Public health expenditure and household poverty: case study of Egypt

Marwa Biltagy[1*] and Manar Hamdi[2]

Abstract

The insufficient and inefficient public expenditure on health services by any health system creates physical and financial barriers to using health care services, especially for poor people and uncovered informal sector workers. This leads to the appearance of household direct out-of-pocket (OOP) payments on health services. OOP will push households into poverty if it exceeds their monetary income, as they cut their spending on other essential needs such as food, clothing, or education fees. The main objective of studying public health expenditure is to provide essential health services to all citizens equally without pushing them into poverty due to health payments OOP. This paper examines the average coverage of Reproductive, Maternal, and Child Health (RMNCH) services according to place of residence and wealth quintile from 2005 to 2015. The rationale for choosing RMNCH only as an indication of health coverage is due to data limitations. This paper depends on World Health Organization (WHO) data. The paper evaluates poverty impact by using poverty head counts and poverty gaps before and after OOP through using nationally representative surveys of Egypt for the years 2005, 2009, 2011, 2013, and 2015. Results show a gap in covering RMNCH services among different groups, but the gap is decreasing over time. Results also show that OOP payments pushed on average 30% of Egyptian households into poverty during the period of the study.

Keywords Public health expenditure, Out-of-pocket health payments, Health Service Coverage Index, Poverty measures, Egypt

Introduction

The insufficient and inefficient public expenditure on health services by any health system creates physical and financial barriers to using health care services, especially for poor people and uncovered informal sector workers. This leads to the appearance of household direct out-of-pocket (OOP) payments on health services. OOP will push households into poverty if it exceeds their monetary income, as they cut their spending on other essential needs such as food, clothing, or education fees.

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Additionally, illness in the absence of adequate public medical insurance for the poor could cause indirectly severe financial hardship. This is because poor households lose their monetary income due to their inability to work. [20] applied their analysis to some Latin American countries, i.e., Brazil, Colombia, Costa Rica, Ecuador, Guatemala, and Mexico. They used vital registration data ranging from 2000 to 2017, and they found that estimates of HIV death rates showed significant differences by geographic region and age over time.

In Egypt, OOP spending as a percentage of total health expenditure increased from 48% in 1995 to reach 62% in 2015. On the other side, the Egyptian government decreased public spending on the health sector as a percentage of total government spending from 7.3% in 2000 to 5.5% in 2015. This indicates the lack of financial protection provided by Egyptian public health spending against the risks of medical expenses.

Sustainability in the health sector can be defined as the organization and provision of health services by the government to all citizens with a reasonable level of resources. From a socioeconomic perspective, the government needs to provide private health coverage for all basic services at reasonable prices commensurate with the economic conditions of citizens. The quality of services covered by public health funds will also protect service users who pay for services out of their own pockets or out of their own money. The main aim of this study is to investigate the impact of public health expenditure on household poverty due to medical payments associated with health care use in Egypt between the years 2005 and 2015. The rationale for choosing the study period from 2005 to 2015 is related to the data availability of variables such as household expenditure and out-of-pocket (OOP) health expenditure collected by Egyptian household surveys. Moreover, the purpose is to shed light on the period before initiating the Egyptian universal insurance coverage program in 2018, i.e., trying to describe the current health services coverage and the level of protection against OOP that encouraged the Egyptian government to gradually launch full insurance coverage.

The study uses two methods to investigate this effect. First, it uses a coverage index of specific health services introduced by the Egyptian health sector. Second, it estimates the poverty headcount and poverty gap after considering OOP spending by Egyptian households.

The paper is organized as follows: Section "Literature review" presents a brief review of the related literature. Section "Theoretical background: an overview of the structure of public health expenditure in egypt" provides an overview of the structure of Egyptian public health expenditures. Section "Methods and analysis" describes the data. Section "Results and Discussion" introduce the empirical model and the related results, and Sect. "Conclusion" concludes.

Literature review

The economic schools of thought do not directly investigate the role of public health spending in reducing income poverty. Instead, they analyze the role of government spending (ex., spending on education, health, and infrastructure) in poverty alleviation.

Both Alam and Mahal [1] and Sanchez and Davis [28] critically analyze the views of poverty adopted by different economic schools of thought. They concluded that there is a debate between the economic schools over the role of public spending in reducing poverty. For example, classical and neoclassical theories assume that public spending has little or no effect on poverty alleviation.

In contrast, Keynesian/Liberal theory and Marxist/Radical theory support the state's role in poverty alleviation, but in different ways. Keynes explains that spending efficiently on state sectors improves macroeconomic indicators and reduces poverty, while Marx believes that public spending should be directed to support the groups deprived of economic activities.

Moreover, Anderson et al. [2] present a meta-regression analysis of the relationship between government spending and income poverty, with a focus on low and middle- income countries. Through the search and screening, the study identified 169 estimates of this relationship in 19 cross-country econometric studies.

The study introduces two findings: first, the composition of the sample used for estimation, the control variables included in the regression model, and the type of government spending are factors that affect the size and direction of the estimated relationship. Second, there is no clear evidence that higher government spending has played a significant role in reducing income poverty in low and middle- income countries.

However, a growing number of studies examined the poverty impact of medical expenses on household income (or impoverishment) in a wide range of countries with a public health spending deficit and during different periods. The studies compare household income and consumption to the poverty line (World Bank poverty line or the national poverty line) before and after subtracting OOP payments from household income and consumption.

The studies found that OOP payments push households into poverty. For example, in the Philippines, Econ [7] examined the poverty impact of OOP using the national poverty line. The study found that 14% of households were pushed below the poverty line due to OOP payments. In India, Karan and Garg [19] and Gosh [10] tested the poverty impact of OOP payments between 1994 and 2000. Both studies found that poverty headcount increased due to Indian health sector privatization, an increase in consultation fees, and medicine prices as well.

