Journal of High Institute of Public Health 2021;51(3):121-127.

Original Article

# Knowledge, Attitude and Practice of Physicians and Pharmacists Working in Alexandria Governmental Hospitals Regarding Food Drug and Drug Nutrient Interactions

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## Abstract

**Background:** Food drug interactions (FDIs) and drug nutrient interactions (DNIs) are considered adverse drug reactions pertaining to nutritional diseases. The primarily and most easily accessible health care professionals to the patients are physicians and pharmacists. Knowledge and expertise about FDIs and DNIs are both essential among healthcare professionals where their lack would eventually lead to inappropriate patient counseling and undesirable adverse medical consequences.
**Aim (s):** To assess the knowledge, attitude and practice of physicians and pharmacists working in Ministry of Health governmental hospitals of Alexandria regarding food drug and drug nutrient interactions and their association to professional characteristics.
**Methods:** A cross sectional study was conducted among 279 physicians and pharmacists. Data were collected using a self-administered questionnaire to gather information on personal and professional characteristics, nutritional background, and knowledge, attitude and practice of physicians and pharmacists towards food drug and nutrient interactions. Linear regression was used to detect the most independent/affecting factors for the knowledge and practice.
**Results**: Only 10.4% and 17.9% of the studied physicians and pharmacists had good level of knowledge and practice respectively, while 86.7% had positive attitude concerning FDIs and DNIs. Multivariate analysis revealed that the main factors affecting knowledge were the graduation year and having nutrition courses either pre or post-graduation, while practice was mainly affected by knowledge and the undergraduate nutrition courses.
**Conclusion:** Knowledge of physicians and pharmacists about FDIs and DNIs was found to be inadequate. They had positive attitude towards FDIs and DNIs, and moderate to poor practice level. This might be greatly advanced through including nutrition modules in the topics taught to medical students (physicians and pharmacists) via multiple educational strategies.

***Keywords:*** food-drug, drug-nutrient interactions, knowledge, attitude, practice, physicians, pharmacists

***Available on line at:***
jhiphalexu.journals.ekb.eg

**Print ISSN: 2357-0601**
**Online ISSN: 2357-061X**


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**Suggested Citations**: Sultan ES, El-Sahn FA, Fetohy EM, Mohamed DT. Knowledge, Attitude and Practice of Physicians and Pharmacists Working in Alexandria Governmental Hospitals Regarding Food Drug and Drug Nutrient Interactions. JHIPH. 2021;51(3):121-127.

## INTRODUCTION

Food drug interaction (FDI) is considered one of the up growing challenges in the oral drug therapy affecting both the pharmacokinetics (PK) and pharmacodynamics (PD) of the co-ingested drug.(1) Nowadays it has become a major health care problem as these interactions either lead to a toxic effect of the co-administered drug or a loss in its therapeutic efficacy.(2) Drug nutrient interactions (DNIs) are currently highly overlooked and undervalued from the relevance to public health. The body metabolism is affected by many vitamins and micronutrients, and so their interactions with drugs may result in physiological impairments that are clinically relevant, particularly in the geriatric age

group who are more prone to chronic diseases and polypharmacy.[3]

It is critical to distinguish and understand the mechanisms by which different foods and drinks can influence the absorption, distribution, metabolism and/or elimination processes of the drug, so as to both predict and evade such interactions.[1] It is famous that the European Medicines Agency (EMA), as well as the Food and Drug Administration (FDA) had given license for the oral medicines analysis since 2010, enlightening that over 40% have displayed significant food effects. Restraining, these medicines are commonly required to be administered in either the fed or the fasted state owing to the alteration in their bioavailability and accordingly deterring their medical efficacy.[4]

Adverse drug reactions (ADRs) are considered one of the primary sources of hospital readmission, ending in fatalities in some developed countries and acting as an ample burden on healthcare delivery systems. However, the obtainable data from low and middle income countries is considered too little.[5] A claim has been made that patients taking two drugs face a 13% hazard of adverse drug interactions, this rises to 38% upon taking four drugs and to 82% when seven or additional drugs are given alongside.[6]

Food, pharma, and health are closely related domains, and so the awareness of the medical community about drug nutrition interactions is becoming crucial. Experts and stakeholders are to be advised to integrate drug nutrition evaluations in their drug development processes. Individual patients' protocols should be developed, by implementing drug review protocols, malnutrition screening and integrating this topic into the patient counseling.[3]

