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# INSTRUCTIONAL DESIGN AND ASSESSMENT

## An Evidence-Based Course in Complementary Medicines

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**Objective.** To evaluate the impact of an evidence-based course in complementary medicines on the attitudes, knowledge, and professional practice behavior of undergraduate pharmacy students.

**Design.** A required 12-week evidence-based complementary medicine course was designed and introduced into the third-year undergraduate pharmacy curriculum. The course included a combination of traditional lectures, interactive tutorial sessions, and a range of formal assessments.

**Assessment.** Pre- and post-course survey instruments were administered to assess changes in students' attitudes, perceptions, knowledge, and the likelihood they would recommend the use of complementary medicines in a pharmacy practice environment.

**Conclusion.** Completion of a required evidence-based complementary medicines course resulted in a positive change in pharmacy students' perceptions of the value of various complementary medicines as well as in their willingness to recommend them, and provided students with the required knowledge to make patient-centered recommendations for use of complementary medicines in a professional pharmacy practice setting. These findings support the need for greater evidence-based complementary medicine education within pharmacy curricula to meet consumer demand and to align with pharmacists' professional responsibilities.

**Keywords:** complementary medicines, natural health products, evidence-based medicine, pharmacy students, pharmacy education

## INTRODUCTION

There is a significant trend toward increased use of complementary and alternative medicines or natural health products in many western countries, including the United States, Canada, United Kingdom, and Australia, and these produces are now a major component of total consumer healthcare spending.[1-11] Complementary medicines (CMs) are available to consumers from many different sources, with community pharmacies having been identified as one of the most common suppliers, especially of herbal medicines, nutritional medicines, and vitamin and mineral supplements.[10,12,13] In Australia, sales for CM products account for an estimated 40% of money spent on all nonsubsidized over-the-counter healthcare products.[5,12] Therefore, community pharmacists are ideally positioned to provide recommendations and guidance to pharmacy customers about the appropriate use of CMs and to address the growing range of customer questions about CM that this increase in use has generated.[10,12-14] Studies on consumer attitudes reveal that users of natural medicines turn to pharmacists for information and expect them to be able to advise on CMs.[10,12,13,15] Ninety-two percent of Australian pharmacy customers surveyed believed it was important for pharmacists to provide safety advice on CMs, and 87% thought pharmacists should recommend CM if they were effective.[12] The same study, however, revealed that only 48% of the customers who used CM believed their pharmacist provided useful CM information about these products.[12] While consumers expect pharmacists to be knowledgeable about CM, research also indicates that many pharmacists lack confidence in their knowledge or feel they do not have sufficient training in CM to enable them to meet this expectation.[13,16-20]

The problem has not gone unnoticed. Against this backdrop, the need for greater CM education for pharmacists and pharmacy students has already been identified by other authors.[10,11,14,16-25] Such educational initiatives need to be evidence-based and should address identified barriers to use, such as a perceived lack of evidence on safety and efficacy.[15,17,22] Evidence-based CM education within a pharmacy curriculum can also be considered consistent with the pharmaceutical care educational outcomes of the American Association of Colleges of

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Pharmacy, which describe a patient-centered approach that is evidence-based and designed to "maintain professional competence by identifying and analyzing emerging issues, products and services that may impact patient-specific therapeutic outcomes."[26] Additionally, the inclusion of CM within pharmacy curricula supports the standards and guidelines described by the Accreditation Council for Pharmacy Education. This is particularly true of Guideline 12, which focuses on professional competencies to provide patient care based on therapeutic principles and evidence-based data and to promote health improvement, wellness, and disease prevention.[27] The Australian Pharmacy Council accreditation standards for curriculum content similarly specify that it should be patient-focused, address specific patient needs, and cover a range of topics, including CMs and the promotion of good health and disease prevention.[28] Further, the Australian National Medicine Policy for the Quality Use of Medicine includes CM in their definition of "medicines."[29] These factors suggest that pharmacists' professional responsibilities should include providing advice pertaining to the use of CMs and that, in the absence of adequate evidence-based knowledge and training on the subject matter, pharmacists may not be able to comprehensively fulfill their professional responsibilities within the broader definition of pharmaceutical care.[10,18,20]

