


BMJ Open Investigating households' out-of-pocket healthcare expenditures based on number of chronic conditions in Riyadh, Saudi Arabia: a cross-sectional study using quantile regression approach

Ziyad S Almalki ¹, Abdullah K Alahmari,² Ahmed M Alshehri,² Abdulaziz Altowaijri,³ Mohammed Alluhidan,⁴ Nehad Ahmed,² Abdulhakim S AlAbdulsalam,² Khalid H Alsaari,² Meshari A Alrashidi,² Abdulrahman G Alghusn,² Ali S Alqahtani,² Abdulaziz I Alzarea,⁵ Mona A Alanazi,⁶ Abdulhadi M Alqahtani⁷

To cite: Almalki ZS, Alahmari AK, Alshehri AM, *et al.* Investigating households' out-of-pocket healthcare expenditures based on number of chronic conditions in Riyadh, Saudi Arabia: a cross-sectional study using quantile regression approach. *BMJ Open* 2022;12:e066145. doi:10.1136/bmjopen-2022-066145

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2022-066145>).

Received 28 June 2022

Accepted 21 September 2022



© Author(s) (or their employer(s)) 2022. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

Correspondence to

Dr Ziyad S Almalki;
z.almalki@psau.edu.sa

ABSTRACT

Objectives This study investigated the level and associated factors, focusing on the number of individuals with chronic conditions, of out-of-pocket healthcare expenditures (OOPHE).

Design A cross-sectional study was conducted from January 2021 to June 2021.

Setting Riyadh Province, Saudi Arabia.

Participants A total of 1176 households that used any healthcare services at least once in the past 3 months.

Outcome measures The OOPHE incurred in the previous 3-month period when a household member is receiving health services. The effects of predisposing, enabling and need factors on the level of OOPHE. The association between the number of individuals with chronic conditions in a household and OOPHE along with the OOPHE distribution.

Results The average household OOPHE among all the surveyed households (n=1176) was SAR1775.30. For households affected by one chronic condition, OOPHE was SAR1806, and for households affected by more than one chronic condition, OOPHE was SAR2704. If the head of the household was older, better educated and employed, they were more vulnerable to a higher OOPHE (p<0.0001). At the household level, the increased number of family members with chronic conditions, the presence of a member less than 14 years old, higher socioeconomic status, coverage from health insurance plans, residence in an urban area and the presence of a member with a disability in the household were correlated with a considerably greater level of OOPHE (p<0.0001). The result of quantile regression analysis indicates that an increase in the number of members with chronic conditions in a household was significantly associated with greater overall OOPHE at higher health expenditure quantiles.

Conclusions The burden of OOPHE on households with chronic conditions remains heavy, and some disparities still exist. The number of individuals with chronic conditions in a household plays a substantial and prominent role in increasing the risk of incurring OOPHE.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ The questionnaire included questions on estimated out-of-pocket healthcare expenditure (OOPHE) incurred by the family in the previous 3-month period to minimise the likelihood of recall bias and assure the accuracy of the data given.
- ⇒ To ensure reliability and consistency, interviews were conducted by teams of well-trained interviewers who had previously been trained in administering the research questionnaire.
- ⇒ The present data were based on a cross-sectional survey with self-reported OOPHE, which may be impacted by recall and reporting bias.
- ⇒ The research did not examine each chronic condition's influence on OOPHE.

INTRODUCTION

After 2010, Saudi Arabia started raising healthcare spending,¹ with domestic healthcare spending (percentage of gross domestic product (GDP)) going up by nearly 78% over the 7 years from 2011 to 2017. The increase was much higher in Saudi Arabia than those in neighbouring countries.^{2 3} In 2020, the Saudi government spent SAR167 billion for health and social affairs, the third-highest amount after allocations for education and military spending, 16.5% of the government's overall budget.⁴

Chronic diseases are among the greatest threats facing all nations. In Saudi Arabia, findings from the Saudi Health Interview Study have identified a high prevalence of chronic diseases among the Saudi population.² Chronic diseases kill more than 83 100 people per year in the Kingdom and are

responsible for 73% of all deaths.⁵ In addition to causing premature mortality, chronic diseases also have a negative impact on the economic well-being of individuals, households and the community at large.

The primary healthcare providers in Saudi Arabia are the public and the private sectors. The public sector remains the dominant source of healthcare finance. More than 60% of Saudi Arabia's health services are provided by the Ministry of Health (MoH), which operates 13 health directories. Several other government health sectors serve 17% of their targeted population, often workers and their families, with healthcare services. They receive their annual budgets directly from the Ministry of Finance through their respective ministries and agencies. However, the private sector provides 23% of all healthcare services, a number that is steadily increasing.⁶ The new regulatory reforms have encouraged greater participation of the private sector. Private sector expats and Saudi natives (and their families) must have medical insurance. As more public services are privatised and public-private partnerships are formed, healthcare will shift to the private sector. Current medical insurance companies are designing solutions to address future needs for public sector workers.⁷

While MoH is working tirelessly to create a transformed revolutionary healthcare system of better quality, more efficiency and to meet patients' health needs,⁷ the enhanced growth of chronic diseases would disrupt the economic transformation plan that Saudi Vision 2030 has set for the country. As the country's population ages and grows, chronic diseases continue to take a huge toll on healthcare systems and society as they usually require various treatments and long-term care, burdening patients, households and the healthcare system with high economic costs.⁸ The projected expense of chronic diseases in Saudi Arabia is currently estimated at US\$18.6 billion a year or 2.8% of GDP. Of that, the US\$5.5 billion from direct healthcare costs was a fraction of the overall spending on healthcare services. The hidden additional costs were more than twice as high at US\$13.1 billion.⁹

Although the Kingdom has provided universal access to healthcare for the Saudi nationals and expatriates working in the government sector for many decades since its establishment,⁷ universal access does not mean that the danger to living standards posed by medical spending is eliminated. In Saudi Arabia, out-of-pocket healthcare expenditure (OOPHE) constitutes a large proportion of total health expenditure. According to WHO, Saudis' OOPHEs accounted for 14.4% of total health expenditure in 2018, and this figure is likely an underestimate of the true OOPHE incurred by those living with chronic conditions.¹⁰ Since patients with chronic diseases are more likely to encounter higher OOPHEs, the spending would be substantial if they suffer from many chronic diseases.¹¹ In addition, some of the country's public and semipublic healthcare providers do not always meet the patients' demands, which often causes such patients to seek medical care in the private sector and to pay more.¹²

