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RESEARCH ARTICLE

Highlighting the pivotal role of the pharmacist in influencing health behaviours during emergency crisis: A lesson from the COVID-19 pandemic

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Abstract

Background: The contribution of the pharmacist in influencing health behaviours and raising awareness of the impact of self-medication (SM) is valuable. During the COVID-19 pandemic, SM was triggered by multiple factors driven by the fear of becoming infected. This study aimed to identify the determinants of SM during the outbreak, with a focus on the role of social media, and to determine areas where the active contribution of the pharmacist needs strengthening. **Methods:** A pilot cross-sectional study using snowball sampling was conducted in thirteen countries. **Results:** A total of 2369 participants with a mean age of 30.62±11.57 years were enrolled in the study. The determinants of SM were 1) sociodemographic characteristics, including developing countries (ORa= 0.670; 95%CI [0.49, 0.91]); 2) communication channels, where Facebook was the most used social media platform (ORa=1.624; 95%CI [1.29, 2.05]); and 3) content and sources of unverified information, i.e. television interviews (ORa=1.357; 95%CI [1.03, 1.78]) and videos with someone confirming the effectiveness of medication used (ORa=1.353; 95%CI [1.06, 1.73]). The perceived risk severity was associated with elderly polypharmacy (ORa= 2.468; 95%CI [1.87, 3.26]). **Conclusion:** The pharmacist should collaboratively and actively contribute to the design and implementation of health promotion programmes and convert to positive the influence of social media.

Introduction

The World Health Organisation (WHO) defines self-medication (SM) as *"the use of pharmaceutical or medicinal products by the consumer to treat self-recognised disorders or symptoms*, the intermittent or continued use of a medication previously prescribed by a physician for chronic or recurring disease or symptom, or the use of medication recommended by lay sources or health workers not entitled to prescribe medicine" (World Health Organisation, 2000). SM is the leading cause of detrimental economic, social, environmental, and health effects (Parulekar *et al.*, 2016), with a prevalence ranging between 12.7% and 95% in developing countries (Shafie *et al.*, 2018). Numerous studies have shown that SM is associated with inappropriate medication use, inaccurate diagnosis, drug interactions, adverse drug reactions, delay in seeking medical care, and environmental disposal of pharmaceuticals (Limaye *et al*., 2017). SM with antibiotics remains the most alarming issue, as it is one of the main drivers of antimicrobial resistance (Limaye *et al*., 2017). A systematic review of SM in developing countries (Limaye *et al*., 2017) showed that these health behaviours are attributable to socioeconomic conditions, previous experience with drug use, mild disease conditions, emergencies, lack of time, and saving money. During the COVID-19 outbreak, multiple socio-cultural, socioeconomic, and regulatory interplays influenced the global prevalence of SM (Karimy *et al.*, 2011; Pakpour & Griffiths, 2020; Dare *et al.*, 2021; Fetensa *et al.*, 2021; Quincho-Lopez *et al.*, 2021; Sadio *et al.*, 2021; Wegbom *et al.*, 2021; Gaviria-Mendoza *et al.*, 2022). The Health Belief Model (HBM) was used in the context of COVID-19 to predict community preventive behaviours (Mirzaei *et al.*, 2021) and investigate the determinants of SM in the community (Sudhewa *et al.*, 2023), including self-perception of the susceptibility to the illness, the likely severity of symptoms, the benefits of SM, and barriers to accessing medical care (Sudhewa *et al.*, 2023). HBM has shown that people who feel vulnerable to health threats and have a high perception of risk severity, such as those taking multiple medications and with comorbidities, tend to engage in risky behaviours such as self-medication (Karimy *et al.*, 2021; Borges do Nascimento *et al.*, 2022; Wilhelm *et al.*, 2023).

Misinformation and dangerously individual opinions posted and shared on social media triggered irrational health behaviours, leading to harmful and sometimes detrimental public health outcomes (Parkour *et al.*, 2020; Fetensa *et al.*, 2021; Ayosanmi *et al.*, 2022; Kazemioula *et al.*, 2022; Gaviria-Mendoza *et al.*, 2022; World Health Organisation, 2022). A countless number of posts and accounts were either deleted or suspended in an attempt to fight this public health threat (Meeks, 2018). Several reviews examined the amount of health misinformation on different platforms (Tang *et al.*, 2018; Wang *et al.*, 2019; Gabarron *et al.*, 2021; Suarez-Lledo & Alvarez-Galvez, 2021), and many studies raised the alarm about the amount of misleading content shared on social media during COVID-19 (Cinell *et al.*, 2020; Kouzy *et al.*, 2020; Mian & Khan, 2020; Roozenbeek *et al.*, 2020; Singh *et al.*, 2020). A systematic review assessed the infodemics and health misinformation and pointed to the double impact of social media in triggering detrimental health behaviours while also providing a tool for fighting this major health issue during disease outbreaks (Borges do Nascimento *et al.*, 2022). The fifth WHO Infodemics

Management Conference identified social media as the primary source of exposure to misinformation, predominantly in minorities and vulnerable populations; nevertheless, it is a valuable resource for understanding COVID-19 the dynamics of misinformation (Borges do Nascimento *et al.*, 2022). According to the WHO, an infodemic is "*too much information, including false or misleading information in digital and physical environments during a disease outbreak. It causes confusion and risk-taking behaviours that can harm health. It also leads to mistrust in health authorities and undermines the public health response*" (World Health Organisation, n.d.). A systematic review identified five determinants of infodemics during disease outbreaks, i.e. information sources, structure and consensus of the online community, communication channels, such as mass media and social media, message content, and contexts, such as health emergencies and public opinion (Alvarez-Galvez *et al*., 2021).

Raising awareness about the detrimental impact of SM is crucial to secure public health. The pharmacist is well-positioned to guide medication use, management, and prevention of the infection (Mallhi *et al*., 2020; Saleem *et al*., 2021; Harnett & Lam Ung, 2022; Valliant *et al*., 2022; Zheng *et al*., 2023). A systematic review of pharmacy practice showed the crucial role of the pharmacist in providing information and infection management (Zheng *et al*., 2023). Ease of access to pharmacists and their expertise is essential to preventing inappropriate health behaviours (Mallhi *et al*., 2020; Saleem *et al*., 2021; Harnett & Lam Ung, 2022; Valliant *et al*., 2022; Zheng *et al*., 2023). However, there are multiple reports of the hazardous impact of SM during the COVID-19 pandemic, which could have been prevented with the contribution of the pharmacists had they been fully empowered (Ayosanmi *et al*., 2022; Kazemioula *et al*., 2022; Gaviria-Mendoza *et al*., 2022; Zheng *et al*., 2023). This study aimed to identify the determinants of SM during the COVID-19 pandemic and the influence of social media across thirteen developed and developing countries.