Despite clear recognition of the need for CM training for pharmacists and several strong arguments in favor of greater CM education within pharmacy curricula, the literature suggests that many colleges and schools of pharmacy, both internationally and in Australia, have not yet taken the initiative to embed this subject matter into their core curriculum.[10,11,14,18-25] In the absence of clear formal guidelines on CM course content, appropriate course structure, and suitable teaching methods, the range and scope of what is taught to pharmacy students about CM also appear to differ among colleges and schools of pharmacy and in different countries.[10,11,14,19,20,22-25]

Recognition of the need for greater CM education for pharmacy students has thus been established. Challenges facing pharmacy educators in introducing new or adapting existing CM courses include determining what to teach; how best to teach the topic, including course structure (elective, core, or incorporated into other course), delivery structure, assessment format, and suitable resources; and in assessing whether these initiatives have been successful in achieving student learning outcomes.

This paper describes the development and implementation of an evidence-based core curriculum course on CM to third-year pharmacy students at an Australian university. The course focused primarily on herbal medicines and nutritional or dietary supplements, although a brief overview of other CM modalities was also included. The impact of this course on the students' attitudes, knowledge, and the likelihood that they would recommend complementary medicines to pharmacy customers were evaluated by means of pre- and post-course surveys conducted with the 2010 and 2011 student cohorts.

## DESIGN

A course entitled Evidence-Based Complementary Medicines was developed and introduced as a core course into the second semester of the third-year pharmacy curriculum at Curtin University, Australia. There were 125 students enrolled in the course in 2010 and 109 students in 2011. The course was designed to provide students with the understanding, knowledge, and skills required to assess the merits of the use of CMs within the context of a community or hospital pharmacy, allowing them to incorporate CM into their overall pharmaceutical care plan and to support a patient-centered, evidence-based approach. A course objective was that the pharmacy students should be able to apply their knowledge and demonstrate competence in recommending patient-specific CMs to promote health, wellness, and disease prevention where appropriate, taking into consideration the best available evidence on safety, efficacy, and how they should be used. A further objective was that the course would enable students to confidently communicate with patients and other health professionals about the use of CMs. Another expected outcome was that by the end of the course, the students would be able to demonstrate an ability to evaluate and interpret the clinical literature on a range of CMs, including analysis of conflicting evidence-based data.

The course consisted of traditional faculty-led, face-to face lecture time, delivered 2 hours per week for 12 weeks. This portion of the course was augmented by 6 hours of interactive student-driven tutorials, delivered to small groups in three 2-hour blocks over the same period, for a total of 30 hours over the semester. The formal lectures were supported by the use of an audiovisual recording of each lesson, which was uploaded to Blackboard (Blackboard Inc., Washington, DC), an online learning environment. A combination of assessment instruments was used, including a formal examination, a midsemester multiple-choice test, and an evidence-based case study report. The instruments also included a practical assignment that involved the review and subsequent oral and written presentation on the evidence for using a specific functional food, supported by demonstration of the practical use of the ingredient by incorporating it into a recipe. For this course, the definition for "complementary medicines" described by the Therapeutic

Goods Administration (Australia's regulatory authority for therapeutic goods) was used, which states that complementary medicines include medicinal products containing herbs, vitamins, minerals, and nutritional supplements, homoeopathic medicines, and certain aromatherapy products, as well as some others, such as traditional Chinese, Ayurvedic, and Australian indigenous medicines.[30]

The first block of lectures introduced complementary and alternative medicines and their underlying principles and philosophies as well as an overview of different forms of complementary and alternative medicines, including differentiation between how the terms "complementary" and "alternative" medicines were to be applied within the course. The concept of evidence-based medicine was introduced with a discussion of how it could be applied to CMs, acknowledging the inherent limitations of applying evidence-based concepts to CMs. Specific safety and Therapeutic Goods Administration regulatory issues relating to the use of CMs compared to those of pharmaceutical medications were also addressed. Two lectures focused on the chemical constituents of medicinal plants and drew correlations between pharmaceutical chemistry and herbal chemistry. One lecture focused specifically on Aboriginal bush medicine.

Thereafter, the lecture content focused on the evidence for use of an extensive range of both nutritional and herbal medicines for various indications. Emphasis was placed on teaching the evidence pertaining to dietary products, vitamins, and nutritional and herbal medicines. These forms of natural medicines have the greatest practical implications for the students in their future profession as pharmacists, as they represent the CM products most commonly sold in a pharmacy setting.[12,20] Greater time was spent on herbal medicines than on nutritional therapies, given that the pharmacy students had already received introductory instruction on vitamins and minerals as part of a different course in the second year of the curriculum.

