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Non-prescription acquisition of antibiotics in community pharmacies in Marib, Yemen: a cross-sectional study

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Research Article

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Abstract

Background:

Antimicrobial resistance is largely caused by non-prescription antibiotic access, especially in low-resource and conflict-affected areas where formal healthcare is scarce. This study assessed the prevalence and determinants of non-prescription antibiotic acquisition in community pharmacies in Marib city, Yemen.

Methods:

A cross-sectional study was conducted among adults (≥ 18 years) visiting community pharmacies to obtain antibiotics. A total of 468 participants were recruited using probability-proportionate-to-size sampling. Individuals purchasing antibiotics for professional use were excluded. The main goal was to get antibiotics without a prescription. Sociodemographic characteristics, displacement status, residential location (urban or rural), and motivations for antibiotic use were all independent variables. Data were collected through in-person interviews and subsequently analyzed to identify correlated factors.

Results:

Of the 468 participants, 321 (68.6%) acquired antibiotics without a prescription. Internally displaced persons, rural residents, males, and individuals with low education, unemployment, and low income were more likely to get drugs without a prescription. The most common reasons for going to the doctor were symptoms of upper respiratory tract infections, such as the common cold, fever, and cough (47.4%). Of these, 91.0% were treated without a prescription. Pharmacists (43.6%) and self-knowledge (25.9%) were the main sources of information guiding antibiotic use. In addition, 66.9% reported keeping leftover antibiotics for future use, and only 33.1% completed the full treatment course.

Conclusions:

In Marib, it is very common for people to get antibiotics without a prescription, especially among vulnerable groups like people who have been displaced from their homes. To stop people from using antibiotics inappropriately and stop antimicrobial resistance, we need to strengthen drug regulation, make it easier for people to get health care, and start community-based antimicrobial stewardship and public education programs.

Background

Antimicrobial resistance (AMR) is widely acknowledged as a significant threat to world health, capable of undermining decades of advancements in modern medicine. The primary source of antimicrobial resistance (AMR) has consistently been identified as the misuse of antibiotics, encompassing self-medication, incomplete treatment courses, and over-the-counter sales.[1] In 2019, antimicrobial resistance (AMR)

resulted in around 5 million fatalities worldwide, ranking among the leading causes of death, comparable to HIV and malaria. [2] Not much has changed, if one refers to current estimates. By 2025, the World Health Organization (WHO) confirmed that global antibiotic consumption was still high, with a median value of 18.3 defined daily doses per 1,000 inhabitants per day. This has been in part blamed on overuse of the so-called "Watch" antibiotics, which are at higher risk of resistance. [3] Despite the global attempt to achieve a 10% reduction in human deaths caused as a result of bacterial antimicrobial resistance (AMR) by 2030, the progress being made is meager, and antibiotics continue to be misused. [4] Limited pharmaceutical regulation, low access to diagnostics, and financial pressure leading patients to pharmacies instead of doctors compound this issue in low- and middle-income countries (LMICs). [5] These factors have aggregated resistance to propagate rapidly, engender incurable diseases, and skyrocket costs on already fragile health systems. One of the most serious public health threats is the consumption of antibiotics without a prescription, which can create antimicrobial resistance. [6] Using over-the-counter antibiotics can pose serious risk to individual safety in terms of potential adverse drug reactions, drug-drug interactions, misdiagnosis, superinfection, alteration of microbiota, and covering up of underlying infectious processes. [7] Meanwhile, in the area of the Middle East and North Africa, for example, studies conducted across Saudi Arabia, Jordan, and Egypt have revealed that over half of neighborhood drug sellers sell antibiotics without a prescription for prices ranging between 40% and > 70%.[8–10] Both the general public and healthcare professionals in sub-Saharan Africa have been known to use antibiotics irrationally; this behavior is frequently connected to low health literacy and insufficient stewardship initiatives. [11, 12] 78% of antibiotics in LMICs are sold without a prescription, according to a recent systematic review and meta-analysis. [13] Such behaviors not just lead to AMR but additionally raise the chance of unsuccessful therapy, drug-related side effects, and delays in getting treatment for serious illnesses.

