# THE IMPACT OF USER CHARGES ON HEALTH OUTCOMES IN LOW- AND MIDDLE- INCOME COUNTRIES: A SYSTEMATIC REVIEW

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Abbreviation

LMICs: low- and middle-income countries

RCT: randomized control trial

QE: quasi-experiment

RoB: risk of bias

ROBINS-I: Risk of Bias in Non-Randomized Studies- of Intervention

UHC: Universal Health Coverage

SDGs: Sustainable Development Goals

DID: difference-in-differences

PSM: propensity score matching

IV: instrumental variable

RD: regression discontinuity

ITS: interrupted time series

# Word Count

Abstract: 293

Main Text: 3751

References: 48

Table: 3

Figure: 2

Appendix Table: 6

# ABSTRACT

## Background

User charges are widely used health financing mechanisms in many health systems in low- and middle-income countries (LMICs) due to insufficient public health spending on health. This study systematically reviews the evidence on the relationship between user charges and health outcomes in LMICs, and explores underlying mechanisms of this relationship.

## Methods

Published studies were identified via electronic medical, public health, health services and economics databases from 1990 to September 2017. We included studies that evaluated the impact of user charges on health in LMICs using randomised control trial (RCT), or quasi-experimental (QE) study designs. Study quality was assessed using Cochrane Risk of Bias (RoB), and Risk of Bias in Non-Randomized Studies- of Intervention (ROBINS-I) for RCT and QE studies respectively. The review was registered with the PROSPERO (registration CRD 42017054737).

**Results**

We identified 17 studies from 12 countries (five upper-middle income countries, five lower-middle income countries, and two low-income countries) that met our selection criteria. The findings suggested a modest relationship between reduction in user charges and improvements in health outcomes, but this depended on health outcomes measured, the populations studied, study quality and policy settings. The relationship between reduced user charges and improved health outcomes was more evident in studies focusing on children and lower-income populations. Studies examining infectious-disease related outcomes, chronic disease management, and nutritional outcomes were too few to draw meaningful conclusions. Improved access to healthcare as a result of reduction in out-of-pocket expenditure was identified as the possible causal pathway for improved health.

## Conclusions

Reduced user charges were associated with improved health outcomes, particularly for lower-income groups and children in LMICs. Accelerating progress towards Universal Health Coverage (UHC) through prepayment mechanisms such as taxation and insurance can lead to improved health outcomes and reduced health inequalities in LMICs.

### What is already known about the topics

* User charges are widely used as a health financing mechanism in many low- and middle-income countries (LMICs), but the relationships between user charges and health outcomes has not been examined in a systematic review.

### What are the new findings?

* This systematic review found that reducing user charges was associated with improvements in health outcomes, especially among children and lower-income populations.
* Improved access to healthcare due to a lower level of out-of-pocket expenditure from user charges was identified as a potential explanatory factor for improved health outcomes.

### What do the new findings imply?

* These findings highlight the importance of shifting away from user charges to finance UHC toward use of prepayment through taxation and insurance contributions.
* Reducing user charges for vulnerable populations can reduce financial hardship from healthcare payments, which in turn improves health outcomes and promotes health equity.

# INTRODUCTION

Achieving universal health coverage (UHC) - defined as ensuring timely access to quality health care without financial hardship([1](#_ENREF_1)) – is a target for the Subtainable Development Goal 3 (SDG 3). UHC has also been identified as an important instrument for countries to attain other key SDGs, including poverty reduction (SDG 1), reduced gender inequality (SDG 5), inclusive economic growth (SDG 8) and reduced inequalities (SDG10).([2](#_ENREF_2), [3](#_ENREF_3))

Alternative approaches to finance UHC and their associated impacts on the SDGs is an emerging area of research. Among the four financing strategies to achieve UHC recommended by the WHO (i.e. increasing efficiency of taxation, reprioritising government budgets toward health, innovative financing, increasing development assistance for health), risk pooling with prepayment is one of the most promising strategies.([4](#_ENREF_4), [5](#_ENREF_5)) However, in low- and middle-income countries (LMIC) user charges, which are fees incurred at the point of care, are widely used as a health financing mechanism to modulate demand for health care and to supplement shortfalls in public spending on health.([6](#_ENREF_6), [7](#_ENREF_7)) Recent statistics have shown that out-of-pocket spending (including user charges) accounts for a large proportion of total health expenditure in many of the most populous LMICs, including Brazil (higher than 28%), China (higher than 32%), Ethiopia (higher than 38%), India (higher than 65%), Indonesia (higher than 48%), Nigeria (72%) Pakistan (higher than 66%).([8](#_ENREF_8), [9](#_ENREF_9)) Out-of-pocket spending can have an impoverishing impact, especially among low-income groups.([4](#_ENREF_4), [10](#_ENREF_10))

There is growing attention to the relationship between user charges and population health outcomes in LMICs. Evidence from high-income countries (HICs) shows that reducing user charges can improve population health outcomes due to more timely treatment and enhanced adherence to medication([11-13](#_ENREF_11)). However, there may be dangers in extrapolating findings from HICs to LMICs where health systems are more fragmented and the cost of healthcare may be a greater barrier for patients to access services.([8](#_ENREF_8), [14](#_ENREF_14))

The relationship between user charges and access to healthcare has been well documented; however, less is known about the impact of user charges on health outcomes in LMICs. The aim of this study is to review and synthesize evidence from robust empirical studies, such as randomized control trials (RCT) and quasi-experimental studies (QE), on the impact of user charges on health outcomes in LMICs and explore potential explanatory mechanisms for the associations identified.

# METHODS

We followed the methods detailed in a peer-reviewed systematic review protocol that is registered with PROSPERO (registration CRD 42017054737).

## Search strategy

In September 2017, we conducted searches of electronic medical and economics databases (MEDLINE, Econlit, Scopus, Jstor, World Health Organization Library Database (WHOLIS), World Bank E-library) to locate studies about the impact of user charges on health outcomes in LMICs. We included all types of health outcomes with quantitative measures, with the search strategy based on a combination of three sets of keywords- 1) health; 2) synonyms of user charges; and 3) a list of LMICs: (detailed search strategy can be found in Appendix- Database search strategy)

* Synonyms of health.
* User charges: “reimbursement”, “copayment”, “cost sharing”, “coinsurance”, “deductible”, “user charge”, “user fee”, “out-of-pocket”, “health insurance”, “medical insurance”
* LMICs: “Low and middle income country”, “Asia”, “South East Asia”, “Central Asia”, “sub-Saharan”, “Africa”, “South America”, “Latin”, “low-income country”, “middle-income country”, “developing country”, “under developed” and all low and middle income countries listed in the World Bank website in year of 2016)([15](#_ENREF_15)).

The searches were restricted to studies written in English (peer-reviewed articles, working papers, conference papers, and reports) published from January 1990 to September 2017. We also carried out additional literature searches by appraising reference lists of the studies identified.

## Inclusion and exclusion criteria

User charges were defined as direct payments made at the time of health service use,([16](#_ENREF_16)) with any possible combination of fees from registration, consultation, drugs and medical supplies, treatment, hospitalization, delivery fees, laboratory tests or other health services provided in public or publicly- subsidized sectors. The charges could be paid based on each visit to a healthcare provider or for treatment of the whole episode of illness.([7](#_ENREF_7))

Studies were screened based on the inclusion and exclusion criteria shown in Table 1. All study populations were eligible. For outcomes, we considered both self-reported and clinically-measured health outcomes in relation to both increases and decreases in user charges. As eligible interventions, only studies which examined changes in the levels of user charges (in either direction or magnitude) were included, whilst studies focusing on the impact of health insurance without explicitly examining changes in user charges were excluded.