Methods

Study design and sampling

A cross-sectional descriptive pilot study was conducted online from January to December 2021. A call to join the survey was sent among national and international research groups. Researchers from Bangladesh, Brazil, India, Jordan, Lebanon, Nigeria, Pakistan, Poland, Qatar, Serbia, Tunisia, the United Arab Emirates (UAE), and the United States of America (USA) showed interest and enrolled in the study. Countries were categorised as developed and developing based on the World Bank country classifications by income level (Hamadeh *et al.*, 2021). Google Forms, a cloud-based survey tool powered by Google, was used to create the questionnaire. Snowball sampling was used to distribute the questionnaire and enrol participants (Parker *et al.*, 2019), who had to be 18 years and older and have access to the Internet. Before filling out the online survey, participants were informed of the objective of the study and their freedom to withdraw at any time. Participants did not receive any financial reward for their participation. The online survey was anonymous and voluntary.

The online survey

The online survey was formulated and adapted according to the context and similar published articles (Arafat *et al.,* 2020; Bridgman *et al.*, 2020; Griffiths, 2020; Kouzi *et al.*, 2020; Malik *et al.*, 2020; Miñan-Tapia *et al.*, 2020; Pakpour & Roozenbeek *et al.*, 2020; Washburn, 2020). The questionnaire was formulated in English and translated into Arabic, Portuguese, Serbian, and Polish using forward and back-translation (Sousa & Rojjanasrirat, 2011). After a forward translation from English into the local language, the translated version was then back-translated into English. The two English versions were compared, and discrepancies were corrected by consensus between the translators and the principal investigator in each country.

The online survey tackled health behaviours and their associated determinants, including:
1) Socio-demographic characteristics, such as age, gender, marital status, and level of education;
2) Community: developing *vs*. developed countries;
3) Context: The perceived severity of the risk in susceptible individuals with underlying diseases that puts them at risk of getting the severe form of COVID-19 or individuals with chronic diseases;
4) Content: trusted sources of information, such as mass media, social media, YouTube, an article, or social networks;
5) Communication platforms;
6) Medications used: the list of medications was formulated based on similar studies and case reports (Jankelson *et al.*, 2020; Nguyen *et al.*, 2020; Axfors *et al.*, 2021; Bryant *et al.*, 2021; Butler *et al.*, 2021; Cacciapuoti & Cacciapuoti, 2021; Eze *et al.*, 2021; Khabour & Hassanein, 2021; Kow & Hasan, 2021; Mehta *et al.*, 2021; Moore *et al.*, 2021; Murai *et al.*, 2021; Srivastava *et al.*, 2021; Temple *et al.* 2021; Thomas *et al.*, 2021; Toscano *et al.*, 2021). The formulated list of medications was approved by co-authors from the thirteen countries involved. Pertained questions were closed-ended.

Ethics approval and consent to participate

The study protocol was approved by the Lebanese International University institutional ethics committee (2020RC-057-LIUSOP). Privacy and anonymity were ensured across the data collection process, as per the Declaration of Helsinki. Submission of the online form was considered informed consent.

Statistical analysis

Data were analysed using SPSS version 25 (SPSS Inc, Chicago, IL). The descriptive analysis considered the categorical variables expressed as quantitative variables. For bivariate analysis, the Chi-square test was used to compare two groups. The logistic regression was built using the enter method. Multivariate analysis considered SM as the dependent variable. Independent variables with a $p < 0.2$ in the bivariate analysis were entered into the model. In all cases, $p < 0.05$ was statistically significant.

Results

The total number of participants who completed the survey was 2369, with a mean age of 30.62±11.57 years (Appendix A). Most Polish participants (82%) confirmed practising SM to treat or prevent COVID-19 infection. Respondents from other countries reported limited use of medications without prescription, not exceeding 36%. Other detrimental health behaviours included administering medicines to children, the elderly, or family members without a prescription and engaging in SM following advice from someone close (Table I).

More than half of the participants indicated that the trusted sources of unverified information triggering SM were social media, mass media, articles from the Internet, and videos uploaded on YouTube (Table II).

Communication channels across all countries varied but were mainly Facebook and YouTube, the predominant sources of health information during the COVID-19 pandemic (Table III).

Table I: Health behaviours during the COVID-19 pandemic

Variable	BGD	BRA	IND	JOR	LBN	NGA	PAK	POL	QAT	SRB	UAE	USA	TUN
Total sample	**n=109**	**n=284**	**n=395**	**n=106**	**n=457**	**n=101**	**n=104**	**n=118**	**n=100**	**n=140**	**n=56**	**n=139**	**n=260**
Medications use without prescription													
Yes	29 (27%)	38 (13%)	97 (25%)	37 (35%)	113 (25%)	30 (30%)	24 (23%)	97 (82%)	29 (29%)	18 (13%)	17 (30%)	14 (10%)	62 (24%)
No	80 (73%)	246 (87%)	298 (75%)	69 (65%)	344 (75%)	71 (70%)	80 (77%)	21 (18%)	71 (71%)	122 (87%)	39 (70%)	125 (90%)	198 (76%)
Medications shared or administered without prescription to*													
An elderly	12 (41%)	6 (7%)	25 (26%)	8 (22%)	24 (21%)	9 (30%)	7 (29%)	0 (0%)	3 (10%)	2 (11%)	3 (18%)	4 (29%)	
Your child	9 (31%)	3 (3%)	21 (22%)	7 (19%)	28 (25%)	11 (37%)	5 (21%)	1 (5%)	6 (21%)	2 (11%)	0 (0%)	4 (29%)	
A family member	11 (38%)	11 (12%)	36 (37%)	14 (38%)	35 (31%)	9 (30%)	6 (25%)	5 (23%)	11 (38%)	5 (28%)	5 (29%)	4 (29%)	
Medication use without prescription following the recommendation of a*													
Parent	11 (38%)	7 (8%)	21 (22%)	2 (5%)	22 (19%)	9 (30%)	4 (17%)	3 (14%)	2 (7%)	0 (0%)	2 (12%)	1 (7%)	
Sibling	15 (52%)	5 (6%)	37 (38%)	7 (19%)	43 (38%)	11 (37%)	7 (29%)	1 (5%)	10 (34%)	4 (22%)	6 (35%)	5 (36%)	
Family member	19 (66%)	7 (8%)	26 (27%)	10 (27%)	30 (26%)	11 (37%)	6 (25%)	1 (5%)	5 (17%)	1 (6%)	7 (41%)	2 (14%)	
Co-worker	9 (31%)	8 (9%)	19 (20%)	6 (16%)	21 (18%)	9 (30%)	6 (25%)	0 (0%)	2 (7%)	1 (6%)	7 (41%)	3 (21%)	
Neighbour	15 (52%)	3 (3%)	25 (26%)	5 (14%)	24 (21%)	11 (37%)	11 (46%)	0 (0%)	8 (28%)	3 (17%)	3 (18%)	5 (36%)	
Friend	12 (41%)	6 (7%)	26 (27%)	6 (16%)	50 (44%)	9 (30%)	9 (38%)	0 (0%)	7 (24%)	3 (17%)	3 (18%)	4 (29%)	