In a recent study, Trigli [29] tested the effect of the Green Card program in Turkey on OOP among poor and low-income households. The study compared OOP payments in 2003 (before program application) to OOP payments in 2006 (after program application). The study found that OOP payments decreased by 33% after program application. However, Narci et al. [25] reported an increase in poverty in Turkey due to OOP payments during the period 2004–2010.

Dorjdagva et al. [6] measured the impoverishment rate and found that about 20,000 people in Mongolia were forced into poverty due to paying for health care despite the high coverage of social insurance. In addition, Chuma and Marina [5] found that

poverty headcount increased in Kenya by 3% due to OOP patient payments.

Furthermore, the poverty headcount in Nigeria, according to Aregbeshola et al. [3], was 97.9% gross of health payments. OOP health payments in Nigeria led to a 0.8% rise in poverty headcount, which means that 1.3 million Nigerians are being pushed below the poverty line. All previous studies agree that increasing reliance on public health expenditure in financing health care services protects the household from being poor due to OOP payments.

Fu [9] concluded that illness resulting from poverty was highly concentrated among rural low-income individuals in China. He found that the solution is to decrease the income gap between urban and rural households, to develop services covered by medical insurance, and to raise the fund rate for public hospitals.

The evidence on the poverty impact of OOP payments in Egypt is limited. For example, Rashad and Sharaf [27] examined the prevalence of impoverishment in Egypt. The poverty impact was evaluated using the poverty headcount and poverty gap before and after the OOP. Results for Egypt show that OOP payments pushed 30% of the population into extreme poverty in 2011.

Elgazzer et al. [8] examined the effect of OOP payments on living standards in six Middle East and North African countries, including Egypt. The study found an increase in poverty rates of 20% after accounting for OOP health payments.

The COVID-19 pandemic emphasized gaps in disease prevention, health systems, and cures all over the world. These gaps can be attributed to the financing of national health systems, particularly in developing countries. Micah et al. [21] presented an assessment of global health spending at the beginning of the pandemic and examined expectations for future health spending from 2021 to 2026. Micah et al. [21] measured four sources of health spending: government spending, out-of-pocket spending, prepaid private spending, and development assistance for health in 204 countries and regions. To estimate spending, the authors used the creditor reporting system of the Organization for Economic Co-operation and Development (OECD) and the global health expenditure database of the World Health Organization. Furthermore, they utilized a keyword search in order to estimate development assistance for general health, COVID-19 response, and epidemic readiness. In 2019, at the beginning of the COVID-19 pandemic, all over the world, US\$9.2 trillion was spent on health. The authors confirmed that there were significant differences in the amount of resources allotted to health between high- and low-income countries.

Table 1 Development of Egyptian public spending and OOP patient Payments (1995–2015)

Year	Public spending on health as a percentage of total public spending (%)	Public spending on health as a percentage of GDP (%)	OOP payments on health as a percentage of total health expenditure (%)
1995	5.3	1.8	48
2000	7.3	1.8	58
2005	6	1.7	59
2010	5.6	1.4	58.3
2015	5.5	1.3	62

Source: Done by the authors based on Central Agency for Public Mobilization and Statistics, (2016), Statistical year book 2016, Issue No (107), Arab Republic of Egypt

Iorember et al. [18] examine the potential relationship between environment and health outcomes and consider the importance of human capital and the use of energy in the MENA region. Empirical findings found a link between environmental factors and health outcomes. The results demonstrate that investment in human capital has a positive and important impact on health outcomes and a negative impact of energy use on health consequences.

By examining the literature at hand, the manuscript found that the main research question for each study is to examine the relationship between household poverty and public health expenditure. Some literature used different case studies, while others used the same case study, but the focus time of the study was changed. Changing the focus time of studies is important in such cases, as it takes time to observe the impact of public health expenditures on variables such as coverage of essential health services or OOP reduction. Furthermore, few studies have looked at the case of Egypt, and almost none of them used our approach, methodology or focus time.

The paper adds to the existing literature on the impact of poverty on public health spending by analyzing coverage of essential health services among different groups and reassessing poverty measures in Egypt over the period 2005–2015.

Through the integrated approach, achieving balance in the provision of health services between different income levels and different geographical areas requires the application of targeted financing plans that can protect citizens in rural areas and low-income areas from disease and poverty.

We argue that the use of our research methodology serves the above approaches. Applying the average annual health coverage to the RMNCH index by place of residence and wealth quintile can reveal improvements

in reducing the gap in service provision. This will ensure healthy results in the short term.

The use of poverty measures (the number of poor people and the poverty gap) annually or after the implementation of a health program will help in evaluating the success of implementing these programs and thus the sustainability of their use. In this case, the result is that healthier people are able to work toward economic growth, which is the goal of sustainability. For example, in 2018, the Egyptian Parliament passed the Universal Health Coverage Law with the aim of achieving one of the development goals for the year 2030. The implementation of the law requires building insurance programs gradually among all Egyptian governorates to cover the basic health services needed by the Egyptian family. In the future, the evaluation of the methodology proposed by this research after achieving full coverage will reveal the success of the Universal Health Coverage Act.

Therefore, we can consider maternal and child reproductive health indicators and measures of poverty as tools for sustainability in the health sector. The results of these tools will help to organize policies and programs that can achieve long-term sustainability.

Theoretical background: an overview of the structure of public health expenditure in Egypt

This section analyzes the structure of Egyptian public health expenditure by using five elements. The elements are: financing sources, managing entities, payment mechanisms, benefit packages and governance rules or laws. These elements must be designed in a way that provides essential health services without pushing Egyptian households below the poverty line.

Egyptian public health expenditure is mainly financed through taxes collected by the Ministry of Finance (MOF) and through beneficiaries' payments collected by the Social Insurance and Pension Fund (SIPF). In addition, Egyptian public health expenditure is covered by the Ministry of Health and Population (MOHP) and by the Health Insurance Organization (HIO).