To synthesize findings from robust evidence, we only included studies with either quasi-experimental (QE) or randomized control trials (RCT) study designs to control for confounding and bias. For example, estimated policy effects could be biased if self-selection exists, when individuals who expect to have high healthcare utilization choose insurance schemes with lower user charges.([7](#_ENREF_7)) Therefore, the relationship between the levels of user charges, healthcare utilization, and health outcomes may have elements of reverse-causality.([17](#_ENREF_17)) A broad definition of QE was considered which included: difference-in-differences (DID), propensity score matching (PSM), instrumental variable (IV), regression discontinuity (RD), and interrupted time series (ITS).([18-20](#_ENREF_18)) To isolate changes in health outcomes attributing to user charges, we removed studies that evaluated multifaceted policy changes (from both demand or supply sides) or consisted of several concurrent policy changes which precluded assessment of individual policy impacts.

<Insert Table 1>

One reviewer (VMQ) independently reviewed titles and abstracts and discussed with another reviewer (JTL) on the uncertain studies. Subsequently, full-texts were screened for eligibility by two independent reviewers (VMQ and JTL). Any disagreements were resolved through discussion with a third reviewer (TH).

## Quality assessment

Quality assessments were dependent on risk of bias for each study. We used a modified ROBINS-I (Risk of Bias in Non-Randomized Studies- of Interventions) tool([21](#_ENREF_21)) for studies adopting a QE design. First, we assessed the risk of biases (two relating to pre-intervention, one relating to at-intervention, four relating to post-intervention) for each QE to reach an overall risk of bias (i.e. low/moderate/serious/critical/no information). We graded the quality of each QE as high (low risk of bias), moderate (moderate risk of bias) or low (serious risk of bias or below) based on the overall risk of bias.

We used the Cochrane Risk of Bias (RoB) tool to assess seven domains of biases for studies adopting an RCT design. The quality of the RCT was then graded high (low risk of bias for more than five domains), moderate (high risk of bias for two domains) or low (high or unclear risk of bias for more than two domains).([22](#_ENREF_22))

## Data extraction and synthesis

The data extracted from selected articles consisted of the study setting, detail on the change in user charge policy, study design, data sources, follow-up period, and key findings on health outcomes. We also examined secondary outcomes, such as access to healthcare and levels of financial protection, where possible.

Due to heterogeneity in policy settings, countries, study designs, intervention, and outcomes, meta-analysis was not feasible. We conducted a narrative review and reported effects, stratified by different types of health outcomes. We also outlined effects for secondary outcomes to explore possible mechanisms of action between user charges and health outcomes. We analysed the impact of user charges policies on health by different population groups, such as low-income populations and children, to explore whether impact varied by population groups.

Additionally, we undertook an analysis to understand the evidence gap by graphically displaying the knowledge gap of the findings in type of health outcomes and population studied, and quality of the studies.

# RESULTS

## Study characteristics

We identified 6902 citations from bibliographic databases and an additional 73 from other sources. After removal of duplicates, 5683 unique citations were screening by title and abstract, and 336 full texts were sourced. Of these studies, 319 studies were excluded for the following reasons: a policy resulting in user charge change not evaluated (56 studies); health outcomes not studied (100 studies); QE or RCT study designs not employed (123 studies); not based in LMICs (26 studies); and other reasons such as duplicate studies, unrelated topics, under review, or no full text available (14 studies). 17 studies met the final inclusion criteria. Figure 1 provides details of the process of study identification.

<Insert Figure 1>

The 17 included studies were conducted in 12 LMICs: five upper-middle income countries – China (two studies), Georgia (one study), Jamaica (one study), South Africa (one study), Mexico (two studies), five lower-middle income countries – India (three studies), Vietnam (three studies), the Philippines (one study), Ghana (one study), Kenya (one study) and two low-income countries – Senegal (one study) and Nepal (one study). Of the 17 studies, 14 were published after 2010. One study was an RCT, nine used difference-in-differences (DID) design, two employed regression discontinuity (RD), three used propensity score matching (PSM), one used difference-in-differences design with propensity score matching (DID-PSM), and one used instrumental variable (IV) regression. More details of study characteristics are shown in Table 2.

<Insert Table 2>

A range of health outcomes was studied and categorized into five groups (Figure 2): general health outcomes (nine studies), mortality (four studies), infectious disease related outcomes (three studies), chronic condition related outcomes (three studies), and nutritional and anthropometric outcomes (two studies).

<Insert Figure 2>

Changes in user charge policies were classified as: removing user charges (15 studies), reducing user charges (one study), or increasing user charges (one study). 13 studies examined user charges in primary or outpatient services, whilst four examined user charges in secondary and tertiary care. The majority (14/17) of the studies examined relevant secondary outcomes on access to healthcare and levels of financial protection. The median follow-up period from intervention to the last observation was 45 months, with a range of 12-144 months. Studies on chronic condition- related outcomes had the longest median follow-up period of 72 months.

## Quality of included studies

Overall study quality was moderate, with four studies of high quality, 10 of moderate quality and three of low quality. Areas of potential bias that many QEs failed to address were: potential selection bias (six studies) with the possibility selection could be related to intervention status or outcome, and potential recall or misclassification bias (seven studies) as using self-reported health outcomes may have affected the “measurement of outcomes”. The quality of the only RCT study included was rated high with nearly all domains assessed at low risk except the domain “performance bias”, which was high risk as participants were un-blinded to the intervention which may contaminate the results (Appendix Table 1).

## Findings on the relationships between user charges and health outcomes

### General health outcomes

Nine studies([23-31](#_ENREF_23)) evaluated the impact of user charges on general health (three in Vietnam, two in China, two in India, one in Jamaica, one in Georgia). In terms of outcomes measured, three studies measured changes in the number of sick days[30](#_ENREF_30), [34](#_ENREF_34), [36](#_ENREF_36) and six in self-reported health status.[31](#_ENREF_31), [40](#_ENREF_40), [41](#_ENREF_41), [43-45](#_ENREF_43)(Supplementary Table 2) Eight studies examined the impact of reducing user charges and one focused on the impact of increasing user charges. Five out of eight studies (based in Vietnam, India, and Jamaica([23](#_ENREF_23), [24](#_ENREF_24), [26](#_ENREF_26), [29](#_ENREF_29), [30](#_ENREF_30))) showed that reducing user charges was associated with fewer sick days and improved self-reported well-being. Nguyen and Wang,([26](#_ENREF_26)) a high quality study, evaluated the Free Care for Children under Six (FCCU6) policy in Vietnam, where they found removing user fees from inpatient and outpatient services for non-poor children under six years old associated with a 26% reduction in self-reported number of sick days, along with a significant increase in the use of secondary care, and a substitutional reduction in the use of tertiary care. Sood et al, a moderate quality study, evaluated the impact of the Indian Vajpayee Arogyashree Scheme (VAS) program which provided free tertiary care for the poor in the state of Karnataka([24](#_ENREF_24)), where they found that removing user charges was associated with a significant improvement on post-hospitalization well-being, accompanied by 4.4% more frequent treatment seeking by VAS participants and 16.5% reduction in re-hospitalization subsequently.

