RESEARCH

Cross-cultural Comparison of Pharmacy Students' Attitudes, Knowledge, Practice, and Barriers Regarding Evidence-based Medicine

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Objective. To explore cultural influences on US and Japanese pharmacy students' evidence-based medicine (EBM) attitudes, knowledge, and behavior.

Methods. A cross-sectional study was conducted using a self-administered survey. Senior students in one pharmacy school in the United States and two pharmacy schools in Japan were invited to complete a 33-item survey instrument.

Results. Students in both countries reported having positive attitudes and understanding of EBM concepts. In their self-evaluation, American students rated their current EBM practice, EBM skills, and access to EBM resources higher than Japanese students rated themselves in these areas. The most common barriers to EBM for American students were lack of time (84.5%), lack of statistical knowledge (63.9%), and lack of critical appraisal skills (53.1%). The most common barriers to EBM for Japanese students were lack of training (92.6%), lack of clinical knowledge (90.4%), and lack of opportunity (88.8%).

Conclusion. Although barriers to implementing EBM and confidence levels in using EBM differed between US and Japanese pharmacy students, both cohorts recognized EBM as an important skillset for the pharmacy profession. Culturally specific approaches to teaching EBM to pharmacy students are needed to improve EBM use in practice.

Keywords: evidence-based medicine, pharmacy student, pharmacy education, international comparison, Japan

INTRODUCTION

Evidence-based medicine (EBM) is a health care concept which integrates the best available research evidence with clinical expertise and patient values and preferences to optimize the care of patients.[1,2] Evidence-based medicine has been embedded within the medical and health professions for over 20 years.[3] Today, most medical schools include training in EBM in their curricula, although its implementation is not standardized and multiple methods of teaching EBM have been shown to be effective.[4,5] Behaviors and attitudes of physicians and medical students have been examined in several studies and have found heterogeneity in their level of knowledge and EBM usage by country and specialty.[6-11]

While evidence-based medicine has been adopted into pharmacy practice over the last decade,[12] little about EBM education in pharmacy has been published in the literature. The role of pharmacists has shifted from dispensing to patient-focused care and clinical decision-making. This has led to the emergence of EBM as a new paradigm for pharmacy practice and education. The ability to retrieve, evaluate, and apply medical literature to patient care is a key skill for pharmacists. Many countries around the world are now following the US Doctor of Pharmacy (PharmD) degree model and modifying their curricular structure from a four-year to a six-year pharmacy education program with enhanced clinical didactic and experiential content in order to meet the goal of being the profession responsible for ensuring optimal medication use.[13-15]

Although the goals for the pharmacy profession to ensure safe and effective medication use for patients may

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be similar among many developed countries,[13-15] the approaches used to meet these goals might not be the same because of cultural and sociological differences. Different cultures may diverge in several aspects that may influence the pharmacy profession, including: varying levels of public trust in the health care system and health care practitioners; diverse technical and/or clinical roles for pharmacists within the health care system, which may then affect the curriculum requirements of pharmacy schools as they prepare students for these roles.

Specifically, there are distinctly different characteristics between American and Japanese societies that may influence both the pharmacy profession and student pharmacists in training. The United States tends to be a more individualistic society, with individuals commonly being highly confident and taking initiative (self-enhancing motivation), while Japan is a collectivistic society, with individuals commonly very humble and follow rather than lead (self-improving motivation).[16-18] Culturally suitable approaches to teaching EBM to pharmacy students may be necessary to ensure optimal education in this area.

Given the importance of EBM in informing decisions regarding medication use, EBM is critical to the practice of pharmacy; thus, culturally specific educational methods may be necessary. Research on student pharmacists' knowledge of as well as attitudes and behaviors toward EBM has been limited. Penetration of EBM education in pharmacy also likely differs in different regions of the world, similar to that seen in medicine.[6-11] The impact of cultural and societal influences on EBM education across the world is poorly understood in general and specifically in pharmacy. Therefore, the purpose of this study was to characterize and compare the knowledge of and attitudes, and behavior of pharmacy students toward EBM in two countries with distinctly different cultures.

