Individual and contextual factors associated with barriers to accessing healthcare among women in Papua New Guinea: insights from a nationwide demographic and health survey

Abdul-Aziz Seidu [a,b,*], **Ebenezer Agbaglo**[c], **Louis Kobina Dadzie**[a], **Bright Opoku Ahinkorah**[d], **Edward Kwabena Ameyaw**[d] **and Justice Kanor Tetteh**[a]

[a]Department of Population and Health, University of Cape Coast, Cape Coast, Ghana; [b]College of Public Health, Medical and Veterinary Sciences, James Cook University, Townsville, Queensland, Australia; [c]Department of English, University of Cape Coast, Cape Coast, Ghana; [d]School of Public Health, Faculty of Health, University of Technology Sydney, Australia

*Corresponding author: Tel: +233244291198; E-mail: abdul-aziz.seidu@stu.ucc.edu.gh

Background: This study sought to assess the individual and contextual factors associated with barriers to accessing healthcare among women in Papua New Guinea.

Methods: The study was conducted among 14 653 women aged 15–49 y using data from the 2016–2018 Papua New Guinea Demographic and Health Survey. The outcome variable was barriers to accessing healthcare. Descriptive and multilevel logistic regression analyses were conducted. Statistical significance was declared at $P < 0.05$.

Results: Women aged 15–19 y were more likely to experience at least one barrier compared with those aged 40–49 y (adjusted OR [AOR]=1.48; 95% CI 1.18 to 1.86). Women with secondary/higher education (AOR=0.68; 95% CI 0.57 to 0.81), women in the richest wealth quintile (AOR=0.36; 95% CI 0.28 to 0.46) and those in the least disadvantaged socioeconomic status (AOR=0.46; 95% CI 0.33 to 0.64) had lower odds of having challenges with at least one barrier to healthcare. However, living in rural areas increased the odds of facing at least one barrier to healthcare (AOR=1.87; 95% CI 1.27 to 2.77).

Conclusions: This study has demonstrated that both individual and contextual factors are associated with barriers to healthcare accessibility among women in Papua New Guinea. To enhance the achievement of the Sustainable Development Goals 3.1, 3.7 and 3.8, it is critical to deem these factors necessary and reinforce prevailing policies to tackle barriers to accessing healthcare among women in Papua New Guinea.

Keywords: barriers, global health, healthcare, Papua New Guinea, public health, women's health.

Introduction

Women play important roles in every society and their health is of immense importance to the international community.[1,2] As such, international development agendas often place particular focus on their health. Currently, women's well-being is being given the utmost attention in the Sustainable Development Goals (SDGs). Specifically, SDGs 3.7 and 3.8 focus on ensuring universal accessibility to sexual and reproductive healthcare services, as well as the integration of such services into national strategies and programmes by 2030.[3,4] Similarly, SDG 3.1 aims to ensure a reduction in the world maternal mortality ratio to as low as

70 per 100 000 live births by 2030. Despite these targets, globally, a large number of women still die each year. In 2017, maternal mortality alone claimed the lives of about 295 000 women.[5] A significant number of women die of diseases such as ischaemic heart disease, stroke, obstructive pulmonary disease, Alzheimer's disease, diabetes, hypertension and lung cancer.[6] However, the majority of these deaths could be prevented through utilisation of better and accessible healthcare delivery systems. In the Western Pacific, thousands of women face a variety of health problems at every stage of life. They also face gender discrimination, often backed by sociocultural norms that serve as obstacles to

their health and socioeconomic status.[7] In the Western Pacific, there are cross-country variations in terms of women's health, with Papua New Guinea (PNG) being among those countries with the poorest women's healthcare services.[7]

In PNG, healthcare is provided by institutions such as aid posts, health centres and hospitals.[8] The hospitals (both provincial and district) provide emergency and outpatient care, as well as support to public health programmes. The services provided by rural health centres and urban clinics include management of chronic and acute conditions, basic surgical care, deliveries and paediatric care, as well as serving as intermediary referral points between lower-level district facilities and district hospitals. Health subcentres (which are based in rural areas) provide the same services as health centres, whereas aid posts deliver basic healthcare services such as mother and child care and community-based health promotion. In remote areas, health services are extended through outreach, patrols and village health volunteer networks.[9] Healthcare professionals in PNG include doctors, health extension officers, nurses, community health workers and aid post orderlies. The doctor-to-population ratio is estimated at 1:19 399, with few doctors posted outside the capital city, Port Moresby.[10] The mountainous nature of PNG's topography, coupled with its dominant rural and remote settings as well as cultural and linguistic diversity, serve as impediments to accessing healthcare.[8]

In PNG, the state of women's healthcare has been deteriorating during recent years. From 2012 to 2016, the prevalence of women's antenatal healthcare visits decreased from 66% to 54%.[11] Additionally, PNG has recorded the highest maternal mortality ratio in the Western Pacific, estimated at around 98 to 733 per 1000 live births,[12] with most of the deaths resulting from obstetric haemorrhage, sepsis, embolism, eclampsia and unsafe abortion.[13] In addition, a substantial number of women in PNG suffer from diseases such as diabetes, malaria and HIV.[14] What worsens the situation is the lack of health practitioners and drugs, low education, poverty and poor water and sanitation.[13] The health situation of women in PNG highlights the need to introduce health interventions and strengthen existing ones, so as to improve the health of women. The effectiveness of such interventions requires an understanding of the health situation of women in the country.

Previous studies of the health situation of women in PNG focused mainly on issues related to maternal mortality, such as maternal health indicators,[13] the use of safe surgery and anaesthesia to reduce maternal mortality,[12] the impact of maternal mortality on children[15] and using maternal health telephone lines to save women.[16] A few others have focused on women's health in general.[17,18] What previous studies seem to have overlooked is the likelihood of women in PNG facing barriers in their attempts to access healthcare. This is critical, since women in PNG face gender inequality, as is evident, for example, in men dominating the political landscape while women's issues are rarely reflected in government policies and decision-making.[17] One earlier attempt to investigate barriers to women's access to healthcare in PNG was Hinston and Earnest's study,[17] which used qualitative methods to explore barriers to healthcare access as infringements of the rights of women. The authors identified violence, a heavy workload, a lack of economic opportunities and limited use of health services as barriers to women's health in

PNG. However, Hinston and Earnest's[17] sample comprised only 70 women, which brings into question the generalisability of their findings to all women in PNG. In the current study, we used nationally representative data to quantitatively investigate the factors associated with barriers to women's access to healthcare in PNG, with the aim of producing findings that reflect the situation of women in PNG. Globally, the predictors of barriers to healthcare access among women are age, marital status, educational level, employment, religion, parity and health insurance subscription, all of which could be associated with barriers to women's healthcare access in PNG.[18,19]