### Mortality

Four studies assessed the impact of reducing user charges on mortality (two on neonatal mortality, one on mortality for children under five, and one on mortality for the total population) in India, Ghana, Nepal and multi-African countries([32-35](#_ENREF_32)) (Supplementary Table 3). Most studies included (three out of four studies) found that removing or reducing user charges was associated with reduced mortality. User charge reduction in these three studies applied to tertiary care and maternal care. For instance, McKinnon et al,([35](#_ENREF_35)) a moderate quality study, conducted a multi-country analysis in Africa to assess removing user fees from facility-based delivery for women, where they found a 9% reduction in neonatal death as well as a 5% increase in facility-based delivery in the policy countries (Ghana, Kenya, Senegal) compared to the control countries (Cameroon, Congo, Ethiopia, Gabon, Mozambique, Nigeria and Tanzania).

*Infectious disease-related outcomes*

Three studies assessed the impact of removing user charges on infectious disease-related outcomes (one in Ghana, India, and the Philippines respectively)([24](#_ENREF_24), [32](#_ENREF_32), [36](#_ENREF_36)) (Supplementary Table 4). Outcomes measured included postoperative infections, malaria caused parasitaemia and pneumonia and diarrhea-related C-reactive protein, with mixed results. Improvement in infectious disease-related outcomes was found in two studies assessing the removal of user charges on tertiary care in India and Philippines, whilst no improvement was found in the study on the removal of user charges for primary care and secondary care in Ghana. Ansah et al, a RCT study, assessed the impact of free primary care, drugs and initial secondary care for children under five years old on various health outcomes in Ghana([32](#_ENREF_32)). Although this study found that removing user charges had an impact on health care utilisation, no significant health benefits were found in the health outcomes assessed, including anaemia, anthropometric measurement, child mortality and parasite prevalence.

### Chronic condition related outcomes

Three studies evaluated the impact of reducing user charge on chronic condition- related outcomes (with two studies in Mexico and one in Ghana)([32](#_ENREF_32), [37](#_ENREF_37), [38](#_ENREF_38)) (Supplementary Table 5). Outcomes in these three studies included blood glucose control (HbA1c), adherence to medication, diet and exercise for hypertension and diabetes, and anaemia. All three studies found reducing user charges was associated with improved chronic condition related outcomes. Sosa-Rubi et al., a moderate quality study, compared enrolees in the Seguro Popular (SP) program in Mexico- for whom the program removed co-payment for health services for diabetes, with those non-participants where no such benefit was introduced. They found that the SP enrolees had 9.5% greater access to blood glucose control test, 3.1 times more insulin injections and more physician visits than those non-participants, with 5.65 times more likely to appropriately control of blood glucose.

### Nutritional and anthropometric outcomes

Two studies reporting nutritional and anthropometric outcomes (one in South Africa and the Philippines respectively) revealed improved health outcomes with user charges removal for maternal health services and tertiary care([36](#_ENREF_36), [39](#_ENREF_39)) (Supplementary Table 6). Outcomes measured included weight/height ratio. Tanaka et al, a high-quality study, examined the removal of user charges for newborns and children in South Africa and found a significant increase in average weight-for-age Z-score for newborns, and weight-for-height Z-score for children, with increased access to health services as the important determinant of nutritional improvement.

## Differential impact of user charges and explanatory factors for improvement in health outcomes

The relationship between reduced user charges and improved health outcomes was more evident in studies focusing on children and lower-income populations. Six out of seven studies([26](#_ENREF_26), [30](#_ENREF_30), [34-36](#_ENREF_34), [39](#_ENREF_39)) focusing on children and infants found improved health following a reduction in user charges, including two studies on improved general health, two on reduced neonatal mortality, one on infectious disease-related outcomes and one on nutritional outcomes.

Among the nine studies([24](#_ENREF_24), [25](#_ENREF_25), [27](#_ENREF_27), [29](#_ENREF_29), [33](#_ENREF_33), [36-39](#_ENREF_36)) evaluating the impact of reducing user charges for the poor (including eight studies on economically poor and one on people working in informal sectors), seven studies (78%) found improved health outcomes following user charges removal. In comparison, of the other eight studies([23](#_ENREF_23), [26](#_ENREF_26), [28](#_ENREF_28), [30-32](#_ENREF_30), [34](#_ENREF_34), [35](#_ENREF_35)) focusing on the impact of user charge policy for the general population, five (63%) found improved health outcomes following user charge removal. Two studies assessed and compared the differential effect of user charges by population groups, with mixed findings. One analysis found that the magnitude of reduction in neonatal mortality was larger among women from the lower castes or indigenous ethnic groups([34](#_ENREF_34)), while the other study found similar policy effect among various income groups.([28](#_ENREF_28))

Among the 14 studies reporting healthcare utilization, 12 found access to and utilization of healthcare increased following reduction in user charges, and nine further found the increase in healthcare utilization along with improved health outcomes. Increased access to healthcare due to reduced user charges of care was posited as the possible explanatory factor for better health outcomes in five quasi-experimental studies.([29](#_ENREF_29), [33-35](#_ENREF_33), [39](#_ENREF_39)) For example, Lamichhane et al., a high-quality study, evaluated the impact of free birth delivery program on neonatal mortality in Nepal,[33](#_ENREF_33) and found a 4%-6.9% reduction in neonatal death in the treatment group compared with control group. The reduced neonatal mortality was consistent with a 6.1%-8.2% increase in women delivering with assistance from skilled birth assistants and an increased utilization of public facilities, which are possible factors to explain the association between reduced user charges and reduced neonatal mortality.

# DISCUSSION

## Main findings and interpretation

Our study is the first to examine and synthesise RCT and QE evidence on the relationship between user charges and population health outcomes in LMICs. Our findings are broadly consistent with evidence from HICs which show that user charges may have adverse impacts on health outcomes.([11](#_ENREF_11), [40-43](#_ENREF_40)) A systematic review by Goldman et al.([43](#_ENREF_43)) found that increased cost sharing for prescription drugs was associated with reduced drug treatment and adherence, in particular for chronically ill patients, resulting in more use of expensive medical services such as hospitalization and emergency visits. This study also suggested that such an adverse effect was likely to be magnified among the poor, who are more price sensitive. However, our study findings contrast with a recent systematic review which focused on maternal health outcomes in LMICs. Dzakpasu et al. (2014) synthesized evidence and found that reduced user charges were associated with increased facility deliveries, yet with little effect on maternal health outcomes.([44](#_ENREF_44)) The inconsistency between our study findings on health outcomes is likely due to the broader inclusion criteria by Dzakpasu et al., which included weaker study designs (mainly cross-sectional studies) that are potentially subject to bias. In contrast, our review only included evidence from studies adopting RCT or QE study designs that would reduce bias arising from potential confounders, therefore strengthening causal inference.([44](#_ENREF_44))

Our review includes several important caveats. Firstly, most studies included here were conducted in middle-income countries (MICs), specifically in China, India, and Mexico. There were only two studies conducted in low-income countries (Nepal and Senegal). Therefore, it is unclear as to whether the results could be extended in other LMICs at different levels of economic and health system development. Secondly, a majority of the studies included have a follow-up period of health outcomes of less than five years. Future studies should examine the long-term health effects of changes in user charge policies. Although user charges were introduced to raise funding for health systems in several LMICs in 1980s, our review only included one study that evaluated the impact of increased user charges on health outcomes. These may reflect the fact that fewer studies adopted QE study designs until more recently or many user charge policies were not properly evaluated at the time.