METHODS

We conducted a cross-sectional survey of student pharmacists in the second and fourth years of the PharmD program at Western University of Health Sciences (Pomona, CA), and in the fourth to sixth years of the Bachelor of Pharmacy programs at Toho University (Chiba, Japan), and at Kobe Gakuin University (Kobe, Japan). All students in were invited to participate in either a web-based or a paper-based survey between March and November 2015. Characteristics of the schools and their EBM curricula are shown in Table 1. While the US four-year PharmD program requires completion of a minimum of two years of prepharmacy undergraduate courses, Japanese students enter the six-year Bachelor of Pharmacy degree program with only a high school education. Experiential education is typically more extensive in US phar-

macy programs than in Japanese programs, and even more extensive at WesternU. Experiential education at WesternU occurs as introductory experiences in the first and second years, with more advanced experiences occurring during the third and fourth year for a total of 60 weeks of experiential education. The duration of experiential pharmacy education in Japan is shorter at 22 weeks, and takes place solely in the fifth year of school. In the United States, lectures often include active learning. In contrast, Japanese lectures are more traditional and include only a limited degree of active learning, which may be due in part to the large class sizes.

The data collection tool used in this study was a self-administered questionnaire consisting of close-ended questions regarding the respondent's attitudes toward EBM, knowledge of and preference to use different evidence-based information sources, and possible barriers to EBM application. The questionnaire was developed based on comprehensive literature review and was adapted from questionnaires used in previous studies in this area.[19-22] The face and content validity of the questionnaire was confirmed by two EBM experts. The questionnaire was originally in English then translated into Japanese by two native Japanese speakers with back translation to English to compare with the original English questionnaire. The questionnaire included 33 questions: attitudes toward EBM (seven items), general knowledge about EBM (four items), exposure to EBM (three items), usage-practice of EBM (three items), self-evaluated skills (five items), access to EBM resources (five items), future use of EBM (four items), EBM terminology (one item with six terms), and barriers to EBM use (one item with 14 barriers in three categories). Similar to other studies, we included a question with a meaningless, dummy term in order to determine students' accuracy of self-assessed EBM knowledge and their interest in learning new terms.[22] To measure students' knowledge, attitudes, and perceptions regarding EBM, we used either yes/no responses or responses based on a four-point Likert scale, with anchors tailored to the specific section. For agreement questions, the response options were strongly agree, agree, disagree, and strongly disagree. For frequency questions, the response options were rarely, sometimes, usually, and always. For terminology questions, the response options were can explain to others, know somewhat, want to know, and don't need to know.[22] Participants were invited to participate in the survey in their classrooms. They were provided with either a web link to the survey sent via email or a paper survey instrument. Email was not routinely used to communicate to students at Kobe Gakuin University, so a paper-based survey was administered. Students completed the survey in class during break time.

Table 1. Characteristics of Schools and Participants in a Cross-cultural Comparison of Pharmacy Students' Attitudes, Practice, and Barriers Regarding Evidence-Based Medicine