For each nutritional and herbal medicine covered, evidence-based information was presented using the Natural Standard Professional database grading system to reflect the level of scientific evidence for or against each therapy for specific indications.[31] Curtin University library subscribed to the Natural Standard Professional database as a support tool for the introduction of this course. The pharmacy students were encouraged to access the database to supplement their lecture material and prepare for written assignments and to use their prescribed textbook, *Herbs and Natural Supplements: An Evidence-Based Guide, 3rd Edition.*[32] The lecture material also covered specific evidence-based studies, including discussion on current controversies or regarding conflicting, limited, or negative evidence for use of a specific CM. Faculty members attempted to avoid presenting in a biased manner and to encourage students to critically evaluate the evidence and form their own opinions. In addition, safety data were included for each selected CM, such as adverse effects, warnings, precautions, contraindications, and integrative interactions of the CM with pharmaceutical medicines. Proper use of the CMs in therapy and relevant practice points were also included, as well as proposed or demonstrated pharmacological mechanisms of action. The final lectures for this course addressed use of CMs for specific patient groups, such as pregnant women, preoperative patients, and cancer patients, and focused on the concept of integrative medicine and the potential role of the pharmacist in this growing paradigm.

The tutorial sessions were designed to support the lecture material in a more practical way, as well as to provide a wider perspective of both complementary and alternative medicine modalities that the pharmacist may encounter. The first tutorial provided the opportunity for practical, hands-on activities with a range of different modalities, including herbal medicines, nutritional medicines, flower essences, homeopathy, and naturopathic diagnostic techniques. The second tutorial focused on the use and practical application of functional or therapeutic foods, with students giving a brief oral presentation on the specific therapeutic foods they had researched, followed by the sharing of food they had prepared incorporating their respective therapeutic ingredients. The third tutorial integrated knowledge gained throughout the semester, using practical case study scenarios. The overall course structure is presented in Table 1.

## EVALUATION AND ASSESSMENT

Traditional assessment measures used in this course include a midsemester, multiple-choice test, a final examination paper, and written evidence-based reports. Students were graded according to a rubric, which had been distributed at the start of the semester with the assignment guidelines. Qualitative and quantitative feedback on the students' perceptions of their learning experience in this course were gathered and reported by Curtin University, indicating that student satisfaction was above both health-science faculty and university averages.

To assess the impact of the course on the third-year pharmacy students, a survey instrument was developed and administered to the students in the first and last lesson of the Evidence-Based Complementary Medicines course. This survey was conducted in the second semester of 2010, the first year that the course was implemented,

Table 1. Course Outline for a Required Course in Evidence-Based Complementary Medicine (CM)

| Date | Lecture Topic (2 hours per week) | Tutorial Topic (2 hours × 3 per semester per tutorial group) |
|---|---|---|
| Week 1 | Introduction to CM and evidence-based medicine; CM safety and interactions, legislation and regulation of CM in Australia | |
| Week 2 | Overview of complementary and alternative medicine modalities; Aboriginal bush medicine | Complementary and alternative medicine modalities |
| Week 3 | Medicinal plant constituents | |
| Week 4 | Evidence-based nutritional medicine (therapeutic use of selected vitamins and minerals) | |
| Week 5 | Evidence-based nutritional medicine (essential fatty acids, selected antioxidant nutrient supplements, glucosamine and chondroitin) | Functional /therapeutic foods |
| Week 6 | Evidence-based nutritional medicine (probiotics, prebiotics, sports supplements, 5-HTP, SAMe, melatonin) | |
| Week 7 | Evidence-based herbal medicine in CNS disorders | |
| Week 8 | Evidence-based herbal medicine in immunity and infection | |
| Week 9 | Evidence-based herbal medicine in cardiovascular disorders and in arthritis | |
| Week 10 | Evidence-based herbal medicine in gastrointestinal tract and endocrine disorders | Practical case scenarios |
| Week 11 | Evidence-based herbal medicine in male and female reproductive disorders | |
| Week 12 | Therapeutic management of specific patient groups including pregnancy, cancer and pre-operative care; integrative medicine and pharmacists | |

Abbreviations: CNS=central nervous system

and to the second student cohort during the second semester of 2011. The questionnaire, which was administered before and again after completion of the course, consisted of a range of questions designed primarily to collect data on the students' attitudes and perceptions about CMs and their willingness to recommend them within in a professional context. Questions from similar survey instruments conducted by other investigators were adopted and adapted for use in this study along with additional relevant questions.[15,22,23] A 5-point Likert rating scale was used for the sections of the survey instrument that focused on various aspects relating to the students' attitudes and perceptions toward CMs. Demographic questions were included in both the 2010 and 2011 survey instruments, and a qualitative question that asked students to summarize their impression of the value of the course was added to the 2011 postcourse survey instrument.