Materials and Methods

Data source
The data used for this study form part of the 2016–2018 Papua New Guinea Demographic Health Survey (PDHS), which were collected from October 2016 to December 2018. The survey adopted a two-stage stratified sampling technique. The survey used the list of census units (CUs) from the 2011 PNG National Population and Housing Census as the sampling frame. Administratively, the country is divided into 22 provinces and each province is subdivided into urban and rural areas. Each province is also divided into districts and each district is divided into local level governments, which are in turn divided into wards. Each ward is composed of CUs. The average CU size is 50 households, with urban CUs having 70 households on average and rural CUs having 48. The sampling frame contains information on CU location, type of residence (urban or rural), the estimated number of residential households and population by gender. Before sampling, the provinces in the country were apportioned into urban and rural areas, which yielded 43 strata; however, the National Capital District only had urban areas. Samples of CUs were selected independently in each stratum in two stages. Implicit stratification and proportional allocation were achieved at each of the lower administrative levels by sorting the sampling frame within each sampling stratum before sample selection, according to administrative units at different levels, and by using a probability proportional-to-size selection at the first stage of sampling. Stage 1 involved the selection of 800 CUs. This was performed through probability proportional to CU size. The second stage saw the systematic selection of 24 households from each cluster through probability sampling and this yielded a total of 19 200 households. For this study, we focused on women of reproductive age (14 653); complete information on the variables used in the present study are available in the Papua New Guinea Demographic and Health Survey 2016–2018 (pp. 1–2).[20] Details of the methodology, pretesting, training of field workers, sampling design and selection are available in the PDHS final report (https://dhsprogram.com/publications/publication-fr364-dhs-final-reports.cfm).

Variables
Outcome variable

The outcome variable was barrier to healthcare accessibility. In the PDHS, each woman was interviewed to answer four questions on barriers to accessing healthcare based on obtaining money,

distance to health facility, receiving permission for treatment and not wanting to go alone. If a woman faced at least one of the problems (money, distance, companionship or permission) then she was considered to have a barrier to healthcare access and coded as '1'. Conversely, if she did not report any barriers she was considered to have no barrier to healthcare access and was coded as '0'.[18,19]

Independent variables

Individual and contextual factors were considered as independent variables in this study. These variables were selected based on their statistical significance in previous studies.[18,19] The individual level factors included age, marital status, educational level, employment, religion, parity, health insurance subscription and exposure to mass media (radio, newspaper and television). The contextual variables were gender of the head of the household, household wealth status, residence, regional and community level socioeconomic status (Table 1). Community level socioeconomic status was generated by aggregating the individual level data into clusters, except for place of residence and geographical region, which were taken as they were. It was operationalised with a principal component comprising the proportion of respondents with no formal education, unemployed, rural resident and living below the poverty level (asset index <20% poorest quintile). A standardised score with mean 0 and SD 1 was generated from this index, with higher scores being indicative of a lower socioeconomic position. We divided the resultant scores into tertiles to allow for non-linear effects and provided results that were more readily interpretable in the policy arena.[21]

Statistical analyses

The data were analysed with STATA version 14.2 for MacOS (Statacorp college station, TX, USA). Three basic steps were followed to analyse the data. The first step was the use of descriptive statistics to describe the sample (univariate analysis) and also the tabulation of all the independent variables against each type of barrier to healthcare access. The second step was a bivariate analysis to select potential variables for the regression analysis. Variables that were statistically significant in the bivariate analysis at p<0.05 were retained. Afterwards, a three-level multilevel binary logistic regression analysis was performed to assess the individual and contextual (household and community level) factors associated with barriers to healthcare access. In this study, women were nested within clusters (primary sampling units [PSUs]) and clusters were nested within the regions. We measured the extent of the proportion of the variance explained by clustering at the PSU and regional level using intraclass correlation coefficients in STATA.[22] Clusters were considered as random effects to account for the unexplained variability at the regional level. We fitted four models. First, we fitted the empty model, model 0, that had no predictors (random intercept). This was followed by model 1, which contained only the individual level variables, model 2 with only contextual level variables and model 3 with both individual and contextual level variables. For all models, we present the adjusted ORs (AORs) and associated 95% CIs. For model comparison, we used the Akaike information criteria test.[23] Using the variance inflation factor (VIF), the

multicollinearity test showed that there was no evidence of collinearity among the independent variables (mean VIF=1.7, maximum VIF=2.4 and minimum VIF=1.01). The dataset was declared survey data due to the complex sampling approach employed. Sample weight was applied in all the analyses to correct for oversampling and undersampling of the respondents. We relied on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement in conducting this study and writing the manuscript.

Results

Background characteristics and barriers to healthcare access among women in PNG

Table 1 presents results of the background characteristics of the study participants in relation to barriers to healthcare accessibility. Women who participated in the study were women of reproductive age; 19.8% were aged 15–19 y, 65% were married, 52% had primary level education, 66.4% were unemployed, 48.0% were Protestants, 50.2% had 1–4 children and 96.1% were not covered by health insurance. In terms of exposure to mass media, 58.4%, 60.6% and 72.5% were not exposed to newspapers/magazines, radio or television, respectively. The majority (81.3%) were in male-headed households, 28.9% were in the richest wealth quintile, 73.4% were in rural areas, 28.8% were in the southern region and 33.5% were of low socioeconomic status. χ^2 analysis showed that all the independent variables had statistically significant associations with securing permission to go to the hospital, not wanting to go alone and at least one barrier to healthcare accessibility at p<0.05. Conversely, age was not significant in terms of money needed for treatment and distance to the health facility, but the other variables showed significant associations (Table 1).

Individual and contextual factors associated with barriers to healthcare in PNG

Table 2 presents results of the multilevel logistic regression of individual and contextual factors associated with barriers to healthcare concerning securing permission to go to hospital, getting the money needed for treatment, distance to the health facility, not wanting to go alone and at least one barrier. The results showed that women aged 15–19 y were more likely to experience difficulty with wanting to go alone to the health facility (AOR=1.51; 95% CI 1.22 to 1.87) and experienced at least one barrier compared with those aged 40–49 y (AOR=1.48; 95% CI 1.18 to 1.86).