Schools	US (WesternU)	Japan (Toho)	Japan (Kobe)
Pharmacy program	4-year PharmD	6-year Baccalaureate	6-year Baccalaureate
Private or public school	private	private	private
Class size	140	230	250
Gender Male/Female (%)	26/74	36/64	41/59
EBM Education (year in school)			
Tertiary resources	1st	4th	3rd
Research methods	1st, 2nd	4th	3rd, 4th
Biostatistics	1st, 2nd	3rd, 4th, 6th	3rd, 4th
Ask focused clinical questions	2nd, 3rd	4th	4th
Acquire the best evidence	2nd, 3rd	4th	4th
Appraise the evidence	2nd, 3rd	4th	4th
Apply the evidence to patient care	2nd, 3rd	4th	4th
Assess their EBM performance	2nd, 3rd	4th	4th
Interpreting results (eg, ARR, NNT, CI)	2nd, 3rd	4th	4th
Pharmacoeconomics	3rd	4th	3rd
Journal club	3rd	4th	4th
Experiential education	3rd, 4th (60 weeks)	5th (22 weeks), 4th-6th basic or clinical research	5th (22 weeks), 4th-6th basic or clinical research
EBM Curriculum	Total 9 credit hours of required courses, and various EBM activities throughout the didactic curriculum and during experiential education.	Total 2.5 credit hours of required courses. Mainly lecture with limited opportunities for EBM practice during didactic curriculum. Rarely practice EBM during experiential education	Total 1.5 credit hours of required courses, and 1.5 credit hours of elective courses. Mainly lecture with limited opportunities for EBM practice during didactic curriculum. Rarely practice EBM during experiential education.

Participants	US (WesternU) (N=194) Response Rate 73%	Japan (Toho) (N=368) Response Rate 54%	Japan (Kobe) (N=347) Response Rate 93%	*p* value
Gender Female (n, %)	147 (76%)	230 (63%)	215 (62%)	.002
Average age (years ± SD)	28 (3.66)	22 (0.99)	23 (2.04)	<.001
Year in school (n, %)	2nd year: 77 (40%) 4th year: 117 (60%)	4th year: 69 (19%) 5th year: 129 (35%) 6th year: 170 (46%)	4th year: 172 (50%) 6th year: 175 (50%)	
English as the first language (n, %)	100 (52%)	0 (0%)	0 (0%)	<.001

Abbreviations: ARR=absolute risk reduction, CI=confidence interval, EBM=Evidence-Based Medicine, Kobe=Kobe Gakuin University, NNT=number needed to treat, PharmD=Doctor of Pharmacy, Toho=Toho University, WesternU=Western University of Health Sciences

Descriptive statistics (expressed as percentages) were used to describe categorical data. Means with standard deviations were used to describe continuous data. Responses of strongly agree and agree were combined, as were responses of always and usually, and strongly disagree and disagree. Because responses from the two Japanese schools did not differ and the purpose of our study was to identify differences between the United States and Japan, the Japanese responses were combined. Two-way analysis of variance was used to compare mean differences between groups. Chi-square was used to compare proportions. A *p* value of <.05 was considered significant. Data were analyzed using SAS, version 9.3 (Cary, NC). The study was approved by the Institutional Review Board at Western University of Health Sciences.

RESULTS

A total of 909 students (response rate, 68.8%) from three pharmacy schools participated in the study: 194

US students in their second or fourth years at Western University of Health Sciences (web-based survey administered, response rate of 73.8%), and 368 students in their fourth, fifth, or sixth year at Toho University (web-based survey administered: response rate 53.7%), and 347 students in their fourth or sixth year at Kobe Gakuin University (paper-based survey, response rate 93.0%). The paper-based survey administered at Kobe Gakuin University had a higher response rate than did the web-based survey completed by students at the other two schools. The majority of participants in the United States (75.8%) and Japan (62.2%) were female. Japanese students were significantly younger than American students (Table 1).

In both countries, the majority of students had positive attitudes toward EBM and reported having an understanding of EBM concepts (Table 2). The majority of students in both the US and Japanese groups agreed that EBM improves the quality of decision making for patient care (97.9% vs 94.7%) and is important for the pharmacy profession (95.9% vs 96.8%). Only one negative attitude regarding EBM use, the overwhelming amount of evidence, was agreed to by both US (59.8%) and Japanese (73.8%) students. Although EBM use had been emphasized within the respective pharmacy curricula, the majority of students in both countries had not observed pharmacists or medical professionals using EBM frequently in practice. American students evaluated their current EBM practice (84.5% vs 64.1%), as well as their own EBM skills and access to EBM resources significantly higher than the Japanese students did. There were no statistically significant differences between the groups regarding their intentions to use EBM in future practice (Table 2).

