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Does Nepal's National Health Insurance Program Protect Against Catastrophic Health Spending?

Simrin Kafle

PhD candidate

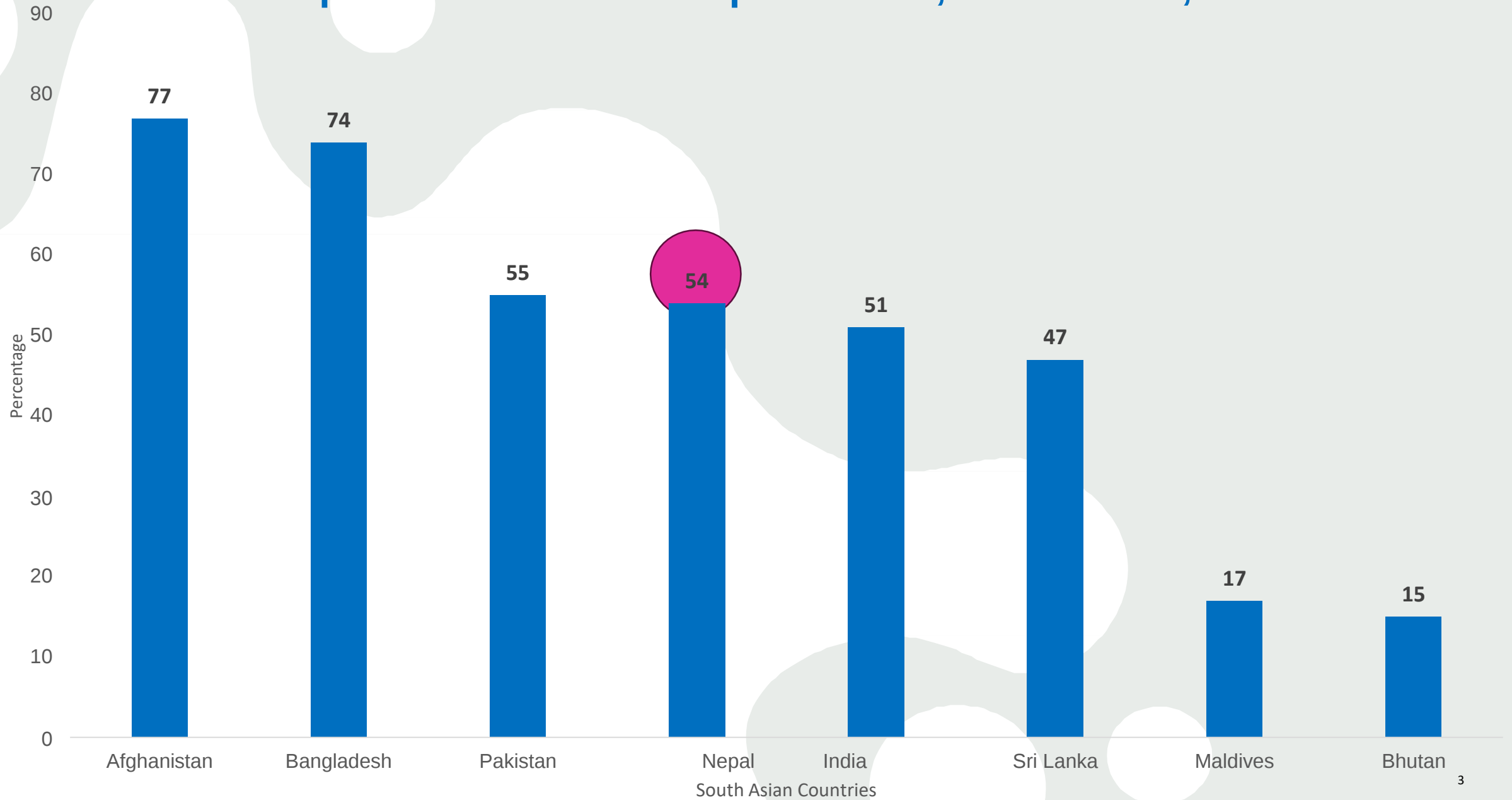
Department of Public Health

Aarhus University

Author's name and affiliation

1. Simrin Kafle, PhD candidate, Department of Public Health, Aarhus University, Aarhus, Denmark
1. Shiva Raj Adhikari, PhD, Central Department of Economics, Tribhuvan University, Kirtipur, Nepal
1. Derek Asuman, PhD, Department of Public Health, Aarhus University, Aarhus, Denmark
1. Per Kallestrup, PhD, Department of Public Health, Aarhus University, Aarhus, Denmark
2. Dinesh Neupane, PhD, Johns Hopkins Bloomberg School of Public Health, Baltimore, United States
1. Ulrika Enemark, PhD, Department of Public Health, Aarhus University, Aarhus, Denmark