Furthermore, the type of evidence contained in RCTs and QEs is unable to support clarity on a range of important questions about the mechanisms by which user fees and health outcomes are inversely related. Likely mechanisms include improved access to effective health care and reduced impoverishment from health care payments with their associated health effects. But health markets are complex, and the price of accessing public services is only one of a set of key variables in those markets. Implications for the mix of public and private, effective and ineffective and higher and lower priced health care options sought, the timeliness of health care seeking decisions, quality of care across all the providers in the market among many other variables are contingent on a host of other contextually specific factors such as the pre-existing public-private mix in any health system, the economic capacity of populations affected, the price levels of other providers and other goods and services, and the regulatory and governance environments. Some measurements of health may not be possible to discern whether user charges had limited effects on health outcomes, or that the conditions measured or the populations studied were not sensitive to the changes.([45](#_ENREF_45)) Future studies should also use comprehensive measures for patients’ health such as patients’ utilisation of secondary care, clinical and self-reported health outcomes, and mortality rates. Despite the complexity of the mechanisms of effect and the contextual variability of the factors involved, RCTs and QEs suggest quite clearly that user charges are a population health damaging policy. Few health system policy assessments can produce such a clear result.

## Policy and Research Implications

An important finding of our review is that decreased user charges lead to improvements in health outcomes, especially for children and low- income groups. A potential reason behind this association is that reducing user charges increases access to health care. These findings highlight the importance of moving away from user charges to finance UHC, and towards contributory schemes based on prepayment through taxation and insurance contributions with large-scale risk pools that enable cross-subsidisation from the healthy and wealthy to the sick and low-income groups.([4](#_ENREF_4))

This evidences the importance of public finance for subsidizing the costs of healthcare for low-income and disadvantaged populations, and as an effective policy lever to reduce inequities in access and improve health outcomes.([4](#_ENREF_4), [46](#_ENREF_46), [47](#_ENREF_47)) While all stand to benefit from enhanced financial protection brought about by greater reliance on prepayment and cross-subsidisation, the lowest-income and less healthy populations will benefit most, as these groups are more likely to face financial hardship due to ill health. Replacing user charges with public funding for these disadvantaged populations should help to reduce financial barriers to accessing care, in turn, improving health outcomes for these groups, and promoting equity in health.([46](#_ENREF_46), [48](#_ENREF_48))

**Conclusion**

# In summary, the published evidence to date suggests that reducing user charges is likely to have beneficial effects on health outcomes and reduce health inequalities in LMICs. Our study supports the elimination of user charges for low-income groups and children, and the WHO’s call for accelerating progress toward UHC in LMICs.

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**Competing Interests**

We declare there is no competing interests

# Tables and Figures

Table 1. Inclusion and exclusion criteria for study selection based on PICOS

|  |  |  |
| --- | --- | --- |
| Selection criteria | Inclusion criteria | Exclusion criteria |
| Population | LMICs | Non-LMICs |
| Intervention | Isolated demand-side user charge changes attributed to financing policy or health insurance scheme for health services, including increased, decreased, introduction and abolition of user charges. The study could either mention direction or magnitude changes in amount or proportion of user charges | Examine complex intervention: both of demand-side and supply-side intervention);  Examined concurrent policy changes;  Only examined the impact of health insurance without explicitly mentioning changes in user charges; |
| Comparator | Individuals or communities in LMICs that were not exposed to user charge changes during the period of study | None |
| Outcome | All types of health outcomes (e.g. general health status, mortality, non-communicable disease, infectious disease, nutritional and anthropometric measurement) | Only assessed health service utilization |
| Study design | Quasi-experimental study design: difference-in-differences (DID), propensity score matching (PSM), instrumental variable (IV), regression discontinuity (RD), interrupted time series (ITS) and any combination of these designs  Randomized control trial (RCT), cluster-randomized control trial (CRT) | Cross-sectional study, simple before-after comparison, qualitative study, cost-benefit/-effectiveness analysis, systematic review, meta-analysis, commentary |

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## Figure 1. Synthesis of study identification in review of the effects of user charges on health in low- and middle-income countries

<<insert figure 1>>

Notes for Figure 1: Other sources include WHOLIS, World Bank e-library and manually search references of the included papers

Table 2. Summary characteristics of included studies (N=17)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Characteristic | Asia | America | Africa | Europe | Total |
| Study published year | | | | | |
| 1990-2000 | 0 | 0 | 0 | 0 | 0 |
| 2001-2010 | 1 | 1 | 1 | 0 | 3 |
| 2011-2017 | 10 | 2 | 2 | 1 | 14 |
| Study design | | | | | |
| DID | 6 | 1 | 2 | 0 | 9 |
| RD | 2 | 0 | 0 | 1 | 3 |
| PSM | 1 | 1 | 0 | 0 | 2 |
| IV | 0 | 1 | 0 | 0 | 1 |
| PSM-DID | 1 | 0 | 0 | 0 | 1 |
| RCT | 1 | 0 | 0 | 0 | 1 |
| Changes in user charges | | | | | |
| Increasing | 1 | 0 | 0 | 0 | 1 |
| Decreasing | 1 | 0 | 0 | 0 | 1 |
| Introducing | 0 | 0 | 0 | 0 | 0 |
| Abolishing | 8 | 3 | 3 | 1 | 15 |
| Economy†\* | | | | | |
| Upper middle income | 2 | 3 | 1 | 1 | 7 |
| Lower middle income | 7 | 0 | 2 | 0 | 10 |
| Low income | 1 | 0 | 1 | 0 | 2 |
| Health outcomes†† | | | | | |
| General health | 7 | 0 | 1 | 1 | 9 |
| Mortality | 2 | 0 | 2 | 0 | 4 |
| Infectious disease-related outcomes | 2 | 0 | 1 | 0 | 3 |
| Chronic condition-related outcomes | 0 | 2 | 0 | 0 | 3 |
| Nutritional outcomes | 0 | 0 | 1 | 0 | 2 |
| Age group of the study population | | | | | |
| General | 5 | 2 | 0 | 1 | 8 |
| Women | 1 | 0 | 2 | 0 | 3 |
| Children | 3 | 0 | 2 | 0 | 5 |
| Elderly | 0 | 1 | 0 | 0 | 1 |
| Social economic status of the study population††† | | | | | |
| Poor | 5 | 2 | 0 | 1 | 8 |
| General | 5 | 1 | 3 | 0 | 9 |

DID= difference-in-difference; RD= regression discontinuity; PSM= propensity score matching; IV= instrumental variable

† The multi-country analysis consisted of three countries: two middle income and one low-income countries.

†† The sum of health outcome category may be double entered because some studies evaluated more than one type of health outcome. America in this review included both South and Latin America.

††† As defined in the context of the study

\*According to World Bank country classification 2016

Figure 2. Intervention focus and outcomes studies

<<insert Figure 2>>

Notes for Figure 2: ● - high-quality study; ◐ - moderate-quality study; ○ – low-quality study.

Table 3. Summary of the impact of user charges on certain health outcomes and secondary outcomes

