

## An Exploratory Survey of Incorporation of Gender- and Sex-related Differences in the PharmD Curricula

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### Abstract

**Introduction:** Clinical presentation and treatment in many disease states vary due to sex- and gender-differences. Sex-related pharmacokinetic differences are particularly important for pharmacists. The Accreditation Council for Pharmacy Education (ACPE) currently has no standard for the inclusion of gender- and sex-related differences in the didactic PharmD curriculum, but encourages advanced pharmacy practice experiences (APPEs) to include diverse populations related to gender. The purpose of this survey is to explore faculty incorporation of gender and sex differences within the PharmD didactic curriculum in preparation for a nation-wide survey. **Methods:** A survey was created to determine how many clinical topics incorporated gender- and sex-related differences and to what extent this information was discussed in the classroom. The survey link was emailed to pharmacotherapeutics and pharmacokinetics faculty at Midwestern University Chicago College of Pharmacy, University of Illinois at Chicago, Roosevelt University, Rosalind Franklin University, and Chicago State University. Chi square analyses were performed to examine relationships across participant responses. **Results:** A total of 56 faculty members participated in the survey, resulting in a 20% response rate. Of these, 30 (54.5%) faculty indicated that they discussed gender- and sex-related differences in the subject area in which they teach. Approximately 33% of respondents found gender- and sex-related differences very clinically important. Gender- and sex- related differences were taught in a variety of subject areas, including cardiology, diabetes, and chronic obstructive pulmonary disease (COPD). **Conclusion:** With no current standard, faculty members independently choose to include gender- and sex-related differences in their lecture topics and the extent of the discussion. Faculty should be aware of this lack of standardization and that they are independently responsible for including gender- and sex-related differences in their particular topics. Because the surveyed faculty find gender- and sex-related differences clinically important and literature suggests differences in medications depending on gender and sex, further research is planned to provide insight on a national level.

**Key words:** pharmacy education, sex differences, pharmacokinetics, pharmacodynamics, gender differences, women's health

### Introduction

The US Department of Health and Human Services (HHS), the Health Resources and Services Administration (HRSA) and the Office of Women's Health (OWH) completed a report in 2013 that reviewed healthcare professional programs, including medicine, nursing, dentistry, public health and pharmacy.<sup>1</sup> The report summarized the incorporation of women's health in these different curricula utilizing student surveys and curriculum reviews. The report suggests that pharmacy students are poorly informed about some women's health issues, including the use of emergency contraceptives. A survey of medical students suggested that respondents felt there was brief to moderate coverage of women's health topics in the curriculum. Only about half of nursing students responded that knew how to meet needs specific to women. Twenty-five percent of dental schools do not offer courses that are specific to women. The authors recommended that improving integration of women's health education could be achieved with service learning in women's health, women's health clerkships and fellowships, creation of core competencies in women's health and much more.<sup>1</sup> Women's

health is an area that should be included in all healthcare curricula to ensure the needs of the patient are met.

Men and women in many disease states present differently due to sex and gender differences. Sex is a biological classification, where there are physiological differences between males and females. Gender is associated with societal, cultural and environmental differences. It is the responsibility of healthcare providers to recognize these differences in sex and gender so that the patient may be diagnosed, managed and treated appropriately. While pharmacists may have an awareness of pharmacokinetic differences, there are other concerns that should be considered as well.

Cardiovascular disease is the number one cause of mortality in both men and women; therefore it is important for all healthcare professionals to understand how men and women present differently in the disease. Women are more likely to present with fatigue, indigestion and back pain compared to men who often present with left sided chest pain during a myocardial infarction (MI).<sup>2</sup> After experiencing a MI, women are less likely to be prescribed an angiotensin converting enzyme inhibitor (ACE-I) and aspirin therapy compared to men.<sup>3</sup> When women are prescribed an ACE-I, they are more likely to develop a cough from the medication as compared to men.<sup>4</sup>

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Women have higher lifetime rates of depression compared to men, and there are differences in clinical presentation.<sup>5</sup> Women's symptoms often include stress, sleep problems and loss of interest. Men often present with aggression, substance abuse, and risk taking behavior. Women tend to respond better to selective serotonin reuptake inhibitor (SSRI) therapy than men.<sup>6</sup>