Women who had never married were more likely to have difficulty in securing permission to go to hospital (AOR=1.50; 95% CI 1.09 to 2.07) and not wanting to go alone (AOR=1.42; 95% CI 1.06 to 1.91) compared with women who were widowed or divorced. Compared with women with no formal education, those with secondary/higher education were less likely to experience difficulties in securing permission to go to hospital (AOR=0.75; 95% CI 0.064 to 0.89), have difficulties in getting the money needed for treatment (AOR=0.67; 95% CI 0.56 to 0.77), have difficulties with the distance to the health facility [AOR=0.64; 95% CI 0.54 to 0.76], have difficulties in going alone

Table 1. Background characteristics and barriers to healthcare access among women in Papua New Guinea (n=14 653)

Variable	N	%	Receiving permission to go Big problem	Money needed for treatment Big problem	Distance to health facility Big problem	Not wanting to go alone Big problem	At least one barrier Yes
Age, y			p<0.001	p=0.323	p=0.176	p<0.001	p<0.001
15–19	2894	19.8	993 (34.3)	1807 (62.4)	1452 (50.2)	1513 (52.3)	679 (23.5)
20–24	2621	17.9	761 (29.0)	1592 (60.7)	1307 (49.9)	1099 (41.9)	727 (27.7)
25–29	2379	16.2	706 (29.7)	1456 (61.2)	1226 (51.5)	940 (39.5)	685 (28.8)
30–34	2117	14.5	604 (28.5)	1259 (59.5)	1106 (52.2)	816 (38.6)	644 (30.4)
35–39	1964	13.4	556 (28.3)	1219 (62.1)	1050 (53.5)	759 (38.7)	576 (29.3
40–44	1488	10.2	406 (27.3)	888 (59.7)	751 (50.5)	517 (34.7)	463 (31.1)
45–49	1190	8.1	349 (29.3)	718 (60.3)	622 (52.3)	469 (39.4)	356 (29.9)
Marital status			p<0.001	p<0.001	p<0.001	p<0.001	p<0.001
Never married	4049	27.6	1321 (32.6)	2477 (61.2)	1977 (48.8)	2005 (49.5)	1048 (25.9)
Married/living together	9547	65.2	2799 (29.3)	5797 (60.7)	5028 (52.7)	3752 (39.3)	2760 (28.9)
Widowed/divorced	379	2.6	90 (23.8)	258 (68.1)	208 (54.9)	150 (39.6)	97 (25.6)
Married but not together	678	4.6	165 (24.3)	407 (60.0)	301 (44.4)	206 (30.4)	225 (33.2)
Educational level			p<0.000	p<0.000	p<0.000	p<0.000	p<0.000
No education	2735	18.7	1042 (38.1)	2102 (76.9)	1936 (70.8)	1532 (56.0)	464 (17.0)
Primary	7616	52.0	2451 (32.2)	4960 (65.1)	4244 (55.7)	3369 (44.2)	1825 (24.0)
Secondary or higher	4302	29.4	882 (20.5)	1877 (43.6)	1334 (31.0)	1212 (28.2)	1841 (42.8)
Occupation			p<0.001	p<0.001	p<0.001	p<0.001	p<0.001
Unemployed	9730	66.4	2861 (29.4)	6176 (63.5)	5248 (53.9)	4283 (44.0)	2514 (25.8)
Managerial	728	5.0	127 (17.5)	201 (27.6)	190 (26.1)	157 (21.6)	414 (56.9)
Clerical/agric.	4085	27.9	1360 (33.3)	2502 (61.3)	2034 (49.8)	1638 (40.1)	1164 (28.5)
Manual	110	0.8	27 (24.6)	60 (54.6)	42 (38.2)	35 (31.8)	38 (34.6)
Religion			p<0.001	p<0.001	p<0.001	p<0.001	p=0.007
Orthodox	4549	31.0	1541 (33.9)	2810 (61.8)	2449 (53.8)	2012 (44.2)	1225 (26.9)
Protestant	7040	48.0	1861 (26.4)	4208 (59.8)	3477 (49.4)	2792 (39.7)	2070 (29.4)
Other	3064	20.9	973 (31.8)	1921 (62.7)	1588 (51.8)	1309 (42.7)	835 (27.3)
Number of children			p<0.001	p<0.001	p<0.001	p<0.001	p<0.001
None	4734	32.3	1509 (31.9)	2864 (60.5)	2289 (48.4)	2258 (47.7)	1261 (26.6)
1–4	7348	50.2	2062 (28.1)	4387 (59.7)	3717 (50.6)	2749 (37.4)	2223 (30.3)
≥5	2571	17.6	804 (31.3)	1688 (65.7)	1508 (58.7)	1106 (43.0)	646 (25.1)
Covered by health insurance			p<0.001	p<0.001	p<0.001	p<0.001	p<0.001
No	14 080	96.1	4269 (30.3)	8761 (62.2)	7386 (52.5)	5970 (42.4)	3827 (27.2)
Yes	573	3.9	106 (18.5)	178 (31.1)	128 (22.3)	143 (25.0)	303 (52.9)

Table 1. (Continued).

Variable	N	%	Receiving permission to go Big problem	Money needed for treatment Big problem	Distance to health facility Big problem	Not wanting to go alone Big problem	At least one barrier Yes
Frequency of reading newspaper or magazine			p<0.001	p<0.001	p<0.001	p<0.001	p<0.001
Not at all	8554	58.4	2938 (34.4)	6001 (70.2)	5361 (62.7)	4156 (48.6)	1798 (21.0)
Less than once a week	3220	22.0	908 (28.2)	1699 (52.8)	1290 (40.1)	1135 (35.3)	1081 (33.6)
At least once a week	2879	19.7	529 (18.4)	1239 (43.0)	863 (30.0)	822 (28.6)	1251 (43.5)
Frequency of listening to radio			p<0.001	p<0.001	p<0.001	p<0.001	p<0.001
Not at all	8886	60.6	2915 (32.8)	6009 (67.6)	5391 (60.7)	4209 (47.4)	2042 (23.0)
Less than once a week	2746	18.7	866 (31.5)	1538 (56.0)	1151 (41.9)	1021 (37.2)	854 (31.1)
At least once a week	3021	20.6	594 (19.7)	1392 (46.1)	972 (32.2)	883 (29.2)	1234 (40.9)
Frequency of watching television			p<0.001	p<0.001	p<0.001	p<0.001	p<0.001
Not at all	10 618	72.5	3461 (32.6)	7117 (67.0)	6353 (59.8)	4955 (46.7)	2441 (23.0)
Less than once a week	1531	10.5	444 (29.0)	791 (51.7)	546 (35.7)	485 (31.7)	552 (36.1)
At least once a week	2504	17.1	470 (18.8)	1031 (41.2)	615 (24.6)	673 (26.9)	1137 (45.4)
Gender of head of household			p<0.001	p<0.001	p<0.001	p<0.001	p<0.001
Male	11 915	81.3	3640 (30.6)	7355 (61.7)	6266 (52.6)	5072 (42.6)	3237 (27.2)
Female	2738	18.7	735 (26.8)	1584 (57.9)	1248 (45.6)	1041 (38.0)	893 (32.6)
Wealth			p<0.001	p<0.001	p<0.001	p<0.001	p<0.001
Poorest	2048	14.0	907 (44.3)	1713 (83.6)	1639 (80.0)	1319 (64.4)	214 (10.5)
Poorer	2221	15.2	822 (37.0)	1677 (75.5)	1567 (70.6)	1187 (53.4)	379 (17.1)
Middle	2565	17.5	779 (30.4)	1761 (68.7)	1609 (62.7)	1201 (46.8)	541 (21.1)
Richer	3589	24.5	1039 (29.0)	2135 (59.5)	1739 (48.5)	1358 (37.8)	1006 (28.0)
Richest	4230	28.9	828 (19.6)	1653 (39.1)	960 (22.7)	1048 (24.8)	1990 (47.0)
Residence			p<0.001	p<0.001	p<0.001	p<0.001	p<0.001
Urban	3894	26.6	741 (19.0)	1662 (42.7)	831 (21.3)	971 (24.9)	1787 (45.9)
Rural	10,759	73.4	3634 (33.8)	7277 (67.6)	6683 (62.1)	5142 (47.8)	2343 (21.8)
Region			p<0.000	p<0.000	p<0.000	p<0.000	p<0.000
Southern	4221	28.8	1064 (25.2)	2352 (55.7)	2031 (48.1)	1742 (41.3)	1334 (31.6)
Highlands	3916	26.7	1116 (28.5)	2609 (66.6)	2039 (52.1)	1621 (41.4)	1047 (26.7)
Momase	2982	20.4	1078 (36.2)	1962 (65.8)	1778 (59.6)	1396 (46.8)	700 (23.5)
Islands	3534	24.1	1117 (31.6)	2016 (57.1)	1666 (47.1)	1354 (38.3)	1049 (29.7)
Community level socioeconomic status			p<0.001	p<0.001	p<0.001	p<0.001	p<0.001
Tertile 1 (least disadvantaged)	4907	33.49	1269 (25.9)	2320 (47.3)	1465 (29.9)	1427 (29.1)	1961 (40.0)
Tertile 2 (middle disadvantaged)	4884	33.33	1255 (25.7)	2882 (59.0)	2513 (51.5)	1893 (38.8)	1408 (28.8)
Tertile 3 (most disadvantaged)	4862	33.18	1851 (38.1)	3737 (76.9)	3536 (72.7)	2793 (57.5)	761 (15.7)

