INTRODUCTION

Influenza is a seasonal epidemic disease,\(^1\) influenza is associated with morbidity and mortality and has significant national and international public health implications. During pandemic influenza, the public health burden is associated with morbidity and mortality. The public health burden is associated with hospitalization and death.\(^1\) Influenza has been associated with increased mortality and hospitalization.\(^2\)

AIMS: In flu pandemics, pharmacy students’ knowledge, attitudes, and practices are critical to save patient’s life. The objective of the study was to determine the knowledge of and attitude toward the pandemic influenza among the pharmacy students of Karachi, Pakistan. Settings and Designs: The cross-sectional study was conducted from September to December 2014 by adopting a prevalidated questionnaire distributed to senior pharmacy students (final year) in seven private and public sector universities of Karachi. Materials and Methods: A total of 443 pharmacy students responded the survey. Data regarding sociodemographic characteristics of the students, perceptions, level of knowledge and attitudes toward influenza, and prophylactic measures were collected. Statistical Analysis: To compute the correlation between different variables, data were analyzed using Pearson’s Chi-square statistic method. \(P < 0.05\) was considered statistical significance for all analysis. Results: Influenza was identified as a viral disease (\(n = 423; 95.48\%\)) and 282 (71.2\%) students correctly identified it as disease affecting humans and pigs. Textbooks reported as most common source of knowledge (\(n = 282; 64\%\)). Most common symptoms identified were fever (81.94\%), sore throat (64\%), and nonproductive cough (43.34\%). The most common preventive measures were covering nose and mouth (268; 60.5\%) and wearing protective coverings (254; 57.3\%). Only half of the students correctly reported about the route of administration (180; 40.6\%) and strains in vaccine (186; 41.98\%). The best time for administration of such vaccine was known by only 156 pharmacy students (35.34\%). The majority of the students (82.6\%) had no idea about the manifestation of influenza pandemic. Knowledge regarding influenza differed according to gender and institutions differing in their affiliation with tertiary care hospitals. Conclusion: It was observed that knowledge about disease progression, transmission, vaccination, and treatment in pharmacy students, especially those who are not getting clinical training in tertiary care hospitals was limited. There is an urgent need to develop awareness programs to increase knowledge of influenza among clinical pharmacists as they are more susceptible to infections and community as a whole. Keywords: Influenza, pandemic, pharmacy students, prophylactic.

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consequences. Universally pandemics are less restricted by season. It ensues most frequently in the winter months (temperate regions) while in tropical and subtropical regions, it occurs with one or two peaks of increased activity.[2] In the past decades, this variable virus was implicated in some pandemic events such as pandemics occurring in 1947, 1976, 1977 and 2009 resulting in millions of deaths.[3] The novel H1N1 virus observed in 2009 pandemic and was reported in Mexico initially followed by global diffusion.[4,5] Worldwide more than 214 countries have reported laboratory-confirmed cases of pandemic 2009 influenza A (H1N1), resulting in over 18,000 deaths.[2]

Human influenza virus belongs to genus orthomyxovirus and recognized as Type A, B, and C. They have been named according to their type, year of isolation, or location.[1,6] Influenza A and B are the causative agents of the major outbreaks and severe disease. Influenza C is mainly associated with a common cold-like illness. The two major surface glycoprotein antigens (hemagglutinin - HA or H and neuraminidase - NA or N) undergo gradual, progressive antigenic variation, referred as “antigenic drift” and “antigenic shift.”[7] In developing countries, where different other noncommunicable and communicable diseases are on priority list, influenza is sometimes overlooked; yet, it imposes a heavy disease burden, especially among populations that are malnourished or immunocompromised. The flu virus can travel on inhaled airborne particles, sprayed droplets that are projected onto mucous membranes, or a contaminated hand that touches the nose or mouth. Once an influenza virus has invaded the body and attached itself to cells lining the respiratory tract, it incubates for one to 7 days before symptoms appear. An infected individual may be able to infect others before and during the symptomatic period. Children and young adults remained infectious for 10 days or longer while individuals with compromised immune systems might be capable of infecting others for weeks. Influenza can survive for hours outside a human host, further aiding its capacity to spread.