One theory as to why men and women respond differently to certain drug therapies may be due to differences in the medication pharmacokinetics or individual patient pharmacodynamics. Women tend to have a higher percentage of body fat, which may lead to an increased distribution of lipophilic drugs. Women also have more active CYP3A4 metabolism, which may lead to an increase in drug clearance. Men often have a higher glomerular filtration rates compared to women. Women renally clear certain drugs like digoxin, aminoglycosides, cephalosporins and fluoroquinolones slower compared to men.<sup>7</sup> Compared to men, women can attain higher plasma concentrations of clozapine, which may be due to activity of cytochrome metabolizing enzymes and slower renal clearance rate in females.<sup>8</sup>

In 2004, by the collaborative effort of many professional pharmacy organizations and the US Department of Health and Human Services Health Resources and Service Administration, a web-based search of each college or school of pharmacy was completed. The search reviewed each curriculum and course catalog to determine if courses were offered in women's health or if women's health is mentioned within other courses. The findings demonstrated that out of 89 US schools or colleges of pharmacy, 34 (approximately 40%) of those offered a women's health course or classes that incorporate women's health.<sup>9</sup>

Because clinical differences exist between men and women, it is important that these differences are highlighted in the PharmD curriculum. The Accreditation Council for Pharmacy Education (ACPE) currently has no standard for the inclusion of gender and sex related differences in the didactic portion of the PharmD curriculum. ACPE does encourage advanced pharmacy practice experiences (APPEs) to include diverse populations related to gender.<sup>10</sup> The American Association of Colleges of Pharmacy (AACP) collaborated with the Food and Drug Association's (FDA) Office of Women's Health to create a program that provides a curriculum of women's health objectives that colleges may use as a guide.<sup>12</sup> This program is not mandatory for pharmacy schools, but it is an available resource. Of the twelve Learning and Performance Outcomes, outcome three is listed as, "Sex and Gender Differences in Disease Presentation and Treatment." The etiology, biological considerations and therapeutic management of gender- and sex-related differences are just a few of the suggested topics to cover. With a better understanding of these differences,

student pharmacists may be better prepared to help and treat their patients and educate other members of the health care team.

With the lack of standards by national pharmacy organizations, research into the breadth and depth of women's health information provided to student pharmacists in required coursework, such as pharmacotherapeutics and pharmacokinetics, is important to the evolution of Doctor of Pharmacy (PharmD) curricula. Results from this survey may highlight gaps in the PharmD curriculum and may stimulate and encourage changes. Specifically, faculty may use the results of this survey to help guide therapeutic areas for required courses and topics for their elective courses. In this exploratory study, it was hypothesized that gender- and sex-related differences were discussed more commonly in elective courses compared to required coursework. It was also theorized that faculty may feel more pressured in the required curriculum to cover other areas of each clinical topic and may not include gender- and sex-differences due to time constraints.

### Methods

A 23 question survey (available in Supplementary File 1) was created by the authors to determine how many clinical topics incorporated gender- and sex-related differences and to what extent this information was discussed in the classroom. The questions focused on the approximate amount of time in the classroom spent on clinical presentation, treatment, physiological differences, and pharmacokinetic/pharmacodynamics differences between males and females. These main focus areas were selected because they were the subjects of recent research on this topic.<sup>2-8</sup> In addition, they were considered relevant to PharmD curricula, as pharmacists may field questions about these areas when in practice. Respondents were also asked if this topic was taught in an elective or required course to address the author's hypotheses. Additional questions were included related to awareness, perceived clinical importance, and perceived comfort in discussing these differences. These areas were measured using 5-point ordered response items. For those who reported not teaching sex- or gender-related differences, a set of questions explored why these topics were not taught in their classes to identify if time was the reason. An open-ended response question was also included to obtain additional relevant faculty comments that may not have been captured by the survey questions.