The survey examined pharmacy students' knowledge of common EBM terms. The percentages of students in the US and Japan, respectively, that indicated at least some understanding of common EBM terms were as follows: 99.0% vs 47.8% for "number needed to treat," 99.0% vs 72.0% for "publication bias," 99.0% vs 60.2% for "confidence interval," 97.4% vs 82.6% for meta-analysis, and 93.8% vs 92.0% for "odds ratio." The term "fixed event rate" was a meaningless dummy term. In Japan, 77.9% of students responded "want to know" and 17.7% reported either "can explain to others" or "know somewhat." However, in the United States, only 29.4% of students reported "want to know," while 69.6% reported that they "can explain to others" or "know somewhat."

The most common barriers to use of EBM among US students were lack of time (84.5%), statistical knowledge (63.9%), and critical appraisal skills (53.1%), and for Japanese students, lack of training (92.6%), clinical knowledge (90.4%), and opportunity (88.8%) (Figure 1). There were 13 barriers identified by >50% of Japanese students, while only three barriers identified by >50% of US students. Time was the only barrier that Japanese students (59.9%) identified less frequently than American students (84.5%. $p<.001$).

Barriers to EBM use were categorized into three groups: skills, environment, and attitudes (with seven items in skills, five items in environment, and two items in attitudes) (Figure 2). The mean number of skill barriers identified by Japanese students was 5.7 (SD=1.7) out of 7 items (81.6% of all possible skills barriers), while US students identified 2.6 (SD=2.2) out of 7 items (36.9% of all possible skills barriers) ($p<.001$). The mean number of environment barriers identified by Japanese students was 3.5 (SD=1.2) out of 5 items (69.2% of all possible environment barriers), while US students identified 1.7 (SD=1.8) items (33.4%) ($p<.001$). The mean number of attitudes barriers identified by Japanese students was 1.2 (SD=0.7) out of 2 items (59.5% of all possible attitudes barriers), while US students identified 1.2 (SD=0.7) out of 2 items (61.5% of all possible attitudes barriers) ($p=.49$). Two questions within the attitude category showed different patterns, which may explain the lack of difference for the attitude category overall. Time was identified as a barrier more often by American students, while interest was identified as a barrier more often by Japanese students.

DISCUSSION

The findings from this study indicate that student pharmacists in both countries value EBM despite different educational structures. Pharmacy students in both countries had positive attitudes toward EBM. This finding was consistent with studies conducted with other medical professionals and students.[8-11,22] There is increasing awareness of and perceived need to incorporate EBM into pharmacy program curricula in both countries.[12, 23,24]

The majority of students in both countries reported at least some understanding of common EBM terms (4 terms out of 5 in Japan, and 5 terms out of 5 in the United States). "Number needed to treat (NNT)" for Japanese students was the least understood term (47.8%), whereas it was the best understood term among US students (99.0%). In contrast, "odds ratio" was the most understood term among Japanese students (92.0%), while it was the lowest for American students (93.8%). Similarly, in a study conducted among Japanese resident physicians, the highest knowledge score was also for odds ratio and the lowest

Table 2. US and Japanese Pharmacy Student's Attitudes, Knowledge, Usage-Practice, Exposure, Skills, Access, and Future Use Regarding Evidence-based Medicine