MOHP is the main health service provider through facilities ranging from outpatient clinics to central hospitals, delivering different care services. The HIO provides health services through different units located in all governorates of Egypt. Both entities, MOHP and HIO, depend on historical budget mechanisms or input budgets as a payment method to fund health service inputs and medical staff wages.

By default, the benefit package funded by MOHP provides 80% of the required primary health care services to all citizens at highly subsidized rates and a small range of second and third-level health care. Moreover, MOHP

provides health care free of charge to the poor and needy through its "treatment at state expense" program. On the other hand, 57% of the population is covered by HIO, including school students, infants, pensioners, and widows, in addition to employees through the employment-based scheme.

For the governance rules, the Egyptian constitution sets in 2014 the minimum level of public spending on the health sector at about 3% of the Gross Domestic Product (GDP). In addition, the Egyptian parliament in 2018 passed the Universal Health Insurance Law No.2/2018 to regulate for the first time the social health insurance activities inside the Egyptian health sector. Both rules aim to achieve a universal health coverage target that protects Egyptian citizens from being poor due to OOP payments.

Table 1 indicates a decrease in public health spending as a percent of total government spending/GDP in Egypt during the period of 1995 to 2015. However, OOP payments account for 60% of total health expenditure due to low public funds on health benefit packages and other reasons, for example, low quality of services, an increasing number of beneficiaries of social health insurance compared to available financial resources, poor staffing levels, outdated equipment, and long queues for treatment, poor sanitation levels, and around 85% of spending on pharmaceuticals being a private expenditure.

This suggests that the current structure of public health expenditure in Egypt may not protect citizens from the financial risks of health payments, resulting in an increase in the poverty headcount or a wide gap.

Methods and analysis

The aim of choosing the methodology is to reflect progress in the level of protection that public health expenditure provides Egyptian households against OOP risks. This was reflected by tracking the provision of government-funded basic health services and by calculating poverty numbers and the resulting OOP gap.

To track coverage of basic health services, the study calculated the RMNC index, which is a weighted average of the following indicators: reproductive, maternal, newborn, and child health. The value of this indicator was collected from the World Health Organization platform for tracking universal health coverage. (This is detailed in point A.)

To measure the impact of poverty, the study used Egyptian Household Survey data on household consumption and out-of-pocket health expenditure. The value of these data has been aligned through the Economic Research Forum (ERF). (This is detailed in point B.)

A. For tracking coverage of basic health services in Egypt, the study used the World Health Organization's (WHO) equity indicators database during the period of 2005 to 2015. Due to the availability of data, the study focused on reproductive, maternal, newborn, and child health indicators according to place of residence (urban and rural areas) and according to wealth quintile (poorest and richest citizens). The specific indicators used to trace the health service coverage gap between the poor and non-poor are:

(1) Family planning coverage: What is the percentage of demand for family planning met by modern methods among women between 15 and 49 years old to unmet demand?
(2) Antenatal care coverage: What is the percentage of four antenatal care visits among pregnant women to unmet visits?
(3) Child immunization coverage: What is the percentage of newborns with three doses of vaccines against Diphtheria, Tetanus, and Pertussis (DTP3) compared to newborns without vaccines?
(4) Child treatment coverage: What is the percentage of care seeking for suspected pneumonia for children younger than five years to children without health care?

B. For measuring the progress of the poverty impact of OOP in Egypt, the study used data from five Egyptian National Household Income, Expenditure, and Consumption Surveys (HIECS) for the years 2005, 2009, 2011, 2013, and 2015. The surveys are conducted by the Central Agency for Public Mobilization and Statistics (CAPMAS) every two years to measure poverty in Egypt.

Access to surveys was provided by the Economic Research Forum, which harmonized and cleaned the five datasets. Two variables are selected to measure poverty impact: the total level of spending on health OOP and the level of total household expenditure. The variables of health spending include spending on: (1) medical products; (2) devices and equipment; (3) outpatient and hospital services. The total expenditure variable is the sum of all expenditures on food, residence, education, etc.

The paper follows the methodology of the World Health Organization and the World Bank methodology for calculating an average of Reproductive, Maternal, New Born, and Child Health indicators (RMNCH) to indicate the poverty impact of public health expenditure. According to the methodology, the average coverage of RMNCH is calculated by taking the geometric mean of the following four variables:

1. Family Planning (FP),
2. Antenatal Care, 4_+ visits (ANC),
3. Child Immunization. (DTP3),
4. Care Seeking for Suspected Pneumonia/Child Health (Pneumonia).

A geometric mean is used rather than an arithmetic mean, as it favors equal coverage across services as opposed to higher coverage for some services at the expense of others. The four variables are measured on a scale of 0 to 100%, with a higher score indicating better performance. Therefore, if the value of RMNCH improved over time, this means Egyptian Public Health

Table 2 Average health coverage of RMNCH according to place of residence and wealth quintile, Egypt (2005–2015)

Indicator	2005		2010		2015	
Wealth quintile	Q_1	Q_5	Q_1	Q_5	Q_1	Q_5
Family planning %	53	60	55	63	56	59
Antenatal care %	32	88	41	89	72	93
Child Immunization %	77	83	89	94	86	92
Pneumonia %	62	76	69	81	63	65
RMNCH	53	76	61	81	68	75
Place of Residence	R	U	R	U	R	U
Family planning %	56	60	57	60	56	60
Antenatal care %	53	76	60	82	81	88
Child Immunization %	90	81	90	93	91	92
Pneumonia %	62	75	69	78	67	68
RMNCH	63	72	68	77	73	75

Source: Authors' Calculations based on data from http://apps.who.int/gho/uhc

Q_1 is the poorest consumption quintile, Q_2 is the richest consumption quintile, R is rural areas, and U is urban areas

Expenditure (EPHE) is providing more protection to households against poverty due to OOP payments.