BGD: Bangladesh; BRA: Brazil; IND: India; JOR: Jordan; LBN: Lebanon; NGA: Nigeria; PAK: Pakistan; POL: Poland; QAT: Qatar; SRB: Serbia; UAE: United Arab Emirates; USA: United States of America; TUN: Tunisia

*more than one answer applies

Table II: Content: trusted sources of unverified health information that influenced self-medication

Variable	BGD	BRA	IND	JOR	LBN	NGA	PAK	POL	QAT	SRB	TUN	UAE	USA
Total sample	n=109	n=284	n=395	n=106	n=457	n=101	n=104	n=118	n=100	n=140	n=260	n=56	n=139
A video uploaded on social media	43 (40%)	48 (17%)	116 (30%)	24 (23%)	93 (20%)	19 (19%)	37 (36%)	111 (94%)	23 (23%)	23 (16%)	98 (38%)	9 (16%)	32 (23%)
A post of someone confirming that he tried a medication	25 (23%)	40 (14%)	110 (28%)	27 (25%)	117 (26%)	29 (29%)	40 (38%)	106 (90%)	19 (19%)	11 (8%)	80 (31%)	5 (9%)	27 (19%)
A TV interview with someone that you do not know	40 (37%)	49 (17%)	108 (27%)	22 (21%)	113 (25%)	27 (27%)	39 (37%)	111 (94%)	21 (21%)	14 (10%)	60 (23%)	9 (16%)	22 (16%)
An article or report published on the internet	67 (61%)	63 (22%)	182 (46%)	56 (53%)	157 (34%)	42 (42%)	49 (47%)	71 (60%)	42 (42%)	28 (20%)	120 (46%)	17 (30%)	46 (33%)
A post on social media	41 (38%)	46 (16%)	109 (28%)	29 (27%)	106 (23%)	29 (29%)	33 (31%)	115 (97%)	18 (18%)	13 (9%)	68 (26%)	12 (21%)	28 (20%)
A TV interview or radio talk with an expert	67 (61%)	52 (18%)	174 (44%)	58 (55%)	267 (59%)	42 (42%)	51 (49%)	64 (54%)	62 (62%)	55 (39%)	140 (54%)	31 (55%)	52 (37%)
A video posted on YouTube	68 (62%)	30 (11%)	184 (47%)	30 (28%)	169 (37%)	43 (43%)	50 (48%)	19 (16%)	34 (34%)	25 (18%)	44 (17%)	9 (16%)	46 (33%)

BGD: Bangladesh; BRA: Brazil; IND: India; JOR: Jordan; LBN: Lebanon; NGA: Nigeria; PAK: Pakistan; POL: Poland; QAT: Qatar; SRB: Serbia; UAE: United Arab Emirates; USA: United States of America; TUN: Tunisia

Table III: Communication channels that influenced self-medication

Variable	BGD	BRA	IND	JOR	LBN	NGA	PAK	POL	QAT	SRB	TUN	UAE	USA
Total sample	n=109	n=284	n=395	n=106	n=457	n=101	n=104	n=118	n=100	n=140	n=260	n=56	n=139
Facebook	68 (62%)	50 (18%)	85 (21%)	20 (19%)	170 (37%)	30 (30%)	41 (40%)	7 (6%)	21 (21%)	18 (13%)	207 (80%)	5 (9%)	27 (20%)
Instagram	24 (22%)	30 (11%)	141 (36%)	10 (10%)	148 (32%)	16 (16%)	38 (36%)	3 (2.5%)	22 (22%)	13 (9%)	44 (17%)	5 (9%)	12 (9%)
Twitter	29 (27%)	9 (3%)	85 (21%)	6 (6%)	122 (27%)	29 (29%)	29 (28%)	9 (7.6%)	20 (20%)	5 (4%)	53 (20%)	10 (18%)	19 (14%)
TikTok	4 (4%)	6 (2%)	11 (3%)	1 (1%)	42 (9%)	8 (8%)	7 (7%)	0 (0%)	1 (1%)	1 (1%)	63 (24%)	2 (4%)	1 (1%)
LinkedIn	22 (20%)	5 (2%)	53 (13%)	16 (15%)	50 (11%)	27 (27%)	13 (12%)	6 (5%)	14 (14%)	9 (6%)	34 (13%)	14 (25%)	28 (20%)
WhatsApp	28 (26%)	42 (15%)	160 (40%)	15 (14%)	92 (20%)	39 (39%)	38 (36%)	3 (2%)	15 (15%)	5 (4%)	58 (22%)	6 (11%)	37 (27%)
Snapchat	1 (1%)	6 (2%)	18 (5%)	2 (2%)	33 (7%)	3 (3%)	13 (12%)	0 (0%)	3 (3%)	1 (1%)	50 (20%)	1 (2%)	5 (4%)

BGD: Bangladesh; BRA: Brazil; IND: India; JOR: Jordan; LBN: Lebanon; NGA: Nigeria; PAK: Pakistan; POL: Poland; QAT: Qatar; SRB: Serbia; UAE: United Arab Emirates; USA: United States of America; TUN: Tunisia

Figure 1 shows a lack of agreement on the perceived positive and negative role of social media among participants. Bivariate analysis showed that being a male, a healthcare professional, and from a developing country were significantly associated with higher self-medication (Table IV).