Out of pocket health care expenditures, World Bank, 2023



Background and objective

Catastrophic health expenditure (CHE) is a critical issue in low- and middle-income countries (LMICs) like Nepal, exacerbating financial hardship among vulnerable households.

This study aims to evaluate whether Nepal's National Health Insurance Program (NHIP) offers protection against catastrophic health expenditures.

Methodology

Conducted in Pokhara Metropolitan City, the study employed an analytical cross-sectional design, with a sample size of 1,276 households, using a two-stage random sampling method.

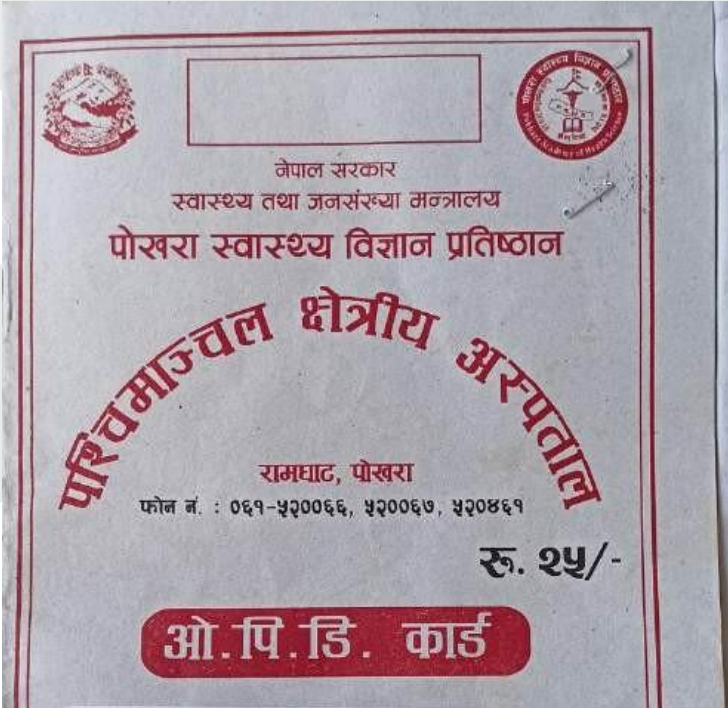
Data was collected via face-to-face interviews in 2023 and 2024.

Rather than relying on income data directly, household spending was used as a proxy for income or available resources.

First, household total consumption per month was estimated by summing food and non-food consumption (including health care expenditures) for that month.

OOPE related to acute conditions (over the past 30 days) and/or chronic conditions/NCDs (over the past 12 months) were converted into monthly figures and aggregated.

Health expenditure was calculated based on self-reported data validated by pertinent documents.⁵



Government of Nepal
Ministry of Health and Population
Pokhara Academy Of Health Sciences
WESTERN REGIONAL HOSPITAL

RAMGHAT, POKHARA

Phone No.: 061-520066,520461

INVOICE

Hos. No. : 80064689

NAME : Ms. TARA PARIYAR

AGE/GENDER : 40 Y/F CONTACT NO: N/A

ADDRESS : POKHARA METROPOLITAN-0

BILL NO. : CS80/81-0031950
BILL DATE/TIME : 2080/04/11-12:00:25
2023/07/27 AD

SN	PARTICULARS	ITEM CODE	RATE	QTY	AMOUNT
1	CBC TEST	CBC	200.00	1	200.00
2	GLUCOSE R	GR	50.00	1	50.00
3	RFT	RFT	500.00	1	500.00
4	LFT	LFT	400.00	1	400.00
5	AST(SGOT)	AST	120.00	1	120.00
6	T3T4.TSH	T34	750.00	1	750.00
7	SEROLOGY	SERO	900.00	1	900.00

In Words [NPR] Two Thousand Nine Hundred Twenty Only

User : DEEVI

Printed Date/Time : 2023/07/27 AD - 2080/04/11 BS 12:00:27

Get Well Soon. Thank You.

