


BMJ Open Cost saving in primary versus tertiary level of reproductive health services in Sana'a, Yemen, 2013: a comparative cross-sectional study

Abdulkareem Ali Hussein Nassar ^{1,2}, Yahia Ahmed Raja'a,³
Najia Saleh Bahubaishi⁴

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¹Directorate General for Disease Control and Epidemiological Surveillance, Supervisor of the COVID-19 Hotline Operation, Yemen Ministry of Public Health and Population, Sana'a, Yemen

²TEPHINET – The Task Force for Global Health, Program Evaluation Consultant in Yemen, Sana'a, Yemen

³Faculty of Public Health and Health Informatics, Umm Al-Qura University, Umm Al-Qura University, Makkah, Saudi Arabia

⁴Community medicine department, Sana'a University Faculty of Medicine, Sana'a, Yemen

Correspondence to

Dr Abdulkareem Ali Hussein Nassar;
abdulkareemnassar@gmail.com

ABSTRACT

Objectives To estimate the cost saving for utilisation of vaginal delivery (VD), antenatal care (ANC) and an intrauterine device (IUD) services at primary health level facilities (PHLF) instead of tertiary health level facilities (THLF) in Sana'a.

Design A comparative cross-sectional study.

Setting Eight PHLF in Sana'a governorate and three THLF in Sana'a city.

Participants A total of 180 women aged (15–45 years) were enrolled equally from PHLF and THLF. Sixty women attended for each reproductive health service (VD, ANC and IUD services).

Primary and secondary outcome measures The direct and indirect costs of services at PHLF and THLF, and the cost saving for utilisation of PHLF instead of THLF.

Results The median of direct medical cost (DMC) of VD, ANC and IUD services were US\$43.86, US\$14.77 and US\$9.07 at THLF compared with US\$19.54, US\$0.93 and US\$11.17 at PHLF, respectively. The DMC difference of VD, ANC and IUD services between THLF and PHLF was US\$24.32, US\$13.84 and US\$–2.1, respectively. Regarding the direct non-medical costs (DNMC), the median of VD, ANC and IUD services were US\$43.05, US\$19.07 and US\$17.27 at THLF compared with US\$13.96, US\$0.00 and US\$0.00 at PHLF, respectively. The DNMC difference of VD, ANC and IUD service between THLF and PHLF was US\$29.09, US\$18.07 and US\$16.27, respectively. Moreover, the median of indirect cost (INDC) for VD, ANC and IUD services were US\$23.93, US\$9.49 and US\$10.44 at THLF compared with US\$7.90, US\$1.59 and US\$1.06 at PHLF, respectively. The INDC difference of VD, ANC and IUD service between THLF and PHLF was US\$16.03, US\$7.90 and US\$9.38, respectively.

Conclusion The study found the utilisation of VD, ANC and IUD services at PHLF instead of THLF is a considerable cost saving for families. Therefore, shifting the utilisation of services from THLF to PHLF reduces the financial burden affecting individuals, families and their productivity.

INTRODUCTION

Global initiatives have embraced ambitious new goals to reduce maternal mortality through improving primary healthcare and achieving health coverage. However, maternal

Strengths and limitations of this study

- The study estimated the direct medical and non-medical costs from patient's perspective (the costs borne by the women and her family's out-of-pocket expenses).
- All cost data were collected before and after discharge from the health facilities.
- The study used a non-probability sampling technique.
- The costs were estimated from the patient's perspective that may represent the minimum economic burden of bypassing the primary health level facilities.

mortality remains the second leading cause of death among women of reproductive age. In 2017, an estimated 295 000 maternal deaths, almost all of them in developing countries.^{1 2}

Despite the global efforts to improve primary healthcare services, women still tend to bypass the nearby primary reproductive health services (RHS) and it grows frequently in developing countries.^{3 4} Previous studies showed that bypassing the primary health level facilities (PHLF) to use the antenatal care (ANC),^{3 5–9} vaginal delivery (VD)^{3 5–7 9–17} and family planning services¹⁸ at higher levels even if the care available at the nearby PHLF. These studies indicated that the direct medical cost (DMC), direct non-medical cost (DNMC) and indirect costs (INDC) of RHS are different between PHLF and tertiary health level facilities (THLF). The bypassing transfers the healthcare expenditures away from DMC to DNMC and INDC. The women need more accompanying individuals, long distance and absence from their work to get RHS at higher levels, which is reflected on borne more expenses such as transportation, food, lost wages.^{3 5 6 8–11 14–18} Therefore, this phenomenon increases the financial burden

on families, underuses the nearby PHLF and overloads the higher level facilities. Conversely, reducing the bypassing would reduce the financial burden borne by families associated with travelling further among bypassers.⁴