It is of paramount concern that influenza epidemic may emerge at any time, and sometimes, coupled with lack of strain-specific vaccine and sufficient antiviral agents at the time of outbreak.[8] A case study worth quoting here is from Iraq where the Ministry of Health in 2009 updated pandemic influenza preparedness strategies, comprised posters, leaflets, and subtitles in many Iraqi TV channels. Moreover, the World Health Organization (WHO) guidelines related to case management, laboratory diagnosis, and infection control have been distributed to all concerned authorities and personnel.[9]

Pharmacy students’ knowledge, attitude, and practices are crucial to prevent and control the disease along with doctors, especially the residents who has a greater risk of infection.[10] Health-care workers including pharmacists are responsible for providing the knowledge and delivering good quality management and treatment and protecting them from illness at the time of epidemic prevalence. Thus, pharmacy students’ education about precautionary measures, effective treatment, and follow-up is critical as well as their behaviors in these fields.[3-5,11] Therefore, the present study was carried out to evaluate the knowledge about influenza as an attempt to identify the degree of students’ know how which may contribute in developing the education program to create awareness among these future practitioners.

**Materials and Methods**

**Study design and setting**

This cross-sectional analysis was conducted in September–December 2014 by adopting a prevalidated questionnaire[5] distributed to final year pharmacy students in all private and public sector universities of Karachi. A total of seven institutions offering Pharm.D program surveyed. The total students enrolled in final year Pharm.D program in different universities of Karachi were 750. The sample size was calculated by OpenEpi® online software, and nonprobability sampling technique was adopted. Overall, four hundred and forty-three students participated in the study. The researchers appraised the students about the importance of their participation and request them to fill the questionnaires completely and carefully. They were encouraged to fill up the given questionnaire on spot. After completion, the questionnaires were subsequently collected for further analysis.

**Ethical approval**

Prior permission was taken from each institution’s head of department to initiate the study in their institutes. The participants briefed about the rationale of the study, and thus, their written consent was obtained. Participants were assured about the confidentiality of their personal information and responses.

**Data collection**

A prevalidated questionnaire used in other studies was adapted and modified. The questionnaire consisted of three parts: the first part included guideline to fill the questionnaire for students and their demographic factors. Second part reflected 67 items exploring the knowledge of students regarding types, signs and symptoms, spread, prevention, and treatment of pandemic influenza. The domains of knowledge had both single-choice and multiple-choice questions. Third and last part was related...
to the attitude of students toward the role of pharmacist, ethical, and moral obligations toward pandemic influenza.

**Statistical analysis**
The data from filled questionnaires were analyzed using Statistical Package for Social Science version 21.0 (SPSS 20.0, Chicago, IL), and the level of significance was set at <0.05 for all analysis. Pearson’s Chi-squared test was used to compute the correlation between different variables (gender and institution) on the responses. The scoring method and categorization were used to identify the degree of pandemic influenza knowledge in the current study. Scoring of the questions was determined by giving one point for each correct answer and zero for wrong answers. The mean knowledge scores (KSs) of the respondents were calculated by adding up the scores for each question in the test. KS ranged from 0 to 67, with higher scores demonstrating a higher level of pandemic influenza knowledge. According to the median split method, students with a total score of <34 (median) were considered as having inadequate knowledge.[12-14]

**RESULTS**
A total of seven universities Pharm.D final year students contacted for current research. All the students present on the day of the study were asked to respond to the questionnaire. Among the 443 students responded, the most prevalent gender was female (76.7%). A small group of students answered in the beginning that they have good knowledge of influenza (171; 38.6%). The students thought that they have no knowledge were only 30 (6.8%). Students’ perception regarding source of health-related information is presented in Figure 1. Figure 2 represents their confidence level on such sources. The most common source of information was textbooks (64%), followed by internet sources (48%). However, they were very confident (81%) on textbooks and not confident (17%) on internet source for health-related information [Figures 1 and 2]. Table 1 reflects knowledge of pharmacy students about the types of influenza.