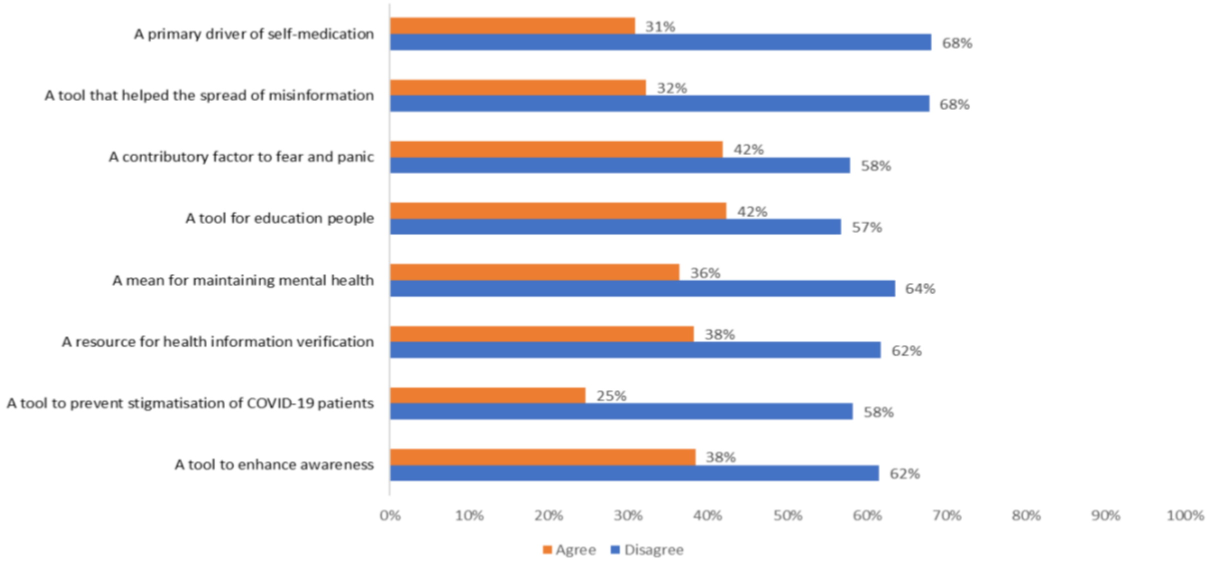

Figure 1: The perceived positive and negative role of social media during the COVID-19 pandemic

Table IV: Determinants of self-medication

Variable	Self-medication				*P*
	No		Yes		
	n	%	n	%	
Socio-demographic factors					
Gender (Female)					
No	659	73%	245	27%	**0.013**
Yes	1129	77%	336	23%	
Age 50 years and above					
No	1655	76%	517	24%	**0.005**
Yes	133	67%	64	33%	
Marital status (Married)					
No	1124	76%	357	24%	0.286
Yes	664	75%	224	25%	
Countries (Developing)					
No	332	80%	81	20%	**0.006**
Yes	1456	74%	500	26%	
University degree					
No	522	75	173	25%	0.414
Yes	1266	76%	408	24%	
Being a healthcare professional					
No	267	78%	76	22%	**0.013**
Yes	76	67%	38	33%	
Context: Individual factors that may enhance the perceived risk severity					
Suffering from chronic diseases					
No	1566	76%	485	24%	**0.008**
Yes	222	70%	96	30%	
Suffering from any specific disease that puts you at risk of contracting severe COVID-19 infection					
No	1525	77%	464	23%	**0.001**
Yes	263	29%	117	31%	
Taking more than three medications other than vitamins and minerals					
No	1605	78%	**444**	**22%**	**<0.001**
Yes	137	57%	137	43%	
Communication channels					
Facebook as a source of information					
No	1185	78%	331	22%	**<0.001**

Table IV: Determinants of self-medication (Continued)

Variable	**Self-medication No n**	**No %**	**Yes n**	**Yes %**	***P***
Yes	603	71%	250	29%	
Instagram as a source of information					
No	1348	77%	403	23%	**0.003**
Yes	440	71%	178	29%	
Twitter as a source of information					
No	1414	77%	430	23%	**0.007**
Yes	374	75%	581	25%	
TIK-TOK as a source of information					
No	1598	76%	506	24%	0.076
Yes	190	72%	75	28%	
LinkedIn as a source of information					
No	1506	76%	466	24%	**0.015**
Yes	282	71%	115	29%	
WhatsApp as a source of information					
No	1334	78%	385	22%	**<0.001**
Yes	45	70%	196	30%	
Snapchat as a source of information					
No	1603	76%	512	24%	0.169
Yes	185	73%	69	27%	
Content and sources of misleading information					
A post on social media of someone confirming that he tried a medication					
No	1352	78%	380	22%	**<0.001**
Yes	435	68%	201	32%	
A TV interview a random person					
No	1358	78%	375	22%	**<0.001**
Yes	429	68%	206	32%	
A TV interview or radio talk with an expert					
No	979	78%	273	22%	**0.001**
Yes	808	72%	307	28%	
An article or report					
No	1127	79%	301	21%	**<0.001**
Yes	660	28%	280	30%	
A video uploaded on social media					
No	1316	78%	377	22%	**<0.001**
yes	472	70%	204	30%	
A post on social media					
No	1348	78%	373	22%	**<0.001**
Yes	439	68%	208	32%	
A video uploaded on YouTube					
No	1149	78%	318	22%	**<0.001**
Yes	639	71%	263	29%	

The most widely used medications were vitamin D, vitamin C, and zinc supplements, followed by antimicrobials, including azithromycin, ivermectin, hydroxychloroquine, and levofloxacin. Antimicrobials were the second most reported drugs used to manage or prevent COVID-19, particularly azithromycin (antibiotic), followed by levofloxacin (antibiotic), and hydroxychloroquine (antimalarial), except in Serbia, Qatar, and the UAE in the case of hydroxychloroquine. Ivermectin (anti-parasitic) was used in all countries except Serbia. Other medications, such as anticoagulants, anti-inflammatories, influenza vaccine, colchicine, xylocaine gel, and ambroxol, were utilised in variable amounts among different countries. All respondents, except Pakistanis, Emiratis, and Americans, reported self-medication with zolpidem for insomnia. Other drugs used to treat insomnia were paracetamol/diphenhydramine, melatonin, and valerian. Benzodiazepines and Flupentixol/melitracen were used to treat anxiety (Table V).