Table 2. Multilevel logistic regression of individual and contextual factors associated with barriers to healthcare among women in Papua New Guinea (fixed effects results)

Variable	Getting permission to go to hospital AOR (95% CI)	Getting money needed for treatment AOR (95% CI)	Distance to health facility AOR (95% CI)	Not wanting to go alone AOR (95% CI)	At least one barriers AOR (95% CI)
Age, y					
15–19	1.23 (0.98 to 1.52)			1.51*** (1.22 to 1.87)	1.48*** (1.18 to 1.86)
20–24	0.99 (0.81 to 1.21)			1.17 (0.97 to 1.42)	1.39** (1.13 to 1.69)
25–29	1.04 (0.86 to 1.26)			1.06 (0.88 to 1.28)	1.22* (1.01 to 1.48)
30–34	0.96 (0.79 to 1.15)			1.00 (0.84 to 1.20)	1.09 (0.90 to 1.32)
35–39	0.88 (0.73 to 1.06)			0.93 (0.78 to 1.12)	1.06 (0.88 to 1.28)
40–44	0.90 (0.74 to 1.10)			0.83 (0.68 to 1.00)	1.04 (0.86 to 1.27)
45–49	Ref.			Ref.	Ref.
Marital status					
Never married	1.50* (1.09 to 2.07)	0.86 (0.64 to 1.15)	1.00 (0.74 to 1.36)	1.42* (1.06 to 1.91)	0.90 (0.65 to 1.23)
Married/living together	1.37* (1.03 to 1.81)	0.67** (0.52 to 0.87)	0.88 (0.67 to 1.16)	0.96 (0.74 to 1.23)	0.76 (0.57 to 1.00)
Married but not together	1.19 (0.85 to 1.67)	0.85 (0.63 to 1.16)	0.88 (0.63 to 1.22)	0.79 (0.58 to 1.08)	0.83 (0.59 to 1.15)
Widowed/divorced	Ref.	Ref.	Ref.	Ref.	Ref.
Educational level					
Primary	0.93 (0.82 to 1.05)	0.85* (0.75 to 0.97)	0.86* (0.75 to 0.99)	0.75*** (0.66 to 0.85)	0.89 (0.77 to 1.04)
Secondary or higher	0.75*** (0.64 to 0.89)	0.67*** (0.56 to 0.77)	0.64*** (0.54 to 0.76)	0.65*** (0.55 to 0.76)	0.68*** (0.57 to 0.81)
No education	Ref.	Ref.	Ref.	Ref.	Ref.
Occupation					
Unemployed	0.89 (0.54 to 1.48)	1.00 (0.65 to 1.54)	1.00 (0.62 to 1.62)	1.00 (0.63 to 1.59)	1.14 (0.72 to 1.81)
Managerial	0.94 (0.54 to 1.62)	0.49** (0.30 to 0.78)	0.94 (0.56 to 1.57)	0.90 (0.54 to 1.49)	0.69 (0.42 to 1.13)
Clerical/agric.	1.09 (0.66 to 1.81)	0.98 (0.63 to 1.51)	0.94 (0.58 to 1.52)	1.01 (0.63 to 1.61)	1.03 (0.65 to 1.64)
Manual	Ref.	Ref.	Ref.	Ref.	Ref.
Religion					
Orthodox	0.97 (0.85 to 1.11)	1.01 (0.88 to 1.14)	1.05 (0.91 to 1.22)	1.03 (0.90 to 1.17)	0.98 (0.85 to 1.13)
Protestant	0.83** (0.74 to 0.94)	0.94 (0.84 to 1.05)	0.97 (0.85 to 1.10)	0.93 (0.83 to 1.05)	0.92 (0.81 to 1.04)
Other	Ref.	Ref.	Ref.	Ref.	Ref.

Table 2. (Continued).