The study applied the average coverage of RMNCH among rural and urban areas and between the poorest and richest income quintiles over the period of 2005 to 2015. This is to investigate the progress of RMNCH service coverage over time in the Egyptian health sector. Subsequently, if the coverage gap decreased over time, this indicates that EPHE protects people from poverty due to OOP payments.

The effect of health care payments (OOP) on poverty estimates (poverty headcount and poverty gap) can be expressed algebraically and graphically.

Algebraically, the paper uses O'Donnell et al. [26] methodology:

$$H^{gross} = \frac{\sum_{i=1}^{N} s_i h_i^{gross}}{\sum_{i=1}^{N} s_i} \tag{1}$$

Equation (1) measures poverty headcount gross of OOP, in which s_i is the household size and N is the number of households in the sample. The household (i^1) is poor if its per-capita spending is less than poverty line (PL).

Define the gross of health payments individual-level poverty gap by $g_i^{gross} = h_i^{gross}(PL - x_i)$, then the mean of this gap in currency units is calculated using Eq. (2):

$$G^{gross} = \frac{\sum_{i=1}^{N} s_i g_i^{gross}}{\sum_{i=1}^{N} s_i} \tag{2}$$

Poverty gap gross of OOP for household i equal PL—per-capita total spending by household (x_i).

The effect of OOP (health payments) on "H" and "G" is captured by replacing h_i^{gross} with h_i^{net} and by replacing g_i^{gross} with g_i^{net}. Where:

(1) $h_i^{net} = 1$ (i.e. household is poor) if $(x_i - T_i) < PL$. and equals zero otherwise.
(2) $g_i^{net} = h_i^{net}(PL - (x_i - T_i))$, where x_i is the per-capita total spending by household (i^1) and T_i is per-capita health spending (OOP) by household (i^1).

Then the study compares between H^{gross} and H^{net} and between G^{gross} and G^{net} to demonstrate the effect of health payments (OOP). In addition, the study measured mean poverty gap (MPG) gross and net health payments by Eq. (3). This is to find out if the rise in the poverty gap

Table 3 Measures of poverty in Egypt based on consumption gross and net of spending on health care, Egypt, 2005–2015

	Poverty impact at $1.90 per day		Poverty impact at $3,10 per day		Poverty impact at national PL	
	Gross of health payments	Net of health payments	Gross of health payments	Net of health payments	Gross of health payments	Net of health payments
Egypt 2004/2005						
Poverty Headcount (%)	0.5	0.6	8.6	9.9	–	–
Poverty gap (EGP)	0.4	0.5	15.8	18.5	–	–
Mean positive poverty gap (%)	11.8	11.6	15.9	16.2	–	–
Egypt 2008/2009						
Poverty Headcount (%)	1.3	1.7	12.4	14.9	–	–
Poverty gap (EGP)	1.8	2.4	41.5	50.6	–	–
Mean positive poverty gap (%)	13	13.3	18.5	18.8	–	–
Egypt 2010/2011						
Poverty Headcount (%)	0.4	0.5	7.4	9.7	26.4	32.4
Poverty gap (EGP)	0.8	1	25.7	34.8	170.4	215.4
Mean positive poverty gap (%)	16.8	15.5	15.7	16.3	20.8	21.7
Egypt 2012/2013						
Poverty Headcount (%)	0.4	0.8	5.1	7.3	27	34.3
Poverty gap (EGP)	0.2	1.2	23.4	32.9	214.1	286.1
Mean positive poverty gap (%)	13.8	15.4	17.8	17.3	20.3	21.4
Egypt 2014/2015						
Poverty Headcount (%)	0.1	0.2	2.1	3.1	28.1	35.1
Poverty gap (EGP)	0.2	0.3	8.7	13.5	338.9	447.5
Mean positive poverty gap (%)	23.1	22.6	12.8	13.8	20.8	22

Source: Authors' calculations based on data from references (12–16)

value is due to the widening gap in front of current poor or due to pushing more households below the poverty line.

$$G^{\text{gross}} = \frac{\sum_{i=1}^{N} s_i g_i^{\text{gross}}}{\sum_{i=1}^{N} s_i} \tag{3}$$

The poverty gap (G) is equal to the fraction of the population who are poor (H) multiplied by the average deficit of the poor from the poverty line (MPG).

The paper used three poverty lines: the World Bank absolute poverty lines, $1.90 per head per day and $3.10 per head per day, and the national poverty lines of Egypt calculated by CAPMAS for the years 2011, 2013, and 2015.

Graphically, the paper follows the Pen's Parade technique adopted by O'Donnell et al. [26]. The Pen's Parade analyze the poverty impact of OOP by plotting two parades of household expenditure: one gross of OOP and another net of OOP. Then it compares the two parades values with the value of the poverty line (PL).

The distance between the intersection of two points of the parade is the fraction of individuals that are not counted as poor before netting out OOP payments. Furthermore, the poverty gap increases because those already counted as poor appear even poorer once health payments are netted out of household expenditures.

However, the study uses the World Bank application (ADEPT 6.0) to calculate poverty measures algebraically and graphically by using Egyptian household survey data during the period of 2005 to 2015. ADEPT 6.0 is an application developed by the World Bank (WB) to investigate equity in sectors such as education and health. The application can be easily accessed and downloaded from the WB website.

The application technique for analyzing health equity is to use household survey data and compare household income and consumption before and after spending on health services. The results of the application can be presented algebraically by enumerating the poor and calculating the poverty gap at a given point in time, or graphically by arranging the income and consumption levels of households on a graph compared to different poverty line values.

Results and discussion

A. For tracking health service coverage in Egypt, Table 2 represents the progress of health coverage according to place of residence and wealth quintile, where Q_5 is the highest consumption quintile of Egyptian households and Q_1 is the lowest consumption quintile of Egyptian households.

