



## Original article

## Use of proton pump inhibitors: An exploration of awareness, attitude and behavior of health care professionals of Riyadh, Saudi Arabia



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## ABSTRACT

**Background & Objectives:** One of the broadly talked about class of medications for their extravagantly expanded abuse is proton pump inhibitors (PPIs). In spite of the fact that, they are known to be profoundly useful, it is accounted for several adverse manifestations. Health care professionals can assume an essential part in controlling its irrational use. The purpose of this study was to explore the knowledge, attitude and behavior of health care professionals of Riyadh region of Saudi Arabia on the use of PPIs by a cross-sectional study design.

**Methods:** The study data was obtained through a validated self-administered questionnaire covering knowledge (20 items), attitude (8 items) and behavior (6 items). Furthermore, demographic questions were placed to decide their effect on the intended three domains. The results were analysed by descriptive analysis and affirmed by multinomial regression method using SPSS-IBM 25.

**Results:** Of 414 surveyors, 121 (31%), 182 (44%) and 103 (25%) were doctors, pharmacist and nurses, respectively. Average age of participants' was  $33.96 \pm 8.37$  years. Both doctors and pharmacist showed better degree of information (13.17/20 and 13.25/20) and good attitude (6.66/8 and 6.9/8) towards PPI use compared to nurses. Altogether higher extent of knowledge score showed by highly educated individuals, middle age groups and those with more practicing experience. The reliance on the utilization of PPI is less among pharmacist and nurses when compared to doctors. The outcome of the regression analysis exhibited that the odds of having low knowledge is more in young and bachelor degree holders.

**Interpretation & Conclusion:** Healthcare professionals in the Riyadh area are generally positive about the use of PPIs. However, increasing their level of knowledge and reducing their reliance on PPIs must be strengthened. Frequent professional development programs and trainings for healthcare professionals are needed to minimize widespread PPI overuse.

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## 1. Introduction

Proton pump inhibitors (PPIs) are one of the mostly commonly prescribe drugs for treatment and prophylaxis of gastrointestinal problems. They stay the medical care experts' best option for treatment of upper gastrointestinal issues going from dyspepsia, gastroesophageal reflux infection (GERD) to peptic ulcer illnesses and their difficulties (Grube et al., 2007). Despite the fact that, it is profoundly effective, has more prominent degree of tolerability and safety, its irrational use may prompt unfavorable therapeutics results (Mohzari et al., 2020). Several studies reported excessive use of PPIs that surpasses the quantity of revealed cases of gastrointestinal issues (Friedenberg et al., 2010). The archived

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utilization of PPIs has expanded by just about multiple times in eight years (from 2002 to 2009) in United States (Rotman and Bishop, 2013). Number of published literatures from other parts of the world also report undeniable degree of reliance on the utilization of PPIs (Nguyen and Tamaz, 2018; Kelly et al., 2015). An investigation completed in Saudi Arabia detailed prevalence rate of 57.6% for PPI prescriptions in an academic hospital (Basheikh et al., 2017). Besides, according to a study conducted in Saudi Arabia in 2019, all community pharmacist regularly recommends the use of PPIs to their patients. (Alhossan et al., 2019).

Overabundance utilization of PPI is nothing but utilization of PPIs improperly. Irrational use of PPIs is known to have adverse therapeutic outcomes. Abuse of PPIs may introduce expanded danger of bone fracture (Zhou et al., 2016), may prompt mineral and nutrient inadequacies (Lam et al., 2013) and *Clostridium difficile* infection (Janarthanan et al., 2012). Advancement of dementia (Haenisch et al., 2015), pneumonia (Sadowski et al., 2018), gastric malignancy (Cheung et al., 2018) and chronic kidney diseases (Lazarus et al., 2016) are other secondary diseases detailed in patients with long term use of PPIs. Hence utilization of PPIs shall be controlled under the system regulations given by FDA ([www.cms.gov/Medicare](http://www.cms.gov/Medicare), 2013).

The knowledge of the health care professionals on therapeutic indications of PPIs is critical for advancing appropriate use of PPIs. Positive attitude of the practicing professionals and rational approach in their behavior towards the prescription of PPIs are other factors postulated for regulating PPI use. The health care team that consistently take an interest in Saudi Arabia towards dealing with the utilization of medications made out of doctors, pharmacist and nurses. The practicing doctors are responsible for initial diagnosis and prescription writing, while the pharmacist assume a critical part in apportioning and patient advising and nursing staff control medications to the patient and give in-hospital patient care.