The burden of chronic conditions does not just fall on and remain with the chronically ill individual. It also affects the entire household; hence, the entire household becomes an indirect sufferer. Because chronic diseases tend to be lengthy and often require continuous monitoring, there are frequent, unexpected and additional OOPHEs. Several studies suggest that non-communicable diseases (NCDs) impact OOPHE in various nations. For example, families with patients with NCD in Vietnam were 3.2 times more likely to face catastrophic health costs and 2.3 times more likely to face poverty.¹³ According to a different study, the poorest patients with cardiovascular disease (CVD) and their families in China, Tanzania and India are the most impacted by catastrophic health spending.¹⁴ Another study discovered that households with NCDs are statistically more likely than non-NCD households to experience catastrophic costs in low and middle-income nations.¹⁵ Low-income individuals with CVD and stroke had the greatest catastrophic spending rates in Tanzania, India and China. Patients with cancer in Iran, Vietnam and Nigeria reported the greatest costs.¹⁶ The total household's OOPHEs would be even higher with an increased number of members in the household with chronic conditions. This may lead to difficulties in healthcare access, adversely impacting patients' health. Moreover, high levels of OOPHE have been shown to influence patients' behaviour in seeking medical attention, influence treatment decisions, cause financial distress for patients, reduce adherence to medicine and cause delayed diagnosis.^{11 17 18} Previous studies have shown that households' socioeconomic status (SES) and other characteristics influence the levels of OOPHE.^{11 19 20}

The Saudi MoH acknowledges that eliminating or reducing financial obstacles leads to greater accessibility to healthcare. However, there are limited data in the literature on the levels of OOPHE among households with chronic conditions in Saudi Arabia. Decision-makers and policymakers must be aware of these conditions' financial burdens on individuals, households and society, and understand its determinants. One study focused on the relationships among income, insurance and OOPHE.²¹ In response to this limitation in the literature, we first determined the extent of OOPHE among households in Riyadh, Saudi Arabia. Second, we aimed to determine the factors independently associated with OOPHE among households with chronic conditions. Finally, we estimated the association between the number of members with chronic conditions and the OOPHE distribution. This information is essential to reveal the extent of this impact and help the government, healthcare sector and other policymakers in designing new policies to ease the burden of the OOPHE among households with chronic conditions.

MATERIALS AND METHODS

Study design

A cross-sectional study design was used in Riyadh Province from January 2021 to the end of June 2021. The Province of Riyadh is the second-largest region in area after the Eastern Province, with 404240 km², and the second largest in population after the Region of Mecca, with 3681927 Saudi households.²² It comprises urban areas (defined as having at least 5000 people) and roughly a hundred dispersed villages with fewer than 5000 inhabitants. Rural regions in the Riyadh Province account for 8.5% of Riyadh's total population.²³ In 2019, the national per-capita GDP was SAR86 901. Riyadh was ranked second in per-capita GDP among the 13 provinces in Saudi Arabia, with a GDP per capita of SAR121 395.²²

Study population and sampling methods

The study population comprised households that received care during the 3 months before the interview. We included any head of the household aged 18 years or older whose household had used any healthcare services at least once in the past 3 months. The household headship was self-identified by household members. We excluded newly married couples who had been in a household for less than 3 months at the interview and households with incomplete data for the dependent or independent variables. Households were excluded if any of the household members were suffering from seasonal cases or were hospitalised.

Using reported numbers by the General Authority for Statistics, which gave the prevalence of chronic conditions in Saudi Arabia as 15.9%,²⁴ at the 95% level of significance and a margin of error of 5%, we determined the smallest sample size possible to be ≈ 205.47 households. To attain a representative sample of the study population living in Riyadh, we followed the WHO cluster sampling method.²⁵ Using a study design effect of 1.5 (as recommended by the STEPwise approach to NCD risk factor surveillance survey guideline),²⁶ we recalculated the sample size to be $205.47 \times 1.5 = 308$. Assuming a 10% non-response rate, the end sample size was determined to be $308 \times 100/90 = 343$ households. We increased the sample size to 1255 households to better understand the situation.

To select households, the sample size was divided into 60 clusters: 50 from urban areas and 10 from rural areas. The districts were randomly selected from each cluster, and households were sampled in proportion to the area's population. Only one household per apartment complex or building was included to ensure the sample was representative and geographically diverse. A substitute household was used if the home location was remote or inaccessible from a road or if the household refused to participate in the interview.

Data collection

Face-to-face interviews with the heads of selected households were conducted using a standardised questionnaire. To ensure reliability and consistency, interviews were

conducted during home visits by teams of well-trained interviewers who had previously been trained in administering the research questionnaire. Each team consisted of two men and one woman. Male household heads were interviewed by male interviewers, while female interviewers interviewed female household heads.

Measures and questionnaire

The questionnaire was built to accomplish the study's aims. The Andersen's behavioural model was used as a guideline to identify variables that may affect the OOPHE level.²⁷ Although Andersen's suggested concepts were used, further literature checks were conducted to confirm their suitability.

The questionnaire consisted of four sections: information on OOPHE, predisposing characteristics, enabling characteristics and need-based characteristics. Experts carefully checked the content validity of research materials to ensure that the structured questionnaire was suitable and contained the necessary information. A pilot research project was conducted to assess the questionnaire's reliability, and the questionnaire was tested on 30 participants on two occasions, 2 weeks apart. All the questionnaires that had been completed were reviewed for their internal validity (see online supplemental file 1).

The dependent variable

The primary outcome of this study was OOPHE. According to the International Classification for Health Accounts, OOPHE is defined as payments made at the time of using any healthcare item or service given by any type of provider, both formal and informal, including deductibles, copayments and coinsurance, and excluding prepayments made in the form of insurance and any compensation received from a third party.²⁸

The questionnaire included a section for reporting direct medical OOPHE. We did request estimated spending on several components of OOPHE to verify the overall OOPHE incurred by the family in the previous 3-month period when receiving healthcare. We used a 3-month time frame to minimise the likelihood of recall bias and assure the accuracy of the data given, as it has been shown that reporting error rises as the time frame of the recall time extends.²⁹ To determine which categories are important drivers of increased spending, we specify the following components: medical services, which include doctor consultations and physiotherapy; diagnostic tests, such as X-rays, ECG and pathology testing; hospital admission charges; medicines; and other expenses. The interviews did not include questions on inpatient and outpatient admissions. Other expenses included informal care, hearing aids, therapeutic appliances and equipment. Spending on nutritional supplements and alternative and/or traditional medicine was also included in OOPHE. All results were divided by three to report the monthly OOPHE at the household level.