A total of 423 students answered correctly that influenza is caused by viruses (95.48%). Most of the students identified the symptoms of influenza, i.e., fever (363; 81.94%), sore throat (232; 64.1%), and nonproductive cough (192; 43.34%) [Table 2]. Table 2 also represents students’ knowledge about influenza spread. Its spread was identified correctly. They were aware that it does not spread by blood transfusion (398; 89.84%) and sexual transmission (428; 96.6%). Mostly influenza spread by cough or sneeze from infected person (364; 82.2%) and close contact with infected

Table 1: Pharmacy students’ knowledge about who get influenza and types

| Items                  | Correct response, n (%) | Incorrect response, n (%) |
|------------------------|-------------------------|---------------------------|
| Who can get influenza? |                         |                           |
| Pigs                   | 58 (13.09)              | 385 (86.90)               |
| Horses                 | 330 (74.49)             | 111 (25.05)               |
| Dogs                   | 311 (70.20)             | 132 (29.79)               |
| Humans                 | 415 (93.67)             | 28 (6.32)                 |
| Birds                  | 216 (48.75)             | 227 (51.24)               |
| Cats                   | 313 (70.65)             | 130 (29.34)               |
| Reptiles               | 435 (98.19)             | 8 (1.80)                  |
| Which type(s) of influenza affect humans? | | |
| Type A                 | 235 (53.04)             | 208 (46.95)               |
| Type B                 | 228 (51.46)             | 215 (48.53)               |
| Type C                 | 330 (74.49)             | 113 (25.50)               |
| Type D                 | 410 (92.55)             | 33 (7.44)                 |
| Type E                 | 428 (96.61)             | 15 (3.38)                 |
| Type F                 | 403 (90.97)             | 40 (9.02)                 |

Figure 1: Pharmacy students' reliance on different sources of information

Figure 2: Pharmacy students’ confidence on different sources of information
person (306; 64%). They were confused that whether spread with contact with infected birds, chickens, etc. The body system most affected was correctly identified by 81.71% students. However, a majority were unaware about types of influenza (300; 67.72%) and incubation time (286; 63.65%). The highest group get affected by influenza are children and appropriately identified by 60.27% of students. A total of 278 (62.75%) were able to identify cause due to which patients die after getting influenza. The function of hemagglutinin and neuraminidase was known by only 25.73% and 18.28% of students, respectively [Table 3].

### Table 2: Pharmacy students’ knowledge about sign/symptoms of influenza and spread

| Items                                                                 | Correct response, n (%) | Incorrect response, n (%) |
|-----------------------------------------------------------------------|-------------------------|---------------------------|
| Which of the following is/are considered a sign or symptom of an influenza infection? |                         |                           |
| Fever                                                                 | 363 (81.94)             | 80 (18.05)                |
| Headache                                                              | 329 (74.26)             | 114 (25.73)               |
| Nonproductive cough                                                    | 192 (43.34)             | 251 (56.65)               |
| Sore throat                                                           | 232 (52.37)             | 211 (47.62)               |
| Nausea/vomiting                                                       | 89 (20)                 | 354 (79.90)               |
| Lack of appetite                                                      | 347 (78.32)             | 94 (21.21)                |
| Rhinitis                                                              | 284 (64.10)             | 159 (35.89)               |
| Diarrhea                                                              | 427 (96.38)             | 16 (3.61)                 |

How is influenza spread?

- Close contact with an infected person: 306 (69.1) vs. 137 (30.9)
- Blood transfusion: 398 (89.84) vs. 45 (10.15)
- Sexual transmission: 428 (96.61) vs. 15 (3.38)
- Cough or sneeze from an infected person: 364 (82.2) vs. 78 (17.6)
- Touching doorknobs previously handled by an infected person: 320 (72.2) vs. 123 (27.8)
- Contact with infected wild birds, chicken: 197 (44.5) vs. 245 (55.3)