In the nation of Yemen, the inappropriate use of antibiotics becomes an alarming and increasing risk. The health care system has broken down because the war, which has gone on for long terms, weakened laws and regulations and also had the effect of moving millions of people, which in turn plays a role in the improper use of antibiotics. [14] Community-based research efforts in Yemen reveal the magnitude of the problem: in the capital of Yemen, simulated client visits to community drugstores demonstrated that 73% gave out antibiotics without an accurate prescription [15], whereas in the Dhamar region, almost 96% of pharmacists agreed to give out antibiotics without having physician authorization. [16] Research conducted with educators in Yemen additionally found that 78% had self-medicated with antibacterial medications, which were generally purchased directly from pharmacies without a prescription. [17] Hospital-related research results demonstrate that the problem spreads into clinical practice; a 2024 cross-sectional study in Sana’a stated that 92.5% of hospitalized patients had received antimicrobial therapy, with over fifty percent of these prescriptions derived from the WHO “Watch” category. [14] These practices are a result of a number of factors, including systemic barriers (reduction of stewardship programs and limited diagnostic capacity), provider-level pressures (economic incentives, lack of training), and individual patient reasons (insufficient awareness of AMR, belief in the efficacy of antibiotics for infections caused by viruses, and rejection of consultation costs). [18–20]

Despite that research, there is still a lack of data from certain Yemeni regions that have particular wars. For example, in Marib Governorate, which has large IDP populations, there are current periodic outbreaks of

violence, population displacement, and stress on key health facilities. These conditions not only enhance the burden of infectious disease but also increase unauthorized and informal medical marketplaces where access to antibiotics is easy. [21] Studies on antibiotic behaviors in Marib have a substantial information gap, as behaviors of abuse are likely affected by the governorate's specific socioeconomic and health system environment. It is essential to investigate the prevalence and causes of antibiotics acquired with or without a prescription in Marib City. This research has informed national management programs, effected legislative change, and supported community-level AMR efforts. The present study was to determine prevalence and determinants of non-prescription antibiotic acquisition in community pharmacies in a conflict-affected setting in Marib City, Yemen.

Methods

Study setting and design:

The study was conducted in community pharmacies in two districts of Marib governorate: Marib City District (urban) and Harib District (rural). A cross-sectional study conducted in both locations in 2025 on a random sample of resident and internally displaced populations attending community pharmacies for purchasing antibiotics in the Marib Governorate of Yemen.

Participants:

The target population comprised persons attainted for purchasing antibiotics for themselves or first-degree family members at a community pharmacy. Inclusion criteria: Participants are at age ≥ 18 years and have visited a pharmacy for sold antibiotics. Exclusion criteria: doctor who got drugs for their own practice and participants who return to pharmacies. (filtered using short identifiers to eliminate duplicates).

Sampling frame, site selection, and recruitment:

A list of licensed community pharmacies in Marib was acquired from local health authorities and professional networks. Community pharmacies segmented by geography (urban vs rural) and catchment (areas with high IDP presence versus primarily host communities). Used the proportional allocation method to get the sample from each district (based on the number of community pharmacies and population in each district), and subjects were selected randomly. In order to reduce time-of-day bias, successive sampling of eligible consumers was done during pre-specified shifts (morning, afternoon, and evening, weekdays and weekends). As soon as a customer made a purchase, trained data collectors approached them, verified their eligibility, got their agreement, and, if possible, gave the questionnaire in a private setting

Sample size:

The estimated sample size for the survey was estimated at 468, using a standard formula for cross-sectional studies assuming a prevalence of non-prescription antibiotic use of 50%, a 5% margin of error, 95% confidence level. Using the online sample size calculator RaoSoft®, the minimal effective sample size was

calculated and found to be 377 at a 95% confidence level. However, in order to decrease the chance of error, an aggregate of 468 participants were requested to participate in this study and accepted to answer the interviews. (n = 468).

