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Editorial

Differences and similarities between Journal Impact Factor and CiteScore

Fernando FERNANDEZ-LLIMOS.
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Abstract

Two major journal-based metrics are in competition: the Journal Impact Factor and CiteScore. Although these two metrics are based on similar principles of measuring the impact by citations, some differences between them exist. Years used to calculate the metric, access to computing data, and number of journals covered are some of these differences. One of the most relevant differences for pharmacy journals is the recognition in CiteScore of Pharmacy as an independent Subject Area, whereas it appears to have merged with pharmacology in the Journal Citation Reports. The immediate consequence of this differentiation is that pharmacy journals remain in the third and fourth quartiles in the Journal Impact Factor distribution, while a true quartile distribution exists in CiteScore.

Keywords

Periodicals as Topic; Databases, Bibliographic; Journal Impact Factor; Publication Bias; Pharmacy

Journals are usually evaluated by means of citation metrics. These metrics are highly criticized because of the lack of correlation between their values and the real importance of the articles.[1] Alternative metrics have not improved this situation, likely because these alternative metrics do not measure the impact of science on science but instead measure the impact of science on social media.[2,3] It is also very important to remember that the General Recommendation of the San Francisco Declaration advises that people "not use journal-based metrics …//… to assess an individual scientist's contributions…".[4]

Journal Impact Factor is a well-known citation metric that was created in the 1950s.[5] The Journal Impact Factor is published through the Journal Citation Reports and is calculated from data compiled in the Web of Science database, thus covering approximately 11,000 journals with an indexed 2.2 million articles.[6] Elsevier launched a new citation metric in 2016: CiteScore.[7] CiteScore is calculated with the 22,800 journals indexed in Scopus, which contains approximately 70 million articles.[8] In addition to these figures, there are other differences between these two journal-based citation metrics.

Both metrics are based on similar principles: the number of citations received by a journal in a given year to papers published in a given period of time, over the number of papers published by that journal in that time period. A primary difference between these two metrics is the period of time for the calculation; while the Journal Impact Factor calculates the metric using the two previous years as a basis for the citation count, CiteScore uses a three-year period. The time period to compute the citations received is relevant because of the different citation half-lives between scientific disciplines. Areas such as Immunology or Genetics and Molecular Biology cite a substantially greater proportion of articles in the two-year window than papers in Arts and Humanities or Social Sciences.[9] Citations received for a paper published beyond the computing window are ignored in these two metrics. This means that papers published in 2018 will not influence the Journal Impact Factor citing papers published in or before 2015 or the CiteScore citing articles published in or before 2014. While "today's newspaper wraps tomorrow's fish", should we support the idea that today's articles will be ignored in two or three years? Journal Citation Reports provided a partial solution with the 5-year Impact Factor, which computes a five-year window. This computing window may not be sufficient for pharmacy, with a cited half-life of more than 7.5 years (e.g., Am J Health Syst Pharm 7.8; J Am Pharm Assoc 9.3).

The update frequency is something the two metrics have in common; both metrics are calculated and published yearly. A component in favor of CiteScore is the CiteScore Tracker, which is a monthly release of a provisional calculation. Publication frequency should not be synonymous with potential modifications in either metric. CiteScore cannot modify the data published until the next publication, even when an error is identified.

A major difference between the two metrics is the transparency in their calculations. Journal Impact Factor was blamed as being opaque because the calculations are "based on hidden data".[10] The quality of the data used to calculate the Impact Factor was criticized even by high Impact Factor journals.[11] The most intriguing situation is why one cannot easily access the complete list of cited and citing records used to calculate a given Impact Factor, even with full access

* **Fernando FERNANDEZ-LLIMOS**. PhD, PharmD, MBA. Editor-in-chief, Pharmacy Practice. Institute for Medicines Research (iMed.ULisboa), Department of Social Pharmacy, Faculty of Pharmacy, Universidade de Lisboa. Lisbon (Portugal).

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to the Web of Science. This issue was solved in CiteScore, since citing and cited documents are available through a one-link distance for a Scopus-subscribing institution or individual.

In addition to the lack of transparency, another major difference between the two metrics is the famous denominator, which is the number of articles published by the journal in the given period of time. It might sound strange that scientometricians have difficulties identifying the number of articles published by a journal in a year. This occurs when we add the adjective "citable" to the term "item". What is a citable item? As far as we know, journals' instructions to authors do not prevent citing any kind of contribution. Since the 1980s, Journal Impact Factor calculations have defined the denominator by using an algorithm to identify what they called "meaty" items that "contain substantive research". This algorithm is based on a number of criteria to allocate "points" to the contribution, as a proxy for "the amount and type of information the article contains". Regardless of the contribution's content, the number of authors, references and pages are used to identify what counts in the denominator of the Impact Factor calculations. The consequence of this correction to the simple calculation is that journals' publishing policies have a tremendous impact on Impact Factor.[12] Let us use The Lancet as an example. As published in the 2016 Journal Citation Reports, The Lancet published 309 citable items in 2015 and 271 in 2014 and was cited 13,983 and 13,759 times by articles published in 2016, resulting in a 47.831 Impact Factor. Figures are different if we search PubMed for articles published in The Lancet: 1,992 articles for 2015 and 1,770 for 2014. The Impact Factor would be 7.374 if we use these alternative data. In contrast, CiteScore includes all the documents published in a journal. Data for The Lancet in the 2016 CiteScore showed 5,886 articles (for the three-year window) that received 40,789 citations, resulting in a 6.93. There are more articles to cite but also fewer citations received, which reinforces the lack of transparency of the previously mentioned Journal Impact Factor.

Journal coverage is another difference between the two metrics. Almost 11,000 journals compared to almost 23,000 journals are figures that speak for themselves. The Web of Science bases their "why to be selective" on Bradford's Law.[13] Journal restriction could be a reasonable procedure in the 1950s, when computers and computing power had serious limitations. Limiting the number of journals covered due to the reason "this is a well-covered category" is not acceptable in the "big data age". What does "a well-covered category" mean? The 2016 Journal Citation Reports comprises 228 Subject Categories with a median of 62 journals per category. Should Andrology be considered a "well-covered category" with 5 journals, when Economics has 347 journals? Despite the greater coverage of CiteScore, journal selection criteria are also not perfect. Apart from several quality-related criteria (e.g., journal policy, content, regularity), Scopus uses other criteria to re-evaluate journals. Among these criteria, citation rate or clicks on scopus.com (all of them if lower than 50% of the average in the field) would be reasons to be excluded from the Scopus catalog and subsequently from the CiteScore analysis.[14]

This leads to another major difference between the two metrics that carries enormous relevance for our research area: the definition of Subject Area, as named by CiteScore, or Subject Category, following the Journal Citation Reports terminology. The definition of sister journals is crucial because bibliometric indexes only can be compared among analogous components by using the quartile distribution as a simple metric. To do this, each of these metrics classifies the journals among categories that represent areas of knowledge and research. The Journal Citation Reports includes pharmacy journals in the Subject Category of Pharmacology & Pharmacy, which comprises 257 journals ranging from a 57.000 to a 0.035 Impact Factor in the 2016 edition. The Pharmacology & Pharmacy Subject Category was criticized as heterogeneous because it comprises three different research areas (i.e., basic pharmacology, clinical pharmacology and pharmacy) with a very different number of journals in each area.[15] Additionally, journals such as Res Soc Admin Pharm are classified under different subject categories (indexed in two categories: Public, Environmental & Occupational Health; and in Social Sciences, Biomedical). Conversely, CiteScore and Scopus created a specific Pharmacy Subject Area, which includes 24 journals ranging from a 3.14 to a 0.00 CiteScore in the 2017 edition. Unfortunately, CiteScore also presents inconsistencies in the definition of the Subject Area. J Pharm Anal, an Elsevier journal with a declared scope about "all aspects of pharmaceutical analysis", is classified under six categories, including Pharmacy. However, Am J Health Syst Pharm is classified under Health Policy and under Pharmacology, or Eur J Hosp Pharm Sci Prac is classified under General Pharmacology, Toxicology and Pharmaceutics, but none of them are classified under Pharmacy. Unfortunately, due to the yearly update, these errors will not be corrected until the 2019 release of the 2018 CiteScore, and only then if we are able to convince Scopus managers. It seems that pharmacy practice researchers should devote efforts to describe clearly what pharmacy practice research is, and prioritizing pharmacy journals for their publications could be a required first step.

As a consequence of the definition of the Pharmacy Subject Area in CiteScore, and the correction of the inappropriate classification of the journals in previous years, **Pharmacy Practice** became a first quartile journal in the Pharmacy subject area (Table 1).[16] This is not a merit of the Editorial Board, but the combined effort of the authors, reviewers and citers in what we called a collaborative publishing project.[17] So, thank you very much indeed.

Table 1. Pharmacy Subject Area in 2017 CiteScore

Rank order	Journal	CiteScore	Quartile	2016 Impact Factor
#1	Journal of Pharmaceutical Analysis*	3.14	1st quartile	-
#2	Research in Social and Administrative Pharmacy	2.18	1st quartile	2.403
#3	Journal of managed care & specialty pharmacy	2.11	1st quartile	1.114
#4	International Journal of Clinical Pharmacy	1.58	1st quartile	1.555
#5	**Pharmacy Practice**	**1.35**	**1st quartile**	**-**
#6	International Journal of Pharmacy Practice	1.02	1st quartile	-
#7	Journal of the American Pharmacists Association	1.01	2nd quartile	1.241
#8	GaBI Journal	0.98	2nd quartile	-
	American Journal of Health-System Pharmacy**	0.97		1.969
#9	Canadian Pharmacists Journal	0.87	2nd quartile	-
#10	Currents in Pharmacy Teaching and Learning	0.67	2nd quartile	-
#11	Canadian Journal of Hospital Pharmacy	0.56	2nd quartile	-
#12	Hospital Pharmacy	0.40	2nd quartile	-
	European Journal of Hospital Pharmacy**	0.37		0.718
#13	Pharmacy Education	0.29	3rd quartile	-
#14	Journal of Pharmacy of Istanbul University	0.28	3rd quartile	-
#15	Journal of Pharmacy Practice and Research	0.21	3rd quartile	-
#16	Farmatsija	0.15	3rd quartile	-
#17	Regulatory Rapporteur	0.08	3rd quartile	-
#18	Clinical Pharmacist	0.07	4th quartile	-
#18	Klinicka Farmakologie a Farmacie	0.07	4th quartile	-
#18	Revista Cubana de Farmacia	0.07	4th quartile	-
#21	U.S. Pharmacist	0.06	4th quartile	-
#22	Australian Journal of Pharmacy	0.02	4th quartile	-
#23	Pharmacy Times	0.01	4th quartile	-
#24	Journal of the Malta College of Pharmacy Practice	0.00	4th quartile	-
	Journal of Research in Pharmacy Practice	N/A		-
	Journal of Advanced Pharmacy Education and Research	N/A		-
	European Journal of Parenteral and Pharmaceutical Sciences	N/A		-
	Bulletin of Faculty of Pharmacy, Cairo University	N/A		-
* Should not be included in this category; ** Should be included in this category				

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Original Research

Impact of printed antimicrobial stewardship recommendations on early intravenous to oral antibiotics switch practice in district hospitals

Wei T. SZE, Mei C. KONG.
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Abstract

Background: Early intravenous to oral (IV-PO) antibiotics switch, which is one of the important elements in antimicrobial stewardship (AMS) is not well implemented in Malaysian district hospitals. A systematic interventional strategy is required to facilitate IV-PO antibiotic switch.

Objective: This study aimed to evaluate the impact of printed AMS recommendations on early IV-PO antibiotics switch practice in district hospitals.

Methods: This study was an interventional study conducted in medical wards of eight Sarawak district hospitals from May to August 2015. In pre-intervention phase, pharmacists performed the conventional practice of reviewing medication charts and verbally informed the prescribers on eligible IV-PO switches. In post-intervention phase, pharmacists attached printed checklist which contained IV-PO switch criteria to patients' medical notes on the day patients were eligible for the switch. Stickers of IV-PO switch were applied to the antibiotic prescription to serve as reminders.

Results: 79 and 77 courses of antibiotics were studied in the pre-intervention phase and post-intervention phase respectively. Timeliness of switch was improved by 1.63 days in the post-intervention phase (95%CI 1.26:2.00 days, p<0.001). Mean duration of IV antibiotics in the post-intervention phase was shorter than pre-intervention phase (2.81 days (SD=1.77) vs 4.05 days (SD=2.81), p<0.001). The proportion of IV-PO switches that were only performed upon discharge reduced significantly in the post-intervention phase (31.2% vs 82.3%, p<0.001). Length of hospital stay in the post-intervention phase was shortened by 1.44 days (p<0.001). Median antibiotic cost savings increased significantly in the post-intervention phase compared to the pre-intervention phase [MYR21.96 (IQR=23.23) vs MYR13.10 (IQR=53.76); p=0.025)].

Conclusions: Pharmacist initiated printed AMS recommendations are successful in improving the timeliness of IV-PO switch, reducing the duration of IV, reducing the length of hospitalisation, and increasing antibiotic cost savings.

Keywords

Anti-Bacterial Agents; Antimicrobial Stewardship; Drug Administration Routes; Pharmacy Service, Hospital; Pharmacists; Evaluation Studies as Topic; Malaysia

INTRODUCTION

Antibiotics have been prescribed in an uncontrolled and injudicious trend which leads to an increase in healthcare costs and antibiotic resistance.[1] As a response to this emerging crisis, antimicrobial stewardship (AMS) protocol have been introduced by Ministry of Health Malaysia in 2015 for streamlining the use of antibiotics, one of the strategies being intravenous (IV) to oral (PO) antibiotic switch.[2] A study carried out by Sevinc *et al*. in a large teaching hospital in the United States concluded that 40% of patients starting on IV antibiotics were eligible for an early IV-PO switch, in which short intravenous therapy were given for 2-3 days, followed by oral treatment for the remainder of the course.[3] Similar result was shown by a prospective observational study carried out in hospitalized patients with community-acquired pneumonia.[4] However, the practice of early switch to oral antibiotics has not been implemented fully in hospital clinical setting, in which most of the studies showed that 60-75% of eligible patients did not receive the IV-PO switch.[5-7]

Wei Thing SZE. MSc. School of Pharmacy, University of London. London (United Kingdom). w_thing5142@hotmail.com
Mei Chieng KONG. BPharm. Clinical Pharmacist. Pharmacy Department, Sibu Hospital. Sibu (Malaysia). jane_libra87@hotmail.com

Early switch of IV antibiotics resulted in equal clinical efficacy compared with patient administered with full parenteral course.[8-11] Advantages of an early iv- oral switch include decreased risk of infection of the iv catheter, decreased risk of thrombophlebitis, increased comfort and mobility for the patient, and the possibility of earlier discharge from the hospital.[8] Furthermore, oral therapy is less labour intensive for the nursing staff, and economic benefits are clear due to hidden costs of IV administration, such as cost of diluents, equipment for administration, needles, syringes, and nursing time.[7,12]

The Infectious Diseases Society of America (IDSA) recommends institutions to introduce a systematic plan for switching from IV to PO antimicrobial therapy, facilitated by the development of clinical criteria and guidelines for switching to oral agents.[13] A study carried out in a community hospital in Canada reported that implementation of clinical intervention form had reduced IV antibiotic duration by 42%.[14] A checklist with criteria for switching to oral antibiotics in general medical wards was shown to shorten the duration of IV antibiotics without any negative effect on treatment outcome.[15] In the United Kingdom, IV-PO switch promotion is implemented through IV-PO antibiotic switch protocol in wards, pharmacy intervention forms, and reminder notes in medication

charts.[16-18] Timeliness of switch, length of stay and antimicrobial cost savings were improved through the application of stickers and criteria for the switch to the drug charts than conventional practice of giving verbal reminders.[19]

Many doctors were not aware of the existence of any clear guidelines on the adequate timing of the switch.[20] Furthermore, an interview conducted by a group of researchers discovered that one of the barriers of IV-PO switch was doctors' unawareness of which patients were on intravenous antibiotics and those to whom the guideline applies. One of the solution to overcome this barrier was the reminder stickers that were affixed to the medication charts.[21] In Malaysia, a cross-sectional study conducted to explore clinicians' baseline knowledge, practice beliefs and acceptance of IV-PO switch practice in a tertiary hospital had found that 47% of clinicians agreed that 'patient should receive a standard duration of IV antibiotic'.[22] In district hospitals in Sarawak, although ward pharmacists are present in the wards to conduct routine review on patients' prescriptions and giving verbal recommendations when necessary, there are no systematic interventional strategies to facilitate the IV-PO antibiotics switch.

We conducted a before and after interventional study to compare the conventional practice by giving verbal reminders to doctors on IV-PO switch with implementing printed AMS recommendations. This study aimed to evaluate the impact of printed AMS recommendations on early IV-PO antibiotics switch practice in district hospitals, with regards to the comparison of timeliness of IV-PO switch, duration of IV antibiotics, mean length of hospital stay, and antibiotics cost savings pre and post implementation of printed AMS recommendations.

METHODS

This study was a cross-sectional interventional study conducted prospectively in eight Sarawak district hospitals from May to August 2015, namely Hospital Bau, Hospital Lundu, Hospital Betong, Hospital Saratok, Hospital Mukah, Hospital Dalat, Hospital Limbang and Hospital Lawas with total beds number of 474 as shown in Table 1. This study was divided into 2 phases, which was pre-intervention and post-intervention. Pre-intervention phase was conducted from May to June 2015, while post-intervention was conducted from July to August 2015. The study was performed in accordance with the ethical principles in the Declaration of Helsinki and that are consistent with Good Clinical Practice. Approval has been obtained from the Medical Research and Ethics Committee to conduct this study.

Table 1. Beds number and total number of pharmacists of each hospital involved

Hospital	Beds (n)	Pharmacists (n)
Hospital Mukah	80	4
Hospital Dalat	8	2
Hospital Saratok	78	6
Hospital Limbang	100	6
Hospital Lawas	46	2
Hospital Betong	48	4
Hospital Bau	68	4
Hospital Lundu	46	4
Total	474	32

Subjects

Patients eligible for IV-PO switch fulfilled these criteria: 18 years and above, received an IV antibiotic for more than 48 hours, body temperature <38^{o} C for the past 24 hours, normal or decreasing white cell count, tolerating orally and showing clinical improvements from signs of infection. In this study, one of the switch criteria is patient must be at least on IV antibiotics for at least 48 hours, which lessen the risk and possibilities that the intravenous to oral switch may be occurring too early, resulting inadequate treatment of the infection.[3] 'Clinical improvement' for community-acquired pneumonia comprises of resolution of tachypnea and pulse rate <100 beats/min[23]; for cellulitis it includes reduced swelling, redness, pain and warmth.

Excluded from the study were patients younger than 18 years of age, oral route compromised (vomiting, nil by mouth, severe diarrhoea, swallowing disorder, unconscious, active gastrointestinal bleeding, malfunctional gastrointestinal tract or malabsorption syndrome), continuing sepsis (2 or more of the following: Temperature >38^{o} C or <36 ^{o} C, heart rate > 90bpm, respiratory rate >20/min, white cell count >12 or <4) , deteriorating clinical condition, prolonged course of IV antibiotics needed (eg: endocarditis, meningitis, Staphylococcus aureus bacteraemia, immunosuppression, bone and joint infection, deep abscess, empyema, cystic fibrosis, orbital cellulitis, endophthalmitis, prosthetic infection and melioidosis), febrile with neutropenia, absence of oral formulation that fit the susceptibility, hypotension (systolic blood pressure <90 mmHg, diastolic blood pressure <60mmHg), and shock.[2,3,7,17]

Intervention

In this study, convenience sampling method was used as the data collection was fit into the work timetable of the ward pharmacists of each study hospitals. One ward pharmacist from each study hospitals was assigned as study investigators. The ward pharmacists identified cases eligible for inclusions through daily screening of the medication charts in the ward, except on weekends when ward pharmacy service was unavailable.

All the patients eligible for IV-PO switch were followed up prospectively by the study investigators. In pre-intervention phase, the investigators performed the conventional practice of reviewing antibiotic prescriptions in the wards and verbally informed the prescribers on the day patient was eligible for switching to oral antibiotics. In post-intervention, a clinical intervention form (online appendix) with the criteria of IV-PO switch and recommendation of a suitable oral antibiotic was attached to the medical notes on the day patients were eligible for the switch. Doctors were required to document on the form whether the switch recommendation was accepted and stated the reasons if the recommendations were being rejected. An IV-PO switch sticker was placed beside the antibiotic prescription in the medication charts to serve as a reminder for IV-PO switching. All the doctors in the study hospitals were handed a written formal letter by the research investigators of each study hospitals on the availability of IV-PO switch protocol in the wards one week before the post-intervention phase commenced. The IV-PO protocols

Table 2. Demographic characteristics and site of infections indicated for the antibiotic courses being investigated

Characteristics	Pre intervention	Post intervention
Num. of patients	72	76
Female, n (%)	31 (39.2)	34 (44.2)
Num. IV antibiotic courses	79	77
Age (years): mean (SD)	57.18 (17.86)	58.52 (17.87)
Site of Infection: *n* (%)		
Respiratory Tract	44 (55.7%)	47 (61.0%)
Skin and Soft Tissue	12 (15.2%)	10 (13.0%)
Urinary Tract	14 (17.7%)	9 (11.7%)
Others	9 (11.4%)	11(14.3%)

were also attached to the letters. The study investigators followed up the patients daily until IV-PO switch was done or until patients were discharged home (whichever was earlier). The conventional practice of clinical pharmacists reviewing drug charts and contacting prescribers to discuss a switch to an oral antimicrobial was continued throughout the post-intervention phase.

Outcome measures

In our study, the primary outcome measured was timeliness of IV-PO switch. 'Timeliness' was defined as differences in days between the actual switch and the days patients met criteria for a switch to oral therapy.

The secondary outcomes measured were duration of IV antibiotics, length of hospital stay, and antibiotic cost savings. 'Duration' was defined as total days of IV antibiotics given from the first dose until the last IV dose in the ward. 'Length of hospital stay' was defined as the total number of days patient stayed in hospital from the first day of admission until the day of discharge home. 'Antibiotics cost savings' was defined as cost savings incurred by switching IV antibiotic to oral antibiotic, as was calculated from the formula:

Cost savings = (Cost of IV antibiotics x cost-saving days) – (Cost of oral antibiotics x cost savings days).

Cost savings days was defined as number of days of oral antibiotics including the duration of discharged oral antibiotics.[2]

Data collection

A data collection form was developed, which required the investigators to record the following information obtained from the medication charts, medical notes and discharge prescriptions: Age and gender of switch eligible patients, diagnosis (as per determined by medical officer either clinically, microbiologically, or both), admission date, IV antibiotics started, time taken for switching, total duration of IV antibiotics in ward, oral antibiotics switched, duration of oral antibiotics, date of discharge, whether IV antibiotic was restarted for the same indication after IV-PO switch, and whether the switch was only done upon discharge. The data collection form was pretested through a pilot study in Hospital Mukah for one week to ensure suitability. All investigators were briefed regarding the data collection to ensure reliability.

Data Analysis

Based on the calculation done using Power and Sample Size Calculator (Dupont and Plummer, 1997), the minimum sample size required was 128 patients (64 patients in each group) and at 80% certainty with a precision of 0.05 and estimated standard deviation of 2.

Table 3. Number of antibiotic courses investigated in pre and post intervention group. n (%)

	Pre intervention	Post intervention
IV ampicillin	8 (10.1)	15 (19.4)
IV amoxicillin-clavulanic acid	28 (35.4)	34 (44.2)
IV benzylpenicillin	4 (5.1)	1 (1.3)
IV ceftriaxone	7 (8.9)	1 (1.3)
IV cefuroxime	16 (20.3)	12 (15.6)
IV cloxacillin	7 (8.9)	5 (6.5)
IV metronidazole	2 (2.5)	4 (5.2)
IV ampicillin- sulbactam	5 (6.3)	5 (6.5)
IV azithromycin	2 (2.5)	
Total	79	77

The data collected was transcribed into Excel spreadsheet. Statistical analysis was performed using the SPSS version 20.0. Descriptive statistics were used to describe percentage of IV courses switched to oral on appropriate day (day of criteria for switch met), percentage of IV-PO switched performed only upon discharge, percentage of patients requiring reinstatement of IV antibiotics after switch to oral as well as continuous variables such as timelines of switch, length of hospital stay, duration of IV antibiotics in ward, and antibiotics cost savings. The two groups of patients (pre and post intervention) were compared for mean timeliness of IV to oral switch, length of hospital stay, duration of IV antibiotics using independent t-test. Median antibiotic cost savings between two groups were compared using Mann-Whitney test. Fisher's Exact Test was used to compare the number of IV-PO switches performed on the appropriate day, number of IV-PO switches performed only upon discharge, and number of IV courses restarted for the same indication after IV-PO switch. All reported p-values were two-sided with the alpha set at a significance of 0.05.

RESULTS

In this study, 79 courses of antibiotics were recruited from 72 patients in pre-intervention phase, while 77 courses of antibiotics were recruited from 76 patients in post-intervention phase. The characteristics of the study samples were shown in Table 2. The most frequent site of infection is respiratory tract infection in both stages as shown in Table 2 (55.1% vs 61.0% in pre and post-intervention respectively). The type of antibiotics prescribed in both groups were as stated in Table 3, with amoxicillin-clavulanic acid being the most commonly prescribed antibiotic in both groups.

IV antibiotics were switched in a more timely fashion in the post-intervention group compared to the pre-intervention group ($p<0.0001$). In the pre-intervention group, the mean difference in days between the actual switch and the days patients met criteria for a switch to oral therapy was 1.83 days (SD=1.55), while in the post-intervention group the mean difference in days was 0.21days (SD=0.59) (Table 4).

In the post-intervention group, the mean duration of IV antibiotics was 2.81days (SD=1.77), which was significantly shorter than the pre-intervention group, with an overall

Table 4. Comparing outcome variables between pre and post intervention group

Variables	Pre-[a] (n=79) Mean (SD)	Post-[b] (n=77) Mean (SD)	Mean difference (95% CI)	t statistic (df)	p-value
Timeliness	1.83 (1.55)	0.21 (0.59)	1.63 (1.26: 2.00)	8.72 (100.87)[c]	0.000[c]
Duration of IV antibiotics	4.05 (1.58)	2.81 (1.17)	1.23 (0.79:1.67)	5.54 (143.39)[c]	0.000[c]
Mean length of hospital stay	5.53 (3.22)	4.09 (1.73)	1.44 (0.62:2.26)	3.49 (120.57)[c]	0.001[c]
Antibiotics cost savings	13.10 (53.76)[d]	21.96 (23.23)[e]	-	-2.278[c]	0.025[f]

[a] pre-intervention; [b] post-intervention; [c] independent t test; [d] median and interquartile range; [e] z statistic; [f] Mann-Whitney test

mean IV antibiotic duration in the ward of 4.05 days (SD=2.81) (p<0.0001). The most frequently used antibiotic for respiratory tract infection was amoxicillin-clavulanic acid. The overall consumption of IV amoxicillin-clavulanic acid decreased by 27.9% in the post-intervention group. For skin and soft tissue infections, cloxacillin was used most frequently, and post-intervention group had brought decrement in consumption of injection form by 21.7%. Cefuroxime was the most popular antibiotic for the treatment of urinary tract infection, and the pharmacist implemented antimicrobial stewardship strategies has brought down the consumption of IV cefuroxime by 46.5% (Table 4).

The length of hospital stay for patients in the post-intervention group was significantly shortened by 1.44 days compared to the pre-intervention group [4.09 days (SD=1.73) vs 5.53 (SD=3.22) days, p=0.001] (Table 4). The median antibiotic cost savings was significantly higher in the post-intervention group, which was [MYR 21.96 (IQR=23.23) vs MYR13.10 (IQR=53.76), (p=0.025)] (Table 4).

IV antibiotic courses switched to oral antibiotics on the day of criteria for switch met was significantly more in post-intervention group compared to pre-intervention group (88.3% vs 24.1%, p<0.0001). There was a significant reduction in the number of IV-PO switch that was only being performed upon discharge from the ward in the post-intervention group compared to pre-intervention group (31.2% vs 82.3%, p=0.000). There was no reinitiation of IV therapy after the early switch was made in both pre and post-intervention group. In the post-intervention group, doctors agreed on early switch on 75 out of 77 cases, which constitute 97.4% of acceptance rate of the intervention.

DISCUSSION

Our results had shown that implementation of pharmacist initiated printed AMS recommendations had significantly improved the timeliness of IV to oral antibiotic switch and shortened the duration of IV antibiotics in the ward. This finding was in accordance with the study by Dunn *et al*. conducted in Ireland, in which antimicrobials were switched in a more timely fashion in the intervention group (n=92) consisting of antimicrobial strategies such as application of stickers highlighting the patient was on IV antimicrobial and application of guidelines to the drug chart by the clinical pharmacists, compared to the pre-intervention group (n=85) where clinical pharmacists reviewed the drug charts and contacting prescribers to discuss a switch.[19] Similar approach was implemented by McLaughlin *et al*., who employed IV to oral switch therapy (IVOST) guidelines and a 'REFER TO IVOST PROTOCOL' stickers has reported improvement in the appropriateness of IV-PO switch timing in the post-intervention group (n=107) compared to pre-intervention group (n=118).[16] These printed tools have growing importance as strategies to promote IV to oral antibiotic switch.

The significant reduction of length of hospital stay as well as medication cost savings from our study agreed with the study conducted by McLaughlin *et al*., which reported reduction in length of hospital stay and antibiotic expenditure through the implementation of IVOST guidelines.[16] A study conducted in Taiwan also showed that pharmacist-managed IV to oral switch service decreased the length of hospital stays as well as significant cost savings on both the medication costs and total inpatient expenditures.[24] The use of printed AMS interventions had helped to lessen the cost by shorter duration of IV and replaced with more consumption of cheaper oral dosage form.

In our study, there was no reinitiation of IV therapy due to relapse of infection after IV-PO switches were being made. Dunn *et al*, which utilised similar interventional strategies in our study also reported only one case of reinitiation of IV antibiotic in the interventional phase. This proves the reliability of pharmacist initiated printed AMS recommendations in guiding switch decision. This result was also in concurrent with the study conducted by Mertz *et al*. that there was no significant increase in patients relapse in the intervention phase where a printed checklist of criteria for switching to oral antibiotics was used.[15] The optimal time for switching to oral antibiotics is on days 2–4 of IV therapy, when the culture results and the initial clinical course allow a reassessment of the treatment plan.[25] Evidence from several studies had reported that once a patient's temperature is 37.8^{o}C or less for 24 hours and he or she is otherwise stable, he or she can be switched to oral therapy as the subsequent risk of clinical deterioration is very low.[26]

In the post-intervention stage, clinicians were required to provide reasons if they did not agree with pharmacist's recommendation on early switch. One of the doctors disagreed with early switch as patient's white blood cell level was 20.4x10^{9} cells/liter, despite the fact that the white blood cell is trending downwards since admission. The patient was given full IV course in the ward before discharge. In fact, a guideline from the NHS Gloucestershire hospitals has suggested that absence of normal white cell count should not impede the switch if all other criteria are met and patients are not neutropenic.[27] In another case, the reasoning given by clinician for employing delayed switch was 'to keep another day of IV antibiotic'. This shows that some prescribers are more comfortable with maintaining full IV course. Some clinicians felt that patient was not ready to take PO antibiotics even though patient was ordered for other medications or food orally.[28] In our study, early switch was disagreed in another patient who

Table 5. Recommended switch (similar coverage) in our study

IV antibiotics	Oral antibiotics	Bioavailability (%) [34,35]
Ampicillin	Amoxycillin	74-92
Amoxicillin-clavulanic acid	Amoxicillin-clavulanic acid	60
Benzylpenicillin	Phenoxymethylpenicillin /	60-73
	Amoxycillin	74-92
Ceftriaxone	Amoxicillin-clavulanic acid /	60
	Cefuroxime	60-90
Cefuroxime	Cefuroxime	60-90
Cloxacillin	Cloxacillin	35-76
Metronidazole	Metronidazole	>90
Ampicillin-sulbactam	Ampicillin-sulbactam	60-90
Azithromycin	Azithromycin	60-90

had history of severe community-acquired pneumonia with para-pneumonic effusion, despite patient meeting the IV-PO switch criteria in this current admission.

Another main obstacle limiting IV-PO switch was the belief that oral antibiotics do not achieve the same bioavailability as that of intravenous forms.[29] Moreover, they believed that chances of reinfection would be less if they give a complete IV course of antibiotics.[22] As a result, physicians usually tend to opt for the IV medications at the time of admission and continue them till patient discharge. But the fact was that some antibiotics have good bioavailability when given orally (Table 5).[30,31] In our study, we recommended the IV-PO switch for eligible patients based on suitable oral antibiotics with good bioavailability as shown in Table 5.

Limitations

One of the limitations of this study was that costs of drug preparation, administration, as well as pharmacist and nursing labour were not included in the analysis. We were not able to follow up the discharged patients longer than the hospital stay period, as there were no hospital electronic database where we can monitor if there were readmissions due to relapse after IV-PO antibiotic switches were made. Further study can be done to assess the impact of printed AMS recommendations towards hospital readmissions and mortality of the patients.

This study was a pre-post intervention study without the use of control group. This is a common quasi-experimental design which we aim to demonstrate causality between our intervention and the outcomes. Including a pre-intervention group could provide some information about what the outcome would have been if the intervention does not occurred. However, without the use of control group, we could not deny the pre-existing factors and other confounders that might influence our results.

CONCLUSIONS

Printed AMS recommendations initiated by pharmacists had shown to improve the timeliness of IV-PO switch, reduce the duration of IV, reduce the length of hospitalisation, and increase antibiotic cost savings. It can be incorporated as one of the AMS strategies of the hospitals to encourage IV-PO antibiotics switch. Although our study involved printed AMS recommendations, this study can also apply to hospitals using electronic health record. Similar intervention can be created electronically such as electronic trigger tool and integrated in the electronic health records system.

