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# Informal employment and catastrophic health expenditures: Evidence from Pakistan

Shabana Kishwar[1] (iD)  |  Saima Bashir[2] (iD)  |  Akseer Hussain[3,4]  |
Khorshed Alam[5,6] (iD)

[1]Pakistan Institute of Development Economics, Islamabad, Pakistan

[2]Clinical Tropical Medicine, University Hospital Heidelberg, Heidelberg, Germany

[3]Department of Economics and Related Studies, University of York, York, UK

[4]Department of Business Administration, Sukkur IBA University, Sukkur, Pakistan

[5]School of Business, Faculty of Business, Education, Law and Arts, Toowoomba, Queensland, Australia

[6]Centre for Health Research, University of Southern Queensland, Toowoomba, Queensland, Australia

**Correspondence**
Saima Bashir.
Email: saima.arif@uni-heidelberg.de

## Abstract

Workers in informal employment suffered significant out-of-pocket healthcare expenditures (OOPHEs) due to their low earnings and a lack of a social safety net or health insurance. There is little or no evidence of impoverishment caused by OOPHEs in the context of labor market categorization. Therefore, this study examines the economic burden of OOPHEs and its associated consequences on households, whose members are in informal employment. This study estimates the incidence of catastrophic health expenditures (CHEs) and impoverishment across the households in formal and informal employment and their key determinants in Pakistan by employing the data from the two rounds of the Household Integrated Economic Survey (2015-16, 2018-19). For measuring CHEs and impoverishment, the budget share and capacity-to-pay approaches are applied. Various thresholds are used to demonstrate the sensitivity of catastrophic measures. We found a higher incidence of catastrophic healthcare payments among the informal workers, that is, 4.03% and 7.11% for 2015-16 and 2018-19, respectively, at a 10% threshold, while at a 40% threshold, the incidence of CHEs is found to be 0.40% and 2.34% for 2015-16 and 2018-19, respectively. These OOPHEs caused 1.53% and 3.66% of households who are in informal employment

to become impoverished, compared with their formal counterparts. The study demonstrates that the probability of incurring CHEs and becoming impoverished is high among informal workers, compared with their formal counterparts. This result has clear policy implications, in which to protect the informal workers, it is necessary to expand the insurance coverage, particularly during the COVID-19 response and recovery efforts.

**Highlights**

- Out-of-pocket-payment (OOPP) is a major health financing mechanism in Pakistan.
- Informal workers are more vulnerable to many health problems than formal workers.
- Higher incidence of catastrophic healthcare payments among the informal workers
- OOPHEs caused 1.53% and 3.66% to become impoverished in 2015-16 and 2018-19, respectively

## 1 | INTRODUCTION

In low and middle-income countries (LMICs), healthcare financing is one of the critical issues for all levels of government. Healthcare costs are mostly self-financed by individuals in these economies and are referred to as out-of-pocket health expenditures (OOPHEs). Regardless of government and private sector initiatives, most people incur significant OOPHEs. In 2017, OOPHEs accounted for 44% of overall health spending in LMICs.[1] Due to the heavy reliance of healthcare system on OOPHEs, households are forced to deal with catastrophic health expenditures (CHEs). CHEs occur when OOPHEs surpass a particular level as a percentage of total income or consumption expenditures/capacity-to-pay [CTP].[2,3] An increase of CHEs as a percentage of overall healthcare spending from 2000 to 2015, irrespective of a decline in share of OOPHEs out of total health spending, indicates the financial problems faced by households worldwide.[1] An increase in CHEs is associated with impoverishment that causes an increase in income gap across different socioeconomic groups.[4,5]

The informal sector plays a significant role in the economy and labour market, as it employs two billion people, accounting for 61.2% of the global workforce.[6] In emerging and developing economies, the informal sector accounts for almost one-third of the gross domestic product (GDP).[7] Despite their significant social and economic contributions, these workers are more vulnerable to many health problems than formal workers because they work in unhealthy environments and are unprotected against negative health shocks.[8] In addition, only a limited number of informal workers and their families have access to affordable and adequate healthcare services, and others may be hesitant to seek care and often forego care if their employment status is insecure, or because of the high cost or loss of income.[9] Nearly 700 million informal workers live in extreme poverty and are unable to afford the expenses of seeking medical help and missing a day's work.[8]

Similar to most other LMICs, the informal sector plays a significant role in Pakistan's economy in terms of its contribution to the GDP (62.54% in 2015% and 56.25% in 2017)[10] and employment (excluding agriculture sector) (72.6% in 2014%-15% and 72.5% in 2020-21).[11,12] Overall distribution of informal worker, and by industry and profession is provided in appendix (Figure A1, Table A1). In industrial classification, the wholesale and retail trade have higher percentage of informal worker, whereas transport, storage and communication has lowest. While, by occupation, highest percentage of informal workers are in services and sales, whereas, lowest are in skilled agriculture, forestry, and fisheries. The rural and urban share in informal employment is 76.1% and 69.2% for 2014-15, compared with 76.2% and 68.5% for 2020–2021. The informal workers do not pay income taxes and have low-income levels.[13] Therefore, they may be perceived as a source of public expenditure, rather than revenue. Low government health-care spending, urban biased healthcare infrastructure, and a lack of the Universal Health Coverage (UHC) and awareness are associated with informal workers' access to the system.[8] In 2017–18, it was reported that 40.9% of overall health expenditures in Pakistan are made by the government, whilst 58.5% are made by the private sector, with 88% being made by individuals and their families.[14] On the one hand, the share of informal employment is very high (almost 76%), and on the other hand out of pocket health expenditures (OOPHEs) are also very high (88%) in case of Pakistan. Therefore, it was necessary to explore the prevalence of CHEs, and their impoverishment impact in case of the households whose heads are employed in the informal sector. The households with CHEs have higher chances of falling into poverty, and this have a greater implication for policies related to labour market, and poverty eradication.