Independent variables

To conduct our research, we identified independent variables of interest and recategorised them into three groups: predisposing, enabling and need-based characteristics. These variables describe to respondents and their households' characteristics.

Predisposing factors include information related to the household head such as gender, age, marital status (not married or married) and educational status (illiterate/read/write, school degree or higher education), and information related to the household, such as the total number of family members and the presence of at least one member less than 14 years old. According to previous studies, those who live alone are more likely to have health problems and to spend more money on healthcare than those who live in a household with others.^{30–34} It is unknown if those living alone in Saudi Arabia experience an increased burden. Thus, we collected information on the household living condition (alone or not alone).

Enabling factors include household head employment status (unemployed or employed), residential area (rural or urban), health insurance (yes or no) and having a regular doctor (yes or no). Taking into consideration the high level of unreliability,³⁵ including the reluctance of individuals to reveal accurate information about their income,³⁶ researchers consider a valid country-specific SES index as a better economic indicator for the household than income. Our study measured SES using the principal component analysis, which uses information from the households' asset holdings as a proxy for the SES of the household.³⁷ For each interview, an SES index was created using education level, household head employment status, type of housing, housing tenure, car ownership and ownership of household assets. We classified the type of housing as a traditional home, a villa, a floor in a villa, an apartment and other forms of housing. Furthermore, housing tenure was divided into four categories: house owned, home leased, the home provided and other forms of tenure. Data on car ownership were divided into three categories: no car, one car and two or more cars. We examined asset ownership using eight dichotomous variables (yes/no): phone available, television available, personal computer available, internet access, library available, satellite available, video available and video games available. The household's SES index was ranked into one of five quintiles, with the quintile including the poorest households labelled as the first quintile and the quintile containing the wealthiest households labelled as the fifth quintile.

Need-based characteristics include the household head's level of physical activity classified according to WHO guidelines³⁸ (active (at least 75 min of vigorous activity or at least 150 min of moderate or vigorous activity per week), moderately active (1–74 min of vigorous activity or 1–149 min of moderate or vigorous activity per week) or inactive (0 min of moderate or vigorous activity per week)); presence of at least one member with a chronic condition (yes or no); information on the presence of

at least one person with a disability condition, such as physical disability, mental disability, blindness, deafness/muteness or the other types of disability that interfere with their usual work or lifestyle (yes or no); and presence of at least one pregnant member (yes or no).

This study included all chronic diseases to reflect the full effect of diseases on households in Saudi Arabia. There is no conventional definition of a chronic condition. However, the broad consensus is that it is characterised as a condition that persists over a lengthy time. Various sources specify different amounts of time for a disease to be chronic, from 3 months to 1 year. Any individual using medicines regularly for the last 30 days was deemed to have a chronic condition in the current study. Participants in the study were asked whether they had been diagnosed with any of the following chronic diseases: cancer, hypertension, dyslipidaemia, diabetes mellitus, congestive heart failure, kidney disease, thyroid disease, pneumonia, psychiatric disease, anaemia or other chronic illnesses. Since our research determined the impact of the number of members with chronic illnesses on OOPHE, we did not request specific information about the disorders. The surveyed households were grouped into three categories: households not affected by a chronic condition (not-CCA households) when there was no chronically ill member in the household; households affected by one chronic condition (one-CCA households) when there was only one chronically ill member in the household; and households affected by more than one chronic condition (more-than-one-CCA households) when there was more than one chronically ill member in the household.

Statistical analysis

The household's head and characteristics were investigated for their many aspects during the descriptive analysis. To describe the OOPHE data, we used mean and SD. Then, to determine the effects of predisposing, enabling and need factors on OOPHE levels among CCA households, we used a generalised linear regression model (GLM) accounting for the specific characteristics of our data. GLM can effectively handle non-normality and heteroscedasticity data. For the final model specification, standardised specification testing was conducted. Link functions were selected using Box-Cox tests, and distribution families were selected using modified Park tests. A modified Park test and a Box-Cox regression indicated a gamma distribution with a log link function. Multiple diagnostics were used to assess the fit of the chosen link and family: the Pregibon link test, the Ramsey Regression Equation Specification Error Test and the modified Hosmer-Lemeshow goodness-of-fit test. We concluded that a log link function is most appropriate in all cases. The gamma distribution was better than other family distributions in general. We estimated all models with the exact specification, so results are comparable across OOPHE items: total OOPHE, medical services, medicines

and other expenses. Regression models adjusted for sociodemographic and other data characteristics.

Quantile multivariate regressions were used to estimate the associations among the number of members with a chronic condition and OOPHE level and the OOPHE distribution at the 10th, 25th, 50th, 75th and 90th percentiles, controlling for study variables. We applied the same models to estimate the impact on OOPHE's different categories, services, medicines and other expenses for a given number of members with chronic conditions. Quantile regression is similar to ordinary least squares regression that does not assume normality and homoscedasticity of the underlying distribution. Thus, it is appropriate for modelling highly skewed or non-normally distributed outcomes as it allows for the analysis of the complete distribution of the outcome variable, providing a vast landscape of different factors that can affect disease costs. The coefficients at lower percentiles represent the relationship of the number of members with chronic conditions with OOPHE in those individuals with low OOPHEs, while upper percentiles reveal the relationship for those with higher OOPHEs. The Kruskal-Wallis test was used to test for differences of OOPHE among quintiles. All data were analysed using SAS V.9.4. For all tests, a p value <0.05 was considered statistically significant. For all analyses, Saudi Arabian riyal (SAR) (US\$1=SAR3.75) was used as the currency.

Patient and public involvement

Patients and/or the public were not involved in the design, conduct, reporting or dissemination plans of this research.

RESULTS

This survey involved the interview of 1255 households. After excluding the 79 (6.3% of the total) households that could not provide all of the requested information, we had 1176 households remaining, for which the overall response rate was 88.2%.

Surveyed households' characteristics

Out of the total 1176 households, more than three-quarters (75.51%) were male-headed households, and the majority of household heads were aged 29 years and younger (27.3%) or between 30 and 39 years (21.17%). The study also revealed that the majority of household heads were married (82.65%), lived together with their families (91.84%), had a school degree (43.62%), were employed (55.1%) and were physically active (37.76%). Surveyed households' characteristics are shown in table 1.