	US (%)	Japan (%)	*p* value
Attitudes	Strongly Agree + Agree	Strongly Agree + Agree	
EBM improves the quality of decision-making	98	95	.05
Pharmacists have a responsibility to refer to evidence to make recommendations	97	94	.05
Pharmacists have a responsibility to keep updating their knowledge	99	98	.27
EBM is an important skill for pharmacists	96	97	.54
Pharmacists, in general, should not practice EBM	5	9	.11
The amount of evidence is overwhelming	60	74	<.001
The adoption of EBM places an unreasonable demand on pharmacists	22	9	<.001
General Knowledge	Strongly Agree + Agree	Strongly Agree + Agree	
EBM requires effective search skills	97	98	.58
Critically appraised evidence should be appropriately applied	98	96	.12
EBM does NOT take into account patients' preferences	35	12	<.001
EBM is cook-book medicine that disregards clinical experience	13	19	.05
Exposure	Always + usually	Always + usually	
How frequently do you see pharmacists using EBM?	32	21	.001
How frequently do you see other medical professionals using EBM?	28	23	.20
Professors emphasize the importance of EBM use during lectures	95	76	<.001
Usage-practice	Strongly Agree + Agree	Strongly Agree + Agree	
The practice of EBM is a routine part of my learning	85	64	<.001
The practice of EBM has changed the way I learn	86	31	<.001
I personally appreciate the advantages of practicing EBM	96	90	.007
Self-evaluated skills (5As)	Strongly Agree + Agree	Strongly Agree + Agree	
I can formulate a focused clinical question	98	64	<.001
I can effectively search	94	35	<.001
I can critically appraise	91	28	<.001
I can appropriately apply	94	35	<.001
I can assess my own EBM skills	85	28	<.001
Access (How frequently do you access)	Always + usually	Always + usually	
Textbook	28	18	.002
Any data source	82	13	<.001
Internet	62	39	<.001
Original research papers	38	11	<.001
UpToDate, ACP Journal Club or Clinical Evidence	78	4	<.001
Future use	Strongly Agree + Agree	Strongly Agree + Agree	
EBM will be useful in my future practice	97	98	.50
I support lifelong learning	94	91	.14
I am willing to practice EBM in the future	92	95	.18
EBM should be an integral part of the pharmacy curriculum	95	92	.24

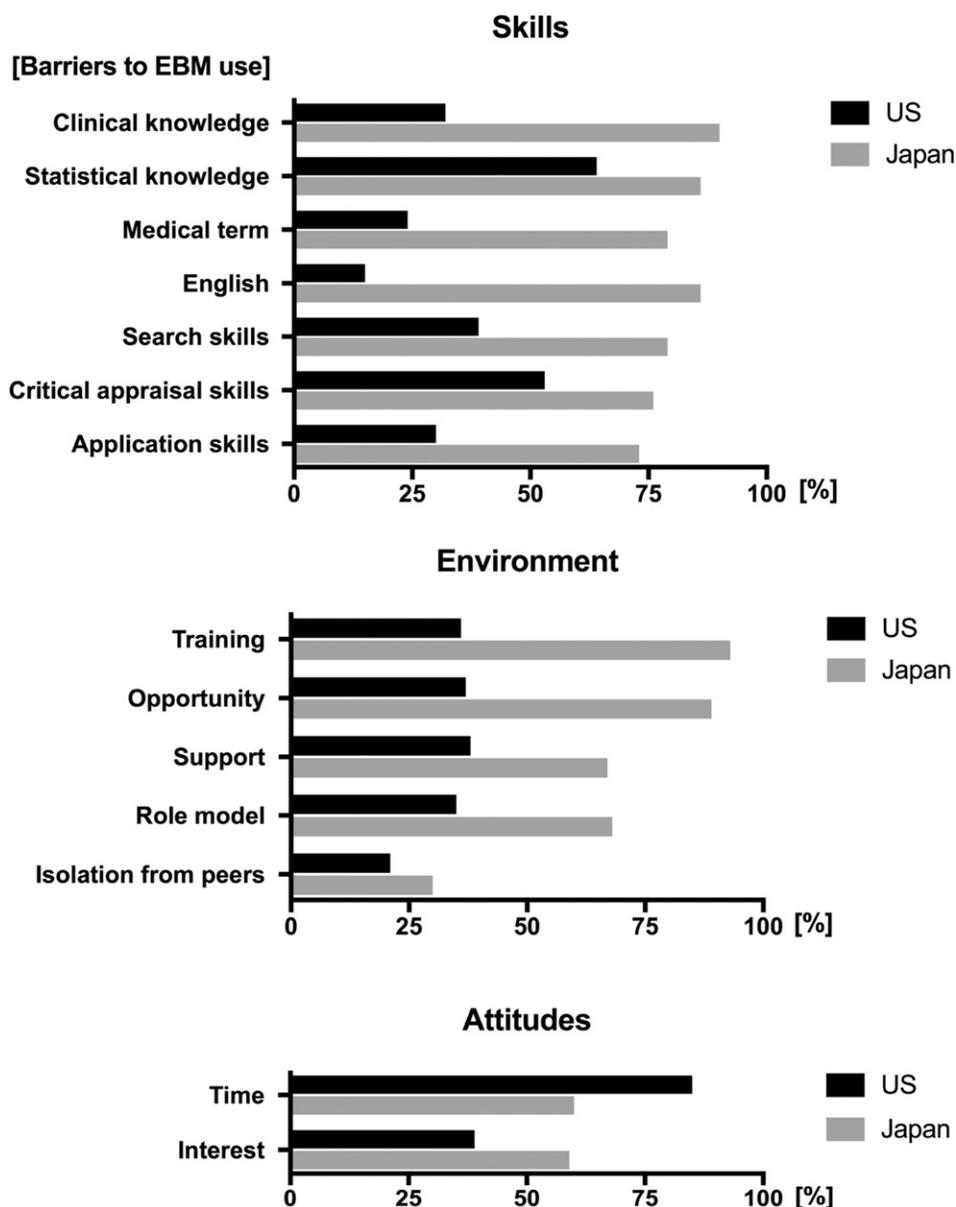Abbreviations: ACP=American College of Physician, EBM=evidence-based medicine