Knowledge and expertise about FDIs and DNIs are both essential among healthcare professionals, where their lack would eventually lead to inappropriate patient counseling and undesirable adverse medical consequences on the wellness of patients.[7] Numerous factors might influence the knowledge, attitude and practice (KAP) of physicians and pharmacists regarding the interactions between food and drugs. These factors may include age, gender, specialty, degree level, graduation year, experience years and nutritional background. Comprehending the levels of knowledge, attitudes and practices usually facilitates a more efficient process of awareness formation by discovering certain gaps, which permits tailoring of programs necessary to and required by the community.[8] The aim of the current study is to assess the knowledge, attitude and practice of physicians and pharmacists working in Ministry of Health governmental hospitals of Alexandria regarding food drug and drug nutrient interactions and their association to professional characteristics.

# METHODS

**Study setting:**
The study was conducted in governmental hospitals affiliated to Ministry of Health and Population in Alexandria Governorate.

**Study design:**
A cross sectional approach.

**Target population:**
Physicians (internists and pediatricians) and pharmacists (clinical and non-clinical) working in governmental hospitals affiliated to Ministry of Health and Population in Alexandria Governorate having at least one year of experience in their field.

**Sampling**
Assuming that 50% of physicians and pharmacists have good knowledge about food drug interactions, using margin of error 6% and alpha error of 0.05, the minimum required sample size was 267 of physicians and pharmacists. The actual sample included in the study was 279. A multistage stratified random sampling technique was used. Five districts were randomly selected from the eight health districts in Alexandria. These districts were Montazah, Sharq, Wasat, Gomrok, and Gharb. One hospital was randomly selected from each district. Physicians and pharmacists from each hospital were enrolled consecutively till reaching the required sample size.

**Data collection**
Data were collected using a self-administered questionnaire in English, which was used to collect the following information:

1. **Personal characteristics:** age, sex, graduation year, and specialty.
2. **Professional characteristics:** experience years/last degree achieved and qualifications
3. **Nutritional background:** undergraduate courses and postgraduate courses/training sessions about nutrition.
4. **Knowledge of physicians and pharmacists about food drug and drug nutrient interactions:**

This part included 20 multiple choice questions (MCQs) of the most common food drug interactions and the drug nutrient interactions developed by the researcher. Some questions included interactions of food with anticoagulants, antibiotics, antidepressants and antihypertensive drugs. Other questions included interactions of nutrients with anticonvulsants, antihyperlipidemics, diuretics, laxatives, antacids and analgesics.

The correct answer was given two points; the incomplete answer was given one point and the wrong or do not know answer was given zero. The respondents were asked to choose more than one answer whenever possible, as some questions were designed to have more than one answer. The respondent, who chose only one from two correct answers or only one from three correct answers, was considered as an incomplete answer. The total score for physicians' and pharmacists' knowledge regarding FDI/DNI was calculated by adding up the points for each question. The points ranged from 0-40. They were converted into percentage and were divided as follows:

- Poor level of knowledge <50% (scored from 0 to 19)
- Moderate level of knowledge 50% to less than 75% (scored from 20 to 29)
- Good level of knowledge ≥75% (scored from 30 to 40)
- The mean score % was calculated (mean score/total score x100).

**5. Attitudes of physicians and pharmacists towards food drug and drug nutrient interactions:**

Physicians' and Pharmacists' attitudes were assessed through eight statements measured using **3 points Likert scale** ranging between agree, uncertain and disagree to review the main concepts and importance of FDI/DNI. The positively stated statements ranged from disagree (1) to agree (3), while the negatively stated statements ranged from disagree (3) to agree (1). The total score ranged from 8-24 and was classified as follows:

- Negative attitude <50% (scored from 8 to 15)
- Neutral attitude 50% to less than 75% (scored from 16 to 19)
- Positive (good) attitude ≥75% (scored from 20 to 24)
- The mean score was calculated.

**6. Self-reported practices of physicians and pharmacists regarding food drug and drug nutrient interactions:**

Physicians' and Pharmacists' practices regarding FDI/DNI were assessed by four statements, using a five-points frequency response scale ranging from "Never" to "Always", and two multiple choice questions constructed by the researcher.