Published literatures display the positive result of clinical pharmacist intervention in reducing the inappropriate utilization of PPIs (Luo et al., 2017; Agee et al., 2015). Another investigation recorded lack of awareness on the normal utilization of PPIs among health care professionals especially nurses, while, the degree of consciousness of pharmacist was fundamentally more compared to doctors and nurses (Luo et al., 2019). Given the high predominance of PPI utilization in the Saudi Arabia (Basheikh et al., 2017), there is a need to investigate the degree of awareness, attitude and practices of the healthcare professionals so that it will help health care authorities on developing strategies on safe PPI use. Therefore, the purpose of this study was to determine the awareness, attitude and behavior of the health care professionals of Riyadh region of Saudi Arabia by cross sectional study design using validated self-administered questionnaire.

## 2. Methods

### 2.1. Questionnaire design

This is a questionnaire based cross-sectional study using validated survey items adopted from the published literature (Luo et al., 2018). The Cronbach's alpha for internal consistency was 0.78 and consequently the dependability of the survey was affirmed. The items of the questionnaire were developed by earlier studies based on the guidelines for the safe and appropriate use of PPIs (ASHP Therapeutic Guidelines, 2015; Tan et al., 2015; Huang et al., 2013). After expansion of sociodemographic characteristics such as age, gender, professional rank, professional title, educational level, experience in practice, and location of practice to the main body of questionnaire, logical and content validity was carried out based on the proposed outcomes by expert researchers

and statisticians. Consequently, pretest of the questionnaire was done on the same sample population by self-administration to determine its comprehension. The first section of the questionnaire had sociodemographic questions which are outlined above. The second, third and fourth sections of the questionnaire composed of questions that determine awareness (20 questions), attitude (8 items) and behavior (06 items), respectively.

The answers for all questions of awareness were set as 'yes' or 'no'. Right response for every one of the thing give 'one point' and wrong answer gives zero point. The greatest points a member can accomplish is twenty. Based on the adjusted Bloom's cut-off points, each participant's knowledge score was divided into three categories: poor (<50 percent: <10 points), fair (50 percent–75 percent: 10–15 points), and good (>75 percent: 16–20).

There were eight questions included in the attitude section of the questionnaire. The choices available were either yes or no. The individuals who replied in assertion scored one point and the individuals who denied were given zero point. The last section of the questionnaire had only six questions and options were available as always (point 0), often (point 1) and never (points 2).

Higher score in awareness and attitude category classification address great performance of the participants in terms of better knowledge and positive attitude, though, high score in the last section, behavior, shows less reliance on the utilization of PPIs relating to better PPI use behavior.

### 2.2. Data collection

Respondents in this study were medical staff doctors, pharmacist and nurses from various public and private hospital in Riyadh, Saudi Arabia. In accordance with COVID-19 guidelines the questionnaire was conveyed electronically to the members by means of web-based media. Five researchers of the study personally visited the participants in their practicing sites and shared the questionnaire link through social media such as WhatsApp, telegram, gmail, i-drop, etc. Data were collected from beginning of September to the end of October 2020. This project was approved by the institutional review board of the AlMaarefa university [MCST/(AU)-COP 1920/RC dated 15/06/2020]. Participants were educated about the objective of the study by both verbal interaction and in the form of brief description written at the start of the questionnaire form. There was no incentive or coercion for the participants. Their identity was kept anonymous and secrecy of their responses were guaranteed to them.

### 2.3. Statistical analysis

Gathered information were entered into SPSS statistical software and analyzed. For correlation between doctors, nurses and pharmacists, data were analyzed using chi-squared test. Descriptive analysis was done to correlate dependent variables (knowledge, attitude and behavior) with sociodemographic characters. *P* value less than 0.05 considered significant. Multinomial regression analysis done to find out the risk coefficient. Correlation statistics were done to test the relationship between knowledge, attitude and behavior of each domain on others. All statistical analysis done using SPSS IBM 25.

## 3. Results

### 3.1. Demographic characteristics of the participants based on knowledge level on PPI

A total of 414 respondents completed the survey, The most populous group within the study were pharmacists –182 (44%)

responders, followed by doctors –129 (31.2%) responders, and nurses 103 (24.9%) responders. Basic characteristics of respondents were provided in Table 1. The Average age of participants was 33.96 ± 8.37 years. Significantly higher proportion of knowledge score exhibited by highly educated individuals, middle age groups and those with more practicing experience.