Table V: Types of medications used without prescription

Variable	BGD	BRA	IND	JOR	LBN	NGA	PAK	POL	QAT	SRB	UAE	USA
Total sample	**n=109**	**n=284**	**n=395**	**n=106**	**n=457**	**n=101**	**n=104**	**n=118**	**n=100**	**n=140**	**n=56**	**n=139**
Total SM sample	**n=29**	**n=38**	**n=97**	**n=37**	**n=113**	**n=30**	**n=24**	**n=97**	**n=29**	**n=18**	**n=17**	**n=14**
Medications used to treat or prevent COVID-19 infection												
Antimicrobials												
Azithromycin	15 (52%)	23 (26%)	53 (55%)	13 (35%)	40 (35%)	4 (13%)	6 (25%)	21 (100%)	1 (3%)	8 (44%)	4 (24%)	6 (43%)
Levofloxacin	6 (21%)	6 (7%)	20 (21%)	3 (8%)	20 (18%)	3 (10%)	1 (4%)	21 (100%)	0 (0%)	0 (0%)	2 (12%)	1 (7%)
Hydroxychloroquine	7 (24%)	12 (13%)	14 (14%)	1 (3%)	16 (14%)	3 (10%)	1 (4%)	21 (100%)	0 (0%)	0 (0%)	0 (0%)	2 (14%)
Ivermectin	7 (24%)	25 (28%)	23 (24%)	0 (0%)	23 (20%)	1 (3%)	3 (13%)	21 (100%)	2 (7%)	0 (0%)	4 (24%)	1 (7%)
Anti-inflammatory drugs												
Ibuprofen	2 (7%)	22 (25%)	9 (9%)	5 (14%)	25 (22%)	4 (13%)	3 (13%)	9 (43%)	0 (0%)	0 (0%)	3 (18%)	2 (14%)
Prednisone	3 (10%)	4 (4%)	7 (7%)	0 (0%)	16 (14%)	2 (7%)	3 (13%)	19 (90%)	1 (3%)	0 (0%)	0 (0%)	0 (0%)
Anticoagulants												
Enoxaparin	5 (17%)	3 (3%)	8 (8%)	0 (0%)	22 (19%)	1 (3%)	2 (8%)	21 (100%)	0 (0%)	0 (0%)	1 (6%)	0 (0%)
Fondaparinux	5 (17%)	39 (44%)	28 (29%)	16 (43%)	34 (30%)	3 (10%)	11 (46%)	21 (100%)	10 (34%)	9 (50%)	7 (41%)	5 (36%)
Aspirin	5 (17%)	41 (46%)	10 (10%)	7 (19%)	24 (21%)	0 (0%)	5 (21%)	21 (100%)	3 (10%)	3 (17%)	4 (24%)	0 (0%)
Vaccines												
Influenza vaccine	11 (4%)	10 (4%)	61 (22%)	27 (10%)	71 (26%)	10 (4%)	9 (3%)	18 (86%)	23 (8%)	14 (5%)	13 (5%)	3 (1%)
Vitamins and minerals												
Zinc	10 (34%)	24 (27%)	44 (45%)	18 (49%)	66 (58%)	9 (30%)	8 (33%)	12 (57%)	19 (66%)	12 (67%)	9 (53%)	6 (43%)
Vitamin D	10 (34%)	27 (30%)	71 (73%)	30 (81%)	67 (59%)	15 (50%)	13 (54%)	8 (38%)	27 (93%)	16 (89%)	14 (82%)	3 (21%)
Vitamin C	5 (17%)	4 (4%)	7 (7%)	2 (5%)	25 (22%)	0 (0%)	3 (13%)	10 (48%)	0 (0%)	0 (0%)	1 (6%)	1 (7%)
Other												
Colchicine	5 (17%)	5 (6%)	15 (15%)	9 (24%)	24 (21%)	0 (0%)	1 (4%)	21 (100%)	5 (17%)	1 (6%)	3 (18%)	1 (7%)
Ambroxol	4 (14%)	5 (6%)	13 (13%)	3 (8%)	25 (22%)	0 (0%)	4 (17%)	20 (95%)	1 (3%)	0 (0%)	1 (6%)	1 (7%)
Xylocaine gel	4 (14%)	1 (1%)	6 (6%)	2 (5%)	35 (31%)	1 (3%)	2 (8%)	21 (100%)	4 (14%)	1 (6%)	1 (6%)	0 (0%)
Self-medication to treat anxiety												
Benzodiazepines	8 (28%)	5 (6%)	9 (9%)	2 (5%)	23 (20%)	3 (10%)	2 (8%)	20 (95%)	1 (3%)	3 (17%)	2 (12%)	1 (7%)
Flupentixol/melitracen	5 (17%)	3 (3%)	11 (11%)	3 (8%)	23 (20%)	3 (10%)	3 (13%)	21 (100%)	1 (3%)	1 (6%)	1 (6%)	1 (7%)
Self-medication to treat insomnia												
Zolpidem	4 (14%)	1 (1%)	12 (12%)	2 (5%)	22 (19%)	3 (10%)	0 (0%)	21 (100%)	0 (0%)	1 (6%)	0 (0.0%)	0 (0%)
Melatonin	5 (17%)	3 (3%)	9 (9%)	4 (11%)	18 (16%)	4 (13%)	4 (17%)	18 (86%)	3 (10%)	4 (22%)	2 (11.8%)	3 (21%)
Valerian	5 (17%)	5 (6%)	11 (11%)	1 (3%)	23 (20%)	2 (7%)	1 (4%)	19 (90%)	0 (0%)	3 (17%)	1 (5.9%)	0 (0%)
Paracetamol/ diphenhydramine	5 (17%)	5 (6%)	11 (11%)	1 (3%)	23 (20%)	2 (6.7%)	1 (4%)	21 (100%)	0 (0%)	3 (17%)	1 (5.9%)	0 (0%)

BGD: Bangladesh; BRA: Brazil; IND: India; JOR: Jordan; LBN: Lebanon; NGA: Nigeria; PAK: Pakistan; POL: Poland; QAT: Qatar; SRB: Serbia; UAE: United Arab Emirates; USA: United States of America

Multivariate analysis showed that factors contributing to an enhanced risk of developing the severe form of COVID-19, such as age of more than 50 years, the presence of chronic illnesses, and diseases evidenced to increase this risk, were not significantly associated with SM ($p > 0.05$). Other factors significantly associated with SM included taking multiple medications (ORa= 2.468; 95% CI [1.87, 3.26]) and being from a developing country (ORa= 0.670; 95% CI [0.49, 0.91]). Facebook was the only social media platform influencing SM (ORa=1.624; 95% CI [1.29, 2.05]). While for the trusted sources of misleading information, a TV interview with someone not previously known to people (ORa=1.357; 95% CI [1.03, 1.78]) and a post on social media of a person confirming having tried the medication (ORa=1.353; 95% CI [1.06, 1.73]) significantly influenced SM (Table VI).