Ethics approval for this research project was obtained from Curtin University prior to distribution of the survey instruments. Participation was voluntary and responses were anonymous. In 2010, 100 students responded to the precourse questionnaire, and 80 students responded to the postcourse questionnaire, whereas in 2011, 78 students responded to the precourse questionnaire and 57 students responded to the postcourse questionnaire. The variation in sample size can be attributed to differences in class attendance rates in the first compared with the last lesson of the semester, rather than a higher number of nonrespondents to the postintervention survey instruments or a difference in response rates between the 2010 and 2011 student cohorts.

Responses on the 5-point Likert scale were scored on a continuous scale, and mean and standard deviations of scores for each question were calculated. Because student responses were gathered anonymously, responses belonging to the same student pre- and post-course were not identifiable. Therefore, changes from baseline to postcourse were conducted by comparing the means of the responses for each question using the (independent) student's *t* test. Using this conservative approach, the significance of changes was underestimated and some changes may have been missed, but any changes that appear significant are likely to be real. Significance for differences between groups in all analyses was set at $p<0.05$. The data were analyzed using the IBM SPSS Statistics version 18 (2010) and version 20 (2011) software packages (IBM SPSS, Chicago, IL).

Survey results demonstrated that prior to the course, the majority of pharmacy students had a positive attitude

toward CMs as a component of a pharmacist's professional competence (Table 2). Of the 100 students in 2010 and 78 students in 2011 who completed the initial precourse questionnaire, 97% (2010) and 99% (2011) indicated that they believed that knowledge about CMs would be required as part of their future practice as a pharmacist. The precourse survey instrument also revealed that 94% (2010) and 95% (2011) of the students believed that pharmacists have a professional responsibility to advise patients on the safe, effective, and rationale use of CMs, with 87% (2010) and 88% (2011) of students wanted to incorporate CMs into their practice as future pharmacists, as indicated by a response of either "agree" or "strongly agree" to each of these survey statements.

The next series of questions focused on the personal attitudes and beliefs held by the pharmacy students about CMs (Table 3). Survey results show a significant positive postcourse change toward a belief that there is evidence for a number of CMs for the treatment of several conditions and diseases, and for symptom management (2010, $p=0.002$; 2011, $p=0.027$), and that there is scientific evidence to support the efficacy of many CMs beyond that of a placebo effect (2010, $p=0.002$). There was also a significant shift in students' personal confidence in making recommendations to patients as part of the pharmaceutical care provided as a pharmacist (2010, $p<0.001$; 2011; $p<0.001$) as well as in respect for patients' right to make informed choices between conventional and complementary or alternative medicine (2010, $p=0.003$).

The next set of questions explored the likelihood of recommending the use of CMs for various conditions or disease states commonly seen by pharmacists, based on the attitudes, perceptions, and knowledge of the pharmacy students before and after the CM course. For the purpose of this set of questions, use could be for prophylaxis or for treatment and could be as either primary or adjunct therapy, as appropriate. The 20 conditions that were included in the survey instrument were depression (mild-moderate and moderate-severe), anxiety/stress, insomnia, fatigue, Alzheimer's disease/dementia, migraine prophylaxis, osteoarthritis, rheumatoid arthritis, menopausal symptoms, benign prostatic hypertrophy, sexual dysfunction, cold and flu prophylaxis, cold and flu treatment, nausea, irritable bowel syndrome, minor cuts/abrasions, hypertension, hyperlipidemia, and diabetes. A comparison of pre- and post-course responses indicated a positive change toward a greater willingness to recommend CMs for all listed conditions and disease states following completion of the evidence-based course. This was especially notable within the 2010 student cohort, for which the change was significant with respect to the majority of conditions included in the questionnaire.