### 3.2. The awareness of respondents regarding PPI knowledge

Table 2 presented the frequency of correct responses for each item related to awareness about PPI knowledge. Doctors, nurses and pharmacists responded with correct possibility (96%) in question 2 (see Table 2 items 1,2,3,4,10,11, 12,14,15,16,17,18,20) of 20 items. The top three highest rates of correct answers to questions was in the following items: ‘Do PPIs include omeprazole, pantoprazole, lansoprazole, rabeprazole, esomeprazole, etc.’, ‘Should PPI be swallowed as whole piece?’ , ‘Can PPI be used to prevent stress ulcer?’ .On the other hand, only 71(17%) the respondents responded correctly to ‘Does PPI treatment of gastric ulcer take 2 weeks to 4 weeks?’. the majority of respondents 299 (72%) believed that the long-term use of PPI may cause adverse reactions such as osteoporosis, pneumonia, etc. The frequency of correct responses for most questions in doctor and pharmacist was significantly higher than that in nurse.

### 3.3. The attitude and behavior of respondents regarding PPI use

Table 3 shows that 170 (93.4%) of pharmacists considered that overuse of PPI would cause an increase in adverse drug reaction and medical cost, in addition 110 (85.3%) of doctors and 80 (77.7%) of nurse did so. Furthermore, 365 (88.2%) of respondents thought it is necessary to launch certain large scale education for

medical staff and the public to promote better understanding about PPI.

### 3.4. Respondents' behavior of using PPI

Table 4 shows higher number of respondents 208 (50.2%) always prescribe/dispense PPI for nausea, followed by 204 (49.3%) of respondents always prescribe/dispense PPI for ventosity.

### 3.5. Average score

Table 5 showed average score of the knowledge, attitude and behavior on PPI use. Pharmacist scored better than doctors and nurses in attitude, while both Doctors and Pharmacist scored almost similar score in knowledge domain. Doctors group scored high on the questions of behavior (6.58 ± 2.39) compared with Pharmacists (5.96 ± 2.37) and nurses (5.88 ± 2.31). Having a higher score in behavior is an indication for more reliance on the use of PPI. Overall, the average score for behavior was just 51.16 percent, while knowledge was 65.15 percent and attitude was 83.6 percent.

### 3.6. Regression analysis

As shown in Table 6 below, the outcome of the regression analysis demonstrated that the odds of having low knowledge is more in young and bachelor degree holders. The odds of having good knowledge found in people with middle level professional experience (6–10 years).

### 3.7. Correlation of knowledge, attitude, and practices

A positive correlation was observed between attitude and knowledge scores. The attitude score increased significantly with

**Table 1**  
Knowledge level on PPI use based on demographic characteristics of the participants.

Demographics	Knowledge type			Total	P value*
	Poor N (%)	Average N (%)	Good N (%)		
<b>Professional type</b>					0.543
Doctor	15 (11.6%)	98 (76%)	16 (12.4%)	129 (31.2%)	
Pharmacist	21 (11.5%)	139 (76.4%)	22 (12.1%)	182 (44%)	
Nurse	16 (15.5%)	80 (77.7%)	7 (6.8%)	103 (24.9%)	
Overall	52 (12.6%)	317 (76.6%)	45 (10.9%)	414 (100%)	
<b>Age</b>					0.000
≤ 25 years	22 (33.3%)	43 (65.2%)	1 (1.5%)	66 (15.9%)	
26–40 years	28 (10.6%)	207 (78.7%)	28 (10.6%)	263 (63.5%)	
>40 years	2 (2.4%)	67 (78.8%)	16 (18.8%)	85 (20.5%)	
Overall	52 (12.6%)	317 (76.6%)	45 (10.9%)	414 (100%)	
<b>Educational level</b>					0.034
Bachelor	45 (14.9%)	231 (76.5%)	26 (8.6%)	302 (72.9%)	
Masters	5 (7.4%)	51 (75%)	12 (17.6%)	68 (16.4%)	
Ph.D or equivalent	2 (4.5%)	35 (79.5%)	7 (15.9%)	44 (10.6%)	
Overall	52 (12.6%)	317 (76.6%)	45 (10.9%)	414 (100%)	
<b>Experience in practice</b>					0.001
Less than 5 years	29 (19.5%)	115 (77.2%)	5 (3.4%)	149 (36%)	
6–10 years	14 (9.5%)	111 (75.5%)	22 (15%)	147 (35.5%)	
11–20 years	5 (6.3%)	63 (78.8%)	12 (15%)	80 (19.3%)	
>20 years	4 (10.5%)	28 (73.7%)	6 (15.8%)	38 (9.2%)	
Overall	52 (12.6%)	317 (76.6%)	45 (10.9%)	414 (100%)	
<b>Gender</b>					0.335
Female	28 (14.7%)	140 (73.3%)	23 (12%)	191 (46.1%)	
Male	24 (10.8%)	177 (79.4%)	22 (9.9%)	223 (53.9%)	
Overall	52 (12.6%)	317 (76.6%)	45 (10.9%)	414 (100%)	
<b>Hospital class</b>					0.178
Tertiary	23 (13.4%)	123 (71.5%)	26 (15.1%)	172 (41.5%)	
Secondary	15 (13.2%)	90 (78.9%)	9 (7.9%)	114 (27.5%)	
Primary health care	14 (10.9%)	104 (81.3%)	10 (7.8%)	128 (30.9%)	
Overall	52 (12.6%)	317 (76.6%)	45 (10.9%)	414 (100%)	