Variable	Getting permission to go to hospital AOR (95% CI)	Getting money needed for treatment AOR (95% CI)	Distance to health facility AOR (95% CI)	Not wanting to go alone AOR (95% CI)	At least one barriers AOR (95% CI)
Number of children					
0	1.12 (0.93 to 1.36)	0.93 (0.79 to 1.09)	0.92 (0.77 to 1.10)	1.07 (0.89 to 1.28)	0.92 (0.76 to 1.12)
1–4	1.05 (0.92 to 1.20)	0.97 (0.86 to 1.08)	0.98 (0.87 to 1.11)	0.92 (0.81 to 1.04)	0.89 (0.78 to 1.02)
≥5	Ref.	Ref.	Ref.	Ref.	Ref.
Covered by health insurance					
No	0.88 (0.68 to 1.13)	1.30* (1.05 to 1.61)	0.94 (0.73 to 1.20)	0.85 (0.67 to 1.07)	1.06 (0.87 to 1.30)
Yes	Ref.	Ref.	Ref.	Ref.	Ref.
Frequency of reading newspaper or magazine					
Not at all	1.30*** (1.12 to 1.51)	1.22** (1.07 to 1.38)	1.23** (1.06 to 1.42)	1.10 (0.96 to 1.27)	1.19* (1.03 to 1.36)
Less than once a week	1.22* (1.05 to 1.43)	1.08 (0.95 to 1.23)	1.07 (0.92 to 1.25)	1.16* (1.00 to 1.34)	1.12 (0.98 to 1.29)
At least once a week	Ref.	Ref.	Ref.	Ref.	Ref.
Frequency of listening to radio					
Not at all	0.95 (0.83 to 1.09)	0.90 (0.79 to 1.01)	0.96 (0.84 to 1.10)	0.89 (0.79 to 1.02)	0.93 (0.81 to 1.06)
At least once a week	0.82* (0.70 to 0.97)	0.85* (0.74 to 0.97)	0.89 (0.76 to 1.04)	0.81** (0.70 to 0.94)	0.86 (0.75 to 1.00)
Less than once a week	Ref.	Ref.	Ref.	Ref.	Ref.
Frequency of watching television					
Not at all	1.00 (0.85 to 1.18)	1.12 (0.97 to 1.29)	1.06 (0.90 to 1.24)	1.14 (0.97 to 1.33)	1.20* (1.03 to 1.40)
At least once a week	0.95 (0.78 to 1.15)	0.95 (0.81 to 1.12)	0.93 (0.77 to 1.12)	1.11 (0.92 to 1.32)	1.02 (0.86 to 1.21)
Less than once a week	Ref.	Ref.	Ref.	Ref.	Ref.
Gender of head of household					
Male	1.01 (0.90 to 1.14)	1.05 (0.95 to 1.17)	1.09 (0.97 to 1.23)	1.09 (0.98 to 1.22)	1.11 (0.99 to 1.24)
Female	Ref.	Ref.	Ref.	Ref.	Ref.
Wealth					
Richest	0.58*** (0.46 to 0.72)	0.31*** (0.25 to 0.39)	0.42*** (0.33 to 0.53)	0.50*** (0.40 to 0.62)	0.36*** (0.28 to 0.46)
Richer	0.69*** (0.57 to 0.82)	0.49*** (0.41 to 0.59)	0.54*** (0.44 to 0.65)	0.58*** (0.48 to 0.69)	0.50*** (0.40 to 0.62)

Table 2. (Continued).

Variable	Getting permission to go to hospital AOR (95% CI)	Getting money needed for treatment AOR (95% CI)	Distance to health facility AOR (95% CI)	Not wanting to go alone AOR (95% CI)	At least one barriers AOR (95% CI)
Middle	0.75*** (0.64 to 0.88)	0.66*** (0.55 to 0.78)	0.66*** (0.55 to 0.80)	0.75*** (0.63 to 0.88)	0.64*** (0.52 to 0.79)
Poorer	0.91 (0.78 to 1.05)	0.77** (0.64 to 0.92)	0.76** (0.63 to 0.91)	0.83* (0.71 to 0.97)	0.71** (0.58 to 0.88)
Poorest	Ref.	Ref.	Ref.	Ref.	Ref.
Residence					
Rural	1.55* (1.04 to 2.30)	1.39 (0.98 to 1.98)	4.10*** (2.72 to 6.18)	1.75** (1.15 to 2.65)	1.87** (1.27 to 2.77)
Urban	Ref.	Ref.	Ref.	Ref.	Ref.
Region					
Southern	0.69 (0.42 to 1.14)	0.79 (0.50 to 1.24)	0.89 (0.56 to 1.42)	1.12 (0.66 to 1.89)	0.79 (0.48 to 1.30)
Highlands	0.63 (0.39 to 1.04)	0.90 (0.58 to 1.41)	0.37*** (0.23 to 0.59)	0.64 (0.38 to 1.07)	0.617 (0.38 to 1.01)
Islands	0.96 (0.57 to 1.61)	1.00 (0.62 to 1.60)	0.94 (0.57 to 1.54)	1.12 (0.65 to 1.93)	0.97 (0.58 to 1.64)
Momase	Ref.	Ref.	Ref.	Ref.	Ref.
Community level socioeconomic status					
Tertile 1 (least disadvantaged)	0.91 (0.66 to 1.27)	0.56*** (0.42 to 0.74)	0.22*** (0.15 to 0.33)	0.40*** (0.28 to 0.56)	0.46*** (0.33 to 0.64)
Tertile 2 (middle disadvantaged)	0.71** (0.55 to 0.90)	0.55* (0.44 to 0.68)	0.29*** (0.21 to 0.39)	0.41*** (0.32 to 0.53)	0.45*** (0.34 to 0.58)
Tertile 3 (most disadvantaged)	Ref.	Ref.	Ref.	Ref.	Ref.
N	14 653	14 653	14 653	14 653	14 653

AIC, Akaike's information criterion; ICC, intraclass correlation; PSU; primary sampling units; Ref., Reference.
Exponentiated coefficients; 95% CIs in brackets.
*p<0.05, **p< 0.01, ***p< 0.001.
Model 0 is the null model, a baseline model without any determinant variable.
Model 1 = individual level variables.
Model 2 = community level variables.
Model 3 is the final model adjusted for individual and household/community level variables.

to the health facility (AOR=0.65; 95% CI 0.55 to 0.76) and facing at least one barrier (AOR=0.68; 95% CI 0.57 to 0.81).

Occupation only had a significant association with difficulties in getting the money needed for treatment, with women in managerial positions less likely to face challenges in this regard compared with those in manual occupations (AOR=0.49; 95% CI 0.30 to 0.78). The likelihood of experiencing difficulties in securing permission to go to hospital was lower among women who professed orthodox faith (AOR=0.84; 95% CI 0.74 to 0.94). Women who were not covered by health insurance were more likely to have challenges in getting the money needed for treatment (AOR=1.30; 95% CI 1.05 to 1.61).

Exposure to newspaper and radio were associated with facing challenges in securing permission to go to hospital, getting the money needed for treatment, the distance to the health facility and not wanting to go alone. Women in the richest wealth quintile had lower odds of facing challenges in securing permission to go to hospital (AOR=0.58; 95% CI 0.46 to 0.72), getting the money needed for treatment (AOR=0.31; 95% CI 0.25 to 0.39), distance to the health facility (AOR=0.42; 95% CI 0.33 to 0.53), not wanting to go alone (AOR=0.50; 95% CI 0.40 to 0.62) and facing at least one barrier to healthcare (AOR=0.36; 95% CI 0.28 to 0.46) compared with those in the poorest wealth quintile. Living in a rural area increased the odds of facing challenges in securing permission to go to hospital (AOR=1.55; 95% CI 1.04 to 2.30), distance to health facility [AOR=4.10; 95% CI 2.72 to 6.18], not wanting to go alone (AOR=1.75; 95% CI 1.15 to 2.65) and facing at least one barrier to healthcare (AOR=1.87; 95% CI 1.27 to 2.77).

The odds of experiencing problems with distance to the health facility were low among women who lived in The Highlands region (AOR=0.37; 95% CI 0.23 to 0.59) compared with those who lived in the Momase region. Women of the least disadvantaged socioeconomic status had lower odds of having barriers to healthcare concerning securing permission to go to hospital, getting the money needed for treatment, distance to the health facility, not wanting to go alone and at least one barrier. Further details of all the models for each of the barriers to healthcare as well as at least one barrier to healthcare are presented in the Supplementary Tables S1–S3.