Yemen National Health and Demographic Survey (YNHDS) in 2013 indicated the maternal health indicators have improved in recent years, however it is still low. The maternal mortality ratio is 148 deaths per 100 000 live births, 60% of Yemeni women received ANC, 45% of deliveries performed by skilled health workers and 29% married women are currently using a modern method of family planning.¹⁹ In 2011, Yemen aimed in the national reproductive health policy to improve access to high quality RHS as well. The number of health facilities has significantly increased in all Yemeni districts, nearly 80% of the health facilities are in the rural areas.²⁰ However, women tend remarkably to go to hospitals seeking healthcare, that is, growing demand on health services, rising the expenses on healthcare, overloading of hospitals and increasing the burden of expenses on women that can be reduced by using RHS at PHLF in their regions. Moreover, the burden of household spending on healthcare has escalated over the past 10 years due to political and military conflicts. The conflict started as demonstrations in 2011, followed by internal fighting that has worsened the households' economic situation, such as stopping salaries and increasing the prices of commodities and fuel.¹ Consequently, understanding the economic aspect and quality of RHS is critical especially during collapsing economic situation with limited resources and growing costs. The community needs to be aware of the size of healthcare expenses in different health levels and cost saving due to avoid bypassing the nearby PHLF, particularly in rural areas where nearly 70% of the total population live.¹ Estimating the cost of RHS can provide valuable information for decision-makers about the size of problems in the health system, assess the resources used in facilities and suggest improving the efficiency of health services.

In Yemen no such study has been conducted to estimate the cost of VD, ANC and family planning only intrauterine device (IUD) services. This study aimed to estimate the DMC, DNMC and INDC saving for utilisation of VD, ANC and IUD services at PHLF instead of THLF in Sana'a city and its surrounding districts, and identify the reasons for not using the PHLF.

METHODS

Study design and setting

A comparative cross-sectional study design was conducted among reproductive health (RH) clients/patients who live in Sana'a governorate in 2013. It was used to estimate the costs of RHS at THLF compared with PHLF in Sana'a city and its surrounding districts (Sana'a governorate).

The cost was estimated from the patient's perspective (out-of-pocket expenses born by RH clients/patients and accompanying individuals). The PHLF including health

centres provide primary healthcare services, which are preventive, diagnostic and therapeutic health services, and represents the link between the health units and district hospitals. The RHS is one of these provided services in PHLF, such as VD, ANC and IUD services. The THLF provides more complex and specialised services to patients who are referred from lower levels of the health system where such services are not available. However, the hospitals in Yemen provide primary, secondary and tertiary healthcare services, in contrast to its function.

Patient and public involvement

The participants and the public were not involved in the design, or conduct, or dissemination of this research.

Selected health facilities and services

A total of eight health centres in Sana'a governorate and three hospitals in Sana'a city were selected. Hezam, Walan, Bani Mansor, Al Rekh, Bait Ghofr, Al Kebs, Al Aghmoor and Ghaiman Health Centers were selected from Sana'a governorate. Availability of the selected RH services and clients (Sana'a governorate's health office, reproductive health department. RHS report 2010) and the geographically surrounding districts that are not far from Sana'a city and closer than any other city (Ministry of Public Health and Population, researches and data administration, map of health centres in Sana'a governorate, 2010) were taken into consideration when selecting these health centres. Al-Thawra, Al-Sab'een and Al-Kuwait hospitals were selected because they are considered the major public hospitals in Sana'a city.

Three RHS (VD, ANC and IUD) were involved in this study. The VD, ANC and IUD services were selected according to the following considerations: the services are more available and common in PHLF (Sana'a governorate's public health and population office, reproductive health department. RHS report 2010). According to the Ministry of Public Health and Population, ANC procedures are similarly provided at both facilities. IUD is the second of family planning methods used and preferred by most women especially in rural areas.¹⁹ As well the services are more cost and measurable compared with other RHS at PHLF.

Sample size

A sample size of 180 RH clients/patients were enrolled. It was classified equally according to the RHS used into 60 women who came for VD, 60 for ANC and 60 for IUD. They were allocated equally into PHLF and THLF groups.

As a result of political conflicts and the limited financial resources, a convenience sample size was determined as 180 from PHLF and THLF groups, and for the selected three RHS. A sample size of 30 is considered as a minimum statistical number and sufficient to estimate the quantitative variables ($n \geq 30$ is the guideline for quantitative variables).²¹

Inclusion and exclusion criteria

This study included women aged (15–45 years), who lived in the surrounding districts of Sana'a city and came for VD, ANC or IUD services at THLF. The accompanying adult individuals (men and women) who associated the women were included in this study. Those who agree to participate in this study were also included. While women who were subjected to caesarean section, referred from PHLF to THLF and came for family planning (pills, condoms, injection, tubal ligation and implants) were excluded from this study. Women in the post-menopausal state or who lived in districts other than the surrounding districts of Sana'a city and accompanying children and those who disagree to participate in this study were also excluded from this study.