Username : 80064689
Password : 26298111
<https://www.midas.com.np/hospital/labreports/629>

Government of Nepal
Ministry of Health and Population
Pokhara Academy of Health Sciences
WESTERN REGIONAL HOSPITAL
DEPARTMENT OF RADIOLOGY
Ramghat, Pokhara

Name: Tara Pariyar

Age: 42 Sex: F Date: 2080/7/13

Clinical Information:

Address:

USG - Neck

● **FINDINGS:**

● **Thyroid gland:**

● **RIGHT LOBE:** Normal in size, outline and parenchymal echogenicity. Normal homogenous parenchymal echotexture. No space occupying lesion seen. No abnormal calcification noted.

● **LEFT LOBE:** Normal in size, outline and parenchymal echogenicity. Normal homogenous parenchymal echotexture. No space occupying lesion seen. No abnormal calcification noted.

● Isthmus is also normal with homogenous parenchymal echotexture.

● **Bilateral submandibular and parotid glands** have normal in size, parenchyma and echotexture. No focal lesion noted.

● No significantly enlarged lymphnode seen along the course of common carotid artery and jugular vein.

IMPRESSION:

Normal Scan

Consultant Radiologist
MD (Radiology & Imaging)

Gandaki Medical College

Prithivi Chowk-9, Pokhara, Nepal

Phone :977-61-538595,550254

Pan No. :302845752

CREDIT MEMO

SALE INVOICE

OPD COUNTER Department

NSHI No :736004706

Scheme: NEPAL GOVERNMENT INSURANCE

Claim code :402082310

Sales Bill No. :CR79/80-0625404

Date :2080/02/10 (2023/05/24)

Name :SURYALAL SUNAR(79067188)

Time :11:07:22

Prescribed by:

SN	Name	Exp.Date	Batch	Qty	Rate	Amount
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1	FORMIN 500MG TAB 36#	2024/08	9071	30	2.00	60
2	STAGEL SUSP.170ML	2025/01	362	1	132.00	132
3	PANTOROL 40 TAB	2025/02	013	15	8.00	120
4	CETOPHEN TAB	2026/04	1823	15	1.00	15
5	THYLOMINE 1500 MG	2025/02	006	15	19.00	285

Total: 612

Net Amt.: 612

GEETA LAMSAL

In words:

Six Hundred Twelve

बिक्री भएको औषधि १२ दिन भित्र मात्र फिर्ता हुनेछ।

औषधि फिर्ता गर्ने आउदा बिल अनिवार्य लिएर आउनुहोला अन्यथा फिर्ता हुने छैन।

Credit Bill Amount : -4246

Note :Net Amount negative value (Receive), positive value (Pay)

औषधि फिर्ता गर्ने समय १० बजे देखि ५ बजे सम्म

11:22

नेपालमा नसर्ने रोगसम्ब...

* अन्तर्वार्ता शुरु हुने समय

Select date

22 Feb 2024

Select time

11:22

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NEXT >

11:23

नेपालमा नसर्ने रोगसम्ब...

भाग १. सामाजिक-जनसांख्यिक विवरण

* उत्तरदाताको पुरा नाम (१६ वर्ष वा माथिकालाई मात्र सोध्ने)

< BACK

NEXT >

Q¹ W² E³ R⁴ T⁵ Y⁶ U⁷ I⁸ O⁹ P⁰
A S D F G H J K L
↑ Z X C V B N M ⊞
?123 , ☺ . ↵

Outcome measures (dependent variable)

Catastrophic health expenditure (CHE)

Out of Pocket Health Expenditure (OOPE) on health care is defined as payments made at the point of service, after deduction of any reimbursement. CHE was calculated using the threshold whether OOP expenditures equaled or exceeded 10% of the total household expenditure

Key independent variable of interest

Enrollment in NHIP: Households with NHI enrollment card

Covariates

Household health conditions (e.g., presence of NCDs, acute illnesses, and elderly members), socio-demographic factors (e.g., caste/ethnicity, family size, and education level of the household head), and economic indicators (e.g., consumption expenditure quintiles). These variables were included as covariates to adjust for confounding.