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CONFLICT OF INTEREST

We attest that we have no financial or other relationships that could be construed as a conflict of interest for this study.

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Original Research

Pharmaceutical care in community pharmacies in Jordan: a public survey

Tareq L. MUKATTASH, Nour H. BAZZI, Khawla Q. NUSEIR, Anan S. JARAB, Rana K. ABU-FARHA, Maher R. KHDOUR.

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Abstract

Objective: This study aims to assess the views and attitudes of the general public towards the current role of pharmacists in Jordan.

Methods: This study is a cross-sectional quantitative questionnaire-based study. After a thorough literature review on public perspectives of pharmaceutical care services, a draft questionnaire was designed. This questionnaire was examined and discussed in a focus group of invited public members and was amended accordingly to reach the final draft. The questionnaire was administered using a structured interview technique in which members of the public were asked a series of questions by a trained pharmacist. The study took a place over a period of six months, from January to June 2013. Individuals were recruited from urban and rural areas of Jordan.

Results: A total of 1214 respondents were interviewed during the study. Of the respondents, 67.8% were female. Most of the respondent were married (64%) and had a university degree (88.5%). Approximately half of the respondents (55.1%) had no previous knowledge of pharmaceutical care. A relative majority of respondents considered the most important activity performed by pharmacists to be dispensing medications (46.2%), followed by patient counseling (34.6%). The majority of respondents (86.4%) believed that pharmacists have a role in providing healthcare services, and 68% of respondents reported that in order to serve their needs, a pharmacist must consider the patient's needs and engage patients in determining medication timing and options.

Conclusions: The plurality of respondents believed in the importance of pharmacists in providing pharmaceutical care services. However, respondents expected much from pharmacists and felt that their current role was unsatisfying.

Keywords

Pharmacies; Community Pharmacy Services; Pharmacists; Professional Role; Professional Practice; Health Knowledge, Attitudes, Practice; Surveys and Questionnaires; Jordan

INTRODUCTION

Pharmacy has changed significantly in recent years. In the past, pharmacists' responsibilities focused on dispensing and compounding drugs, but little importance was given to communication with patients about their medications or their health status in general.[1]

Today, with the introduction of many topics regarding good pharmacy practice and clinical pharmacy into the medical world, pharmacists have largely turned their attention towards the importance of interaction between the pharmacist and the patient.[2] In this framework, it becomes essential for the pharmacist to contribute to the public's health by preventing diseases, prolonging life, and the promoting health status of the entire population. These outcomes, we suggest, can be achieved by implementing good standards for health practice in order to provide the best pharmaceutical care for patients.[3]

Pharmacies provide promising grounds for such interventions, as they see a high percentage of the general public per day compared to other health workers.[4] Pharmacists can also be considered the most accessible among all healthcare providers, as they require no appointment for consultations.[5,6] Through pharmacies, patients can easily get access to a wide range of healthcare services.[7] Additionally, a community pharmacist's contact with both sick and healthy individuals allows pharmacists to contribute to preventative efforts such as screening for different diseases and their risk factors, as well as providing treatment for those who need it.[8]

These facts potentiate the pharmacists' role in improving health and are supported by evidence from studies in various countries which provide lists of health services and priorities on which community pharmacies have had a positive impact.[9,10]

Improving healthcare through pharmacies requires more interaction between pharmacists and the public regarding health topics that are complementary to the use of medications. To a greater extent, it also requires further collaboration regarding topics that are related to health improvement, not solely medication use.[8] Currently, interactions between community pharmacists and the public are not improving public health to their maximum potential. This may be due to a poor understanding of pharmaceutical care services by both the public and the

Tareq L. MUKATTASH. PhD. Department of Clinical Pharmacy, Faculty of Pharmacy, Jordan University of Science and Technology. Irbid (Jordan). tlmukattash@just.edu.jo
Nour H. BAZZI. MSc. Department of Clinical Pharmacy, Faculty of Pharmacy, Jordan University of Science and Technology. Irbid (Jordan). noor_bazzi@yahoo.com
Khawla Q. NUSEIR. PhD. Department of Clinical Pharmacy, Faculty of Pharmacy, Jordan University of Science and Technology. Irbid (Jordan). kqnuseir@just.edu.jo
Anan S. JARAB. PhD. Department of Clinical Pharmacy, Faculty of Pharmacy, Jordan University of Science and Technology. Irbid (Jordan). asjarab@just.edu.jo
Rana K. ABU-FARHA. PhD. Department of Therapeutics and Clinical Pharmacy, Faculty of Pharmacy, Applied Science Private University. Amman (Jordan). r_abufarha@asu.edu.jo
Maher R. KHDOUR. PhD. Faculty of Pharmacy, Al-Quds University. Jerusalem (Palestine). maher.khdour@gmail.com

pharmacists, and it could further result from the lack of emphasis placed on the pharmacist's role to the public during pharmacy training.[11]

It is important to explore the general public's understanding, views, and attitudes towards the roles of pharmacists in giving healthcare-related advice and the implementation of pharmaceutical care services. This is also necessary in order to determine the actions needed to enhance and extend the public's awareness and acceptance of the pharmacists' role towards the public.

Pharmaceutical care is an essential area for the future development of the pharmacy profession.[11] Past studies have discussed health-related topics and emphasized "pharmaceutical care" as "The direct responsible provision of medication-related care for the purpose of achieving definite outcomes that improve patient's quality of life".[12] In Middle Eastern, Arabic speaking countries the pharmaceutical care concept is still unclear.[13] For instance, the public in the Sultanate of Oman reported the need for providing better service in community pharmacies[14], while many challenges and barriers to enhance pharmacy services were reported in the United Arab Emirates.[15] This study aims to assess the views and attitudes of the general public towards the current role of pharmacists in Jordan and to compare their performance to the public's ideal role for pharmacists in enhancing healthcare services in Jordan. This study could be considered an inductive study and a benchmark for further studies assessing pharmaceutical care services in Jordan. No previous studies have explored public views regarding pharmaceutical care services in Jordan.

METHODS

Questionnaire design

Following an extensive literature review on pharmaceutical care in Jordan, a draft questionnaire was designed. Afterwards, the draft questionnaire was discussed among a number of public members who were invited to take part in a focus group discussion. This allowed feedback to be collected in an interactive manner. Questions in the draft questionnaire were discussed separately, and all arising comments and concerns were recorded and transcribed. The final version of the questionnaire took into consideration all comments from the focus group. It was further tested for face and content validity by experts in the field of pharmaceutical care who ultimately had minimal reported concerns. Those concerns were addressed, and then the questionnaire was piloted in a small sample group (n=50) to ensure that all of the questions were clear. The findings from those respondents were not included in the final data analysis.

The questionnaire consists of 26 questions and was divided into four sections. The first section focuses on public awareness of pharmaceutical care. The second section explores the respondents' interactions with pharmacists and asks questions about their visits to pharmacies. At the beginning of the second part of the questionnaire, respondents were given the definition of pharmaceutical care along with examples of how pharmacists deliver pharmaceutical care services. This aimed to compare their expectations of the pharmacist before and after they were introduced to the definition of pharmaceutical care and assess whether respondents are receiving pharmaceutical care services from pharmacists. The third part of the survey explores the respondents' needs, wants, and expectations of the pharmacists and the services that they provide. Finally, the fourth section collects the respondents' demographic information.

Ethical approval

After being approved by the postgraduate committees in the department of clinical pharmacy at Jordan University of Science and Technology (JUST), the final version of the questionnaire with a full study outline was approved by the research on human beings committee of the Institutional Review Board (IRB) at Jordan University of Science and Technology (JUST). Final approval was obtained from the deanship of research (REF: 20120206).

Public survey

The public survey was administered using a structured interview technique (face to face), during which members of the public were asked a series of questions by a trained pharmacist who introduced himself as a researcher from the Jordan University of Science and Technology. The study took a place over a period of six months, from January to June 2013. Individuals were recruited from urban and rural areas of Jordan.

The target sample size was 1000. This sample size has been shown to yield statistically reliable results in previous surveys of the general public.[13] Care was taken to ensure that the investigator visited various places on different days of the week, thereby encountering a wide-section of the general public. Members of the public who appeared over 18 were randomly approached and informed that the questionnaire was about pharmaceutical care and the pharmacist's role in providing pharmaceutical care services. They were told that the questionnaire would take 5-10 minutes to fill out. Having been given this information, they were asked about their willingness to participate in the survey. Members of the public who agreed to take part in the study were asked to sign a consent form that included detailed information about the study. Respondents were assured of the anonymity and confidentiality of the study.

Data analysis

The data collected from the questionnaires was coded and entered into a custom-designed database using SPSS software. This software allowed exploratory descriptive data analysis using the appropriate summary statistics, e.g. frequency and percentage for categorical data.

RESULTS

Demographic Details of Participants

A total of 1214 respondents were interviewed during the study. The time needed for the respondent to fill out the questionnaire ranged from 7 to 10 minutes. Of the respondents, 66.9% (n=812) were female, and most of the respondents were married and had a university degree (n 777=, 64% and n= 1074, 88.5%, respectively). Demographic details of the respondents are presented in Table 1.

Table 1. Demographic details of the respondents	
Parameter	**Results**
Gender	
Male	32.2%
Female	67.8%
Age distribution of population	
Under 20 years	8.5%
20 – 30 years	30.0%
31-40 years	25.3%
41-50 years	27.7%
Over 50 years	8.6%
Marital status	
Single	32.3%
Married	64.0%
Divorced	2.7%
Widow	1.0%
Educational level	
University degree	88.5%
Secondary school	10.9%
Elementary school	0.3%
Illiterate	0.3%
Income (Jordanian Dinar)	
Less than 150	6.3%
From 150 to 300	16.4%
From 300 to 600	35.3%
From 600 to 1000	30.7%
More than 1000	11.3%
Place of living	
Central cities	71.0%
Rural places	29.0%

General awareness about the concept of pharmaceutical care and the role of pharmacist

More than half of the respondents (54.4%, n=660) had no previous knowledge of the concept of pharmaceutical care. When respondents were asked about the preferred source for health information, 82.2% (n=998) referred to general practitioners. However, for the majority of respondents, pharmacists were the preferred source for obtaining information about medication (66.4%, n=806). Further results are presented in Table 2.

Dispensing medications was considered to be the most important activity performed by pharmacists (n=561, 46.2%) followed by patient counseling (n=420, 34.6%), explaining healthcare issues (n=163, 13.4%), monitoring blood pressure (n=68, 5.6%), and other reasons (n=9, 0.7%).

Respondents' interactions with pharmacists and their visits to pharmacies

Participants were asked how often they visited a pharmacy; 52.5% of the participants (n= 638) indicated that they visited a pharmacy at least once per month. Almost half of the participants (48.6%, n=590) always chose to visit the same pharmacy, they reported. The most important reasons for choosing the same pharmacy each time were trust (46.4%, n=274); good interactions (25.4%, n=150), which includes medical advice, patient counseling and personal relations; proximity of the pharmacy to the home (19.2%, n=113); and discounts promoted by the pharmacy (9.0%, n=53).

The majority (84.8%, n=1030) of respondents perceived the time they spent with pharmacists as convenient, and 60.1% (n=730) of the respondents perceived that their privacy was maintained when visiting a pharmacy.

Respondent's needs, wants, and expectations of pharmacists and the services that they provide

Respondents were asked about pharmacists' role in providing healthcare services. 85.5% (n=1038) believed that their pharmacist had a role in providing healthcare services, and 66.4% (n=806) of respondents reported that they need a pharmacist who considers patient needs and involves the patient when determining medication options. 86.2% (n=1046) thought that participating in the decision-making process would increase their adherence to the treatment course and improve their overall health status.

Results revealed that 47.6% (n=578) of respondents needed a follow-up from a pharmacist during their medication-use period. Furthermore, 62.8% (n=762) indicated that the pharmacist was well-qualified to provide healthcare information and services. Almost two-thirds of respondents (63.4%, n=770) reported that their pharmacist applied the pharmaceutical care concept, and 68.0% (n=826) claimed to be satisfied with services provided by pharmacists. Moreover, 87.5% (n=1062) hoped for improvements to areas of pharmaceutical care such as patient follow-up, keeping patient records, and screening for drug-related problems.

Of the respondents only 41.2% (n=500) were willing to pay fees for the pharmaceutical care services provided in the pharmacy setting, while 58.8% (n=714) agreed that medication prices covered the pharmaceutical services.

Finally, participants were asked their thoughts of the pharmacist assistant. 68.0% (n=826) reported that they did not consider the pharmacist assistant to be as skilled as the pharmacist, and 55.3% (n=654) did not think that pharmacist assistant could adequately provide the needed pharmaceutical care services.

DISCUSSION

Pharmaceutical care is a new concept in Jordan. It has been introduced recently to faculties of pharmacy curriculum in the country.[17] This may be a reason that many pharmacists don't adapt the concept into their practice, leaving the public unaware of the services the pharmacist can offer. This is not surprising, as almost half of the respondents had no previous knowledge of the concept of pharmaceutical care. It has been reported in a study of multiple Arabic countries that the concept of pharmaceutical care is not clear and usually confused with clinical pharmacy and not related to pharmacy practice in the community pharmacy.[13]

Table 2. Different sources for obtaining health-related information and medication-related information.		
Source of information	**Obtaining health-related information**	**Obtaining medication-related information**
General practitioner	86.8%	26.7%
Pharmacist	4.9%	69.4%
Nurses	0.7%	0.7%
Newspaper, magazines or internet	7.3%	2.1%
Friends or relatives	0.3%	1.1%

Regardless of the low level of awareness about pharmaceutical care, the majority of respondents indicated that pharmacists had more of a role than simply dispensing medications. This is very important and highlights the need for pharmacists to actively engage with the general public. Internationally, pharmacy has shifted from a drug-oriented profession towards a patient-oriented profession[18], however this has not yet been implemented widely in a lot of Middle Eastern countries.[15] In Lebanon, it was reported that public's perceptions and attitudes toward community pharmacist is poor.[19] It is very important to enhance pharmacy image and build a longtime relation based on trust.[20]

According to respondents, dispensing medical prescriptions is a pharmacist's most important responsibility. This indicates that respondents still don't perceive pharmacists beyond the role of dispensing medication, even though they think that dispensing is not the only role for the pharmacist. Furthermore, the indicated lack of patients' trust in the pharmacists' ability to provide health advice may have an influence. This was confirmed by the finding that more than half of respondents found the current pharmacist role unsatisfying, reflecting the current status of the profession in Jordan.

Pharmacists are now given more responsibilities regarding patient medications. Within the pharmaceutical care concept, pharmacists are asked to offer comprehensive medication advice, making sure that the medications patients take are the most suitable for their condition, the most effective, the safest, and the most cost-effective.[12] Pharmacies also represent public places that are easily accessible.[5,6] In Jordan, the number of community pharmacies is rapidly growing, as is the number of registered pharmacists.[21] Furthermore, going to the pharmacy requires no appointment, which makes it easy for patients to get a consultation and access a wide range of healthcare services.[6] It is therefore not surprising that 69.4% of the respondents indicated that pharmacists are their preferred source of information about medications.

It was found that 86.3% of respondents were satisfied with the time spent with their pharmacists, which reflects that these pharmacists devoted individualized attention to each case. Hence, pharmacist's responsibilities are growing to include different needs for both sick and healthy individuals.[22]

The relationship between the pharmacist and the patient should be matured towards a collaborative relationship in which both pharmacists and patients have roles and responsibilities that must be recognized in order to optimize the treatment outcomes.[23] This assertion is supported by the outcomes of this study, as the majority of respondents thought that their participation in decision-making processes about treatment regimen would increase their adherence to the treatment and improve their health status and their overall quality of life. This is referred to as patient concordance, a practice in which patients are viewed by all parties as partners in their own treatment. Their preferences and choices are taken into consideration when designing care plans. Furthermore, about half of all respondents indicated that they needed to follow up with their pharmacist during their period of medication use. If pharmacists do not follow up on the outcomes of treatment with their patients, they will not be able to adopt an effective pharmaceutical care plan.[15]

Pharmacy is maturating as a clinical profession and is becoming a more patient-oriented discipline. Pharmacists must be dedicated to practices that clearly identify the patient as the primary beneficiary.[24] This can be achieved by implementing the pharmaceutical care practices discussed in this study.[12]

Pharmaceutical care services encompass a wide range of areas through which the pharmacist can offer help to patients, as well to those who perceive themselves as healthy individuals. These services include blood pressure measurements, glucose-checks, vital signs, and weight measurement. Furthermore, the pharmacy is a promising setting for providing smoking cessation and weight management programs.[4]

Some pharmacies in Jordan have already adopted such services, and consumers have already begun to benefit. This is consistent with the respondents' views; 86.4% indicated that the pharmacist had a role in providing pharmaceutical care services, and 89.2% hoped for improvements to the services provided and the inclusion of different areas of pharmaceutical care.

Pharmacy is a profession with characteristic traits, and practitioners possess a statutory license to perform certain actions. The occupation attracts social and economic rewards. It is worth mentioning here that pharmacy as a profession is likely to remain a life-time occupation. Pharmacy possess the core features of such a profession, including lengthy training in order to learn specialized knowledge that is unavailable to the public; a service orientation that acts in the public's best interests rather than pursuing their own self-interest; and self-regulation as a result of specialized skills and knowledge.[25] Hence, the quality of pharmaceutical care services will be lesser if only pharmacist assistants are left to perform them.[26] This corresponded with the respondents' views, as 70.4% of the respondents did not consider the pharmacist assistant to be as skilled as the pharmacist in their experience. Additionally, 55.3% did not think that a pharmacist assistant is capable of providing all pharmaceutical care services.

Limitations

Though the investigator administering this survey had been trained to interview respondents without influencing their responses, being included in the study could have influenced the outcomes and caused some bias. This could be overcome in future research.

CONCLUSIONS

The majority of the respondents believed the pharmacist played an important role in providing pharmaceutical care services and reported a desire for a comprehensive care service from pharmacists. Furthermore, respondents expected much from pharmacists. They largely found the current role unsatisfying, and the majority considered dispensing medications to be a pharmacist's most important task.

CONFLICT OF INTEREST

None to Declare.

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Original Research

Assessing the perceptions of pharmacists working in Lebanese hospitals on the continuing education preferences

Katia ISKANDAR, Etwal BOU RAAD, Souheil HALLIT, Nibal CHAMOUN, Ulfat USTA, Youssef AKIKI, Lamis R. KARAOUI, Pascale SALAMEH, Rony M. ZEENNY.

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Abstract

Background: Continuing education (CE) is an international tool that requires lifelong active participation in learning activities allowing the pharmacist to stay a major player among others. In 2014 the CE program was introduced to the pharmacists licensed in Lebanon as a mandatory requirement for re-licensure. In the absence of guidelines regarding the quality and quantity of CE programs, behavioral resistance to precipitate in the CE programs might be encountered among the pharmacists.

Objective: The objective of this study is to assess the perceptions of pharmacists working in Lebanese hospitals on the continuing education preferences. The advantage of this program is to collect information that would help the Order of Pharmacy in Lebanon to upgrade the CE program in a way that is more acceptable and convenient for the pharmacists.

Methods: A cross-sectional study was carried out in 2016, using a proportionate random sample of Lebanese hospital pharmacies from all governorates in Lebanon. A structured questionnaire was distributed to all hospital pharmacies in Lebanon. Descriptive statistics were calculated for all study variables. This includes the mean and standard deviation for continuous measures, counts and percentages for categorical variables

Results: A total of 107 (53.5%) participants completed the questionnaires. The majority of participants were from Beirut and Mount Lebanon. The percentage of participants working at private hospitals was (68.2%).The majority of participants who completed the questionnaire (86.2%) agreed that continuing education programs affects their way of practice and increases their knowledge. Their preferred CE types to be used in the future were the computer based ones (60.6%), interactive workshops (45.5%) and printed materials (44.9%). Their considerations for selecting the CE type is based on their interest in the topic (80.6%), the ease of access to print or online material (77.2%), or the convenience of being offered during an event (67.1%). Participants noted that barriers to attend live CEs were mainly work responsibilities (76%), travel distance (65.6%), family commitments (48.4%) and scheduling (40.6%).

Conclusions: Lebanese hospital pharmacists are highly committed to CE. They consider it a practical tool for career development and advancement.

Keywords

Education, Pharmacy, Continuing; Attitude of Health Personnel; Pharmacists; Pharmacy Service, Hospital; Surveys and Questionnaires; Lebanon

INTRODUCTION

In recent years, pharmacy practice has shifted from product oriented to patient-oriented services, and pharmacist's knowledge is currently a pre-requisite for patient-centered care practice.[1] Continuing improvement is one of the most important standard and a requirement in pharmacy education which contains programs that ensure that pharmacy practice and educational programs are heightened and advanced. Continuing education (CE) is a part of the continuous improvement standard. It is well recognized as part of the professional pharmacy landscape.[1] It is an international tool that entails lifelong active participation in learning activities, allowing pharmacists to keep their knowledge up to date, to assert their skills and to play a major player among other healthcare professionals.[2-4] In 2009, the Accreditation Council for Pharmacy Education defined Continuing Education for the profession of pharmacy as "a structured educational activity designed or intended to support the continuing development of pharmacists and/or pharmacy technicians to maintain and enhance their competence".[5]

Pharmacy profession mirrors the broader health care community; as such it is continuously changing and increasing in complexity. As new technologies are added to the therapeutic armamentarium, pharmacists must attain new knowledge, skills, attitudes, and behaviors to be able to optimally apply these new therapeutic modalities to

Katia ISKANDAR. PharmD, MPH. School of Pharmacy, Lebanese International University, & Faculty of Pharmacy, Lebanese University. Beirut (Lebanon). katia_iskandar@hotmail.com
Etwal Bou RAAD. PharmD, MPH. School of Pharmacy, Lebanese International University. Beirut, (Lebanon). etwal.bouraad@liu.edu.lb
Souheil HALLIT. PharmD, MSc, MPH, PhD. Research Department, Psychiatric Hospital of the Cross. Jal Eddib; & Faculty of Medicine and Medical Sciences, Holy Spirit University. Kaslik (Lebanon). souheilhallit@hotmail.com
Nibal CHAMOUN. PharmD. School of Pharmacy, Lebanese American University. Byblos (Lebanon). Nibal.chamoun@lau.edu.lb
Ulfat USTA. PharmD. Pharmacy Department, American University of Beirut Medical Center. Beirut (Lebanon). uu00@aub.edu.lb
Youssef AKIKI. MBA. Faculty of Pharmacy, Lebanese University. Beirut; & Faculty of Business, Balamand University. Koura (Lebanon). Youssef_akiki@yahoo.com
Lamis R. KARAOUI. PharmD. School of Pharmacy, Lebanese American University. Byblos (Lebanon). lamis.karaoui@lau.edu.lb
Pascale SALAMEH. PharmD, MPH, PhD. Faculty of Medicine & Faculty of Pharmacy, Lebanese University. Beirut (Lebanon). pascalesalameh1@hotmail.com
Rony M. ZEENNY. PharmD, MPH. Pharmacy Department, American University of Beirut Medical Center. Beirut (Lebanon). rony_zeenny@hotmail.com

patient care.[6] In Lebanon, the CE is mandatory since the enactment of the Law No. 190 on November 18, 2011. Its implementation started on January 1, 2014 by the Order of Pharmacists of Lebanon (OPL). The law mandates a total of 45 credits to be documented in a 3-year cycle; one-third of which must be CEs during attended as a seminar. The law was put into effect in 2016 with an amended requirement for an extended first cycle (60 credits to be completed by December 2019) then 45 credits thereafter per 3-year cycle. Like all other countries with CE requirements, the system is credit-based or time-based, and learners are, in most cases, only required to provide evidence of participation during the CE duration.[7]

Substantial differences in requirements for pharmacist license renewal exist globally in terms of quality and quantity of CE.8 Till this date, there is no standard program or clear guideline that describes the component of the CE programs. In Finland, the universities for example can provide most of the CE curricula for pharmacists by following their own standards or the standards of the pharmaceutical learning center. On the contrary, CEs in Canada are accredited by the national council for continuing education in Pharmacy practice and the provincial regulatory authority. Furthermore, the quality of each CE activity is subject to evaluation by the Portuguese Pharmaceutical Society.[9]

Pharmacist or their employers might not perceive the value of the CE programs in advancing the knowledge and practice especially in the absence of program evaluation. As such mandatory requirement CE credits may lead to a disengaged, dependent, and passive form of learning.[10,11] Other barriers would also prevent pharmacist from attending CE such as lack of dedicated time to attend the sessions, perceived lack of relevant CE activities and lack of opportunity for attending CEs.[9,12] The OPL played a vital role in monitoring and evaluating the CE programs that were provided to the pharmacists in Lebanon. Despite the efforts that have been implemented to promote the effectiveness of the CE programs in advancing and updating pharmacist knowledge, the OPL perceived some resistance from the pharmacist to the current CE program. Therefore, the main objective of this study is to assess the perception and views of Lebanese hospital pharmacists towards the current continuing education programs. In addition, this study will determine hospital pharmacist preferences for a CE program. The aim of this study is to collect data that might help in formulating a sustainable CE program that will be based on the hospital pharmacist needs.

METHODS

General study design

A cross-sectional study was carried out in 2016, using a proportionate random sample of Lebanese pharmacies from all governorates in Lebanon (Beirut, Mount Lebanon, North, South and Bekaa). A list of 148 hospital pharmacies was provided by the OPL, which includes a total of 328 hospital pharmacists who are registered as licensed pharmacists.

Data collection process

The detailed paper-based questionnaire (online appendix) was randomly distributed to pharmacists working in hospitals in Lebanon by the OPL inspectors. They are not related to the study, yet they received training by the study investigators about the study objectives and tool used. The OPL investigators in turn explained the study objectives to each pharmacist. When consent of participation was granted, the pharmacist received the anonymous and self-administered questionnaire. At the end of the process, the completed questionnaires were collected back by the inspectors and sent back for data entry by the study investigators. During the data collection process, the anonymity of the pharmacists was guaranteed. On average, participants completed the questionnaire within approximately 15 minutes. The pharmacist had the choice to accept or refuse to fill the questionnaire. The Lebanese University ethics committee waived the need for approval since the study was observational, anonymous and respected the individuals' confidentiality.

The anonymous questionnaire was in French or English language, based on a thorough review of the related literature[13-17]; it was composed of different sections: socio-demographic characteristics, characteristics of the hospital (number of beds, opening hours of the pharmacy, on call pharmacy service, number of employees in the pharmacy, qualifications of the employees and their working schedule).

Further questions were related to the perception of the CE program offered in Lebanon, topic interest, format of CE activities they used to meet their required needs, preferred CE activity they would like to use in the future, reasons for using such format and level of level of satisfaction for each. The questionnaire assessed obstacles that prevent the pharmacist from attending CE sessions and included a section at end where the participants can suggest CE topics of interest. The questionnaire was piloted in a group of 10 hospital pharmacists before being used.

Statistical analysis

Data entry was completed by an independent person who was not involved in the data collection process. Descriptive statistics were calculated for all study variables. This includes the mean and standard deviation for continuous measures, counts and percentages for categorical variables. The statistical package SPSS version 23 was used for all statistical analysis.

Table 1. Perception of Continuing Education (N=107)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The value that your employer places on your participation in continuing education	19 (19%)	8 (8%)	32 (32%)	19 (19%)	22 (22%)
Your interest in/value of continuing education	2 (2%)	3 (3%)	9 (8.9%)	28 (27.7%)	59 (58.4%)
Continuing education affects the way you practice	2 (2%)	3 (3%)	9 (8.9%)	33 (32.7%)	54 (53.5%)
Continuing education helps increase your knowledge	1 (1%)	2 (2%)	3 (3%)	33 (32.7%)	62 (61.4%)

Table 2. Comparative Assessment of the Current vs/ optimal continuing Education (N=107)		
	What type of continuing education have you used in the past?	**What type of continuing education would you prefer to use in the future?**
Live in-person	37 (37%)	29 (30.2%)
DVD/Video/audio	31 (31%)	21 (21.2%)
Computer/Internet based	71 (71%)	60 (60.6%)
Printed materials	64 (54%)	44 (44.9%)
Interactive workshop	38 (38%)	45 (45.5%)
Journals	31 (31.3%)	35 (35.4%)
Webinar	34 (34%)	23 (23.5%)
Textbooks/reference books	40 (40%)	20 (20.4%)
Medical search engines	16 (16.7%)	13 (13.3%)
Others :please specify:	2 (1.9%)	2 (1.9%)

RESULTS

Out of 200 pharmacists who were approached by interviewers, a total of 107 (53.5%) participants completed the questionnaires from October 2016 through December 2016. The majority of participants were from Beirut and Mount Lebanon where the majority of the participants worked in private hospitals (68.2%).The results indicated that 19.7% have achieved a certification for a specialty practice or disease management, with 32.5% among whom practicing in the discipline of their certification. In regards to professional affiliations besides the Lebanese Order of Pharmacists, 17.7% of participants are members in professional organizations such as the American Health-System Pharmacists (ASHP), and the American Clinical College of Pharmacy (ACCP).

The participants agreed that 41% of their employers place high interest on their participation in continuing education, compared to the interest of the participants themselves (86.1%). The majority of the participants (86.2%) agreed that continuing education affects their way of practice and helps increasing their knowledge (94.1%) (Table 1).

The participants were asked about the most common format of continuing education that they have used in the past, and the responses were the followings: computer/internet based ones (71%), printed materials (54%) and textbooks (40%). On the other hands, they highlighted that their preferred format of CE is computer/internet based ones (60.6%), followed by interactive workshop (45.5%) and printed materials (44.9%) (Table 2). Their considerations for selecting the CE format was mostly based on their interest in the topic (80.6%), the ease of access to print or online material (77.2%), or the convenience of being offered during an event that they are already attending (67.1%) (Table 3).

Participants acknowledged that they were mostly satisfied with CEs when they attended computer/internet based ones (76.1%), followed by live/in-person ones (75.2%), interactive workshop (67.8%) (Table 4).

Participants highlighted that the barriers to attend live CEs were mainly work responsibilities and scheduling (76%), distance that they have to travel to reach the designated site (65.6%) and family commitments (48.4%) (Table 5).

When asked about their interest in the following preselected topics, the participants highlighted the followings: Innovations in pharmacy practice (84.5%), Innovations in drug press (82.6%), Innovations in disease management (82.5%), pharmacy management (81.3%), skills development (77.4%), and humanities or psychology topics (42.5%) (Table 6).

In the comment section, four pharmacists highlighted their interest in topics such as drug-drug interactions, antimicrobial stewardship, neonates dosing, and new updates in commonly used drugs.

DISCUSSION

In this study, we were able to evaluate hospital pharmacists' perception, needs, barriers, experience and convenience of engaging in continuing education in Lebanon. This is the second study conducted in Lebanon after the one from last year among pharmacists practicing in the country.[18]

As more and more leading professional organizations are calling for radical changes in CE models for healthcare practitioners, advocating for continuing professional development, the OPL is engaged to meet these goals and started by conducting this study in order to explore ways to assist hospital pharmacists in developing and maintaining continuing competence, enhancing their professional practice, and supporting achievement of their career goals in order to implement CE models similar to the one adopted by the International Pharmaceutical Federation (FIP) in the second edition of its Global Framework for Quality Assurance of Pharmacy Education.[19]

This study showed that hospital pharmacists have an overall positive perception of CE sessions offered by the OPL regarding their objectives, plans, and acquired information. The majority of participants confirmed that

Table 3. Considerations for selecting CE format (N=107)					
	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Low or no cost	6 (6.5%)	6 (6.5%)	25 (27.2%)	39 (42.4%)	16 (17.4%)
Interested in /motivated to learn about topic regardless of the venue	0	5 (5.4%)	13 (14%)	48 (51.6%)	27 (29%)
Networking and socializing opportunities	1 (1.1%)	12 (13.2%)	29 (31.9%)	34 (37.4%)	15 (16.5%)
Offered during a conference or event already attending	4 (4.5%)	5 (5.7%)	20 (22.7%)	35 (39.8%)	24 (27.3%)
Effective advertising	7 (7.9%)	14 (15.7%)	20 (22.5%)	36 (40.4%)	12 (13.5%)
Easily accessed print or online material	2 (2.2%)	3 (3.3%)	16 (17.4%)	40 (43.5%)	31 (33.7%)

Table 4. Level of Satisfaction with different types of CE (N=107)

Rate your level of satisfaction with the types of CE you have participated in	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Live in-person	1 (1.1%)	5 (5.4%)	17 (18.3%)	55 (59.1%)	15 (16.1%)
Computer/Internet based	1 (1.1%)	3 (3.3%)	18 (19.6%)	55 (59.8%)	15 (16.3%)
Interactive workshop	3 (3.4%)	5 (5.7%)	20 (23%)	40 (46%)	19 (21.8%)
DVD/Video/audio	11 (13.4%)	6 (7.3%)	23 (28%)	31 (37.8%)	11 (13.4%)
Printed materials	2 (2.3%)	5 (5.8%)	22 (25.6%)	48 (55.8%)	9 (10.5%)
Journals publications	13 (15.1%)	4 (4.7%)	27 (31.4%)	36 (41.9%)	6 (7%)
Medical search engines	14 (16.3%)	8 (9.3%)	21 (24.4%)	37 (43%)	6 (7%)
Authorship textbooks/reference books	6 (6.7%)	3 (3.4%)	25 (28.1%)	46 (51.7%)	9 (10.1%)

the sessions enhanced their knowledge and induced changes in their daily practice. The introduction of the OPL mandated CE requirements seem to have instilled the motivation to enhance professional practice and advances in career goals. The most preferred topics for the hospital pharmacists were innovations in disease management and pharmacy practice followed by pharmacy management. These findings are consistent with previously published literature showing more interest in patient care related CE given the multitude of new drugs, treatment guidelines, and development of new treatment methods.[19] This area was also observed to be the category of preference for pharmacists in a study by Wanzie *et al*. in 1990, reflecting a shift from programs related to dispensing functions to more clinically oriented topics.[20]

Self-study CE format including computer based, printed materials, textbooks and journals is the most commonly used method, while internet based CEs is identified as the preferred method. Inclination towards online CE has also been reported in the literature because individuals are able to complete their requirements at their leisure, have more time with their family, eliminate travel and lodging and reduce or eliminate program costs in case of free self-study courses.[21] Even though self-study was the most commonly used method to obtain CE, pharmacists are more interested in live lectures as they are usually organized by national or international professional societies in specialty or generalized fields, offering a wealth of activities and networking opportunities for health system pharmacists. Factors that prevented hospital pharmacists from attending live CEs were primarily job responsibilities followed by distance travel and then family commitment. These barriers are similar to those identified in other surveys of Flemish, Egyptian and Qatari pharmacists commonly cited time considerations and excessive workload or job constraints, scheduling (location, distance, time) and family constraints, indicating that hospital pharmacists have similar views of CE barriers across many countries.[22,23]

Furthermore, less than half of the participants indicated that their employer placed high interest in their participation in continuing education as compared to the interest of the participants themselves These findings might be explained by the wealth of free activities provided by professional body or associations, the limited budget for professional development reimbursement and the contributions provided by pharmaceutical companies to hospital pharmacists (e.g. support to attend international conferences). Despite the limited support provided by employers, pharmacists participated and showed interest in CE sessions even though not required by their employers with the objectives of self-fulfillment and increasing job competence as major motivational factors

Although the survey results reflected a subjective assessment of pharmacists' learning experience, outcomes of the training and willingness to apply the learning to practice are rarely evaluated or quality assured, and therefore it is difficult to infer a change in patient care due to the CE. Quite often, CE courses provide general updates and reviews, rather than experience focused learning on particular practice situations where actual skills can be simulated and tested. A wealth of literature has shown that active and case based learning provide pharmacists with the opportunity of increased retention.[24] Studies evaluating the impact of CEs on medical doctors and health care outcomes showed that didactic lectures alone do not appear to change physician performance, whereas some evidence exists that interactive CE engage the participant and can potentially affect professional practice and health care outcome.[25]

In Lebanon , the OPL , through the scientific committee is trying to implement radical changes in CEs by creating different sub-committees among which the hospital pharmacist subcommittee is engaged in boosting practitioners interest and participation in CEs and in assessing and exploring unmet needs tailored to the hospital pharmacists continuing education and finding ways to collaboratively enhance the practice performance in terms of quality assurance, medication safety, management skills development, clinical knowledge optimization and ultimately meeting patient safety goals that is the core of pharmacy practice. Such initiatives are encouraged.