An additional set of questions investigated the students' likelihood of recommending a specific CM based on their knowledge of CMs before and after completing the course. Selection of the CMs in this section of the questionnaire was based on 20 examples of herbal and nutritional medicines covered in the course, including: St. John's wort, feverfew, ginkgo, garlic supplements, ginger supplements, ginseng, echinacea, andrographis, black cohosh, saw palmetto, fucus, gymnema, cranberry, omega-3 fish oils, evening primrose oil, glucosamine, chondroitin, vitamin C, CoQ10, and probiotics. For 15 of the 20 CMs listed on the questionnaire, there were postcourse positive changes in attitude and likelihood of use, most of which were significant across both student cohorts.

A significant negative change was demonstrated for 2 of the complementary medicines: evening primrose oil (2010 and 2011, $p<0.001$) and vitamin C (2010 and 2011, $p<0.001$), with students indicating they were less likely to recommend these products after the course than before. Compared with student perceptions prior to the course, this outcome can be considered favorable, given that these 2 products are examples of CMs commonly sold in pharmacies, but for which there is relatively less scientific evidence to support widespread use. There was almost no

Table 2. Changes in Students' Attitudes Toward Complementary Medicine After Completion of a Required Course in Evidence-Based Complementary Medicine (CM)

| Statement About Professional Competence as a Pharmacist | Student Cohort | Precourse | | Postcourse | | *P* |
|---|---|---|---|---|---|---|
| | | No. | Mean (SD) | No. | Mean (SD) | |
| Knowledge about complementary and alternative medicine will be required in my future practice of pharmacy. | 2010 | 100 | 4.5 (0.1) | 80 | 4.5 (0.1) | 0.98 |
| | 2011 | 78 | 4.7 (0.1) | 57 | 4.6 (0.1) | 0.69 |
| I believe pharmacists have a responsibility to advise patients on the safety concerns pertaining to CMs. | 2010 | 100 | 4.5 (0.1) | 80 | 4.5 (0.1) | 0.96 |
| | 2011 | 78 | 4.6 (0.1) | 57 | 4.6 (0.1) | 0.87 |
| I believe pharmacists have a responsibility toward their patients on the rational and effective use of CMs. | 2010 | 100 | 4.3 (0.1) | 80 | 4.4 (0.1) | 0.40 |
| | 2011 | 77 | 4.5 (0.1) | 57 | 4.6 (0.1) | 0.44 |
| Pharmaceutical care should integrate the best of conventional and CMs. | 2010 | 100 | 4.1 (0.1) | 78 | 4.2 (0.1) | 0.76 |
| | 2011 | 76 | 4.1 (0.1) | 56 | 4.4 (0.1) | 0.02 |

Table 3. Changes in Students' Personal Attitudes Toward Complementary Medicine After Completion of a Required Course in Evidence-Based Complementary Medicine

| Statement About Personal Attitudes and Beliefs | Student Cohort | Precourse | | Postcourse | | *P* |
|---|---|---|---|---|---|---|
| | | No. | Mean (SD) | No. | Mean (SD) | |
| I believe that there are limitations to conventional approaches in health care. | 2010 | 99 | 3.7 (0.1) | 79 | 3.9 (0.1) | 0.28 |
| | 2011 | 76 | 3.8 (0.1) | 57 | 4.1 (0.1) | 0.04 |
| A number of CMs hold promise for the management of symptoms, conditions and/or disease. | 2010 | 99 | 3.8 (0.1) | 79 | 4.1 (0.1) | 0.002 |
| | 2011 | 78 | 3.9 (0.1) | 57 | 4.2 (0.1) | 0.027 |
| I believe there is insufficient evidence on the safety, efficacy and mechanism of action of most CMs to be able to make recommendations about their use. | 2010 | 99 | 3.2 (0.1) | 80 | 3.0 (0.1) | 0.13 |
| | 2011 | 78 | 3.3 (0.1) | 57 | 3.4 (0.1) | 0.62 |
| The results of CMs are, in most cases, due to a placebo effect. | 2010 | 100 | 2.9 (0.1) | 80 | 2.5 (0.1) | 0.002 |
| | 2011 | 78 | 3.1 (0.1) | 57 | 3.2 (0.1) | 0.68 |
| I believe that patients should have the right to choose between conventional and alternative approaches in health care. | 2010 | 100 | 3.9 (0.1) | 80 | 4.3 (0.9) | 0.003 |
| | 2011 | 78 | 4.2 (0.1) | 57 | 4.4 (0.1) | 0.11 |
| I hope to be able to incorporate CM into my practice as a pharmacist. | 2010 | 99 | 4.3 (0.1) | 80 | 4.3 (0.1) | 0.69 |
| | 2011 | 78 | 4.3 (0.1) | 57 | 4.4 (0.8) | 0.24 |
| I am confident in my ability to provide pharmaceutical care to patients using CMs. | 2010 | 100 | 2.5 (0.1) | 80 | 3.5 (0.1) | <0.001 |
| | 2011[a] | 43 | 2.7 (0.2) | 40 | 3.7 (0.1) | <0.001 |