Figure 1. Proportion of Students' Reporting Barriers to EBM Use by Skills, Environment, and Attitudes

score was for NNT.[8] Japanese students and practitioners are more familiar with statistical terms than EBM-specific terms. This may be the result of greater exposure to basic sciences and traditional research concepts in Japanese pharmacy schools than in US schools. This is reflected in the compositional differences in pharmacy faculty members between the pharmacy schools examined in the two countries. In our study, the proportion of basic sciences to clinical faculty members in Japan was much higher (>85% are basic scientists) than that in the US (<40% are basic scientists). In addition, Japanese students have a lengthy, mandatory research course, which occurs in the fourth through the sixth years, during which

students conduct either clinical or basic science research. Therefore, Japanese students have more exposure to basic science and traditional research concepts. In a meta-analysis of physicians from 18 different countries, 83% of physicians indicated their understanding of NNT,[22] while 74%-75% of pharmacists in the United States and Australia understand NNT.[25,26] While common EBM terms have been penetrating the health profession lexicon around the world, American pharmacy students appear to have greater recognition of the terms than do Japanese pharmacy students.

We included the meaningless dummy term "fixed event rate" to determine students' accuracy of self-
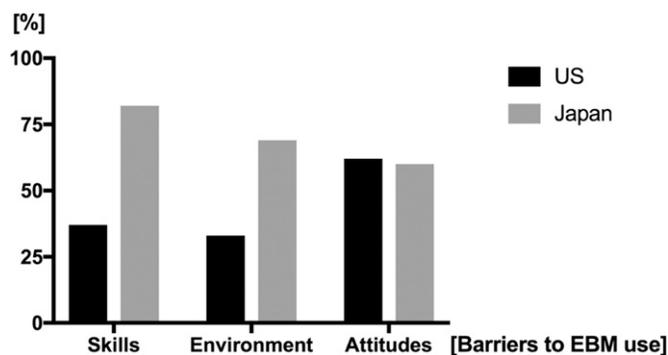
Figure 2. Proportion of Students' Reporting Barriers to EBM Use According to Three Categories