Limitations

This pilot study adds value to the offerings of future CE activities in order to meet Hospital pharmacists' expectations. However, high response rate was noted in some regions in Lebanon as compared to others and the study focused on hospital pharmacy practitioners; therefore, a selection bias is possible and the generalization to all Lebanese pharmacy practitioners remains

Table 5. Reasons preventing Attending Live CE's (N=107)

Reasons	N (%)
Cost	23 (24%)
Timing of talk	39 (40.6%)
Family commitment	46 (48.4%)
Work responsibilities	73 (76%)
Interest in the topic	35 (36.5%)
Easier to receive print/electronic material	18 (18.8%)
Distance Travel	63 (65.6%)
Others	9 (8.4%)

Table 6. Topics of Interest for CE offering (N=107)					
	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Innovations in disease management	7 (7.2%)	1 (1%)	9 (9.3%)	46 (47.4%)	34 (35.1%)
Humanities or psychology topic	4 (4.2%)	10 (10.4%)	41 (42.7%)	26 (27.1%)	15 (15.6%)
Innovations in pharmacy practice	2 (2.1%)	1 (1%)	12 (12.4%)	32 (33%)	50 (51.5%)
Innovations in drug press	4 (4.3%)		12 (13%)	44 (47.8%)	32 (34.8%)
Results in skill development	5 (5.3%)	1 (1%)	25 (26.3%)	39 (41.1%)	25 (36.3%)
Pharmacy management concepts	1 (1%)		17 (17.7%)	40 (41.7%)	38 (39.6%)

inadequate. The data in this study are survey based and rely on self-reported information, which may lead to an information bias. Therefore, we recommend nationwide survey involving pharmacy practitioners working in different institutions and healthcare settings.

CONCLUSIONS

In conclusion, Lebanese hospital pharmacists are highly committed to continuing education. They consider it a practical tool for career development and advancement. Work and family commitments, time constraints and geographic location (travelled distance) were considered as barriers for attending live CE sessions. Future proposed CE programs should be comprehensive, designed to fill the gaps between the knowledge and practice in the healthcare. This goal can be achieved by enhancing the engagement and support of employers and by the collaborative work of Pharmacy regulators and CE providers to define the skills and competencies and offer CE programs intended for self-directed, life-long learning.

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CONFLICT OF INTEREST

The authors have nothing to disclose.

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Original Research

Evaluating glycemic control for patient-aligned care team clinical pharmacy specialists at a large Veterans Affairs medical center

Jessica GARDEA, James PAPADATOS, Richard CADLE.
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Abstract

Background: Management of diabetes mellitus (DM) remains a challenge in the US, as almost half of patients with diabetes are uncontrolled with a hemoglobin A1c (HbA1c) >7%. Over the last decade there has been increasing evidence supporting the integration of Clinical Pharmacy Specialists (CPSs) to multidisciplinary medical teams which have demonstrated improved glycemic control and better clinical outcomes in the primary care setting.

Objectives: The primary objective of this study was to evaluate the change in HbA1c levels in patients with diabetes followed by a CPS. The secondary objectives of this study were to evaluate the percent of patients who reached American Diabetes Association (ADA) goal HbA1c (<7%) by study conclusion and evaluate documentation of hypoglycemic events in progress notes.

Methods: A retrospective chart review evaluating glycemic control was conducted on patients with DM managed by a CPS at a large Veterans Affairs Medical Center. Patients with a diagnosis of Type 1 or Type 2 DM with a baseline HbA1c ≥9% and at least three CPS visits over twelve months were included in this study. Patients with cognitive impairment as documented by ICD-9 codes or with less than three CPS visits over twelve months were excluded.

Results: A sample of 79 patients was identified. The mean HbA1c declined by 1.5 percentage points (from 10.6%, SD=1.4 to 9.1%, SD=1.5) after one year. No patients reached ADA goal of HbA1c <7% at study conclusion, however 23% of patients reached a less stringent goal of <8%. All CPS progress notes assessed episodes of hypoglycemia and provided education, and no hospitalizations were related to hypoglycemic events.

Conclusions: Integration of a CPS into a veteran's diabetes care was associated with improved outcomes and enhanced hypoglycemic education. Our results advance the existing literature by demonstrating a positive association between CPS intervention and improved glycemic control in a complex veteran population.

Keywords

Diabetes Mellitus; Pharmaceutical Services; Pharmacists; Patient Care Team; Ambulatory Care; Patient Outcome Assessment; Retrospective Studies; Texas

INTRODUCTION

Diabetes mellitus (DM) is the seventh leading cause of death in the United States (US), affecting more than 30 million Americans and accounting for USD245 billion annually in direct and indirect costs.[1] The prevalence has more than doubled over the past two decades, and continues to grow.[2] Complications are preventable, but if DM is left uncontrolled it can lead to renal failure, lower-limb amputations, and blindness. Appropriate glycemic control has proven to delay onset and reduce risk of long-term complications, thereby decreasing hospitalizations.[3] Management of DM remains a significant challenge in the US, as estimates indicate that greater than 40% of diabetes patients are uncontrolled with a hemoglobin A1c (HbA1c) >7%.[4]

Over the last decade there has been increasing evidence supporting the integration of Clinical Pharmacy Specialists (CPSs) into multidisciplinary medical teams. CPSs can make a positive impact on patients with diabetes by promoting medication adherence, assessing appropriate use of medications, optimizing and individualizing drug therapy, as well as providing education, especially in a high-risk population, which has resulted in improved glycemic control and better outcomes in the primary care setting. In a Veteran Affairs (VA) study conducted by Cioffi *et al*. in 2004, HbA1c levels were reduced by about 3%, from 10.3% to 6.9%, over a 12 month period in a pharmacist-managed outpatient diabetes clinic.[5] In a more recent VA study in 2014, Collier et al found that the addition of a CPS to a multidisciplinary care team decreased baseline HbA1c by 1%, from 9.1% to 7.9%, over three months.[6] Clinical pharmacists in these studies provided continuity of care between physician visits by adjusting insulin and oral medications according to patient self-monitored blood glucose values. In addition to improving glycemic control, engaging pharmacists resulted in positive economic outcomes and reduced health care costs.[7] Iyer *et al*. showed a 30% reduction in hospital admissions and a 24% reduction in emergency room visits during a one-year period due to CPS interventions.[3]

Within the VA Healthcare System, DM is the third most prevalent diagnosis, with a higher occurrence among veterans than the general population.[8] In order to help improve chronic disease state management, VA implemented multidisciplinary Patient-Aligned Care Teams

Jessica GARDEA. PharmD, BCACP. Assistant Professor of Pharmacotherapy, College of Pharmacy, University of North Texas System. Fort Worth, TX (United States). jessica.gardea@unthsc.edu
James PAPADATOS. PharmD, BCPS. Clinical Pharmacy Specialist. Michael E. DeBakey Veterans Affairs Medical Center. Houston, TX Fort Worth, TX (United States). James.Papadatos@va.gov
Richard CADLE. PharmD, BCPS (AQ ID), FASHP. Clinical Pharmacy Specialist. Michael E. DeBakey Veterans Affairs Medical Center. Houston, TX Fort Worth, TX (United States). [DECEASED]

Table 1. Baseline Characteristics	
Characteristic (N=79)	**Overall**
Age (years) - Mean	65.3, (SD=7.9)
Sex (male) - N (%)	75 (94.9)
Body Mass Index (kg/m^2) - N (%)	32.3 (SD=5.6)
Ethnicity - N (%)	
White	20 (25.3)
African American	41 (51.8)
Hispanic	18 (22.7)
Comorbidities - N (%)	
DM Type 1	0 (0)
DM Type 2	79 (100)
Hyperlipidemia	64 (81)
Hypertension	63 (79.7)
Coronary Artery Disease	17 (21.5)
Chronic Kidney Disease	16 (20.2)
Congestive Heart Failure	6 (7.5)
Follow-up visits within 1 year; median	
Clinical Pharmacy Specialist	5, (SD=1.8)
Primary Care Physician	2, (SD=1.2)
Endocrinologist	0, (SD=0.8)
Diabetes medications at baseline. N(%)	
Insulin	58 (73.4)
Metformin	44 (55.7)
Sulfonylurea	32 (40.5)
Alpha Glucosidase Inhibitors	8 (10.1)
Thiazolidinedione	4 (5.1)
Dipeptidyl Peptidase-4 Inhibitors	2 (2.5)
Incretin Analogs	0 (0)
Pramlintide	0 (0)
Meglitinides	0 (0)
Sodium Glucose Cotransporter-2	0 (0)

(PACTs) to include a CPS. At the Michael E. DeBakey VA Medical Center (MEDVAMC) in Houston, Texas, scope of practice agreements between CPS and primary care physicians have been established for over two decades. The MEDVAMC is an academic teaching institution that serves as the primary healthcare provider of more than 130,000 veterans with one million outpatient visits annually. Pharmacist-managed outpatient clinics are a highly utilized and reliable resource for veterans, providing knowledge and expertise that allows them to manage their chronic disease states. This study will evaluate the impact that the PACT CPS has on DM performance measures, including HbA1c target values and hypoglycemic patient education, at the MEDVAMC.

METHODS

Study Design

A single-center, retrospective, electronic chart review evaluating glycemic control was conducted on patients with DM managed by a CPS at MEDVAMC. Patients with a diagnosis of Type 1 or Type 2 DM with a baseline HbA1c ≥9.0% and at least three CPS visits over twelve months were included in this study. Patients with cognitive impairment as documented by ICD-9 codes or with less than three CPS visits over twelve months were excluded. Data collected at baseline included age, gender, ethnicity, body mass index, HbA1c level, co-morbidities including hypertension, hyperlipidemia, coronary artery disease, heart failure, and chronic kidney disease, initial CPS visit including time and date, and diabetes oral and injectable medications. Data collected during treatment period included HbA1c levels, addition or discontinuation of diabetes oral and injectable medications, number of pharmacy, primary care or endocrine visits, and documentation of any hypoglycemic events in progress notes or hospitalizations related to hypo/hyperglycemia. The study was approved by the Institutional Review Board at the Baylor College of Medicine and the Office of Research and Development at the MEDVAMC.

Study Objectives

The purpose of this study was to evaluate the impact that the PACT CPSs have on DM performance measures at the MEDVAMC. The primary objective of this study was to evaluate the change in HbA1c levels in patients with diabetes followed by a CPS. The secondary objectives of this study were to evaluate the percent of patients who reached American Diabetes Association (ADA) goal HbA1c (<7%) by study conclusion and evaluate documentation of hypoglycemic events in progress notes.

Statistical analysis

Descriptive statistics were used to analyze baseline characteristics and medication use. Paired t-test was used to measure change in glycemic control and chi-square test was used to compare the proportion of patients reaching ADA goal HbA1c of <7%. A p-value of < 0.05 was accepted as statistically significant.

RESULTS

A total of 184 patients managed in the CPS clinics at the MEDVAMC from October 2014 to October 2015 were evaluated for this study and 79 patients were identified that met inclusion criteria. Baseline characteristics (Table 1) showed a majority of African American obese male patients with an average age of 65.3 years (SD=7.9). All patients were diagnosed with Type 2 DM and about 80% also had hyperlipidemia and hypertension. The median number of follow-up visits within one year with a CPS was 5 (SD=1.8), 2 (SD=1.2) with a primary care physician, and few 0 (SD=0.8) with an endocrinologist. In the 79 patients included, the majority were prescribed insulin (73.4%), metformin (55.7%), and a sulfonylurea (40.5%) before CPS initial visit. Few were prescribed an alpha glucosidase inhibitor (10.1%), thiazolidinedione (TZD) (5.1%), and a dipeptidyl peptidase-4 (DPP-4) inhibitor (2.5%). No patients were prescribed a sodium glucose cotransporter-2 (SGLT-2), meglitinide, pramlintide, or incretin analog throughout the entire study.

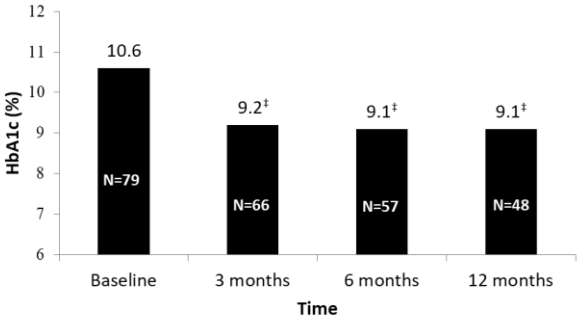

Figure 1. HbA1c at baseline and 3, 6, and 12 months after CPS visit. ‡p <0.05

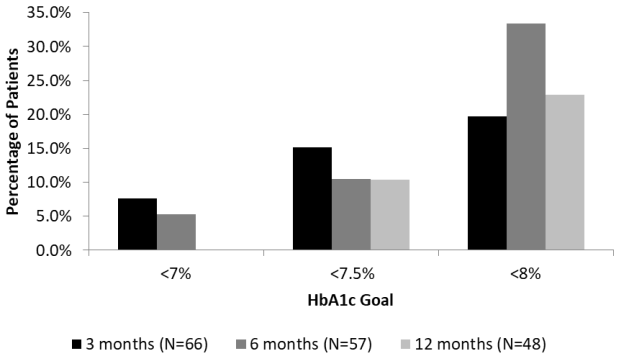

Figure 2. Percentage of patients at HbA1c goal

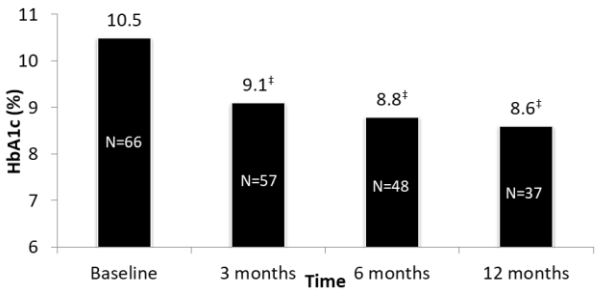

Figure 3. HbA1c excluding patients with documented non-adherence. ‡p <0.05

Significant reductions in HbA1c were seen at 3, 6, and 12 months. The mean HbA1c of all included patients was 10.6% (SD=1.4) at baseline and declined by 1.4 percentage points after 3 months to 9.2% (SD=1.6). After 6 months and one year, the mean HbA1c was 9.1% (SD=1.5), with an HbA1c lowering of 1.5 percentages points (Figure 1).

Figure 2 depicts the secondary objective to evaluate the percent of patients who reached ADA goal HbA1c of <7%. After 3 months, 5 out of 66 patients (7.6%) reached this goal, 3 out of 57 patients (5.3%) after 6 months and no patients at study conclusion. In addition, less stringent HbA1c goals were evaluated in our study and the largest group of patients met a goal HbA1c of <8%, with 13 out of 66 patients (19.7%) at 3 months, 19 out of 57 patients (33.3%) at 6 months and 11 out of 48 patients (22.9%) meeting this goal at study conclusion.

For the safety secondary objective, 21 patients (26%) had documented hypoglycemic events within computerized patient record system progress notes. CPS documentation of appropriate hypoglycemia education was included in all progress notes and no hospitalizations were related to episodes of hypoglycemia. Two hospitalizations occurred throughout the study time frame, one for diabetic ketoacidosis and the other for a diabetic foot ulcer.

A subgroup analysis was performed on patients with documented non-adherence (Figure 3). Thirteen patients had documentation in pharmacy progress notes of either not following instructions or not administering insulin regularly and were removed from the analysis. The mean HbA1c was 10.5% at baseline, 9.1% at 3 months, 8.8% at 6 months, and declined by nearly 2 percentage points after one year to 8.6%.

Another subgroup analysis was performed on patients who were only on oral diabetes medications throughout the study time frame (Figure 4). The mean HbA1c was 10.6% at baseline, 8.9% at 3 months, 8.4% at 6 months, and declined by 3 percentage points after one year to 7.6%. All patients in this subgroup were on metformin and a sulfonylurea.

DISCUSSION

The results of our study show that care with a CPS had a significant improvement on glycemic outcomes in a veteran population. During each clinic visit, CPSs individualized and optimized diabetes medication therapy, provided and reinforced disease state and lifestyle modification education, and helped patients overcome any adherence barriers. By providing these services, CPSs at the MEDVAMC have enhanced overall diabetes care. Our study saw a greater decline in HbA1c at 3 months (1.5%) compared to another VA study by Collier and colleagues, which showed a 1.2% decline. However, veterans in our study were less controlled with a baseline HbA1c of 10.6% compared to 9.1%.[6] Helping veterans achieve ADA goal HbA1c presented a challenge for CPSs at our facility due to the complex patient population. Another major difference in the two studies was that our CPSs operated under a scope of practice and did not use a standardized protocol for diabetes management and insulin intensification.

The HbA1c reductions seen in our study were significant compared to values prior to being followed by a CPS, however a limited number of veterans met ADA goal of <7% throughout the study. The ADA guidelines state that less stringent HbA1c goals (such as <8%) may be appropriate for patients with a history of severe hypoglycemia, limited life expectancy, advanced microvascular or macrovascular complications, extensive comorbid conditions, or long-standing diabetes in whom the general goal may be more difficult to attain.[9] Additionally, the VA guidelines for management of diabetes recommend a range of 7-8.5% as appropriate for individuals with established microvascular or macrovascular disease, comorbid conditions, or 5-10 years life expectancy.[10] The patient population in our study was on average older with multiple comorbid conditions, and therefore we also assessed those patients who met goal HbA1c of <7.5% and <8%. Approximately 80% of the population had concomitant hypertension and hyperlipidemia, and about 20% had coronary artery disease and chronic kidney disease. These percentages may also be

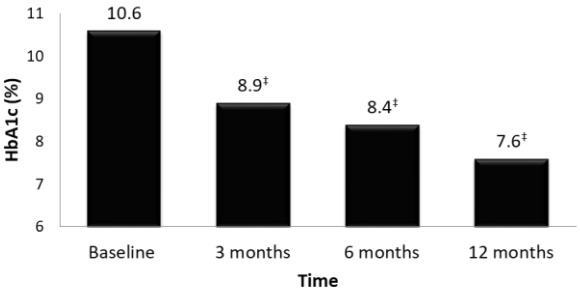

Figure 4. HbA1c of patients on oral medications. ‡p <0.05

underestimated as the "active problem list" used on the VA computerized patient record system is not always updated. The average age of the population was 65 years old, further suggesting that less stringent HbA1c goals, such as <8%, may be an appropriate target for our study.

The majority of patients were prescribed insulin, metformin, and a sulfonylurea before their first visit with a CPS. No patients were prescribed a sodium glucose cotransporter-2 (SGLT-2), meglitinide, pramlintide, or incretin analog throughout the entire study as these were all non-formulary medications at the VA during the study period. Four patients had metformin discontinued from their diabetes regimen due to worsening renal function, and four patients were initiated on metformin by a CPS to optimize glycemic control. Eleven patients were discontinued from their sulfonylurea, likely due to older age and increased risk of hypoglycemia with concomitant insulin therapy. A large portion of patients were already prescribed insulin before their first visit with a CPS (73.4%), and 15 additional patients were started on insulin therapy throughout the study. This was expected as all patients included had an HbA1c ≥9% at baseline. The subgroup analysis performed on patients who were only on oral diabetes medications showed a decline by three percentage points after one year (Figure 4). This significant reduction may have been due to CPS optimizing oral medication dosing, lifestyle modification education, and assessing adherence at every visit.

Clinical pharmacists faced barriers when assisting patients to achieve optimal glycemic control. Documented medication and dietary non-adherence accounted for 16% of the population. This number is likely underreported as approximately one third of all diabetes patients prescribed insulin do not properly adhere to their regimen.[8] When patients with documented non-adherence were excluded, a more significant glycemic improvement was seen. Another barrier was the lack of self-monitored blood glucose readings available to the CPS. Patients with diabetes often forget to monitor their blood glucose readings or bring their glucometer to visits. This limits the appropriate insulin intensification strategies that a pharmacist is able to safely recommend. Finally, no-show clinic rates are another barrier to optimal chronic disease state management. Pharmacists make attempts to call and remind patients before their scheduled appointments, however no-show rates remain high.[11]

There were further limitations to this study. The study design was a retrospective, observational chart review and can only be used to show associations. The sample size was small with the majority of the population being elderly men, which may affect external validity. Ideally, a comparator group of diabetes patients managed by primary care physicians only would have allowed us to better assess CPS interventions and effect on diabetes management compared to other primary care providers. Another limitation was that the follow-up time frame was only one year, and drastic changes in glycemic control may have occurred after study conclusion. Finally, this study did not assess a decrease in diabetes related hospitalizations, mortality or cost savings.

CONCLUSIONS

In summary, the study shows that integration of a CPS into a veteran's diabetes care was associated with improved HbA1c values and enhanced hypoglycemic education in a primary care setting at an academic teaching institution. Clinical Pharmacy Specialists at a Veterans Affairs hospital are a valued resource for both patients and other health care professionals. Our results advance the existing literature by demonstrating a positive association between CPS intervention and improved glycemic control in a complex veteran population.

CONFLICT OF INTEREST

The authors have no conflicts of interest to disclose.

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Original Research

Community pharmacists' perceptions towards online health information in Kuala Lumpur, Malaysia

See W. ONG, Mohamed A. HASSALI, Fahad SALEEM.

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Abstract

Objective: The current study was carried out to assess community pharmacists' perceptions towards online health information, to examine the type of information seek from Internet and to identify the barriers when they retrieved online health information.

Methods: The study was designed as a cross-sectional questionnaire-based survey whereby all (300) community pharmacists practicing in Federal Territory of Kuala Lumpur, Malaysia were targeted for data collection. A 35-itemed questionnaire was posted out along with a stamped addressed envelope, invitation letter and support letter. Responses were also accepted via online response. Both descriptive and inferential statistics were used for data analysis. All statistical analysis was performed using SPSS v. 20.0.

Results: A total of 67 responses were received with a response rate of 22.3%. The top three frequently health information searched by respondents were medicine information, general healthcare information and disease-related information. High number of respondents agreed that Internet had too much health information to scan through. Gender (p=0.018) showed significant association with visiting established health websites. Meanwhile, statistical significant was observed between age and searching medicine information (p=0.037), undertaking online continuing professional development (p=0.023), as well as searching clinical guidelines (p=0.047). Respondents' education level showed significant association with uncertainty about the reliability of online health information (p=0.023) and unsure about filtering the information (p=0.007).

Conclusions: Majority of the respondents expressed positive perception with the use of Internet for health information. The findings of the current study showed the widely use of Internet for health information among community pharmacists. Hence, this study provides opportunity for future works to further examine community pharmacist's retrieval and appraisal skills for online health information, as well as application of this information into their daily pharmacy practice.

Keywords

Online Systems; Education, Distance; Drug Information Services; Pharmacies; Pharmacists; Attitude of Health Personnel; Surveys and Questionnaires; Malaysia

INTRODUCTION

In recent years the Internet has developed tremendously and health information is widely available on the Internet with the potential of improve information distribution.[1,2] People rely on Internet for information and other purposes, and this technology is becoming increasingly important in people's daily lives around the world.[3] This is because Internet is convenient and widely available, where a person can go online from home, workplace or libraries. In addition, Internet offers almost unlimited information to public.[4]

The literature reports that there is an increase trend of Internet usage among healthcare professionals for medical and health information.[3] Since the Internet is readily available, the use of web based searching becomes an important clinical tool for doctors that may help them to diagnose difficult cases.[5] The Internet improves the quality care of family physicians and may influence the way they shape their questions and search for responses.[6] A study regarding Internet technology in UK community pharmacy found that with the use of Internet technologies in practice improves isolation problems, self-confidence, perceived lack of clinical knowledge and enhance communication between pharmacists and patients.[7,8] Additionally, studies have reported that both general practitioners and community pharmacists performed various search activities while visiting health websites, such as continuing professional development (CPD) programs; seeking for drug information, disease-related information, general healthcare information[9], as well as retrieval of information from online journals.[3] In addition, it was also stated that healthcare professional used Internet to obtain professional updates[3], to access latest research on specific topics, new product or therapy information and to search guideline summaries.[10]

Although there is a widespread use of Internet for online health information, some studies described significant barriers towards its usage in professional practice. Some of the perceived barriers include limited time available to undertake the search[3,7,11], difficulty in finding pertinent information[7,10], lack of knowledge or searching skill[3,7,11], navigation or searching difficulties, excessive information to scan[6,10] and resources problems such as lack of technology in practice.[7] Furthermore, other reported barriers included evaluation of online health information and website for its credibility and effectiveness, low diversity of websites visited, as well as lack of coherent for available health information were reported too.[3]

It is now realized that due to free accessibility of online health information, the healthcare practice has change.[12]

See Wan ONG. Discipline of Social & Administrative Pharmacy, School of Pharmaceutical Sciences, Universiti Sains Malaysia. Penang (Malaysia). ongsw84@gmail.com
Mohamed Azmi HASSALI. Discipline of Social & Administrative Pharmacy, School of Pharmaceutical Sciences, Universiti Sains Malaysia. Penang (Malaysia). azmihassali@gmail.com
Fahad SALEEM. Faculty of Pharmacy & Health Sciences, University of Balochistan. Quetta (Pakistan). fahaduob@gmail.com

Consumers are playing active role in using Internet for medicine information[2] and they are better informed regarding their healthcare needs.[12] Therefore, the issue of source credibility and reliability in health websites is becoming a critical issues.[3] In such scenario, healthcare professionals such as community pharmacists have to become proactive in assisting consumer to search, select and interpret the information.[2] As community pharmacists are the most accessible healthcare professionals to the public and are recognized as source for professional health advice[13] they can educate consumers about medicines and online health information.[2] Community pharmacists have the responsibility to dispense medication and to ensure consumers are provided with adequate information, to assist medication safety and effectiveness in order to enhance health outcomes.[7] Pharmacists can support the quality use of medicines by providing online health information, but they must be able to use Internet to ascertain and evaluate the quality of the information.[7]

Inline to what is reported above, studies had been carried out to assess healthcare professional's information-seeking behaviour especially among physicians, such as family physicians' information searching behaviour in US[6], and pharmacists' online information literacy in Australia.[2] However, to date, there is no information available regarding Malaysian community pharmacists' perception towards online health information. Hence, it is crucial to study their perception and the employment of Internet technologies in community pharmacy practice. In response to this issue, the aim of this study is to assess community pharmacists' perception pertaining online health information, to examine the type of information that they seek from the Internet, and to identify the barriers while they are retrieving online health information.

METHODS

Study design and sample

This study was designed as a questionnaire based cross-sectional survey. All (300) community pharmacists practicing in Kuala Lumpur were identified from the list obtained from Pharmaceutical Services Divisions, Ministry of Health Malaysia. The questionnaire was mailed with an invitation letter explaining the purpose of the study, a support letter and a self-addressed postage paid envelope. In order to increase the response rate of this survey, community pharmacists were given alternative option to respond via an online form whereby a link was provided along invitation letter. The participation for this survey was strictly voluntary. Completion and returned of the questionnaire implied the consent from the respondents.

Study instrument

The questionnaire was developed and modified from the literature review.[2,6,8-10] The questionnaire was tested for face and content validity and was pilot tested with 15 community pharmacists prior to general distribution. Data collected from pilot study were not included in the final data analysis. The reliability of this survey was supported by the overall fit measure, where Cronbach alpha coefficient yields a value of 0.807. The final questionnaire comprised of four sections. The first section assessed the demographic and practice characteristics of the community pharmacists. The second section evaluated the community pharmacists' perceptions towards online health information. The third section included statements pertaining to the type of online health information accessed by community pharmacists, while the final section focused on the barriers faced by community pharmacists with online health information. The respondents were requested to answer using a three-point Likert scale response format.

Table 1. Demographics characteristics of respondents

Characteristic	N (%)
Gender	
Male	28 (44.4%)
Female	35 (55.6%)
Age (years)	
18 – 27	7 (11.1%)
28 – 37	29 (46.0%)
38 – 47	17 (27.0%)
> 47	10 (15.9%)
Ethnicity	
Malay	11 (17.5%)
Chinese	49 (77.8%)
Indian	2 (3.2%)
Others	1 (1.6%)
Status of ownership	
Manager and owner of pharmacy	25 (39.7%)
Manager	18 (28.6%)
Employee	20 (31.7%)
Educational level	
Bachelor	53 (84.1%)
Master	10 (15.9%)
Pharmacy setting	
Single outlet independent pharmacy	26 (41.3%)
Multi outlet independent pharmacy	10 (15.9%)
Chain pharmacy	27 (42.9%)
Working experience as CP (years)	
1 – 5	29 (46.0%)
6 – 10	7 (11.1%)
11 – 15	8 (12.7%)
> 15	19 (30.2%)

Data analysis

Statistical Package for Social Science (SPSS®) was used to analyze the data. The KS test was used for normality assessment. Descriptive analysis was performed to obtain the frequency and percentage of occurrence. Mann-Whitney test and Kruskal-Wallis test were used to investigate the significance of association. Where significant associations were observed, Bonferroni correction was used to interpret the information. A p-value of less than 0.05 was considered to be statistically significant.

Ethical approval

This study protocol was registered with National Medical Research Register (NMRR). Ethical application was reviewed and approved by Medical Research and Ethics Committee (MREC), Ministry of Health Malaysia prior to the commencement of this study (NMRR-15-1880-28384).

RESULTS

A total of 67 questionnaires were received, giving a response rate of 22.3%. However, only 63 questionnaires were usable. More than half of the responses were

Table 2. Type of online health information retrieved by community pharmacists

Statement	Frequency (%)		
	Always	Sometimes	Never
I search for disease-related information from the Internet.	37 (58.7%)	26 (41.3%)	0 (0.0%)
I search for general healthcare information from the Internet.	42 (66.7%)	21 (33.3%)	0 (0.0%)
I search for medicine information from the Internet.	46 (73.0%)	17 (27.0%)	0 (0.0%)
I read online journals/articles.	31 (49.2%)	28 (44.4%)	4 (6.3%)
I undertake online CPD/CME.	30 (47.6%)	25 (39.7%)	8 (12.7%)
I contribute to online discussion forums on health topics.	16 (25.4%)	10 (15.9%)	37 (58.7%)
I search for guidelines/protocol such as Malaysia CPG, WHO, SIGN.	19 (30.2%)	33 (52.4%)	11 (17.5%)
I search and read latest updates from pharmaceutical company.	21 (33.3%)	32 (50.8%)	10 (15.9%)

received via online (n=36, 53.7%) compare to postage (n=31, 46.3%). Thirty-five respondents were females (n=35, 55.6%) and most of the respondents were manager and owner of the pharmacy outlets (n=25, 39.7%) (Table 1).

Type of online health information

The types of online health information searched by community pharmacists were assessed. From this survey, it was found that the top three health information that mostly looked up by the respondents was medicine information (n=46, 73.0%), general healthcare information (n=42, 66.7%), and disease-related information (n=37, 58.7%). In contrast, they were least interested to make contribution to online discussion forum on health topics (n=37, 58.7%). Majority of the respondents always read online journals (n=31, 49.2%) and undertook online CPD (n=30, 47.6%), and sometimes searched for professional guidelines (n=33, 52.4%) and read the latest updates from pharmaceutical company (n=32, 50.8%) (Table 2).

Perception towards online health information

The community pharmacists were required to express their general perception towards online health information. Over half of the respondents agreed with majority of the statements regarding perception of online health information. It was also noted that almost equal number of respondents rated 'agreed' (n=28, 44.4%) and 'neutral' (n=26, 41.3%) in respond to the need for more practice to seek online health information effectively. When respondents were assessed with regard of referring to social media, blog or forum for health information, majority (n=29, 46.0%) remained neutral to the usage and the rest (n=26, 41.3%) mainly disagreed with the usage of opinion-based source (Table 3).