Abbreviations: CM = complementary medicine.

[a] Response rates for this question were lower in the 2011 survey because the Likert rating scale for this item was inadvertently omitted from the questionnaire.

change in the likelihood of students recommending cranberry, omega-3 fish oils, or glucosamine pre- and postcourse across both student cohorts. This finding can be attributed to students having a positive baseline attitude for each of these 3 products. Table 4 presents selected examples of the impact of the course on pharmacy students' willingness to recommend CMs following the course.

The evidence-based CM course had a positive impact on students' attitudes, perceptions, and willingness to recommend CMs. These findings were further supported by qualitative feedback, which demonstrated that the pharmacy students saw merit in learning about evidence-based CMs to prepare them for future careers as pharmacists and that this CM course had equipped them with the knowledge and confidence to make CM recommendations in a pharmacy. Examples of these qualitative statements include: "A very valuable unit. CM is a huge part of pharmacy and it's important to have knowledge in this area"; "It has provided me with valuable knowledge to better my patient counselling and CM recommendations"; and "This unit has enabled me to make evidence-based recommendations to patients regarding CM indications, safety and efficacy."

## DISCUSSION

Although CM has been integrated into pharmacy education in Australia, the development of this course was innovative in that it was the first core curriculum course specifically focused on evidence-based CM to be introduced into an undergraduate pharmacy curriculum in Australian universities. The quantitative results of the precourse and postcourse survey instruments for both 2010 and 2011 revealed that the course positively changed the majority of the pharmacy students' attitudes and beliefs regarding use of CMs and increased the likelihood that they would recommend a variety of CMs in their capacity as pharmacists. The findings also suggest that after completing the course, students were able to discern when use of CMs was suitable and rational, based on evidence, and the appropriateness of use for certain disease states or conditions.

The postcourse qualitative data collected from the 2011 survey instruments highlight the perceived value of the course by the students with respect to its importance within the curriculum and its ability to equip them with the knowledge and skills required to enable them to make appropriate CM recommendations in a pharmacy setting.

The 2010 and 2011 data indicate that prior to the course, the majority of the students believed that knowledge of CM was an important pharmacy practice competence and that pharmacists have a professional responsibility to be able to advise pharmacy customers on the safe, rational, and effective use of CMs. This positive precourse attitude explains why a comparison of pre- and post-course responses showed no significant change for the first series of attitudinal questions relating

Table 4. Changes in Student Attitudes Toward Use of Specific Complementary Medicines After Completion of Required Course in Evidence-Based Complementary Medicine