Statistical analysis

Households were matched one-to-one based on propensity scores using the nearest neighbor algorithm with a caliper width of 0.1 to ensure close matches, resulting in a final sample of 1,068 households, consisting of 534 enrolled and 534 non-enrolled households.

The propensity score estimates the probability of NHIP enrollment based on household characteristics. It helps reduce selection bias in observational studies by balancing differences between enrolled and non-enrolled households through matching.

A strict tolerance for propensity score matching ($1e-50$) was imposed to enhance precision and ensure high-quality matching. The Average Treatment Effect on the Treated (ATET) was estimated to quantify the effect of NHIP enrollment on CHE, specifically among households that chose to enroll in NHIP.

This diagnostic test compares the standardized differences of key covariates before and after matching. A significant improvement in covariate balance was observed after matching, as evidenced by the reduction in standardized differences for variables such as the presence of NCDs (from 0.341 to -0.012) and the proportion of elderly household members (from 0.311 to 0.011).

Statistical analysis

Variance ratios across the matched covariates approached 1, indicating the enrolled and non-enrolled households were well-balanced after matching ([Annex 1](#)).

An overlap analysis was conducted to assess the common support between the propensity score distributions of NHIP-enrolled and non-enrolled households. [Figure 1 \(Annex 2\)](#) illustrates the density distributions of propensity scores for both groups before and after matching.

Before matching, substantial discrepancies in the distributions were observed, indicating significant selection bias. Following matching, the overlap between the distributions improved, demonstrating the effectiveness of PSM in mitigating selection bias and validating the comparisons between the groups.

Variance estimation was performed under the Independent and Identically Distributed (IID) assumption to provide consistent standard errors for the treatment effect.

Statistical analysis

To assess the robustness of our findings to unobserved confounding, we conducted a Rosenbaum bounds sensitivity analysis. This method evaluates how strongly an unmeasured confounder would need to influence NHIP enrollment to alter the significance of its estimated effect on CHE.

We tested Gamma (Γ) values ranging from 1.1 to 3.0 to examine the potential impact of hidden bias. The Γ parameter represents the odds ratio of differential assignment to NHIP enrollment due to an unobserved confounder.

Additionally, we used the Hodges-Lehmann estimate (t-hat), a non-parametric measure of the median treatment effect, to provide a robust assessment of the association between NHIP enrollment and CHE.

This estimate provides an alternative to traditional mean-based estimates, ensuring that our sensitivity analysis remains robust against outliers and skewed distributions. The analysis was conducted using Stata version 18.

Results

Table 1: Socio-demographic, health, and economic characteristics of enrolled and non-enrolled households

Note: Cut off points for Household consumption quintiles: Q1=NPR 31981, Q2=NPR 41672, Q3=NPR 50031, Q4=NPR 71012, Q5=NPR 83014.

Variables	Enrolled households (n=534)		Non-enrolled households (n=742)	
	Frequency (n)	Percentage	Frequency (n)	Percentage
Households (HHs) with at least one NCD	363	68.0	382	51.5
HHs with at least one acute illness/injury	116	21.7	134	18.1
HHs with elderly ≥60 years	306	57.3	311	41.9
HHs with children under five	103	19.3	109	14.7
Caste/ethnicities				
Brahmin/Chettri	378	70.8	357	48.1
Janajatis	95	17.8	218	29.4
Dalits and others	61	11.4	167	22.5
Family size				
≤5	394	73.8	593	79.9
>5	140	26.2	149	20.1
Gender of household head				
Male	411	77.0	575	77.5
Female	123	23.0	167	22.5
Education level of household head				
Above 10 th grade	176	33.0	278	37.5
10 th grade and below	213	39.9	317	42.7
Read and write only	145	27.2	147	19.8
HHs visiting health facilities				
Government	249	46.6	252	34.0
Private	285	53.4	490	66.0
HHs total consumption expenditure				
Q1 (Lowest)	73	13.7	182	24.5
Q2 (Second)	91	17.0	164	22.1
Q3 (Third)	107	20.0	149	20.1
Q4 (Fourth)	120	22.5	135	18.2
Q5 (Highest)	143	26.8	112	15.1

Table 2. Correlates of enrolment into the NHIP

(n=1070)