Table VI: Logistic regressions using self-medication as the dependent variable

Variable	ORa	*P*	95% CI	
Individual determinants				
Gender (Male /Female*)	0.868	0.178	0.706	1.067
Age 50 years and above (No /Yes*)	1.189	0.350	0.828	1.707
Being a healthcare professional (No /Yes*)	1.896	0.027*	1.074	3.347
Countries (Developing/Developed*) (No/Yes*)	0.670	**0.010***	0.493	0.909
Suffering from chronic diseases (No /Yes*)	0.943	0.756	0.653	1.363
Suffering from any specific disease that puts you at risk of contracting the severe form of COVID-19 infection (No /Yes*)	1.285	0.129	0.930	1.774
Taking more than three medications other than vitamins and minerals (No/Yes*)	2.468	**0.000***	1.866	3.264
Communication channels				
Facebook as a source of information (No/Yes*)	1.624	**0.000***	1.289	2.046
Instagram as a source of information (No/Yes*)	1.127	0.294	0.901	1.410
Twitter as a source of information (No/Yes*)	1.104	0.464	0.847	1.438
TIK-TOK as a source of information (No/Yes*)	0.911	0.478	0.705	1.178
Linkedin as a source of information (No/Yes*)	0.916	0.499	0.710	1.182
WhatsApp as a source of information (No/Yes*)	1.130	0.417	0.842	1.517
Snapchat as a source of information (No/Yes*)	0.903	0.426	0.704	1.160
Content and sources of health unverified information				
A post on social media of someone confirming that he tried a medication (No/Yes*)	1.353	**0.016***	1.057	1.731
A TV interview with someone that you do not know (No/Yes*)	1.357	0**.028***	1.033	1.783
A TV interview or radio talk with an expert (No/Yes*)	0.982	0.870	0.790	1.220
An article or report published on the internet	1.190	0.127	0.952	1.489
A video uploaded on social media (No/Yes*)	1.018	0.897	0.781	1.326
A post on social media (No/Yes*)	1.299	0.060	0.989	1.705
A video uploaded on YouTube (No/Yes*)	1.117	0.374	0.876	1.424

* $p < 0.05$

Discussion

This pilot study evaluated the determinants of self-medication and sources of information that influenced this detrimental health behaviour in thirteen countries during the COVID-19 pandemic. Except for Poland, SM had a low prevalence among participating countries, ranging from 10% to 35%. It was influenced by infodemics shared on social media, seen or heard on mass media, or read in articles. The studied determinants of SM were individual factors, communication channels, health information sources and content, and the context of health belief risk severity perceived by people with diseases or conditions that increase the risk of contracting the severe form of COVID-19 infection.

Several similar studies reported a heterogenous overall rate of SM in the general population, ranging from less than 4% to 88.3% (Dare *et al.*, 2021; Quincho-Lopez,2021*;* Quispe-Cañari *et al.,* 2021, Amuzie *et al.,*

2022) and from 33.9% to 83% in targeted groups (Karimy *et al.,* 2011; Miñan-Tapia *et al.*, 2020; Sadio *et al.*, 2021; Yasmin *et al.*, 2022). A systematic review of 14 studies from 14 countries totalling 15,154 participants found a pooled prevalence across countries of 44.9% (ranging from 3.4 to 96%), which was particularly alarming in developing countries (Ayosanmi *et al.,* 2022). Another systematic review and meta-analysis showed that the pooled prevalence of SM during COVID-19 was 48.6%, with 41% in Europe and 53% in Asia (Kazemioula *et al.,* 2022).

In this study, being a developing country was the only sociodemographic determinant associated with SM. Socioeconomic and sociocultural interplays and loose regulations facilitate access to SM in developing countries (Ocan *et al.*, 2015; Torres *et al.*, 2021).

The context related to individual factors that may enhance the perceived risk of disease severity did not influence SM. The health belief model (HBM) explains these dynamics. This model predicts and helps understand health behaviours and related contributory factors by focusing on the risk perception determined by the perceived susceptibility and severity of the disease. The model also explores the individual health motivation to adopt a behaviour according to the perceived efficacy or benefit of such practice (Chuang & Liao, 2022)

HBM predicts that people who feel vulnerable to health threats, such as those with comorbidities and taking multiple medications, tend to engage in risky behaviours such as self-medication (Washburn, 2020). This model explains why participants with underlying disease conditions trusted more social media, similar to previous findings showing that social media enhances health beliefs (Chuang & Liao, 2022). In this study, participants taking multiple medications other than vitamins and minerals tended to self-medicate. The association between polypharmacy and SM has been evidenced in seniors (Heshmatifar *et al.,* 2021; World Health Organisation, 2023). Medication leftovers in a household can potentially facilitate SM for chronic users. In addition, a successful experience with SM and perceiving drugs as harmless create a false sense of confidence, especially when exposed to misleading information from social media. As a result, this health behaviour may exacerbate inappropriate drug use and increase the risk of worst outcomes in this age group. Similar findings were also reported and raised the alarm about the consequences of this health practice (Washburn, 2020).

Communication channels play an essential role in connecting people and influencing different behaviours and outcomes (Welch *et al*., 2016). People using social media to seek health inquiries feel empowered and in control of their disease condition (Smailhodzic *et al*., 2016). During the COVID-19 pandemic, the role of social media was ambivalent (Rismanbaf, 2021; Chung, 2022).

In this study, similar results were found since participants showed no agreement on the perceived impact of social media. The primary social media platform used was Facebook, which was significantly associated with SM, followed by WhatsApp. Previous studies showed similar findings (Arafat *et al.,* 2020; Radwan *et al.,* 2021).

Facebook is usually used for entertainment, status-seeking, and socialising purposes rather than for getting health information (Yang *et al.*, 2021). Twitter is another popular platform among health policy and health services researchers (Bridgman *et al.*, 2020). In this study, Twitter was not among the top three used social media. Facebook and Twitter have different user profiles (Bridgman *et al.*, 2020) and showed divergence in the prevalence of popular low-credibility content (Bridgman *et al.*, 2020). They were sources of concern about the spread of misinformation predominantly at the beginning of the current outbreak (Li *et al.,* 2020). Studies also stressed the extensive misleading information and fake news posted on WhatsApp during this period (Ataç *et al.,* 2020; Galhardi, 2020*; A*ndika *et al.,* 2021).

The content and sources of misleading information that influenced SM were a post on social media of someone who confirmed trying the medication and an interview on TV with a random person. These results postulate that misinformation and disinformation affect health behaviours potentially because ways of content communication to the audience promote trust and belief. It is also well documented that misleading information posted on social media and videos uploaded on YouTube impact health behaviours (Anwar *et al*., 2020; Stewart *et al*., 2022).