The RMNCH index is calculated as the weighted average of four indicators. First is family planning=reproductive health (demand for family planning satisfied with modern methods); second is antenatal care=maternal health (antenatal care coverage with at least one visit and skilled attendance at birth); third is child immunization=(BCG, measles and DTP3 immunization coverage), and fourth is pneumonia=management of
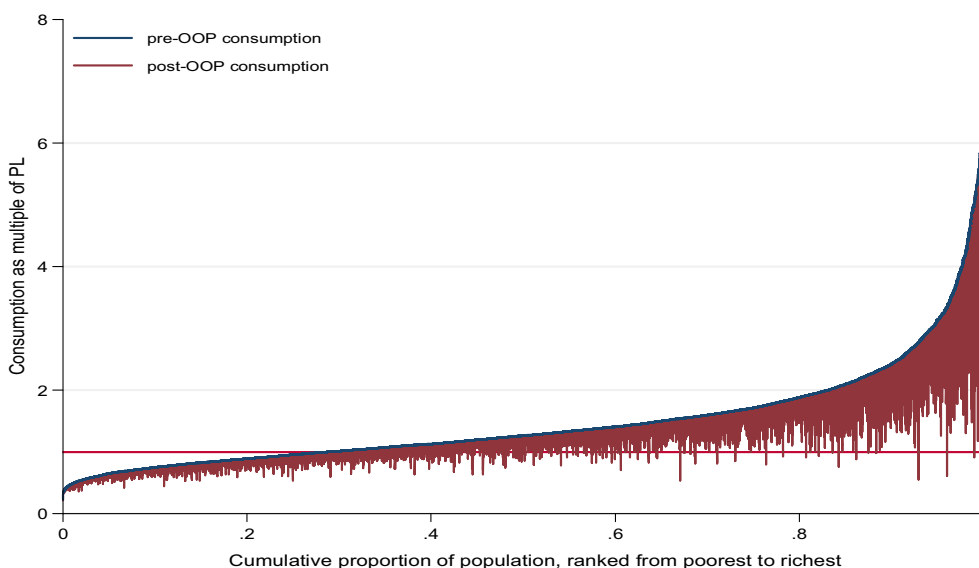

Fig. 1 The pen parade for household consumption gross of health payments in 2015. *Source*: Authors' calculations based on data from references (12–16)

Table 4 WB poverty lines values in Egyptian Bound (EGP)

Year	PL = $1.90 (EGP)	PL = $3.10 (EGP)
2004/2005	710	1150
2008/2009	1110	1810
2010/2011	1355	2210
2012/2013	1600	2600
2014/2015	1950	3200

Source: Authors' calculations based on annual value of purchasing Power Parity and Exchange Rate Values in Egypt

childhood illnesses (therapy and care seeking for suspected pneumonia).

Although there has been improvement in the value of average coverage of RMNCH services over time in Egypt, there is also a coverage gap between urban areas and rural areas, and between the rich and the poor. In addition, the coverage gap according to place of residence is less than the gap according to income quintile. For example, the average gap in 2015 accounted for 2% between urban and rural areas, and 7% between the poorest and richest households.

Table 2 results indicate the progress of EPHE over time in providing more health services reflected by RMNCH to rural areas and the poorest income quintile. The progress of EPHE is oriented toward smoothing the physical obstacles of health coverage faster than the financial obstacles of health service coverage. Inequalities in Health Coverage (HC) exist mainly for specific reasons, i.e., some population subgroups have less access to services and interventions or systematically worse health outcomes. In addition, coverage tends to be higher among more advantaged groups, such as the richest, most educated, or those who live in urban areas.

B. The poverty impact of OOP health payments.

B.1. Algebraically, Table 3 demonstrates the sensitivity of poverty measures in Egypt to health payments (OOP). Estimates are presented for the $1,90 and $3.10 per person per day poverty lines used by the World Bank and the Egyptian National Poverty Line (NPL) used by CAP-MAS {NPL(2011) = 3100 EGP, NPL(2013) = 3900 EGP, NPL(2015) = 5800 EGP}.

In 2005, when assessed based on the total household consumption approach, 0.5 percent of Egyptians were in extreme poverty (< $1.90). This percentage rises to 0.6 percent after omitting OOP payments from household consumption. So about 0.1 percent of the Egyptian population is not counted as living in extreme poverty but would be considered if spending on health care is discounted from household resources. This represents a substantial rise of 20 percent in the estimate of extreme poverty. Over the years, estimates of extreme poverty also rise by 30 percent on average.

Moreover, the estimates of the poverty gap in 2005 rose by 25 percent from 0.4 EGP to 0.5 EGP. The estimates of the poverty gap showed the highest rise of almost 66 percent in 2013 and 50% in 2015, mainly because of Egyptian currency depreciation. The mean positive poverty gap for each year does not increase except for the year 2008/2009. It falls slightly. This suggests that the rise in the poverty gap is due to more households being brought into poverty for the years 2005, 2011, 2013, and 2015 and because of a deepening of the poverty of the already poor.

At the $3.10 per day poverty line and national poverty line for each year, the pattern of results is the same, but the relative difference in poverty is less, and the intensity of poverty, as measured by the mean positive poverty gap, no longer falls when poverty is assessed on consumption net of health care costs.

B.2. Graphically, Fig. 1 shows the pen parade for household consumption gross of health payments in 2015. Egyptian household consumption is expressed here as multiplies of a national poverty line (NPL (2015) = 5800 EGP) based on minimum food requirements.

For each household, a vertical bar (or otherwise known as "paint drip") shows how much subtracting health payments reduces consumption. If a bar crosses the poverty line, then a household is not counted as poor based on gross consumption but is poor on the basis of net consumption.

Effect of Health Payments on Pen's Parade of the Household Consumption Distribution, Egypt 2015, NPL = 5800 EGP.

The graph shows that health payments are the largest at higher values of total consumption, but it is the households in the middle and lower half of the distribution that are brought below the poverty line by health payments.