### Table 3: Correct and incorrect responses of pharmacy students to single-choice questions

| Items                                                                 | Correct response, n (%) | In correct response, n (%) |
|-----------------------------------------------------------------------|-------------------------|---------------------------|
| What causes influenza?                                                | 423 (95.48)             | 20 (4.51)                 |
| How many types of influenza exist?                                    | 139 (31.37)             | 300 (67.72)               |
| Typically, how long is the incubation time seen with influenza?       | 160 (36.11)             | 282 (63.65)               |
| What body system does influenza typically affect?                    | 362 (81.71)             | 80 (18.05)                |
| Once a person gets influenza, how long are they considered infective?| 135 (30.5)              | 307 (69.3)                |
| Which group has the highest reported rate of influenza infection?     | 267 (60.27)             | 175 (39.50)               |
| Which group has the highest likelihood of experiencing severe illness, hospitalization, or death from influenza? | 326 (73.6)              | 116 (26.2)                |
| Patients who get influenza are most likely to die secondary to which of the following causes? | 278 (62.75)              | 163 (36.79)               |
| What is the function of hemagglutinin?                               | 114 (25.73)             | 325 (73.36)               |
| What is the function of neuraminidase?                               | 81 (18.28)              | 354 (79.90)               |
| Influenza vaccines are available in formulations for administration by which routes? | 180 (40.63)             | 261 (58.91)               |
| How many strains of influenza are contained in the vaccine?           | 186 (41.98)             | 254 (57.33)               |
| Live strains of influenza are contained in the vaccine that is available for administration by which route? | 147 (33.18)             | 293 (66.13)               |
| Where are the components of the live vaccine grown?                   | 148 (33.40)             | 293 (66.13)               |
| Which of the following vaccine formulations could cause influenza?    | 97 (21.89)              | 346 (78.10)               |
| Approximately how long after the vaccine has been administered does it take for the host to develop antibodies? | 54 (12.18)              | 388 (87.58)               |
| When do medications against influenza need to be started in order for them to be most effective? | 42 (9.48)               | 401 (90.51)               |
| Are patients with egg allergies able to receive any of the influenza vaccine formulations? | 217 (48.98)             | 226 (51.01)               |
| Are patients with egg allergies able to receive any medications to treat influenza? | 243 (54.85)             | 194 (43.79)               |
| What months are considered the best time to administer the influenza vaccine? | 68 (15.34)              | 375 (84.65)               |
| If an influenza pandemic were to occur, how would it likely manifest?  | 73 (16.5)               | 366 (82.6)                |
The preventive measures and treatments as reported by students are shown in Table 4. The most common preventive measures were covering nose and mouth (268; 60.5%) and wearing protective coverings (254; 57.3%). The preventive measure which rated least in students’ opinion were nothing can prevent influenza (388; 87.6%) and moving to a state where there is not an influenza outbreak (399; 90.1%). Students were confident that antibiotics (384; 86.7%) and antiviral (285; 64.3%) cannot be used to prevent influenza spread/acquisition. Their response to the question regarding influenza treatment was good enough. Most of them thought that bed rest (73.8%), hydration (74.9%), complimentary medicines (90.5%), and chicken soup (79%) cannot be used to treat influenza. A total of 290 students (65.5%) knew that antiviral is the treatment available for influenza.

A total of eight questions were asked to conceive their knowledge regarding influenza vaccine. Their knowledge was limited. Only half of the students correctly answer about the route of administration (180; 40.6%) and strains in vaccine (186; 41.98%). The best time for administration of such vaccine was known by only 156 (35.34%) pharmacy students. They were also lacking about information that influenza vaccine does not cause influenza, and only 97 students (21.89%) gave the correct answer. They were also not aware about manifestation of influenza pandemic (366; 82.6%) [Table 3].

Figure 3 illustrates the role of pharmacist in students’ viewpoint. Three most common role of pharmacist in case of influenza vaccine as enlisted by students were to provide medication for influenza (216; 48.8%), provide OTC medications (192; 43.3%), and administer influenza vaccine (178; 40.2%). Students thought that they are not responsible to conduct a diagnostic test for influenza (329; 74.3%). In response to question about ethical/moral obligation to volunteer during influenza pandemic, majority of students replied positively (315; 71.1%).