The mass media had a role in disseminating facts and knowledge about COVID-19 that triggered a sense of fear by portraying COVID-19 as an imminent risk (Giri & Maurya, 2021; Yakunin *et al.*, 2021; Al-Dmour *et al.,* 2022).

In this study, mass media (TV and radio) reached a large audience from all age groups. Mass media must be accountable to host experts and filter broadcasted information. Results showed that participants used SM after a TV or radio interview with a random host, while no association was found when interviewing an expert.

The rates of self-medication with a plethora of off-label drugs varied across countries. Vitamin C, vitamin D, zinc supplements, aspirin, ibuprofen, and ivermectin are labelled over-the-counter (OTC) and can be purchased without a prescription in most countries. Other drugs reportedly used in this sample include antimicrobials (azithromycin, levofloxacin, hydroxychloroquine, ivermectin), anticoagulants (enoxaparin, fondaparinux), corticosteroids (prednisone), influenza vaccine, mucolytic (ambroxol), and medication for acute gout (colchicine). Respondents also used benzodiazepines and flupentixol/melitracen to treat anxiety and zolpidem, while they self-medicated with paracetamol/diphenhydramine, melatonin, and valerian to treat insomnia. Different studies, systematic reviews, and meta-analyses assessed the repurposing of the above-listed medications for the prevention or the management of COVID-19 infection, with variable results and non-conclusive benefits (Arjomandi Rad *et al.,* 2020; Jankelson *et al*., 2020; Nguyen *et al*., 2020; Axfors *et al*., 2021; Bryant *et al*., 2021; Butler *et al*., 2021; Cacciapuoti & Cacciapuoti, 2021; Eze *et al*., 2021; Khabour & Hassanein, 2021; Kow & Hasan, 2021; Mehta *et al*., 2021; Moore *et al*., 2021; Murai *et al*., 2021; Srivastava *et al*., 2021; Temple *et al*., 2021; Thomas *et al*., 2021; Toscano *et al*., 2021;).

The study showed that vitamins and minerals were the most highly consumed medications, followed by antimicrobials, consistent with the findings of other studies that assessed SM during the COVID-19 outbreak. Self-medication with these drugs can lead to harmful effects, especially in vulnerable populations like pregnant women, children, and the elderly and in patients with comorbidities, such as underlying cardiac diseases and hepatic or renal failure. The inappropriate use of these medications can have severe health consequences (Arjomandi Rad *et al.,* 2020; Nguyen *et al*., 2020; Jankelson *et al*., 2020; Axfors *et al*., 2021; Bryant *et al*., 2021; Butler *et al*., 2021; Cacciapuoti & Cacciapuoti, 2021; Eze *et al*., 2021; Khabour & Hassanein, 2021; Kow & Hasan, 2021; Mehta *et al*., 2021; Moore *et al*., 2021; Murai *et al*., 2021; Srivastava *et al*., 2021; Temple *et al*., 2021; Thomas *et al*., 2021; Toscano *et al*., 2021):

- High doses of vitamin C, vitamin D, and zinc are associated with side effects ranging from but not limited to gastrointestinal problems, hypercalcemia, kidney stones, and even fatal outcomes with toxic doses.
- The abuse and misuse of antimicrobial agents are the drivers of antimicrobial resistance.
- Azithromycin, hydroxychloroquine, or a combination can lead to fatal cardiac complications such as torsades de pointes, cardiac arrest, or severe ventricular arrhythmia.
- Ivermectin is associated with neurologic symptoms and hypotension.
- Benzodiazepines can cause dependence and increase sedation, patient falls, and withdrawal syndrome.
- Fondaparinux can cause bleeding, sleep disturbances, and other mild to moderate adverse events.

Health behaviour changes rely on the understanding and identification of the determinants and health beliefs that drive certain behaviours in a defined context and under specific circumstances. During an emergency crisis, overwhelming information can create confusion and sometimes panic due to the lack of governance and leadership (Briand *et al*., 2021; Silva *et al*., 2022). The key is transparent risk communication from trusted sources, including academia, community, international organisations, professional societies, the government, and social and mass media, to enhance community engagement and awareness about unverified and misleading information (Briand *et al*., 2021; Silva *et al*., 2022). HBM can promote safe health behaviours using health promotion programmes to engage individuals in protective health behaviours by preventing detrimental health effects (Ferrer & Klein, 2015; Savadori & Lauriola, 2021). To design effective health promotion programmes, HBM can provide an understanding of individuals' self-perception of (1) the severity of the disease, which was quite extreme in the case of COVID-19, (2) the susceptibility of developing the disease depending predominantly on patient advanced age and comorbidities, and (3) perceived benefits and barriers to taking actions to manage the disease condition (Kin *et al*., 2012; Jones *et al*., 2015; Yoo *et al*., 2017).

The role of the pharmacist is crucial in addressing this global health problem. Ease of access to pharmacists and their expertise in the community is a game changer in fostering the safe use of medications and securing public health. Empowered pharmacists play an active role in fighting infodemics and proactively planning to address future emergencies. Empowering the pharmacist can be done through rules and regulations, continuous education, and building trust in the pharmacist as a reliable source of information in the community. Through effective communication, the pharmacist, in collaboration with the government, other healthcare providers, professional and scientific organisations, and the community, can advise health policy, contribute to safe medication practice, and minimise health expenditures.

Study implications

Based on the findings of this study, HBM provides an understanding of health behaviours, predominantly during emergency crises. The global awareness of the need to prepare for the next pandemic mandates the collaboration of healthcare professionals, health organisations, professional societies, healthcare professionals, the community, the government, and social media. Continuous and timely communication among stakeholders can help raise awareness about misinformation and promote positive health behaviours through public education about the underlying risks. Pharmacist engagement is crucial in designing, fostering, and implementing health promotions tailored to the context. The pharmacist being accessible and a trusted healthcare professional can eliminate the barrier of waiting time, economic issues, and delays in seeking care.

Limitations

This pilot study provided insights into the determinants and sources of unverified information that influenced self-medication during the COVID-19 pandemic. The findings add to the available data that highlight the ambiguous perception of the role of social media and identify the determinants that trigger detrimental health behaviours. The limitations are inherent to its observational design, sampling, and snowball technique, leading to selection and information bias. The web-based data collection method tends to attract younger and better-educated participants while preventing the participation of people with no access to the Internet. The sociodemographic analysis showed that most participants were females, which prevented sex-disaggregated data analysis. The number of participants is not proportional to the populations of the countries represented.