NHIP	Adjusted Odds Ratio (AOR)	St. Error	P-value	(95% CI)
HHs with at least one NCDs	1.71*	0.22	0.000	(1.32-2.21)
HHs with at least one acute illness/injury	1.38*	0.21	0.040	(1.01-1.88)
HHs with elderly ≥60 years	1.48*	0.26	0.027	(1.04-2.11)
HHs with children under five	1.80*	0.24	0.000	(1.38-2.36)
Caste/ethnicity (Brahmin/Chettri)	1			
Janajati	0.41*	0.06	0.000	(0.30-0.55)
Dalits and others	0.39*	0.07	0.000	(0.27-0.56)
Gender Male	1			
Female	0.78	0.13	0.147	(0.56-1.09)
Family size, less than 5 members	1			
More than five members	0.73	0.12	0.077	(0.52-1.03)
HHs consumption expenditure with/before HE, lowest	1			
Second	1.31	0.26	0.178	(0.88-1.96)
Third	1.63*	0.33	0.016	(1.09-2.43)
Fourth	2.00*	0.41	0.001	(1.34-2.99)
Richest	2.52*	0.53	0.000	(1.66-3.82)
Education level of HH head, Above SLC	1			
Below SLC	0.94	0.13	0.703	(0.71-1.25)
Read and write only	1.69*	0.31	0.005	(1.17-2.43)
Types of health facilities visited, Private	1			
Government HF	1.72*	0.21	0.000	(1.34-2.20)
Constant	0.24	0.05	0.000	(0.16-0.37)

Note: 1 denotes the reference category. An asterisk(*) denotes statistical significance at the 95% confidence level ($p < 0.05$)*

Table 3. Association between CHE and enrollment in NHIP

(n=

CHE	AOR	St. error	P-value	(95% CI)
HHs NHIP enrollment	1.22	0.25	0.326	(0.81-1.83)
HHs with at least one NCD	6.61*	2.35	0.000	(3.29-13.30)
HHs with at least one acute illness/injury	4.13*	0.97	0.000	(2.60-6.55)
HHs with elderly ≥60 years	0.88	0.27	0.701	(0.48-1.63)
HHs with children under five	1.85*	0.46	0.014	(1.13-3.03)
Caste/ethnicity (Brahmin/Chettri)	1			
Janajati	0.68	0.19	0.185	(0.39-1.19)
Dalits and others	0.52	0.18	0.068	(0.26-1.05)
Gender Male	1			
Female	0.60	0.19	0.124	(0.31-1.15)
Family size, less than five members	1			
More than five members	1.25*	0.35	0.422	(0.72-2.18)
Household expenditure with HE, Lowest	1			
Second	0.36	0.11	0.002	(0.19-0.68)
Third	0.18	0.06	0.000	(0.09-0.37)
Fourth	0.30	0.09	0.000	(0.16-0.57)
Highest	0.12	0.04	0.000	(0.06-0.26)
Education level of HH head, Above SLC	1			
Below SLC	0.81	0.19	0.385	(0.51-1.29)
Read and write only	0.90	0.31	0.762	(0.45-1.77)
Types of HF visited, Private	1			
Government HF	0.93	0.19	0.735	(0.61-1.40)
Constant	0.05	0.02	0.000	(0.02-0.13)

Table 4. Average Treatment Effect on the Treated

CHE	Coef.	St. Error	p-value	(95% CI)
Household NHIP enrollment	0.031	.024	.187	(-0.01-0.07)
Mean CHE	0.098	SD, CHE 0.297		

The ATET analysis indicated a 3.1 percentage point increase in the likelihood of experiencing CHE among enrolled households.

*Note: * $p < .05$ indicates statistical significance at the 5% level.*

Addressing hidden bias

The underlying assumption of the PSM approach is that households with similar propensities to enroll in the NHIP, given their observed characteristics, may be similar in unobserved characteristics.

However, this assumption is not formally testable. We, therefore, performed a Rosenbaum bounds test to examine whether our results are affected by hidden bias. The Rosenbaum bounds test revealed that the estimated association between NHIP enrollment and CHE remains robust to hidden bias.

The extremely small p-values (e.g., 4.2×10^{-10} at $\Gamma = 3$) suggest that even in the presence of unobserved confounders, the primary conclusions would remain unchanged. Furthermore, the estimated effect size (-4.0×10^{-7}) and confidence intervals remain stable across increasing levels of hidden bias, reinforcing the reliability of the findings.