Research have focused on the incidence, intensity, impoverishment impact of CHEs, and determinants of OOPHEs and CHEs employing different research design and settings, such as panel,[15] cross-sectional and country-specific studies.[16,17] A few studies also focused on employment status,[18] and specific diseases[19,20] to examine the burden of OOPHEs across employed and unemployed, and across the patients with high blood pressure and diabetes. However, only one study has yet to focus on the burden of health shocks and its associated consequences on households, whose members are in informal employment.[21] Their analysis is based on cross-sectional design, which meant that data were collected across the study population at a single point in time. A key limitation of this study design is that it does not show how variables change overtime. A presentation of data collected over an interval of time might reflect a better picture and the factors associated with the increase in OOPHEs. This can ameliorate the formulation of health policies covering informal workers. In the setting of the labour market, no study has yet examined the OOPHEs and impoverishment in Pakistan focusing on informal workers, despite their significant contribution to the economy and employment.

Therefore, in this study, we aim to provide the answer to the following research questions: (i) What is the incidence of OOPHEs among the informal workers in Pakistan? (ii) What is the intensity of CHEs and the level of impoverishment caused by CHEs across the informal and formal workers? (iii) What are the key determinants of OOPHEs and CHEs among the informal workers?

In developing economies such as Pakistan, where the informal sector is increasing overtime, a study on the intensity of OOPHEs, CHEs and impoverishment focusing on workers in informal employment is crucial. This can help in understanding why there is a difference in OOPHEs across formal and informal workers and the association between increased informality and CHEs overtime. Developing countries are increasingly formulating their health policies to achieve UHC, therefore this study will help policy makers to target and deliver the health insurance to the vulnerable group of the society so that they may not expose to financial hardships due to OOPHEs.

The rest of the paper is arranged as follows; Section 2 examines the data and methods used to analyse the underlying objectives. Sections 3 and 4 presents and discusses the results. The conclusion and policy implications are discussed in Section 5.

## 2 | MATERIAL AND METHODS

### 2.1 | Data sources

The data used for this study is drawn from the Household Integrated Economic Survey (HIES) of 2015–16 and 2018–19 that is conducted by the Pakistan Bureau of Statistics. These surveys are provincially representative, and in 2015–16 and 2018–19, they cover 24,238 and 24,809 households (0.08% of the whole population in each time), respectively. It is the only available survey that covers almost all districts of Pakistan and provides information regarding income, consumption and health expenditures at the household level. Income consists of employment earnings and income from other household resources. That is why it is the most suitable survey for measuring poverty. Furthermore, these datasets also cover both individual and household characteristics with the urban/rural divide. For 2015–16 and 2018–19, the urban area covers 16,155 (67%) and 8873 (36%) households, respectively, whilst the rural area covers 8083 (33%) and 15,936 (64%) households, respectively.

These surveys used a stratified two-stage sampling design. Each administrative division in each of the four provinces has been treated as a separate stratum in the urban domain. Each administrative district in Punjab, Sindh and Khyber Pakhtunkhwa (KP) as well as each administrative division in Balochistan, has been treated as a separate stratum in the rural domain.

Primary Sampling Units (PSUs) are enumeration blocks in the urban and rural domains. The probability proportional to size sampling strategy is used to select sample PSUs from each ultimate stratum/sub-stratum. Households representing the Secondary Sampling Units (SSUs) were selected from sample PSUs. Using a systematic selection approach, 12 to 16 households (SSUs) were selected from the urban and rural domains, respectively. The flow chart of household's selection with employed head and missing observation is provided in appendix (Figure A2). The households with missing values of OOPHEs and unemployed head are dropped.

### 2.2 | Variables

In general, the HIES does not provide the information either the individual is in informal or formal employment, and the production units are also not classified as formal or informal. Therefore, based on the literature[22] multiple criteria have been used to define informal employment. Self-employed workers (excluding agriculture sector workers, managers, professionals and technicians), contributing family workers, own-account workers, and the workers of firms who have less than 10 workers are considered as informal workers.[23] OOPHEs include expenses on medical products, appliances and equipment, out-patient and in-patient services.

In regression analysis, we used individual, household-level, and geographic-level characteristics by following the relevant literature. The age, education, gender and marital status of the household's head are all individual factors considered. The household level characteristics included the family size, the total number of working individuals, elderly members (age>=65 years), children (age<6 years) (both of these population groups are more vulnerable and seek more healthcare utilization and consequently increase the burden of OOPHEs of a household) for determining CHEs and impoverishment. The log of total income was used to depict the household's financial condition. In the regression analysis, four dummy variables were included to quantify the differences in CHEs across four regions of Punjab, Sindh, KP and Balochistan.

Furthermore, quintiles representing the socio-economic status of the households are constructed from their total consumption expenditures.

### 2.3 | Statistical analysis

Two approaches are commonly used to measure CHEs, which are the household's total consumption expenditures[24] and capacity-to-pay (CTP).[3] CTP measures the proportion of the household's consumption in non-food items. There

are three indicators of CHEs: catastrophic head counts,[25] catastrophic payment overshoot (OS) and the mean positive overshoot (MPOS).[7]

Through the headcount ratio, the incidence of CHEs is measured as follows:

A household incurs CHEs if $T_i/x_i$, or $T_i/[x_i - f(x)]$ surpasses a defined amount, Z (threshold). $T_i$ shows the OOP payments disbursements for families i, $x_i$ is the entire expenditures of the family I and $f(x)$ represents food expenditures.

The headcount is represented as follows:

$$H = \frac{1}{N}\sum_{i=1}^{N} E_i \qquad (1)$$

Let sample size be N and $E_i$ equals 1 if $T_i/x_i$ or $T_i/(x_i - f(x)) > Z$ and zero otherwise.

There is no standard threshold for measuring the CHEs. Two threshold values are mostly used by researchers. The first threshold is 10% out of the total consumption expenditures[2,26] and the second one is 40% out of non-food expenditures.[3] Therefore, in this study, we used a range of thresholds (5%–40%) for assessing the sensitivity of CHEs measures. A dummy variable is constructed assigning the value 1 if the household incurred CHEs and 0 otherwise.