The amount of OOPHE of households

Table 2 illustrates the average monthly OOPHE for households: total OOPHE and OOPHE related to healthcare services, medicines and other expenses across all households with different numbers of individuals with chronic conditions. The average total monthly household

Table 1 Surveyed households' characteristics (N=1176)

Characteristics	n	%
Predisposing		
Household head gender		
Female	288	24.49
Male	888	75.51
Household head age group (years)		
≤29	321	27.3
30–39	249	21.17
40–49	240	20.41
50–59	207	17.6
≥60	159	13.52
Household head marital status		
Not married	204	17.35
Married	972	82.65
Household head living condition		
Alone	96	8.16
With family	1080	91.84
Household head educational status		
Illiterate/read/write	174	14.8
School degree	513	43.62
Higher education	489	41.58
Number of family members		
≤3	384	32.65
4–6	528	44.9
≥7	264	22.45
Presence of at least one member less than 14 years of age		
No	552	46.94
Yes	624	53.06
Nationality		
Saudi	1116	94.90
Non-Saudi	60	5.10
Enabling		
Residential area		
Rural	264	22.45
Urban	912	77.55
Household head employment status		
Unemployed	528	44.9
Employed	648	55.1
SES index		
Q1 (Poorest) (lowest 20%)	156	13.27
Q2 (Poor)	327	27.81
Q3 (Middle)	288	24.49
Q4 (Wealthy)	234	19.9
Q5 (Wealthiest) (higher 20%)	171	14.54
Health insurance		
No	648	56.84

Continued



Table 1 Continued

Characteristics	n	%
Yes	492	43.16
Having a regular doctor		
No	624	53.06
Yes	552	46.94
Need based		
Household head's level of physical activity		
Active	444	37.76
Moderately active	420	35.71
Inactive	312	26.53
Presence of at least one member with a chronic condition		
No	456	38.78
Yes	720	61.22
Number of members with a chronic condition in the households		
Not-CCA household	456	38.78
One-CCA household	408	34.69
More-than-one-CCA household	312	26.53
Presence of at least one member with a disability		
No	864	75.79
Yes	276	24.21
Presence of at least one pregnant member		
No	958	81.51
Yes	218	18.49
Not-CCA household denotes households not affected by a chronic condition. One-CCA household denotes households affected by one chronic condition. More-than-one-CCA household denotes households affected by more than one chronic condition. SES, socioeconomic status.		

OOPHE was SAR1775. This appears to be driven mainly by healthcare services and medicines.

One-CCA households spent a total average of SAR1806 (SD=SAR297) on their health per month, three times as much as not-CCA households (mean=SAR651, SD=SAR454), with the most considerable portion of OOPHE spent on healthcare services. The average monthly OOPHE per more-than-one-CCA households was even more significant compared with not-CCA households (mean=SAR2704, SD=SAR466), with the most significant share of the OOPHE spent on medicines.

Determinants of OOPHE among all CCA households

According to GLM findings (table 3), regardless of the number of chronically ill household members, household head characteristics impact OOPHE. An older, better educated, employed household head had a positive coefficient ($p<0.0001$). At the household level, the number of family members, the number of members with chronic diseases, the presence of a member under 14 years old, non-Saudi nationality, urban residence and a person with a disability were positively linked with OOPHE ($p<0.0001$).

The findings also show that the amount of OOPHE increased significantly with the household SES increase. For example, the wealthiest (highest 20%) households tend to spend more on OOPHE compared with the poorest (coefficient=0.154, $p<0.0001$). Households covered by health insurance plans are remarkably associated with higher OOPHE than those without health insurance ($p<0.0001$). Finally, having a regular doctor has a negative effect on the level of OOPHE ($p<0.0001$).

The OOPHE distribution of households with varying numbers of chronic conditions was explored. Quantile regression findings are in table 4. The regression coefficient for the variable 'number of members with chronic conditions' is defined as the marginal change in the given quantile of the dependent variable that corresponds to the incremental change in the variable. Estimated coefficients and p values are divided into five percentiles.

Table 2 Distribution of OOPHE incurred by the household per month, SAR

OOPHE items	Number of members with chronic conditions							
	All households		Not-CCA household		One-CCA household		More-than-one-CCA household	
	N=1176		n=456		n=408		n=312	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Total OOPHE	1775	897	651	454	1806	297	2704	466
Services	653	323	335	265	849	131	861	169
Medicines	621	485	179	202	643	176	1240	346
Other expenses	321	209	136	88	313	72	602	136
Not-CCA household denotes households not affected by a chronic condition. One-CCA household denotes households affected by one chronic condition. More-than-one-CCA household denotes households affected by more than one chronic condition. OOPHE, out-of-pocket healthcare expenditure; SAR, Saudi Arabian riyal.								

Table 3 The effects of predisposing, enabling and need factors on OOPHE level among CCA households: generalised linear model (Box-Cox transformation)

Independent variable	Coefficients	95% CI	P value
Household head gender (reference category: Female)			
Male	0.015	−0.038 to 0.068	0.5
Household head age group, year (reference category: ≤29)			
30–39	−0.002	−0.082 to 0.078	0.9
40–49	0.084	0.007 to 0.161	0.03
50–59	0.079	0.008 to 0.149	0.02
≥60	0.225	0.152 to 0.297	<0.0001
Household head marital status (reference category: Not married)			
Married	0.023	−0.059 to 0.105	0.7
Household head living condition (reference category: Alone)			
With family	0.053	−0.098 to 0.204	0.1
Household head educational status (reference category: Illiterate/read/write)			
School degree	0.124	0.055 to 0.193	0.0005
Higher education	0.157	0.077 to 0.237	0.0001
Number of family members (reference category: ≤3)			
4–6	0.177	0.093 to 0.261	<0.0001
≥7	0.181	0.093 to 0.269	<0.0001
At least one member less than 14 years (reference category: No)			
Yes	0.131	0.079 to 0.182	<0.0001
Nationality (reference category: Saudi)			
Not Saudi	0.251	0.107 to 0.394	0.0007
Residential area (reference category: Rural)			
Urban	0.245	0.196 to 0.294	<0.0001
Household head employment status (reference category: Unemployed)			
Employed	0.133	0.068 to 0.198	<0.0001
SES index (reference category: Q1 (Poorest) (lowest 20%))			
Q2 (Poor)	0.011	−0.034 to 0.056	0.9
Q3 (Middle)	0.081	0.026 to 0.136	0.01
Q4 (Wealthy)	0.079	0.008 to 0.149	0.02
Q5 (Wealthiest) (higher 20%)	0.154	0.077 to 0.231	<0.0001
Health insurance (reference category: No)			
Yes	0.112	0.061 to 0.163	<0.0001
Having a regular doctor (reference category: No)			
Yes	−0.151	−0.227 to −0.074	<0.0001
Household head's level of physical activity (reference category: Active)			
Moderately active	0.001	−0.061 to 0.063	0.9
Inactive	0.029	−0.041 to 0.099	0.07
At least one member with a disability (reference category: No)			
Yes	0.292	0.237 to 0.347	<0.0001
At least one pregnant member (reference category: No)			
Yes	0.004	−0.049 to 0.057	0.8
Not-CCA household denotes households not affected by chronic conditions. One-CCA household denotes households affected by one chronic condition. More-than-one-CCA household denotes households affected by more than one chronic condition. Results are controlled for study variables. OOPHE, out-of-pocket healthcare expenditure; SES, socioeconomic status.			