Conclusion

The identified determinants of self-medication during the pandemic must be investigated by larger-scale studies based on the HBM to understand the drivers of health decisions in different health systems, predominantly during an emergency crisis. As the world is proactively preparing for the next pandemic, fighting misleading information should be one of the pillars of health promotion programmes. Social media played a negative role during the pandemic and triggered inappropriate health behaviours. However, social and mass media also helped raise awareness about COVID-19 prevention and management. The collaboration between stakeholders, social media, and government engagement is fundamental. The expertise of community pharmacists and ease of access to their pharmacies allow them to play a pivotal role in improving community education awareness and health equity, usually at no charge. Empowering and engaging pharmacists is a game changer because they are well-positioned to foster safe medication use, implement health policy, and reach diverse communities to guide appropriate health behaviours.

Conflict of interest

The authors declare no conflict of interest.

Source of funding

The authors did not receive any funding.

Informed consent

Informed consent was obtained from all subjects involved in the study.

Data availability

Raw data are available at INSPECT-LB data repository. https://inspect-lb.org/the-role-of-social-media-in-self-medication-during-the-covid-19-outbreak-a-multi-national-cross-sectional-study-across-thirteen-countries/

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Appendix A: Description of participants sociodemographic characteristics

Variable	BGD	BRA	IND	JOR	LBN	NGA	PAK	POL	QAT	SRB	TUN	UAE	USA
	N=109	N=284	N=395	N=106	N=457	N=101	N=104	N=118	N=100	N=140	N=260	N=56	N=139
Gender													
Male	65 (59.6%)	118 (41.5%)	134 (33.9%)	30 (28.3%)	129 (28.2%)	46 (45.5%)	31 (29.8%)	29 (24.6%)	20 (20.0%)	54 (38.6%)	141 (54.2%)	20 (35.7%)	87 (62.6%)
Female	44 (40.4%)	166 (58.5%)	261 66.1%)	76 (71.7%)	328 (71.8%)	55 (54.5%)	73 (70.2%)	89 (75.4%)	80 (80.0%)	86 (61.4%)	119 (45.8%)	36 (64.3%)	52 (37.4%)
Age, years (mean±SD)	23.66 ±2.48	35.67 ±14.15	26.84 ±8.05	35.18 ±14.57	25.15 ±10.61	23.55 ±3.06	28.44 ±9.30	28.10 ±8.72	40.16 ±8.31	35.90 ±13.65	33.94 ±9.82	37.14 ±11.63	38.81 ±8.08
Marital status													
Single/ widowed/ divorced	95 (87.2%)	178 (62.7%)	264 (66.8%)	66 (62.3%)	359 (78.6%)	95 (94.1%)	67 (64.4%)	87 (73.7%)	19 (19.0%)	82 (58.6%)	127 (48.8%)	28 (50.0%)	14 (10.1%)
Married	14 (12.8%)	106 (37.3%)	131 (33.2%)	40 (37.7%)	98 (21.4%)	6 (5.9%)	37 (35.6%)	31 (26.3%)	81 (81.0%)	58 (41.4%)	133 (51.2%)	28 (50.0%)	125 (89.9%)
Education level													
Primary education	0 (0%)	82 (28.9%)	2 (0.5%)	0 (0%)	9 (2.0%)	0 (0%)	1 (1.0%)	2 (1.7%)	0 (0%)	1 (0.7%)	22 (8.5%)	0 (0%)	1 (0.7%)
Middle education	1 (0.9%)	47 (16.5%)	8 (2.0%)	0 (0%)	28 (6.1%)	0 (0%)	5 (4.8%)	1 (0.8%)	1 (1.0%)	0 (0%)	75 (28.8%)	0 (0%)	0 (0%)
Secondary school	1 (0.9%)	90 (31.7%)	5 (1.3%)	7 (6.6%)	71 (15.5%)	18 (17.8%)	23 (22.1%)	37 (31.4%)	5 (5.0%)	54 (38.6%)	93 (35.8%)	4 (7.1%)	1 (0.7%)
Tertiary education	107 (98.2%)	65 (22.9%)	380 (96.2%)	99 (93.4%)	349 (76.4%)	83 (82.2%)	75 (72.1%)	78 (66.1%)	94 (94.0%)	85 (60.7%)	70 (26.9%)	52 (92.9%)	137 (98.6%)
Chronic disease													
Yes	8 (7.3%)	32 (11.3%)	22 (5.6%)	12 (11.3%)	46 (10.1%)	0 (0%)	11 (10.6%)	89 (75.4%)	15 (15.0%)	21 (15.0%)	34 (13.1%)	12 (21.4%)	16 (11.5%)
No	101 (92.7%)	252 (88.7%)	373 (94.4%)	94 (88.7%)	411 (89.9%)	101 (100%)	93 (89.4%)	29 (24.6%)	85 (85.0%)	119 (85.0%)	226 (86.9%)	44 (78.6%)	123 (88.5%)
Other underlying medical conditions that increases the risk for severe COVID-19 illness													
Yes	14 (12.8%)	47 (16.5%)	27 (6.8%)	10 (9.4%)	57 (12.5%)	2 (2.0%)	12 (11.5%)	96 (81.4%)	14 (14.0%)	28 (20.0%)	45 (17.3%)	12 (21.4%)	16 (11.5%)
No	95 (87.2%)	237 (83.5%)	368 (93.2%)	96 (90.6%)	400 (87.5%)	99 (98.0%)	92 (88.5%)	22 (18.6%)	86 (86.0%)	112 (80.0%)	215 (82.7%)	44 (78.6%)	123 (88.5%)
Taking more than three medication excluding vitamins and minerals													
Yes	11 (0.5%)	33 (11.6%)	21 (5.3%)	17 (16.0%)	60 (13.1%)	3 (3.0%)	15 (14.4%)	5 (4.2%)	15 (15.0%)	11 (7.9%)	102 (39.2%)	14 (25.0%)	12 (8.6%)
No	98 (89.9%)	251 (88.4%)	374 (94.7%)	89 (84.0%)	397 (86.9%)	98 (97.0%)	89 (85.6%)	113 (95.8%)	85 (85.0%)	129 (92.1%)	158 (60.8%)	42 (75.0%)	127 (91.4%)

BGD: Bangladesh; BRA: Brazil; IND: India; JOR: Jordan; LBN: Lebanon; NGA: Nigeria; PAK: Pakistan; POL: Poland; QAT: Qatar; SRB: Serbia; TUN: Tunisia; UAE: United Arab Emirates; USA: United States of America