The average level at which payments as a percentage of consumption expenditures surpasses the threshold Z is known as the catastrophic payment overrun. The average overshoot is calculated as follows:

$$OS = \frac{1}{N}\sum_{i=1}^{N} OS_i \qquad (2)$$

where $O_i$ is the amount by which household i share of health expenditure in non-food expenditure exceeds the specified threshold and is calculated as

$$OS_i = E_i(R_i - Z) \qquad (3)$$

The mean positive overshoot (MPOS) which measures the payments in excess of the threshold average over all households is defined as

$$MPOS = OS/HC \qquad (4)$$

Incidence of poverty is measured by applying the official measurement of the poverty line in Pakistan: PKR 3250 (US\$ 1 = PKR 170) and PKR 3776 for the year 2015-16 and 2018-19. This poverty line is measured by the Government of Pakistan using the cost of basic needs approach (i.e., the amount of per-capita spending necessary by households to fulfil their basic needs).[27,28] This comprises food and non-food consumption items. Considering low volatility in consumption overtime induced by negative/positive income shocks, we utilised a consumption-based measure of poverty. This is especially true for the economies which are highly dependent on agriculture because household income fluctuates significantly on a seasonal basis.[29,30] Furthermore, in the measurement of income, the risk is associated where individuals are self-employed. These households' income is calculated with substantial inaccuracies. If it is used to calculate poverty, then the results will be significantly biased. Additionally, according to Gazdar[31] and Jamal,[30] expenditure is a reliable proxy for permanent income in creating the poverty rankings.

The impoverishment is assessed by taking the difference of incidence of poverty with OOP payments in total consumption expenditures and excluding these expenditures from total consumption expenditures. This difference refers to the number of households who are forced into poverty as a result of OOP expenses. Firstly, for measuring the incidence of poverty, we calculated the per adult equivalent consumption expenditures with OOP payments in total consumption expenditures and compared these expenditures with the poverty line. Formally, the incidence of poverty is given as follows:

$$P_0 = 1/M\sum_{i=1}^{M} I(C_i < Z) \qquad (5)$$

*M* represents the total number of the households, $C_i$ indicates the consumption expenditures and *Z* is the poverty line. $I(C_i < Z)$ is an indicator function showing that if this expression is true, then it will take the value 1 and the household would be counted as poor. Simply, the average of this function is termed as the head count index.

Secondly, we calculated the per adult equivalent consumption expenditures, excluding OOP payments from total consumption expenditures and measured the incidence of poverty (Equation (5)). Impoverishment is measured based on the difference between these two estimates:

$$PI^H = H_{pov}^{post} - H_{pov}^{pre} \tag{6}$$

The impoverishment variable is assigned the value of 1 if households fall into poverty after paying for healthcare services, otherwise 0.

Following,[32] the logistic regression model is applied to assess the determinants of CHEs. The dependent variable, CHEs, equals 1 if a household faces catastrophic health payments and 0 otherwise.

# 3 | RESULTS

## 3.1 | Summary statistics

Socio-economic characteristics of households are provided in the appendix (Table A2). The average age of household head, family size, number of older members of household, education level, and average income is lower in informal sector as compared to formal sector. Whereas reverse is true for number of children, male headed and married household head. Average OOP payments and share of OOPHEs across the household in formal and informal employment are provided in appendix (Table A3). Average OOP payments are lower for households with informal employment, compared with the formal employment at the national and regional levels. There is a decrease in average OOP payments from 2015 to 16 to 2018–19. The share of OOP expenditures is higher in 2018–19 and for the households with informally employed heads. The overall share of OOP payments in total expenditure is 4.1% and 4.9% in 2015–16, whilst 6.0% and 7.4% in 2018–19 for the formally and informally employed household heads. Nevertheless, the rural share is higher than the urban share by 2.0% and 1.7% across the formal and informal employment in 2015%–16 and 2.0% and 3.1% in 2018–19, respectively. Appendix (Figure A3), reported the comparison of shares of healthcare expenditures across the different employment and quintile shows that the share of healthcare payments for informal workers is higher compared with formal workers and the poorest quintile has a higher burden of OOPHEs for the surveys. The share of OOPHEs for the poorest group is 5.4% and 9.0%, compared with the richest group (i.e., 4.4% and 5.5%) for the informal workers in 2015–16 and 2018–19, respectively.

## 3.2 | Incidence, intensity, and impoverishment impact of CHE

The incidence and intensity (mean gap) of CHEs are reported in Table 1 with the thresholds ranging from 5% to 40% as a share of the household's total expenditure and non-food expenditures. The incidence and intensity of CHEs are higher when defining CHEs as a share of non-food expenditures, compared with CHEs as a share of total expenditures. Region wise incidence of catastrophic health expenditures are presented in appendix (Table A4).

A high incidence of CHEs is observed for 2018–19, compared with 2015–16, and for the households in the informal employment than the formal employment. For instance, for the year 2015–16 and at the threshold of 5% of total consumption expenditure, 31.47% of households face CHEs with household heads in informal employment, compared with 24.29% of households with the heads in the formal employment. Similarly, for 2018–19, the estimated incidence of CHEs is 38.38% and 30.16% for the households with informal and formal heads, respectively. Similarly, for 2015–16, 0.86% of households with informal heads and 0.55% of the households with formal heads