Data collection and measurements

A structured questionnaire was quoted from literature^{5 11 12} and then reconstructed in the English language according to the objectives of the study. It was translated into the Arabic language. The data were collected through a face-to-face interview. The questionnaire was tested and reviewed by two experts, to ensure simplicity and clarity of questions. It consisted of questions to collect data related to socio-demographic characteristics, DMC and DNMC and INDC. The socio-demographic characteristics include age, education and working status and residence of RH clients/patients and accompanying individuals (is one or more persons who associated clients to health facilities). The DMC was elicited through questions related to the cost of clinical visits, diagnostic procedures (laboratory test and ultrasound), therapeutic procedures (delivery and IUD insertion or removal), medication costs (drugs, IUD items, tetanus toxoid vaccine and hepatitis B virus vaccine) and other expenses related to medical care, such as baby milk and diapers costs. The RH clients/patients and accompanying individuals were asked questions on the following DNMC; transportation (the trips from home to the health facility and back), accommodation, eating, khat and other costs like tips, clothes for baby or mother, blanket, cigarette and phone call. To estimate the INDC (lost wages due to absence from work), RH clients/patients and accompanying individuals were asked questions related to the time lost (time spent from leaving until return to home), and working status and wage. Only one ANC visit was estimated in this study. One more open-ended question for the THLF group to elicit data about the reasons for not using the nearby or adjacent PHLF.

Data processing and analysis

Data were entered and cleaned in an Excel program and analysed by the Statistical Package for the Social Sciences (SPSS) V.17. All costs are presented in the local currency, Yemeni Riyal (YER), and changed to US\$ using the average exchange rate in 2013 (US\$1.00=YER214.89). The wage rate of housewives was estimated according to the minimum limit of wage in Yemen, YER20 000 per

month (Ministry of Civil Service and Pensions, The law of Jobs, Wages and Salaries System. Law No. (43). Article (38). Paragraph (E). 2005. p. 10). The wages of those who work without earnings are derived from the replacement cost method which uses the wages of persons who work to pay for these tasks, as a measure of their value. The INDC was calculated by multiplying the wage per minute by the time lost in minutes. Cost saving is calculated as the difference between the cost in PHLF and THLF. The responses to open-ended questions were grouped, classified and summarised into seven themes. Most of the data were not normally distributed. Descriptive analyses were performed. The data were presented in frequency, percentage, median, range and IQR as quartile 1 and quartile 3. The median difference was calculated to compare the costs between PHLF and THLF groups. The mean and SD were used as an additional measure. The Mann-Whitney U test was used to compare the differences between PHLF and THLF groups. P value<0.05 was considered as a cut-off-point for statistical significance.

RESULTS

A total of 180 RH clients/patients were enrolled from PHLF and THLF, equally. Sixty women attended for each RHS (VD, ANC and IUD services). In addition, 246 accompanying individuals who attended with RH clients/patients were interviewed to estimate the DNMC and INDC.

Socio-demographic characteristics

Table 1 shows the socio-demographic characteristics of the RH clients/patients. The median (IQR) age of VD clients/patients among PHLF and THLF groups were 25 (22 and 30) years and 26 (20 and 30) years, respectively (p value=0.800). The percentage of illiterate was 90% among PHLF and 80% THLF groups. All the VD clients were housewives in the PHLF group and 93% were housewives in the THLF group.

For ANC, the median (IQR) of age among PHLF and THLF groups were 25 (23 and 28) years and 28.5 (21 and 35) years, respectively (p value=0.186). The percentage of illiterate were 80% and 83% among PHLF and THLF groups, respectively. Almost 97% were housewives in the PHLF group and 100% were housewives in the THLF group. Moreover, the median (IQR) age of IUD clients among PHLF and THLF groups were 26 (25 and 29) years and 28.5 (25 and 33), respectively (p value=0.467). The percentage of illiterate were 80% and 63% among PHLF and THLF groups, respectively.

All IUD clients were housewives in the PHLF group and 97% were housewives in the THLF group.

Table 2 shows the distribution of the costs of RHS in PHLF and THLF. The overall costs median (IQR) of VD, ANC and IUD services were US\$114.10 (91.62 and 140.45), US\$43.39 (33.60 and 67.78) and US\$37.67 (31.93 and 52.60) at THLF compared with US\$42.78 (26.60 and 53.92), US\$3.1 (1.60 and 6.13) and US\$14.22

Table 1 Socio-demographic characteristics of reproductive health clients/patients in primary and tertiary health levels

Socio-demographic characteristics	Vaginal delivery services (no=60)		Antenatal care (no=60)		Intrauterine device (no=60)	
	Primary health level	Tertiary health level	Primary health level	Tertiary health level	Primary health level	Tertiary health level
Age*						
Median (IQR)	25 (22 and 30)	26 (20 and 30)	25 (23 and 28)	28.5 (21 and 35)	26 (25 and 29)	28.5 (25 and 33)
Mean (\pm SD)	26.5 (\pm 5.9)	26.2 (\pm 5.9)	25.4 (\pm 3.7)	28.3 (\pm 7.9)	27.5 (\pm 3.2)	28.5 (\pm 5.4)
Education level*						
Illiterate	90%	80%	80%	83.3%	80%	63.3%
Primary school	10%	10%	16.7%	10%	16.7%	20%
Secondary school	0.0%	10%	3.3%	3.3%	0.0%	13.3%
University	0.0%	0.0%	0.0%	3.3%	3.3%	3.3%
Working status*						
Working with earning	0.0%	3.3%	3.3%	0.0%	0.0%	3.3%
Working without earning	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%
Housewife	100%	93.3%	96.7%	100%	100%	96.7%

*P value >0.05.