These results suggest that the absence of a significant effect is not merely an artifact of selection bias or unmeasured confounding.

A Rosenbaum Sensitivity Analysis (n = 1068 matched pairs)

* Gamma - log odds of differential assignment due to unobserved factors

sig+- upper bound significance level

sig- - lower bound significance level

t-hat+ - upper bound Hodges-Lehmann point estimate

t-hat- - lower bound Hodges-Lehmann point estimate

CI+- upper bound confidence interval ($\alpha = .95$)

CI- - lower bound confidence interval ($\alpha = .95$)

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	0	0	-4.0e-07	-4.0e-07	-4.0e-07	-4.0e-07
1.5	0	0	-4.0e-07	-4.0e-07	-4.0e-07	-4.0e-07
2	2.8e-14	0	-4.0e-07	-4.0e-07	-4.0e-07	-4.0e-07
2.5	8.9e-12	0	-4.0e-07	-4.0e-07	-4.0e-07	-4.0e-07
3	4.2e-10	0	-4.0e-07	-4.0e-07	-4.0e-07	-4.0e-07

Table 5. NHIP experiences and challenges faced by enrolled households (n=534) cont...

(in frequency and percentage)

Variables	Enrolled households (n=534)	
Median duration of enrollment	4 years	-
Households with renewed NHI card at the time of the survey	450	84.3
HHs reported known disease before enrollment	306	57.3
Enrolled household members went for a routine health check-up in the past 12 months	266	49.8
Motivation for the household to get enrolled in NHIP	Frequency	(%)
Insurance Employees	268	50.2
Neighbors and Friends	117	21.9
Social media	49	9.2
FCHVs	32	6.0
Health Workers	30	5.6
TV/Radio	30	5.6
Family	8	1.5
Positive things felt by enrolled households*	Responses	Percent of cases
Saved money	282	52.8
Has not received services yet	118	22.1
Tests/treatment available	95	17.8
Got medicines	33	6.2
Could do a whole body check-up	10	1.9
Liked HW behavior	6	1.1
Nothing	76	14.2

Table 5. NHIP experiences and challenges faced by enrolled households (n=534) cont...

(in frequency and percentage)

Variables	Enrolled households (n=534)	
Challenges felt by enrolled households*	Responses	Percent of cases
Waited for long	342	64.0
No medicines	131	24.5
Haven't received services yet	119	22.3
HW behavior	49	9.2
No required test/treatment	47	8.8
Complex process/differentiated treatment	32	6.0
Medicines did not work	23	4.3
Nothing	47	8.8
Reasons for non-renewal (n=84)*	Responses	Percent of cases
Waited for long	38	45.2
Complex procedures/differentiated treatment	29	34.5
Was busy	20	23.8
No medicines	18	21.4
No test/treatment	14	16.7
Medicines didn't work	8	9.5
HW behavior	7	8.3

CHE among enrolled and non-enrolled households (in past 12 months)

SN	Variables	Enrolled HHs, n=534	Non-enrolled HHs, n=534
1	CHE	12.5	9.2
1.1	HHs with above NRS 100000 HE in the past 12 months suffer from CHE	8.8	5.1
1.2	HHs suffered from CHE even though the HE is below NRS 100000	3.7	4.1
2	Preventable CHE		
2.1	HHs could have been prevented from CHE if the benefit limit exceeds NRS 100000 and up to NRS 200000	5.4	3.4
2.2	HHs could have been prevented from CHE if the benefit limit is set above NRS 100000 up to the highest level of HE (highest level of HE for enrolled NRS 3051920 and for non-enrolled NRS 1231550) %	8.8	5.1

Proportions of different expenditures among households who paid for health services

Headings	Proportion out of NCDs expenditures (n=732)	Proportion out of acute illnesses/injuries expenditures (n=238)
Medicines	63.2	59.7
Transportation	18.9	21.5
Laboratory	8.3	6.1
Ticket	3.5	5.2
X ray/USG	3.9	3.8
Inpatient	1.2	2.5
Medical equipment	0.3	1.1
Emergency	0.1	0.1
Accommodation	0.6	0.1

Conclusion

- These results suggest limited effectiveness of NHIP in protecting against CHE.
- Barriers to enrollment and retention, such as long waiting times (64%) and medication shortages (25%), contributed to a 16% dropout rate and reflect significant accessibility and operational inefficiencies.
- Additionally, the NHIP's benefit package was found to be insufficient, with essential services like transportation, diagnostics, and medicines inadequately covered, leading to persistent OOPE.
- The findings highlight the need for NHIP to expand its coverage, introduce flexible coverage limits based on income and healthcare needs.