**TABLE 1** Incidence of catastrophic health expenditures (CHEs): Formal-informal sector.

| | | 2015–16 | | | | 2018–19 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | OOPP as a share of total household expenditures | | OOPP as a share of household non-food expenditures | | OOPP as a share of total household expenditures | | OOPP as a share of household non-food expenditures | |
| | | Formal | Informal | Formal | Informal | Formal | Informal | Formal | Informal |
| 5% | Incidence | 11.94 | 13.24 | 24.29 | 31.47 | 16.89 | 18.88 | 30.16 | 38.38 |
| | OS | 0.53 | 0.65 | 1.31 | 1.79 | 1.42 | 1.61 | 3.10 | 4.11 |
| | MPOS | 4.45 | 4.89 | 5.38 | 5.69 | 8.38 | 8.52 | 10.27 | 10.70 |
| 10% | Incidence | 3.19 | 4.03 | 7.67 | 10.98 | 6.98 | 7.11 | 13.61 | 17.52 |
| | OS | 0.23 | 0.28 | 0.60 | 0.84 | 0.87 | 1.04 | 2.08 | 2.79 |
| | MPOS | 7.12 | 7.06 | 7.82 | 7.66 | 12.50 | 14.62 | 15.29 | 15.95 |
| 15% | Incidence | 1.26 | 1.73 | 3.51 | 5.09 | 3.96 | 4.04 | 8.17 | 9.71 |
| | OS | 0.12 | 0.15 | 0.34 | 0.47 | 0.62 | 0.77 | 1.55 | 2.15 |
| | MPOS | 9.61 | 8.73 | 9.62 | 9.23 | 15.72 | 19.06 | 18.97 | 22.12 |
| 20% | Incidence | 0.76 | 0.89 | 1.91 | 2.77 | 2.3 | 2.75 | 5.23 | 6.45 |
| | OS | 0.07 | 0.09 | 0.21 | 0.28 | 0.47 | 0.60 | 1.22 | 1.75 |
| | MPOS | 9.41 | 9.76 | 10.75 | 10.15 | 20.41 | 21.98 | 23.36 | 27.19 |
| 25% | Incidence | 0.39 | 0.52 | 1.02 | 1.64 | 1.79 | 1.9 | 3.87 | 4.68 |
| | OS | 0.04 | 0.05 | 0.13 | 0.17 | 0.37 | 0.49 | 1.00 | 1.48 |
| | MPOS | 11.04 | 10.06 | 12.62 | 10.63 | 20.74 | 25.76 | 25.76 | 31.65 |
| 30% | Incidence | 0.31 | 0.34 | 0.71 | 1.03 | 1.19 | 1.43 | 3.02 | 3.54 |
| | OS | 0.03 | 0.03 | 0.09 | 0.11 | 0.30 | 0.41 | 0.83 | 1.28 |
| | MPOS | 8.21 | 9.31 | 12.13 | 10.47 | 25.08 | 28.40 | 27.40 | 36.09 |
| 35% | Incidence | 0.16 | 0.13 | 0.47 | 0.64 | 0.98 | 1.10 | 2.00 | 2.84 |
| | OS | 0.01 | 0.02 | 0.06 | 0.07 | 0.24 | 0.34 | 0.71 | 0.62 |
| | MPOS | 9.23 | 15.38 | 12.25 | 10.56 | 24.78 | 31.25 | 35.36 | 38.01 |
| 40% | Incidence | 0.13 | 0.10 | 0.34 | 0.40 | 0.55 | 0.86 | 1.62 | 2.34 |
| | OS | 0.01 | 0.02 | 0.04 | 0.04 | 0.20 | 0.30 | 1.12 | 0.99 |
| | MPOS | 5.32 | 14.83 | 10.99 | 10.72 | 36.87 | 34.32 | 39.46 | 42.38 |

Abbreviations: MPOS, mean positive overshoot; OS, overshoot.

incur CHEs. The incidence of CHEs for the households with an informally employed head is 2.34%, compared with 1.62% for those with a formally employed head for 2018–19.

To capture the intensity of CHEs, the mean gap of CHEs referred to as 'overshooting' is also reported in Table 1. Overshooting is higher for informal workers compared to formal workers, for both rounds of the survey. In 2015–16, at the 5% threshold level (out of non-food expenditures), the overshoot is 1.79% for households in informal employment, compared to 1.31% for those in formal employment. It means that the households with informal heads and incurring the CHEs at 5%, their health expenditures are 1.79% higher than their formal counterpart. In 2018–19, the overshoot estimates are 4.11% and 3.10% for the households whose heads are in informal and formal employment, respectively. The overshoot is lower at higher thresholds of 40%—the overshoot is 0.04% for both formal and informal heads in 2015–16, but it is increased to 0.99% for informal heads and 1.12% for formal heads in 2018–19. It is also observed moving from 5% to 25% threshold levels the mean positive overshoot is increasing and always higher for informal workers compared to the informal workers. Furthermore, there is a decline in overshooting with an

**TABLE 2** Incidence of poverty before and after healthcare payments (informal-formal employment).[24]

| | 2015–16 | | 2018–19 | |
| --- | --- | --- | --- | --- |
| | **Formal** | **Informal** | **Formal** | **Informal** |
| Poverty headcount | | | | |
| Gross of health expenditures | 10.52 | 24.48 | 5.36 | 22.12 |
| Net of health expenditures | 11.18 | 26.01 | 7.1 | 25.78 |
| Difference | 0.66 | 1.53 | 1.74 | 3.66 |
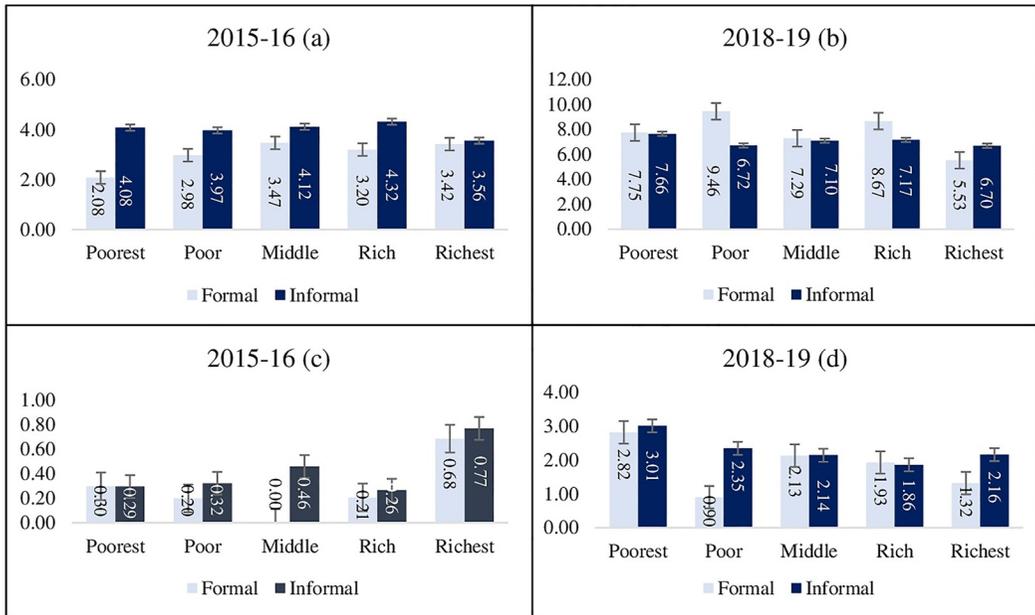