At the World Bank poverty lines for each year, the pattern of results is the same, but the difference in households brought below the poverty line by health payments is in the lower half of the distribution.

Hasio [12] defined the financial health system as the correlation between five inputs: managing entities, government regulations, benefit packages, payment methods, and fund sources to achieve outcomes in the short and long term. Improving access to health services and introducing them with quality and efficiency is short-term outcomes. The study used descriptive analysis of RMNCH indicators to track progress in the introduction of health services in the short run. It is shown in the data presented in Table 2 that the coverage of services for mothers and children has improved between 2005 and 2015. The percentage of coverage is higher in urban areas and among the richest quintiles.
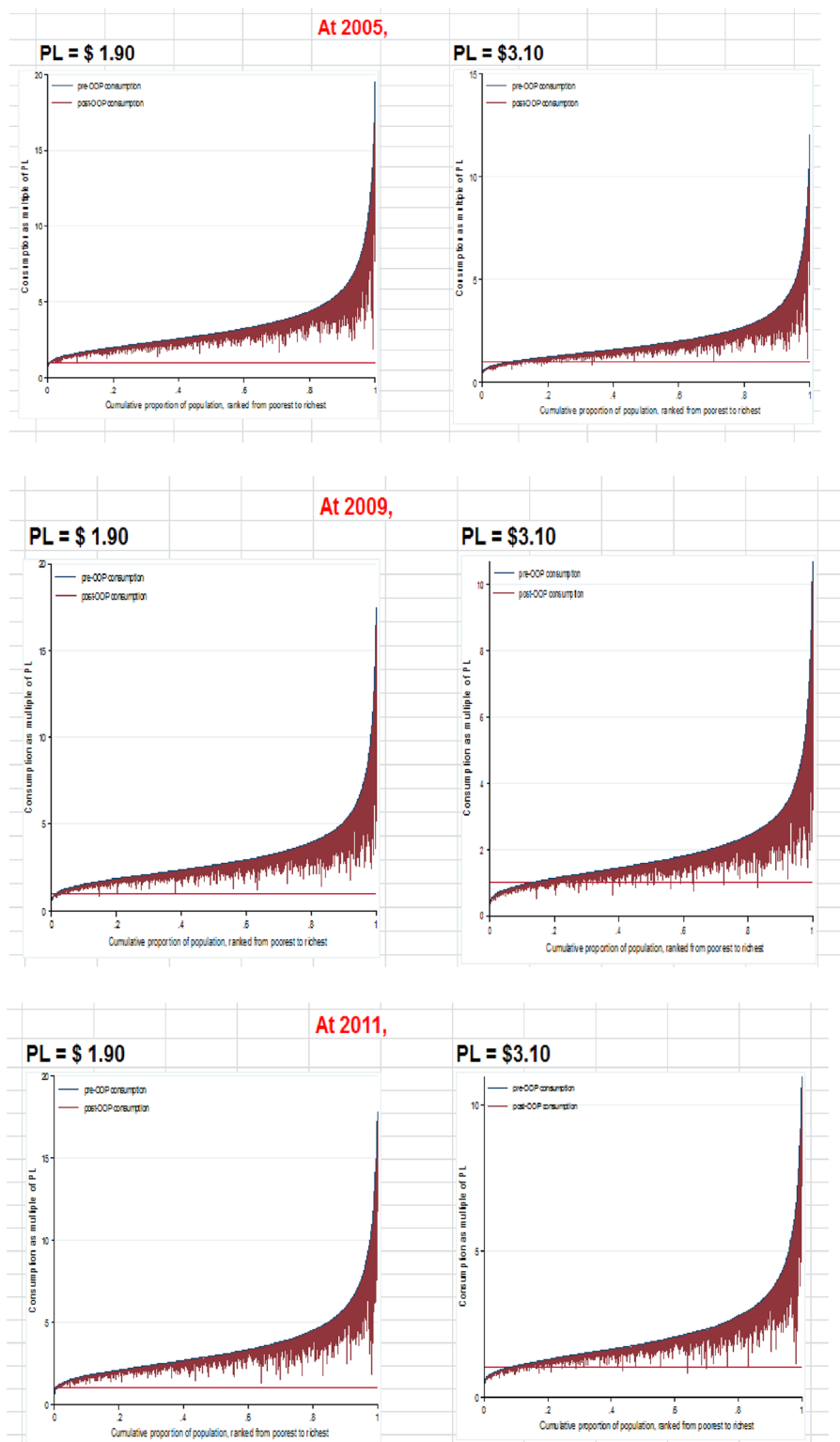
Fig. 2 Versions of the pen parade representation of the consumption distribution using WB PL values. *Source*: Authors' calculations based on data from references (12–16)
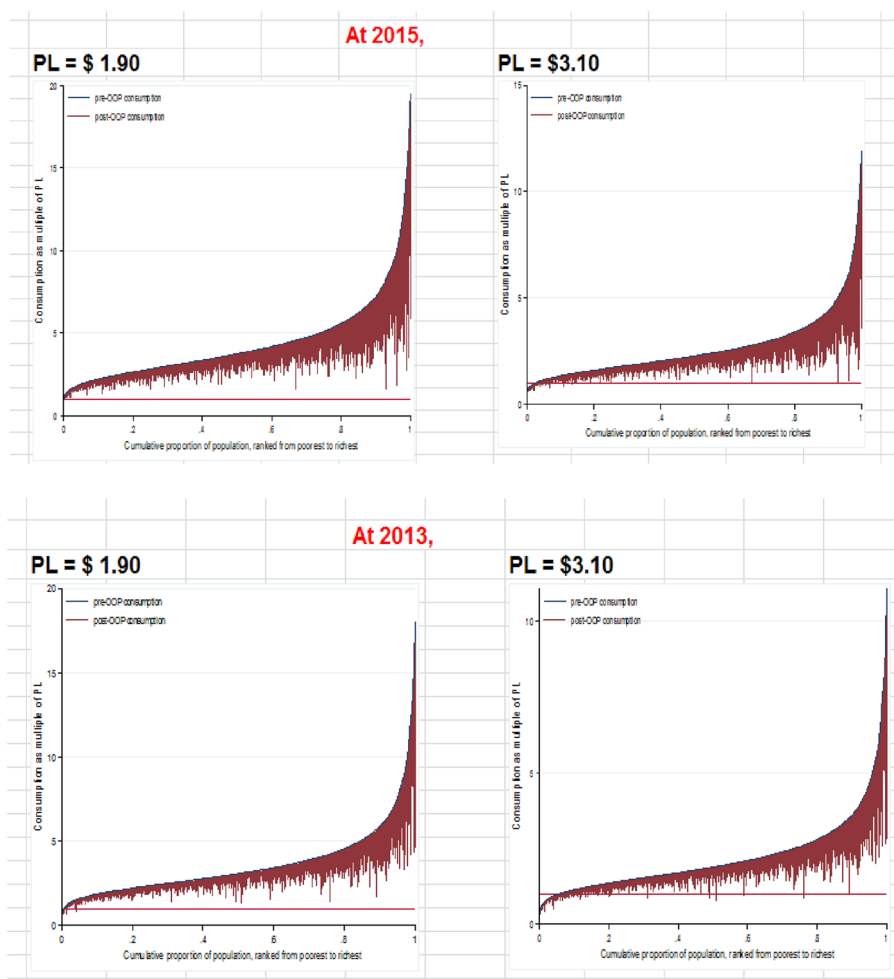
Fig. 2 continued