The four statements using a 5 points-frequency response scale ranged from never (0) to always (4), with two multiple choice questions scoring 0 and 2. The first was given a 0 score for those who said nothing, while a score of 2 was given for those who said that they counsel/refer to a specialist, interfere, report, and document the case. The second was given a 0 score for those who said nothing, while a score of 2 was given for those who said this could be achieved through lectures/courses, scientific meetings, handbooks, and mass media awareness. The total score was calculated by summing up (4x4) + (2x2=) =16+4=20. The score ranged from 0-20 and it was classified as follows:

- Poor practice <50% (scored from 0 to 9)
- Moderate practice 50% to less than 75% (scored from 10 to 14)
- Good practice ≥75% (scored from 15 to 20)
- The mean score was calculated.

**Statistical analysis**

Data was carefully checked, adjusted, coded, and fed to the statistical software IBM SPSS version 21.[9] Having p value less than or equal to 0.05 was considered to be statistically significant. The following statistical tests were used.[9] Reliability was used to assess internal consistency of the different scales. It was calculated using Cronbach's alpha. Validity of the questionnaire was calculated using Pearson correlation against the total score and the responders' qualification. Descriptive statistics were made in the form of frequencies and percentages. Mean and standard deviation were calculated. Analytical statistics included the following:

- Chi squared test ($X^2$) was used as test of significance of association between two categorical variables. Whenever more than 20% of expected values were less than 5, Monte Carlo test was used. Fisher's Exact test was used instead of Monte Carlo test for the 2x2 tables.
- Linear regression was used to detect the most independent/ affecting factor for the knowledge and practice (with p value < 0.05). Personal and professional characteristics of physicians and pharmacists were the factors included in the multivariate analysis of predictors of knowledge (age, graduation, experience, undergraduate, and postgraduate nutrition course) and practices (gender, undergraduate and post graduate nutrition course, and knowledge) with the total score of knowledge and practice as the dependent variables of each regression, respectively.

**Ethical considerations**

The study was approved by the Ethics Committee of High Institute of Public Health, Alexandria University, Egypt on 9 April 2019. After explaining the aim and purpose of the study, informed verbal consent was obtained from all participants. Anonymity and confidentiality were assured and maintained. No private questions were included. No obligation of any kind for participation in the study. The authors declare that they have no conflict of interest.

## RESULTS

### 1- Personal and professional characteristics of the studied physicians and pharmacists

More than three quarters (86.4%) were females and more than 85% of them were in the age group from 30 to 39 years and < 30 years (45.2% and 40.1% respectively) with mean age of 33.8±8.6 years. Two thirds of the studied sample (66%) were pharmacists while one third (34%) was physicians. The graduation year of 53% of the studied sample was from 2010 or above and 33.4% was from 2000-2009 while only 13.6% were graduated in the year 1999 or before. More than half (54.8%) of the studied sample had less than 10 years of experience while about one third of them (31.9%) had experience from 10 to less than 20 years and only 13.3% had 20 years or more experience, with mean years of experience of 10.6±8.1 years. Less than half of the studied sample (43.7%) had a bachelor degree, followed by 30.8% with a master degree and 20.1% with a diploma, while only 4.3% had a fellowship and 1.1% had a doctoral degree. Less than two thirds of the studied sample (63.8%) did not have an undergraduate nutrition course while 73.5% of the studied sample did not attend a post graduate nutrition course **(Table 1)**.

### 2- Knowledge, attitude, and practices of physicians and pharmacists

Mean score of knowledge was 22.6±5.5, and the % score was 56.5%. Level of knowledge was moderate in both physicians and pharmacists (58.9% and 647%) while physicians had poor level of knowledge higher than pharmacists (28.4% and 26.1%) with no statistically significant difference (p=0.563) **(Figure 1)**. Most of the studied sample (86.7%) had a positive attitude, pharmacists had a positive level of attitude more than physicians (89.1% and 82.1%, respectively), but that difference was not statistically significant (p=0.101). The mean score of attitude was 18.9±1.8, and the % score was 78.75% **(Figure 2)**. The mean score of practice was 10.6±3.9, and the % score was 53.0%. poor practice was higher among physicians than pharmacists (43.2% and 40.2%, respectively) but that difference was not statistically significant (p=0.250). **(Figure 3)**.