Table 2 Distribution the costs of reproductive health services in primary and tertiary health level facilities

Cost type	Vaginal delivery services (no=60)			Antenatal care (no=60)			Intrauterine device (no=60)		
	Primary health level	Tertiary health level	Cost saving (%)	Primary health level	Tertiary health level	Cost saving (%)	Primary health level	Tertiary health level	Cost saving (%)
Direct medical cost									
Median (IQR)	19.54 (15.24 and 22.00)	43.86 (32.91 and 51.40)	24.32 (125)*	0.93 (0.00 and 1.86)	14.77 (9.82 and 22.89)	13.84 (1488)*	11.17 (9.31 and 14.55)	9.07 (6.42 and 18.53)	-2.1 (-18)†
Mean (±SD)	18.89 (4.57)	42.41 (12.01)		1.60 (2.16)	16.94 (10.19)		12.25 (4.00)	12.70 (10.00)	
Range	18.61	50.72		7.68	47.70		15.59	41.18	
Direct non-medical cost									
Median (IQR)	13.96 (4.65 and 23.62)	43.05 (33.21 and 55.02)	29.09 (208)*	1.00‡ (0.00 and 0.12)	19.07 (12.56 and 26.81)	18.07 (1807)*	1.00 (0.00 and 0.00)	17.27 (11.53 and 25.00)	16.27 (1627)*
Mean (±SD)	14.59 (10.39)	46.56 (16.81)		1.39 (3.80)	23.30 (15.24)		1.63 (4.67)	21.52 (15.20)	
Range	33.51	70.73		19.07	56.77		23.27	71.19	
Indirect cost									
Median (IQR)	7.90 (5.92 and 12.22)	23.93 (16.92 and 33.12)	16.03 (203)*	1.59 (1.15 and 2.51)	9.49 (6.89 and 14.10)	7.90 (496)*	1.06 (0.90 and 2.31)	10.44 (7.41 and 12.21)	9.38 (884)*
Mean (±SD)	9.08 (4.38)	26.74 (10.26)		2.15 (1.61)	12.00 (7.65)		2.00 (2.25)	10.30 (3.75)	
Range	18.67	32.36		7.59	33.90		11.46	16.39	
Total cost									
Median (IQR)	42.78 (26.60 and 53.92)	114.10 (91.62 and 140.45)	71.32 (166)*	3.12 (1.60 and 6.13)	43.39 (33.60 and 67.78)	40.27 (1291)*	14.22 (11.13 and 18.42)	37.67 (31.93 and 52.60)	23.45 (165)*
Mean (±SD)	42.62 (15.45)	115.67 (27.33)		5.10 (6.12)	52.21 (22.73)		15.90 (8.54)	44.50 (21.51)	
Range	57.61	101.82		29.01	72.01		44.78	94.45	

*P value<0.0001.

†P value=0.117.

‡The zero was substituted by US\$1.00 to avoid the infinity result.

(11.13 and 18.42) at PHLF, respectively. The overall cost difference between THLF and PHLF groups was US\$71.32 (166%) for VD, US\$40.27 (1291%) for ANC and US\$23.45 (165%) for IUD services, respectively (with p value<0.0001).

DMC

Table 2 shows the median (IQR) of DMC for VD service was US\$43.86 (32.91 and 51.40) at THLF compared with US\$19.54 (15.24 and 22.00) at PHLF. Similarly, the median (IQR) of DMC for ANC service in THLF and PHLF were US\$14.77 (9.82 and 22.89) and US\$0.93 (0.00 and 1.86), respectively. However, the median (IQR) of DMC for IUD service was US\$9.07 (6.42 and 18.53) in THLF and US\$11.17 (9.31 and 14.55) in PHLF. The DMC difference between THLF and PHLF groups was US\$24.32 (p value<0.0001) for VD service, US\$13.84 (p value<0.0001) for ANC service and US\$-2.1 (p value=0.117) for IUD service.

