are available in Appendix A.

Catastrophic health expenditure

If, in the 30 days before the survey, a study household had spent more than 10% of its total expenditure on health care, that household was considered to have experienced catastrophic health expenditure in that period.[2,4] For the study households in general and for each economic quintile of the study households, we assessed the impact on household economic welfare of out-of-pocket spending on each of the 10 types of illness that were most commonly reported. We used the concentration index[25] to see if the percentage of households that experienced catastrophic health expenditure was unequally distributed across the five economic quintiles. Concentration indexes with 95% confidence intervals (CI) and their associated *P*-values were calculated using bootstrapping with 100 iterations and the delta method.[26–28] The concentration index can range between −1 and +1. In our study, indexes well below and well above zero would indicate that catastrophic expenditure is concentrated among the relatively poor and relatively wealthy households, respectively. We measured the intensity of expenditure burden using catastrophic overshoot, i.e. the average of payments surpassing the catastrophic threshold across all households, expressed as the proportion of additional payments above 10% of the total household consumption and averaged by the total number of households. A concentration index significantly below zero indicates a greater overshoot among the poor. We also report the mean positive overshoot, i.e. the share of additional payments above 10% of the total household consumption, averaged by the number of households with catastrophic expenditure.

Analysis of risk factors

We used a Poisson regression model to predict the incidence of catastrophic health expenditure among households affected by a particular illness. We stratified the model by household economic quintile to assess the relative risk – of catastrophic household expenditure – posed by each of the commonly reported illnesses in each quintile. The variables included in the model were: whether there was a history of hospitalization in the previous 30 days; the number of people in the household; whether the household had used a health-care provider in the previous 30 days and, if so, whether the provider or providers used by the household in the previous 30 days were public, private or both public

and private; the age of the household head; whether the household head had primary or lower, secondary or higher education; the number of children aged less than five years in the household; the number of people aged over 65 years in the household; and whether, in the previous 30 days, a household member had reportedly suffered more than one episode of the 10 most commonly reported illnesses. We adjusted all analyses for the sampling structure of the survey. The results are reported as rate ratio (RR) and 95% CI. All the analyses were performed using Stata version 12.1 (StataCorp. LP, College Station, United States of America).

Ethical approval

Ethical approval was given by the Ethics Committee of the University of Tokyo and – under registration number 49/2011 – by the Nepal Health Research Council. Written informed consent was obtained from the participating respondents before they were interviewed.

Results

Morbidity, provider choices and costs

Some details of the study households are shown in Table 1. As no consenting respondents could be found in three households, data were collected from 1997 (99.8%) of the 2000 selected households. The 10 illnesses that were most commonly reported as occurring among members of the study households – in the 30 days before interview – are shown in Table 2. Cases of common cold and concurrent cough and fever were grouped as cold/cough/fever, since many household members reportedly suffered these complaints simultaneously. Hypertension among household members aged more than 20 years appeared to be positively correlated with household expenditure (Table 2). In the 30 days before interview, members of the study households who needed health care had mostly used just private providers or a combination of private providers with other types of facilities (Appendix A). When comparing the respondents' aggregated and disaggregated estimates of their households' out-of-pocket spending on health using a nonparametric test, we found little difference between the two types of estimate ($z = 0.102$, $P = 0.92$).The disaggregated estimates

Table 1. **Characteristics of the study households, Nepal, 2011–2012**

Household characteristic	Value[a]
Mean no. of household members (95% CI)	4.4 (4.3 to 4.5)
Proportion of household members (95% CI) ($n = 9177$)	
Aged < 5 years	0.09 (0.07 to 0.10)
Aged > 65 years	0.05 (0.04 to 0.06)
Mean age of household head, years (95% CI) ($n = 1997$)	46.1 (44.7 to 47.5)
No. (%) of household heads ($n = 1997$)	
Male	1653 (84.2)
Female	344 (15.9)
With no education	532 (24.0)
Educated only to primary level	259 (13.4)
Educated only to secondary level	575 (31.6)
With higher education	631 (31.0)
Owning home	1148 (46.0)
Renting	794 (50.0)
In home provided free of charge	14 (0.6)
Squatting/occupying land illegally	40 (3.4)
Living in other types of dwelling	1 (0.1)

CI: confidence interval.
[a] Adjusted for sample weights.

Table 2. **Illnesses most commonly reported as occurring in the previous 30 days, by economic quintile,[a] Nepal, 2011–2012**

Illness	% of households (95% CI)						Difference between groups, P^b
	All ($n = 1997$)	Quintile 1 ($n = 371$)	Quintile 2 ($n = 359$)	Quintile 3 ($n = 401$)	Quintile 4 ($n = 415$)	Quintile 5 ($n = 451$)	
All household members							
Cold/cough/fever	12.8 (11.2 to 14.4)	12.9 (10.1 to 15.7)	11.6 (9.4 to 13.8)	13.7 (10.3 to 17.0)	13.2 (9.9 to 16.4)	12.6 (10.5 to 14.8)	0.811
Gastritis/peptic ulcer	3.6 (2.8 to 4.3)	5.5 (3.3 to 7.6)	2.8 (1.8 to 3.7)	3.8 (2.4 to 5.2)	3.4 (2.3 to 4.5)	2.4 (1.5 to 3.2)	0.008
Arthritis	2.9 (2.3 to 3.5)	2.4 (1.6 to 3.2)	4.8 (3.1 to –6.6)	2.7 (1.9 to 3.5)	2.2 (1.4 to 3.0)	2.1 (1.3 to 3.0)	< 0.001
Asthma	1.1 (0.9 to 1.4)	1.3 (0.6 to 2.0)	0.9 (0.3 to 1.5)	1.0 (0.5 to 1.4)	1.5 (0.8 to 2.1)	1.0 (0.6 to 1.5)	0.526
Migraine/headache	0.9 (0.6 to 1.2)	1.3 (0.5 to 2.1)	0.5 (0.2 to 0.8)	1.2 (0.4 to 2.0)	0.9 (0.1 to 2.6)	0.6 (0.2 to 1.1)	0.336
Injury	0.7 (0.5 to 1.0)	1.1 (0.5 to 1.7)	0.4 (0.0 to 0.8)	0.6 (0.2 to 1.0)	0.7 (0.3 to 1.0)	1.0 (0.4 to 1.7)	0.202
Heart disease	0.6 (0.4 to 0.8)	0.8 (0.3 to 1.2)	0.3 (0.1 to 0.6)	0.6 (0.2 to 1.0)	0.5 (0.1 to 0.8)	1.0 (0.5 to 1.4)	0.132
Household members aged > 20 years							
Diabetes	3.7 (3.1 to 4.3)	2.3 (1.0 to 3.6)	3.1 (1.7 to 4.5)	3.8 (2.7 to 4.8)	3.8 (2.6 to 5.1)	5.3 (3.8 to 6.8)	0.045
Hypertension	10.5 (9.2 to 11.7)	5.8 (3.9 to 7.8)	9.4 (7.0 to 11.9)	11.9 (9.4 to 14.3)	11.4 (9.1 to 13.7)	13.4 (10.9 to 15.9)	< 0.001
Hyperuricaemia	0.7 (0.3 to 1.1)	0.3 (0.0 to 0.5)	1.6 (0.2 to 3.1)	1.1 (0.0 to 2.3)	1.3 (0.3 to 2.3)	1.0 (0.2 to 1.9)	0.291

CI: confidence interval.
[a] Quintile 1 represents the poorest households and quintile 5 represents the wealthiest households.
[b] Calculated using χ^2 tests.