\* Chi-Square test.

**Table 2**  
Frequency of correct responses about PPI knowledge in different medical groups [n (%)]

No	Question	Doctor (129)	Nurse (103)	Pharmacist (182)	Total (414)	P value
1	Is PPI inactive prodrug? (yes)	83 (30%)	70 (25%)	126 (45%)	279 (67%)	0.657
2	Do PPIs include omeprazole, pantoprazole, lansoprazole, rabeprazole, esomeprazole, etc.? (yes)	124 (31%)	93 (23%)	180 (45%)	397 (96%)	<b>0.002</b>
3	Do PPI cure acid-related diseases by suppressing hydrochloric acid secretion? (yes)	120 (33%)	76 (21%)	166 (46%)	362 (87%)	<b>0.001</b>
4	Can PPI be used to prevent stress ulcer? (yes)	112 (30%)	83 (22%)	176 (48%)	371 (90%)	<b>0.001</b>
5	Can PPI be used to treat acute pancreatitis? (yes)	70 (35%)	43 (21%)	88 (44%)	211 (49%)	0.166
6	Does omeprazole have the largest individual difference compared with other PPIs? (yes)	87 (31%)	73 (26%)	121 (43%)	281 (68%)	0.742
7	Does omeprazole have the largest interaction compared with other PPIs? (no)	62 (32%)	41 (21%)	92 (74%)	195 (47%)	0.211
8	Does esomeprazole have the longest acid inhibition time compared with other PPIs? (yes)	87 (31%)	68 (24%)	128 (45%)	283 (68%)	0.727
9	Should omeprazole be selected for pediatric patients? (yes)	50 (24.4%)	64 (31.2%)	91 (44.4%)	205 (50%)	<b>0.002</b>
10	Should rabeprazole be selected for pregnant patients? (no)	95 (35%)	62 (23%)	114 (42%)	271 (67%)	0.057
11	Do you think the more expensive or newer PPI will produce better and safer effect? (no)	44 (30%)	30 (20%)	71 (49%)	145 (35%)	0.235
12	Is PPI usually available as enteric-coated capsules or tablets? (yes)	86 (33%)	52 (20%)	121 (47%)	259 (63%)	0.014
13	Should PPI usually be taken at breakfast? (yes)	70 (28%)	72 (29%)	105 (43%)	247 (60%)	0.042
14	Should PPI be taken after meal? (no)	92 (31%)	71 (24%)	139 (46%)	302 (73%)	0.350
15	Should PPI be swallowed as whole piece? (yes)	117 (32%)	86 (23%)	169 (45%)	372 (90%)	0.039
16	Is it advisable to increase the dose frequency rather than a single dose to improve effect? (yes)	87 (32%)	78 (29%)	107 (39%)	272 (66%)	0.013
17	Should patients take PPI for only 7 days in the Helicobacter pylori eradication therapy? (no)	94 (33%)	72 (25%)	122 (42%)	288 (70%)	0.543
18	Does PPI treatment of gastric ulcer take 2 weeks to 4 weeks? (no)	26 (37%)	24 (34%)	21 (30%)	71 (17%)	0.022
19	Is duration of PPI prophylaxis until no high risk factors, or able to tolerate enteral feeding? (yes)	91 (31%)	76 (26%)	131 (44%)	298 (72%)	0.861
20	Do you think long-term use of PPI may cause adverse reactions such as osteoporosis, pneumonia, etc.? (yes)	102 (34%)	52 (17%)	145 (49%)	299 (72%)	0.001