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Study | Intervention | Population | Improved general health | Improved mortality outcomes | Improved infectious disease-related outcomes | Improved chronic disease-related outcomes | Improved nutritional outcomes | Increased access to primary care or outpatient | Increased access to secondary care | Increased access to tertiary care or inpatient | Improved financial protection | Notes | Study quality |
| Decreased user charges | | | | | | | | | | | | |  |
| Nguyen & Wang([26](#_ENREF_26)) | Before: User fees in the public hospitals were major financial burden  After: Free Care including inpatient and outpatient services, and associated lab tests and generic medicines | Vietnam-  non-poor Children Under six years old | ↑ | — | — | — | — | — | ↑ | ↓ | ↑ | There was a “substitution” effect between increased use of secondary hospitals and decreased use of tertiary hospitals. | High |
| Sood & Wagner([24](#_ENREF_24)) | Before: unspecified  After: No premiums or copayments at the point of tertiary care at both private and public hospitals in 2010-2012 | India-  Poor population | ↑ | — | ↑ | — | — | — | — | ↑ | — | There was a “substitution” effect between increased use of tertiary care and readmission. | Moderate |
| Beuermann et al.([23](#_ENREF_23)) | Before: pay out-of-pocket fees (amount unspecified)  After: no user fee for healthcare services (i.e. doctor's consultation, diagnosis, surgeries) | Jamaica-  General population | ↑ | — | — | — | — | — | — | — | — | Improved general health had a positive labor supply effect with increased labor hours. | Moderate |
| Bauhoff et al.([27](#_ENREF_27)) | Before: unspecified  After: Comprehensive benefit package with few coverage limits and no co-payments for beneficiaries; Basic universal package subjected to co-payments of 25%-50% for non-MIP population | Georgia-  Poor population | → | — | — | — | — | → | — | → | ↑ | The reduction of user charges provided financial protection, but little impact on service utilization and self-reported health status. | Moderate |
| Guindon([25](#_ENREF_25)) | Before: unspecified  After: No deductibles for most outpatient and inpatient care at government facilities and drugs on the Ministry of Health list, financed from general government revenues at both national (75%) and provincial (25%) levels | Vietnam-  Poor population | → | — | — | — | — | → | — | ↑ | — |  | Low |
| Aggarwal([29](#_ENREF_29)) | Before: full cost for treatment  After: free outpatient diagnosis for all types of medical events and up to 50% discount on all laboratory tests | India-  disadvantaged rural general population | ↑ | — | — | — | — | ↑ | — | ↑ | ↑ | The author suggested that decreased user charges increased access to healthcare services and improved financial protection, which should translate into better health outcomes. | Moderate |
| Wang et al.([28](#_ENREF_28)) | Before: unspecified  After: out-of-pocket reduced 26%-35% (covered service not specified) | China-  Rural general population (age 12 year and above) | → | — | — | — | — | ↓ | ↑ | — | → |  | Low |
| Nguyen & Sasso([30](#_ENREF_30)) | Before: unspecified  After: free care at public facilities for inpatient and outpatient services (excluding non-prescription medicines) | Vietnam-  Children under age of six | ↑ | — | — | — | — | ↑ | — | ↑ | → |  | Moderate |
| Sood et al.([33](#_ENREF_33)) | Before: unspecified  After: free tertiary care at the point of service in both private and public hospitals | India-  Poor population | — | ↑ | — | — | — | — | — | ↑ | ↑ | Both increased access to healthcare and reduced out-of-pocket expenditure might have contributed to reduction in mortality. | Moderate |
| Ansah et al.([32](#_ENREF_32)) | Before: unspecified  After: free primary care, drugs and initial secondary care on moderate anaemia | Ghana-  Rural children age under five | — | → | → | → | — | ↑ | — | — | — | Increased primary care utilization did not improve health. A possible reason could be that user fees may not be the major financial barrier to care. | High |
| McKinnon et al.([35](#_ENREF_35)) | Before: unspecified  After: Free deliveries in public, private and facility-based health facilities, covering all normal deliveries, management of assisted deliveries including caesareans, and management of medical and surgical complications of delivery (Ghana)  Free deliveries in all public dispensaries and health centres, including all supplies required for delivery. The policy did not initially cover delivery fees in district hospitals and thus did not apply to Caesarean sections (Kenya)  Covers normal deliveries at health posts and health centres and Caesarean sections at district and regional hospitals (Senegal) | Multi African countries-  Women | — | ↑ | — | — | — | — | ↑ | — | — | Removing user fees increased facility-based deliveries and contributed to reduction in neonatal mortality. | Moderate |
| Lamichhane et al.([34](#_ENREF_34)) | Before: unspecified  After: free delivery at public facilities | Nepal-  women (15-49 years old) | — | ↑ | — | — | — | — | ↑ | — | — | Reduction in mortality was consistent with the increased use of skilled birth assistance and public facilities for delivery | High |
| Quimbo et al. | Before: 49% of total health expenditure paid out-of-pocket  After: Increase peso ceilings to eliminate copayment for hospitalization | Philippines-  Poor children | — | — | ↑ | — | ↑ | — | — | — | — |  | Low |
| Rivera-Henandez et al. | Before: unspecified  After: remove copayment for crucial health care services for diagnosis & treatment of diabetes and hypertension | Mexico-  poor population aged 50 and above | — | — | — | ↑/→ | — | ↑ | — | — | — |  | Moderate |
| Sosa-Rubi et al.([37](#_ENREF_37)) | Before: unspecified  After: no co-payment for specific type of healthcare received | Mexico-  Poor population (aged 20-80 years)- | — | — | — | ↑ | — | ↑ | ↑ | — | — | Decreased user charges increased access to healthcare and improve blood glucose level control. | Moderate |
| Tanaka([39](#_ENREF_39)) | Before: unspecified  After: Free services to pregnant women included prenatal and postnatal care from confirmation of pregnancy until 42 days after delivery, and all health services to children under six years old became free. | South Africa- poor women and children under six years old | — | — | — | — | ↑ | — | — | — | — | Improved child health status was through increased access to health services. | High |
| Increased user charges | | | | | | | | | | | | |  |
| Huang and Gan([31](#_ENREF_31)) | Before: Outpatient care: Around 30%~40% of total health expenditure were paid out-of-pocket.  Inpatient care: Around 20% of total health expenditure were paid out-of-pocket  After:  Outpatient care: Around 86% of total expenditure were paid out-of-pocket  Inpatient care: Around 28% of total health expenditure were paid out-of-pocket. | China-  Urban general employees | → | — | — | — | — | ↓ | — | → | — | Increased user charges decreased outpatient utilization and expenditure but not for inpatient utilization and expenditure, and health outcomes. | Low |

“↑” = beneficial effect on health or increased utilization/expenditure; “↓” = negative change; “→” = not statistically significant change; “—” = not reported;

# Supplementary Table

Supplementary Table 1- Risk of Bias and Study Quality

a) Risk of bias of quasi-experimental studies

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Domain | | | | | | | Overall risk of bias | Quality |
| Study | Confounding | Selection bias | Misclassification | Deviation from intended intervention | Missing data | Measurement of outcomes | Selection of reported results |
| Nguyen and Wang | Low | Low | Low | Low | Low | Low | Low | Low | high |
| Guindon | Moderate | Serious | Moderate | Moderate | Low | Serious | Moderate | Serious | low |
| Sood and Wagner | Moderate | Moderate | Moderate | Moderate | Moderate | Moderate | Moderate | Moderate | moderate |
| Mckinnon et al. | Moderate | Moderate | Moderate | Low | Moderate | Moderate | Moderate | Moderate | moderate |
| Huang and Gan | Low | Moderate | Serious | Low | Moderate | Moderate | Moderate | Serious | low |
| Bauhoff et al. | Moderate | Moderate | Moderate | Low | Low | Moderate | Moderate | Moderate | moderate |
| Sood et al. | Moderate | Low | Moderate | Moderate | Moderate | Moderate | Moderate | Moderate | moderate |
| Tanaka | Moderate | Moderate | Moderate | Moderate | Low | Moderate | Moderate | Low | high |
| Beuermann and Garzon | Moderate | Moderate | Moderate | Low | Low | Moderate | Moderate | Moderate | moderate |
| Aggarwal | Moderate | Moderate | Moderate | Moderate | Low | Moderate | Moderate | Moderate | moderate |
| Wang et al. | Moderate | serious | Low | Moderate | Moderate | Moderate | Moderate | Serious | low |
| Quimbo et al. | Low | Serious | Serious | Low | Low | Low | Low | Serious | low |
| Sosa-Rubi et al. | Moderate | Moderate | Low | Low | Moderate | Moderate | Low | Moderate | moderate |
| Rivera-Hernandez et al. | Moderate | Moderate | Low | Low | Moderate | Moderate | Low | Moderate | moderate |
| Nguyen and Sasso | Moderate | moderate | Low | low | low | Moderate | Low | Moderate | moderate |
| Lamichhane et al. | Low | Low | Low | Low | Low | Low | Low | Low | High |

b) Risk of bias and quality of RCT study

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Study | selection bias | | reporting bias | Other bias | Performance bias | Detection bias | Attrition bias | Overall quality |
| Random sequence generation | Allocation concealment | Selective reporting |  | Blinding of participants and personnel | Blinding of outcome assessment | Incomplete outcome data |
| Ansah et al. 2009 | Low | Low | Low | Unclear | High | Low | Low | high |