Table 3 presents results of the random effects of the association between the explanatory variables and barriers to healthcare access. In relation to securing the permission needed for treatment, the results indicate that 8.4% and 32.6% of variance was attributable to the variance between PSUs and regions, respectively (model 0). From model 0, individual level variables alone (model 1) contributed 6.8% of the variation of PSUs and 29.9% of regions. The contextual variables (model 2) alone contributed 4.6% of the variation of PSUs and 27.9% of regions. All covariates (model 3) explained 4.4% and 27.1% variation levels for PSUs and regions, respectively. This indicated that most of the variation in securing the permission needed for treatment could be attributed to individual level factors.

With distance to health facility, the results indicated that 24.9% and 58.2% of variance was attributable to the variance between PSUs and regions, respectively (model 0). From model 0, individual level variables alone (model 1) were attributed with 20.7% of the variation of PSUs and 53.4% of regions. The

contextual variables (model 2) alone contributed 1.9% of the variation of PSUs and 37.9% of regions. All covariates (model 3) explained 2.6% and 37.4% of variation levels for PSUs and regions, respectively. This indicated that most of the variation in distance to health facility could be attributed to individual level factors.

Regarding getting the money needed for treatment, the results indicate that 25% and 58% of its variance was attributable to the variation between PSUs and region, respectively (model 0). From model 0, individual level variables alone (model 1) contributed 21% of the variation of PSUs and 53% of regions. The contextual variables (model 2) alone contributed 2% of the variation of PSUs and 38% of regions. All covariates (model 3) explained 3% and 37% of variation at the levels of PSUs and regions, respectively. This meant that most of the variation in not wanting to go alone could be attributed to individual level factors.

Concerning not wanting to go alone, the results indicate that 11.8% and 39.5% of its variance was attributable to the variance between PSUs and regions, respectively (model 0). From model 0, individual level variables alone (model 1) contributed 10.0% of the variation of PSUs and 37.5% of regions. The contextual variables (model 2) alone were attributable for 4.5% variation of PSUs and 29.8% of regions. All covariates (model 3) explained 4.5% and 30.4% variation at the levels of PSUs and regions, respectively. This indicates that most of the variation in not wanting to go alone could be attributed to individual level factors.

Finally, with at least one barrier, the results indicate that 14.8% and 40.3% of its variance was attributable to the variance between PSUs and regions, respectively (model 0). From model 0, individual level variables alone (model 1) were attributable for 10.6% variation of PSUs and 34.3% of regions. The contextual variables (model 2) alone were attributable for 4.3% variation of PSUs and 26.8% of regions. All covariates (model 3) explained 4.4% and 26.7% variation at the levels of PSUs and regions, respectively. This indicates that most of the variations in facing at least one barrier could be attributed to individual level factors.

Discussion

The current study revealed that women aged 15–19 y are more likely to experience barriers to healthcare. Typically, women aged 15–19 y had a higher likelihood of experiencing difficulties in receiving permission to go to hospital and not wanting to go alone. This finding is consistent with previous studies in Nigeria[24] and Malaysia.[25] This observation could be attributed to the fact that younger women in PNG in the age bracket of 15–19 y are likely to be in school as students, unmarried, unemployed and dependent on their parents or guardians. This limits their ability to make decisions freely to access healthcare, unlike their older counterparts (aged 45–49 y), who are likely to be married, employed, independent, able to afford healthcare and also make free, independent informed decisions to access healthcare. This finding is, however, in disagreement with results from a study in Tanzania that found that ageing was associated with higher odds of facing barriers to accessing healthcare.[18] The disparities in findings could be

Table 3. Multilevel logistic regression of individual and contextual factors associated with barriers to healthcare among women in Papua New Guinea (random effects results)

Barriers	Model 0	Model 1	Model 2	Model 3
Getting permission to go to hospital				
N		14 653	14 653	14 653
Variance PSU	0.41	0.32	0.21	0.23
Variance region	1.18	1.09	1.06	1.03
AIC	15 685.71	15 559.55	15 618.38	15 526.05
ICC PSU	0.08	0.07	0.05	0.04
ICC region	0.33	0.30	0.28	0.27
Distance to health facility				
N		14 653	14 653	14 653
Variance PSU	1.96	1.46	0.10	0.11
Variance region	2.63	2.31	1.90	1.86
AIC	15 128.07	14 994.63	14 840.61	14 787.14
ICC PSU	0.25	0.21	0.02	0.03
ICC region	0.58	0.53	0.38	0.37
Getting money needed for treatment				
N		14 653	14 653	14 653
Variance PSU	1.96	1.46	0.10	0.11
Variance region	2.63	2.31	1.90	1.86
AIC	15 128.07	14 994.63	14 840.61	14 787.14
ICC PSU	0.25	0.21	0.02	0.03
ICC region	0.58	0.53	0.38	0.37
Not wanting to go alone				
N		14 653	14 653	14 653
Variance PSU	0.64	0.53	0.21	0.21
Variance region	1.51	1.44	1.18	1.22
AIC	16 907.78	16 535.31	16 748.45	16 411.60
ICC PSU	0.12	0.10	0.04	0.05
ICC region	0.40	0.37	0.30	0.30
At least one barrier				
N		14 653	14 653	14 653
Variance PSU	0.81	0.53	0.19	0.20
Variance region	1.40	1.19	1.01	1.00
AIC	15 075.49	14 786.58	14 809.11	14 631.64
ICC PSU	0.15	0.11	0.04	0.04
ICC region	0.40	0.34	0.27	0.27

AIC, Akaike's information criterion; ICC, intraclass correlation; PSU, primary sampling units.

attributed to differences in the geographical settings of these two studies.

In the current study, educational level was found to be inversely associated with healthcare accessibility barriers. Women who had received at least secondary level education had lower odds of experiencing at least one barrier to healthcare compared with women who had no formal education. This inverse relationship is in agreement with results reported from studies in Ghana,[26] Ethiopia,[27,28] Tanzania[18] and southern Mozambique.[29] Education influences labour market outcomes such as employment and earnings as well as non-market outcomes such as healthcare accessibility.[30] This implies that women's level of education in PNG has the potential to determine their type of

employment and earnings, which can influence their ability to afford healthcare.

Marital status was a significant factor that influenced women's healthcare accessibility in PNG. Specifically, we noted that women who had never married were more likely to encounter difficulties in securing permission and not wanting to go to hospital alone compared with women who were widowed or divorced. Studies conducted in Malaysia,[31] Montenegro,[32] Ethiopia,[27,33] Nigeria[34] and Tanzania[18] have reported similar findings. Women who have never married are likely to be younger and under the influence of their parents compared with those who are widowed or divorced. However, a study in Japan found no significant relationship between marital status and healthcare

access.[35] The differences in findings could be a consequence of disparities in socioeconomic conditions and sociocultural practices present in each study area.