Barriers towards online health information

This study had accessed the barriers encountered by community pharmacists when they retrieved online health information. The major obstacle reported by respondents in this study was scanning through abundance of health information from the Internet (n=40, 63.5%). A high proportion of respondents neither trusts blindly nor remains skeptical towards health websites or health information (n=36, 57.1%). Majority of the respondents think that they had no issue with resource (n=32, 50.8%), had appropriate searching skill (n=31, 49.2%), as well as having sufficient time to seek for online health information (n=30, 47.6%) (Table 4).

Statements that showed statistical significant with demographic characteristics were summarized in following table (Table 5). Significant association was observed between gender and visiting established health websites (p=0.018). Meanwhile, age was found statistically associated with statements on searching medicine information (p=0.037), undertaking online CPD (p=0.023), and searching professional guidelines or protocol (p=0.047). Respondents' educational level showed statistically association with statement on uncertainty about the genuine and reliability of health websites (p=0.023) as well as unsure how to filter online health information (p=0.007).

DISCUSSION

Due to the extensive availability of health information on Internet[1], general practitioners are using Internet for their professional development.[14] The present study will provide vital understanding and empirical evidences regarding Malaysian community pharmacists' perception towards online health information.

Perception towards online health information

Majority of the respondents perceived positively about online health information, where they believed Internet provides useful and updated health information. Consistent with the findings of previous studies, Internet is known to be a useful resource.[6,9,15] Interestingly, about half of the respondents used online health information to prepare

Table 3. Community pharmacists' perception towards online health information

Statement	Frequency (%)		
	Agree	Neutral	Disagree
The Internet provides useful health information.	53 (84.1%)	10 (15.9%)	0 (0.0%)
I can find up-to-date health information on the Internet.	53 (84.1%)	9 (14.3%)	1 (1.6%)
It is easy to find appropriate online health information about a particular topic.	48 (76.2%)	12 (19.0%)	3 (4.8%)
I visit established trusted health websites only (for example MIMS Malaysia).	47 (74.6%)	13 (20.6%)	3 (4.8%)
I am confident that I can determine the quality of online health information.	43 (68.3%)	18 (28.6%)	2 (3.2%)
I use online health information to prepare talks for community groups.	35 (55.6%)	27 (42.9%)	1 (1.6%)
I am familiar with the criteria to evaluate a health website.	33 (52.4%)	26 (41.3%)	4 (6.3%)
The Internet has health information that I cannot find in other resources.	32 (50.8%)	27 (42.9%)	4 (6.3%)
I need more practice in order to use the Internet to search health information effectively.	28 (44.4%)	26 (41.3%)	9 (14.3%)
I refer to blog, forum or social media for health information.	8 (12.7%)	29 (46.0%)	26 (41.3%)

Table 4. Barriers towards Online Health Information

Statement	Frequency (%)		
	Agree	Neutral	Disagree
There is too much health information to scan from the Internet.	40 (63.5%)	21 (33.3%)	2 (3.2%)
I am distracted by the links to other sources.	19 (30.2%)	27 (42.9%)	17 (27.0%)
I do not have enough time to search for online health information.	10 (15.9%)	23 (36.5%)	30 (47.6%)
I do not have searching skills towards online health information.	6 (9.5%)	26 (41.3%)	31 (49.2%)
I have resource problem (such as slow Internet connection, not familiar with technology, etc.).	10 (15.9%)	21 (33.3%)	32 (50.8%)
I am unable to pay for the subscription fee for online health resources.	20 (31.7%)	29 (46.0%)	14 (22.2%)
I am uncertain about the genuine and reliability of the health websites / online health information.	11 (17.5%)	36 (57.1%)	16 (25.4%)
I am not sure how to filter online health information to find what I want.	9 (14.3%)	28 (44.4%)	26 (41.3%)

talks/sessions for community group programs. This finding was supported by previous study where Internet had made an impact on healthcare professional practice.[9] It is worth to mention that more than half of the respondents claimed that they were confident in determining the quality of online health information and they recognized the criteria in evaluating health websites. Thus further study could specifically concentrate on assessing community pharmacist's ability to search and appraise the information. There were studies stated that the use of social media to share health information among physicians and other healthcare professionals is expanding[16,17], nevertheless, merely 12.7% respondents in this study referred blog, forum or social media for health information. Perhaps more research is required to study this area and researcher could redefine the term of 'social media'. Current study found that male respondents (mean rank: 36.64, p=0.018) visited established only health websites, for example MIMS Malaysia. As web portal serves a good start to gain medical information[18], it is possible that the female community pharmacists are readily to expose different kind health websites and do not constrain themselves to only the well-known resources.

Type of online health information

It was identified that medicine information is the most frequent searched topic, followed by general healthcare information and disease-related information. This finding could imply that community pharmacists are more likely to deal with drug-orientated information instead of broader range of health information.[9] However, in terms of reading online journals, finding from the current study is in contrast with one of studies carried out among community pharmacists and general practitioners in Northern Ireland where online journals is the most popular sites for both of these profession.[9] Majority of the respondents claimed that they occasionally seek for professional guidelines and read the latest research by pharmaceutical company. This is because access to technology supports the understanding of current best practice and clinical guidelines.[6] Overall, the finding from this section provides a useful insight regarding the regular use and trust of online resources among community pharmacists.[9] It was also noticed that respondents' age group showed significant association with the following study questions: respondents aged between 38 - 47 years old (mean rank: 40.18) were associated with searching medicine information from Internet (p=0.037), while respondents aged more than 47 years was associated undertaking online CPD (mean rank: 45.75, p=0.023) and searching professional guidelines or protocol (mean rank: 42.30, p=0.047). This finding might imply that the use of Internet to update professional knowledge among Malaysian community pharmacists was not confined by age, as one of the study carried out in Taiwan found that physicians with age of 50 and above were less likely to access online databases which might due to unfamiliarity with latest technology.[18]

Barriers towards online health information

Although respondents used Internet to obtain health information regularly, the major barrier reported in this study was to scan through the overwhelming of online health information, which was reported in other studies.[6,14,19] This reported barrier was expected and Internet users require sophisticated skills to look for answer from online resources.[14] Perhaps the respondents from this study were equipped with competent literacy skill as most of the respondents claimed that they possessed searching skills, had adequate time and no issue with resources, though previous studies reported them as challenges.[3,10,11,20] On the other hand, respondents with Master qualification showed significant association when they were asked if they were convinced about the reliability (mean rank: 42.75, p=0.023) and certainty to filter (mean rank: 45.10, p=0.007) online health information, majority of them remained neutral and respondents with Master qualification showed significant association with these statements. It could be correlated to previous study where

Table 5. Association between statements and demographic characteristics

Statements	p-values			
	Gender[a]	Age[b]	Educational level[a]	Pharmacy setting[b]
I visited established trusted health websites only (for example MIMS Malaysia)	**0.018**	0.061	0.519	0.541
I search for medicine information from the Internet.	0.753	**0.037**	0.191	0.844
I undertake online CPD/CME.	0.277	**0.023**	0.495	0.682
I search for guidelines/protocol such as Malaysia CPG, WHO, SIGN.	0.879	**0.047**	0.384	0.263
I am uncertain about the genuine and reliability of the health websites / online health information.	0.277	0.419	**0.023**	0.282
I am not sure how to filter online health information to find what I want.	0.856	0.199	**0.007**	0.537

[a] Mann-Whitney Test, [b] Kruskal-Wallis Test

credibility was cited as the most important criterion for Internet clinical information[3,6,10], and it could be Master-qualified respondents deal with Internet resources more frequently especially during their postgraduate studies. Therefore, future study should explore how community pharmacist constructs search strategies[11] as well as evaluate health website.[3]

Limitations

The major limitation of this study is the low response rate and it is impossible for researcher follow up with non-respondent due to its anonymous nature. Nevertheless, the low response rate was expected with the study design and it is comparatively similar to previous studies conducted among Malaysian practicing community pharmacists.[21-23] However, the finding of this study is not generalized to all community pharmacists, and perhaps a nationwide study could be carried out in order to achieve broader view on this topic.

CONCLUSIONS

In conclusion, the Internet offers extensive resources for healthcare professional, as current study shows the impact and widely use of Internet among community pharmacists in Kuala Lumpur. The present study demonstrates positive response towards online health information yet certain reservation was reported. Hence, this study provides groundwork for more rigorous investigation, in terms of searching skill, quality determination as well as evaluation skill for online health information for pharmacy professional development.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest to disclose.

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Original Research

A cross-sectional survey on cold chain management of vaccines in Cebu, Philippines

Patrisha L. MAGLASANG, Ma L. BUTALID, Maria F. PASTORIL, Antonius N. PRATAMA, Elizabeth Y. TAN.
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Abstract

Background: Appropriate cold chain management is the foundation of safety and quality of vaccines.
Objectives: This cross-sectional study was conducted to assess the cold chain management of the rural health units of Consolacion and Liloan, Cebu, Philippines on August to September 2017.
Methods: Data was collected using a structured questionnaire, which was developed based on previous studies of cold chain survey. The questionnaire was administered to one personnel who is responsible for the storage and maintenance of vaccines in each public health center (PHC).
Results: Of 42 targeted PHCs, only 52.4% (n=22) agreed to join in the study. The results of the study indicated that storage units and equipments were available in all 22 PHCs, even though only five of them (22.7%) stored vaccines. The majority of PHCs (90.9%, n=20) did not have access to a generator and only 9% (n=2) had a voltage stabilizer connected to the refrigerator. Refrigerators that were equipped with thermometer were only found in 68.2% (n=15) PHCs. No statistically significant relationship was found (p=0.159) between the statuses of PHCs to store vaccine and the level of knowledge of health professionals assigned to manage the vaccine.
Conclusions: Primary health centers that store vaccines have at least one functional refrigerator and freezer and alternative power sources. Contingency plans in the event of mechanical and power failure as well as proper temperature monitoring are needed. Personnel handling vaccines must be updated on proper storage and transport of such like the use of cold boxes and ice packs to maintain cold chain. Improvement of cold-chain management for vaccines in Cebu City's PHCs was necessary.

Keywords

Refrigeration; Drug Packaging; Drug Stability; Rural Population; Drug Storage; Immunization Programs; Vaccines; Total Quality Management; Cross-Sectional Studies; Philipines

INTRODUCTION

The substantial success of immunization in ameliorating human health by preventing, controlling, and for some cases, eradicating infectious diseases has been well documented.[1,2] Globally, a rough estimate of 2 to 3 million deaths due to diphtheria, whooping cough (pertussis), measles, and tetanus were averted annually because of immunization.[3] Over the last two decades, in the Western Pacific Region alone, immunizations have saved millions of lives and prevented disabilities in children, stopped the spread of wild poliovirus, and visibly dropped the spread of measles and hepatitis B virus.[4]

The impetus of vaccination program that can reach global population is the Expanded Program on Immunization (EPI) which was established by World Health Assembly in 1974 and took focus on developing or maintaining immunization and surveillance programs against poliomyelitis, tuberculosis, diphtheria, whooping cough (pertussis), and measles.[5] Tetanus was later added to the program.[1] Proper storage of vaccines from manufacturing process to administration must be done to ensure the effectiveness of immunizations.[6] Therefore, cold chain, or vaccine cold chain, plays a pivotal role in the activities of this EPI program.[7] Cold-chain system is designed to cope with inherent temperature sensitivity of vaccines due to either their antigen structure or their additives and adjuvants.[8]

Three main components of cold chain include transport and storage equipment, personnel training, and efficient management procedures.[6] Potency loss of vaccines can occur during every part of the chain including the long-term storage, shipping from the manufacturers to distribution centers, and just before the administration.[2] The causes of potency loss can be excessive exposure to heat, freeze, or light.[7] The temperature range recommended to store and transport vaccines by the WHO is 0-10ºC. This range is intended for diptheria-tetanus containing vaccines, tetanus toxoid (TT), hepatitis A and B, human papillomavirus (HPV), meningitis C, pneumococcal (PCV), cholera, influenza, haemophilus influenza b (Hib), typhoid and inactivated poliovirus (IPV).[9,10] Ideally, vaccine should not be stored in a dormitory-style refrigerator because it does not support temperature regulation and monitoring.[6]

Problems related to cold chain occur in every country that has had a surveillance for vaccine temperature monitoring; meaning it may certainly not only happen in developing countries.[8] Although cold chain is commonly thought to avoid vaccine inactivation due to exposure to heat, it is necessary to also highlight potency loss due to exposure to freezing temperatures resulting to inactivation of aluminum added as adjuvant to vaccines.[2,10] Vaccines such as OPV, measles, varicella, oral typhoid are unstable to

Patrisha Louise F. MAGLASANG. University of San Carlos. Cebu (Philippines). patrishamags@gmail.com
Ma Lalaine C. BUTALID. University of San Carlos. Cebu (Philippines). lalaine_butalid@yahoo.com.ph
Maria Feibe PASTORIL. University of San Carlos. Cebu (Philippines). mafeilabenia@gmail.com
Antonius N. W. PRATAMA. Faculty Member, Faculty of Pharmacy, Universitas Jember. Jember (Indonesia). anton.farmasi@unej.ac.id
Elizabeth Yu TAN. Faculty Member, Department of Pharmacy, University of San Carlos. Cebu (Philippines). shirineko@yahoo.com

heat, while other vaccines such as DTP, HepA, HepB, and TT are sensitive to freezing.[8] It is believed that overheating problem is more common in developing countries; conversely accidental exposures to freezing temperatures are more likely in developed countries.[7] The latter has an estimated 33.3% of vaccine storage units exposed to freezing temperatures, while in the former, the figure was slightly higher, 37.1%.[10] This figure is surprisingly higher than the findings in 2007 that the occurrence of exposure to temperatures below the recommended range was 29% in developed countries and 21.9% in developing countries.[10] Several responsible factors of overheating in developing countries are tropical climates, unreliable electricity, and shortage of resources (equipment, finances, and manpower).[7] Research in Cameroon highlighted that excessive exposure to heat was recorded in 24% of surveyed refrigerators and this was linked with the absence of alternative source of power (OR=6.5, p=0.03).[7]

Improving cold chain capacity and logistics throughout innovation becomes an activity of the Global Vaccine Action Plan in the Western Pacific.[4] Since 2003, 80 provinces, 38 cities, and 16 regions in the Philippines have been upgraded with the cold chain equipment.[11] However, it seems that research on this matter is still limited in number. In a recent thorough literature review, only one study about cold chain from the Philippines in 2010 was included.[10] Therefore, this study aimed to assess current cold chain management of the rural health units of Consolacion and Liloan, Cebu, Philippines.

METHODS

Study Design and Setting

This cross-sectional analytical survey was conducted from August to September 2017 in the towns of Consolacion and Liloan, Cebu. Both towns were chosen to be surveyed to assess the functionality of the cold chain management of vaccines in their respective Rural Health Units (RHU). Letters of permission were sent to the municipal mayor of each town and were referred to their respective planning departments on May 2017. In Consolacion, the head of the planning office disseminated an endorsement letter to each *barangay* health center that served as notification for the conduct of the cold-chain survey. In Liloan, the head of the rural health unit endorsed the request to the medical health officer and nurse supervisor and was eventually granted permission.

Data was obtained using a structured questionnaire, which was developed based on the US CDC Pinkbook[12] and some research reports of cold-chain survey.[13,14] This questionnaire was administered to one personnel who is responsible for the storage and maintenance of vaccines in each barangay health center. Thirty minutes was allotted to explain the consent form and questionnaire to the respondent, as well as answering clarifications from the respondents. The respondent, who gave consent, was given 10-15 minutes to answer the questionnaire.

Participants, Eligibility Criteria, and Sample Size

Participants in this study were the personnel-in-charge of each health centers in both towns. A total number of 42 *barangay* health centers were identified from Liloan and Consolacion. Only health centers that provide vaccination in both towns were included in the study as some health centers do not provide vaccination services. An informed consent was presented to the personnel-in-charge of each health center and those that signed the consent were included in the survey. Thus, health centers that gave their consent were counted as an eligible health center for the study, which was the basis for the sample size (Figure 1).

Variables

Outcome variable is the knowledge of personnel in terms of vaccine storage management. Explanatory variables were divided into three major groups: the basic information of health centers, cold-chain facilities, and socio-demographic information of health personnel assigned to fill up the questionnaire. Variables about the identity of health centers include urban/rural status, number of staff, types of vaccines provided, and an updated population in the area. Cold-chain facility variables comprise the availability of functional refrigerators, freezers, cold boxes, ice packs, and thermometers. Variables related to facilities also include source of electricity, availability of generator sets, availability of voltage stabilizers, and a standard procedure if outage happens. Variables related to health personnel include age, sex, professional status, and experience to participate in a workshop of cold-chain management.

Statistical Methods

Descriptive statistics in the form of percentage was used for qualitative data. Pearson's Chi-Square or Fisher's Exact Test with Cramer's V value was used to explore the

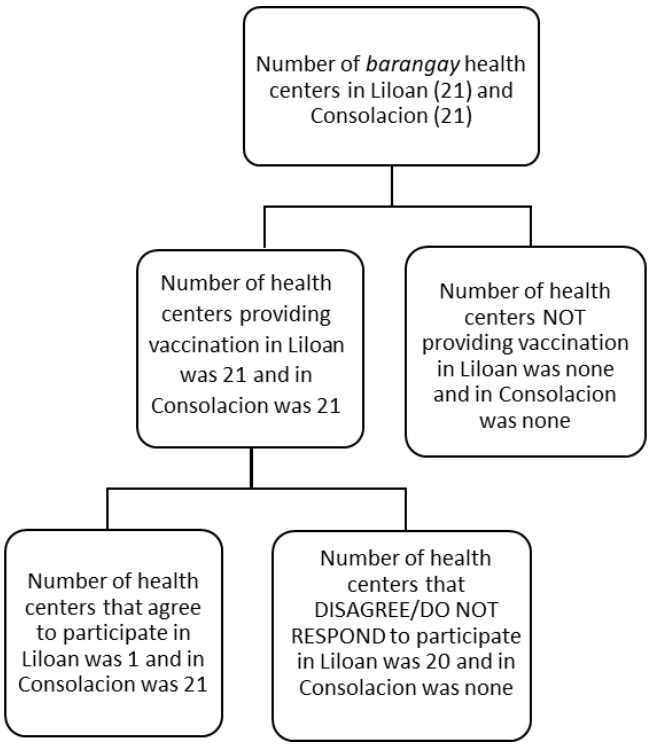

Figure 1. Number of health centers participating in the study

Table 1. Availability of Storage Units and Equipment

Storage units and equipments	Store Vaccine	
	Yes (%)	No (%)
Functional refrigerators available in the PHC		
None	0	10 (45.5)
One	4 (18.2)	7 (31.8)
> 1	1 (4.5)	0
Functional freezers available in the PHC		
None	0	10 (45.5)
One	4 (18.2)	7 (31.8)
> 1	1 (4.5)	0
PHC with available cold boxes	5 (22.7)	17 (77.3)
PHC with available ice packs	5 (22.7)	17 (77.3)

association between the statuses of PHCs to store vaccine and the level of knowledge of health personnel. Statistical analyses were conducted using Stata v. 13 (StataCorp, College Station, Texas, USA) and an alpha of 0.05 was used as cut-off for significance.

Ethical Considerations

Prior to the actual survey, ethical review was sought to the Ethics Committee of University of San Carlos, Cebu City, Philippines. Approval was granted with the number 008-2017-06. During the actual survey, informed consent was sought from all barangay health centers. The researchers allotted 30 minutes to read and explain the informed consent and the questionnaire, as well as to answer any clarifications from the respondents. Once the respondents signed the consent paper, the questionnaire was administered immediately. The name of the health personnel in each barangay health center interviewed by the researchers were coded as initials. Identity of involved health centers were also coded. Raw data can only be accessed by the research team. Data was presented as aggregate within any publication generated by this research.

Withdrawal Criteria

The respondents may refuse to participate in the study at any time without affecting their relationship with the investigators of the study. Their decision would not result in any loss or benefits to which they were otherwise entitled to. They had the right not to answer any single question, as well as to withdraw completely from the interview at any point during the process; additionally, they had the right to request that the interviewer should not use any of the interview material.

RESULTS

Table 1 presents the availability of storage units and equipment of PHCs surveyed. Out of 22 respondents, only 5 (22.7%) store vaccines. Four out of five have functional refrigerator/freezer; the other carried more than one unit. The other 17 facilities claimed to provide vaccination services but lack the basic equipment essential for storing vaccines as only 7 had at least one functional refrigerator/freezer. All 22 PHCs have cold boxes and ice packs available for 24-hour vaccine storage and transport. As vaccination is part of the service provided by primary health centers, appropriate equipment for storage is important.

Table 2. Source of Power

Electricity	Store Vaccine	
	Yes (%)	No (%)
Main source of power supply		
Electricity	5 (22.7)	17 (77.3)
Gas	0	0
Kerosene	0	0
Accessible generator		
Yes	1 (4.5)	1 (4.5)
No	4 (18.2)	16 (72.7)
The refrigerator is connected to an automatic voltage stabilizer		
Yes	1 (4.5)	1 (4.5)
No	4 (18.2)	8 (36.4)
Don't know	0	8 (36.4)
A contingency plan for outage available in the PHC		
Yes	5 (22.7)	7 (31.8)
No	0	2 (9.1)
Don't know	0	8 (36.4)
The contingency plan is pasted near the fridge		
Yes	2 (9.1)	6 (27.3)
No	2 (9.1)	2 (9.1)
Don't know	0	8 (36.4)
Other	1 (4.5)	1 (4.5)

Table 2 shows the power source available and necessary back-ups for the PHCs. All 22 PHCs use electricity as their main power source. Only 1 out of 5 PHCs that store vaccine had a back-up generator for use in the event of power outage. The same trend is seen in the use of an automatic voltage stabilizer. Five PHCs have available contingency plans in case of power outage but only 2 out of 5 posted their plan near the refrigerator.

Table 3 lists the temperature monitoring and availability of thermometers. Of the 5 PHCs that store vaccines, 4 have refrigerators equipped with a functional thermometer and they are placed inside the refrigerators. Four PHCs monitor the temperature of the refrigerator twice daily while the other indicated no pattern of monitoring. All 5 PHCs had at least one refrigerator with temperature between 2°C-8°C and only stores vaccine inside.

Table 3. Temperature monitoring and other items inside the refrigerator

Temperature Monitoring and Other Items	Store Vaccine	
	Yes (%)	No (%)
Refrigerator is equipped with a functional thermometer		
Yes	4 (18.2)	11 (50.0)
No	1 (4.5)	2 (9.1)
Don't know	0	4 (18.2)
Thermometer is placed inside the refrigerator		
Yes	5 (22.7)	9 (40.9)
No	0	3 (13.6)
Don't know	0	5 (22.7)
Temperature monitoring chart is maintained regularly		
No	1 (4.5)	2 (9.1)
Once daily	0	2 (9.1)
Twice daily	4 (18.2)	1 (4.5)
>Twice daily	0	7 (31.8)
Don't know	0	5 (22.7)
At the moment of observation, at least one refrigerator is with temperature between common recommended range (2°C-8°C)		
Yes	5 (22.7)	11 (50.0)
No	0	3 (13.6)
Don't know	0	3 (13.6)
Other items, especially non-medicine ones, are present with vaccines.		
Yes	0	0
No	5 (22.7)	17 (77.3)
Don't know	0	0

Table 4. Knowledge Assessment on the Personnel-in-charge of the Cold Chain System

Questions	Answer (n=22)	
	Correct (n,%)	Incorrect (n, %)
Do you think that the incidence of vaccine-preventable diseases are correlated with proper storage and handling of vaccines?	22 (100)	0
Do you think improper storage and handling of vaccines can decrease potency and effectiveness?	22 (100)	0
Do you think improper storage and handling of vaccines can increase cost due to wasted vaccine and revaccination?	22 (100)	0
Do you think improper storage and handling of vaccines can enhance patient confidence?	22 (100)	0
Do you think it is better to not vaccinate than to administer a dose of mishandled vaccine?	21 (95.5)	1 (4.5)
Do you think the temperature in storage unit(s) (i.e. refrigerator) should be monitored at least twice a day?	16 (72.7)	6 (27.3)
Which method is best applied to store the vaccines?	5 (22.7)	17 (77.3)
Do you think all vaccines must not be stored in freezer?	20 (90.9)	2 (9.1)
Do you think food and beverages should be allowed to be stored in the same unit with vaccines?	22 (100)	0
Do you think that an emergency plan must be made to anticipate unwanted situations such as outage and disaster?	14 (63.6)	8 (36.4)
Where should be the temperature monitoring device (i.e. thermometer) placed inside the storage unit(s)?	9 (40.9)	13 (59.1)
Do you think each transport may increase the risk that vaccines could be exposed to improper storage condtion?	21 (95.5)	1 (4.5)

In Table 4, the respondents (n=22) unanimously agreed that incidence of vaccine-preventable diseases are related to improper handling and storage of vaccines; that its potency may decrease when mishandled; that patients' confidence in the vaccines may decrease and cost due to wastage and re-vaccination increased. Some respondents (77.3%) did not know the best method to store vaccines while 59.1% did not know where the thermometer must be placed in the storage units. Majority of the respondents (95.5%) did not believe that each transport of vaccines may increase the risk of their exposure to improper storage conditions compromising their quality and potency.

There was no significant relationship between the statuses of PHCs to store vaccine and the level of knowledge based on Fisher's exact test (p=0.159). However, this result could be because of the relatively small sample size. Additionally, the Cramer's V value is moderate in measuring the strength of the relationship (0.4).

DISCUSSION

This small study was conducted to evaluate the functioning status of the cold chain system in the northern part of Cebu, particularly the towns of Consolacion and Liloan. Initially, the researchers planned to survey all PHCs in the towns of Consolacion and Liloan, in which both have 21 PHCs and would have totaled to 42 PHCs/respondents. However, only 1 PHC, which was the main health center have been surveyed in Liloan since the medical health supervisor did not consent for the survey in other PHCs around town. Therefore, a total of 22 respondents have been surveyed for this study which was also equivalent to 22 PHCs evaluated.

Stated in RA No. 3720 also known as Food, Drugs, and Cosmetics Act, as amended by EO No. 175 and in line with the objectives of the Department of Health AO No. 56 s 1989, 27 s 2001, and 47-A s 2001, are the requirements for outlets handling vaccines and other biological products to ensure cold chain management efficiency. This covers facility and equipment, monitoring tools, and personnel requirements. Only 22.7% of the 22 respondents store vaccines and the remaining 77.3% do not store vaccines but claimed to provide vaccination. This setup is prevalent in most places in Cebu since not all public health centers are equipped with a functional refrigerator or has a personnel who is trained in the proper storage and handling of vaccines. The respondents stated that the PHCs that do not store vaccines obtained the vaccines from another PHC. These vaccines were used on that same day of delivery. That is why 100% of the respondents have cold boxes and ice packs in their respective PHCs for a short-time storage and delivery of vaccines around town. This practice may result to predisposing vaccines to overheating and long term exposure which can consequently lead to damage and loss of potency as observed in a study in Cameroon.[13] The PHCs that do not carry vaccines ideally should not provide immunization services. However, due to geographical challenges, residents near the PHC requests that vaccination be made available. That explains why the vaccines should be transported by some means and that poses a risk on the quality of the vaccines being provided to the residents.

Power outage is common in developing countries[15]; hence, each of the PHCs should have an accessible generator or a contingency plan for vaccine storage in order to ensure the vaccines' shelf life. The personnel-in-charge must have a standard operating procedure (SOP) that must be strictly followed and these should be placed in an accessible area, preferably near or on the refrigerator where everyone could read it. Among the 5 respondents who store vaccines, only 1 has an accessible generator while 4 of them do not. Fluctuations of electric current could be a concern so voltage stabilizers are used to feed constant voltage to the refrigerator and protects it from damage due to fluctuations. Of the 5 respondents that store vaccines, only 1 had a refrigerator connected to a voltage stabilizer while the other 4 were not. A study by Buledi *et al.*[16] reported similar predicament in Pakistan where among 42 respondents, 74% had no voltage regulators and 90% did not have standby power generators. Power outage and fluctuations are common and standby generators and voltage regulators are not common in PHCs. The appropriate government agencies must look into this to avoid wasting of expensive vaccines that may be damaged as a consequence of inefficient power supply and poor address of power outages and fluctuations.

All vaccines have a designated storage condition that would determine the temperature for its storage and handling. These conditions must be strictly followed to retain the vaccines' potency and therapeutic effectiveness. Therefore, all refrigerators should have a working thermometer to monitor its temperature. The personnel-in-charge in each

PHC should monitor the temperature at least twice a day as suggested by the Food and Drug Administration (FDA) Philippines to ensure that the storage conditions of every vaccine is followed. A temperature monitoring chart for each refrigerators should be made available.[17] Surprisingly, the researchers found out that one PHC that carries vaccines does not update the temperature monitoring chart at all. A report from Pakistan found out that 43% of 42 centers do not maintain twice daily temperature monitoring.[16] Another study found that 55.3% (n=425) did not have temperature logging charts at all. 65.4% had no thermometers and among those who have only 90.5% were functional. A similar study conducted in India in 2012 shows that all their surveyed PHCs had dial thermometers for monitoring the temperature.[18] Dial thermometers are no longer recommended as they lose their calibration over time especially when they are dropped.[19] WHO states that the use of thermometers are as back-up device for temperature monitoring as they do not require batteries or power supply to use. They have been replaced by more efficient and better devices.[19] While the thermometers no longer meet the requirement of WHO, these have remained useful especially in developing countries. Over time, ideal monitoring devices such as 30-day electronic temperature logger should be used.

The knowledge of personnel-in-charge of handling vaccines on cold chain system was assessed and revealed some worrisome results. Some respondents (27.3%) were not aware that temperature in the refrigerator must be monitored at least twice daily.[19] A study by Naik *et al*.[20] had better findings citing 95% of their respondents know appropriate monitoring frequency. The present study reports 77.3% did not know the best method to store vaccines as opposed to only 10% from the same cited study. Another study by Rao *et al*.[18] shows 97.4% knows the ideal equipment for storage of vaccines while findings in this study has a lower value, at 90.9%. The cited studies were conducted in India, also a developing country yet it appears their personnel are more adept and knowledgeable in handling vaccines and about the cold chain system. This study reported that 59.1% of the personnel in PHCs in Liloan and Consolacion, Cebu did not know where the thermometer must be placed inside the refrigerator for correct temperature monitoring. Even if regular monitoring of temperature is done, incorrect reading may be recorded if the thermometer is not placed correctly. Some respondents (36.4%) did not see the need for an emergency plan to anticipate situations such as power outage and disaster. Stressing on the cost of these vaccines, not having a backup plan in case of emergency may result to wastage of the vaccines or the risk of administering ineffective vaccines to recipients. The researchers would like to point out that the need for updating the training of the personnel be given priority. As there are limitations in terms of ideal equipment availability, investment should be placed on updating the training of the personnel so that no further compromise may be placed on potency of vaccines. National guidelines must be disseminated to all personnel handling vaccines and be followed accordingly. An interesting commentary article mentions that countries can no longer rely on a few trained personnel to distribute vaccines that are costly.[21] Improvement of distribution will require substantial increase on the number, training, and retention of logistics staff. It is good to note that several countries have started to offer degree programs in health supply chain management at the Masters level.[21] This signifies that advance degrees and leadership development programs create a capable workforce who understands the sensitivity of vaccines.

The data collected is based on the answers of each respondents on the provided structured-survey questionnaires. Hence, those who do not answer truthfully or is having difficulty in recalling the right information predisposes the results obtained to dishonesty and recall bias. Not all targeted PHCs/respondents gave consent to the study thus, the non-response rate had affected or biased the final results of the study. The same limitations from a study by Yakum *et al*.[13] indicated that there could be bias in the results knowing that the study was conducted at a particular period of the year and that the researchers could hardly know what happens throughout the year. Furthermore, updating the temperature twice daily or at the moment of observation with a thermometer may not actually show the extent of vaccine exposure to sub-optimal temperatures since the study only reported the exposure of vaccines to sub-optimal temperatures at the storage unit or equipment and vaccines can equally be exposed to sub-optimal temperatures during transfer and transportation to other PHCs.

CONCLUSIONS

The results of the study indicated that the availability of storage units and equipment was acceptable. The availability of power supply was also satisfactory since all PHCs use electricity. However, in terms of temperature monitoring, the results were not satisfactory. In the assessment of knowledge for each personnel, it was revealed from the statistical analysis made that there was no relationship between the statuses of public health centers to store vaccines and the level of knowledge of each personnel handling them. However, it is difficult to make a definite conclusion for this since the sample size was too small. Improvement of cold-chain management for vaccines in PHCs in Cebu is necessary. The main emphasis should be on power supply-related issues and the knowledge of health professionals who handles vaccines.

CONFLICT OF INTEREST

There are no conflicts of interest in any form in the conduct of the study.

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Original Research

What drives using antibiotic without prescriptions? A qualitative interview study of university students in United Arab Emirates

Khalid A. AL-KUBAISI, Mark DE STE CROIX, Don VINSON, Liz ELLIS, Suleiman I. SHARIF, Abduelmula R. ABDUELKAREM.

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Abstract

Background: Bacterial resistance to antibiotics is considered as natural phenomenon that occurs over the time due to genetic changes. Bacterial resistance to antibiotics is significantly increasing in the UAE. Self-medication with antibiotics has been identified as a major factor for the development of antibiotic resistance, which is significantly increasing in the UAE.

Objectives: The purpose of this study was to explore the factors that contribute to the use of antibiotics without prescriptions among first year healthcare university students in UAE.

Methods: Based on the findings of an earlier survey study, a qualitative interview study was designed to explore common themes related to student's knowledge, awareness, attitude, views, and perceptions. Data were analyzed thematically for the identification of themes and subthemes within the data through the use of coding.