After completing the questionnaire, it was observed that their response to the question that they have knowledge about influenza was shifted, and now, 31.6% (140/443) of students thought that they have enough knowledge. Half of the students (215; 48.5%) thought that they have somewhat knowledge. The percentage

| Table 4: Pharmacy students’ knowledge about influenza prevention and treatment |
|--------------------------------------------------|------------------|------------------|
| Items | Correct response, n (%) | In correct response, n (%) |
| How can the spread and/or acquisition of influenza be prevented |
| Nothing can prevent influenza | 388 (87.6) | 55 (12.4) |
| Hand washing | 244 (55.1) | 199 (44.9) |
| Covering mouth when coughing or sneezing | 268 (60.5) | 175 (39.5) |
| Vaccination | 199 (44.9) | 244 (55.1) |
| Vitamins and herbal supplement | 402 (90.7) | 41 (9.3) |
| Antiviral | 285 (64.3) | 158 (35.7) |
| Antibiotics | 384 (86.7) | 59 (13.3) |
| Quarantine | 406 (91.6) | 37 (8.4) |
| Staying home and avoiding public places | 367 (82.8) | 76 (17.2) |
| Moving to a state where there is not an influenza outbreak | 399 (90.1) | 44 (9.9) |
| Wearing protective equipment in public places (e.g., masks, gloves, etc.) | 254 (57.3) | 189 (42.7) |
| How can influenza be treated once you have it? |
| Nothing can treat influenza | 386 (87.1) | 57 (12.9) |
| Antibiotics | 334 (75.4) | 109 (24.6) |
| Antiviral | 290 (65.5) | 152 (34.3) |
| Vaccination | 281 (63.4) | 162 (36.6) |
| Bed rest | 327 (73.8) | 116 (26.2) |
| Hydration | 332 (74.9) | 111 (25.1) |
| Complimentary medicine (e.g., acupuncture, homeopathy) | 401 (90.5) | 42 (9.5) |
| Chicken soup | 350 (79) | 93 (21) |
of students responded “no knowledge” was shifted from 6.8% to 4.5%.

**DISCUSSION**

Health-care workers especially physicians, pharmacists, and nurses are the people at risk of acquiring infections as they are the most exposed population group. Pharmacist being a vital member in any health-care team plays a significant role in handling special situations such as pandemics and disaster management. Therefore, it is not incorrect to expect that they should have sound knowledge on tackling these issues.

To the best of our knowledge, the current research is one of the initial attempts to explore the knowledge of pharmacists about influenza. The knowledge of medical students was reported previously in another study. In countries like Pakistan, mostly female students acquire admission in medical or health sciences, and thus, the current research also accounts majority participants as females (76.7%). As only final year Pharm.D program comprises study population, there was a minor variation in the age of participants.

The mean KS was calculated by summation of individual student’s score divided by a total number of students. The mean KS was 30.29 with standard deviation of 3.35 for 67 items questionnaire. The low KS in our study is consistent with some previous reports. In some studies conducted on health-care workers, high KS was also reported. Khazaiepour et al. reported the high KS of 17.37 for 35-item questionnaire. Ofstead et al. observed KS of 9.6 for 13 items. The low knowledge can be handled with properly focused training on influenza and emphasize on procedural knowledge rather than conceptual knowledge.

Many studies conducted in the past years endorsed that mostly general public rely on media (television, newspapers, etc.,) as a major source of information. A study conducted in Turkey on health-care workers reported that participants more relied on internet source. In the same year 2010, Khowaja et al. surveyed medical students of Karachi and observed that they use television and newspaper as the source of information. However, in our study, the most common source from where pharmacy students get knowledge was textbooks and reported to be very confident on such source of knowledge. Second, they get knowledge from the internet but did not feel confident on such sources of information. More than one-fourth of the students opined that they also get knowledge from physician slightly higher as reported in one previous study. Our results are different from some previous reports, in which Internet and media were the most reliable sources of information. The reason may be the fact that students mostly read textbooks during their study and easily get reliable knowledge from them.