We also observed that occupation was significant in determining the odds of encountering barriers to healthcare access. Women who were in a managerial profession had lower odds of experiencing barriers in getting the money to go to hospital compared with women engaged in manual occupations. Managerial professions require a higher level of education with correspondingly high remuneration. As such, women who are engaged in managerial professions are likely to be in a better position to afford the cost of healthcare. Such women may also have the ability to access information, which comes with increased health literacy.[24] A similar finding was reported by Makmor et al.[36] and Sun et al.[37]

Women who reported never reading newspapers or magazines or watching television each week had higher odds of experiencing barriers to healthcare accessibility compared with those who were exposed to newspapers, magazines and television. Reading newspapers and magazines and watching television at least once a week improve information and health literacy, which have been reported as important determinants of healthcare utilisation.[38] Women who are exposed to mass media are better informed about their health and how to overcome barriers in accessing healthcare, which could explain the reason for this finding. Similar findings have been reported in Ethiopia,[39] Malawi,[40] Bangladesh[41] and India,[42] where exposure to mass media was found to significantly influence healthcare utilisation for diarrhoea.

There was an inverse relationship between household wealth index and the odds of experiencing barriers to healthcare access. Women from the richest households recorded lower odds of healthcare accessibility barriers compared with women from poorer households. We observed that the odds of healthcare accessibility barriers for women decreased as the household wealth increased. Women in communities with a poorer socioeconomic status also had higher odds of barriers to healthcare access compared with their counterparts in communities with good/rich socioeconomic status. This finding supports findings from studies in Afghanistan,[43] Uganda[44] and Tanzania.[18] Women from richer households have an increased ability to afford the costs associated with healthcare access, which are a common barrier to healthcare accessibility in low- and middle-income countries, which could explain the situation in PNG.

From the results, place of residence was significant in predicting the likelihood of encountering barriers to healthcare access. Women living in rural areas had higher odds of barriers to healthcare access compared with women in urban areas. This finding confirms the findings of studies conducted in Minnesota[45] and South Africa[46] that reported that rural residents were more disadvantaged in accessing healthcare compared with urban residents. Women in urban PNG have the benefits of adequate health infrastructure with reduced patient-to-health facility distance compared with their counterparts in rural areas that are often characterised by inadequate health infrastructure and long distances to health facilities. Barriers to healthcare access reported among rural populations include financial barriers, distance to clinics, lack of available clinics or hospital facilities, provider–patient relationship problems, low satisfaction with and

lack of confidence or trust in providers or the healthcare system, language barriers, concerns about confidentiality, concerns about stigma and resistance to medical interventions.[47,48]

The likelihood of experiencing difficulties in getting the money needed for treatment was high among women who were not covered by health insurance. Globally, health insurance has been identified as an edge-cutting cost-effective intervention for obviating out-of-pocket payment for health services.[49,50] On this premise, our finding is plausible because women who subscribe to health insurance might only pay the extra amount not covered by insurance, or pay nothing for healthcare.[51] However, those who have not subscribed may be required to pay in full for every health service. As such, encouraging women to subscribe to health insurance could reduce healthcare barriers for women in PNG.

Strengths and limitations of the study

This study used nationally representative data to assess the factors associated with barriers in accessing healthcare among women in PNG. There was a high response rate and the study's methodology followed best practice including using experienced data collectors and multistage sampling. The findings can, therefore, be generalised to all women of reproductive age in PNG. The study also employed advanced statistical models that accounted for individual, household and community level factors. Despite these, the study design was a cross-sectional one and, as a result, causal interpretation cannot be inferred. Finally, since this was a secondary data analysis, we could not account for the effects of the health system and health worker-related factors.

Conclusions

This study has demonstrated that both individual and contextual factors are associated with barriers to healthcare accessibility among women in PNG. It has further indicated that measures to offset barriers in healthcare need to prioritise female education, their wealth status, as well as those in rural settings. Further, to enhance the achievement of the SDGs 3.1, 3.7 and 3.8, it is critical to deem individual and contextual factors necessary and reinforce prevailing policies to tackle barriers to accessing healthcare among women in PNG.

Supplementary data

Supplementary data are available at *International Health* online (http://inthealth.oxfordjournals.org).

References

1　Regan L. Addressing Unmet Needs in Global Women's Health. British Medical Association, 2012.

2　World Health Organisation. Addressing the challenge of women's health in Africa: a Summary of the Report of the Commission on Women's Health in the African Region, 2012.

3　Badiuzzaman M, Murshed SM, Rieger M. Improving maternal health care in a post conflict setting: evidence from Chittagong Hill tracts of Bangladesh. J Dev Stud. 2018;36:1–17.

4　World Health Organization. Primary Health Care on the Road to Universal Coverage: 2019 Global Monitoring Report.

5　United Nations, Department of Economic and Social Affairs, Population Division. World mortality 2019: Highlights (ST/ESA/SER. A/432).

6　The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG). Improving Women's Health in the Pacific. RANZCOG, 2017.

7　National Department of Health (2017). Sector performance annual review for 2016. Port Morseby, Government of Papua New Guinea. Available at: http://www.health.gov.pg/publications/SPAR_2016.pdf [accessed 20 May 2020].

8　Pilang CL, Gray MA, Oprescu FL. The evolution of the community health worker program in Papua New Guinea. Rural Remote Health. 2017;17(4):133.

9　Grundy J, Dakulala P, Wai K, et al. Independent State of Papua New Guinea Health System Review, New Delhi: WHO Regional office for southeast Asia; 2019.

10　Au N, Hollingsworth B, Spinks J. Measuring the efficiency of health services in lower-income countries: The case of Papua New Guinea. Dev Policy Rev. 2014;32(2):259–72.

11　Dennis AT. Reducing maternal mortality in Papua New Guinea: contextualizing access to safe surgery and anesthesia. Anesth Analg. 2017;126(1):252–9.

12　Robbers G, Vogel JP, Mola G, et al. Maternal and newborn health indicators in Papua New Guinea - 2008–2018. Sex Reprod Health Matters. 2019;27(1):52–68.

13　WHO. World Health Statistics 2016. Monitoring Health for the Sustainable Development Goals. Geneva, Switzerland: World Health Organization Press; 2015. Available at: http://www.who.int/gho/publications/world_health_statistics/2016/en/ [accessed 20 May 2020].

14　Williams JC. Maternal deaths and their impact on children in Papua New Guinea. Aust N Z J Public Health. 2014;38(5):405–7.

15　Watson AHA, Sabumei G, Mola G, et al. Maternal health phone line: saving women in Papua New Guinea. J Pers Med. 2015;5:120–39.

16　Ganster-Breidler M. 2010. Gender-based violence and the impact on women's health and well-being in Papua New Guinea. Contemporary PNG Studies: DWU Res J. 2020;13:17–30.

17　Hinton R, Earnest J. The right to health: overcoming inequalities and barriers to women's health in Papua New Guinea. Women's Studies International Forum. 2010;33:180–7.