Note: panel (a) and (b) represent catastrophic health expenditures at 10% threshold, while panel (c) and (d) represent at 40% threshold.

**FIGURE 1** Catastrophic health expenditures (CHEs) (10% and 40% threshold). [Colour figure can be viewed at wileyonlinelibrary.com]

increase in mean positive overshoot, highlighting the fact that the CHEs is more indicative of a deepening of poverty (overshoot) than an incidence of poverty (headcount).

Table 2 presents the patterns of poverty and impoverishment overtime across formal and informal employment. For 2015–16, almost 10.52% and 24.48% of households with formal and informal employment are estimated to be in poverty before any payments for healthcare services. After making OOPHEs, about 11.18% and 26.01% of households with formal and informal employment were impoverished. In 2018–19, compared with 2015–16, although the incidence of poverty fell, the high impoverishment effect of OOP payment is estimated for the households with formal and informal employment, which is 1.74% and 3.66%, respectively.

Figure 1 shows the quintile-wise distribution of households incurring CHEs at the 10% (out of the total consumption expenditure) and 40% (out of non-food expenditures) thresholds. The percentage of households bearing the CHEs is high for households with informal heads in both surveys (Figure 1). For 2015–16, the incidence of CHEs is found to be highest for rich informal households. The richest households bear high CHEs either with formal heads or informal heads. For 2018–19, the incidence of CHEs was high among the households with formal household heads and with the poor, middle and rich quintiles.

## 3.3 | Determinants of catastrophic health expenditures and impoverishment

We estimated the logistic regression with the households in the informal employment to determine the incidence of CHEs (10% and 40% thresholds) and their impoverishment. Results revealed that informal employment is significantly and positively associated with CHEs and impoverishment for the rounds of surveys (Table 3). The households in the informal employment have higher odds of affecting the CHEs, compared to the households in formal employment. This holds for both CHEs at 10% and 40% and 2015–16 and 2018–19, respectively.

For 2015–16, at the 10% threshold, households with informally employed heads have 17.6% higher incidence of bearing CHEs, whereas for 2018–19, at the 40% threshold, the incidence of CHEs is 49.5% higher for households with informally employed heads, compared to households with formal employment heads. This indicates that households with informally employed heads had to bear a higher incidence of CHEs (despite having lower average health expenditures and an increase in the burden of CHEs overtime). Households have to bear a lower burden of CHEs if the household head has high schooling, except at the 40% threshold in 2018–19. In 2015–16, a married person has lower odds of bearing CHEs, whilst in 2018–19, the odds of being married for affecting the CHEs is high. Moreover, a higher number of children and elderly members are also associated with a higher incidence of CHEs for both rounds. The families with more dependent members (children and the elderly) are more likely to spend money on health because these family members are more vulnerable to health shocks due to lower immunity and needs more support. Compared to the poorest class, the middle and richest classes incurred a lower burden of CHEs, except at a catastrophic 40% threshold. It is due to the fact that with higher wages and earning capacity, they spend a lower portion on health compared to their income.

An increased income is associated with higher odds of CHE. For the case of impoverishment, it is found in both rounds that the informal workers have higher odds of falling into poverty compared to formal workers due to OOPHEs. Households with informal employment are 47.9% (2015–16) and 37.1% (2018–19) more impoverished due to OOPHEs. Higher impoverishment is due to a higher share of OOPHEs out of non-food expenditures for informal workers. The impoverishment effect of family size is higher in 2018–19 (8.2%) than in 2015–16 (5.4%). The increase in income is also associated with higher odds of incurring CHEs, but with lower odds of impoverishment.

## 3.4 | Determinants of out of pocket and catastrophic health expenditures among informal employment

Spending on OOPHEs is higher in households with more children and elderly members, larger family size and income, as shown in Table 4. Because the immunity is lower among children and the elderly, they are more prone to health hazards. An increase in children and elderly family members increases the health expenditure by 7.6% and 24.1% in 2015–16. The increase in OOPHEs associated with elder members is lower in 2018–19 that is, 14.7%. Additionally, households with higher income have to bear 24.2% and 14.3% OOPHEs in 2015–16 and 2018–19, respectively. This may be due to the fact that with high wages and earnings, these households may spend more compared to the poorest households. Education of the household head is a negative predictor of OOPHEs.

As far as CHEs are concerned, education is associated with lower odds of incurring CHEs, whilst the number of children less than 6 years of age and older members more than 65 year of age are associated with higher odds of CHEs.

We have also applied modified Poisson Regression for robustness check as it is argued[33] that in case of rare events the odds ratio and incidence of relative risk are almost the same (results are provided in appendix (Table A5 and A6)). The results of these two models are found to be almost similar which ensures that the results are robust with different analytical models.