The Centers for Disease Control (CDC) defines influenza as a contagious disease common in pigs and humans caused by viruses. Sign/symptoms are fever, sore throat, coughing, rhinitis, lethargy with some rare signs such as nausea, vomiting, and running nose. Pharmacy students were aware about the cause of influenza but not sure about the type which affects humans. Their knowledge about signs/symptoms was also good enough about fever, sore throat, and rhinitis, but they were confused about nausea/vomiting. Similar results were mentioned in a study conducted previously on medical students. Pharmacy students were well aware about the spread of influenza. Close contact with infected person and cough or sneeze from infected person were the two most common ways of influenza dispersion in student’s point of view. According to CDC, infected person with seasonal and pandemic influenza may be able to infect others when they are asymptomatic from day one before getting sick to 5 days. There was no significant association of type of institution with their response to the question asked about its spread; however, gender was associated with their response to above-mentioned question. Body system most affected and group having highest reported rates were correctly identified by majority of students. Hemagglutinin and neuraminidase functions play an important role in disease progression. It was thought-provoking that their functions were unknown by students.

Covering mouth or nose, hand washing, and wearing protective equipment in public places were identified as protective measure by most of the students in the present study. The least rated preventive measure as reported in the study was herbal remedies and moving to a state where there is not an influenza outbreak. Facemasks covering nose and mouth were considered as most effective preventive measure in medical students’ opinion of the previous studies. However, in some previous studies, health-care workers were unaware of preventive measures. Seale et al. reported quarantine as the most effective prevention technique. Indian public considered vaccination and facemasks as the most while herbal remedies and antiviral as least effective prevention. Akan et al. reported that university students believed on hand washing, wearing facemasks, and quarantine as most effective preventive measures. In another study conducted by Van et al., the majority of the students did not undertake any specific preventive measure. During pandemic of influenza, WHO strongly recommends good hygiene as a mean to limit its
spread. However, there is no evidence of impact of these preventive measures to limit spread.[30]

Literature has many evidence that the only possible way to restrict influenza pandemics is vaccination. Although it is important to improve compliance to preventive measures among public in general and health-care workers specifically to slow down the spread of influenza.[31] Kilbourne stated that the keystone to prevent influenza is vaccine.[32] It was also reported in many studies that people including health-care workers thought that vaccines are unsafe.[27,33] In the present study, about half of the pharmacy students considered vaccine as preventive measure. Besides promoting influenza vaccination, concerned authorities have to initiate educational campaigns before in a pandemic region. Programs that are concurrently launched with the introduction of the vaccine will not be as flourishing as those which have constructed impetus along the pandemic.

In a previous study conducted on medical students in Karachi,[11] their awareness about antiviral treatment for influenza was only in 51.3%. However, pharmacy students (65.4%) were more aware which is a good indication. The detailed knowledge about vaccinations, treatment of people having egg allergies, and time duration to develop antibodies were insufficient in pharmacy students which is in accordance with one previous research.[3]

Pharmacist as a member of health-care team can play a crucial role in case of any pandemic, especially influenza. A good knowledge of influenza establishes confidence to deliver their best in such situations. The role of pharmacist providing medications for influenza was selected by 48.8%. Other roles as selected by students were providing OTC medication (94.3%) and administer influenza vaccine (40.2%). They (71.1%) also thought that this is moral/ethical obligation of pharmacist to volunteer in case of influenza outbreak in their community. Herman et al. reported in 2007 that medical students (69.8%) were also thought that this is an ethical or moral obligation for health-care workers.[25] This is very satisfactory that the pharmacist from the start of their professional career, realize their responsibilities, and willing to facilitate their people whenever there is an outbreak or disaster.

**Conclusion**

At the time of study, there was no high level of morbidity and mortality due to influenza worldwide. However, it is important to know community knowledge about this pandemic. During the study, it was observed that knowledge about disease progression, transmission, vaccination, and treatment in pharmacy students, especially those who are not getting clinical training in tertiary care hospitals was limited. There is an urgent need to develop awareness programs to increase the knowledge of influenza among clinical pharmacists as they are more susceptible to infections.

**Study limitations**

In the present study, only final year pharmacy students were surveyed in a specific period in Karachi. The outcomes may not be generalized to all pharmacy students of Pakistan. The study limitations also include the sample population which was a specific part of the whole population surveyed at a specific time. Knowledge and attitude toward influenza as reported in the study was not of general population of Pakistan. The respondents group was very homogenous; it is difficult to compare KS regarding socio-demographic context.

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**Conflicts of interest**

There are no conflicts of interest.

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