DNMC

Regarding the DNMC, the median (IQR) of DNMC of VD was US\$43.05 (33.21 and 55.02) in THLF compared with US\$13.96 (4.65 and 23.62) in PHLF. For ANC service, the median (IQR) was US\$19.07 (12.56 and 26.81) at THLF compared with US\$0.00 (0.00 and 0.12) at PHLF. Moreover, the median (IQR) of DNMC for IUD service was US\$17.27 (11.53 and 25.00) in THLF compared with US\$0.00 (0.00 and 0.00) in PHLF. Therefore, The DNMC difference between THLF and PHLF groups was US\$29.09 (p value<0.0001) for VD service, US\$18.07 (p value<0.0001) for ANC service and US\$16.27 (p value<0.0001) for IUD service (table 2).

INDC

The median (IQR) of INDC for VD, ANC and IUD services were US\$23.93 (16.92 and 33.12), US\$9.49 (6.89 and 14.10) and US\$10.44 (7.41 and 12.21) at THLF compared with US\$7.90 (5.92 and 12.22), US\$1.59 (1.15 and 2.51) and US\$1.06 (0.90 and 2.31) at PHLF,

respectively. Therefore, the INDC difference between THLF and PHLF groups was US\$16.03 (p value<0.0001) for VD service, US\$7.90 (p value<0.0001) ANC service and US\$9.38 (p value<0.0001) for IUD service (table 2).

Reasons for not using PHLF

Table 3 shows the reasons for not using RHS at PHLF. The reasons for not using VD services were the unavailability of gynaecologists at PHLF (28%), followed by carelessness (19%) and loss of confidence at PHLF (19%). While unskilled health workers (24%), carelessness (18%), unavailability of gynaecologists (15%), unavailability of technical resources (15%) and loss of confidence (11%) were the reasons for not using ANC at PHLF. Moreover, the appropriate or free price of IUD services at THLF was the main reason (22%), followed by unskilled health workers (18%) and unavailability of technical resources at PHLF (18%).

DISCUSSION

This is the first study on cost saving in primary versus tertiary RHS conducted in Yemen. It revealed RHS costs were significantly different in PHLF and THLF, except for the DMC of IUD service. Therefore, the utilisation of PHLF would be a significant saving for RH clients and their families.

Our results indicate that the ages of RH clients at both PHLF and THLF were comparable. As well as higher illiteracy and unemployment among married women. This is because all the clients come from the same districts of Sana'a governorate who share the same cultural trends of reproductive behaviour, education and employment.

Our findings revealed that the DMC of VD services was significantly higher at THLF compared with PHLF (p value<0.0001). The utilisation of PHLF instead of THLF saves the family 125% of DMC for VD services. This result is consistent with previous studies in Tanzania,^{10 12 16} Bangladesh,^{5 14} India,^{9 17} Ghana,³ Malawi,⁶

Table 3 The reasons for not using reproductive health services in primary health level facilities

Reasons	Vaginal delivery services No. (%)	Antenatal care No. (%)	Intrauterine device No. (%)	Total No. (%)
Unavailability of gynaecologists	12 (28)	5 (15)	4 (12)	21 (19)
Carelessness in health centres	8 (19)	6 (18)	2 (6)	16 (15)
Loss of confidence	8 (19)	4 (11)	5 (15)	17 (15.5)
Unavailability of technical resources	6 (14)	5 (15)	6 (18)	17 (15.5)
Unskilled health workers	5 (11)	8 (24)	6 (18)	19 (17)
Unavailability*	4 (9)	4 (11)	3 (9)	11 (10)
Appropriate or free price in hospitals	0 (0)	2 (6)	7 (22)	9 (8)
Total answers	43 (100)	34 (100)	33 (100)	110 (100)

*Unavailability: include health centre is closed or non-existent, unavailability of drugs and the doctors are transferred to other health facilities.

Ethiopia,¹³ three African countries (Burkina Faso, Kenya and Tanzania),¹¹ Zambia,¹⁵ Burkina Faso,²² Vietnam,²³ Pakistan,²⁴ Afghanistan²⁵ and the Democratic Republic of the Congo²⁶ reported that the DMC of VD was higher at a high level or among bypassers compared with low level or non-bypassers. As well as two systematic reviews studies in low-income and middle-income countries.²⁷ Moreover, the study found the DMC of ANC was more than 15 times higher in THFL compared with PHFL. The utilisation of ANC at PHFL will save almost all the costs at THFL. Our finding similar to the finding of studies in Bangladesh,^{5,8,14} Malawi,⁶ India,⁹ Ghana,³ Vietnam²³ and Niger,²⁷ showed that the DMC of ANC was higher at a high level compared with a low level. As well as two systematic reviews studies in low-income and middle-income countries.²⁷ Although the DMC of IUD was slightly higher at PHFL as compared with THFL, there is no significant difference between THFL and PHFL (p value=0.117). This might be because the hospitals do not usually charge for IUD insertion or removal in contrast to the health centres. This result disagrees with the result of the study in Ghana which indicates that the cost of family planning was high in THFL as compared with PHFL.¹⁸

The DMC difference of VD and ANC between PHFL and THFL could be attributed to several possible explanations; the provision of services is a shortage, the laboratory tests are often not requested and the ultrasound is often not available in PHFL as compared with that in THFL. The drug prescription pattern of the specialists (higher professional qualifications) in THFL differs from the less qualified personnel (midwives) in PHFL. As well as the variation in availability and price of drugs.