Results: The interview study identified four main themes with multiple subthemes related to the use of antibiotics without a physician's prescription by first-year healthcare students. The thematic analysis of the interviews revealed four main themes; medication habits and practices; reasons for self-medication; access to antibiotics without a prescription and gaps in students' knowledge regarding antibiotic resistance

Conclusions: Healthcare students in UAE are influenced by several factors including parents and friends influence, successful previous experience and investment of time and money to visit a physician. Our sample of healthcare students has a misconception about the use of antibiotics. The current interview study identified six new reasons for using antibiotics without prescriptions as compared to our earlier survey study. There is a need of multifaceted strategies to decrease unnecessary antibiotic use in our population sample.

Keywords

Anti-Bacterial Agents; Self Medication; Students, Health Occupations; Drug Resistance, Bacterial; Attitude of Health Personnel; Prescription Drug Misuse; Qualitative Research; United Arab Emirates

INTRODUCTION

Bacterial resistance to antibiotics is considered as natural phenomenon that occurs over the time due to genetic changes. However, various factors lead to the acceleration of these processes and the development of antibiotic resistance. These factors include both the under-and over-use as well as the irresponsible use of antibiotics.[1] such a practice may be attributed to consumer's lack of knowledge about the rational use of antibiotics, or the wrong habits in using antimicrobials. A key cause, among others, of the increased antimicrobial resistance is self-medication with drugs on one's own initiative without consulting a qualified medical practitioner.[2,3]

Bacterial resistance to antibiotics is significantly increasing in the UAE.[4] Self-medication with antibiotics has been reported to be high among university students, with the highest prevalence of 77% and 80% being reported among Pakistani[5] and Sudanese[6] students respectively. On the other hand, 40% of self-medication with antibiotics was reported among Palestinian, Iranian and UAE students.[7-9] Our earlier unpublished cross sectional survey among university students identified a high prevalence of misuse of antibiotics among university students in UAE.[10] We also demonstrated that misuse of antibiotics was higher among healthcare than non-healthcare students particularly those in their first year at the university.[10] The purpose of this study was to explore the factors that contribute to the use of antibiotics without prescriptions among first year healthcare university students in UAE. Therefore, our interview study targeted junior medical students who are at high risk of misusing antibiotics to gain a better understanding of participants' knowledge, awareness, beliefs, attitude, behavior, experience and the reasons behind misusing antibiotics. Furthermore, there was a need to explore and understand students' views and conceptions of antibiotics, symptoms of condition and bacterial resistance.[11]

In the UAE, the health care system is well developed and the predominantly governmental facilities offer their services to all citizens. However, outside the secondary care sector the majority of patients obtain their medication

Khalid Awad AL-KUBAISI. MSc. University of Gloucestershire. Cheltenham (United Kingdom). Khalid@glos.ac.uk
Mark DE STE CROIX. PhD. University of Gloucestershire. Cheltenham (United Kingdom). mdestecroix@glos.ac.uk
Don VINSON. PhD. St John's Campus, University of Worcester, Worcester (United Kingdom). d.vinson@worc.ac.uk
Liz ELLIS. PhD. School of Health and Social Care, University of Gloucestershire. Cheltenham (United Kingdom). lellis2@glos.ac.uk
Suleiman Ibrahim SHARIF. PhD. Department of Pharmacy Practice and Pharmacotherapeutics, College of Pharmacy, University of Sharjah. Sharjah (United Arab Emirates). sharifsi@sharjah.ac.ae
Abduelmula R. ABDUELKAREM. PhD. Department of Pharmacy Practice and Pharmacotherapeutics, College of Pharmacy, University of Sharjah. Sharjah (United Arab Emirates). aabdelkarim@sharjah.ac.ae

from the growing number of private community pharmacies. Although pharmacy practices in community pharmacies in the Gulf area, such as in the UAE, has shown some improvement during the last 20 years, it has not yet fully gained the trust of the public or health professionals. This seems to be due to several reasons, including the misconception by the public and health professionals that pharmacists are deficient in professionalism. In addition, the workload pressure on community pharmacists and a lack of enforcement of the regulations governing pharmacy practice within both the community and hospital pharmacies restrict the role played by the pharmacist.

Humans have different personal perspectives and phenomenological research is a popular methodological approach in health Care research.[12] Since phenomenology rely on human experiences and often have different interpretations, phenomenological research helps researchers to see the phenomena under investigation through the eyes of the participants. Furthermore, it provides a mean to understand the sense of making a framework of each participant that has been developed over time to shape their subjective experiences regarding a particular phenomenon under study.[12] Therefore, we employed a qualitative research design to address the objectives of the study with the aim to re-evaluate the problem of misuse of antibiotics from a different perspective and to fill a gap in the literature with regard to this phenomenon. This study, based on phenomenological research, is the first report in the Gulf region including UAE to apply qualitative direct interview to explore the knowledge, attitude, belief and experience of university students towards using antibiotics without prescriptions. Therefore it is hoped to fill a gap in the literature with regard to this phenomenon. Our findings are broadly consistent with other qualitative study among the public in addition to quantitative surveys among university students.

METHODS

A qualitative research study design was conducted at the college of dentistry, Ajman University, UAE. Purposive or 'criterion-based' sampling was employed to recruit study subjects because this approach depends on certain criteria determined by the purpose of the study to decide the type of participants that need to be investigated (inclusion or exclusion criteria) and where and when to conduct the interview.[12] Purposive or 'criterion-based' sampling was employed in this work to recruit study subjects to allow for theoretical data saturation.[12]

Guest, Bunce, and Johnson propose that saturation often occurs around 12 participants in homogeneous groups.[13] Approximately 15 participants were recruited and a brief screening questionnaire was used to ensure eligibility. Each respondent was approached via an invitation letter and an informed consent form delivered by hand during the dental histology lab sessions.

The primary data collection method used in this study was semi-structured interviewing. This schedule has clearly defined goals and guidelines to make data collection systematic and at the same time offers flexibility to change the sequences of the questions and respond to circumstances during the interview. A face-to-face approach was employed in this study to build a relaxing and personal relationship with participants. Furthermore, face-to-face interviews assisted in overcoming some logistical challenges, such as obtaining the written informed consent from the participants prior to the interview and recoding the interview.

The interview topic guide was developed based on the risk factors identified from the survey study conducted by the same researchers. An Ethical approval from Ajman University was obtained prior to conducting the study. Permission to conduct the study and access study participants was also granted from the Dean of the College of Dentistry.

All participants in the study were provided with a clear explanation of its purpose and procedure. Protocols were established to protect all participants from being exposed to any harm during the course of their participation. All participants were given information sheets, which were reviewed and discussed in order for everyone to clearly understand the study's parameters and procedures. Each participant was also required to sign the consent form and to provide verbal confirmation. They were also advised that their participation was voluntary and that they could terminate their agreement to be in the study at any point in time without any repercussions. Each participant also provided verbal consent to be tape-recorded during the interview.

Reflexivity is important to promote the honesty and transparency of the research process with the aim of improving the quality of research in order to improve rigor.[14] Reflexivity and rigour were integrated at all stages of this research by the use of a reflection diary and an ongoing process of self-awareness and self-reflection, with the main focus on the researcher's subjectivity and how the relationship between both the researcher and the research environment altered the conduct of the study. Furthermore, the researchers undertook training in qualitative data collection and data analysis and consulted local advisor after each interview and during the analysis of the data.

The collected data was analyzed using thematic analysis, which is a method of analysis that aims to identify, analyze and report repeated patterns of meaning (or "themes") within a data set.[15]

There are different analytical methods such as interpretative phenomenological analysis (IPA), narrative analysis, discourse analysis, Content analysis, and grounded theory.[15] Thematic analysis was chosen as the method of analysis for this study as it is a flexible technique that enabled the researcher to determine themes in several ways.[15]

This study applied a theoretical thematic analysis using Andersen model[16,17], because this form of analysis provide more detailed analysis of some aspect of the data related to the risk factors identified from the survey rather than giving a rich description of the overall data .

As the analysis was driven by the theoretical propositions, the data was approached with specific research questions

Table 1. Theme One: Medication habits and practices.

Sub-theme	Quote
Sub-theme 1: Frequency of antibiotic use behavior (Nearly all participants)	"I generally do use antibiotics frequently when I get sick when I feel that I have flu or am starting a cough or am developing any symptoms or fever and such diseases" (Participant 9)
Sub-theme 2: Method of selecting antibiotics with five participants	"Usually when I self-medicate I took the one that I took from the last infection. If it has the same symptoms … with the same antibiotic I took. If it is the first time I have these symptoms I usually go to a doctor and find what is wrong with me exactly because it is the first time that I have a sequence of symptoms and all that" (Participant 1)
Sub-theme 3: Attitude of brand Preference	"For the branded antibiotic, because that is the one I always use. That is the one I'm generally prescribed" (participant 4)
Sub-theme 4: Self-medicated with other drugs	"Yes, usually I start off with Panadol and see. So, like I said, if I have a sore throat or a fever sometimes I do start with Panadol and then I see if I feel better the next day. If I don't then I go straight to the antibiotic"
Sub-theme 4: Differences between participant's experience and other students.	"I have had conversations with friends where they assume the antibiotic is the best way to go if they have a fever or a sore throat or anything like that"(Participant 14).
Sub-theme 5: Perception of pharmacists' advice	"He [pharmacist] advises me to complete the course, to take it before the breakfast or after the breakfast, twice or once a day. Only one week, such things" (participant 12).

in mind, rather than wanting research questions to evolve via the coding process. One of the researchers coded a section of the data and then meets with another researcher who has read the transcripts to discuss the emerging codes. This process can help to identify any potential themes the researcher had not yet captured so far; and to address the validity of the codes and to give constructive critique (Investigator Triangulation).

The use of respondent's validation involves the study's participants in the process of validation.[18] This study employed this method by presenting the findings in an oral presentation to the participants after the completion of the study. Respondents were able to check the consistency of the findings and interpretations and then offer clarification or feedback on issues they identified.

The guidelines outlined by Braun and Clarke were the basis for performing the thematic analyses in this study and are illustrated by the steps below: phase 1 familiarising yourself with your data; phase 2: generating initial codes; phase 3: searching for themes; phase 4: reviewing themes; phase 5 defining and naming themes; and phase 6 producing the report.[15]

RESULTS

The age range of participants was 18-22 years old with the majority (13, 86.7%) of them being 18 years old. With the exception of one British, the rest of participants were Arabs including 3Iraqi, 2 Emirati, 4 Egyptian, 2 Jordanian, 1 Palestinian, 1 Iranian, 1 Sudanese, and 1 British student with expatriates comprising 13 (86.7%) participants. Analysis of the data revealed four main themes relating to participants' experiences, knowledge, attitude, belief and perceptions about antibiotic use, which reflects the existing student understanding of the relationship between self-medication with antibiotics and the development of antibiotic resistance, as well as methods for potentially enhancing the level of awareness of students and public on rational use of antibiotics. These 4 themes include; medication habits and practices, reasons for self-medication, access to antibiotics without a prescription and perceptions of antibiotic and the development of resistance.

Theme one: Medication habits and practices:

The first theme revealed in the analysis of the interview data including responses that reflect the participants' descriptions of their personal experiences with self-medication. This theme comprised six subthemes namely frequency of antibiotic use, method of selecting antibiotics, attitude of brand preference, self-medicated with other drugs, differences between participant's experience and that of other students and perception of pharmacists' advice (Table1).

Theme two: Reasons for self-medication

As can be seen in Table 2, two different risk factors related to the reason for the use of antibiotics without prescription were identified from the survey study. These include saving money and urgency of use. Therefore, participants were probed to explain the reasons behind misusing antibiotics. When asked about the reasons for their self-medication with antibiotics, the most common responses highlighted were time constraints or scheduling difficulties, reliance on prior prescriptions given for similar symptoms, the urgency of their situations, and advice from parents or friends to take the antibiotics. In addition, participants also cited financial reasons and fear of not getting antibiotics from the first visit to the physician.

Theme three: Access to antibiotics without a prescription

This section examined how participants get access to antibiotics without visiting a physician (Table 3). According to the participants, there are several ways students gain access to antibiotics without a prescription. Thus, this theme consists of three subthemes including; using antibiotics leftover from another prescription, buying them from the pharmacy without a prescription, or getting the medication from a family member or friends. Despite the fact that most participants were aware that using leftover antibiotics was not rational, they still used them as long as they are not yet expired.

Table 2. Theme two: Reasons for self-medication	
Sub-theme	**Quote**
Subtheme 1: Time and Convenience	"Usually it is because of time. Us being students, like on the campus and all of that. You do not really have time and if it happens during the week and you still have lectures tomorrow or during the day, and we have a strict attendance so you know you cannot miss the lecture. So you need something to help you get through the day without it being a fact that makes you delays work or anything". (Participant 1)
Subtheme 2: Previous experience	"The same issue that I face in there, I face it one or three times in here so I will take the same antibiotics because it worked the first time so it will work the second or third time."(Participant 6)
Subtheme 3: Urgency of situations	"Usually it is time and urgency." (Participant 1)
Subtheme 4: Advice from friends and family	"as soon as I started getting worse my dad advised me to take some antibiotics." (Participant 9)
Subtheme 5: Advice from pharmacist	"It was based on the advice of the pharmacist who had given it to me".(Participant 5)
Subtheme 6: Financial reasons	"Financial cos you know nowadays it's really, expensive to go and see doctors and find … and I don't think it's a major problem to have a headache or some, you know some minor diseases. So, that's why I usually self-medicate myself" (participant 7).
Subtheme 7: Not wanting to worry family members	"But if it is fever and if it is during the night and I can't go to doctor or my parents are asleep, I'm usually scared to just tell them because they worry and all that. So yeah, I just end up taking an antibiotic." (Participant 1).

Theme four: Perceptions of antibiotic and antibiotic resistance

Participants were probed to describe their current level of knowledge about antibiotics and antibiotic resistance as well as the method of determining the dosage of antibiotics. During the discussion, participants were also probed further about their attitude towards using leftover antibiotics and whether they recommend antibiotics to others. A total of even key subthemes emerged from the analysis (Table 4).

DISCUSSION

The aim of this qualitative study was to gain a deeper understanding of the use of antibiotics without prescription. The semi-structured interviews were constructed based on the results of the quantitative survey study. Interestingly, the main message provided by participants' responses was that knowledge and awareness alone is not sufficient to change participants' behaviour towards using antibiotics with or without prescription. Behavioural change requires multiple approaches of which the researcher should be aware in order to enhance the likelihood of a successful intervention.

The semi-structured interviews had shown substantial misconceptions about the indications for antibiotics as most of the participants used it for illnesses that are usually caused by viruses rather than by bacteria. Furthermore, some participants confused antibiotics with painkillers as they usually used antibiotics for curing pain. This study also demonstrated that participants had several reasons for their self-use of antibiotics and multiple accesses to them without prescriptions. Most participants were at least somewhat familiar with the term antibiotic resistance and had some understanding of the phenomenon. Moreover, the majority of the participants know that self-medication with antibiotics contribute to the development of antibiotic resistance.

The respondents indicated that they frequently use antibiotics without a prescription when ill. According to a previous report[19] self-medication with drugs, home remedies or herbs without consulting a physician, in order to treat sickness was a common practice. While making informed decisions regarding one's own health is recommended[19], the self-medication with some drugs including antibiotics should not be encouraged. This statement is also supported by the suggestion that diagnostic processes are needed to determine whether an infection is bacterial or viral in origin with the use of antibiotics being rational or irrational respectively.[20,21]

In the present study, respondents were also probed for their habits in selecting antibiotics as a preferred drug for self-medication. The findings suggested that students often rely on previous recommendations from a physician for similar symptoms, or the pharmacist's advice and some of them claiming they take whatever is available in the house whether for a family member or past illnesses. Moreover, three of the participants believed that their university courses make them more prepared to make a decision regarding self-medication with antibiotics. Our results in this respect are similar to findings in India where the majority (685; 82.3%) of medical students practiced self-medication with antibiotics for symptoms such as fever, headaches, or respiratory tract infections.[22]

The respondents argued that their main reason for self-medication using antibiotics may be the effectiveness of such medications when previously taken to treat similar symptoms, the fact that they are saving time by not seeing a physician, urgency of use, financial reasons, or the

Table 3. Theme 3: Access to antibiotics without a prescription and its sub-themes	
Sub-theme	**Quote**
Subtheme 1: Leftover Antibiotics	"Well, yeah if it's not expired, I will take it. Because, why would I go buy another one if I already one." (Participant 7).
Subtheme 2: Pharmacy	"So, I went to a pharmacist and he prescribed me with antibiotic. And that is the first time I got an antibiotic from a pharmacy". (Participant 5).
Subtheme 3: Family	I'm not sure. I think my dad gets it from the hospital where he works from. But I don't go to the doctor and have a check-up in order to get it. (Participant 11).

Table 4. Theme four: Perceptions of antibiotic and antibiotic resistance and its subthemes.

Sub-theme	Quote
Subtheme 1: Antibiotic- seeking behavior	I started when I was in the school. Once I went to a doctor and he gave me an antibiotic, my mother realised that I got cured fast with the antibiotic so every time I get sick my mother goes and buys me an antibiotic. (Participant 13)
Subtheme 2: Knowledge about indications of antibiotics	"Well when I feel unwell and ill. Like even if I have a headache or something I usually take antibiotics" (Participant 7)
Subtheme 3: Effectiveness belief	"It is powerful but it depends on … if you are using it for the right bacterial infection some people use wrong antibiotics for the wrong bacteria so that won't be effective at all. So it depends on what you are treating in your body. Then the antibiotic will be effective and if you continue the course fully".(participant 1)
Subtheme 4: Method of determining the dosage of antibiotics	"I know that based upon reading the labels which are found on the boxes and based on the questions that I ask from the pharmacist from the pharmacy."(Participant 5)
Subtheme 5: Understanding of antibiotic resistance	"In some cases the bacteria may develop a mutation against the bacteria where they are no longer sensitive against the antibiotic and they are able to multiply and this will come into negative effect with the human " (participant 10).
Subtheme 6: Association between misusing antibiotics and developing antibiotic resistance	"Yes. Because if you are misusing it you are allowing your body a chance to build up resistance and you are not needing it so you are just building up useless resistance and it overall your body will stop reacting with the antibiotics." (Participant2).
Subtheme 7: Attitude towards recommending antibiotics to others	"I don't recommend them because I'm not a doctor and usually, I don't usually do the things which are not in my own criteria. So, I don't usually recommend anyone to do it." (Participant 6).
Subtheme 8 : Attitude towards completing the course of antibiotics	"When I came to know that finishing the course is really important, it is part of the treatment so I have to finish the course." (Participant 15)

encouragement they received from friends and family regarding antibiotic use. These findings are consistent with those reported in Saudi dental patients where 80% self-medicated with antibiotics and 72.9% of them based their use on friend's advice.[23] Another reason for resorting to self-medication, as highlighted by the respondents, was lack of time because of their busy study schedule. This reason was not a prevalent factor in some studies.[24,25] However, other studies claimed that lack of time and previous experience with similar symptoms are influential factors promoting self-medication.[5,26] Moreover, lack of time intermingles with the urgency of use.[5] It is interesting to point out that one of our respondents argued that she often self-medicated with antibiotics because she cannot visit a doctor at night when she gets a fever. In addition, a small number of respondents argued that their economic status is a reason for self-medication, as it is less expensive to purchase the medication without visiting a physician. This is further supported by reports that self-medication with antimicrobial drugs is common in low and middle-income countries.[27]

Easy access to antibiotics without a prescription as revealed by our thematic analysis indicates that students in the UAE can easily access antibiotics without a need for a specialist's prescription. In harmony with recent observations in the Middle East[28-30], the most common sources for obtaining antibiotics, according to our respondents, were left over from previous treatments, friends and family and pharmacies. Irrational antibiotic use for mild illness, such as fever, cold and cough has also been reported in Saudi patients[30] and more recently in Malaysia.[31] Intriguingly; in the later study a small (4.5%) number of participants used antibiotics to prevent illness. Despite the strict UAE regulations on dispensing antibiotics, the later seems to evade such restrictions as evident by one respondent admitting that his healthcare father freely brings the drugs to their home. This indeed suggests that not only the public but also healthcare professionals are misusing antibiotics.

In our present study, respondents also demonstrated the existence of significant gaps in their knowledge regarding responsible antibiotic use and the possible risk of development of resistance. This is consistent with the findings in Pakistan[28] where a large number of Pakistani students were unaware of the significance and risks of bacterial resistance. Moreover, only one participant in the present study was able to "define" correctly the antibiotic resistance. Their responses indicated they perceived antibiotic resistance as a change in the human body, not in the bacteria, as the body becomes resistant to the effect of the antibiotic. Similar confusion among patients in relation to antibiotic resistance has also been reported elsewhere.[32,33] In the studies of Sharif and co-workers[9,34], students were aware of antibiotic resistance however they did not provide details of this awareness.

Earlier studies[35,36] have shown that patients often expect a treatment using antibiotics for upper respiratory tract infections, which are generally of viral origin.[20] Poor knowledge and misconceptions about antibiotic use are enhanced in patients by physicians who prescribe antibiotics without thorough examination of their patients and also by pharmacists who freely dispense antibiotics without prescriptions. It has been suggested that in addition to poor law enforcement in UAE, an additional ethical component may contribute to the progression of the problem.[37] However, the assumption of the later authors that such a component is not encountered in other countries is not totally correct as shown by studies in other countries.[38,39]

Limitations

Limitations associated with this research included the sample size of the study, the selection process, cultural issues and sensitivities regarding revealing socially undesirable behaviors. The fact that the interview was conducted by a male foreigner who is not associated with the university may have also had an impact relating to culture and sensitivities to openly and freely speak about their experience of using antibiotics without prescriptions.

CONCLUSIONS

This study provides valuable data on irrational use of antibiotics. There is a clear misconception about the use of antibiotics in the sample under investigation. While few participants reported some knowledge of antibiotic resistance, there was little elaboration on secondary infections or consideration of misdiagnosis among the participants. More research is needed to determine the effectiveness of policy change on individual self-prescribing behaviors. Nevertheless, a parallel awareness campaign aimed at training physicians could help address the over-prescribing of antibiotics as perceived by the participants. More research is necessary to fully understand the medication experiences of students who frequently take antibiotics without a physician's prescription. Future research studies in the UAE should examine the effectiveness of enforcing laws prohibiting the selling of antibiotics without prescriptions.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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Original Research

Magnitude and determinants of uncontrolled blood pressure among hypertensive patients in Ethiopia: hospital-based observational study

Tadesse M. ABEGAZ, Ousman A. ABDELA, Akshaya S. BHAGAVATHULA, Fitsum S. TENI.
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Abstract

Background: Hypertension is an important public health problem worldwide. There is lack of data on uncontrolled blood pressure in developing countries.

Objectives: To determine the magnitude and predicting factors of uncontrolled blood pressure in hypertensive patients attending Gondar university hospital, Ethiopia.

Methods: A hospital-based cross-sectional survey was conducted from July 2015 to March 2016. All hypertensive patients were followed and the blood pressure levels were measured. Binary logistic regression analysis was done to determine the predictors of uncontrolled blood pressure. A p-value of <0.05 was set at priori with 95% confidence interval to test the level of significance.

Results: Of the total 578 hypertension patients, 543 (93.9%) fulfilled the study criteria and were included in the final analysis. The mean age of the participants was 55.96±14.6 years. Nearly two-third (58.2%) of the participants were females. More than one-tenth (11.4%) of the respondents had uncontrolled blood pressure. High salt intake carried six times more risk of uncontrolled blood pressure. Elderly individuals had lower risk as compared to young age group. However, comorbidities were not related with uncontrolled blood pressure.

Conclusions: Blood pressure control was relatively high in the hospital studied. High salt intake was strongly linked with uncontrolled blood pressure. Individuals with high salt intake should be followed for their medication experience and disease knowledge.

Keywords

Hypertension; Risk Factors; Sodium Chloride, Dietary; Dietary Approaches To Stop Hypertension; Diet, Sodium-Restricted; Blood Pressure; Cross-Sectional Studies; Ethiopia

INTRODUCTION

Hypertension (HTN) is an important public health problem worldwide. According to the Report of the Joint National Committee on Prevention, Detection and Evaluation of High Blood Pressure JNC-7, hypertension is said to be uncontrolled when the blood pressure (BP) exceeds 140/90 mmHg. The targets BP should be below 130/80 mmHg patients with diabetes mellitus (DM) and chronic kidney disease (CKD).[1] Therefore, uncontrolled blood pressure (UBP) occur when these target are not achieved. Attaining the goal of optimal medication therapy is difficult for most chronic diseases including HTN.[2] It is evident in previous study that in spite of accessible therapeutic alternatives, blood pressure remained above the cut-off point (140/90) in large number of hypertensive patients in Ethiopia.[3] A report from Center for Disease Prevention and Control (CDC) found that the rate of UBP approached to 53.5% in United States of America (USA).[4] A meta-analysis also showed that in most sub-Saharan Africa (SSA), the control of BP to the target level (140/90) was less than 30%.[5] However, a recent study done in Addis Ababa, Ethiopia, reported that approximately 60% hypertensive patients achieved target BP level.[6]

UBP predisposes patients to cardiovascular, cerebrovascular and renal events. It is an independent risk factor for cardiovascular and cerebrovascular accidents.[7] According to a World Health Organization (WHO) report, about more than one-half of cardiovascular diseases (CVD) and three-fourth of strokes are consequences of high BP.[8] It was estimated that 62% of cerebrovascular disease and approximately half of ischemic heart disease were attributable to elevated BP worldwide.[9] The magnitude of UBP is becoming of public health importance in developing countries including Ethiopia as evidenced by study findings.[10-13]

A review on HTN in developing countries cited a number of factors related to its prevalence including urbanization, ageing of population and social stress. Reasons for BP control in these countries were discussed in the review. These included problems including poverty, limited access to health facilities and high cost of medicines in addition to problems in dietary habits.[14]

Studies have shown that, multiple factors were found to contribute for inadequate HTN control. Particularly, non-adherence is a potentially modifiable risk factor that affects BP control.[15-17] Other factors such as male sex, age and

Tadesse Melaku ABEGAZ. BPharm, MSc, Department of clinical pharmacy, School of Pharmacy, College of Medicine and Health Sciences, University of Gondar. Gondar (Ethiopia). abegaztadesse981@gmail.com
Ousman Abubeker ABDELA. Department of Clinical pharmacy, School of Pharmacy, College of Medicine and Health Sciences, University of Gondar. Gondar, (Ethiopia). ousmy2009@gmail.com
Akshaya Srikanth BHAGAVATHULA. PharmD, Assistant professor. Department of Clinical Pharmacy, School of Pharmacy, College of Medicine and Health Sciences, University of Gondar. Gondar (Ethiopia). akshaypharmd@gmail.com
Fitsum Sebsibe TENI. BPharm, MSc. Department of Pharmaceutics and Social Pharmacy, School of Pharmacy, College of Medicine and Health Sciences, Addis Ababa University. Addis Ababa (Ethiopia). fitse4@gmail.com

comorbidities specifically DM were associated with elevated BP.[18]

In order to achieve optimal BP level, various types of alternatives have been investigated. Long-term randomized controlled trials (RCTs) have shown that incidence of cardiovascular accidents were significantly reduced due to the appropriate use of antihypertensive drug therapy (AHT) with the correct dose, frequency and duration.[19] The application of proper lifestyle instructions such as exercise and diet were supposed to work along with or in place of medical therapy.[20,21] However, these interventions might not be thoroughly implemented by the patient due to compliance issues.[22,23] Furthermore, hypertension may occur as a coincidence or as a complication to other comorbidities, which demand strong BP control. In such instances, the achievement of tight control of BP is difficult as compared to other hypertensive cases.[24]

Therefore, adequate control of BP requires the identification of factors associated with uncontrolled hypertension. To our best knowledge there is lack of data on the exposing factors for UBP in our population. Few community based studies if any, focus on the level and determinants of adherence to antihypertensive medications.[25] Thus, this study aims to comprehensively assess the magnitude and the predictors of UBP in hypertensive patients attending the outpatient department of Gondar University Hospital (GUH), Ethiopia.

METHODS

Study setting and period

The study was conducted in GUH outpatient department from July 1, 2015 to March 30, 2016. GUH is located in Gondar town which is found in the northwestern part of Ethiopia. It is a referral and teaching hospital with a catchment population of more than 5 million. The outpatient department of the hospital comprises medical outpatient department (OPD) and chronic illness wards. The chronic disease ward is composed of cardiovascular, asthma, DM and CKD units. HTN is the most common disease among cardiovascular cases seen in the hospital. Hence, frequent appointments are arranged to follow high turnover of patients.

Study design

A hospital-based cross-sectional survey was conducted in GUH outpatient department.

A total of 578 hypertensive patients who were available during the study period (from July 1, 2015 to March 30, 2016) were screened for eligibility. Of these, 543 patients satisfied the inclusion criteria and were considered for the study.

Inclusion and exclusion criteria

All adult hypertensive patients who did have follow-up at GUH during the study period and willing to participate were included. Patients who didn't started medication atleast a month before and had irregular follow-up were excluded.

Variables

The dependent variable in the study was the level of BP of patients in their last follow-up. The independent variables included age, sex, comorbidity, level of adherence, dose of medications number of regimens and salt intake of patients.

Data collection procedure

Data was collected by all investigators who have been working as mentors and clinical pharmacists at the emergency and ambulatory wards of GUH. A structured questionnaire was prepared to collect all relevant information. Patients' medical records were reviewed to retrieve the sociodemographic data. Supplementary information was taken from physicians when they take histories from patients. The BP goal was set 140/90 mmHg for most hypertensive patients and 130/80 mmHg for patient with CKD and DM.[1] The level of adherence of patients and the amount of dose of the antihypertensive medication were assessed routinely by the follow-up physicians. Low dose of antihypertensive medication was identified referring to physicians' orders and comparing the dose with a standard stated in national treatment guideline.[26] Adherence of patients towards their medication was measured by the number of pills they brought back with them (pill count). Adherence by pill count was considered to be achieved if 80% to 100% of the prescribed pills were not returned to the clinic/ pharmacy during refill. The results of the assessment were documented and kept inside locked box to maintain confidentiality.

BP measurement procedure

The BP was measured by senior physician who followed hypertensive patients during their office visit. Patients were allowed to relax for 5 minutes before the first reading of BP. Patients assume upright position in such a way that their upper arm is at their heart level. They were also told not to take tea or coffee. Excess clothing that might affect the BP cuff was removed. Patients were kept calm during BP measurement. The proper BP cuff size that fit with individual patient's arm was selected. The BP cuff has inflated enough to stop blood flow until no sounds was heard through the stethoscope. Then the cuff deflates slowly to measure the systolic and diastolic BP. Three readings were taken and average of the readings was considered for data analysis.[27]

Salt intake measurement

The extent of salt intake was measured based on WHO recommendations. Accordingly, optimal salt intake is defined as consumption below 5gram per day or equivalent to one teaspoon full. High salt intake represents a daily salt consumption of more than one teaspoonful or 5gram per day. Patients were told to report their salt consumption in terms of gram or teaspoon based on their level of understanding.[28]

Ethics approval and consent to participate

The study protocol was approved by the Institutional ethical committee from School of Pharmacy, University of Gondar (UoG). Verbal consent was obtained from

Table 1. Hypertensive patients socio-demographic characteristics, University of Gondar Hospital; July, 2015 to march 30, 2016. (N= 543)

Variables	Num. patients (%)
Sex	
Female	316 (58.2)
Male	227 (41.8)
Age	
21-30	24 (4.4)
31-40	66 (12.4)
41-50	86 (15.8)
51-60	143 (26.3)
61-70	133 (24.4
70+	91 (16.7)
Residence	
Urban	430 (79.2)
Rural	113 (20.8)
Co-morbidities (N= 153)	
Diabetes mellitus	51 (33.3)
Cardiovascular diseases	26 (17.0)
Dyslipidemia	22 (14.3)
Arthritis	18 (11.7)
Peptic ulcer diseases	16 (10.4)
Asthma	16 (10.4)
Others	4 (2.6)
Level of adherence	
Adherent	465 (85.64)
Non-adherent	78 (14.36)
Adherent with controlled BP	414 (76.2)
Adherent with uncontrolled BP	51 (25.8)
Rate of BP control	
Controlled	481 (88.6)
Uncontrolled	62 (11.4)

participants for their willingness to participate in the research and contact information of the researchers were provided. Participation in the research was voluntary and no compensation was provided. Confidentiality of the data was maintained by not disclosing any personal details of the study participants.

Data analysis

The obtained data was entered into and analyzed by SPSS software version 20 for windows. Descriptive statistics including frequency, percentage, mean and standard deviations were done to describe sociodemographic variables. Binary logistic regression analysis was done to determine the predictors of UBP. A p-value of <0.05 was regarded as statistically significant in the regression models with 95% confidence interval to test the level of significance.

RESULTS

A total of 578 hypertension patients followed, 543 (93.9%) fulfilled the study criteria included in the final analysis. The mean age of the participants was 55.96 (SD=14.6). Female participants constituted nearly two-third (316, 58.2%) of the study population. The number of individuals aged older than 50 years accounted for (67.4%) of the respondents, and nearly (79.2%) of the patients were from urban areas. The mean systolic and diastolic BP level of participants was 138 (SD=11.2) and 87 (SD=5.6) mmHg, respectively. The prevalence of comorbidities was 28% (n=153) of which 33.3% were attributed to DM, other CVDs (17%) and 14.4% with dyslipidemia, respectively (Table 1).

Table 2. Patterns of antihypertensive medication prescription at University of Gondar Hospital, July 1, 2015 to March 30, 2016.