Data collection instrument and procedures:

The data of this study was collected by using a questionnaire developed and adapted from previously published studies on self-medication and non-prescription antibiotic use[22,23]. The questionnaire was refined based on a literature review and input from local experts to ensure its relevance to the Marib, Yemen context. The English version of the questionnaire is provided as a supplementary file (Supplementary File 1). Data collected through face-to-face interviews by trained personnel. The interviews were held in public areas in front of the community pharmacy. The objectives of the research were explained to the respondents, and their informed agreement was obtained prior to the study beginning. The period of the study carried out from May to September 2025; the questionnaire was drafted in English, translated to Arabic, and back-translated to ensure semantic equivalence. Content validity was assessed by a panel of three subject-matter experts (clinical pharmacy, public health, and epidemiology). A pilot test (n ≈ 30) in one urban and one rural pharmacy evaluated clarity and timing; minor wording changes followed. Pilot data has been excluded from the final analysis. Field teams received standardized training, including role-play and mock interviews, and used a uniform script to reduce interviewer variability.

Data analysis:

Data collected was analyzed with the aid of SPSS version 26, 2024. Descriptive statistics are expressed as frequency and percentage. The associations of dependent (use of nonprescription antibiotics) with independent variables were evaluated. The Pearson chi-square test was used to identify the relationship between usage and other variables as well as between groups. It was also used to test for significant association between them. Statistical significance was set at $p < 0.05$ for all tests, and results were interpreted with a confidence interval of 95%. Logistic regression analysis was used to estimate the adjusted odds ratios and 95% confidence intervals for the association between antibiotic prescription and the affecting factors.

Result

A socio-demographic characteristics and acquisition antibiotic with a prescription.

Table 1 shows socio-demographic characteristics and purchased antibiotics with a prescription; this study included 468 participants with a mean age of 32.82 + 12.50 years. Of these, 76 were female and 392 were male. 178 of the participants were host residents, while 290 individuals were internally displaced. Most people bought antibiotics without a prescription (68.6%, n = 321). The possible variables among participants and behavior of obtained antibiotics were examined by using Pearson's chi-square test. The individuals in urban areas were significantly more likely to purchase antibiotics with a prescription (35.5%) as compared to those in rural areas (23.8%) ($\chi^2 = 6.82$, $p = 0.014$). Antibiotics obtained with a prescription were seen at a greater rate (33.70%) among respondents aged 18–30 compared to those over 30, with no significant

connection between age and purchased antibiotics with a prescription ($p = 0.381$). Although female purchase antibiotics with a prescription in a higher proportion than male, there is a statistically significant association between gender and antibiotic purchase behavior ($\chi^2 = 6.076$, $p = 0.014$). Resident or internally displaced status was significant ($\chi^2 = 12.290$, $p < 0.004$). The most substantial disparity was observed based on residency status. Nearly three-quarters of internally displaced individuals purchase antibiotics without a prescription (74.50%) as compared to resident individuals (59.0%). A strong, positive gradient was observed between educational attainment and prescribed antibiotic purchase ($\chi^2 = 58.109a$, $p = 0.000$). The prevalence increased from 15.10% among illiterate or read-and-write individuals to 70.30% among those with graduated or past-graduate-level education. Individuals who are working in government jobs bought antibiotics with prescriptions more than individuals who did not work, with a significant difference (χ^2 9.246 a, $p = 0.002$). Monthly income was a highly significant predictor ($\chi^2 = 58.109a$, $p < 0.000$). The practice of using a prescription was markedly higher among high-income earners (52.70%) compared to those with low income (20.20%). The health problems for which antibiotics were obtained: the present study revealed that common cold, fever, and cough were the most common health problems for which antibiotics were obtained without prescription (91.00%) follow up by upper respiratory tract infections (URTIs), Dysentery/diarrhea/food poisoning, and abdominal or other pain, which represent 60.8%, 41.30%, and 30.40%, respectively. There was a significant connection between health problems and got antibiotics without a prescription predictor ($\chi^2 = 108.775$ a, $p < 0.0004$). Regarding how they handled leftover antibiotics, 66.9% of participants said they kept them at home for future use, and just 33.1% typically finished the whole course.