A survey link was emailed selectively to faculty teaching in pharmacotherapeutics and pharmacokinetics at the following colleges of pharmacy: Midwestern University Chicago College of Pharmacy, University of Illinois at Chicago, Roosevelt University, Rosalind Franklin University, and Chicago State University. These colleges of pharmacy were selected due to

the close proximity to each other in the Chicago area and were deemed representative of public and private institutions in exploring these hypotheses and questions in preparation for a comprehensive survey. Because this was a regional sample of colleges, faculty email addresses were easily obtained from online resources and faculty listservs. The survey was not piloted, but remained open for four weeks with two reminders.

The invitation email provided respondents with the objective of the study, the expected time it would take to complete, contact information to a primary investigator, and disclosure that no results would be linked to individual participants. Data were collected through REDCap (Research Electronic Data Capture, Vanderbilt University, Nashville Tennessee). Text responses about clinical topic areas taught by respondents were categorized by the study investigators. Quantitative items were analyzed using Stata/SE statistical software (College Station, TX: StataCorp LP; 2015). Chi-square tests were used to examine associations among the participants' responses. This study was reviewed by the Midwestern University Institutional Review Board and granted exempt status.

### Results

The survey was emailed to 286 faculty members at five colleges/schools of pharmacy. A total of 56 faculty responded to the survey resulting in a 20% response rate. Overall, 30 (55%) of respondents indicated they discussed gender- and/or sex-related differences in the subject areas in which they teach. Most of the respondents teach gender- and sex-related differences in one clinical topic (57%). The remaining respondents teach these differences in two (23%), three (6%) or four or more (14%) clinical topics. Using an open text box in the survey, respondents listed the types of clinical topics in which they discussed gender- and sex-related differences. Results were varied and are listed in Table 1. It was noted that 16% of these clinical topics are taught in elective courses.

When faculty were asked about time spent, most respondents spent time discussing clinical presentation (Table 2). Time spent on clinical presentation, treatment options and pharmacodynamics/pharmacokinetics was mostly between 1-10 minutes. None of the responding faculty spent more than 20 minutes lecturing on gender- and sex-related differences. Faculty who spent time discussing physiological differences were also more likely to discuss pharmacokinetic and pharmacodynamic differences ( $p = 0.001$ ).

Respondents were also questioned about the clinical importance of gender- and sex-related differences on a scale of 1-5, with 1 being not at all important and 5 being very clinically important, (Figure 1). In addition, respondents were questioned regarding their level of comfort and awareness

regarding gender- and sex-related differences. There was no association found between faculty who were aware of gender- and sex-related differences and who actually teach these differences in their subject area ( $p=0.384$ ). There was also no association found between how comfortable the respondent felt with the topic and the time spent teaching treatment option for gender- and sex-related differences ( $p=0.200$ ).

Utilizing skip-logic questions in the electronic survey, questions addressing barriers to teaching gender- and sex-related differences were included if a respondent answered "no" to teaching these differences. A total of 26 respondents (46%) noted that they do not teach these differences. Of these respondents who reported that they do not teach gender- or sex-related differences at all, 94% (24 respondents) answered that gender- and sex-related differences were not relevant to the class or subject area and only 1 respondent answered that they do not have time to teach it. At the end of the survey, respondents were given the option for a free text box to express any additional thoughts or comments on gender- and sex-related differences in regards to importance and the PharmD curriculum. Table 3 lists all of the statements provided by respondents.

### Discussion

This survey explores the incorporation of gender- and sex-related differences in the PharmD curriculum. Although over half of the surveyed faculty discuss gender and sex related differences, most only discuss the differences in one subject area. Surprisingly, the subject areas vary, which indicate that such differences exist across many disease states/conditions. The majority of respondents spent the most time discussing clinical presentation and treatment options for the specific topic. This may be because more information is known about these two areas. A survey was previously conducted addressing the incorporation of this content in medical education and it was found that the average time allocated to these topics in 176 medical schools in Canada and the United States was five hours, but the number of topics varied greatly.<sup>12</sup> Compared to the results of this survey, incorporation in the PharmD curriculum is less compared to medical curriculum.

This survey included questions to identify the barriers that exist to including this topic in lecture. It was hypothesized that faculty may feel pressured for time to cover the basics of each clinical topic and that differences between men and women may not be included due to time constraints. It was, however, surprising to find that most faculty who do not teach these topics felt that they were not relevant to the class or subject area.