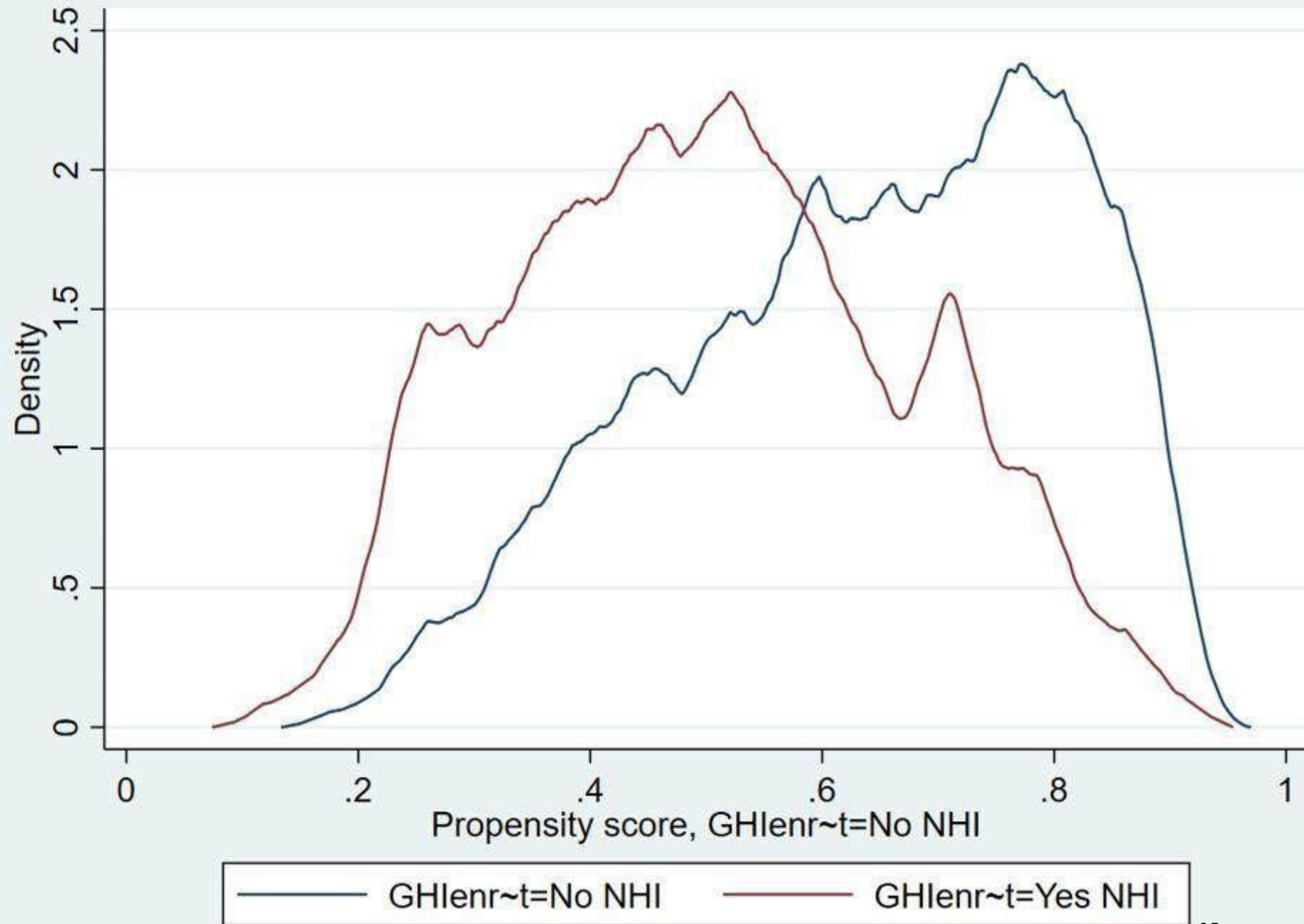
Implementation of strategies to mitigate adverse selection and optimization of resource allocation and administrative processes will be critical to finance these improvements.