Medication	Num. patients (%)
Hydrochlorthiazide	150 (27.62)
Enalapril+ hydrochlorthiazide	124 (22.83)
Hydrochlorthiazide + nifedipine	68 (12.52)
Enalapril	44 (8.10)
Nifedipine	30 (5.52)
Enalapril + furosemide	19 (3.50)
Atenolol + hydrochlorthiazide + Eealpril	18 (3.31)
Nifedipine + enalapril	17 (3.13)
Furosemide + spironolactone	16 (2.94)
Hydrochlorthiazide +atenolol	15 (2.76)
Atenolol + nifedipine	13 (2.40)
Amlodipine	10 (1.84)
Furosemide	7 (1.30)
Atenolol	4 (0.74)
Enalapril + hydrochlorthiazide + furosemide	4 (0.74)
Nifedipine + hydrochlorthiazide + enalapril	3 (0.55)
Amlodipine / nifedipine + furosemide	1 (0.18)

The vast majority (95.2%) of study participants were on mono-therapy and dual therapy. Hydrochlorothiazide is the most frequently prescribed mono antihypertensive medication with which 27.6% (n=150) of study participants were on. This is followed by enalapril (44, 8.1%) and nifedipine (30, 5.5%). On the other hand, the most frequently used dual therapy consisted of enalapril with hydrochlorthiazide (124, 22.8%), enalapril with furosemide (19, 3.5%) and nifedipine with enalapril (17, 3.1%). Similarly, 26 study participants (4.8 %) were on triple therapy where atenolol, hydrochlorthiazide and enalpril were combined for 18 of them (Table 2). More than one tenth (11.4%) of hypertensive patients experienced UBP status during their last visit.

The most significant determinant factors associated with the occurrence of UBP were shown in Table 3. Hypertensive patients with high salt intake were six times more likely to encounter UBP than those who took normal amount (adjusted odds ratio (aOR)=6.271 95%CI=[2.047-19.214]), controlling for other variables. Individuals between age group of 31 and 40 years (aOR=0.136 [0.029-0.650], 51-60 (aOR=0.261 [0.079-0.861] and >70 (aOR=0.249 [0.069-0.896]) had lower risk of UBP than those in the age group of 21-30. However, the number of regimen, sex, residence and comorbidities were not related with the incidence of UBP in a statistically significant manner (Table 3).

DISCUSSION

Target BP is difficult to achieve as different factors contributing for UBP and may lead to multiple end organ damages.[7-9] This study determined the level of BP control and associated factors in a tertiary teaching hospital. It was found that there was a high level of controlled BP (88.6%) among hypertensive patients on treatment. Unlike these study findings, similar study conducted in Michigan reported that only small proportion of patients attained goal BP (38.2%). A large number of DM patients in the Michigan study (122) could be a reason for the variation between the two groups of patients.[18] Another study also revealed the poorest rate of BP control among diabetics (55.8%) and renal impairment patients (18.1%).[29] About

Table 3. Determinant factors of uncontrolled blood pressure (UBP) in hypertensive patients

Variable	UBP 62(11.4%)	Crude OR [95% CI]	Adjusted OR [95% CI]	p-value
Sex				
Male	29 (12.8)	1.256 [0.739-2.136]	1.490 [0.848-2.618]	0.307
Female	33 (10.4)	1	1	
Age group (years)				
21-30	5 (20.8)	1	1	
31-40	3 (4.5)	0.181 [0.040-0.828]*	0.136 [0.029-0.650]*	0.033
41-50	20 (23.3)	1.152 [0.381-3.476]	0.927 [0.290-2.961]	0.576
51-60	11 (7.7)	0.317 [0.099-1.012]	0.261 [0.079-0.861]*	0.022
61-70	15 (11.3)	0.483 [0.157-1.484]	0.346 [0.107-1.117]	0.961
>70	8 (8.8)	0.366 [0.108-1.245]	0.249 [0.069-0.896]*	0.041
Residence				
Urban	51 (11.9)	1.248 [0.628-2.481]	1.206 [0.579-2.512]	0.580
Rural	11 (9.7)	1	1	
Adherence				
Adherent	51 (11.0)	1	1	
Non-Adherent	11 (14.1)	1.333 [0.661-2.686]	1.637 [0.763-3.513]	0.626
Co-morbidity				
Yes	5 (22.7)	2.394 [0.851-6.736]	2.914 [0.935-9.084]	0.151
No	57 (10.9)	1	1	
Salt intake				
High	6 (35.3)	4.578 [1.630-12.856]*	6.271 [2.047-19.214]*	0.021
Optimal	56 (10.6)	1	1	
Dose				
Low dose	5 (12.5)	1.118 [0.421-2.969]	1.209 [0.426-3.433]	0.862
Normal	57 (11.3)	1	1	
Regimen				
Mono-therapy	22 (8.8)	1	1	
Dual-therapy	31 (13.4)	1.599 [0.897-2.852]	1.576 [0.852-2.912]	0.618
Triple- therapy	9 (14.3)	1.720 [0.750-3.945]	1.590 [0.658-3.840]	0.924

60% BP control was reported in Addis Ababa and concomitant DM and CKD were found to be associated with the lower proportion.[6] Over three quarter of DM patients in South Africa failed to attain target BP.[30] BP control in other sub-Saharan countries was found to be below 30%.The discrepancy between the present study and the former studies could be due to the high level of non-adherence (54.2%) in the previous studies versus 14.3% in this study (Table 3).[31]

Studies conducted in Kenya stated that male sex was strongly associated with the high incidence of UBP. But, in this study gender was not related with UBP.[32] In addition, it is evident in this study that the patients' level of adherence to antihypertensive medication was not implicated with the occurrence of UBP. But, other study findings indicated non-adherent patients have experienced higher incidence of UBP than their counter parts.[15] Dave *et al*. also suggested that non-adherence with medications was significant predictors of uncontrolled HTN.[33] Another study reported significant variation in the level of BP control among adherents and non-adherents.[34] This inconsistence might be due to the involvement of the patients in alternative non pharmacologic hypertensive therapy or lifestyle modifications such as exercise and Dietary Approaches to Stop Hypertension (DASH) therapy.[35]

The coincidence of comorbidities such as DM, heart failure and CKD were frequently observed in HTN patients. These ailments are found to contribute for progression of HTN by involving in its pathogenesis, although no hypothesis has been able to elucidate the clear mechanism of the development of HTN from these comorbidities as the majority of the presentation is classified as primary. In the present study, the coincidence of HTN with other comorbidities was not statistically associated with the occurrence of UBP. This discrepancy could be due to the early detection, control and appropriate management of comorbid conditions. Management of HTN relies on the proper handling of these illnesses. For this, experts have prepared a lower cut-off point of BP for DM, CKD and Coronary Artery Disease (CAD). The drug selection was also based on the presence of comorbidities commonly called "compelling indication" and targeting the lower cut point during management process of HTN in these special population with the most appropriate regimen is associated with low incidence of UBP and its complications.[1] The appropriate treatment of comorbidities could substantially reduce their impact on BP. For instance, strict glycemic control and slow progression of CKD reduces the vascular damage and fluid retention, respectively. Hence, despite the occurrence of comorbidities it could be reasonable to see tight BP control as long as the comorbid conditions is adequately managed. In addition to this, exposure of patients to medication to treat these comorbidities would probably increase their experience of complying with instructions, coping with side effects and dealing with polypharmacy.[36] This justification is supported by the finding of large number (>75%) of adherent and controlled cases in this study despite 28% of comorbidities. Another study revealed that duration of antihypertensive drug use and morbidity count had significant associations with BP control.[37]

The amount of dose was not found to be related with the incidence of UBP. Due to fear of side effects clinicians usually start their patients with lower effective pharmacologic dose of antihypertensive drug. Based on the response and tolerability of the side effects, doses could be escalated. However, patients are usually non-responsive for

this dose. They need either additional dose or additional drug. Based on the JNC-7 patients whose current medication is not working should receive either high dose or new regimen on top of the previous medication.[1] The lack of difference in response between patients who took lowest effective dose and normal therapeutic dose could be placement of significant number of patients on more than one drug (42.5%) and triple therapy (11.6%) that might acquire synergistic activity eventhough their dose is the lowest possible.[38] Meta-analysis finding indicated that, the amount of sodium could attribute for UBP by retaining water and increasing the cardiac output (CO). BP is the product of CO and peripheral resistance. If CO increases, it increases BP. During their investigation Ha stated that salt was strongly associated with elevated BP. Patients with low average daily salt intakes had low BP.[9] This study has also demonstrated that high amount of salt intake increased the incidence of UBP nearly six times as compared to optimal dose. WHO advocated to reduce dietary salt intake to lower incidence of non-communicable disease burden and called nations to take action to reduce population wide dietary salt intake especially in elderly patients that are more salt sensitive.[9] In Ethiopia salt is added in most of the food items during dish preparation. Hence, patients could face difficulties to optimize the recommended dose of daily salt allowance of nearly 6 g unless they are strictly advised by the health care professionals.[15] Middle aged and elderly individuals experienced lower rate of elevated BP than their young counter parts. This could be the low level of awareness and medication experiences in the young patients. A study on Chinese hypertensive subjects indicated that old age and long standing hypertension were associated with high level of adherence while adherence in turn was associated with controlled BP.[39] In the present study, the common order of medication prescribed for the patients were, dual therapy and mono-therapy followed by triple therapy. This pattern was comparable with a finding reported by Oliveira-Filho *et al*. study in which antihypertensive mono-therapy was prescribed to 47.1% of patients whereas 45.3% and 7.1% were taking two and ≥3 drugs, respectively. In this study, antihypertensive mono-therapy was prescribed to 45.1% of patients whereas 50.1% and 4.8% were taking dual and triple drugs respectively.[40] The present study provided valuable information on the level of BP control and its predictors in developing country. Nonetheless, it was not without limitations. The study was a mono-center study. Therefore, rigorous evaluation of potential predicting factors from different population at community level is required. Hence, authors recommend another community based multi-center studies incorporating large number of subjects.

CONCLUSIONS

In conclusion, BP control was relatively higher in the set-up. High salt intake was an important determinant factor of UBP. Middle to old age groups were associated with low incidence of UBP. However, the level of adherence, sex, number of antihypertensive medications and amount of dose didn't affect the extent of BP control. The chronic illness department of the tertiary hospital should consider establishing a counseling unit on non-pharmacologic alternatives for chronic diseases management and should link patients to this unit so as to optimize high salt intake. The Ministry of Health of Ethiopia should work to increase the level of understanding of the population towards the consequences of high salt intake. This study demonstrated possible predictors of UBP. The findings of the study would be very important in counter acting risk factors by giving attention and priorities to the most responsible factors.

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CONFLICT OF INTEREST

None.

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None.

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Original Research

Communicating risk of medication side-effects: role of communication format on risk perception

Ruta SAWANT, Sujit SANSGIRY.

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Abstract

Background: Medication side-effects often arouse fear in the minds of consumers and therefore need to be communicated in a manner such that the intended message is clearly understood, without causing undue fear.

Objectives: Considering the message format and contextual factors that influence perceptions of risk, this study aimed at assessing the interaction effects of message format and contextual factors (rate of occurrence and severity) on risk perception of medication side-effects.

Methods: Using Rhormann's risk communication process model, a 2 (message format: words-only vs. words + numeric) X 2 (rate of occurrence: high vs low) X 2 (severity: mild vs severe) experimental factorial study was designed. Participants were presented with four of eight possible combinations of the three factors and were asked to indicate the risk perception with the associated side-effects. Repeated measures analysis was conducted while adjusting for control variables.

Results: A total of 196 completed surveys were collected. Communication format did not have significant main effect on risk perception (P=0.4237) but demonstrated a significant interaction with rate of occurrence (P=0.0001). As compared to words-only format, least square means for words + numeric format were lower among low-rate side-effects but were higher among high-rate side-effects. Rate of occurrence (P<0.0001) and severity (P<0.0001) had significant main effects on risk perception as well as interaction effect with each other (P<0.0001).

Conclusions: The results indicated that effect of communication format on risk perception of side-effect is dependent on the underlying rate of occurrence of side-effect. Healthcare providers should therefore carefully construct risk communication messages for effective communication with patients.

Keywords

Drug-Related Side Effects and Adverse Reactions; Health Risk Behaviors; Risk Reduction Behavior; Health Communication; Models, Theoretical; Surveys and Questionnaires; United States

INTRODUCTION

Consumers' decision towards a healthcare behavior is dependent on the perceptions of risks and benefits associated with the behavior.[1] Decision making is particularly important in the case of medications for chronic conditions, wherein decision to adhere to treatment regimen and following the appropriate prescribed regimen is an important factor in optimizing treatment effectiveness.[2] It is well known that lack of adherence is one of the causative factors for poor health outcomes and increasing costs.[3] At the same time, problematic patterns of adherence to regimen due to misunderstanding of appropriate medication use instructions or variability in adopting to standardize guidelines for communicating medication use information have been significant challenges faced by the healthcare sector. Previous studies have reported that more information regarding the medication and treatment options may improve adherence among patients.[4,5] Misunderstanding of information provided has been reported to be associated with lack of adherence to intended course of action.[6] Therefore communicating medication information, in an understandable manner is essential to ensure appropriate medication use.

Consumers and patients prefer specific, detailed and readily-accessible information regarding side-effects[7,8], and make decisions based on a risk versus benefit assessment of the treatment.[7,9] Patients often correlate safety of the medication to the side-effects and base their decisions to adhere depending on the side effects.[10] Conventionally risk of side-effects is presented using either words-only descriptors or numeric descriptors. Words-only descriptors refer to non-numeric descriptors, which use only words such as 'rarely', 'likely' or 'commonly', to describe the frequency of the side-effects and do not include any numeric information. Such descriptors are often used in spoken as well as written communications and are somewhat vague and difficult to interpret. Healthcare providers often use words-only descriptors to communicate information about side-effects.[11] Patients on the other hand, prefer numbers rather than words such as 'likely', while receiving information about medication side effects.[12] Although numeric information may provide more detailed description of the rate of occurrence of side-effects, the numeric information may not always be correctly interpreted leading to differing perceptions about safety and risk.[13]

The European Commission Pharmaceutical Committee provides some guidance on specific verbal (words-only) descriptors of risk and their corresponding numeric probabilities.[14,15] However a wide variability exists in interpretation of words-only expressions and when

Ruta SAWANT. MSs. Department of Pharmaceutical Health Outcomes and Policy, College of Pharmacy, University of Houston. Houston, Tx (United States). rvsawant2@uh.edu
Sujit SANSGIRY. PhD. Professor. Department of Pharmaceutical Health Outcomes and Policy, College of Pharmacy, University of Houston. Houston, Tx (United States). ssansgiry@uh.edu

patient's interpretation differ from that of healthcare providers, compliance problems may arise.[15] In a study evaluating the European Union (EU) and Medicines and Health Products Regulatory Agency's (MHRA) recommendations for words-only descriptions and associated numeric frequencies, the recommendations by the agency failed to correlate with general consumers' interpretations of the words-only descriptions.[16] It was observed that patients, doctors as well as general public overestimated risk based on the recommended descriptions. Recent research conducted by Blalock and colleagues reported that non-numeric (words-only) information on side-effect risk conveys that medication can cause harm and thus decreases willingness to use the medication.[17] Despite the inconsistencies in interpretations with words-only descriptors, pharmacists mostly use vague words-only descriptions in their counseling sessions with patients.[18,19] Words-only descriptions seem to be advantageous because they are more natural to use and better appeal to a person's emotional interests.[20] Although some literature reports that use of terms such as 'may' or 'if…' may lead to positive attitude about the medications or willingness to experiencing side effects, it may not necessarily reflect accurate comprehension.[8,21,22] Numbers or numeric descriptors on the other hand may communicate frequencies of side effects more accurately and may lead to a better understanding of the side effects both by patients and physicians.[23,24]

Words-only and numeric descriptors both have pros and cons. Due to the more natural appeal and familiarity of words-only descriptors, it is unreasonable to eliminate their use in communicating risk information for side-effects. However, inclusion of numeric descriptors along with the words-only descriptors may account for the advantages of both and mitigate the unintended consequences of misinterpretation. Research in psychology and education has suggested that presentation of information in multiple formats increases understanding.[25] For e.g., in the case of words-only and visual representations, parallel learning from both formats lead to better memory of the information as well as greater integration with the knowledge. However it is yet unclear whether the combination of words-only and numeric descriptors is superior to either communication format alone.[26] Therefore we aimed to examine the effect of two different written communication formats, one with words-only descriptors and the other with a combination of words and numeric descriptors on risk perceptions of experiencing medication side-effects.

An important aspect often overlooked in studies evaluating risk perception with different communication formats is the context in which the risk is embedded. According to a socio-psychological model developed by Rohrmann in 1999 for analyzing risk communication process, the characteristics of the risk message and the context in which the communication process occurs determines the results of risk communication efforts.[27] In the case of the current study, characteristics of the risk message were defined by the communication format. Context of the side-effect risk was defined by the rate of occurrence (henceforth referred to as 'rate') and the severity of the side-effect. Previous studies have reported that rate and severity have an impact on risk perception with manipulations of severity having the greatest impact on individuals'' judgement.[28-30]

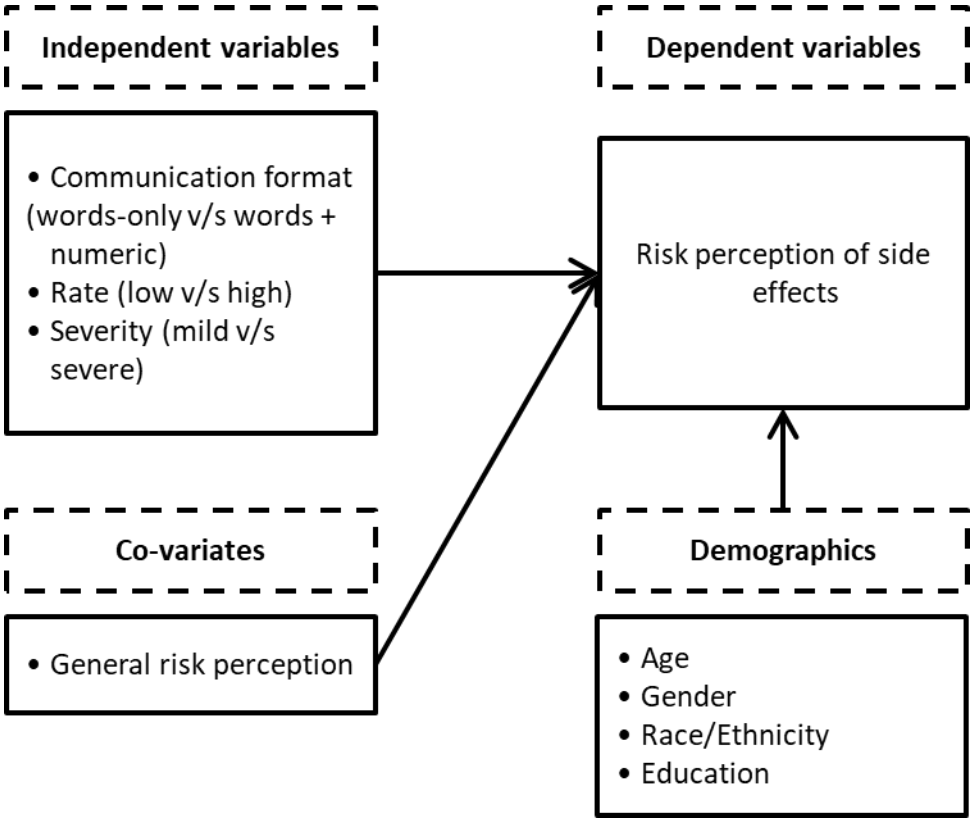


Figure 1. Study Model Based on Rohrmann's Risk Communication Process Framework.

Table 1. Selected study side-effects and associated severity, rate and communication style descriptions

Side-effect	Severity	Rate	Words-only Description	Numeric Description
Stomach Bleeding	Severe	Low	very rarely	2 out of 100
		High	likely	70 out of 100
Facial Flushing	Mild	Low	rarely	10 out of 100
		High	very likely	85 out of 100

However no study has yet evaluated the interaction of all three factors i.e., the communication format, rate and severity of the side effect in shaping the perceptions of risk associated with medication side-effects. The risk communication process framework also posits that risk appraisal (i.e., risk perception) is also affected by prior risk perception, risk specific biases, and general individual characteristics. A final model based on the risk communication process framework was thus operationalized as seen in Figure 1. The primary objective of the study was to evaluate the impact of communication format, side effect rate and severity on risk perceptions. The communication format in the current study refers to written information about side-effects that may be publicly available to individuals seeking information about medications (example: patient information leaflets).

METHODS

Sample and study design

The sample consisted of adults greater than 18 years of age, recruited via convenience sampling method. Data was collected from May 2014 to June 2014 from places of public congregation such as public parks. Individuals were approached, and a short communique was recited regarding the study objectives. Once the participants consented to participate in the study, they were provided with the survey booklet. Participants were briefly explained that they would see some information about a drug followed by some questions regarding the information that they view; and that the process will be repeated four times. After completion, the researcher requested each participant to fold the survey and drop it in a data collected box so that no specific survey could be linked to any participant. Additionally, no identifying information was obtained as a part of the survey thus ensuring anonymity. No incentives were provided for participation in the study. The study was approved by University of Houston's Institutional Review Board.

An experimental cross-sectional factorial design was used to address the study objectives. The factorial design consisted of three factors with two levels each (2x2x2 factorial). The three factors were communication format, side-effect rate and side-effect severity (Table 1). These three factors represented the characteristics of the side-effect information. The information about side-effects was presented to the participants as a component of a drug information box (DIB). The DIB consisted of drug name (de-identified using labels A, B, C and D to avoid any biases due to prior knowledge, familiarity, or experience with the drugs), drug use and information about one drug side-effect. The side-effect information had three characteristics corresponding to the three factors being tested i.e. communication format, rate and severity, each with two levels. The two levels of communication formats were (i) words-only format and (ii) words + numeric format (combined), those for rate were (i) low and (ii) high and those for severity were (i) mild and (ii) severe. Thus three factors, each with two levels produced a total of eight possible combinations. Information about a side-effect in a DIB could be presented using either of the eight combinations. The experiment was set up in a manner wherein the eight combinations were divided into two groups (Table 2) and each participant was randomly assigned to one of the two groups. Thus, each participant received four DIBs based on the group assignment, and each DIB contained information on one side-effect presented using a combination of the three factors.

Development and structure of drug information box

Online Appendix presents the DIBs used in the study. The statements for description of side-effects were developed using information from drug package inserts and existing literature and were presented as follows:

Words description: Drug [X] will [Y] cause [Z]

Combined (words + numeric) description: Drug [X] will [Y] cause [Z]. Out of 100 people taking Drug [X], [W] will experience [Z].

Where,

X = Drug letter A, B, C or D

Y = Words-only description of side effect rate

Z = Side effect

W = Numeric description of side effect

Table 2. Study groups based on eight possible combinations in the 2 (communication style: words-only versus words-only combined with numeric) X 2 (rate: low versus high) X 2(severity: mild versus severe) factorial design

Drug name	Side-effect	Severity	Rate	Communication style
Group 1				
A	Stomach Bleeding	Severe	Low	Words-only
B	Facial Flushing	Mild	Low	Words-only
C	Stomach Bleeding	Severe	High	Combined
D	Facial Flushing	Mild	High	Combined
Group 2				
A	Stomach Bleeding	Severe	Low	Combined
B	Facial Flushing	Mild	Low	Combined
C	Stomach Bleeding	Severe	High	Words-only
D	Facial Flushing	Mild	High	Words-only

Table 3. Repeated Measures Analysis of Covariance for the Effect of Communication Style, Rate, and Severity on Risk Perception of Experiencing Side-Effects

Variable	DF	F Value	P-value
Communication style (C)	1	0.64	0.42
Rate (R)	1	325.63	<.0001
Severity (S)	1	190.77	<.0001
R x S	1	88.62	<.0001
R x C	1	15.57	0.0001
S x C	1	2.38	0.12
F x S x C	1	0.07	0.80
General risk perception	1	23.41	<0.0001
Age	1	7.38	0.0072
Race/ethnicity	4	3.06	0.0181

Numeric descriptors can be presented in different formats such as natural frequencies (e.g., 5 out of 100), absolute (50 % chance) or relative risks (e.g., 70% risk reduction). Among all these formats, natural frequencies have been reported to be better and easier to understand and lead to more adequate statistical reasoning and more accurate risk estimates.[23,31,32] The current study therefore used natural frequencies for numeric descriptors. With respect to words-only descriptors, , 'very rarely' and 'rarely' were used for low rate side-effects and 'very likely' and 'likely' were used for high rate side-effects. This was done to minimize effect of prior exposure/viewing of the descriptors in one DIB on the perception about descriptors in subsequent DIBs.

Study variables

Before presenting the DIBs, general risk perception of participants was measured using the question "How risky do you believe it is in general to take medications for any condition?" Responses were measured on a 0 to 100 visual analog scale (VAS). Each DIB was followed by a series of questions based on the information provided in the drug information box. The primary dependent variable of risk perception of experiencing side-effects was measured using the question "What do you think is the risk to your health from taking Drug A, bearing in mind its side-effects?" Risk perception was measured on a visual analog scale ranging from 0-100. Primary independent variables were the three factors of communication format, rate and severity. Control variables included perception of severity of the illness for which the drug was prescribed, general risk perception, profession and demographic information (age, gender, race/ethnicity and education). Perception of severity of the illness was measured using the questions "Overall how severe do you consider the illness for which Drug X is prescribed?" A VAS ranging from 0 to 100 followed the question for recording their responses with respect to risk perception. Higher scores on the VAS indicated higher perceived risk. The visual analog scale has been previously used to measure perceptions with various behaviors such as weight and other health-related measurements.[33] Previous studies have tested and validated the scale and have found satisfactory results. The scale has been also reported to produce more normally distributed data and greater variation in scores as compared to scales which offer discrete fixed choices.[34-36]

Statistical Analysis

All analyses were conducted using SAS version 9.3. Repeated Measures Analysis of Variance was used to assess the effects of communication format, rate and severity on risk perception while adjusting for general risk perception, perceived severity of illness, age, gender, race/ethnicity and education. General risk perception, perceived severity of illness and age were included as continuous variables. Gender (Male/Female), race/ethnicity (non-Hispanic Whites/African Americans/Hispanic/Asian), education level (college education/bachelor's degree/master's degree/doctoral degree) and profession (Healthcare/non-Healthcare) were included as categorical variables. Descriptive statistics were obtained by calculating means for continuous variables and frequencies for categorical variables. Mean risk perception scores were obtained for eight possible combinations of the three factors of communication format, rate and severity. Pairwise comparisons of mean risk perception scores of all eight combinations were made to evaluate the differences across the combinations. All statistical analyses were performed at an a priori significance level of 0.05.

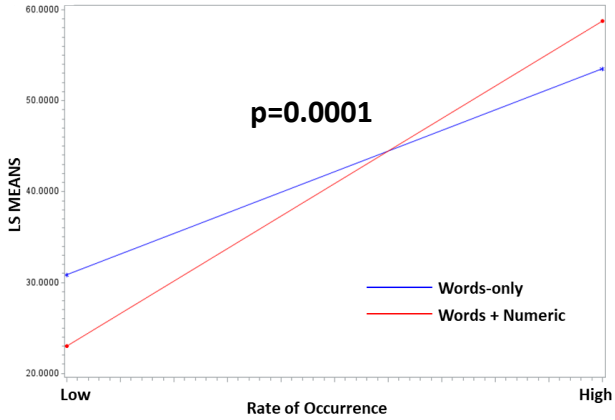
RESULTS

A total of 240 individuals were approached to participate in the study. Forty-two individuals refused to participate and provided reasons such as lack of interest in the study (n=17), language barrier (n=10), lack of time (n=7), and

Table 4. Least Square Means of Risk Perception for Communication Format, Rate and Severity

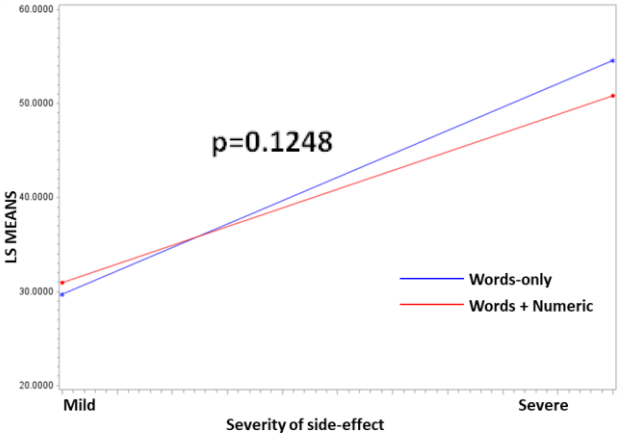
Communication style	Rate	Severity	Risk perception [LS Mean (SE)]	Range
Words-only	Low	Mild	25.84 (2.75)	20.42 - 31.26
Words+Numeric	Low	Mild	20.90 (2.90)	15.18 - 26.61
Words-only	Low	Severe	35.87 (2.75)	30.45 - 41.29
Words+Numeric	Low	Severe	25.10 (2.90)	19.38 - 30.82
Words-only	High	Mild	33.67 (2.90)	27.95 - 39.39
Words+Numeric	High	Mild	41.00 (2.75)	35.59 - 46.43
Words-only	High	Severe	73.35 (2.90)	67.63 - 79.07
Words+Numeric	High	Severe	76.53 (2.75)	71.11 - 81.95

LS=Least Square; SE=Standard Error



Rate	Communication format	Least square means (SE)
Low	Words-only	30.85 (2.24)
Low	Words + Numeric	23.00 (2.38)
High	Words-only	53.51 (2.38)
High	Words + Numeric	58.77 (2.24)

Figure 2. Interaction effect between communication format and rate of occurrence.
Plot of least square means of risk perception across levels of rate of occurrence (low versus high) for words-only and words + numeric communication formats.



Severity	Communication format	Least square means (SE)
Mild	Words-only	29.75 (2.31)
Mild	Words + Numeric	30.95 (2.31)
Severe	Words-only	54.61 (2.31)
Severe	Words + Numeric	50.82 (2.31)

Figure 3. Interaction effect between communication format and severity.
Plot of least square means of risk perception across levels of severity (mild versus severe) for words-only and words + numeric communication formats.

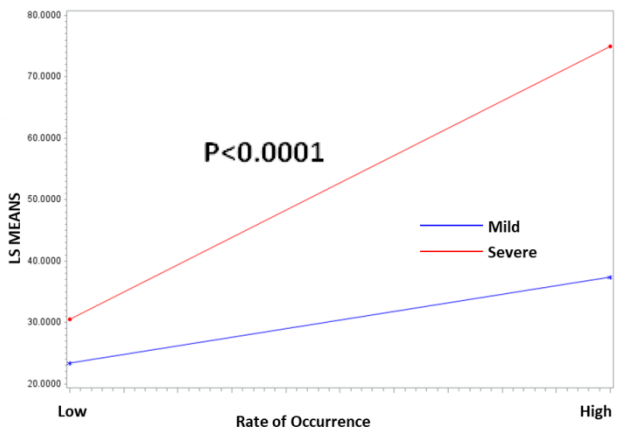
other (n=8). Two individuals started the survey but did not complete due to loss of interest and were not included in the final sample. Thus, 196 completed responses were obtained leading to a response rate of 81.6%. Participants' age ranged from 19 to 74 years with a mean of 42 (SD=12) years. A slight majority of participants were females (53%). Most participants were non-Hispanic White (58%) followed by African Americans (18%), Hispanic (16%), and Asian (7%). With respect to education level, 57% had a college education while approximately 32% has masters or doctoral degree. A majority of participants (81%) belonged to non-healthcare profession. When asked to rank the side-effects in the order of their severity from 1 to 4 (1 =mild, 4 =severe), participants correctly identified stomach bleeding (mean rank =3.33) as severe and flushing of the face (mean rank =2.33) as mild side-effect. Validation of the simulations used for severity was thus achieved.

Repeated Measures analyses were conducted to test independent and interaction effects of communication format, rate and severity on risk perception (Table 3). The results demonstrated main effects of rate of occurrence of side-effects (F value=325.63, p<0.0001) and severity (F value=190.77, p<0.0001) on risk perception. Two-way interactions between rate X communication style (F value=15.57, p=0.0001) and, rate X severity (F value=88.62, p<0.0001) and, were found to be significant. Three-way interaction between communication format, rate and severity was not significant (F value=0.07, p=0.80). Additionally, general risk perception (F value=23.41, p<0.0001), age (F value=7.38, p=0.0072) and race/ethnicity (F value=3.06, p=0.0181) were also found to have significant effects on risk perception.

Least square means were obtained for the main effects and interaction effects between communication format, rate and severity (Table 4). Further, interaction plots were obtained for the two-way interactions between communication format X rate (Figure 2), communication format X severity (Figure 3) and rate X severity (Figure 4). As can be seen in Figure 2, for low-rate side-effects, words-only format had a higher risk perception score as compared to words + numeric format. This effect was reversed for high-rate side-effects i.e. words-only format had lower risk perception scores as compared to words + numeric format. As in Figure 3, although an interaction was observed between communication format and severity, it was not statistically significant. Figure 4 represents the significant interaction between rate and severity such that the difference of least square means between mild and severe side effects was significantly larger when the side-effects occurred at a high-rate as compared to when the side-effects occurred at a low-rate.