Table 1
socio-demographic characteristics and acquisition antibiotic with a prescription (N = 468). Mean age = 32.82 + 12.50

Variable	Total	with prescription	Without prescription	χ^2	P. value
468(100.0%)	**147(31.4%)**	**321(68.6%)**			
Locality					
An urban area	304(65.0%)	108(35.5%)	196(64.5%)	**6.82[a]**	**0.014**
A rural area	164(35.0%)	39(23.8%)	125(76.2%)		
Age					
18–30	190(40.6%)	64(33.7%)	126(66.3%)	0.76 [a]	0.381
> 30 years	278(59.4%)	83(29.9%)	195(70.1%)		
Gender					
Male	392(83.8%)	114(29.1%)	278(70.9%)	**6.07[a]**	**0.014**
Female	76(16.2%)	33(43.4%)	43(56.6%)		
Residence					
Resident	178(38.0%)	73(41.0%)	105(59.0%)	**12.29 [a]**	**0.004**
Displaced	290(62.0%)	74(25.5%)	216(74.5%)		
Level of Education					
Illiterate/can read and write	73(15.6%)	11(15.1%)	62(84.9%)	**58.11[a]**	**0.000**
primary or preparatory school	191(40.8%)	47(24.6%)	144(75.4%)		
Secondary school	140(29.9%)	44(31.4%)	96(68.6%)		
University graduate or postgraduate	64(13.7%)	45(70.3%)	19(29.7%)		
Occupation					
Employed	191(40.8%)	75(39.3%)	116(60.7%)	**9.25 [a]**	**0.002**
Not-employed	277(59.2%)	72(26.0%)	205(74.0%)		
Monthly Family Income (Yemeni Rial					
Low (< 100,000)	218(46.6%)	44(20.2%)	174(79.8%)	**35.99[a]**	**0.000**
Medium (100,000–300,000)	140(29.9%)	45(32.1%)	95(67.9%)		

Note: Bold values are statistically significant

Variable	Total	with prescription	Without prescription	χ^2	P. value
468(100.0%)		**147(31.4%)**	**321(68.6%)**		
High (> 300,000)	110(23.5%)	58(52.7%)	52(47.3%)		
The main reason for purchasing the antibiotic					
Fever, common cold, or cough	222(47.4%)	20(9.0%)	202(91.0%)	**108.75** [a]	**0.0004**
Dysentery/diarrhea/food poisoning	79(16.9%)	31(39.2%)	48(60.8%)		
URTi	46(9.8%)	27(58.7%)	19(41.3%)		
Abdominal/ other pain	23(4.9%)	16(69.6%)	7(30.4%)		
Other reason	98(20.9%)	53(54.1%)	45(45.9%)		
leftover of antibiotic					
Usually complete the full course.	155(33.1%)	64(41.3%)	91(58.7%)	**10.50** [a]	**0.001**
Keep it at home for future use.	313(66.9%)	83(26.5%)	230(73.5%)		
Note: Bold values are statistically significant					

Sources of knowledge affecting the acquisition of antibiotics without a prescription

Table 2 revealed that Pharmacists constituted the principal source of information acquisition of antibiotics without a prescription among participants (43.6%), follow by self-knowledge of participants (25.9%), family members (16.8%), and friends/neighbors (13.7%). This finding highlights the prominent role of pharmacists and self-knowledge of participants in influencing non-prescription antibiotic use.

Table 2
Sources of knowledge affecting the acquisition of antibiotics without a prescription among participants in Marib City, Yemen.

Sources of knowledge	No.	%
Pharmacist	140	43.6%
Self-Knowledge/ Previous personal experience	83	25.9%
Family member	54	16.8%
Friends/neighbor	44	13.7%
Total	**321**	**100.0%**

Independent Predictors of Purchased antibiotics without prescription.

Table 3 found that the results of the multivariable logistic regression analysis being rural (AOR: 2.486, 95% CI (1.295, 4.772)); illiterate or reading (AOR: 2.486, 95% CI (1.295, 4.772)); primary or preparatory schools (AOR: 6.954, 95% CI (3.051, 848)); secondary schools (AOR: 5.843, 95% CI (2.501, 13.654)); not employed (AOR: 2.74, 95% CI (1.231, 6.124)); low income (AOR: 4.419, 95% CI (2.317, 8.431)); and moderate income (AOR: 2.17, 95% CI (1.10, 4.25)) were independent predictors of purchasing antibiotics without a prescription among the population. In contrast, the odds of having antibiotics without a prescription were significantly lower among those who were aged 18–30 (AOR: 0.9, 95% CI (0.5, 1.5)) and host residents (OR: 0.6, 95% CI (0.2, 1.5)).