Regarding the DNMC, this study revealed that the expenses for VD were three times higher in THFL compared with PHFL. Therefore, the DNMC saving as a result of the utilisation of the VD services at PHFL rather than THFL is 208%. This result agrees with the result of previous studies in Bangladesh,⁵ Malawi,⁶ Ghana³ and Tanzania.¹² Other studies in Tanzania,^{10,16} Zambia¹⁵ and India^{9,17} indicated that the transport costs are higher at a high level or among bypassers. In addition, the study showed that the utilisation of PHFL instead of THFL might save the whole DNMC of ANC and IUD services. Three previous studies in Bangladesh,^{5,8,14} Ghana³ and Malawi⁶ indicated that the DNMC of ANC was higher at a high level or among bypassers compared with a low level or non-bypassers. A study in Ghana reported that the transportation cost for family planning services at the THFL was higher in cost compared with PHFL.¹⁸

The DNMC difference of VD, ANC and IUD services between PHFL and THFL is possibly owing to discrepancies in transportation, food, water and number of accompanying individuals. The far distance of the THFL from the client's homes pushes them to hire vehicles which costs considerably while most RH clients usually cover the distance to PHFL walking, especially for ANC and IUD services. The RH clients usually have more accompanying persons in THFL than in PHFL and this increases the

DNMC in terms of transportation and food, while most RH clients either go alone or with minimal accompanying individuals for PHFL especially in ANC and IUD services.

Our findings agree with a previous study in Nepal²⁸ that showed the expenses on feeding and accommodation are higher among those bypassing PHFL.

The result of this study revealed that the INDC for the VD client and her accompanying individuals was three times higher at THFL compared with that at PHFL. The INDC saving as a result of the utilisation of the VD services at PHFL rather than THFL was 203%. This result is consistent with the results of studies in Bangladesh⁵ and Malawi,⁶ which reported that the costs of travelling and waiting time of VD were higher at a high level compared with a low level. A study in Tanzania indicated that bypassers incur a substantial opportunity cost due to the long time away from their farming work.¹⁰ Moreover, our result found the INDC for the ANC client and her accompanying individuals was six times costlier at THFL compared with that at PHFL. The INDC saving of one ANC visit at PHFL was 496%. The INDC of ANC at THFL might cover the total expenses of ANC at PHFL. This result agrees with the result of studies in Bangladesh^{8,14} which reported that the lost wage for ANC visit was greater at a high level compared with a low level. Another study in Malawi⁶ indicated that the costs of travelling and waiting time were higher at a high level compared with a low level. Similarly, the INDC for the IUD client and her accompanying individuals are nine times costlier at THFL compared with PHFL. The PHFL might save 884% of INDC for the IUD client and her accompanying individuals. A study in Ghana reported that the time value lost for family planning services was higher at a high level compared with a low level.¹⁸

The difference in lost wages for RH clients and their accompanying individuals between PHFL and THFL is possibly due to the discrepancy in the location of these services from the client's homes and the number of accompanying individuals.

Additionally, regarding the reasons for the bypassing of the PHFL, this study showed the majority of women did not use the VD services at PHFL because of the unavailability of gynaecologists, loss of confidence and carelessness in health centres. Four studies in Tanzania reported good provider performance or practice,^{10,12,23,29} a greater trust in health workers^{10,12} and availability of drugs and medical equipment.^{16,29} Another study in Vietnam reported that women often trust the professional qualifications of physicians and medical equipment at upper level facilities to give birth.²³ A study in Nepal reported that lack of necessary equipment and drugs, lack of skilled health workers and low confidence were the reasons for bypassing.⁴

This study found that unskilled health workers were the main reason for not using ANC at PHFL, followed by the carelessness in health centres. However, the appropriate or free price of IUD was the most important reason for selecting THFL. Unskilled health workers and



unavailability of technical resources in PHLF were other reasons that make women bypass the PHLF. Although family planning methods are provided for free in all PHLF in Yemen, still the patients have to pay the costs, as well as unskilled nurses.²⁰ A study in Yemen found that rural women's use of health centres for VD and ANC were limited by their perceived poor quality of services, as indicated by the lack of critical staff, particularly female doctors, equipment and essential medicines.¹ As well YNHDS indicated that 63% of women report no female provider is a problem of accessing healthcare.¹⁹

The strength of this study is that the first study on cost saving in the primary versus the tertiary level of RHS was conducted in Yemen. In addition to interviews before discharge, the costs paid after discharge were collected by phone when they arrived home. However, it has some limitations which should be considered. First, the cost might be estimated as the minimum economic burden of cost as a result of the utilisation of RHS at THLF because it was conducted from the patient perspective. Second, it used a non-probability sampling technique, which limits the generalisation of our results. Third, because of different types of vehicles (according to fuel type, fuel consumption and car size) and different ways, and lack of fixed price for distance, the private transport cost was estimated by asking about the cost of trips from home to the health facility and back as a measure of their value. Moreover, the costs estimated in this study are very low compared with current expenses and accessibility of health services, due to the deteriorating economic situation of the population and the health system.