Supplementary Table 2- Effect of user charges on general health outcomes

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Study | Country and policy scale | Quality of study | Population and settings | Data | Study design | Impact on health | Impact on secondary outcomes |
| Nguyen and Wang 2012 | Vietnam (National level) | High | Removing user fees for non-poor Children Under six years old-  Before:  User fees in the public hospitals were major financial burden After: Free Care including inpatient and outpatient services, and associated lab tests and generic medicines | Two waves of the Vietnam Household Living Standard Surveys 2004 (n=2941) and 2006 (n=2504)  Follow-up period: 12 months | DID | Number of sick days: Significantly reduced 26% for children aged 4-5 years old (P<0.001) | Out-of-pocket expenditure:  1.7% reduction (p<0.01) for age group 4-5 years;  Not statistically significant result for age group 0-3 years;  Inpatient admission to secondary hospital: 0.02 (p<0.01) increase for age group 0-3 years;  0.03 (p<0.01) increase for age group 4-5 years  Inpatient admission to tertiary hospital:  Not statistically significant result for age group 0-3;  0.035 (P<0.05) reduction for age group 4-5 years |
| Sood and Wagner 2015 | India (State level: Karnataka | Moderate | Removing user charges for the people below poverty line-  Before: unspecified After:  No premiums or copayments at the point of tertiary care at both private and public hospitals in 2010-2012 | Random sample n= 6964 below poverty line households in villages eligible and ineligible for VAS  Follow-up period: 31 months | RD | Posthospitalization well-being:  Not statistically significant result for self-care; Not statistically significant result for usual activities;  Not statistically significant result for overall health;  0.7 (P<0.01) increase for walking ability;  0.66 (P<0.01) reduction in pain; 0.45 (P<0.1) reduction in anxiety  Occurrence of infectious during hospitalization:  9.4% reduction (95% CI: -20.2, 1.4)  Need for rehospitalization after the initial hospitalization: 16.5% reduction (95% CI: -28.7, -4.3) | Report any infection after hospitalization: 9.4 percentage points reduction (95% CI −20.2 to 1.4; P=0.087) |
| Beuermann et al. 2016 | Jamaica (National level) | Moderate | Remove user fees for all adult Jamaicans-  Before: pay out-of-pocket fees (amount unspecified) After: no user fee for healthcare services (i.e. doctor's consultation, diagnosis, surgeries) | The Jamaica Labor Force Survey (LFS) and the Survey of Living Conditions (SLC), yearly waves from 2002 to 2012, sample size n= 35,434 individual-year observations  Follow-up period: 45 months | DID | Suffered illness four weeks prior to survey:  Not statistically significant result  Likelihood of suffering illness: 28.6% reduction (P<0.05)  Number of sick days:  34% reduction (P<0.05) | Contribution to net real production to the Jamaican economy: yearly average of US$PPP 26.6 million increase during the period 2008–12  Labor supply: 2.15 labor hours per week increase |
| Bauhoff et al., 2011 | Georgia (National level) | Moderate | Medical Insurance Program for the poor (MIP) in 2006 for the poor (cut-off score lower than 70000 (MIP 70) or 100000 (MIP 100) points in two regions)-  Before: unspecified After:  Few coverage limits and no co-payments for most emergency outpatient care and both planned and emergency inpatient care for the MIP beneficiaries; Basic universal package subjected to co-payments of 25%-50% for non-MIP population | A total sample n= 3600 households, with households n= 900 for each of the two geographically varying thresholds with above and below thresholds  Follow-up period: 24 months | RD | Self-reported activities of daily living:  Not statistically significant result between undisabled with age of 40+ beneficiaries and non-beneficiaries;  Not statistically significant result between disabled with age of 40+ beneficiaries and non-beneficiaries;  Not statistically significant difference between beneficiaries and non-beneficiaries aged 12-39;  General health: Not statistically significant difference between beneficiaries and non-beneficiaries; | Out-of-pocket expenditure:  0.526 reduction for inpatient (P<0.05) (MIP70);  0.424 reduction for inpatient (P<0.01) (MIP100);  1.45 reduction for outpatient (MIP70);  0.454 reduction for outpatient (P<0.01) (MIP100);  Outpatient or inpatient service  utilization: Not statistically significant for inpatient and outpatient;  Drugs and treatment for chronic diseases:  Not statistically significant standard difference for high blood pressure;  Not statistically significant standard difference for arthritis; |
| Guidon, 2014 | Vietnam (National level) | Low | Health Care Fund for the Poor (HCFP) 2003 to remove user charges for officially classified poor and ethnic minority-  Before: unspecified After: No deductibles for from most outpatient and inpatient care at government facilities and drugs on the Ministry of Health list, financed from general government revenues at both national (75%) and provincial (25%) levels | Vietnam Household Living Standards Survey (VHLSS) 2004 and 2006 with sample n=6575 individuals from 1790 households  Follow-up period: 36 months | DID | Number of sickness days:  Not statistically significant result;  Number of bed days estimate:  Not statistically significant result; | Number of inpatient admissions (2004 vs 2006):  More than 55% increase (SE=0.02);  Utilization of outpatient services: Not statistically significant result; |
| Aggarwal 2010 | India (District level: Karnataka State) | Moderate | Community-based Health Insurance Program (CBHI) to remove user charges for disadvantaged rural farmers and informal sector workers-  Before: full cost for treatment After: free outpatient diagnosis for all types of medical events and up to 50% discount on all laboratory tests | Household survey in 82 villages across 16 districts in rural Karnataka between 2007 and 2008 n=4109  Follow-up period: 47 months | PSM | Satisfaction level (scale 1-3):  0.054 increase (P<0.10);  Days lost per sick time:  Not statistically significant result;  Whether work regularly (1= yes):  0.076 increase (P<0.1);  Whether post-surgery life improved (1=yes):  3.80 increase (P<0.10);  Whether caesarean (1= yes): Not statistically significant result; | The number of consultations and visits to medical facility:  6%-7% higher for the insured than the uninsured. (P<0.1);  Use of inpatient treatment in private hospital services: 17% increase for the better-off segment of population; Not visible for the lower socio-economic group;  Use of government hospitals:  19% reduction for outpatient (P<0.1);  25% reduction for surgery (P<0.1);  Borrowings for catastrophic expenditure for surgical treatment:  36% reduction for the better-off group; 30% reduction for the worse-off group;  Overall health expenditure:  19%-20% higher for the insured than the uninsured; |
| Wang et al. 2016 | China (Rural area) | Low | Reduce out-of-pocket payment for rural residents aged older than 12 years-  Before: unspecified  After: reduced 26%-35% | China Health and Nutrition Survey (CHNS) waves 2000, 2004, 2006, and 2009 total sample size n= 46,116 individuals or 13,025 households  Follow-up period: 72 months | DID-PSM | Report sickness in past month (with the model eliminating county-level selection bias):  Not statistically significant difference between treatment and control group for household- and individual- level matching, and among low-income and high- income group compared to their respective counterparts;  Self-reported health status is fair or poor (with the model eliminating county-level selection bias):  Not statistically significant difference between treatment and control group for household- and individual- level matching, and among low-income and high- income group compared to their respective counterparts;  Measured hypertension (with the model eliminating county-level selection bias):  Not statistically significant difference between treatment and control group for household- and individual- level matching, and among low-income and high- income group compared to their respective counterparts; | Total treatment cost:  Ln (-0.153) (P<0.01)- Ln (-0.184) (P<0.005);  Doctor visit in last 4 weeks:  -0.024 (P<0.1) ~ -0.032 (P<0.05) reduction (individual level matching);  Preventive service utilization:  0.022 (P<0.001)- 0.018(P<0.05) increase (individual level matching);  Visits to folk doctors:  0.02 reduction (P<0.1) (individual level matching); |
| Nguyen and Sasso 2017 | Vietnam (National level) |  | Remove user charges for children under six years old-  Before: unspecified  After: free care at public facilities for inpatient and outpatient services (excluding non-prescription medicines) | Vietnam Household Living Standards Survey (VHLSS) waves 2002 n=132384 individuals, 2004- 2006- 2008 n=40000 individuals  Follow-up period: 36 months | DID | Number of days staying in bed:  Not statistically effect size for children aged 0-2 years;  Not statistically effect for children aged 3-5 years;  Number of days having limited activities:  Not statistically effect size for children aged 0-2 years;  12% reduction (P<0.01) in for children aged 3-5 years; | Outpatient visit:  27% increase for aged 0-2;  20% increase for aged 3-5;  Hospital admission:  56% increase for aged 0-2;  22% increase for aged 3-5;  Out-of-pocket spending:  50% reduction for inpatient for aged 3-5 years (P<0.01);  Not statistically significant effect size for inpatient for aged 0-2 years;  Not statistically significant effect size for outpatient for aged 0-5 years; |
| Huang and Gan 2015 | China (urban area of the country) | Low | Increased user charges for urban employees-  Before: Outpatient care: Around 30%~40% of total health expenditure were paid out-of-pocket.  Inpatient care: Around 20% of total health expenditure were paid out-of-pocket After:  Outpatient care: Around 86% of total expenditure were paid out-of-pocket Inpatient care: Around 28% of total health expenditure were paid out-of-pocket. | 1991-2006 waves of China Health and Nutrition Survey (CHNS) n=7065  Follow-up period: 98 months | DID | Self-reported poor health status:  not statistically significant results; | Outpatient utilization: 7% reduction (SE=2.3), P<0.05;  Outpatient expenditure: 35.2% reduction (SE=10.8), P<0.05;  Inpatient utilization: 0.1% reduction (SE=1.0), P>0.05;  Inpatient expenditure:  4.1% increase (SE=7.8), P>0.05; |