**TABLE 3** Determinants of catastrophic health expenditures (CHEs) and impoverishment.

| | 2015–16 (N = 15,191) | | | 2018–19 (N = 15,050) | | |
|---|---|---|---|---|---|---|
| | Cat10 | Cat40 | Impoverishment | Cat10 | Cat40 | Impoverishment |
| | Odds ratio | Odds ratio | Odds ratio | Odds ratio | Odds ratio | Odds ratio |
| **Employment (ref: Formal)** | | | | | | |
| Informal | 1.176** | 1.293 | 1.479* | 0.982 | 1.495** | 1.378* |
| | (1.01–1.37) | (0.61–2.72) | (0.93–2.34) | (0.85–1.14) | (1.02–2.20) | (0.97–1.95) |
| Age | 0.994** | 0.981 | 0.998 | 1.002 | 1.013** | 1.00 |
| | (0.99–1.00) | (0.96–1.01) | (0.98–1.01) | (1.00–1.01) | (1.00–1.02) | (0.99–1.01) |
| Schooling | 0.955*** | 0.916*** | 0.960** | 0.980*** | 1.023* | 0.973** |
| | (0.94–0.97) | (0.86–0.97) | (0.93–0.99) | (0.97–0.99) | (1.00–1.05) | (0.95–0.99) |
| **Gender (ref: Male)** | | | | | | |
| Female | 0.87 | 1.432 | 0.994 | 1.161 | 1.397 | 0.802 |
| | (0.54–1.41) | (0.32–6.51) | (0.23–4.31) | (0.84–1.60) | (0.62–3.16) | (0.36–1.78) |
| **Marital status (ref: Unmarried)** | | | | | | |
| Married | 0.777** | 0.575 | 1.95 | 1.017 | 1.858* | 1.379 |
| | (0.62–0.98) | (0.25–1.33) | (0.83–4.60) | (0.83–1.25) | (0.97–3.55) | (0.83–2.28) |
| Children (age<6) | 1.297*** | 1.039 | 0.998 | 1.096*** | 1.043 | 1.029 |
| | (1.23–1.37) | (0.77–1.41) | (0.86–1.15) | (1.05–1.15) | (0.93–1.17) | (0.94–1.13) |
| Family size | 0.937*** | 0.841** | 1.054* | 0.955*** | 0.98 | 1.082*** |
| | (0.91–0.96) | (0.73–0.97) | (0.99–1.12) | (0.93–0.98) | (0.93–1.04) | (1.04–1.12) |
| Elderly (age>=65) | 1.539*** | 1.585* | 1.133 | 1.299*** | 1.428*** | 1.138 |
| | (1.37–1.73) | (0.92–2.74) | (0.82–1.57) | (1.18–1.43) | (1.15–1.77) | (0.94–1.38) |
| Income | 1.220*** | 1.900*** | 0.640*** | 0.987 | 0.851 | 0.671*** |
| | (1.09–1.37) | (1.22–2.95) | (0.46–0.89) | (0.90–1.08) | (0.68–1.06) | (0.57–0.78) |
| **Expenditures quintiles (ref: Poorest)** | | | | | | |
| Poor | 0.915 | 1.058 | --- | 0.797*** | 0.765 | --- |
| | (0.78–1.08) | (0.40–2.79) | --- | (0.70–0.91) | (0.55–1.06) | --- |
| Middle | 0.819** | 1.323 | --- | 0.757*** | 0.781 | --- |
| | (0.69–0.97) | (0.52–3.39) | --- | (0.66–0.87) | (0.55–1.11) | --- |
| Rich | 0.868 | 0.996 | --- | 0.745*** | 0.732 | --- |
| | (0.73–1.04) | (0.36–2.78) | --- | (0.64–0.87) | (0.49–1.09) | --- |
| Richest | 0.828* | 2.778** | --- | 0.520*** | 0.838 | --- |
| | (0.68–1.01) | (1.09–7.11) | --- | (0.42–0.64) | (0.51–1.37) | --- |
| **Region (ref: Rural)** | | | | | | |
| Urban | 0.611*** | 0.422*** | 0.799 | 1.506*** | 1.723*** | 1.597*** |
| | (0.54–0.69) | (0.23–0.76) | (0.58–1.10) | (0.60–0.73) | (0.45–0.75) | (0.51–0.77) |
| **Province (ref: KP)** | | | | | | |
| Punjab | 1.076 | 2.388** | 1.166 | 0.913 | 1.004 | 0.835 |
| | (0.94–1.24) | (1.10–5.19) | (0.79–1.72) | (0.49–0.61) | (0.44–0.78) | (0.57–0.92) |
| Sindh | 0.623*** | 0.944 | 0.72 | 1.830*** | 1.705*** | 1.382*** |
| | (0.52–0.74) | (0.34–2.59) | (0.45–1.15) | (0.44–0.57) | (0.43–0.81) | (0.46–0.79) |

**TABLE 3** (Continued)

| | 2015–16 (N = 15,191) | | | 2018–19 (N = 15,050) | | |
|---|---|---|---|---|---|---|
| | Cat10 | Cat40 | Impoverishment | Cat10 | Cat40 | Impoverishment |
| | Odds ratio | Odds ratio | Odds ratio | Odds ratio | Odds ratio | Odds ratio |
| Balochistan | 0.708*** | 0.698 | 1.295 | 0.886 | 0.646* | 1.099 |
| | (0.57–0.88) | (0.15–3.34) | (0.79–2.13) | (0.41–0.57) | (0.23–0.62) | (0.58–1.09) |

*Note*: Standard errors in parentheses. Cat10 and Cat40 are generated by taking the ratio of total health expenditures out of total non-food expenditures.

***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

## 4 | DISCUSSION

This study is the first attempt to analyse the burden and impoverishment caused by OOPHEs across the households in formal and informal employment in Pakistan. It is the country with the largest informal sector without financial protection and safe working conditions. Therefore, analysing the burden and impoverishment caused by OOPHEs was crucial to assess the existing policies and the extent of their capabilities in addressing this issue.

The incidence of OOPHEs is found to be higher among the formal workers compared to informal workers. Our results are consistent with the literature.[21] This may be due to the fact that the level of income and the utilisation of healthcare services is higher among them, compared to informal workers.[34,35] In contrast to this, the incidence of CHEs was observed to be higher among the households with informal workers compared to formal workers. The considerable reason is that the households in informal employment have lower income compared to households in formal employment, which may cause lower spending on OOPHEs and other essential items. Further, higher share of OOPHEs of households with informal head might be due to lower total consumption expenditures compared to formal workers. Furthermore, the probability of facing associated consequences injuries and contracting various diseases is high among the informal workers,[9] wherein this can also cause an increase in OOPHEs, resulting in its higher share out of the total consumption expenditures.