DISCUSSION

The study was one of the first to evaluate the effect of communication format on risk perception of side-effects in the light of contextual factors of rate and severity. An important finding of the study was the interaction between communication format and rate in regards to its effect on risk perception. It was observed that the effect of communication format was different for low-rate side-effects as compared to high-rate side-effects. Among low-rate side-effects, use of numeric descriptors along with words resulted in lower-risk perception as compared to words-only descriptors. These findings correspond to reports from prior studies which have indicated that use of words-only (or verbal) descriptors alone may result in over-estimation of the risk.[15,16,37] On the other hand, for high-rate side-effects, use of words-only descriptors had lower risk perception scores as compared to words + numeric descriptors, indicating that words-only descriptors may not always lead to over-estimation of risk. These interaction



Rate	Severity	Least square means (SE)
Low	Mild	23.37 (2.31)
Low	Severe	30.48 (2.31)
High	Mild	37.34 (2.31)
High	Severe	74.94 (2.31)

Figure 2c. Interaction effect between rate of occurrence and severity.
Plot of least square means of risk perception across levels of rate of occurrence (low versus high) for mild and severe side-effects.

effects highlight the importance of the contextual factor of rate of occurrence of side-effect in understanding the influence of communication format. Low-rate side-effects which are likely to be over-estimated in term of their risk may benefit from the use of numeric descriptors to avoid over-estimation of the risk. While for high-rate side-effects, risk perception may initially assume a higher value due to words such as 'likely' or 'very likely'. In such cases, numeric descriptors may aid in better understanding of the high rate of occurrence and help in relative evaluation of the risk and benefits of the treatment, resulting in more informed decision. Carling and co-workers in their prior research have suggested that formats of presenting risk information which are in line with patients' values (i.e. relative evaluation of desirable and undesirable outcomes) are most influential in increasing acceptance of the treatment.[38] Thus it may be worthwhile for future studies to evaluate which of the two formats (words versus words + numeric) better align with patients' values.

An important consideration in interpreting results from current study as compared to prior literature is the hypothetical rates used for the side-effects. Knapp and colleagues[16] used actual frequencies of side-effects (common=1-10%; rare=0.01-0.1%) among patients. In the current study, the low-rate used was close to the 'common' description used by Knapp and thus yielded consistent results. The high-rate used in the current study was very high compared to prior studies, which may have influenced the conflicting results. Additional studies evaluating side-effects occurring at a higher rate may help in validating some of the findings from the current study. Overall, it may be inferred from the current study that the use of numeric descriptors aid in better understanding of the underlying rate and associated risk of side-effects. These results correspond to findings from prior studies which have reported that use of numbers or numeric descriptions in risk communications resulted in better evaluations of the risk.[15,39,40] Research by Blalock and colleagues has also demonstrated that numeric risk information of side-effects may enhance decision making and also increase the willingness to take the medications.[17]

The study findings also hold implications for both written and spoken communications. Healthcare providers such as pharmacists and physicians should avoid vague words-only descriptions when designing communication material or during direct interactions with the patients. The findings from the current study may also help in future efforts to standardize verbal descriptors with their associated numeric frequencies, as the study sheds light onto risk perceptions associated with some verbal descriptors. Standardization of verbal descriptors is of importance considering the familiarity and ease of use of such descriptors. Literature on fuzzy-trace theory concerning risk perceptions indicates that gist interpretations (i.e. subjective representation of information) rather than verbatim interpretations (i.e. exact numbers given in the information) after exposure to risk information guides decision making.[41] Standardization of verbal descriptor may help in minimizing the variability in gist interpretations and more accurate perceptions of risk in the future.

The results of the study should be viewed within the context of certain limitations. The study tested the effects of communication format only for two side effects and the associated frequencies and severity. The effects observed may not be generalizable for all side effects. Individuals were selected into the study depending on accessibility for the researcher (convenience sampling) and thus may not be a representative sample. At the same time, since all the approached participants may not be taking medications in their daily lives, the hypothetical decision making for a hypothetical medication may demonstrate different perceptions as compared to real-life decision making. Individuals with limited English speaking ability were not included in the study thus limiting the generalizability of the sample. Future studies with randomized sampling methods and inclusive of non-English speaking adults are thus warranted. A majority of the participants had high educational attainment i.e. at least a college degree or masters, which may have been due to the proximity of data collection locations to medical center areas. The high education level may have impacted the interpretation of risks associated with side-effects as education may impact knowledge about a particular behavior, event or understanding about the same.[42] Other factors that might affect risk perception were not taken into consideration and may have affected risk perceptions. Finally, no information was collected on the individuals who did not agree to participate in the study. Thus, non-response bias could not be assessed.

CONCLUSIONS

The effect of communication format on risk perception was significantly impacted by the underlying rate of occurrence. Risk of low rate side effects may be over-estimated when words-only descriptions are used and hence should be carefully communicated. Overall, use of words + numeric descriptors lead to better understanding of the risk and

should be routinely incorporated in communication resources.

CONFLICT OF INTEREST

The authors have no conflict of interest to disclose.

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None.

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Original Research

Assessing adherence to current national guidelines for appropriate albumin use at an academic medical center

Angelina M. CASTILLO, Jamie NATKOWSKI, Georgina RUBAL-PEACE.
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Abstract

Objective: To assess adherence to current national guidelines for appropriate albumin use at an academic medical center.

Methods: This retrospective chart review of 150 randomly selected patients prescribed and administered at least one dose of albumin was conducted in an urban academic medical center to evaluate the adherence of albumin orders to current national guidelines. Inclusion criteria consisted of discharged patients at least 18-years-old admitted to the intensive care unit or medical/surgical unit from September 1, 2015 to August 31, 2016. The primary outcome was the number of patients who inappropriately received albumin based on national guidelines and FDA approved indications. Secondary outcomes included the number of patients who received the incorrect concentration or dose of albumin based on indication, as well as the cost associated with inappropriate albumin prescribing. Descriptive statistics were used to report outcomes.

Results: There were 68 instances (45%) where albumin was prescribed inappropriately according to guideline recommendations. Of the 82 instances where albumin was used appropriately, 18 patients received an incorrect dose (22%), and 6 received the inappropriate concentration of albumin (7%). The cost for the 150 patients included in the study associated with inappropriate albumin prescribing was approximately $13,000.

Conclusions: This study identified areas for pharmacist intervention to ensure appropriate albumin utilization, as well as proper dosing for the most frequently incorrectly dosed indications, including hepato-renal syndrome, spontaneous bacterial peritonitis, and paracentesis. This study also identified an unexpected indication with significant inappropriate albumin utilization, perioperative hypotension, which is an area for further intervention to monitor and decrease use.

Keywords

Serum Albumin; Critical Care; Drug Utilization Review; Guideline Adherence; Clinical Audit; Pharmacy Service, Hospital; Cost Savings; Hospital Costs; Clinical Audit; United States

INTRODUCTION

Albumin is used throughout intensive care units (ICU) and medical/surgical floors. Albumin use is recommended over crystalloids in certain settings, such as large volume paracentesis, hepatorenal syndrome, and spontaneous bacterial peritonitis (SBP) treatment.[1] However, there is little data proving mortality benefit of albumin as the initial resuscitation fluid over less expensive crystalloids.[2-4] Fluid therapy practice standards have considerable variation in terms of volume and choice of fluid administered.[5] The Colloids Versus Crystalloids for the Resuscitation of the Critically Ill (CRISTAL) randomized trial determined there was no mortality benefit at 28 days when using colloids such as albumin, versus crystalloids such as normal saline or Ringer lactate solution in patients with hypovolemic shock.[2] Raghunathan *et al*. also determined giving colloids in addition to crystalloids resulted in increased cost per day without improved survival.[3] The Surviving Sepsis Campaign guidelines reflect the findings of these studies by recommending crystalloids as the preferred fluid therapy.[4]

Angelina M. CASTILLO. PharmD, BCPS. Clinical Inpatient Pharmacist. The Hospitals of Providence – East Campus. El Paso, TX (United States). amcastillo@utexas.edu
Jamie NATKOWSKI. PharmD, BCPS. Clinical Pharmacist - Intensive Care. Banner University Medical Center South. Tucson, AZ (United States). Jamie.Natkowski@bannerhealth.com
Georgina RUBAL-PEACE. PharmD, BCPS. Pharmacy Program Coordinator, Residency Program Director. Banner University Medical Center South. Tucson, AZ (United States). Georgina.Rubal-Peace@bannerhealth.com

Inappropriate fluid selection can have a large economic impact on institutions.[3,5-9] In a sequential multifaceted intervention to decrease albumin use in eight ICUs at two hospitals in an academic healthcare system, no statistically significant difference was found in ICU mortality or in-hospital mortality before and after the interventions.[6] These findings reinforce the notion that aligning clinical practice with evidence-based literature can both lower the economic impact of albumin, and also maintain the integrity of patient-centered care.

One component lacking from many studies regarding institutional albumin utilization is an assessment of the appropriateness of albumin orders.[6] Examples of inappropriate albumin prescribing, not supported by national guidelines or evidence-based literature, include first line for intradialytic hypotension (IDH)[10,11], paracentesis of less than 5 liters[1], and septic shock responsive to crystalloids.[2-4,9] A randomized, double-blind, crossover trial in 72 chronic hemodialysis patients was conducted to determine whether 5% albumin was more effective than normal saline for the treatment of IDH. The results showed that 5% albumin was no more effective than normal saline, and the investigators recommended that normal saline should be used as the initial fluid treatment for IDH.[10] A similar study by Emili et al evaluated the safety and efficacy of a stepwise protocol utilizing normal saline, mannitol, and albumin designed to minimize albumin use for IDH treatment. They found that of the 433 instances where the protocol was used, hypotension was reversed without the need for albumin in 91% of cases.[11]

Table 1. Assessment of albumin orders by indication

Indications[a]	Number of orders (%)	Inappropriate indication	Inappropriate dose	Inappropriate concentration
SBP	12 (8)	0	8	1
Large volume paracentesis	4 (3)	0	1	1
Paracentesis < 5 L	4 (3)	4	…[b]	…
HRS	16 (11)	0	9	4
IDH	4 (3)	4	…	…
Persistent hypotension despite adequate fluid resuscitation	41 (27)	0	0	0
Hypotension without adequate fluid resuscitation	32 (21)	32	…	…
Plasmapheresis	4 (3)	0	0	0
ARDS	5 (3)	0	0	0
Enhanced diuresis	10 (7)	10	…	…
Hypoalbuminemia	2 (1)	2	…	…
Perioperative hypotension	16 (11)	16	…	…
Total	150 (100)	68	18	6

[a] SBP =spontaneous bacterial prophylaxis, HRS =hepato-renal syndrome, IDH =intradialytic hypotension, ARDS =acute respiratory distress syndrome.
[b] Orders that were classified as an inappropriate indication were not evaluated for appropriateness of dose or concentration.

Enhanced diuresis and perioperative hypotension are two other controversial instances where albumin is used. Two studies, one in medical ICU patients and one in patients with cirrhosis and ascites, have shown no benefit to the addition of albumin to enhance diuresis.[12,13] Regarding perioperative hypotension, The British Consensus Guidelines on Intravenous Fluid Therapy for Adult Surgical Patients lists either crystalloid or colloid as potential fluids to correct hypotension, but does not comment on which order they should be used in.[14]

Given the widespread use of albumin in different hospital areas, practice variation regarding fluid selection, and the high cost of albumin as compared to therapeutic alternatives, a unique opportunity for pharmacist intervention presents itself to align clinical practice with evidence-based literature and lower the economic impact of albumin by decreasing its use in inappropriate settings.

The purpose of this study was to assess adherence to current national guidelines in the literature for appropriate albumin use at an academic medical center. Albumin orders were assessed for appropriateness using Food and Drug Administration (FDA) approved labeling and national guidelines including the American Association for the Study of Liver Diseases (AASLD) and the Society of Critical Care Medicine's Surviving Sepsis Campaign.

METHODS

This study was conducted as a retrospective chart review in an urban academic medical center in the United States.

Selection of Participants

Inclusion criteria for this study consisted of discharged patients at least 18-years-old admitted to the ICU or medical/surgical unit from September 1, 2015 to August 31, 2016. During this period of time, an electronic list of patients was generated consisting of patients that were prescribed and administered at least one dose of albumin. A sample size of 150 patient charts was selected prior to Institutional Review Board submission. The electronic list generated 192 patient charts that met the inclusion criteria. In order to stay with the pre-determined sample size, a random numbers table was used to select a sample of 150 patient charts to be evaluated for the appropriateness of albumin orders.

Definitions

Hypotension was defined as a mean arterial pressure (MAP) less than 65 mmHg, a systolic blood pressure less than 90 mmHg, or if MAP was greater than or equal to 65 mmHg while on vasopressors. The Surviving Sepsis Guidelines were utilized to determine the definition of adequate volume resuscitation, 30 mL/kg of crystalloid.[4] A diagnosis of HRS or the attempt to rule out HRS, and diagnosis of SBP or empiric SBP treatment was determined by physician documentation in the electronic medical record. The term perioperative was defined as the period of time from when the patient entered the preoperative unit, to when the patient left the post-anesthesia care unit. Appropriate dosing regimens were determined using the corresponding evidence-based literature and guidelines per indication.

Outcome Measures

The primary outcome of interest was the number of patients who received albumin that was not indicated based on national guidelines or FDA approved indications. Secondary outcomes included the number of patients who received the inappropriate concentration of albumin according to indication, the number of patients who received the inappropriate dose of albumin according to indication, and the wholesale acquisition cost (WAC) associated with inappropriate albumin prescribing.

Table 2. Location of albumin administration

Location	Number of albumin orders	Appropriate indication	Inappropriate indication
Intensive care unit	80	48	32
Medical/surgical unit	41	26	15
Emergency department	8	6	2
Dialysis	3	0	3
Perioperative	18	2	16

Table 3. Wholesale acquisition cost (WAC) associated with inappropriate albumin prescribing

Albumin Product	Amount of inappropriately prescribed albumin	Cost in USD/unit[a] (WAC)	Cost in USD (WAC)
Albumin 5% (Albutein ®)	1,315 g	48.51/unit	5,103.25
Albumin 25% (Albutein ®)	2,230.7 g	44.00/unit	7,852.06
Total	3,545.7 g	…[b]	12,955.31

[a] Unit = 12.5 g of albumin.
[b] Not applicable.

Statistical Analysis

Data was extracted from electronic medical records for patients included in the study during the one year study period. Descriptive statistics were used to report outcome measures. This retrospective study was deemed exempt by the Institutional Review Board.

RESULTS

Of the 192 patient charts that met the inclusion criteria, 150 were randomly selected to be included in the analysis. Patient ages ranged from 20 to 89 years, with a median (interquartile range) of 57 years (48 to 67 years). The majority of patients were male (n=97, 65%).
Regarding the primary outcome of interest, 68 patients (45%) received albumin that was not indicated based on guidelines or FDA approved indications. Of the 82 patients that received albumin based on an appropriate indication, 18 (22%) received the inappropriate dose, and 6 (7%) received the inappropriate concentration of albumin (Table 1). The majority of albumin orders were administered in the intensive care, medical/surgical, and perioperative units (Table 2). It was calculated that 3,545.7 grams of albumin was used inappropriately, and the cost (WAC) associated with this inappropriate albumin prescribing was USD 12,955.31 (Table 3).

DISCUSSION

In this study, we determined whether a patient received albumin for either an appropriate or an inappropriate indication. The distinction between appropriate and inappropriate indications was based on evidence-based literature and national guidelines. Appropriate indications included: SBP, large volume paracentesis, HRS, persistent hypotension despite adequate fluid resuscitation, plasmapheresis, and acute respiratory distress syndrome (ARDS). Inappropriate indications included paracentesis less than five liters, intradialytic hypotension, hypotension without adequate fluid resuscitation, enhanced diuresis, hypoalbuminemia, and perioperative hypotension.

Table 1 details the classification of the 150 orders into their respective appropriate or inappropriate indications. Sixty-eight (45%) of the orders were classified as inappropriate indications, with the three most frequent being hypotension without adequate fluid resuscitation, perioperative hypotension, and enhanced diuresis. Perioperative hypotension was an unexpected indication identified, making up almost one-fourth of the inappropriate orders. Of the appropriate indications, HRS and SBP were frequently ordered with an incorrect dose or with the incorrect concentration of albumin.

Limitations of this study include those that are inherent to a retrospective study, namely relying of the accuracy of documentation in the electronic medical record. One area where this lack of information was notable was the documentation of the amount of intravenous fluids used in the perioperative units. Another limitation was that this study was performed at a single medical center. The inclusion of additional sites may have yielded more indications for albumin not seen at our institution (i.e. ovarian hyperstimulation syndrome).

Defining adequate fluid resuscitation for the purposes of classifying albumin orders was another potential limitation in this study. The quantity of 30 mL/kg of crystalloid was derived from the Surviving Sepsis Campaign recommendations. However, a timeline for when this resuscitation occurred in relation to albumin administration needed to be established. There is little guidance in the literature defining this time period. The criteria used in this study to determine adequate resuscitation was for a patient to receive 30 mL/kg of crystalloid within 24 hours prior to albumin administration. However, there are some populations where risk and benefit should be weighed when administering these large amounts of fluid, such as heart failure patients. Although the Surviving Sepsis Campaign does not comment on these patient populations, perhaps a patient's overall volume status may be a determinant of appropriate albumin use.

Using this information, a pharmacy driven protocol outlining appropriate albumin use was implemented at our institution to align clinical practice with evidence-based literature and lower the economic impact of albumin, while maintaining the integrity of patient-centered care. Implementation strategies used include a pocket reference card for physicians and pharmacists with the dosing regimens for SBP, HRS, and paracentesis, prescriber education, formulary restrictions, and criteria based ordering. Data will be collected after sufficient implementation of these strategies to assess the impact of this pharmacist driven initiative to decrease albumin use.

Table 4 shows a pocket reference card created to aid in dosing for these indications.

CONCLUSIONS

This study used evidence-based literature to assess adherence of albumin orders to current national guidelines. The results demonstrated a high rate of inappropriate

Table 4. Dosing "Pocket" Reference[1]

Indication	Strength	Dose
SBP	25%	Day 1: 1.5 g/kg Day 3: 1 g/kg
HRS	25%	1 g/kg body weight daily up to maximum of 100 g
Paracentesis > 5 L	25%	5-10 g/L removed; or 50 g total

albumin prescribing within our institution. These results reveal potential areas for pharmacist intervention to decrease the amount of inappropriate albumin prescribing, as well as to ensure that the correct dosing and concentration be used with frequently incorrectly dosed indications such as SBP, HRS, and paracentesis. This study also identified an unexpected indication with significant inappropriate albumin utilization, perioperative hypotension, which is an area for further intervention to monitor and decrease use.

CONFLICT OF INTEREST

No conflicts of interest to disclose.

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Original Research

An initial exploration of the perceptions of preparedness to practise among Saudi Arabian trained hospital pharmacists

Luma AMEER, Katie MACLURE, Antonella TONNA, Derek STEWART.
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Abstract

Background: There is a dearth of literature on perceptions of preparedness to practise, which explores the extent to which educational institutions prepare their students to fulfil their professional role.

Objective: The aim of this study was to explore perceptions of preparedness to practise among Saudi Arabian pharmacy graduates working in hospital.

Method: Face-to-face, semi-structured interviews were conducted with ten hospital pharmacists based in four hospitals in the Eastern Province of Saudi Arabia who had qualified within the last five years from a Saudi Arabian School of Pharmacy. Interviews focused on expectations of hospital practise, perceptions of preparedness and challenges encountered, and reflections on how to better prepare students. Interviews were audio-recorded, transcribed and analysed thematically by two independent researchers using the Framework Approach.

Results: Five key themes were identified: expectations versus reality of practise; issues relating to university course; practice related training; adapting to the work environment; and proposed improvements to undergraduate education. Participants were generally disappointed to find practise was not as expected. University training was largely didactic, with skills such as critical thinking not being sufficiently developed. Where practice related training was provided, it was variable in length and content. Cultural issues, most notably working in a mixed sex environment, were also considered to impact preparedness. Suggested improvements included greater focus on skills development and structured training placements.

Conclusions: Participants experiences in university, and experiential placements varied greatly and were perceived to impact greatly on preparedness to practise. Further multiple perspective exploration of perceptions of preparedness to practise is warranted.

Keywords

Professional Practice; Pharmaceutical Services; Pharmacy Service, Hospital; Pharmacists; Education, Pharmacy; Qualitative Research; Saudi Arabia

INTRODUCTION

The concept of 'preparedness to practise' considers the extent to which educational institutions prepare students for professional roles, encompassing aspects of attitudes, knowledge and skills. Researching preparedness to practise facilitates reviewing curricula to identify and address any areas of deficiency.[1] Moriarty *et al*., in a scoping review of the transition from student to newly qualified professional across social work, teaching, nursing and allied health professions, reported the lack of consensus on how to measure preparedness to practise. They also noted that the primary literature generally researched mentors' perceptions of performance, with little emphasis on preparedness.[2]

Luma AMEER. MSc, MPharm. School of Pharmacy Life Sciences, Robert Gordon University. Aberdeen (United Kingdom). luma_ameer@hotmail.com
Katie MACLURE. PhD, MSc, BSC, (1st)DipSysPrac, PgCert, MBCS, SRPharmS, AFHEA. Senior Research Fellow & Lecturer. School of Pharmacy Life Sciences, Robert Gordon University. Aberdeen (United Kingdom). k.m.maclure@rgu.ac.uk
Antonella TONNA. PhD, MSc, BPharm. Lecturer. School of Pharmacy Life Sciences, Robert Gordon University. Aberdeen (United Kingdom). a.tonna@rgu.ac.uk
Derek STEWART. PhD, MSc, BSc Professor in Pharmacy Practice and Development. School of Pharmacy Life Sciences, Robert Gordon University. Aberdeen (United Kingdom). d.stewart@rgu.ac.uk

Ried *et al*. developed the Perception of Preparedness to Perform (PREP) tool to determine students' views and experiences of being sufficiently equipped to carry out advanced pharmacy practice competencies at different stages of their academic training.[1] PREP comprises 41 Likert scale statements derived from the Centre for the Advancement of Pharmaceutical Education guidelines (CAPE) and has been adapted and used in studies in the United States (US), Malaysia and Kuwait. Scott et al. reported a longitudinal study conducted in the US, with findings that students' perceptions of preparedness were increasingly positive as they progressed through the course.[3] In Malaysia, Hasan et al. compared PREP scores prior to and following experiential placements, with significantly higher PREP scores obtained post placement.[4] Katoue *et al*. used an adjusted PREP tool with pharmacy students in Kuwait who had not experienced any work place learning.[5]

In the United Kingdom (UK), Willis et al. conducted a study of preparedness in final year students of 14 Schools of Pharmacy. The data collection tool was based upon the then Royal Pharmaceutical Society of Great Britain (RPSGB) Master of Pharmacy learning outcomes. Study findings highlighted that students deemed themselves more prepared for broad areas than for specific competencies.[6]

Fewer studies have reported pharmacists' perspectives of preparedness to practise, which may be very different to those of pharmacy students. Kairuz *et al*. in New Zealand conducted a cross-sectional study of the perceptions of preceptors, interns and newly registered pharmacists using a bespoke 16-item questionnaire. There were marked differences in that preceptor perceptions of graduates' preparedness were less positive than graduates' self-perceptions.[7] Noble *et al*. conducted face to face qualitative interviews with Australian graduates on the transition from pharmacy student to intern, and professional identity. Although preparedness was not the main focus of the study, themes identified included the impact of curricular experience, as well as difficulties of adjusting to the work environment.[8] In a qualitative study in Australia, Stupans explored areas that needed to be addressed to prepare graduates for the transition to full-time work in pharmacy, identifying deficiencies in placement periods.[9]

To date, no published studies have researched preparedness to practise of pharmacists in the Middle East. Given educational and cultural differences, the tools used and findings of studies from other geographical areas cannot necessarily be generalised or transferred to other contexts and settings. To qualify as a pharmacist in Saudi Arabia, the Saudi Commission for Health Specialties (SCHFS) requires completion of a Bachelor degree of no less than four years' duration.[10] An increasing number of universities offer the undergraduate Doctor of Pharmacy (PharmD) based on the standards set by the Accreditation Council for Pharmacy Education.[11] The undergraduate PharmD is six years, including one year of practice based hospital training. PharmD graduates are recognised as clinical pharmacists upon completion of a residency program in an accredited institution.[10]

The aim of this study was to explore perceptions of preparedness to practise among Saudi Arabian pharmacy graduates working in hospitals.

METHODS

Design

Face to face semi-structured interviews.

The study was conducted with pharmacists based in four hospitals in the Eastern Province of Saudi Arabia. Most Saudi Arabian pharmacy graduates practise in hospital hence this setting was prioritised for study.

Interview schedule development

A semi-structured interview schedule was developed, and reviewed for credibility by an experienced pharmacy practice researcher. The schedule, underpinned by a content analysis orientation, comprised three areas: expectations of hospital pharmacy practice; perceptions of preparedness and any challenges encountered; and reflections on how to better prepare students. The following demographic data were also collected: gender, years since qualified as a pharmacist, undergraduate degree, and any exposure to the practice environment as an undergraduate. The schedule was piloted with two pharmacists in Saudi Arabia; post-pilot, the schedule was translated into Arabic to allow the interviewees the option of participating in English or Arabic.

Recruitment

Hospital pharmacists who had qualified from a Saudi Arabian School of Pharmacy within the last five years were included, with no exclusions. It was considered that recall bias may have been a greater issue in those qualified more than five years previously.

Initial recruitment was undertaken by pharmacy department supervisors in two hospitals who approached all those meeting the inclusion criteria. Those interested were requested to contact the researcher to discuss the study further, following which those still interested were emailed the participant information leaflet and a form to indicate preferred date, time and location of interview. In an attempt to increase participation, snowball sampling[12] was also employed with those interviewed requested to pass study information and researcher contact details to any suitable colleagues or acquaintances. Snowball sampling resulted in recruiting pharmacists from two further hospitals.

Data generation

Interviews were conducted in a setting of the participant's choice, which was either an office close to the workplace or an easily accessible quiet area where the discussion could not be overhead. Prior to the interviews commencing, the researcher obtained signed, informed consent, with each participant allocated a unique identification code to facilitate anonymisation. Interviews of between 30 and 55 minutes were audio-recorded and transcribed by the researcher. The interviewer was female (LA) and at the time of research an MSc research student. She has previously worked at two of the recruitment hospitals, but had not worked with any of the research participants. Where necessary, any dialogue in Arabic was translated by the researcher (who was fluent in Arabic and a native English speaker) for transcription. Interviews were carried out between January and March 2016.

Data Analysis

The five-step Framework Approach to thematic analysis was adopted: data familiarisation; identification of the thematic framework; indexing; charting; and mapping and interpretation.[13] Transcripts were coded independently by two researchers (LA and DS). Themes were derived from data, and no new themes were identified following the ninth interview.

Ethical Approval

Ethical approval was obtained from the ethics review panel of the School of Pharmacy and Life Sciences, Robert Gordon University, United Kingdom. No further approval within Saudi Arabia was required.

RESULTS

Twelve pharmacists expressed interest, ten of whom agreed to participate, and two felt that time constraints made it difficult to participate. Most (6) were female and educated to Bachelor level (6). The median time since

Table 1. Summary of participant demographics

ID code	Gender	Time qualified	Undergraduate course	University*	Place of work **
B001	F	3 years	Bachelor	A	A
A002	F	2 years	Bachelor	B	A
M003	F	5 years	Bachelor	B	A
H004	F	2 years	Bachelor	C	A
Z005	F	1 year	PharmD	D	B
A006	M	1 year	PharmD	E	B
A007	M	4 years	Bachelor	B	B
T008	F	4 months	PharmD	E	A
L009	F	3 months	PharmD	E	C
W010	F	4 months	Bachelor	B	D

* University, and **place of work have not been identified to protect participant anonymity

qualification was 1.5 years, and participants represented all four hospitals and five universities (Table 1).

Analysis identified five key themes, each with several subthemes as given in Table 2.

Expectations versus reality of practice

How role compared to expectations

Some participants expected their role to be accuracy checking, while others, particularly those educated to PharmD level, expected a more clinical role,

> "I expected it to be as it is, nothing exceptional, I dispense the medication written by the doctor. I knew that as a pharmacist, this society will not really accept that I get involved in decision making, in doses, or other things…." A002- Bachelors

> "To be honest, I expected the PharmD would enable me to work as a proper clinical pharmacist, go on rounds with the doctor, with a team but when I qualified, no, of course they treated me as a regular pharmacist" Z005- PharmD

Disappointment in their role

Disappointment was the overwhelming subtheme which emerged, with all participants discussing at length their feelings of disappointment. There were several causes of frustration, with many citing their feelings of wasted study time and knowledge,

> "Thinking about the five years you studied, and the number of modules, and the crying and tears with each exam, it makes it hard" B001- Bachelors

> "Your study is mostly clinical, so that sometimes becomes difficult, when you do basic pharmacy jobs" L009- PharmD

Others also noted the lack of autonomy in their roles,

> "I thought I would be more responsible for the patients, for my decisions, to have more autonomy, nothing would be forced on us" B001- Bachelors

There were also expressions of feeling undervalued as professionals,

> "We don't really work as pharmacists" H004- Bachelors

Issues relating to university course

When asked about how well university prepared participants, the spectrum of answers highlighted differences in university curricular and teaching methods. Those with a more theoretical based curriculum were more negative about their university experiences.

Method of teaching

Many complained that they had been taught didactically and had not developed critical thinking skills,

> "Cases- reading, purely reading, there was nothing practical" B001- Bachelors

> "In university, everything was dictated, dictated, dictated. We didn't learn how to discuss, we went to a lecture, there was no opportunity to discuss" H004- Bachelors

Relevance of course content to practise

The relevance of the course content was also questioned by some, noting that lecturers lacking hospital experience were sometimes teaching outside of their fields of expertise,

> "The problem is that the person who taught us had never worked in a hospital. She graduated, then immediately worked in the university, so she never had any actual experience of what happens in a

Table 2. Themes and subthemes identified from thematic analysis

Theme	Sub themes
1. Expectations versus reality of practise	1.1 How role compared to expectations 1.2 Disappointment in their role
2. Issues relating to university course	2.1 Method of teaching 2.2 Relevance of course content to practise
3. Practice related training	3.1 Duration/ timing of training 3.2 Tasks undertaken to aid learning
4. Adapting to the work environment	4.1 Lack of knowledge 4.2 Lack of specific skills
5. Proposed improvements to undergraduate education	5.1 University curriculum 5.2 Experiential placement structure 5.3 Transition to the workplace

hospital" A002- Bachelors

Practice related training

Duration/ timing of training

It was apparent that there was considerable variation in the duration and structure of any practice related training. This ranged from two months to one year, with some undertaking training during the summer of the undergraduate degree, and others after graduation,

> "So two months in the first summer… then two months second summer, so total four months" A002- Bachelors

> "four to six months training [after university]" B001- Bachelors

Tasks undertaken to aid learning

Tasks undertaken as part of this training ranged from purely observation of what the pharmacists and technicians did, to more systematic and structured approach to individual patient care comprising developing patient profiles and delivering presentations, as described by those who had completed the PharmD,

> "I didn't know how to check, or even how to read anything. I didn't have any practise, only when I started work, did I see a prescription" B001- Bachelors

> "The trainees were ignored, there was no programme, and each hospital teaches its own thing" A002- Bachelors

> "I had to do two presentations during my training…I have to pass both presentations, and at the end of the month there was a test. Some preceptors assess us as a written exam, others test us verbally, and then we had cases." T008- PharmD

Adapting to the work environment

On exploring challenges faced on transitioning from undergraduate study to the work place, lack of knowledge and lack of skills emerged as the two main themes.

Lack of knowledge

Some felt that they lacked even very basic knowledge, such as a systematic approach to checking prescriptions, which was recognised as a weakness by Bachelors graduates,

> "… I didn't know before how to check a prescription" B001- Bachelors

Lack of specific skills

Interpersonal skills, notably the ability to interact with the opposite sex, was raised as a challenge upon qualification, due to the segregated education throughout school and university,

> "...you are working with a female. I mean, from when I was young, until I graduated from university, I haven't done that, so that was hard" A007- Bachelors

Communication with healthcare professionals and patients was also identified as a problem area,

> "I don't know how to do counselling, because I am new, it was so hard" W010- Bachelors

Proposed improvements to undergraduate education

Three key themes emerged in relation to improving undergraduate education, namely the university curriculum, placements and the transition to the workplace.

University syllabus

Recommendations for course content and the method of teaching were made by Bachelors graduates, with overwhelming support for less didactic teaching,

> "To change the dictation method of stuffing us with lots of information. Information should be brief and beneficial so it can be understood and then we know [why]. Discussion should be taught, so that when he/she graduate they know how to discuss, and build their personality" H004- Bachelors

The need to develop communication and negotiation skills was recommended by one participant who had undertaken the PharmD,

> "In university, they concentrate a lot on patient counselling, patient education but they didn't at all mention physician counselling…how do you convince a doctor? I think it is actually much harder than patient counselling, to counsel someone who is experienced, and educated- a physician or consultant." T008- PharmD

One participant noted the need to standardise the level of education at PharmD so that all could benefit from greater clinical exposure and experiential training,

> "they make us all PharmD, so we can all benefit from the one year of training, it doesn't make sense that we are separated, but in the end we are all going to work in the same places" W010- Bachelors

Experiential placement

Increased clinical exposure through enhanced experiential placements was a key recommendation, particularly for those who completed the Bachelor programme,

> "The universities need to increase the therapeutics [through experiential placements], that is the first thing that needs to be done" W010- Bachelors

Transition to the workplace

Several made suggestions on how to ease the transition from undergraduate training to the workplace. One voiced the need to have mixed gender classes at university, as this was a major issue on entering the working environment,

> "In the university, workshops, lectures they could have been mixed. That would overcome this social taboo, or the shock of me working with a female, or a female working with a male" A007- Bachelors

Participants felt that a structured induction program and continuing professional development opportunities would help ease the transition,

> "It would be better if, there is a set way of training, and what they expect from us. Not just, come here, check the prescription" H004- Bachelors

DISCUSSION

This qualitative study of preparedness to practise in Saudi Arabia highlighted issues described in five key themes. Participants expressed disappointment in that their expectations were not met. They voiced that university training was largely didactic and did not develop their critical thinking. Where practice related training was provided, it was highly variable in both timing and content. There were specific, deficient areas of knowledge and skills which were considered to impact their transition from university to the work place.