Table 4 Quantile regression results for the number of individuals with chronic conditions associated with monthly OOPHE

OOPHE items	Number of members with chronic conditions	Quantile regression										P value†
		10th percentile		25th percentile		50th percentile		75th percentile		90th percentile		
		β (SAR)	95% CI	β (SAR)	95% CI	β (SAR)	95% CI	β (SAR)	95% CI	β (SAR)	95% CI	
Overall OOPHE	Not-CCA household‡											
	One-CCA household	646*	550 to 743	689**	597 to 781	1261*	1219 to 1303	1329**	1294 to 1363	1209**	1174 to 1244	0.007
	More-than-one-CCA household	1772**	1600 to 1943	1722*	1613 to 1831	1649***	1518 to 1779	2099**	2051 to 2146	2072**	2027 to 2117	0.0003
Services	Not-CCA household‡											
	One-CCA household	383**	373 to 393	261**	253 to 268	610***	606 to 614***	653*	639 to 666	590**	580 to 599	<0.0001
	More-than-one-CCA household	406**	387 to 426	325**	311 to 338	608*	595 to 621	516*	459 to 572	692**	673 to 710	<0.0001
Medicine	Not-CCA household‡											
	One-CCA household	473**	462 to 483	470*	464 to 477	549**	543 to 555	369*	322 to 417	259***	156 to 362	0.05
	More-than-one-CCA household	785*	762 to 807	947*	933 to 960	1141*	1128 to 1154	1159**	1107 to 1212	1260***	1162 to 1357	<0.0001
Other expenses	Not-CCA household‡											
	One-CCA household	221*	218 to 223	204*	197 to 210	128	106 to 150	157	137 to 176	166**	154 to 177	0.006
	More-than-one-CCA household	464**	455 to 472	473**	461 to 484	471**	418 to 525	515**	491 to 538	517***	507 to 526	<0.0001
Not-CCA household denotes households not affected by a chronic condition. One-CCA household denotes households affected by one chronic condition. More-than-one-CCA household denotes households affected by more than one chronic condition. Coefficients are estimated after adjusting for study variables. *P<0.05; **p<0.01; ***p<0.001. †Kruskal-Wallis test for differences across quintiles. ‡Reference. OOPHE, out-of-pocket healthcare expenditure; SAR, Saudi Arabian riyal.												

Not-CCA household denotes households not affected by a chronic condition. One-CCA household denotes households affected by one chronic condition. More-than-one-CCA household denotes households affected by more than one chronic condition.

Coefficients are estimated after adjusting for study variables.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

†Kruskal-Wallis test for differences across quintiles.

‡Reference.

OOPHE, out-of-pocket healthcare expenditure; SAR, Saudi Arabian riyal.

According to the data, the number of chronic conditions in a household affects OOPHE and its categories differently as the quantile increases. A household's higher number of chronic conditions were related to higher total OOPHE at the top range of health expenditures. One-CCA households had greater effects on OOPHE than not-CCA households, shown at the top of the expenditure distribution (coefficients of SAR646 at the 10th percentile and SAR1209 at the 90th percentile, respectively).

DISCUSSION

OOPHE restricts comprehensive healthcare and financial support, particularly for people with chronic conditions. In Saudi Arabia, identifying population groups that OOPHE may disproportionately impact is crucial. Thus, we examined OOPHE levels in Riyadh Province, Saudi Arabia. The data showed that CCA households reported much higher OOPHE than households with no members with chronic conditions, which is mirrored in the international literature.^{39–41} Looking closely into the composition of OOPHE, we found that households with more than one member suffering from health conditions have greater OOPHE for services and medicines due to their complex care and treatment needs. Our findings are consistent with those of the earlier studies.^{42–44} Policymakers may consider moving from a single-disease perspective to one that includes multimorbidity, especially when allocating financial resources and devising policy strategies.

Additionally, the study examined the relationship between predisposing, enabling and need variables and the magnitude of OOPHEs among CCA households. Our data indicated that the risk of OOPHE was greater in homes headed by older adults, which is in line with previous results.⁴¹ This increased likelihood is due to greater demand for and utilisation of healthcare services by the older generation than by younger age groups. Our research also found that a household head with a higher educational level was associated with a higher level of OOPHE, probably due to higher awareness of the importance of health and more knowledge about healthcare alternatives. This conclusion corroborates research performed in other nations.^{45–46} Our study also discovered that employment status is a major factor. Our finding indicated that employed heads of households are more likely to have larger OOPHE than those who were unemployed. This conclusion is consistent with findings from other nations' investigations.^{47–48} The research found that the 'number of family members' affected OOPHE. Increasing family size increases medical care use and OOPHE. China and Serbia had similar outcomes.^{49–50} On the other hand, this finding contradicts Li *et al* and Choi *et al*.^{48–51} The number of chronically ill household members is a key predictor of OOPHE. As noted, chronic illness prevalence is linked to higher monthly OOPHE. Our results confirm an earlier study on a similar relationship.⁴⁹ A member under 14 is another statistically significant indicator of household healthcare costs. The coefficients

show that adding a member under 14 to the household increases OOPHE, in agreement with prior research.^{49–52} Further, the need for care in terms of the presence of a member with a disability in the household increases the risk of experiencing OOPHE. Disabled people have been found to have a greater need for healthcare, as many studies show.⁵³ Moreover, there is a substantial correlation between a disabled family member's presence and chronic illnesses in most instances.⁵⁴ Experiencing higher OOPHE was significantly associated with nationality, and this effect was highest among the non-Saudi nationals, which seemed to contradict an earlier study.²¹ This contradiction may be due to the differences in methods and population characteristics, as we only focused on those who received care 3 months before the interview. This is an expected finding as over 80% of non-Saudis work in the private sector,⁵⁵ which would limit their access to government-run medical facilities. Another unexpected finding was that the level of OOPHE was much greater in urban households than in rural households. This appears counterintuitive and contradictory to what is observed in other countries.^{41–56–57} Urban regions may be more likely to have superior medical facilities and specialists, and patients with chronic conditions tend to live in close proximity to them.