The study found that there is a significant discrepancy in the RHS expenses between the THLF and PHLF. The utilisation of VD, ANC and IUD services at PHLF is a considerable cost saving for families. Therefore, shifting the utilisation of services from THLF to PHLF reduces the financial burden affecting individuals, families and their productivity. As well as issues related to the quality of RHS such as availability of gynaecologists, skilled health workers, technical resources were the possible reasons for bypassing the PHLF. Efforts are urgently needed to enhance the function of PHLF and protect the families from incurring the high expenditure. Development and implementation of the health referral system between health facility levels, and improving the quality of the health services in PHLF are highly recommended. Further research to estimate the RHS costs from the provider's perspective is also recommended.

Contributors AAHN was the principal author involved in the concept, design and implementation of the study, interpretation of data and preparing the draft manuscript. YAR was the main supervisor who analysed the data and contributed to the concept, design and review of the study. NSB was co-supervisor who contributed to the interpretation of data and review of the study. All authors reviewed and approved the final version of the manuscript. AAHN is responsible for the overall content as guarantor.

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Ethics approval The study was conducted and submitted for the partial fulfilment of the requirements for the degree of Master. It was approved by the Research and Ethics Committee of the Faculty of Medicine and Health Science, Sana'a University. Official letters to conduct this study was sent to The Public Health and Population Offices and the targeted facilities in Sana'a city and governorate. Methods were performed in accordance with the Declaration of Helsinki. Informed consent was taken from all participants. Confidentiality of data was assured and ensured. Participants gave informed consent to participate in the study before taking part.

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Data availability statement Data are available upon reasonable request. All relevant data are presented in this paper; and more information can be provided upon reasonable request from the corresponding author.

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ORCID iD

Abdulkareem Ali Hussein Nassar <http://orcid.org/0000-0002-0496-8444>

REFERENCES

- 1 Hyzam D, Zou M, Boah M, *et al*. Health information and health-seeking behaviour in Yemen: perspectives of health leaders, midwives and mothers in two rural areas of Yemen. *BMC Pregnancy Childbirth* 2020;20:1–12.
- 2 Banke-Thomas A, Abejirinde IOO, Ayomoh FI. The cost of maternal health services in low-income and middle-income countries from a provider's perspective: a systematic review. *BMJ Glob Health* 2020;5:e002371.
- 3 Amoro VA, Abihiro GA, Alatinga KA. Bypassing primary healthcare facilities for maternal healthcare in North West Ghana: socio-economic correlates and financial implications. *BMC Health Serv Res* 2021;21:1–14.
- 4 Shah R. Bypassing birthing centres for child birth: a community-based study in rural Chitwan Nepal. *BMC Health Serv Res* 2016;16:1–8.
- 5 Borghi J, Sabina N, Blum LS, *et al*. Household costs of healthcare during pregnancy, delivery, and the postpartum period: a case study from Matlab, Bangladesh. *J Health Popul Nutr* 2006;24:446–55.
- 6 Levin A, Mangani R, McEuen M. *Costs of maternal health care services in Blantyre district, Malawi. special initiatives report 17*. Bethesda, MD: Partnerships for Health Reform Project, Abt Associates Inc, 1999. http://www.healthsystems2020.org/files/1212_file_Sir17.pdf
- 7 Borghi J. What is the cost of maternal health care and how can it be financed? In: Brouwere D V, Van Lerberghe W, eds. *Safe motherhood strategies: a review of the evidence*. 2nd edn. Antwerp, Belgium: ITG Press, 2001: 243–92. <http://hdl.handle.net/10390/2661>
- 8 Jo Y, Alland K, Ali H, *et al*. Antenatal care in rural Bangladesh: current state of costs, content and recommendations for effective service delivery. *BMC Health Serv Res* 2019;19:1–13.
- 9 Hallad JS, Channakki HR. Out-of-pocket spending on maternal health services in rural North Karnataka. In: Nair CRK, James KS, eds. *Maternal and child health in India. A compendium of studies conducted by the population research centers*. Ministry of Health and Family Welfare, Government of India, 2016: 19–31. <http://prc.mohfw.gov.in/pdf/files/1%20Maternal%20and%20Child%20Health%20in%20India%202014-15.pdf#page=45>
- 10 Kruk ME, Mbaruku G, McCord CW, *et al*. Bypassing primary care facilities for childbirth: a population-based study in rural Tanzania. *Health Policy Plan* 2009;24:279–88.
- 11 Perkins M, Brazier E, Themmen E, *et al*. Out-Of-Pocket costs for facility-based maternity care in three African countries. *Health Policy Plan* 2009;24:289–300.
- 12 Kruk ME, Mbaruku G, Rockers PC, *et al*. User fee exemptions are not enough: out-of-pocket payments for 'free' delivery services in rural Tanzania. *Trop Med Int Health* 2008;13:1442–51.
- 13 Pearson L, Gandhi M, Admasu K, *et al*. User fees and maternity services in Ethiopia. *Int J Gynaecol Obstet* 2011;115:310–5.