### Factors affecting knowledge and practice

Regarding knowledge, it was noticed that the graduation year, the under-graduate nutrition course and the post-graduate nutrition course were the only variables that found to be predictor of the physician's and pharmacist's knowledge (p=0.037, p= 0.048 and p= 0.024, respectively). Regarding practice, it was noticed that the undergraduate nutrition course and the knowledge were the only variables that found to be predictor of the physician's and pharmacist's practice (p=0.037 and p=0.001, respectively) **(Table 2)**.

**Table 1: Personal and professional characteristics of the studied physicians and pharmacists (Alexandria 2019-2020)**

| | Physicians and Pharmacists (n = 279) | |
|---|---|---|
| **Personal and professional characteristics** | No, | % |
| **Gender** | | |
| Male | 38 | 13.6 |
| Female | 241 | 86.4 |
| **Age (years)** | | |
| <30 | 112 | 40.1 |
| 30- | 126 | 45.2 |
| 40+ | 41 | 14.7 |
| **Mean±SD** | 33.8±8.6 | |
| **Specialty** | | |
| Pediatrician | 51 | 18.2 |
| Internist | 44 | 15.8 |
| Pharmacist | 116 | 41.6 |
| Clinical pharmacist | 68 | 24.4 |
| **Graduation year** | | |
| 2010 and after | 148 | 53.0 |
| 2000-2009 | 93 | 33.4 |
| 1999 and before | 38 | 13.6 |
| **Years of experience** | | |
| <10 | 153 | 54.8 |
| 10- | 89 | 31.9 |
| 20+ | 37 | 13.3 |
| **Mean ± SD** | 10.6±8.1 | |
| **Last degree achieved** | | |
| Bachelor | 122 | 43.7 |
| Master | 86 | 30.8 |
| Diploma | 56 | 20.1 |
| Fellowship | 12 | 4.3 |
| Doctoral | 3 | 1.1 |
| **Undergraduate nutrition course** | 178 | 63.8 |
| No | 101 | 36.2 |
| Yes | | |
| **Attendance a post-graduation nutrition course** | 205 | 73.5 |
| No | 74 | 26.5 |
| Yes | | |

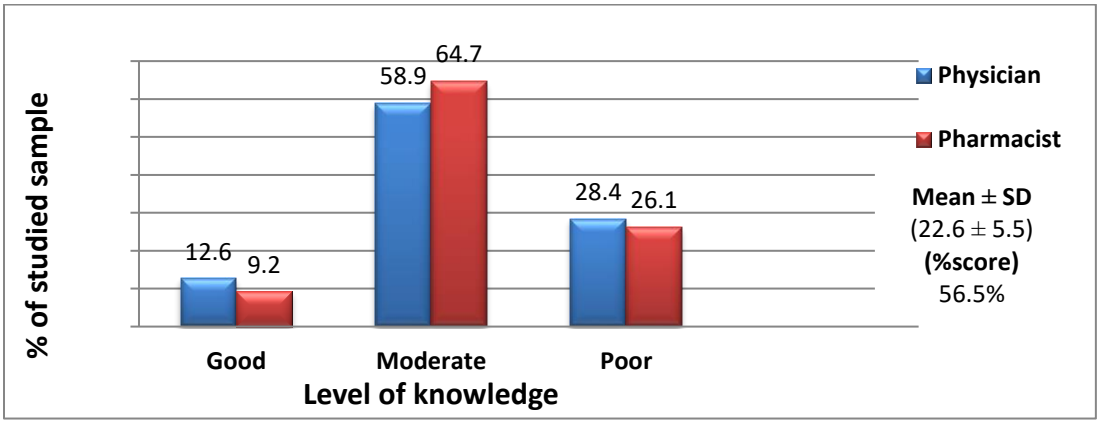


**Figure (1): Distribution of the studied physicians and pharmacists according to their level of knowledge regarding FDIs and DNIs (Alexandria, 2019-2020)**