In addition, the long-term provision of services should improve health status, protect families from OOP health spending, and meet utilization expectations. While Hafeez et al. [11] used indicators such as life expectancy at birth, healthy life expectancy, and disease burden to track the health status of Pakistan. The current study calculated the poverty gap in Egypt during the period 2005–2015 to track the goal of protecting households from OOP health expenditure. These measurements are shown algebraically in Table 4.

Graphically, the study used two poverty line values adopted by the World Bank. These values are converted to Egyptian pounds, as shown in the table (*). Then, it compares the values of total household consumption before and after calculating the health payments according to the poverty line values. The results for each poverty line value for different years are shown in Fig. 2. With a value of $3.10, more people are pushed below the poverty line due to health care payments, but the percentage of poor people is decreasing slightly over time.

The values in Table 3 reflect the fluctuation in the percentage of poor before and after OOP liquidation at all poverty line values used. Although there is an increase in the poverty headcount after excluding OOP, the value of poverty tends to decrease over time. For example, at the poverty line of $3.10 per day, the proportion of poor people fell from about 14% in 2009 to 3.1% in 2015. In addition, Fig. 2 shows the improvement in the percentage of poor people who were pushed below the poverty line, represented by the dotted red line, over time.

Conclusion

The paper found evidence that public health expenditure in Egypt is providing more health services over time among urban and rural areas, and also between the richest

and poorest Egyptian households. This may improve the physical access of Egyptian households to essential health services. But the empirical evidence asserts that Egyptian households are facing financial obstacles to access health services. This is because a significant proportion of the population is pushed into extreme poverty due to OOP payments. The findings are alarming for Egypt to move toward universal health coverage that helps in providing essential health services through coverage of public health expenditure, and in protecting households from the economic consequences of illness.

The results of this study have some important implications for future research. The big differences in poverty levels across the urban and rural areas of Egypt make it essential to adopt the correct economic policies that reduce poverty and income inequality. In that regard, the national poverty reduction policies should be examined.

For future work, alternative poverty lines other than the level of 1.90 dollars per person per day can be used. Moreover, it is necessary to adopt structural reforms for health care systems, especially in the post-COVID-19 period. This implies that governments are responsible for reducing OOP health expenditure by investing more in different aspects of health infrastructure.

Since COVID-19 is an infectious disease, its impact will not be fully captured by the method proposed for this study. Instead, a COVID-19 sub-index should be added to the WHO-developed infectious disease index. The index should collect data on variables such as government spending on COVID-19 vaccination, life expectancy after treatment, frequency of infection, and risk factors for other chronic diseases. Moreover, a model can be used to track the spread of COVID-19 between different age levels, rural and urban areas, different levels of education, and urban and rural governorates in Egypt.

The potential policy changes or initiatives that could be put in place to alleviate the financial burden of health payments on households may include:

- Reducing out-of-pocket health spending is important to reduce financial hardship among the population, such as reducing medicine costs.
- Building different insurance programs based on conditions such as income, education, employment, and environmental conditions of the population.
- Changing health input policies to target poverty resulted from OOP, such as increasing public health funding, establishing a payment system that protects the population from private expenses at the point of service, and introducing a list of health service benefits that caused OOP to rise.

Abbreviations

OOP	Out of pocket
RMNCH	Reproductive, Maternal, and Child Health
WHO	World Health Organization
DAH	Development assistance for health
OECD	Organization for Economic Co-operation and Development
CRS	Creditor reporting system
GHED	Global Health Expenditure Database
MOF	Ministry of Finance
SIPF	Social Insurance and Pension Fund
MOHP	Ministry of Health and Population
HIO	Health Insurance Organization
GDP	Gross Domestic Product
DTP	Diphtheria, Tetanus, and Pertussis
HIECS	Household income, expenditure and consumption surveys
CAPMAS	Central Agency for Public Mobilization and Statistics
PL	Poverty Line
EPHE	Egyptian public health expenditure
MPG	Mean poverty gap
NPL	National poverty line