18　Bintabara D, Nakamura K, Seino K. Improving access to healthcare for women in Tanzania by addressing socioeconomic determinants and health insurance: a population-based cross-sectional survey. BMJ Open. 2018;8(9):e023013.

19　Nisingizwe MP, Tuyisenge G, Hategeka C, et al. Are perceived barriers to accessing health care associated with inadequate antenatal care visits among women of reproductive age in Rwanda? BMC Pregnancy Childbirth. 2020;20(1):88.

20　National Statistical Office (NSO) [Papua New Guinea] (PNG) and ICF. (2019). Papua New Guinea Demographic and Health Survey 2016–2018. National Report. Port Moresby, PNG: National Statistical Office.

21　Yaya S, Uthman OA, Ekholuenetale M, et al. Women empowerment as an enabling factor of contraceptive use in sub-Saharan Africa: a multilevel analysis of cross-sectional surveys of 32 countries. Reprod Health. 2018;15(1):214.

22　Amegbor PM, Rosenberg MW, Kuuire VZ. Does place matter? A multilevel analysis of victimization and satisfaction with personal safety of seniors in Canada. Health Place. 2018;53:17–25.

23　Merlo J, Wagner P, Ghith N, et al. An original stepwise multilevel logistic regression analysis of discriminatory accuracy: the case of neighbourhoods and health. PloS One. 2016;11(4):e0153778.

24　Azuh D, Fayomi O, Ajayi L. Socio-cultural factors of gender roles in women's healthcare utilization in Southwest Nigeria. Open J Soc Sci. 2015;3:105–17.

25　Lau A, Spark S, Smith TM, et al. Socio-demographic and structural barriers to being tested for Chlamydia in general practice. Med J Australia. 2016;204(3):112.

26　Badu E, Gyamfi N, Opoku MP, et al. Enablers and barriers in accessing sexual and reproductive health services among visually impaired women in the Ashanti and Brong Ahafo regions of Ghana. Reprod Health Matters. 2018;26(54):51–60.

27　King R, Jackson R, Dietsch E, et al. Barriers and facilitators to accessing skilled birth attendants in Afar region. Ethiopia Midwifery 2015;31:540–6.

28　Okwaraji YB, Webb EL, Edmond KM. Barriers in physical access to maternal health services in rural Ethiopia. BMC Health Serv Res. 2015;15(1):493.

29　Munguambe K, Boene H, Vidler M, et al. Barriers and facilitators to health care seeking behaviours in pregnancy in rural communities of southern Mozambique. Reprod Health. 2016;13:84–97.

30　Oreopoulos P, Salvanes K. Priceless: the nonpecuniary benefits of schooling. J Econ Perspect. 2011;25(1):159–84.

31　Wahab SN, Satar NM, Tumin M, et al. Socio-demographic factors and structural barrier in accessing public clinics among the urban poor in Malaysia. J Soc Sci Humanities. 2020;17(3):71–81.

32 Bojovic O, Medenica M, Zivkovic D, *et al*. Factors associated with patient and health system delays in diagnosis and treatment of tuberculosis in Montenegro 2015–2016. PLoS ONE. 2018;13(3): e0193997.

33 Kea A, Tulloch O, Datiko D, *et al*. Exploring barriers to the use of formal maternal health services and priority areas for action in Sidama zone, southern Ethiopia. BMC Pregnancy Childbirth. 2018;18:1–12.

34 Ani F, Abiodun O, Sotunsa J, *et al*. Demographic factors related to male involvement in reproductive health care services in Nigeria. Eur J Contracept Reprod Health Care. 2016;21(1):57–67.

35 Murata C, Yamada T, Chen CC, *et al*. Barriers to health care among the elderly in Japan. Int J Environ Res Public Health. 2010;7: 1330–41.

36 Makmor T, Khaled T, Ahmad FO, *et al*. Demographic and socioeconomic factors associated with access to public clinics. J Health Translat Med. 2018;21(1):28–33.

37 Sun R, Wu L, Barnett S, *et al*. Socio-demographic predictors associated with capacity to engage in health care. Patient Exp J. 2019;6(2):35–41.

38 Collins L, Glasser AM, Abudayyeh H, *et al*. E-cigarette marketing and communication: how e-cigarette companies market e-cigarettes and the public engages with e-cigarette information. Nicotine Tob Res. 2019;21(1):14–24.

39 Woldeamanuel BT. Trends and factors associated with healthcare utilization for childhood diarrhea and fever in Ethiopia: further analysis of the demographic and health surveys from 2000 to 2016. J Environ Public Health. 2020;1–10.

40 Zamawe CO, Banda M, Dube AN. The impact of a community driven mass media campaign on the utilisation of maternal health care services in rural Malawi. BMC Pregnancy Childbirth. 2016;16(1): 21.

41 Uddin MF. Impact of Mass Media on Antenatal Care (ANC) Utilization in Bangladesh. Institute for Population and Social Research (IPSR), Mahidol University, 2009:149.

42 Ghosh D. Effects of mother's exposure to electronic mass media on knowledge and use of prenatal care service: a comparative analysis of Indian States. In The Professional Geographer. Oxford, UK: Blackwell Publishing, 2006.

43 Steinhardt L, Waters H, Rao K, *et al*. The effect of wealth status on care seeking and health expenditures in Afghanistan. Health Policy Planning. 2009;24:238.

44 Kalule-Sabiti I, Amoateng AY, Ngake M. The effect of socio-demographic factors on the utilization of maternal health care services in Uganda. African Population Studies. 2015;28(1): 515–25.

45 Loftus J, Allen EM, Call KT, *et al*. Rural-urban differences in access to preventive health care among publicly insured Minnesotans. J Rural Health. 2018;34(Suppl 1):S48–S55.

46 Silal SP, Penn-Kekana L, Harris B, *et al*. Exploring inequalities in access to and use of maternal health services in South Africa. BMC Health Serv Res. 2012;12(1):120.

47 Douthit N, Kiv S, Dwolatzky T, *et al*. Exposing some important barriers to health care access in the rural USA. Public Health. 2015;129(6):611–20.

48 Baldwin LM, Hollow WB, Casey S, *et al*. Access to specialty health care for rural American Indians in two states. J Rural Health. 2008;24(3):269–78.

49 Sarquist CC, Soni S, Hwang H, *et al*. Rural HIV-infected women's access to medical care: Ongoing needs in California. AIDS Care. 2011;23(7):792–6.

50 Institute of Medicine (US) Committee on the Consequences of Uninsurance. Care Without Coverage: Too Little, Too Late. Washington (DC): National Academies Press (US); 2002. 3, Effects of Health Insurance on Health. Available at: https://www.ncbi.nlm.nih.gov/books/NBK220636/ [accessed 20 May 2020].

51 Spaan E, Mathijssen J, Tromp N, *et al*. The impact of health insurance in Africa and Asia: a systematic review. Bulletin of the World Health Organization. 2012;90:685–92.