Our data suggest that wealthy families are more likely to have OOPHE than poor households. It is safe to infer that the lower class has limited access to medical care and tends to avoid doctors owing to budgetary issues.⁵⁸ This finding emphasised the vulnerable position of the poor population when seeking health services. Although data from various countries indicate that insured households incur lower OOPHE,^{46–59} our results show that households covered with health insurance spend more on OOPHE. A close look at the connection suggests that health insurance is inadequate to control OOPHE. However, denying health insurance because of this perception may be misguided. Improved access to treatment and greater healthcare use by insured households may explain the high OOPHE. On the other side, it might be due to adverse selection: families make insurance purchase choices based on their estimated risks; thus, those with chronic conditions are more likely to buy the insurance and use more healthcare services. Insured households with generous plans face moral hazards from the increased usage of services.⁶⁰ Finally, having a regular doctor has a robust detrimental influence on the OOPHE level. Usually, households with a doctor who visits them regularly have better access to preventive services and are more likely to follow the doctor's prescriptions. Consequently, such patients are less likely than others to return for follow-up appointments after an emergency department visit and have lower rates of health and drug complications.^{61–62}

The quantile regression analysis results offer supplemental information on how the number of members in a household with chronic conditions influences the household's overall OOPHE. The mean of OOPHE across

the number of individuals with chronic conditions in the household indicates an obvious positive increasing pattern along the OOPHE distribution, reflecting that its mean significantly overestimates having an individual with expenditures related to a chronic condition at the lower end of OOPHE distribution and underestimates the difference of medical payments between different numbers of members with chronic conditions at higher quantiles along the expenditure distribution. The result implies that the number of individuals with chronic conditions in a household imposes weaker effects on OOPHE when the OOPHE is at a small scale, and this effect is increased as the OOPHE becomes larger.

It is essential to analyse the potential financial impact of other expenses, particularly for low-income households. Although our data indicate that families with several CCAs incur much higher costs across the quantiles, other expenses may disproportionately impact low-income families, who are also more likely to experience catastrophic health costs. In other words, low-income families may allocate much of their income to other expenses than higher income families. Policymakers should ensure that people with chronic diseases from low-income families get the help they are entitled to and do not have to carry the financial burden associated with their condition.

Survey data and methodology have certain limitations. First, the present data were based on a cross-sectional survey with self-reported OOPHE, which may be impacted by recall and reporting bias. Second, individuals with untreated chronic diseases were not included in our research. Because untreated chronic diseases tend to develop into other conditions and health issues that impose an additional financial burden, the total OOPHE reported in our research may be underestimated. Third, the research did not examine each chronic condition's influence on OOPHE. Future studies must address these gaps and examine how OOPHE is linked to specific chronic diseases. Fourth, the study sample comprised households receiving care 3 months before the interview; OOPHE may be overstated relative to the general population.

Despite these limitations, our results have significant implications for Saudi strategy. Saudi Arabia has undertaken several financial reforms as part of its Health Sector Transformation Program. The government has created the Center for National Health Insurance (CNHI), formerly known as the Program for Health Assurance and Purchasing, to guarantee that all citizens and legal residents who work in the government sector have access to free, accessible and high-quality healthcare. People are eligible only if registered at the Primary Healthcare Center, regardless of SES.⁶³ The Center receives funding from the Ministry of Finance, which it uses to purchase healthcare services from providers via health clusters. Purchased services are based on a benefits package that is heavily founded on clinical and cost-effectiveness studies to ensure the delivery of appropriate care. The CNHI is currently developing a payment structure to

fund health clusters. Before implementation, it must be planned appropriately, and lowering OOPHE should be a priority. Seniors, individuals with disabilities and chronic conditions and those on social assistance would have lower copayments and subsidised prescriptions. Another reform is a supplementary health insurance system that will allow most citizens and residents to add additional benefits.⁶⁴ These reforms are expected to reduce OOPHE and provide financial protection against high OOPHE only if policymakers consider the impact of these policies on persons with chronic conditions and their families. However, their effectiveness can be assessed to improve access to healthcare and reduce OOPHE in families. From the clinical practice perspective, OOPHE associated with chronic diseases can be further minimised by adopting the patient-centred medical home model of care. This model is based on the same principles as the chronic care model, with the primary goal of providing patients with organised, proactive and coordinated care rather than episodic treatments to improve outcomes while lowering management costs.^{65 66}

CONCLUSIONS

Our findings indicate that CCA families pay considerably greater OOPHE compared with not-CCA households. The number of individuals with chronic conditions in a home played a substantial and more prominent role, with a more significant and apparent influence on the higher quantile (vs the lower quantile). The determinants of OOPHE were studied to identify helpful information for decision-making to reduce the OOPHE among households with chronic conditions. These results may give helpful information to policymakers in the implementation of future healthcare transformation programme policies.

Author affiliations

¹Clinical Pharmacy, Prince Sattam Bin Abdulaziz University, Al Kharj, Saudi Arabia

²Clinical Pharmacy, Prince Sattam Bin Abdulaziz University College of Pharmacy, Al-Kharj, Saudi Arabia

³Clinical Leadership Department, Center of National Health Insurance, Riyadh, Saudi Arabia

⁴General Directorate for National Health Economics and Policy, Saudi Health Council, Riyadh, Saudi Arabia

⁵Clinical Pharmacy, Al-Jouf University College of Pharmacy, Sakaka, Saudi Arabia

⁶Medical Research Administration, Prince Mohammed Bin Abdul Aziz Hospital, Riyadh, Saudi Arabia

⁷Clinical Research Department, King Fahad Medical City, Riyadh, Saudi Arabia

Twitter Abdulhadi M Alqahtani @Ph_Abdalhadi

Acknowledgements This project was supported by the Deanship of Scientific Research at Prince Sattam Bin Abdulaziz University. The authors would like to thank the Research Center at King Fahd Medical City, Riyadh, for their valuable support in reviewing and proofreading this manuscript.

Contributors ZSA, AKA and AMAIs designed the study and were responsible for the overall content as the guarantor. AKA, NA, KHA, AMAIs, ASAlq, AGA and AIA collected the data. ZSA, MAAlr, AKA and AMAIs provided statistical expertise. ZSA, AMAIq and MA critically revised the manuscript and analysed the data. Moreover, ZSA, MAAlr, KHA, ASAlq and AGA performed questionnaire translation and literature review. NA and MAAla provided administrative support. ZSA, AA, AIA and MA made critical

revisions to the paper for important scientific content and reviewed various drafts and the final manuscript. All authors read and approved the final manuscript.