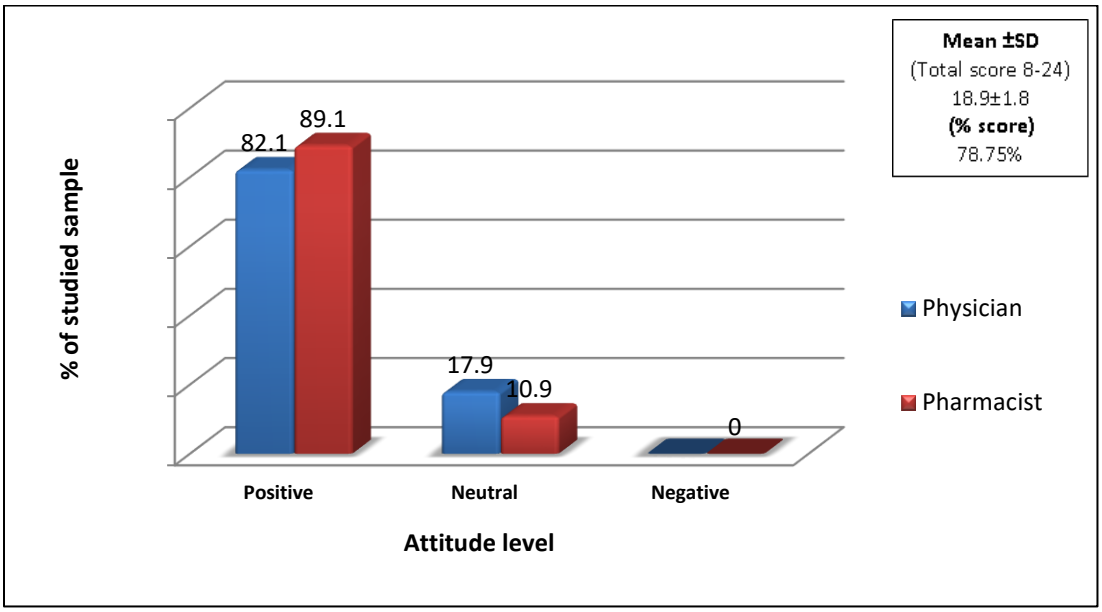


**Figure (2): Distribution of the studied sample according to their level of attitude towards FDIs and DNIs (Alexandria, 2019-2020)**

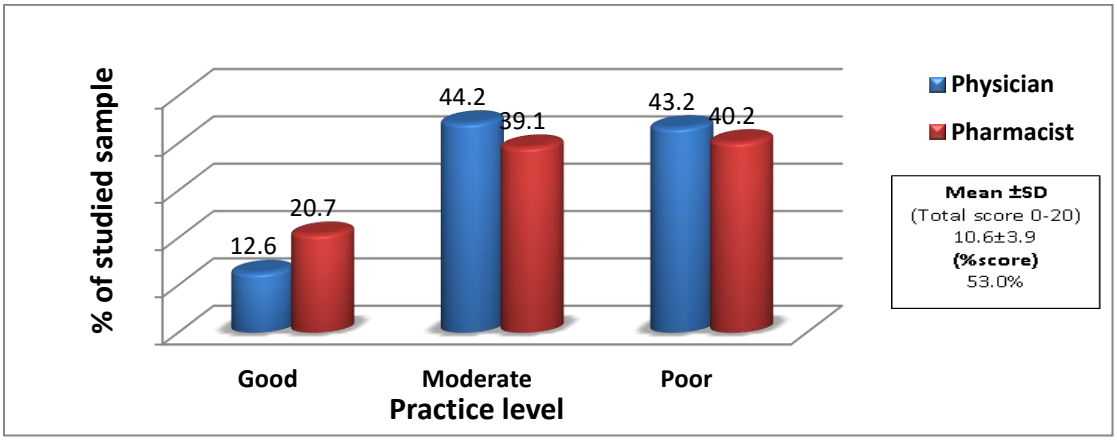


**Figure (3): Distribution of the studied physicians and pharmacists according to their practice level about FDIs and DNIs (Alexandria, 2019-2020)**

**Table 2: Mulivariate analysis of predictors of the knowledge and practice towards FDIs/DNIs (Alexandria, 2019-2020)**

| Parameter | Coefficient B | Standard error | t | 95% CI (L.L – U.L) | p-value |
|---|---|---|---|---|---|
| **Knowledge** | | | | | |
| Graduation (years) | -1.823 | 0.870 | 2.096* | –3.534 —0.111 | 0.037* |
| Undergraduate nutrition course | 1.357 | 0.682 | 1.989* | 0.014 – 2.701 | 0.048* |
| Attendance of a nutrition course post-graduation | 1.689 | 0.742 | 2.275* | 0.228 – 3.150 | 0.024* |
| **Practice** | | | | | |
| Undergraduate nutrition course | 1.046 | 0.498 | 2.100* | 0.066 – 2.026 | 0.037* |
| Knowledge | 0.153 | 0.043 | 3.576* | 0.069 – 0.237 | <0.001* |