assessed knowledge and their interest in learning new terms. The majority of Japanese students (77.9%) reported "wanted to know" and only 4.4% reported "no need to know," while the majority of US students (69.6%) indicated their understanding of the dummy term, either unconsciously or consciously, which suggests a possible bias of socially desirable responding (SDR). Paulhus refined SDR into two distinct factors: self-deceptive enhancement (SDE) and impression management (IM).[27] Studies show that American students have higher SDE than Japanese students, whereas Japanese have higher IM than American students.[28] Self-deceptive enhancement is part of SDR and reflects an overly positive presentation of oneself unconsciously, in other words, positively biased self-perceptions. This may have affected our results regarding American students' perception of their skills, knowledge, and barriers to EBM use. Possible reasons that Japanese students may not have exhibited SDR is that unfamiliarity with EBM may be common among pharmacy students; hence, they could express their uncertainty without feeling judged. Furthermore, Japanese tend to be self-critical by nature and that may influence their response to self-perception questions. Although we cannot conclude the existence of SDR, the erroneous answer from US students regarding the dummy term was notable. In contrast, Japanese students recognized their unfamiliarity with the dummy term despite having less understanding of common EBM terms as compared to US students.

Although students in both countries recognized the value of EBM and possessed general EBM knowledge, there was low self-reported usage of EBM resources by student pharmacists in both countries. Other studies have found similar results among medical residents.[6,9-11] In Japan, where EBM skills are taught in lectures and there are only limited opportunities to practice EBM, the majority (92.6%) of students identified lack of training as a barrier to use of EBM. In contrast, only 36% of American students identified lack of training as a barrier to using EBM. While the six-year pharmacy program that started in Japan in 2006 expanded clinical training compared with the previous four-year program, the clinical curriculum may still not be fully developed. Compared to the United States, the Japanese program also provides fewer didactic credit hours for EBM, limited active learning of EBM, a shorter length of experiential education than in the United States, and limited EBM application during experiential education. Because clinical services provided by pharmacists in Japan are more limited than those provided in the United States, Japanese students also may have less opportunity to learn EBM skills from preceptors. Furthermore, because pharmacy technicians do not exist in Japan, additional time must be taken in the pharmacy curriculum to teach technical skills. This may reduce time available for clinical training, especially during experiential education.

In contrast, among the US school surveyed, where EBM training and presentations are required throughout didactic courses and experiential education, all environmental barriers were identified by <50% of American students. Nevertheless, EBM use in the United States is still suboptimal. Although several studies have demonstrated the effectiveness of EBM training via a one-day workshop, journal club, monograph assignment, or computer- or lecture-based instructions in increasing EBM knowledge in students and practitioners,[29-34] the acquired knowledge did not equate to an increase in their actual use of EBM. Although there is an overwhelming emphasis on the importance of EBM, its implementation into practice remains suboptimal.[38-40] The ever-expanding base of medical knowledge and research evidence, along with increasing complexity of disease management of patients with multiple co-morbidities in aging societies presents challenges for widespread EBM implementation. As others have found, EBM curricula need to be integrated with educational interventions that change behavior in learners to establish a new routine of actual EBM use.[35-37]

Our results show that there were no significant differences between US and Japanese pharmacy students in attitudes about and willingness to use EBM in the future. Students from both countries indicated they did not frequently observe pharmacists or other medical professionals using EBM, which further confirms the reported lack of implementation in practice. The majority (68.0%) of Japanese students identified that lack of a role model was a barrier to EBM use, while fewer (35.1%) American students reported this. As stated earlier, Japan is a collective society as compared with the individualistic society

found in the United States. Thus, Japanese organizations have more resistance to change, and the Japanese people typically prefer to follow others rather than lead.[17,18] This is particularly true in medicine, where decision-making historically has been hierarchy-based or authority or "expert"-based medicine.[41,42] In such an environment, students may not be comfortable using EBM without the influence and encouragement of a role model. In contrast, in an individualistic society like the United States, pharmacy students rely less on role models when entering into new fields and may be more comfortable with taking initiative in implementing EBM. Several studies emphasize the importance of educating instructors themselves as the impact of role models is strong.[43] Despite a lack of role models in Japan, more than 90% of Japanese pharmacy students reported a willingness to use EBM in the future, and nearly all students indicated that they felt EBM would be useful to their practice. This may represent an important area of opportunity in Japan, where the introduction of more role models might facilitate EBM use by students who are willing and ready, as well as encourage students to become role models themselves.