DID= difference-in-difference; RD= regression discontinuity; PSM= propensity score matching; DID-PSM= difference-in-difference- propensity score matching

Supplementary Table 3- Effect of user charges on mortality outcomes

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Study | Country and policy scale | Quality of study | Population and settings | Data | Study design | Impact on health | Impact on secondary outcomes |
| Sood et al. 2014 | India (State level: Karnataka) | Moderate | Remove user charges for households below poverty line-  Before: unspecified After: free tertiary care at the point of service in both private and public hospitals | 31476 households in 300 scheme eligible villages and 28633 households in 272 scheme ineligible villages  Follow-up period: 31 months | RD | Mortality:  64% reduction (95% CI: 0.4, 0.75) among eligible households below poverty line compared to the ineligible;  Not statistically significant difference between households above poverty line in eligible and ineligible area; | Out-of-pocket expenditures: 34% reduction (95% CI: 0.18, 0.51) for admissions to hospitals with tertiary care facilities likely to be covered by the scheme;  Tertiary care utilization:  12.3% increase (95% CI: -0.2, 0.45); |
| Ansah et al. 2009 | Ghana (District level: Dangme West District) | High | Remove user charges for rural children under five years old-  Before: unspecified  After:  free primary care, drugs and initial secondary care on moderate anaemia (treatment arm) paid 17,000 Ghana cedis (≈ US$3865) for a case of malaria (control arm) | Stratified randomization n= 2500 children from 2332 households  Follow-up period: 24 weeks | RCT | Prevalence of moderate anaemia: Not statistically significant different between intervention and control arm;  Mean Hb concentration: Not statistically significant change between intervention and control children;  Prevalence of parasitaemia:  Not statistically significant different between intervention and control arm;  Death: Not statistically significant difference between intervention group and control group; | Utilization of primary care clinic:  RR=1.12 (95% CI, 1.04-1.2, P=0.001);  Utilization of hospital: Not statistically significant result;  Utilization of chemical seller: RR=0.9 (95% CI, 0.85-0.97, P<0.001);  Utilization of home treatment: RR=0.89 (95% CI, 0.82-0.96, P<0.001);  Utilization of traditional healer: Not statistically significant result;  Utilization of normal healthcare service: RR=0.9 (95% CI, 0.86-0.95, P<0.001); |
| McKinnon et al., 2015 | Ghana, Kenya and Senegal (policy countries); Cameroon, Congo, Ethiopia, Gabon, Mozambique, Nigeria and Tanzania (control countries) | Moderate | Remove user fees for women-  Before: unspecified After:  Free deliveries in public, private and facility-based health facilities, covering all normal deliveries, management of assisted deliveries including caesareans, and management of medical and surgical complications of delivery (Ghana 2003) Free deliveries in all public dispensaries and health centres, including all supplies required for delivery. The policy did not initially cover delivery fees in district hospitals and thus did not apply to Caesarean sections (Kenya 2007) Covers normal deliveries at health posts and health centres and Caesarean sections at district and regional hospitals (Senegal (2005) | Demographic and Health Surveys (DHS) 1997-2012  Follow-up period: 108 weeks | DID | Neonatal death: 9% reduction (95% CI: -6.8, 1); | Facility-based delivery: 5% increase (95% CI: 0.9, 5.2);  Cesarean deliveries: Not statistically significant result; |
| Lamichhane et al. 2017 | Nepal (National level) | High | Remove user charges for women (15-49 years old)-  Before: unspecified  After: free delivery at public facilities | Nepal Demographic and Health Surveys (NDHS) 2001-2008  Live-births n=5783 (2006); n=5306 (2011)  Follow-up period: 77 months | DID | Neonatal mortality compared to control group:  4.5 (95%CI: -0.07, -0.02) percentage points reduction for all women  6.9 (95%CI: -0.104, -0.035) percentage points reduction for women from lower castes and indigenous groups; | Probability of delivery by skilled birth assistance:  5.6 (95% CI: 0.002, 0.11) percentage point increase;  8.2 (95% CI: -0.01, 0.17) groups percentage point increase for the lower castes and indigenous;  Delivery in public facility:  5.1 (95% CI: -0.003, 0.11) percentage point increase;  6.3 (95% CI: -0.01, 0.14) percentage point increase for the lower castes and indigenous groups; |

RD= regression discontinuity; RCT= randomized control trial

Supplementary Table 4- Effect of user charges on infectious disease-related outcomes