## DISCUSSION

This research aimed to assess the knowledge, attitude and practice of physicians and pharmacists towards the potential FDIs and DNIs and the main factors affecting both knowledge and practice. Results showed that physicians and pharmacists generally held high positive attitudes with moderate practice and knowledge levels. This was seen in accordance with other studies in which pharmacists' nutrition knowledge was also reported inadequate (mean NK scores were 60.0% (10); 61.7% (11); 65.4% [12] and physicians' nutrition knowledge was also reported inadequate (mean NK scores 62.5±10.6 with 100 being a perfect score (7); 21.35 ± 4.2, 22.89 ± 3.72, 26 ± 4.08 for interns, general practitioners, and professors, respectively, with 31 being the maximum score).[13]

A cross-sectional survey was carried out among community pharmacists in various cities of Ethiopia to study the level of KAP deduced that the greater part of pharmacists had low professional practice regarding dietary supplements (DS) in spite of having sufficient knowledge and a positive attitude. It showed that 66.7% of pharmacists had satisfactory knowledge while 53.7% of them had an affirmative attitude and a lower percentage (41.2%) found within the good practice range of DS. Age, education level, work position and experience level in the community pharmacy were significantly related to KAP.[14] Another study carried out in Amman to discover the level of knowledge of hospital and community pharmacists, concluded that pharmacists had a generally disappointing level of knowledge relevant to most commonly known FDIs.[15]

Regarding attitude, a high percentage of physicians and pharmacists (86.7%) were shown to have an extremely positive attitude towards FDIs and this was seen comparable with other studies.[16,17] Another study conducted on community pharmacists in Lebanon, found that their attitudes were encouraging and coherent with comprehending their role in the clarification of the potential interactions of the prescribed drugs, but they demonstrated unsatisfactory practices.[17]

Practices among health care professionals concerning FDIs are not seen to be prevalent enough nowadays. Not all physicians and pharmacists pay attention to the scarcity of counseling and educating their patients regarding their food intake and its effect on the co-administered medication. Mean score of practice was 10.6±3.9 with 20 being the maximum score, with pharmacists having a higher practice than physicians (20.7% and 12.6% respectively. This was matching with a Lebanese study directed towards the patients that revealed the lower rates of practicing patient counseling by physicians compared to pharmacists regarding drug interactions (35.4% and 89.1% respectively).[18]

Relation analyses showed that knowledge was strongly associated with the graduation year, having an undergraduate nutrition course, and attending post-graduate nutrition courses, while practice was strongly associated with the knowledge and having an undergraduate nutrition course. Upon applying regression analysis for the knowledge and practice in our study, graduation year, having an undergraduate nutrition course and attendance of post-graduate nutrition courses were the main predictors found to significantly affecting physicians' and pharmacists'

knowledge. Also, it was revealed that having good knowledge and taking undergraduate nutrition courses was highly associated with an increase in the good practice of physicians and pharmacists towards FDIs/DNIs, which are in accordance with other studies.[14] These findings highlight the influential role of knowledge and nutrition courses in motivating physicians' and pharmacists' practice towards FDIs and DNIs, therefore, it should be considered when designing health education programs.

## CONCLUSION AND RECOMMENDATIONS

Most of the studied physicians and pharmacists had positive attitude, moderate practice and generally lacked the sufficient knowledge regarding food drug interaction during their daily practice. The main factors affecting knowledge were the graduation year, having an undergraduate nutrition course and attending post-graduate nutrition courses. The main factors affecting practice are knowledge and having an undergraduate nutrition course. Nutrition and food drug interactions are important for physicians and pharmacists, in order to provide the most favorable therapy outcomes via patient education and counseling. This could be improved by continuous educational programs and training campaigns addressing hospital physicians and pharmacists.

### *CONFLICT OF INTEREST*

The authors have no conflict of interest to declare.

### *FUNDING*

No funding sources

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