Declarations

References

1. Alam K, Mahal A (2014) Economic impacts of health shocks on house-holds in low and middle income countries: a review of the literature. Glob Health 10(1):21
2. Anderson E, d'Orey J, Duvendack M, Esposito L (2018) Does government spending affect income poverty? A meta-regression analysis. World Dev 103:60–71. https://doi.org/10.1016/j.worlddev.2017.10.006
3. Aregbeshola BS, Khan SM (2018) Out-of-pocket payments, catastrophic health expenditure and poverty among households in Nigeria 2010. Int J Health Policy Manag 7(9):798
4. Central Agency for Public Mobilization & Statistics (2016) Statistical year book 2016. Issue No (107), Arab Republic of Egypt
5. Chuma J, Maina T (2012) Catastrophic health care spending and impover-ishment in Kenya. BMC Health Serv Res 12(1):413
6. Dorjdagva J, Batbaatar E, Svensson M, Dorjsuren B, Kauhanen J (2016) Catastrophic health expenditure and impoverishment in Mongolia. Int J Equity Health 15(1):105
7. Econ P (2008) Catastrophic health care, poverty, and impoverishment in the Philippines. Ico RD 45:109–126
8. Elgazzar H, Raad F, Arfa C, Mataria A, Salti N, Chaaban J, Majbouri M (2010) Who pays? Out-of-pocket health spending and equity implications in the Middle East and North Africa
9. Fu Xz (2022) The comparison of catastrophic health expenditure and its inequality between urban and rural households in China. Health Econ Rev 12:19
10. Ghosh S (2011) Catastrophic payments and impoverishment due to out-of-pocket health spending. Econ Polit Wkly 63–70
11. Hafeez A, Dangel WJ, Ostroff SM, Kiani AG, Glenn SD, Mokdad AH (2023) The state of health in Pakistan and its provinces and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet Glob Health 11(2):e229–e243. https://doi.org/10.1016/S2214-109X(22)00497-1
12. Hasio WC (2003) What is a health system? Why should we care? Harvard School of Public Health, working paper, 33
13. Harmonized Household Income and Expenditure Surveys (HHIES), Version 2.0 of Licensed Data Files; HIECS 2012/2013—Central Agency for Public Mobilization and Statistics (CAPMAS). Egypt: Economic Research Forum (ERF)
14. Harmonized Household Income and Expenditure Surveys (HHIES), Version 2.0 of Licensed Data Files; HIECS 2010/2011—Central Agency for Public Mobilization and Statistics (CAPMAS). Egypt: Economic Research Forum (ERF).
15. Harmonized Household Income and Expenditure Surveys (HHIES), Version 2.0 of Licensed Data Files; HIECS 2008/2009—Central Agency for Public Mobilization and Statistics (CAPMAS). Egypt: Economic Research Forum (ERF).
16. Harmonized Household Income and Expenditure Surveys (HHIES), Version 2.0 of Licensed Data Files; HIECS 2004/2005—Central Agency for Public Mobilization and Statistics (CAPMAS). Egypt: Economic Research Forum (ERF).
17. Harmonized Household Income and Expenditure Surveys (HHIES), Version 2.0 of Licensed Data Files; HIECS 2015—Central Agency for Public Mobilization and Statistics (CAPMAS). Egypt: Economic Research Forum (ERF).
18. Iorember PT, Iormom B, Jato TP, Abbas J (2022) Understanding the bear-able link between ecology and health outcomes: the criticality of human capital development and energy use. Heliyon 8(12):e12611. https://doi.org/10.1016/j.heliyon.2022.e12611
19. Karan AK, Garg CC (2009) Reducing out-of-pocket expenditures to reduce poverty: a disaggregated analysis at rural-urban and state level in India. Health Policy Plan 24(2):116–128
20. Local Burden of Disease HIV Collaborators (2021) Mapping subna-tional HIV mortality in six Latin American countries with incomplete vital registration systems. BMC Med 19:4. https://doi.org/10.1186/s12916-020-01876-4
21. Micah AE, Bhangdia K, Cogswell IE, Lasher D, Lidral-Porter B, Maddison ER, Dieleman JL (2023) Global investments in pandemic preparedness and COVID-19: development assistance and domestic spending on health between 1990 and 2026. Lancet Glob Health. https://doi.org/10.1016/S2214-109X(23)00007-4
22. Ministry of Health, Egypt, and Health Systems 20/20 (2012) National Health Accounts 2011/2012: Egypt
23. Ministry of Health and Population & USAID. (2018). the Health and Public Health. Health Communication Capacity Collaborative (HC3) Project. Egypt
24. Ministry of Health and Population [Egypt], El-Zanaty and Associates [Egypt], ICF International (2015) Egypt Health Issues Survey 2015. Cairo, Egypt and Rockville
25. Narcı HÖ, Şahin İ, Yıldırım HH (2015) Financial catastrophe and poverty impacts of out-of-pocket health payments in Turkey. Eur J Health Econ 16(3):255–270
26. O'donnell O, Van Doorslaer E, Wagstaff A and Lindelow M (2008) Analyz-ing health equity using household survey data: a guide to techniques and their implementation. The World Bank
27. Rashad AS, Sharaf MF (2015) Catastrophic and impoverishing effects of out-of-pocket health expenditure: new evidence from Egypt. Am J Econ 5(5):526–533
28. Sanchez-Martinez M and Davis P (2014) A review of the economic theories of poverty (No. 435). National Institute of Economic and Social Research
29. Tirgil A, Dickens WT, Atun R (2019) Effects of expanding a non-contribu-tory health insurance scheme on out-of-pocket healthcare spending by the poor in Turkey. BMJ Glob Health 4(4):e001540
30. Tracking Universal Health Coverage platform (2017). http://apps.who.int/gho/uhc
31. World Health Organization. (2016). *Egypt health profile 2015* (No. WHO-EM/HST/225/E). World Health Organization. Regional Office for the Eastern Mediterranean.
32. World Health Organization (2016) World health statistics 2016: monitor-ing health for the SDGs sustainable development goals. World Health Organization
33. World Health Organization (2017) Tracking universal health coverage: 2017 global monitoring report

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