Funding This research was funded by Deputyship for Research and Innovation, Ministry of Education in Saudi Arabia (grant number: IF-PSAU- 2021/03/18178).

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting or dissemination plans of this research.

Patient consent for publication Parental/guardian consent obtained.

Ethics approval This study involves human participants and was subjected to the Ministry of Health Institutional Review Board evaluation and approved (IRB number: 00010471). In agreement with the World Medical Association Declaration of Helsinki, the study met ethical standards. The data anonymisation and aggregation were used to ensure the confidentiality of the information. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iD

Ziyad S Almalki <http://orcid.org/0000-0003-1618-4142>

REFERENCES

- 1 Al-Hanawi MK, Khan SA, Al-Borie HM. Healthcare human resource development in Saudi Arabia: emerging challenges and opportunities-a critical review. *Public Health Rev* 2019;40:1-6.
- 2 Tyrovolas S, ElBcheraoui C, Alghnam SA, et al. The burden of disease in Saudi Arabia 1990-2017: results from the global burden of disease study 2017. *Lancet Planet Health* 2020;4:e195-208.
- 3 The World Bank. World development indicators. Available: <https://databank.worldbank.org/data/reports.aspx?source=2&series=SH.XPD.GHED.GE.ZS>
- 4 Saudi Industrial development fund. The report Saudi Arabia, 2020. Available: <https://www.sidf.gov.sa/en/Documents/The%20Report%20Saudi%20Arabia%202020%20-%20Digital%20version.pdf>
- 5 World Health Organization. Noncommunicable diseases progress monitor, 2020. Available: <https://www.who.int/publications/i/item/9789240000490>
- 6 Almalki M, Fitzgerald G, Clark M. Health care system in Saudi Arabia: an overview. *East Mediterr Health J* 2011;17:784-93.
- 7 Rahman R. The privatization of health care system in Saudi Arabia. *Health Serv Insights* 2020;13:1178632920934497.
- 8 Essue BM, Laba T-L, Knaul F. Economic burden of chronic ill-health and injuries for households in low and middle-income countries. In: *Disease control priorities: improving health and reducing poverty*. Washington, DC: World Bank Group, 2017: 121-43.
- 9 World Health Organization & United Nations Development Programme. The investment case for noncommunicable disease prevention and control in Mongolia: return on investment analysis and institutional context analysis. Available: <https://apps.who.int/iris/handle/10665/259627>
- 10 World Health Organization. Global health expenditure database, by country 2000-2018-Saudi Arabia. Available: https://apps.who.int/nha/database/country_profile/Index/en
- 11 Paez KA, Zhao L, Hwang W. Rising out-of-pocket spending for chronic conditions: a ten-year trend. *Health Aff* 2009;28:15-25.
- 12 Almutairi KM, Moussa M. Systematic review of quality of care in Saudi Arabia. A forecast of a high quality health care. *Saudi Med J* 2014;35:802-9.
- 13 Van Minh H, Xuan Tran B. Assessing the household financial burden associated with the chronic non-communicable diseases in a rural district of Vietnam. *Glob Health Action* 2012;5:1-7.
- 14 Huffman MD, Rao KD, Pichon-Riviere A, et al. A cross-sectional study of the microeconomic impact of cardiovascular disease hospitalization in four low- and middle-income countries. *PLoS One* 2011;6:e20821.
- 15 Murphy A, Palafox B, Walli-Attaei M, et al. The household economic burden of non-communicable diseases in 18 countries. *BMJ Glob Health* 2020;5:e002040.
- 16 Jan S, Laba T-L, Essue BM, et al. Action to address the household economic burden of non-communicable diseases. *Lancet* 2018;391:2047-58.
- 17 Dodd R, Palagyi A, Guild L, et al. The impact of out-of-pocket costs on treatment commencement and adherence in chronic kidney disease: a systematic review. *Health Policy Plan* 2018;33:1047-54.
- 18 Lafata JE, Cerghet M, Dobie E, et al. Measuring adherence and persistence to disease-modifying agents among patients with relapsing remitting multiple sclerosis. *J Am Pharm Assoc* 2008;48:752-7.
- 19 Burney NA, Alenezi M, Al-Musallam N, et al. The demand for medical care services: evidence from Kuwait based on households' out-of-pocket expenses. *Appl Econ* 2016;48:2636-50.
- 20 Lin T-yu, Zhang X-yan, Fang P-qian, et al. Out-Of-Pocket expenses for myasthenia gravis patients in China: a study on patients insured by basic medical insurance in China, 2013-2015. *Orphanet J Rare Dis* 2020;15.
- 21 Al-Hanawi MK, Mwale ML, Qattan AMN. Health insurance and out-of-pocket expenditure on health and medicine: heterogeneities along income. *Front Pharmacol* 2021;12:638035.
- 22 The General Authority for Statistics in Saudi Arabia. Statistical Yearbook of 2018. Available: <https://www.stats.gov.sa/ar/258>
- 23 The General Authority for Statistics in Saudi Arabia. Saudi Arabian census report for 2010. Available: <https://www.stats.gov.sa/en/73>
- 24 The General Authority for Statistics in Saudi Arabia. GASTAT releases results of household health survey, 2018. Available: <https://www.stats.gov.sa/en/news/326>
- 25 Rose AMC, Grais RF, Coulombier D, et al. A comparison of cluster and systematic sampling methods for measuring crude mortality. *Bull World Health Organ* 2006;84:290-6.
- 26 World Health Organization. The WHO STEPwise approach to noncommunicable disease risk factor surveillance (STEPS). Available: <https://www.who.int/teams/noncommunicable-diseases/surveillance/systems-tools/steps>
- 27 Andersen RM. Revisiting the behavioral model and access to medical care: does it matter? *J Health Soc Behav* 1995;36:1-10.
- 28 World Health Organization. Distribution of health payments and catastrophic expenditures methodology. Available: <https://apps.who.int/iris/handle/10665/69030>
- 29 Dalziel K, Li J, Scott A. Accuracy of patient recall for self-reported doctor visits: is shorter recall better? *Health Econ* 2018;11:1684-98.
- 30 Lassila J, Valkonen T. Health and long-term care expenditure in Finland when living alone increases. *Nordic Journal of Political Economy* 2014;39:1-5.
- 31 Shin S. The financial burden of catastrophic health expenditure among older women living alone. *Korean Family Resource Management Association* 2019;23:17-34.
- 32 Ming W, Danan G. Living arrangements and disability among older adults in China. *China: An International Journal* 2021;p. 19.
- 33 Yang T, Chu J, Zhou C, et al. Catastrophic health expenditure: a comparative analysis of empty-nest and non-empty-nest households with seniors in Shandong, China. *BMJ Open* 2016;6:e010992.
- 34 Jing Z, Li J, Fu PP, et al. Catastrophic health expenditure among single empty-nest elderly with multimorbidity in rural Shandong, China: the effect of co-occurrence of frailty. *Int J Equity Health* 2021;20:23.
- 35 Howe LD, Hargreaves JR, Gabrysch S, et al. Is the wealth index a proxy for consumption expenditure? A systematic review. *J Epidemiol Community Health* 2009;63:871-7.
- 36 Davidson R, Gwatkin SR, Jhonson K. Socio-Economic differences in health, nutrition and population within developing countries. Available: <http://bvssan.incap.int/local/File/PubNut-Per%20C3%BA%20texcom/nutricion/Overview.pdf>
- 37 AlOmar RS, Parslow RC, Law GR. Development of two socioeconomic indices for Saudi Arabia. *BMC Public Health* 2018;18:1-0.