Table 3
Logistic regression analysis for finding several socio-demographic and purchased antibiotics without prescription among study participants (N = 468).

Variables	Categories	*p*-value	AOR	95% C.I.	
				Lower	Upper
Locality	Urban versus rural [R]	**0.006**	**2.486**	**1.295**	**4.772**
Age	18–30 versus above 30[R]	0.711	0.904	0.531	1.54
Gender	Male versus female [R]	0.239	0.665	0.337	1.312
Residence	Resident versus internal displaced [R]	0.299	0.629	0.262	1.509
Level of education	Illiterate/ can read versus University graduated or post graduated [R]	**0.000**	**23.530**	**8.127**	**68.124**
	primary or preparatory s versus graduated or post graduated [R]	**0.000**	**6.954**	**3.051**	**15.848**
	Secondary s versus graduated or post graduated [R]	**0.000**	**5.843**	**2.501**	**13.654**
Occupations	**Government** employed versus Non-**government** Employed [R]	0.014	**2.745**	**1.231**	**6.124**
Monthly Family Income (Yemeni Rial (YER)) 2	Low versus high-income [R]	**0.000**	**4.419**	**2.317**	**8.431**
	Moderate versus high-income [R]	**0.024**	**2.171**	**1.108**	**4.252**
The main reason for purchasing the antibiotic	Fever, common cold, and cough	**0.000**	**14.561**	**7.251**	**29.241**
	Dysentery/diarrhea/food poisoning, Infection,	**0.009**	**2.825**	**1.297**	**6.156**
	URTi	0.682	0.836	0.354	1.972
	Abdominal/other pain	0.334	0.575	0.187	1.769
Leftover of AB	What do you usually do with leftover antibiotics?	0.119	1.546	0.894	2.675
Constant		0.000	0.006		

Note: Bold values are statistically significant. Superscript R means reference group.

Discussion

Antibacterial medications are the most often bought medications in pharmacies as well as supply multiple advantages if utilized correctly; nevertheless, the majority of patients in neighborhood pharmacies receive antibiotics without a prescription, which may lead to antibiotic resistance. The current study demonstrated that 68.6% of participants acquired antibiotics without a prescription during the study period, highlighting that

self-medication with antibiotics constitutes a considerable public health issue. This percentage is high because most drugs, particularly antibiotics, can be obtained from pharmacies and drugstores without the need for a prescription in Yemen. That agreement with previous studies conducted in Yemen, which indicated that 73.3% of pharmacies supplied antibiotics without a prescription and 60% of patients used antibiotics without a prescription. [15, 24] Also other rate have been observed in other low- and middle-income countries (LMICs), where antibiotic use without a prescription varied from 60% to 70%. [15, 25–27] These percentages are much higher than reported rates in other nations with tougher controls, such as Jordan (39%) and Saudi Arabia (48%), revealing gaps in enforcement and public understanding. [28, 29]

The independently linked variables with non-prescribed antibiotic usage were being an internally displaced male living in a rural region and holding illiteracy, elementary, or secondary school. Males were more likely than female respondents to take antibiotics without a prescription. Similar results have been proven in Ethiopia [30], Asmara, Eritrea [31], Riyadh, and Saudi Arabia. [32] This finding was contrary to other studies done in Nigeria [33] and the United Arab Emirates. [23] This difference may be due to the current study context; males have better health-seeking behavior to purchase antibiotics from community pharmacies compared to their counterparts. The present study found that population who live in rural areas were 2.5 times more likely than the urban population to obtain antibiotics without a prescription. This aligns with studies in Ethiopia and Sudan, where urban populations had better access to healthcare services, reducing reliance on self-medication. [34, 35] Regarding internally displaced and resident respondents, the odds of non-prescription use of antibiotics among internally displaced respondents (74.5%) were higher than resident respondents (59.0%), reflecting barriers to healthcare access in conflict-affected populations. This agrees with findings that were conducted by Alividza et al. and the WHO Global Evidence Review, which indicated inequitable access and improper antibiotic usage among refugees and internally displaced persons. [36, 37]