**Table 3**  
Respondents' attitude on usage of PPI [Yes, n(%)]

Questions (yes)	Doctors	Pharmacist	Nurse	Total	P value
Overuse of PPI is commonly present In Saudi Arabia	119 (92.2%)	172 (94.5%)	91 (88.3%)	382 (92.3%)	0.174
The main cause of PPI overuse is doctors' or patients' abuse of PPI.	119 (92.2%)	158 (86.8%)	89 (86.4%)	366 (88.4%)	0.258
The main purpose of PPI overuse is Stress ulcer prophylaxis	94 (72.9%)	138 (75.8%)	73 (70.9%)	305 (73.7%)	0.640
Overuse of PPI will cause an increase in adverse drug reaction and medical cost.	110 (85.3%)	170 (93.4%)	80 (77.7%)	360 (87%)	<b>0.001</b>
Necessary to carry out large scale education on rational use of PPI for medical staff and the public.	113 (87.6%)	171 (94%)	81 (78.6%)	365 (88.2%)	<b>0.001</b>
Necessary to strengthen the management of community pharmacy	112 (86.8%)	162 (89%)	83 (80.6%)	357 (86.2%)	0.136
Use of PPI for short duration does not cause significant side effect	95 (74.4%)	144 (79.1%)	87 (84.5%)	327 (79%)	0.175
Over the counter dispensing of PPIs should be restricted	97 (75.2%)	142 (78%)	70 (68%)	309 (74.6%)	0.170

**Table 4**  
Respondents' behavior of using PPI (always).

Questions (yes)	Doctors	Pharmacist	Nurse	Total	P value
Prescribe/dispense PPI when abdominal pain	23 (17.8%)	28 (15.4%)	9 (8.7%)	60 (14.5%)	0.054
Prescribe/dispense PPI when ventosity	80 (62%)	79 (43.4%)	45 (43.7%)	204 (49.3%)	0.004
Prescribe/dispense PPI when nausea	79 (61.2%)	88 (48.4%)	41 (39.8%)	208 (50.2%)	0.023
Prescribe/dispense PPI when vomiting	64 (49.6%)	72 (39.6%)	34 (33%)	170 (41.1%)	0.067
Prescribe/dispense PPI when Acid reflex	8 (6.2%)	8 (4.4%)	10 (9.7%)	26 (6.3%)	0.175
Prescribe/dispense PPI when patient has dyspepsia	27 (20.9%)	35 (19.2%)	27 (26.2%)	89 (21.5%)	0.497

an increase in knowledge score ( $r = 0.165$ ,  $P = 0.001$ ). Further, positive correlation was noticed between practice and knowledge scores ( $r = 0.082$ ,  $P = 0.011$ ). Finally, a significant positive correlation

was found between attitude and knowledge as well practices towards PPI use and also a similar correlation was witnessed between practices with knowledge and attitude score (Table 7).

**Table 5**

Average score of the knowledge, attitude and behavior on PPI use.

Average score	Doctor	Pharmacist	Nurse	Overall
Knowledge	13.17 ± 2.00	13.25 ± 1.96	12.48 ± 2.36	13.03 ± 2.10
Attitude	6.66 ± 1.37	6.90 ± 1.23	6.34 ± 1.99	6.69 ± 1.5
Behavior	6.58 ± 2.39	5.96 ± 2.37	5.88 ± 2.31	6.14 ± 2.3

Values are given as mean ± SD.

**Table 6**

Factors influencing knowledge on the use of PPI.

Factors	Beta co-efficient	P value
Age	≤25 years	4.081
	26–40 years	2.434
Experience in practice	Less than 5 years	3.942
	6–10 years	4.763
	11–20 years	3.541

#### 4. Discussion

There are limited number of studies that are done in Saudi Arabia that evaluate the knowledge, behavior and attitude of health care professional towards proton pump inhibitor. This study surveyed doctor, pharmacist and nurses at various hospitals, primary health care setting and community pharmacy in Riyadh.