Another reason could be low or no coverage of health insurance, causing these workers to rely on informal credit to protect themselves against health shocks and to smooth their spending. The informal source of financing exacerbates the burden because it requires them to pay a high interest rate and return the loan in a short period.[36] Therefore, many of the informal workers do not adopt the informal source of financing and they prefer to remain untreated. In case of necessary treatment, they reduce other expenses, rather than borrow from unofficial sources, which increases their vulnerability. This causes their consumption to fall below the poverty line. Furthermore, if they do not receive treatment due to high OOPHEs, their health will deteriorate, affecting their productivity and their earning potential in the long term.[37] As a result, workers in the informal employment have to deal with not only the physical, but also the financial consequences of illnesses.

Results also show that within informal employment, the households in the lower quintile have higher odds of facing CHEs compared to the households in the upper quintile. These estimates are three times lower than what was reported in an another study at the 10% threshold,[38] which only covered a small number of Indian rural households with informal employment.

Subsequently, estimates show that OOPHEs derived a higher percentage of households with informal employment into poverty compared to households with formal employment and this trend is increasing overtime. A recent study in India reported the close figures of CHEs at the 30% threshold across the households in formal and informal sectors and a two times higher figure of impoverishment for informal workers.[21] However, this study only used the data from a single year (2011–2012). The considerable reason of falling into poverty is the ill health/injuries of informal workers (without any social coverage) which causes the divergence of expenditures from consumption to treatment and the loss of income due to absence from work.[39] The fall in consumption expenditures due to an increase in OOPHEs and their share increases the CHEs.

**TABLE 4** Determinants of out of pocket and catastrophic health expenditures (CHEs) (informal employment).

| | 2015–16 (N = 11,371) | | | 2018–19 (N = 12,728) | | |
|---|---|---|---|---|---|---|
| | OOPHEs | Cat10 | Cat40 | OOPHEs | Cat10 | Cat40 |
| | Coefficient | Odds ratio | Coefficient | Odds ratio | Coefficient | Odds ratio |
| Age | 0.00034 | 0.993** | 0.973* | 0.00175* | 1.002 | 1.012** |
| | ((−0.00)-0.00) | (0.99–1.00) | (0.95–1.00) | ((−0.00)–(0.00)) | (1.00–1.01) | (1.00–1.02) |
| Schooling | −0.011*** | 0.952*** | 0.865*** | −0.00049 | 0.982*** | 1.025* |
| | ((−0.02)–(−0.01)) | (0.94–0.97) | (0.8–0.93) | ((−0.01)–(0.00)) | (0.97–0.99) | (1.00–1.05) |
| Gender (ref: Male) | | | | | | |
| Female | 0.0637 | 0.93 | 1.569 | −0.0667 | 1.148 | 1.432 |
| | ((−0.12)–(0.25)) | (0.54–1.60) | (0.33–7.37) | ((−0.22)–(0.09)) | (0.81–1.63) | (0.59–3.47) |
| Marital status (ref: Unmarried) | | | | | | |
| Married | 0.0134 | 0.781* | 0.476* | 0.101** | 0.989 | 1.848* |
| | ((−0.08)–(0.10)) | (0.6–1.01) | (0.2–1.14) | (0.01–0.19) | (0.79–1.23) | (0.93–3.65) |
| Children (age<6) | 0.0763*** | 1.275*** | 0.976 | 0.0132 | 1.087*** | 1.033 |
| | (0.06–0.10) | (1.2–1.36) | (0.68–1.40) | ((−0.01)–(0.03)) | (1.03–1.14) | (0.91–1.17) |
| Family size | 0.0976*** | 0.926*** | 0.772*** | 0.0861*** | 0.952*** | 0.975 |
| | (0.09–0.11) | (0.9–0.96) | (0.65–0.92) | (0.08–0.10) | (0.93–0.98) | (0.92–1.04) |
| Elderly (age>=65) | 0.241*** | 1.591*** | 1.936** | 0.147*** | 1.265*** | 1.440*** |
| | (0.19–0.29) | (1.4–1.81) | (1.05–3.56) | (0.1–0.20) | (1.14–1.41) | (1.14–1.81) |
| Income | 0.242*** | 1.327*** | 2.719*** | 0.143*** | 0.987 | 0.864 |
| | (0.2–0.29) | (1.15–1.53) | (1.58–4.69) | (0.1–0.19) | (0.89–1.10) | (0.68–1.10) |
| Expenditures quintiles (ref: Poorest) | | | | | | |
| Poor | 0.547*** | 0.914 | 1.045 | 0.192*** | 0.773*** | 0.788 |
| | (0.49–0.61) | (0.77–1.09) | (0.37–2.95) | (0.13–0.25) | (0.68–0.89) | (0.56–1.10) |
| Middle | 0.929*** | 0.794** | 1.492 | 0.340*** | 0.747*** | 0.76 |
| | (0.87–0.99) | (0.66–0.96) | (0.56–4.01) | (0.27–0.41) | (0.64–0.87) | (0.52–1.10) |
| Rich | 1.484*** | 0.87 | 0.909 | 0.475*** | 0.728*** | 0.694* |
| | (1.42–1.55) | (0.72–1.06) | (0.29–2.84) | (0.4–0.55) | (0.61–0.86) | (0.45–1.07) |
| Richest | 2.109*** | 0.823* | 2.490* | 0.607*** | 0.532*** | 0.868 |
| | (2.04–2.18) | (0.66–1.03) | (0.89–7.00) | (0.52–0.70) | (0.42–0.67) | (0.51–1.47) |
| Region (ref: Rural) | | | | | | |
| Urban | −0.161*** | 0.620*** | 0.479** | 0.206*** | 1.516*** | 1.755*** |
| | ((−0.21)–(−0.11)) | (0.54–0.71) | (0.25–0.92) | ((−0.25)–(−0.16)) | (0.59–0.73) | (0.43–0.75) |
| Province (ref: KP) | | | | | | |
| Punjab | −0.276*** | 1.077 | 3.525** | −0.482*** | 0.525*** | 0.554*** |
| | (−0.33)–(−0.22)) | (0.92–1.26) | (1.23–10.13) | ((−0.54)–(−0.42)) | (0.46–0.60) | (0.41–0.75) |
| Sindh | −0.430*** | 0.640*** | 1.542 | −0.446*** | 0.497*** | 0.577*** |
| | ((−0.49)–(−0.37)) | (0.53–0.78) | (0.44–5.44) | ((−0.51)–(−0.38)) | (0.43–0.57) | (0.41–0.81) |
| Balochistan | −0.349*** | 0.698*** | 0.635 | −0.492*** | 0.469*** | 0.390*** |
| | ((−0.43)–(−0.27)) | (0.55–0.89) | (0.07–5.77) | ((−0.57)–(−0.4)) | (0.39–0.56) | (0.24–0.65) |