Moreover, the finding of this study has also shown that level of education has a significant association with non-prescription use of antibiotics. A strong, positive gradient was observed between educational attainment and prescribed antibiotic purchase. Respondents with a lower education level had greater non-prescribed antibiotic use as compared with those who were highly educated. Similar studies have been reported in Saudi Arabia, China, Iran, and Rwanda, suggesting that higher education improves knowledge of antimicrobial resistance (AMR) and rational antibiotic use [38–41], which similarly demonstrated that individuals with a higher educational background are less likely to engage in SMA practices. For the monthly income, family also influenced antibiotic purchasing behavior, with higher-income individuals more likely to seek prescriptions as compared with low-income individuals. Comparable findings were reported in Pakistan, where economic constraints drive self-medication. [42] A comprehensive review and meta-analysis indicated that the correlation between income and antibiotic misuse, Numerous extensive community studies in low- and lower-middle-income regions have revealed elevated rates of antibiotic distribution without prescriptions, indicating that financial constraints and restricted access to healthcare professionals compel lower-income populations to resort to self-medication. [43]

This study found reasons for getting antibiotics without a doctor's prescription were mainly for the common cold, fever, and cough. These conditions are largely viral in origin, where antibiotics are not clinically indicated, and reflect irrational use. These findings imply that antibiotics were frequently abused for mild, mainly viral, infections when using antibiotics is not medically justified. Consistent with irrational use patterns

observed, evidence has been found in Sana'a [15], Rwanda [41], Vietnam [44], China [45], and Sudan. [46] For the source of antibiotics without prescription, the present study revealed that most of the participants obtained their guidance from pharmacists and their experience. This aligns with research carried out in Yemen [15] Rwanda [41]. Pakistan [47] which showed that pharmacists have a role in aiding self-medication. Hence involving pharmacists, in stewardship programs is vital to avoid the misuse of antibiotics. Concerning leftover antibiotics 66.9% of respondents admitted to keeping antibiotics for use and would reuse them if the same symptoms reoccur, whereas only 33.1% completed the full prescribed course. Storing and reusing antibiotics can lead to inadequate treatments and resistant bacterial strains. It's in line with research conducted by Alividza et al. [36], Vietnam [44], and Saudi Arabia [48], which suggested that antibiotic storage and reuse are frequent in low-resource or conflict-affected countries owing to restricted healthcare access and misunderstandings regarding antibiotic therapy.

Limitations:

This study may be affected by contextualized, legal, cultural and socioeconomic factors that were not thoroughly examined. Some eligible individuals, particularly women, may have opted out of participation, resulting in non-response (selection) bias. The limited time for interviews in busy pharmacies may have resulted in incomplete data collection.

Conclusion

AMR is a big worldwide health issue which mainly driven by misuse and over use of antibiotics. Reducing incorrect use of antibiotics in the fight against drug resistance. This study reveals that obtained of antibiotics without a prescription from community pharmacies is a very serious public health issue especially in a conflict affected setting. There are factors associated in Yemen with this issue, including such as socio demographic variables, health care access is limited and pharmacy staff techniques

Recommendations

Immediate wide scale interventions are needed which include strict enforcement of over the counter antibiotic sales, community based antimicrobial stewardship programs which will target pharmacists and the public, and also very focused health education for high risk groups. Solving the fundamental obstacles to getting medical care, especially for internally displaced populations, is vital to controlling irrational antibiotic use and managing the rising danger of antimicrobial resistance in Yemen as well as unstable situations

Abbreviations

AMR
Antimicrobial resistance
ANT
Antibiotics
CI
Confidence interval
IDPs

Internally displaced persons
LMICs
Low- and middle-income countries
OR
Odds ratio
SPSS
Statistical Package for the Social Sciences
WHO
World Health Organization

Declarations

Ethics approval and consent to participate

This study was obtained ethical approval from the Research Ethics Committee of the College of Medicine, University of Saba Region, Marib, Yemen. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Verbal informed consent was obtained from all participants prior to data collection, and confidentiality of the collected information was strictly maintained.

Consent for publication:

Not required.

Competing interests:

The authors have no competing interests to declare.

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Author Contribution

A.S. M. A.-J. conceived and designed the study, developed the study protocol, conducted data collection, performed data analysis and interpretation, and drafted and critically revised the manuscript. The author read and approved the final manuscript.

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Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

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- SupplementaryFile1Questionnaire.pdf