Given the lack of published literature on preparedness to practise generally and specifically within the Middle East, the findings of this study are original and extend the knowledge base. Furthermore, there is a lack of qualitative studies on preparedness to practise, especially for pharmacists. There are, however, several key limitations hence the findings should be interpreted with caution. Recruitment was particularly challenging (especially male participants) and only ten participants could be recruited which may have reduced the likelihood of achieving saturation of themes. Findings may not be transferable within Saudi Arabia or the Middle East more generally.

The International Pharmaceutical Federation (FIP) is a global federation representing pharmacists and pharmaceutical scientists.[14] In terms of education, FIP aims to 'stimulate transformational change in pharmaceutical education and engender the development of science and practice, towards meeting present and future societal and workforce needs around the world'.[15] In particular, FIP is 'building, advocating for, and disseminating evidence-based guidance, consensus-based standards, tools and resources for educational development for both organisations and practitioners'. Ensuring that graduates are fully prepared for the work environment is a fundamental responsibility of all involved in education and practice. While guidance, standards, tools and resources exist in certain parts of the world, particularly those with advanced clinical pharmacy practice[16], there is a need to harmonise then share these which would inform those countries where clinical practise is in its infancy. The findings of this study are therefore of great interest as areas such as the Middle East start to embrace clinical pharmacy and qualifications such as the Doctor of Pharmacy become more commonplace.[17,18]

While the findings of qualitative studies cannot be generalised, there may be areas which require greater focus within Saudi Arabia. Participants in this research expressed concern over approaches to teaching, which were often didactic and considered to have less relevance to practice. There were criticisms over some teaching staff that had little or no practice related experience. Where placement opportunities were provided, there were issues over the type of activities undertaken. These findings were not restricted to only those completing Bachelor level training. In a cross-sectional survey of 246 PharmD students attending one college of pharmacy in Saudi Arabia, Khan et al. reported that only half of the respondents perceived Saudi pharmacists well-trained. A similar proportion claimed that pharmacists' work was not well-respected by other health professionals.[11] Furthermore, the lack of clinical exposure at university was perceived to have impacted their interprofessional development. In a recent qualitative study of the views and opinions of pharmacy education stakeholders regarding the current issues challenging pharmacy education, Al Jadhey *et al*. reported agreement that pharmacy education was in need of improvement. Participants called for clear, measurable, national educational outcomes for pharmacy programmes and new teaching methodologies and accreditation of experiential sites.[19]

Further curriculum development and clinically focused placement opportunities experiencing working within the multidisciplinary team are therefore warranted. Such developments have demonstrated positive impacts in other parts of the world.[4,20] In addition, there have been advances globally in terms of interprofessional education and also teaching approaches such as problem based (PBL) and team based learning (TBL). These approaches were found to better prepare professionals to deal with clinical situations through development of critical thinking skills, and independent learning, as well as raising confidence.[8,21] The benefits of joint appointments between the university and the workplace are well-established.[4,8,22,23]

Disappointment and frustration in the non-clinical focus of the pharmacist role emerged throughout this study, particularly from the PharmD graduates who found reality far removed from practise. Findings such as these are not new and have been reported by authors in many different parts of the world and over many years.[8,24-26] While there is a requirement for universities to train students for future developments, it is important that these are not viewed as being so far removed from practise otherwise feelings of disillusionment are likely. It is therefore important to link and engage academics, practitioners and practice leaders in pharmacy curriculum redesign.

One issue which may be particular to Saudi Arabia is that of the mixed sex environment heightening challenges in adapting to the workplace. These issues are well-recognised and have been reported by others[27,28], and while are not easily resolved, can be eased by appropriate placement experiences.

There may be merit in conducting cross-sectional research to confirm the generalisability of these qualitative findings, adapting tools developed and used by others.[1,3-5] However, there may be more need to implement recommendations made by participants in this study. Interventions should be co-designed by academics, practitioners, practice leaders and students and evaluated using qualitative approaches.

CONCLUSIONS

The undergraduate experiences of participating Saudi Arabian trained hospital pharmacists were diverse. The combination of traditional didactic methods of teaching,

with unaccredited training placements experienced by some led to negative perceptions of preparedness. Tutorial based training and structured training placements produced more positive perceptions of preparedness. Recommendations to better prepare future students included a curricular review, more practice based learning, and structured training placements.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest to disclose.

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Mostaghim M, Snelling T, Katf H, Bajorek B. Paediatric antimicrobial stewardship and safe prescribing-an assessment of medical staff knowledge and behaviour. Pharmacy Practice 2018 Apr-Jun;16(2):1198.
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Original Research

Paediatric antimicrobial stewardship and safe prescribing: an assessment of medical staff knowledge and behaviour

Mona MOSTAGHIM, Tom SNELLING, Hala KATF, Beata BAJOREK.
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Abstract

Objective: Determine baseline knowledge of antimicrobial stewardship, and safe prescribing among junior medical officers, monitor their level of participation in interactive education during protected teaching time and assess day-to-day prescribing behaviours over the subsequent 3-month period.

Methods: A voluntary and anonymous survey of all non-consultant level medical officers was conducted with the use of an audience response system during mandatory face-to-face orientation sessions at a tertiary paediatric hospital. Routine prescribing audits monitored compliance with national and locally derived quality use of medicines indicators.

Results: Eighty-six percent of medical officers participated by responding to at least one question (171/200). Response rate for individual questions ranged between 31% and 78%. Questions that addressed adverse drug reactions, documentation and monitoring for empiric antibiotics and the error-prone abbreviations IU and U were correctly answered by over 90% of participants. Other non-standard and error-prone abbreviations were less consistently identified. In practice, 68% of patients had complete adverse drug reaction documentation (113/166). Error-prone abbreviations were identified on 5% of audited medication orders (47/976), approximately half included a documented indication and intended dose.

Conclusions: Participants demonstrated a good understanding of safe prescribing and antimicrobial stewardship. Audits of prescribing identified potential discrepancies between prescribing knowledge and behaviours.

Keywords

Antimicrobial Stewardship; Pediatrics; Health Knowledge, Attitudes, Practice; Medication Errors; Drug Prescriptions; Surveys and Questionnaires; Australia

INTRODUCTION

Safe and appropriate prescribing requires knowledge of patient and medication factors as well as the skills to effectively gather information and communicate clinical decisions to staff and patients.[1,2] Medication errors may result from illegible or incomplete prescriptions, use of error-prone abbreviations, missed drug interactions or failure to adequately monitor treatment.[3]

Pharmacokinetic and pharmacodynamic changes in paediatric patients introduce unique sources of error in the paediatric setting. For example, paediatric dosing strategies are often age-specific and require individual dose calculations according to weight or body surface area.[4] In addition, paediatric prescribing is frequently off-label[5], and practice may vary between hospitals[6] and prescribers.[7]

Mona MOSTAGHIM. BPharm. Pharmacy Department, Sydney Children's Hospital; & Graduate School of Health, University of Technology Sydney. Sydney (Australia). mona.mostaghim@health.nsw.gov.au
Tom SNELLING. MBBS, PhD, Grad.Dip.Clin.Epid, DTM&H. Department of Infectious Diseases, Princess Margaret Hospital for Children; & Wesfarmers Centre of Vaccines & Infectious Diseases, Telethon Kids Institute, University of Western Australia, Subiaco (Australia). tom.snelling@telethonkids.org.au
Hala KATF. MBBS, FRACP. Medical and Diagnostics Program, Sydney Children's Hospital; & School of Women's and Children's Health, University of New South Wales. Sydney (Australia). Hala.Katf@health.nsw.gov.au
Beata BAJOREK. B.Pharm, GradDipHospPharm, PhD, GradCertEdStud(HigherEd). Graduate School of Health, University of Technology Sydney. Sydney (Australia). Beata.Bajorek@uts.edu.au

Strategies that aim to minimise erroneous and suboptimal prescribing include the use of standardised guidelines and terminology, as well as quality and safety initiatives that target medications associated with high risk of error or complication, such as antimicrobials.[8] Antimicrobial stewardship (AMS) programs have demonstrated significant contributions to hospital patient safety by detecting errors and educating staff on practices that optimise antimicrobial selection, dosage, route and duration.[9]

With a broad range of strategies and individualised hospital practices, there is a recognised need for practical orientation for medical officers.[8] In this study, we assessed baseline AMS and paediatric safe prescribing knowledge among all non-consultant level medical staff (JMOs) as part of mandatory orientation at a tertiary paediatric hospital and evaluated subsequent prescribing behaviours by conducting routine prescribing audits. The primary objective of the study was to determine the educational requirements for JMOs who were newly employed by the hospital and those with prior local experience. A secondary objective was to assess the quality of prescribing in the three months after completing baseline assessment and orientation.

METHODS

On 2 February and 6 February 2017 all JMOs who attended one of three mandatory education sessions on AMS and safe prescribing were offered wireless keypad devices and

invited to participate in an anonymous and voluntary survey. The survey questions were presented to JMOs throughout the AMS and safe prescribing session on presentation slides created in Microsoft PowerPoint (Microsoft Corporation, Redmond, Washington). JMO responses entered using the keypad devices were captured in real-time using an audience response system (KP1, Sydney, NSW) and presented as part of the session. From 8 February to 7 May 2017 weekly prescribing audits were conducted across the hospital using a convenience sampling technique whereby the sample was easily accessible to the auditor.[10] Inpatient wards were scanned for patients with current and available medication charts with a target of 60 patients each month to ensure sustainability. Audit results were reported to JMOs by the JMO unit as part of the JMO newsletter. Approval to conduct the survey and prescribing audit was granted by the local hospital research ethics committee as a quality improvement project (QIE-2017-02-04), and ratified by the University of Technology Research Ethics Committee.

Setting

This study was conducted at a 170-bed university-affiliated tertiary paediatric hospital in Sydney, New South Wales. The hospital employs JMOs with two or more years of post-registration experience that may or may not include prior paediatric experience. During their employment, JMOs may be based onsite at the tertiary hospital or seconded to one of 23 different paediatric sites across New South Wales, Australian Capital Territory and the Northern Territory.

Orientation is mandatory for JMOs and includes attendance at a face-to-face AMS and safe prescribing session designed by medical and pharmacy staff. The session reinforces aspects of safe prescribing in children, introduces local practice expectations and includes demonstrations of how to access local medication-related resources. The information is also summarised in the hospital's Junior Medical Staff Handbook. The Handbook is updated annually and lists frequently used guidelines, prescribing "tips" and prescriber responsibilities. The responsibilities include obtaining approval for the use of restricted antimicrobials according to the hospital's computerised clinical decision support and approval system (CDSS, Guidance MS, Melbourne, Australia) as part of the local AMS policy. Technical training on the use of the CDSS has been in place since its implementation in 2012 and is addressed during a separate face-to-face session.

Since 2015, the time allocated for the safe prescribing session has been extended annually in order to cover broader aspects of paediatric medication use from the point of admission to discharge with a focus on antimicrobial use. However, JMO's baseline knowledge and participation had never been formally assessed.

AMS and safe prescribing session and survey

JMOs who were employed by the hospital and working on site in the week before the start of term 1, 2017 (6 February 2017) attended one of two abridged face-to-face orientation programs that each included a 40 minute AMS and safe prescribing session. JMOs who had spent the previous 3-month term in another facility attended a longer face-to-face orientation program with a 60 minute AMS and safe prescribing session.

Presentation content and survey questions were designed by paediatric pharmacists with experience in quality use of medicines, medication safety and AMS. Content was finalised after feedback was received from: a consultant paediatrician responsible for general paediatric training, the hospital's chief resident medical officer, an advanced trainee in paediatrics, and the lead infectious diseases consultant for AMS. Survey questions were not piloted among JMOs in order to limit pre-exposure to the assessment questions and maximise the number of responses.[11] The content included case studies, unidentified errors, and examples of best practice in vital aspects of safe and appropriate medication use in children from admission to discharge. The examples included:

• Medication history taking[12] and documentation of adverse drug reactions (ADRs).[13]

• Medication information resources.

• AMS principles, clinical standards and indicators for AMS[14], local policies, and JMO roles.

• National standard terminology and error-prone abbreviations.[15]

• Safe prescribing in accordance with national quality use of medicines indicators[16] and the paediatric National In-patient Medication Chart (NIMC).[13]

• Local, legislative and Commonwealth funding prescription requirements.

• Medication documentation requirements for hospital discharge summaries.

Priority areas were determined after consideration of current practice observed in local audits and the potential risk of harm. Survey questions presented throughout the session were designed to enhance participation, engage JMOs and assess basic concepts before each topic was introduced in the presentation slides.

Informed consent was obtained from JMOs at the beginning of each session. JMOs in attendance were informed that their participation in the survey was voluntary, anonymous and there were no incentives encouraging involvement. Participating JMOs could elect not to respond to individual questions and withdraw at any time. Any data collected through the audience response system prior to their withdrawal could not, however, be excluded due to the anonymous nature of the assessment.

During the session, a presenter read aloud each assessment question and all answer options. The audience response system remained open to receive keypad responses until there was a consensus among the attending JMOs that responses had been submitted. Results were presented in the form of a graphical chart after the close of each survey question. The correct response was confirmed by the presenter; incorrect responses prompted further exploration of the topic and clarification as part of the session. All response options were multiple-choice, ranging from binary responses (yes or no, true or false) to a maximum of 5 response options.

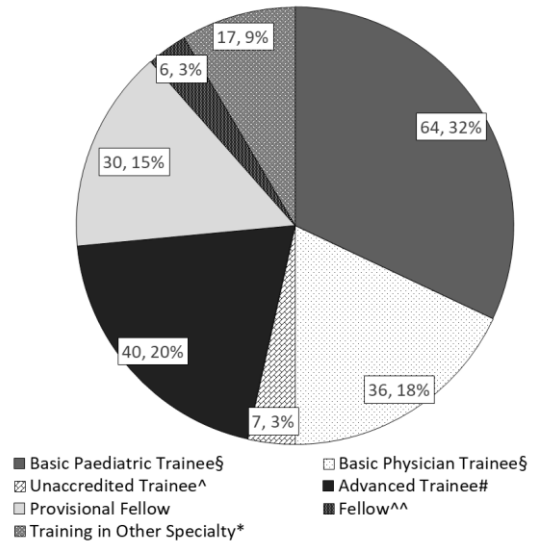

Figure 1. Medical staff in attendance during safe prescribing and antimicrobial stewardship orientation.
§Basic Physician or Paediatric Trainees have committed to, or are in the process of completing Paediatric Training, with 2 or more years of experience; ^Unaccredited Trainees hold registrar positions but may not have participated in the full College training program; #Advanced Trainees have completed Basic Training; ^^Fellows have completed training; *Training in Other Specialty includes: Intensive Care, Emergency Medicine, Surgical Subspecialties, General Practice and Dermatology

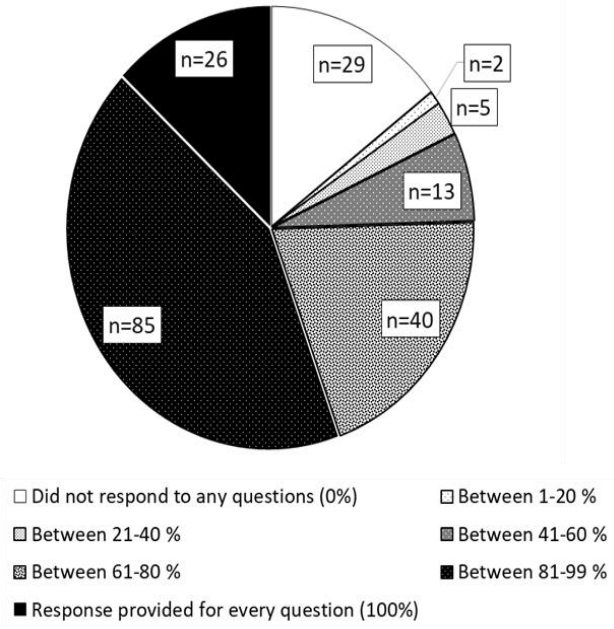

Figure 2. Medical staff participation throughout orientation. Proportion of questions with responses from JMOs in 40 minute session (14 questions) and 1 hour session (17 questions)

Data collection and extraction

Responses captured during each session were extracted from each of the session presentations with the use of the audience response system software and combined into a single database. Codes were assigned to each session and keypad combination. Attendance records obtained from the Junior Medical Unit determined the sample frame.

Prescribing audits assessed all current medication orders for each patient. ADR documentation, error-prone abbreviations, paediatric prescribing, and orders for intermittent therapy (non-daily administration) were collected in accordance with national quality use of medicines indicator definitions.[16] Two additional NIMC criteria were also collected, the percentage of medication orders with a documented indication, and the percentage of "pro re nata" (PRN or "when necessary") orders with the maximum number of doses in 24 hours specified.

Statistical Analysis

Descriptive statistics were performed in SPSS 24 (IBM, Armonk, NY). All survey responses and prescription audit criteria were analysed as categorical data and reported as percentages rounded to the closest whole number. Chi-Square tests were used to explore differences in proportion of correct survey responses between JMOs who identified themselves as new employees and those who had previously worked in the institution. Participation was reported for each survey question separately as the proportion of the sample frame with a captured keypad response (i.e. number of responses/number of JMOs in attendance). The extent of participation by individual JMOs throughout each session was reported as the percentage of questions with a response from a single keypad. Kruskal-Wallis tests assessed differences in prescribing each month after the AMS and safe prescribing session. All statistical tests were two-tailed with P values <0.05 considered statistically significant.

RESULTS

Survey

Two hundred JMOs attended orientation, 89 were assigned to an abridged program. Most JMOs had experience in paediatrics; more than half were in the process of completing either Basic or Advanced Paediatric Training. A small proportion of JMOs were Training in other specialties such as general practice, surgical subspecialties, intensive care and emergency medicine (Figure 1). More than half of all JMOs present responded to at least 80% of the survey questions in their session (Figure 2). The response rate for individual questions ranged between 31% and 78%. Thirty-nine percent of JMOs (77/200) reported working at the hospital in the previous 12 months and 33% (65/200) indicated they had not.

Information Gathering and clinical decision-making

Almost all JMOs (98%) were aware of NIMC requirement to record the specific reaction, reaction type and the date of occurrence as part of complete documentation. Overall, 85% (132/155) of participating JMOs correctly identified the national paediatric medication reference as the preferred guide for medicines information and dosing at the institution. Among those who reported their prior local experience, the correct option was selected by 96% of JMOs who had worked at the hospital in the previous 12 months and 71% of those who had not (p=0.001) (Table 1).

Communicating and reviewing decisions

Between 70% and 74% of JMOs responded to questions about antimicrobial prescribing. Among those who participated, 95% had heard the term antimicrobial stewardship, and knew that prescriptions for empiric antibiotics should document both the indication and a planned review date in the medical record. Very few respondents considered it appropriate to wait until 72 hours of antibiotic therapy or the next consultant ward round to review empiric antibiotic therapy. The majority indicated reviews should take place at least daily (78%) or every 48 hours (20%). Almost all JMOs recognised that fever alone was not an exclusion for intravenous to oral antimicrobial switch (94%).

Ninety-two percent were aware of the correct method by which to cease an order on the NIMC, specifically, the need to document the date of cessation on the order (124/135). Non-standard terminology (i.e., "6/24" and "1/7) in the order "flucloxacillin PO 500mg 6/24 for 1/7" was identified by 85% of JMOs.

Table 1. Assessment survey questions and JMO responses according to self-identified previous work experience at the study hospital#

Assessment questions and responses (Responses rate, all responses/all JMOs, %)	Overall JMO responses, n (%)	Previous work experience unknown^, n (%)	JMOs worked at the hospital in the previous year, n (%)	JMOs who did not work at the hospital in the previous year, n (%)
Have you heard of the term "Antimicrobial Stewardship" or AMS?				
Responses (RR 140/200, 70%)	140	20	63	57
Heard of AMS	133 (95)	20 (100)	61 (97)	52 (91)
Have not heard of AMS	7 (5)	0	2 (3)	5 (9)
In addition to name, signature and date, which of the following indicates a correct example of adverse drug reaction documentation?				
Responses (RR 148/200, 74%)	148	19	69	60
Rash, 20/11/2001	0(0)	0(0)	0 (0)	0 (0)
Amoxycillin, 20/11/2001	0(0)	0(0)	0 (0)	0 (0)
Amoxycillin, Rash, 20/11/2001	3(2)	1(5)	1(1)	1(2)
Amoxycillin, Rash - urticaria, 20/11/2001 (correct)	145 (98*)	18 (95)	68 (99)	59 (98)
For general prescribing the first reference should be:				
Responses (RR 155/200, 78%)	155	23	70	62
Meds4Kids§	21 (14)	2 (9)	2 (3)	17 (27)
UpToDate	0	0	0	0
BNF for Children	2 (1)	0	1 (1)	1 (2)
AMH-CDC (correct)**	132 (85*)	21 (91)	67 (96)	44 (71)
3-Prescriptions for empiric antimicrobial use should document both the indication and planned review date				
Responses (RR 141, 71%)	141	23	65	53
True (correct)	136 (96*)	22 (96)	63 (97)	51 (96)
False	5 (4)	1 (4)	2 (3)	2 (4)
It is unnecessary to document the date on a ceased medication order as long as both the prescription and administration sections of a medication chart are crossed out.				
Responses (RR 135/200, 68%)	135	18	63	54
True	11 (8)	1 (6)	7 (11)	3 (6)
False (correct)	124 (92*)	17 (94)	56 (89)	51 (94)
"Flucloxacillin PO 500mg 6/24 for 1/7" is a safe prescription if one day of antibiotic therapy is required before discharge				
Responses (RR 141/200, 71%)	141	18	69	54
True	27 (19)	5 (28)	13 (19)	9 (17)
False (correct)	114 (81*)	13 (72)	56 (81)	45 (83)
How many of the following are acceptable when prescribing once DAILY prescriptions: OD, d, o.d., qd, QD, mane, M, N nocte?				
Responses (153/200, 77%)	153	20	71	62
One	16(10)	3(15)	6(8)	7(11)
Three	24(16)	4(20)	8(11)	12(19)
Two (correct)	112 (73*)	13 (65)	56 (79)	43 (69)
Five	1 (<1)	0	1 (1)	0 (0)
How many of the following abbreviations are appropriate: subcut, sc, S/C, SC, S/L, SL, IO, D/C?				
Total number of responses (RR 148/200, 74%)	148	23	67	58
Three	30 (20)	4 (17)	12 (18)	14 (24)
One (correct)	79 (53*)	13(57)	39 (58)	27 (47)
Two	32 (22)	4 (17)	14 (21)	14 (24)
Five	4 (3)	2 (9)	1 (1)	1 (2)
Eight	3 (2)	0	1 (1)	2 (3)
U and IU are acceptable abbreviations for units				
Responses (RR 149/200, 75%)	149	21	69	59
True	8 (5)	2 (10)	4 (6)	2 (3)
False (correct)	141 (95*)	19 (90)	65 (94)	57 (97)

Table 1 (Cont.). Assessment survey questions and JMO responses according to self-identified previous work experience at the study hospital#

Assessment questions and responses (Responses rate, all responses/all JMOs, %)	Overall JMO responses, n (%)	Previous work experience unknown^, n (%)	JMOs worked at the hospital in the previous year, n (%)	JMOs who did not work at the hospital in the previous year, n (%)
How many errors (abbreviations symbols etc.) are there in the prescription "clonidine PO .030 mcg 8° x3d then review"				
Responses (RR 144/200, 72%)	144	22	66	56
Five (correct)	86 (60*)	14 (64)	41 (62)	31 (55)
Two	1 (<1)	0 (0)	1 (2)	0 (0)
Three	37 (26)	7 (32)	14 (21)	16 (29)
Six	20 (14)	1 (4)	10 (15)	9 (16)
Chemical symbols (MgSo4, KCl etc.) should be used when ordering electrolytes				
Responses (62/200, 31%)	62	7	47	8
True	8(12.9)	1(14.3)	7(14.9)	0
False (correct)	54 (87.1*)	6 (85.7)	40 (85.1)	8 (100)
Empiric antibiotic therapy should be reviewed:				
Responses (RR 147/200, 74%)	147	23	67	57
48 hours after initiation	29 (20)	4 (17)	13 (19)	12 (21)
At least daily (correct)	114 (78*)	19 (83)	50 (75)	45 (79)
72 hours after initiation	1 (<1)	0	1 (1)	0
On consultant ward round	3 (2)	0	3 (5)	0
Paediatric patients should remain on IV antimicrobials as long as they are febrile				
Responses (RR 145/200, 73%)	145	22	63	60
True	8 (6)	3 (14)	1 (2)	4 (7)
False (correct)	137 (94*)	19 (86)	62 (98)	56 (93)

#Unless otherwise stated there were no statistically significant differences in the proportion of correct responses between groups; ^JMOs who did not respond when asked if they had worked in the study hospital in the previous year; §Intranet resource belonging to another tertiary paediatric hospital with links to their own hospital specific guidelines;** p=0.001; BNF for Children=British National Formulary for Children; AMH CDC= Australian Medicines Handbook-Children's Dosing Companion; Uptodate®; IV=Intravenous; RR: Response rate; *Overall percentage correct

Almost all JMOs recognised that the error-prone abbreviations "IU" and "U" were unacceptable when prescribing medications measured in "international units" and "units" (95%, 141/149). Almost 30% of JMOs were unable to identify the standard terms "mane" and "nocte" from terms that should not be used (OD, D, o.d, M, N, QD, qd). Only 53% could differentiate the standard term "subcut" from the error-prone abbreviations. When asked to count the erroneous and non-standard terms present in the order "clonidine PO .030 mcg 8° x3d then review", only 60% correctly identified all five (Table 1). Although the response rate was considerably lower than any other question (31%, 62/200), 87% of participants were aware that chemical symbols should not be used when prescribing electrolytes.

Discharge prescriptions

The 60-minute AMS and safe prescribing session included three additional assessment questions to gauge awareness of prescribing requirements for special authority and Schedule 8 medicine (drugs of addiction, e.g. oxycodone, fentanyl, etc.). Approximately 90% of JMOs were reportedly aware that standard hospital prescription forms were unsuitable for supply from a retail pharmacy. Over 90% were aware that multiple Schedule 8 medicines could not be prescribed on a single discharge prescription, and that pre-printed patient identification should not be used for Schedule 8 discharge prescriptions (Table 2).

Prescribing Audit

Nine hundred and seventy-six medication orders were reviewed for 166 patients between 7 February and 6 May 2017. No statistically significant changes in prescribing were observed during the auditing period. Over the three months of auditing, between 63 to 75% of audited patients had an appropriately documented ADR (Table 3). The maximum number of PRN doses was included on 77% of PRN orders, ranging from 84% of orders in period 1 and 70% in period 3 (p=0.08); on average 46% of orders included a documented indication.

Error-prone abbreviations were observed in 5 to 8% of medication orders in the first two months and 2% in period 3 (p=0.09). Almost all intermittent medications were documented according to the national QUM indicator with the non-administration days crossed out (27/28). Dose calculations were consistently documented in approximately half of all orders.

DISCUSSION

JMOs who participated in this baseline assessment survey demonstrated an excellent understanding of best practice for safe and appropriate prescribing. Almost all JMOs were familiar with AMS and were aware of the national AMS clinical indicators for empiric antimicrobial therapy that require prescribers to document the indication and date of clinical review in the medical record.[14] JMOs also recognised that fever alone was not an indication for intravenous antibiotic therapy, and that empiric antibiotic

Table 2. Discharge Prescription Assessment Questions[#]

Assessment Question and response options (n=111)	Overall (%)	Previous work experience unknown[^], n (%)	JMOs worked at the hospital in the previous year, n (%)	JMOs who did not work at the hospital in the previous year, n (%)
A PBS Authority may be obtained from an outside (community) pharmacy with a hospital discharge prescription?				
Responses (RR 77/111)	77	11	19	47
True	8 (10)	2 (18)	2 (11)	4 (9)
False (correct)	69 (90*)	9 (82)	17 (89)	43 (91)
When prescribing Schedule 8 medications a separate discharge prescription is required for each form of the medication?				
Responses (RR 83/111)	83	13	20	50
True (correct)	78 (94*)	11 (85)	20 (100)	47 (94)
False	5 (6)	2 (15)	0 (0)	3 (6)
Addressograph (Patient ID stickers) may be used on discharge prescriptions for Schedule 8 medications				
Responses (RR 84/111)	84	12	20	52
True	7 (8)	0 (0)	2 (10)	5 (10)
False (correct)	77 (92*)	12 (100)	18 (90)	47 (90)

#No statistically significant differences between groups; ^ Unknown=No response provided when asked if they had worked in the study hospital in the previous year; *Overall percentage correct
Schedule 8=Drugs of Dependence (oxycodone, morphine, fentanyl etc); PBS=Pharmaceutical Benefits Scheme; Patient ID=Patient identification

therapy should be reassessed at regular intervals. Standard and error-prone terminology was generally differentiated by JMOs. However, the very low response rate to our question about the use of chemical symbols suggests that some JMOs might have chosen not to participate due to uncertainty. If true, this could have implications elsewhere in our survey.

By conducting our survey during face-to-face orientation, we had direct contact with all JMOs. In addition to assessing knowledge amongst respondents, we were able to report participation at each assessment question during the AMS and safe prescribing session. Response rate in this survey is of particular importance due to the conditions in which it was conducted; attendance was mandatory and the sessions were held during protected teaching time so that JMOs were not distracted by their day-to-day tasks. The 1-hour orientation was held at the beginning of the new term, before JMOs were assigned any designated responsibilities to a medical unit or cohort of patients that might prevent them from attending or concentrating on formal teaching.[8] Despite the ideal conditions, 15% of JMOs overall did not respond to a single question during the AMS and safe prescribing session, and only 13% responded to all the survey questions in their session.

JMOs in our study most readily participated when asked to identify preferred medication information resources, in keeping with other research that suggests JMOs view information on guidelines and protocols favourably[8], and rely heavily on online sources of information.[17]

It is widely recognised that prescribing is complex, and influenced by a range of personal factors such as baseline knowledge, awareness and attitudes, as well as environmental interruptions and social dynamics.[1,18] The results of our prescribing audits reinforce these conclusions and are consistent with other evaluations that target prescribing behaviour. Documentation was not ideal at any point in the months following the session despite the results of our baseline survey and the prompts incorporated into the paediatric NIMC that outline where to record the maximum PRN dose in 24 hours, indication for use, the prescriber's dose calculations and how to document an ADR. Incomplete ADR documentation is of particular interest for AMS programs, as patients labelled with allergies to commonly used first line antimicrobials

Table 3. Prescribing behaviour observed after AMS and Safe Prescribing session*

Prescription characteristics	Period 1 n (%)	Period 2 n (%)	Period 3 n (%)	p-value
Patients reviewed	40	65	61	
Prescriptions per patient, median (IQR)	6.5 (4 - 10)	4 (3 - 8)	5 (4 - 7)	0.03
National quality use of medicines Indicators[+]				
Patients with ADR documented on current medication chart	26/40 (65)	41/65 (63)	46/61(75)	0.30
Prescriptions with error prone abbreviations	13/284 (5)	27/345 (8)	7/347 (2)	0.09
Paediatric medication orders that include the correct dose per kilogram or BSA	91/183 (50)	107/221 (48)	135/262 (52)	0.88
Medication orders for intermittent therapy prescribed safely	14/14 (100)	5/6 (83)	8/8 (100)	0.22
Local Indicators				
Order with indication documented	147/284 (52)	157/345 (46)	145/347 (42)	0.37
PRN orders that specified the maximum number of doses every 24 hours	61/73 (84)	83/103 (81)	80/115 (70)	0.08

ADR: Adverse drug reaction; BSA: Body surface area; IQR: Interquartile range; PRN: When required
*Period 1: 7 February-6 March 2017, Period 2: 7 March to 6 April, Period 3: 7 April to 6 May 2017
+ National quality use of medicines indicators specified as:
Indicator 3.2 ADR status must be documented as nil known, unknown or include the drug, reaction, type and date.
Indicator 3.3 Error prone abbreviations: Qd, OD, U, mcg, trailing zeros or failure to include a leading zero when the dose is less than a one. Adapted to include abbreviations IT, SC and µ
Indicator 3.4 Paediatric dose must be documented, safe and effective,
Indicator 3.5 Intermittent therapy non-administration days must be crossed out, days of therapy specified

(e.g., penicillins) may be treated with alternate broad-spectrum agents that are associated with greater risk of adverse effects.[19]

This study has several limitations. We were unable to determine whether the decision to participate during the session reflected individual JMOs confidence or their interest in the content. We also cannot exclude alternate scenarios such as temporary audience response system malfunctions or JMOs using the keypad incorrectly by accidentally or intentionally selecting incorrect answers. In all these scenarios, our results could underreport JMO knowledge and participation. Our survey questions were relatively basic for our cohort of JMOs who had prior hospital experience, and in some cases, were close to completing their paediatric training. Nevertheless, even without JMO's usual workplace distractions we identified gaps in knowledge and observed examples of error-prone prescribing and incomplete documentation. Finally, our study design was not ideal. A sufficiently powered randomised control trial was not feasible in our setting and may have been inappropriate. We did not limit our prescribing audit to JMOs and may have included prescriptions written by Consultant Paediatricians. However, this would be rare as JMOs are most frequently tasked with prescription writing responsibilities, even if they are not responsible for prescribing decisions.[8]

Further studies are needed to determine whether face-to-face education adopted here improves prescribing behaviours, and how suboptimal prescribing can be addressed despite excellent or adequate knowledge of the expected prescribing practice. Targeted behaviour change strategies underpinned by a deeper understanding of prescriber's perceptions and motivations are warranted and should be further explored.

CONCLUSIONS

JMO respondents demonstrated sound baseline knowledge of safe prescribing and good antibiotic prescribing practices. Potential gaps in knowledge included the use of chemical symbols and error-prone abbreviations. Participation in a baseline assessment survey facilitated by an audience response system was adequate but not ideal despite eradicating distractions such as clinical or administrative responsibilities. Suboptimal documentation in the months following the knowledge assessment suggests prescribing is influenced by factors beyond knowledge and awareness.

CONFLICT OF INTEREST

All authors report no conflicts of interest in relation to this manuscript.

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