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Study | Country and policy scale | Quality of study | Population and settings | Data | Study design | Impact on health | Impact on secondary outcomes |
| Sood and Wagner 2015 | India (State level: Karnataka) | Moderate | Removing user charges for the poor-  Before: unspecified After:  No premiums or copayments at the point of tertiary care at both private and public hospitals in 2010-2012 | Random sample n= 6964 below poverty line households in villages eligible and ineligible for VAS | RD | Posthospitalization well-being:  Not statistically significant result for self-care; Not statistically significant result for usual activities; Not statistically significant result for overall health; 0.7 (P<0.01) increase for walking ability;  0.66 (P<0.01) reduction in pain; 0.45 (P<0.1) reduction in anxiety;  Occurrence of infectious during hospitalization:  9.4% reduction (95% CI: -20.2, 1.4);  Need for rehospitalization: 16.5% reduction (95% CI: -28.7, -4.3);  Report any infection after hospitalization: 9.4 percentage points reduction (95% CI −20.2 to 1.4; p=0.087); | Need for rehospitalization after the initial hospitalization: 16.5 percentage points reduction (95% CI −28.7 to −4.3; p<0.01); |
| Ansah et al. 2009 | Ghana (District level: Dangme West District) | High | Remove user charges for rural children under five years old-  Before: unspecified After:  free primary care, drugs and initial secondary care on moderate anaemia (treatment arm) paid 17,000 Ghana cedis (≈ US$3865) for a case of malaria (control arm) | Stratified randomization n= 2500 children from 2332 households | RCT | Prevalence of moderate anaemia: Not statistically significant different between intervention and control arm;  Mean Hb concentration: Not statistically significant change between intervention and control arm;  Prevalence of parasitaemia:  Not statistically significant different between intervention and control arm;  Death: Not statistically significant difference between intervention group and control group; | Utilization of primary care clinic:  RR=1.12 (95% CI, 1.04-1.2, P=0.001);  Utilization of hospital: Not statistically significant result;  Utilization of chemical seller: RR=0.9 (95% CI, 0.85-0.97, P<0.001);  Utilization of home treatment  RR=0.89 (95% CI, 0.82-0.96, P<0.001);  Utilization of traditional healer: Not statistically significant result;  Utilization of normal healthcare service: RR=0.9 (95% CI, 0.86-0.95, P<0.001); |
| Quimbo et al. 2011 | Philippines (central regions) | Low | Remove user charges for poor children-  Before: 49% of total health expenditure paid out-of-pocket After: Increase peso ceilings to eliminate copayment for hospitalization | Two rounds of data with 1100 patients each in the intervention and control sites  Follow-up period: 24 months | DID | Wasting (<0.9 actual weight to ideal weight of actual height):  9-12% reduction (P<0.1);  Presence of an acute infection or other types of inflammation (CRP-positive)\*: 4-9% reduction(P<0.1); | NIL |

\*CRP indicates the presence of an acute infection or other types of inflammation

DID= difference-in-difference; RD= regression discontinuity; RCT= randomized control trial

Any form of infection comes under the infectious disease outcome domain in this paper.

Supplementary Table 5- Effect of user charges on non-communicable disease-related outcomes

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Study | Country and policy scale | Quality of study | Population and settings | Data | Study design | Impact on health | Impact on secondary outcomes |
| Rivera-Henandez et al. 2016 | Mexico (National level) | Moderate | Remove user charges for the poor older adults aged 50 and above-  Before: unspecified After: remove copayment for specific type of health | National Health and Nutrition Survey (ENSA NUT) year 2000 n= 45,294 older adults,  year 2005–2006 n= 45,241, and year 2011–2012 n= 46,277  Follow-up period: 144 months | IV | Use of insulin/oral agents: Marginally significant positive effect of 0.41 (P<0.051);  Blood pressure monitoring: Not statistically significant result for diabetic patients;  Antihypertensive medication: Not statistically significant result for hypertensive patients;  Follow nutritional diet: Not statistically significant result for diabetic patients and hypertensive patients;  Adherence to exercise program: Not statistically significant result for diabetic patients and hypertensive patients;  The use of Alternative medicine: Not statistically significant result for diabetic patients and hypertensive patients; | Use of insulin and oral agents for age older than 50 years old:  40% increase (P=0.051); |
| Sosa-Rubi et al. 2009 | Mexico (National level) | Moderate | Remove co-payment for poor adults (aged 20-80 years)-  Before: unspecified  After: no co-payment for specific type of healthcare received | National Health and Nutrition Survey (ENSANUT) year 2006 adults with diabetes n=1491 (excluding those access to social security service, missing values and women with gestational diabetes)  Follow-up period: 60 months | PSM | Glucose control (HbA1c):  5.6 percentage points increase (P<0.01) in those with appropriate control;  17.5 percentage points decrease (P<0.01) in those with very poor control; | Regular use of any blood glucose control test:  0.095 increase (P<0.01);  Number of insulin shots per week among insulin users:  3.13 increase (P<0.05);  Number of blood sugar control tests per month:  0.14 increase (P<0.01);  Four or more physician visits per year:  0.09 increase (P<0.01); |
| Ansah et al. 2009 | Ghana (District level: Dangme West District) | High | Remove user charges for rural children under five years old-  Before: unspecified After:  free primary care, drugs and initial secondary care on moderate anaemia (treatment arm) paid 17,000 Ghana cedis (≈ US$3865) for a case of malaria (control arm) | Stratified randomization n= 2500 children from 2332 households | RCT | Prevalence of moderate anaemia: Not statistically significant different between intervention and control arm;  Mean Hb concentration: Not statistically significant change between intervention and control arm;  Prevalence of parasitaemia:  Not statistically significant different between intervention and control arm;  Death: Not statistically significant difference between intervention group and control group; | Utilization of primary care clinic:  RR=1.12 (95% CI, 1.04-1.2, P=0.001);  Utilization of hospital: Not statistically significant result;  Utilization of chemical seller: RR=0.9 (95% CI, 0.85-0.97, P<0.001);  Utilization of home treatment  RR=0.89 (95% CI, 0.82-0.96, P<0.001);  Utilization of traditional healer: Not statistically significant result;  Utilization of normal healthcare service: RR=0.9 (95% CI, 0.86-0.95, P<0.001); |

Supplementary Table 6- Effect of user charges on nutritional and anthropometric outcomes

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Study | Country and policy scale | Quality of study | Population and settings | Data | Study design | Impact on health | Impact on secondary outcomes |
| Tanaka, 2014 | South Africa (National level) | High | Remove user fees for poor women and children under six years old-  Before: unspecified  After: Free services to pregnant women included prenatal and postnatal care from confirmation of pregnancy until 42 days after delivery, and all health services to children under six years old became free. | KwaZulu-Natal Income Dynamic Study (KIDS) 1993 wave=1389 households; 1998 wave=1178 households  Follow-up period: 60 months | DID | Short term average weight-for-age z-scores (WAZ) of newborns:  0.64 standard deviations increase for all (P<0.05);  0.969 increase for boys (P<0.05);  Not statistically significant result for girls;  Short term average weight-for-age z-scores (WAZ) of already born children:  0.57 standard deviations increase for all (P<0.1);  1.049 increase for boys (P<0.05);  Not statistically significant result for girls;  Weight-for-height z-score difference at baseline between high and low treatment:  Not statistically significant result; | NIL |
| Quimbo et al. 2011 | Philippines (central regions) | Low | Remove user charges for poor children-  Before: 49% of total health expenditure paid out-of-pocket After: Increase peso ceilings to eliminate copayment for hospitalization | Two rounds of data with 1100 patients each in the intervention and control sites  Follow-up period: 24 months | DID | Wasting (<0.9 actual weight to ideal weight of actual height):  9-12% reduction (P<0.1);  Presence of an acute infection or other types of inflammation (CRP-positive)\*: 4-9% reduction(P<0.1); | NIL |

DID= difference-in-difference

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