Annex 1 Covariate balance summary

	Raw	Matched
Number of observations	1,276	1,068
Treated observations	534	534
Control observations	742	534

	Standardized mean differences		Variance ratio	
	Raw	Matched	Raw	Matched
HHs with at least one NCDs	0.341	-0.012	0.872	1.010
HHs with at least one acute illness/injury	0.092	0.009	1.150	1.013
HHs with elderly ≥60 years	0.311	0.011	1.005	0.997
HHs with children under five	0.123	0.104	1.243	1.198
Caste/ethnicity (Brahmin/Chettri)				
Janajati	-0.275	0.050	0.705	1.093
Dalits and others	-0.298	0.067	0.580	1.192
Gender Male				
Female	0.013	0.045	1.017	1.063
Family size, less than 5 members				
More than 5 members	0.146	-0.096	1.206	1.124
HHs expenditure quintile, Lowest				
Second	-0.128	-0.049	0.822	0.922
Third	-0.001	0.052	0.999	1.087
Fourth	0.106	0.018	1.171	1.025
Highest	0.290	0.038	1.531	1.043
Education level of HH head, Above 10 th grade				
Below 10 th grade	-0.058	-0.110	0.980	0.968
Read and write only	0.174	0.073	1.246	1.085
Types of health facilities visited				
Government HF	0.260	-0.026	1.110	0.997

Annex 2:
Figure 1 Density
distribution of
propensity scores for
enrolled and non-
enrolled households
in NHIP before and
after matching



Acknowledgement

S

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All stakeholders for their support and cooperation throughout this study

Health Directorate, Ministry of Health, Gandaki Province

Reference

- S** 1. World Health Organization. Financial protection. [Internet]. [cited 2024 Mar 18]. Available from: <https://www.who.int/health-topics/financial-protection>.
2. Wang, H., Torres, L. and Travis, P., 2018. Financial protection analysis in eight countries in the WHO South-East Asia Region. *Bulletin of the World Health Organization*, 96(9), pp.610-620E.
3. World Health Organization. Global spending on health: Weathering the storm. [Internet]. 2021[cited 2024 Mar 18]. Available from: <https://www.who.int/publications-detail-redirect/9789240017788>.
4. Rijal, A., Adhikari, T., Khan, J. and Berg-Beckhoff, G., 2019. The economic impact of non-communicable diseases among households in South Asia and their coping strategy: A systematic review. *PLOS ONE*, 14(1), p.e0211588.
5. World Health Organization. Noncommunicable diseases. [Internet]. [updated 2023 Sep 16;cited 2024 Mar 18]. Available from: <https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases>.
6. Nepal Ministry of Health and Population, Nepal Health Research Council, Institute for Health Metrics and Evaluation, UKaid Nepal Health Sector Programme 3. Nepal Burden of Disease 2019: A Country Report based on the 2019 Global Burden of Disease study. Monitoring Evaluation and Operational Research; August 2021.
7. PHRD Nepal. Basic Health Service Package (BHS) 2018 [Internet]. [cited 2024 Mar 18]. Available from: <https://www.phrdnepal.org.np/project/basic-health-service-package-bhs-2018>.
8. Mishra, S., Khanal, P., Karki, D., Kallestrup, P. and Enemark, U., 2015. National health insurance policy in Nepal: challenges for implementation. *Global Health Action*, 8(1), p.28763.
9. Wikipedia. 2021 Nepal census. [Internet]. [cited 2024 Mar 18]. Available from: https://en.wikipedia.org/wiki/2021_Nepal_census



**Thank
you!**



Simrin Kafle is a dedicated public health professional holding a Master of Public Health from Maharajgunj Medical Campus, Institute of Medicine, and a Master's degree in Sociology from Tribhuvan University, Nepal.

In recognition of her academic excellence, she was awarded the prestigious 'Gold Medal' by the President of Nepal in 2018.

Currently, she is pursuing a PhD in Health Economics at Aarhus University, Denmark, where her research focuses on the:

“Catastrophic Health Expenditure and Impoverishment associated with Non-Communicable Diseases and the effectiveness of the National Health Insurance Program in Nepal”.