- 38 Bull FC, Al-Ansari SS, Biddle S, *et al.* World Health organization 2020 guidelines on physical activity and sedentary behaviour. *Br J Sports Med* 2020;54:1451–62.
- 39 Callander EJ, Corscadden L, Levesque J-F. Out-of-pocket healthcare expenditure and chronic disease - do Australians forgo care because of the cost? *Aust J Prim Health* 2017;23:15–22.
- 40 Correa-Burrows P. Out-Of-Pocket health care spending by the chronically ill in Chile. *Procedia Econ Financ* 2012;1:88–97.
- 41 Sum G, Hone T, Atun R, *et al.* Multimorbidity and out-of-pocket expenditure on medicines: a systematic review. *BMJ Glob Health* 2018;3:e000505.
- 42 Shumet Y, Mohammed SA, Kahissay MH, *et al.* Catastrophic health expenditure among chronic patients attending Dessie referral Hospital, northeast Ethiopia. *ClinicoEconomics Outcomes Res* 2021;13:99–107.
- 43 Pallegedara A. Impacts of chronic non-communicable diseases on households' out-of-pocket healthcare expenditures in Sri Lanka. *Int J Health Econ Manag* 2018;18:301–19.
- 44 Wallace E, Salisbury C, Guthrie B, *et al.* Managing patients with multimorbidity in primary care. *BMJ* 2015;350:h176.
- 45 You X, Kobayashi Y. Determinants of out-of-pocket health expenditure in China. *Appl Health Econ Health Policy* 2011;9:39–49.
- 46 Hong GS, Kim SOOY. Out-Of-Pocket health care expenditure patterns and financial burden across the life cycle stages. *J Consum Aff* 2000;34:291–313.
- 47 Yardim MS, Cililingiroglu N, Yardim N. Catastrophic health expenditure and impoverishment in turkey. *Health Policy* 2010;94:26–33.
- 48 Li Y, Wu Q, Xu L, *et al.* Factors affecting catastrophic health expenditure and impoverishment from medical expenses in China: policy implications of universal health insurance. *Bull World Health Organ* 2012;90:664–71.
- 49 Li X, Shen JJ, Lu J, *et al.* Household catastrophic medical expenses in eastern China: determinants and policy implications. *BMC Health Serv Res* 2013;13:506.
- 50 Arsenijevic J, Pavlova M, Groot W. Measuring the catastrophic and impoverishing effect of household health care spending in Serbia. *Soc Sci Med* 2013;78:17–25.
- 51 Choi JW, Kim TH, Jang SI, *et al.* Catastrophic health expenditure according to employment status in South Korea: a population-based panel study. *BMJ Open* 2016;6:e011747.
- 52 Abeldaño RA. Analysis of household expenditure on healthcare in Argentina, as a component of universal health coverage. *Cien Saude Colet* 2017;22:1631–40.
- 53 Krahn GL, Walker DK, Correa-De-Araujo R. Persons with disabilities as an unrecognized health disparity population. *Am J Public Health* 2015;105 Suppl 2:S198–206.
- 54 Ćwirlej-Sozańska A, Wilmowska-Pietruszyńska A, Sozański B, *et al.* Analysis of chronic illnesses and disability in a community-based sample of elderly people in south-eastern Poland. *Med Sci Monit* 2018;24:1387.
- 55 Alkhamis AA. The association between insured male expatriates' knowledge of health insurance benefits and lack of access to health care in Saudi Arabia. *BMC Public Health* 2018;18:1–9.
- 56 Zhou Z, Gao J. Study of catastrophic health expenditure in China's basic health insurance. *Health Med* 2011;5:1498.
- 57 Gotsadze G, Zoidze A, Rukhadze N. Household catastrophic health expenditure: evidence from Georgia and its policy implications. *BMC Health Serv Res* 2009;9:69.
- 58 Zhao X, Ming D-yao, Ma W-jun, Wj M. [Utilization and cost of outpatient care and their influencing factors among middle and aged peasant-workers in China]. *Beijing Da Xue Xue Bao Yi Xue Ban* 2015;47:464–8.
- 59 Kawabata K, Xu K, Carrin G. Preventing impoverishment through protection against catastrophic health expenditure. *Bull World Health Organ* 2002;80:612.
- 60 Bajari P, Dalton C, Hong H, *et al.* Moral hazard, adverse selection, and health expenditures: a semiparametric analysis. *Rand J Econ* 2014;45:747–63.
- 61 Lambrew JM, DeFriese GH, Carey TS, *et al.* The effects of having a regular doctor on access to primary care. *Med Care* 1996;34:138–51.
- 62 Deressa W, Hailemariam D, Ali A. Economic costs of epidemic malaria to households in rural Ethiopia. *Trop Med Int Health* 2007;12:1148–56.
- 63 63. health sector transformation program delivery plan. Available: https://www.vision2030.gov.sa/media/0wop2tds/hstp_eng.pdf
- 64 The government of Saudi Arabia. National transformation program, 2016. Available: <https://www.moh.gov.sa/en/Ministry/vro/Documents/Healthcare-Transformation-Strategy.pdf>
- 65 Almalki ZS, Karami NA, Almsoudi IA, *et al.* Patient-Centered medical home care access among adults with chronic conditions: national estimates from the medical expenditure panel survey. *BMC Health Serv Res* 2018;18:744.
- 66 Almalki ZS, Alotaibi AA, Alzaidi WS, *et al.* Economic benefits of implementing patient-centered medical home among patients with hypertension. *Clinicoecon Outcomes Res* 2018;10:665.