Only seven of the subject areas were included in an elective course, which is surprising because it was hypothesized that

gender- and sex-related differences would be discussed more commonly in elective courses, which typically allow for expanded discussion on disease states. With no current standard, faculty members independently choose to include gender- and sex-related differences in their lecture topics and the extent of the discussion, regardless of the course being an elective or required. If the difference between gender or sex is found to be clinically important to the lecturer, the information is provided to students regardless of the type of course.

Most surveyed faculty found gender- and sex-related differences clinically important. Faculty teaching in areas where gender- or sex-related differences are important should be reminded of valuable resources available, such as those from AACP on women's health.<sup>12</sup> As research regarding gender- and sex-differences continues to be published, faculty should consider evaluating the clinical implications of these findings and incorporate them into coursework.

This project had several limitations. This project had a rather low response rate, so the ability of these results to represent all pharmacy faculty in the Chicago area is questionable. In addition, when the survey was initially sent to faculty members an error was made through the REDCap software, which collected unusable data, and a new email was sent including an explanation of the error and a new survey link. Faculty may have responded to the first survey link and not the correct link.

Due to the low response rate, a new survey sent to additional pharmacy school faculty is warranted. A new survey will be administered nationally to increase generalizability and it will also address the incorporation of content related to treating lesbian, gay and transgender patients in the PharmD curriculum as this is also not addressed in ACPE standards. In addition, this survey will compare the time spent discussing gender- and sex-related differences to the total lecture time.

### Conclusion

The results of this survey provide insight to the proportion of faculty who are teaching gender- and sex-related differences and the time allocated to these topics in the PharmD curriculum at five pharmacy schools. Lecture topics and inclusion barriers were explored, but a larger sample size is needed to capture the full breadth and depth of this topic, which will be addressed in a larger national survey. Faculty members who are not teaching gender- and sex-related differences should be aware that some of their other colleagues are teaching these differences and that faculty members must choose to independently include this in their lectures. Overall, faculty members should be aware of gender- and sex-related medication differences and understand the importance of this incorporation into the PharmD curriculum.

**Disclosures:** None

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**Table 1.** Clinical topics discussing gender- and sex-related differences

Acute coronary syndromes
Alcoholic liver disease
Anticoagulation
Childhood psychiatric Disorders
Clinical decision-making
Contraceptives
Communications/counseling
COPD and asthma
Diabetes
Dyslipidemia
Fluid/electrolytes
Inflammatory bowel disease/Irritable bowel syndrome
Headache
Lifestyle modifications*
Nephrology
Osteoporosis
Preventive care*
Sexually transmitted infections*
Urinary incontinence Urinary tract infections

\*Discussed in an elective course

**Table 2.** Approximate time spent discussing gender- and sex-related differences

	1-5 min	6-10 min	11-15 min	16-20 min	>20 min	Do not teach
Clinical Presentation	19 (7.6%)	7 (21.2%)	1 (3%)	1 (3%)	0 (0%)	5 (15%)
Treatment Options	8 (24%)	8 (24%)	2 (6%)	6 (18%)	0 (0%)	9 (27%)
PK/PD Differences	9 (27%)	4 (12%)	2 (6%)	2 (6%)	0 (0%)	16 (48.5%)

**Table 3.** Faculty comments regarding gender- and sex-related differences and their incorporation into the PharmD curriculum.

“Where there are physiological differences, where there are treatment recommendation differences and where there are PK/PD differences I teach them.”

“Gender and sex related differences are important to consider in treating the patient...It is important to teach this individualization of medicine to better meet the needs of our patients.”

“I think it is an interesting aspect that could apply heavily to some topic areas and very little to others.”

“As more research is done in this area, it will need to be better integrated into the curriculum”

“I do believe that gender and sex differences exist and are important. However, the extent of their effects on pharmacotherapy responses is not well known. Because the data is still very gray, it is not worth spending class time on the subject.” [From a respondent who indicated they do not teach gender- and sex-related differences]

“I think there may also be social/cultural gender-based differences that could relate to the way patients therapies should be selected and the way should be counseled and communicated with.”

**Figure 1:** Faculty reported clinical importance of gender- and sex-related differences.