- 14 Himel MFB, Rimi NA, Sultana R. Assessment of users' perspective of public health services in Bangladesh. Second Draft Report. Bangladesh Health Watch. Available: https://bangladeshhealthwatch.org/front/assets/files/research/Report%20on%20Users'%20Perspective_29April.pdf [Accessed 15 Apr 2020].
- 15 Kaiser JL, McGlasson KL, Rockers PC, et al. Out-Of-Pocket expenditure for home and facility-based delivery among rural women in Zambia: a mixed-methods, cross-sectional study. *Int J Womens Health* 2019;11:411–30.
- 16 Kruk ME, Hermosilla S, Larson E, et al. Bypassing primary care clinics for childbirth: a cross-sectional study in the Pwani region, United Republic of Tanzania. *Bull World Health Organ* 2014;92:246–53.
- 17 Mohanty SK, Srivastava A. Out-Of-Pocket expenditure on institutional delivery in India. *Health Policy Plan* 2013;28:247–62.
- 18 Amissah J, Nakua EK, Badu E, et al. In search of universal health coverage: the hidden cost of family planning to women in Ghana. *BMC Res Notes* 2020;13:58.
- 19 Ministry of Public Health and Population (MOPHP), Central Statistical Organization (CSO) [Yemen], Pan Arab Program for Family Health (PAPFAM) and ICF International. *Yemen National health and demographic survey 2013*. Rockville, Maryland, USA: MOPHP, CSO, PAPFAM, and ICF International, 2015. <https://dhsprogram.com/pubs/pdf/FR296/FR296.pdf>
- 20 Osaiweran MA. *Factors influencing the uptake of family planning in Yemen during conflict. 52nd master of public Health/International course in health development*. The Netherlands: KIT (Royal Tropical Institute)/Vrije Universiteit Amsterdam, 2016. https://bibalex.org/baifa/Attachment/Documents/OyCu517bLQ_20170504163434783.pdf
- 21 Agresti A, Min Y. *On sample size guidelines for teaching inference about the binomial parameter in introductory statistics*. Gainesville, Florida: Department of Statistics University of Florida, 2002: 32611, 38545. http://users.stat.ufl.edu/~aa/ci_proportion.pdf
- 22 Meda IB, Baguiya A, Ridde V, et al. Out-Of-Pocket payments in the context of a free maternal health care policy in Burkina Faso: a national cross-sectional survey. *Health Econ Rev* 2019;9:1–14.
- 23 Toan TK. *Antenatal and delivery care utilization in urban and rural contexts in Vietnam. A study in two health and demographic surveillance sites*. Doctoral thesis. Gothenburg, Sweden: Nordic School of Public Health, 2012: 38. 17. <https://www.diva-portal.org/smash/get/diva2:782639/FULLTEXT01.pdf>
- 24 Khowaja AR, Mitton C, Qureshi R, et al. A comparison of maternal and newborn health services costs in Sindh Pakistan. *PLoS One* 2018;13:e0208299.
- 25 Naseem M. Determining factors and utilization pattern for normal delivery care in Nangarhar province of Afghanistan. 48th Master of Public Health/International Course in Health Development. KIT (Royal Tropical Institute)/ Vrije Universiteit Amsterdam, The Netherlands. September, 2012. Available: <http://www.bibalex.org/Search4Dev/files/428888/455716.pdf>
- 26 Ntambue AM, Malonga FK, Dramaix-Wilmet M, et al. Commercialization of obstetric and neonatal care in the Democratic Republic of the Congo: a study of the variability in user fees in Lubumbashi, 2014. *PLoS One* 2018;13:e0205082.
- 27 Ouédraogo CT, Vosti SA, Wessells KR, et al. Out-Of-Pocket costs and time spent attending antenatal care services: a case study of pregnant women in selected rural communities in Zinder, Niger. *BMC Health Serv Res* 2021;21:1–17.
- 28 Karkee R, Lee AH, Binns CW. Bypassing birth centres for childbirth: an analysis of data from a community-based prospective cohort study in Nepal. *Health Policy Plan* 2015;30:1–7.
- 29 Kruk ME, Paczkowski M, Mbaruku G, et al. Women's preferences for place of delivery in rural Tanzania: a population-based discrete choice experiment. *Am J Public Health* 2009;99:1666–72.