The result of awareness domain demonstrate that doctor and pharmacist showed better degree of knowledge in contrast with nurses, for instance only 21% of nurses realize that proton pump inhibitor cure acid related disease by suppressing hydrochloric acid secretion. Past investigation that address pharmacokinetics and pharmacodynamics of the PPIs clarified that PPI is a prodrug which is enacted by acid. Activated PPI ties covalently to the gastric H<sup>+</sup>, K<sup>+</sup>-ATPase via disulfide bond. Cys813 is the primary site responsible for the inhibition of acid pump enzyme, where PPIs bind (Shin and Kim, 2013).

Concern has been communicated in a few investigations on the level of knowledge of practicing doctors on the safe and effective use of drugs. A study published in 2015 addressed the rampant prescription of first generation antihistamines towards managing allergic manifestation despite availability of new class of safe antihistamines (Chainani et al., 2015). Similarly, a study carried out in Jeddah, Saudi Arabia, reported low level of physician's knowledge on PPI adverse effects and drug–drug interactions (Alnabulsi et al., 2018). The outcome of our study is in contrast with the above two studies, wherein, doctors show relatively similar level of knowledge compared to pharmacist. One of the reason for this contrasting result could be due to high percentage of the physician who participated in this study were either master or Ph.D. qualified (56%) and 78% of them are practicing in either secondary or tertiary care units. Both high qualification and practice in high level care units may necessitates the doctors to refresh themselves with most recent safety regulations.

The literature on the knowledge and attitude scales of pharmacist on the use of PPIs is scarce both at national and international level, nonetheless, this investigation give an outline about the great degree of knowledge towards PPIs usage among the partici-

pating pharmacists. Our report is in compatible with different investigations that showed the fruitful interventional of clinical pharmacist through educational programs and training to the physicians and nurses to diminish the irrational use of PPIs and promoting the economical outcome of PPIs (Luo et al., 2017; Agee et al., 2015).

Regardless of that a large portion of PPIs are named as prescribed medications, yet some of their users take them without prescription in Saudi Arabia (AlKhamees et al., 2018). Many drug utilization studies have revealed the abuse of PPIs in various developed and developing countries, be that as it may, there is a need to have systematic assessment of perceptions and practices of health care providers towards the utilization of this class of medications (Lazarus et al., 2016). Community pharmacists in Saudi Arabia usually recommend PPIs to their patients. Overseeing OTC PPI use in the community pharmacy setting is important to advance both patient and medicine security. Pharmacists are in the situation to control the choice of the best treatment by affirming the conclusion alluding patients with indistinct indications to doctors, and teaching patients on the appropriate utilization of their OTC medications, in this study both doctor and pharmacist showed good attitude toward PPI use.

One past examination (Alhossan et al., 2019) didn't discover any measurably critical relationship between participants' demographics and the prescribing patterns of these medications, alternately, in this investigation higher extent of knowledge score exhibited by highly educated, middle age, and those with middle level of practicing experiences.

Proton pump inhibitors (PPI) are commonly prescribed in the primary care setting. While by and large viewed as protected, there is developing proof proposing that PPI abuse is related with an assortment of huge adverse outcomes and unnecessary cost. Excessive PPI prescription and the associated adverse effects and economic burden are progressively perceived (Boster et al., 2020), our study shows the dependency on the use of PPI is less among pharmacist and nurses when contrasted to doctors.

##### 4.1. Limitation

The questionnaire was appropriated electronically, which may prompt self-revealed inclination and it is influenced by psychological and surrounding components during the response to the questions. We can't sum up the results because the research was limited to Riyadh hospitals and centers; we need a more comprehensive and broad investigation at the national level to measure the health staff's knowledge, attitude, and behavior about these medicines.

**Table 7**

Correlation between knowledge, attitude and behavior scores.

Variables	Knowledge		Attitude		Behavior	
	Correlation coefficient (r)	P value	Correlation coefficient (r)	P value	Correlation coefficient (r)	P value
Knowledge	1		0.165	0.001	0.082	0.011
Attitude	0.165	0.001	1		0.151	0.021
Behavior	0.082	0.011	0.151	0.021	1	

## 5. Conclusion

The Riyadh region's healthcare professionals have a generally positive attitude about the use of PPIs. However, this must be supplemented by increasing their level of knowledge and reducing their dependence on PPIs. To reduce the widespread overuse of PPI, frequent professional development programs and trainings for healthcare professionals are required.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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