Nearly 90% of American students reported confidence in their EBM skills. In addition, all survey terms were reported to be understood by more than 90% of American students, and the majority of skills were not identified as a barrier to their use of EBM. In contrast, the majority of Japanese students evaluated their own skills as insufficient and their proficiency in all skills as posing a barrier to implementing EBM. Because of cultural differences in self-evaluation and SDR, students' reported or self-perceived level of confidence may not reflect their actual skills and confidence. In contrast to the self-confidence reflected in the American pharmacy students' self-evaluation, one meta-analysis reported that the majority of physicians from 18 different countries considered their evidence-based practice skills to be insufficient.[22] As compared to practitioners in the United States, US pharmacy students in this study may have had poor insight or overly evaluated their skills, which may have a negative impact on their EBM use in the future. On the other hand, these students may have had better EBM training, as EBM has been adopted to a greater extent in the US pharmacy curriculum in recent years. Also, practitioners may be more aware of the difficulty of EBM implementation than students who lack practical experience.

The fact that the "number needed to read" (NNR) for identifying clinically relevant studies published in one journal of emergency medicine was 26.7, shows that searching for evidence is not an easy task in practice.[44] Despite the reality of NNR, few students in the United States identified concerns for EBM searching skills. American and Japanese students may have different perspectives on the role of barriers. One study showed that Americans work longer if they succeed at the first task while Japanese individuals work longer if they fail.[16] Japanese have a "self-improving motivation," ie, trying to prevent failure, while Americans have a "self-enhancing motivation," ie, focusing on their strengths.[16] Also, American students may not be willing to admit their uncertainty.[45] While capitalizing and building on strengths is helpful, in order to continue learning essential EBM skills, accurate self-assessment capabilities are critical. In contrast, Japanese students may focus excessively on uncertainty, which may prevent them from building confidence. Repetitive training tends to result in better learning outcomes than single training sessions.[46] Especially for those with a tendency of self-improving motivation, providing repetitive training, or engaging in repetitive practices may improve their skills and help them to gain confidence. The methods for gaining self-confidence in Japan may differ from those in the United States, and added emphasis on adequate training and support may be necessary.

There are some limitations to our study. First, this was a self-administered survey that examined self-perceptions, not actual knowledge. Future research should assess EBM knowledge using validated questionnaires that focus on outcomes rather than simply perceptions.[20,21] Second, our survey instrument was not prospectively tested for validity; however, it was tested for face and content validity. Future studies should test for validity in different populations. Third, as we administered the survey at only one or two schools in each country, the results may not represent all of the schools in each of the countries, which limits the external validity of our findings. Future research should survey a larger number of institutions in each country. Fourth, as is common to surveys, the responses represent participants' self-assessment. And there is a possible non-response bias as all those who were invited did not participate in the survey. Those who responded may have had a different perspective than those who did not respond. Finally, we only evaluated student pharmacists in their later years of education, after a greater degree of exposure to EBM education. Student pharmacists' perceptions may be different earlier in their pharmacy education, and future studies should examine students at this time point.

CONCLUSION

Substantial awareness of EBM was identified within this cohort of US and Japanese pharmacy students.

Students in both countries understood the importance of EBM and reported their willingness to use EBM. However, barriers faced and level of confidence differed between the two cohorts. Lack of EBM role models may hinder optimal student practice, particularly in Japan. Self-assessment is critical for students to continue developing their EBM skills. Culturally specific approaches may be needed in order to improve EBM use and self-directed learning behaviors.

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