*Note*: Standard errors in parentheses.

***p < 0.01, **p < 0.05, *p < 0.1.

The major determinants that significantly increases the OOPHEs are found to be family size, number of old members and the income in both rounds of the survey. In case of CHEs, age, education, family size and number of old members are identified as significant factors associated with higher odds for both rounds of the survey. Our results are in consistent with the literature.[18]

To achieve universal health coverage by 2030, Sehat Sahulat Programme (SSP), as a health insurance initiative, has been initiated by the Federal Government of Pakistan in partnership with the provincial Government in 2015. Currently, the labour expert group of Ehsaas programme is working on the extension of social protection services to the informal sector workers in Pakistan.[40] Recent statistics on the OOP payments and inpatient care utilisation are not available yet. Well-targeted policy interventions and programmes will only succeed if they reach the grassroots level and reach the intended beneficiaries. Additional studies and social audits are required on a regular basis to determine the coverage in various socio-demographic conditions, as well as limiting variables, to guide efficient coverage.

Furthermore, social security programmes should pay attention to more dynamic work patterns which have emerged as a result of the informalization of labour, rather than plans established exclusively for formal, full-time and lifelong workers. Innovative policies and regulatory frameworks are required for a complicated landscape. Informal workers must be included in mainstream social protection programmes, which should extend beyond specific short-term interventions. Additionally, access to social insurance programmes should be extended to those who are able to contribute. Self-employed informal employees do not have an employer who may contribute to social insurance plans. To join such programmes, informal workers may have to contribute a larger portion of their salary than formal employees. Payments tied to social protection regulations can be matched to the status of the firms in question, as well as the worker's ability to pay. Furthermore, allowing unregistered workers to self-register can enhance coverage. Individuals and communities can be empowered through health education and promotion programmes to adopt healthy behaviors such as establishing healthier eating habits and being physically active that may lower the likelihood of having chronic illnesses and other morbidities.

There are some limitations of the study. Because the employment status of the household head is not reported in the survey as formal or informal, we constructed this variable by using the criteria defined by different studies, in which there might be an over- or underestimation in the preference of informal employment. Moreover, we could not analyse the burden of disease across the two sectors due to the unavailability of disease-specific information in HIES (2015-16). Furthermore, a separate analysis for inpatient and outpatient health expenditures across the two sectors could not be conducted due to the unavailability of inpatient and outpatient health expenditures in HIES (2018–19). Due to the lack of data on the coverage of health and social security programmes, we are unable to provide the statistics on it across the types of employment. Despite these limitations, this study highlighted the consequences of OOPHEs faced by the households' heads in the informal employment, which is the more vulnerable group of society and requires a greater amount of social protection than their formal counterpart to avoid the burden of diseases.

# 5 | CONCLUSION AND POLICY IMPLICATIONS

The informal sector plays a significant role in providing employment opportunities in Pakistan. The findings have shown that households with informal employment had a higher incidence of CHEs and poverty because informal workers are not covered by insurance or other financial support programmes which can shield them from the devastating effects of OOPHEs. As the share of informal employment out of the total employment is high and is generating revenue, to avoid productivity losses in the future due to disease burden and low coverage of treatment, it is necessary to bring informal sector workers under health insurance coverage and provide better health facilities to all of them.

## AUTHOR CONTRIBUTIONS

Conception and study design: Shabana Kishwar and SA; analysis and interpretation of data: Shabana Kishwar, SA and Akseer Hussain; drafting the manuscript: Shabana Kishwar; critical revision of the manuscript for important intellectual content: Khorshed Alam. All authors have read and approved the final version of the manuscript.

## ORCID

*Shabana Kishwar* https://orcid.org/0000-0002-3781-4118
*Saima Bashir* https://orcid.org/0000-0002-4558-9432
*Khorshed Alam* https://orcid.org/0000-0003-2232-0745

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## AUTHOR BIOGRAPHIES

**Shabana Kishwar** is working as a Research Associate at the Pakistan Institute of Development Economics, Islamabad, Pakistan. Her research interests include labor, development, and health economics, with a particular focus on poverty, informal employment, and health financing.

**Saima Bashir** is a post doc Research fellow at Clinical Tropical Medicine, University Hospital Heidelberg, Heidelberg University, Germany. Her focus of research is in the area of Health Economics and Applied Micro econometrics with special interest in exploring the efficiency and quality of health services, health economics evaluation and health financing.

**Akseer Hussain** is a PhD candidate at the University of York's Department of Economics and Related Studies. He is Assistant Professor at the Institute of Business Administration (IBA), Sukkur, Pakistan. His focus of research is in the field of development, health and political Economics.

**Khorshed Alam** is a Professor at the School of Business, University of Queen's Land, Australia. Health economics and policy, agriculture, environmental and resource economics, and applied economics are among his research interests. He has also taught many courses and supervised PhD thesis.

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