| Item | Student Cohort | Precourse | | Postcourse | | *P* | Change[a] |
|---|---|---|---|---|---|---|---|
| | | No. | Mean (SD) | No. | Mean (SD) | | |
| Would recommend use of St John's wort | 2010 | 100 | 2.8 (0.1) | 80 | 3.6 (0.1) | <0.001 | ↑ |
| | 2011 | 78 | 3.0 (0.1) | 57 | 3.6 (0.2) | 0.002 | ↑ |
| Would recommend use of ginger supplements | 2010 | 100 | 3.6 (0.1) | 80 | 4.0 (0.1) | 0.003 | ↑ |
| | 2011 | 77 | 3.9 (0.1) | 57 | 4.1 (0.1) | 0.041 | ↑ |
| Would recommend use of ginseng | 2010 | 100 | 3.6 (0.1) | 80 | 4.0 (0.1) | 0.003 | ↑ |
| | 2011 | 76 | 3.7 (0.1) | 57 | 4.1 (0.1) | 0.001 | ↑ |
| Would recommend use of andrographis | 2010 | 100 | 2.8 (0.1) | 80 | 3.8 (0.1) | <0.001 | ↑ |
| | 2011 | 76 | 3.0 (0.1) | 57 | 4.3 (0.1) | <0.001 | ↑ |
| Would recommend use of black cohosh | 2010 | 100 | 2.8 (0.1) | 80 | 4.1 (0.1) | <0.001 | ↑ |
| | 2011 | 77 | 2.9 (0.1) | 57 | 4.4 (0.1) | <0.001 | ↑ |
| Would recommend use of saw palmetto | 2010 | 99 | 2.9 (0.1) | 80 | 3.7 (0.1) | <0.001 | ↑ |
| | 2011 | 78 | 2.9 (0.1) | 57 | 3.8 (0.1) | <0.001 | ↑ |
| Would recommend use of chondroitin | 2010 | 100 | 4.0 (0.1) | 80 | 4.5 (0.1) | 0.001 | ↑ |
| | 2011 | 77 | 3.7 (0.1) | 57 | 4.4 (0.1) | <0.001 | ↑ |
| Would recommend use of CoQ10 | 2010 | 100 | 3.9 (0.1) | 80 | 4.4 (0.1) | 0.002 | ↑ |
| | 2011 | 78 | 4.0 (0.1) | 57 | 4.5 (0.1) | 0.003 | ↑ |
| Would recommend use of cranberry | 2010 | 100 | 4.1 (0.1) | 80 | 4.1 (0.1) | 0.97 | - |
| | 2011 | 78 | 4.3 (0.1) | 57 | 4.4 (0.1) | 0.72 | - |
| Would recommend use of omega-3 fish oils | 2010 | 100 | 4.6 (0.1) | 80 | 4.6 (0.1) | 0.72 | - |
| | 2011 | 77 | 4.7 (0.1) | 57 | 4.8 (0.1) | 0.74 | - |
| Would recommend use of glucosamine | 2010 | 100 | 4.4 (0.1) | 79 | 4.5 (0.1) | 0.14 | - |
| | 2011 | 78 | 4.3 (0.1) | 57 | 4.5 (0.1) | 0.16 | - |
| Would recommend use of evening primrose oil | 2010 | 99 | 3.9 (0.1) | 80 | 3.1 (0.2) | <0.001 | ↓ |
| | 2011 | 77 | 4.0 (0.1) | 57 | 3.0 (0.2) | <0.001 | ↓ |
| Would recommend use of vitamin C | 2010 | 100 | 4.3 (0.1) | 80 | 3.8 (0.1) | <0.001 | ↓ |
| | 2011 | 78 | 4.3 (0.1) | 57 | 3.6 (0.2) | 0.001 | ↓ |

[a] Change in likelihood of use of this CM after the course: ↑ = significantly more likely to recommend a specific CM after completion of the evidence-based course; - = no significant change; ↓ = significantly less likely to recommend a specific CM after completion of the evidence-based course.

to pharmacy professional competence (Table 2). Of the students who completed the precourse survey instrument, 69% of the 2010 student cohort and 60% of the 2011 student cohort were already working in a pharmacy, which likely influenced their positive attitudes toward CMs as they pertain to community pharmacists. In addition, the student cohorts were ethnically diverse, with 52% of the 2010 group and 60% of the 2011 group reporting that CMs were an important part of their family culture.

There was a positive change in personal attitudes and beliefs of students in both cohorts toward complementary medicines after completion of the course, with this change being significant for many of the questions in this section (Table 3). There was a greater change in personal attitudes toward CM after the course than the amount of change seen in professional competence attitudes after the course. This finding suggests that the majority of students already perceived knowledge about CMs to be an important professional requirement prior to the course; however, many may have been personally skeptical about the use of CMs in a pharmacy setting prior to the course.

The course material adopted a scientific focus, addressing the evidence to both support and, in some circumstances, refute the use of specific CMs sold by pharmacies. Areas of controversy were highlighted and students were encouraged to critically evaluate the literature. We believe this approach was instrumental in bringing about such positive changes in the students' personal attitudes and beliefs about CMs and significantly increased their' self-confidence regarding their ability to provide pharmaceutical care to pharmacy customers and patients using CMs.

The results of the survey instruments in both 2010 and 2011 showed that after completing the course, students were significantly more likely to recommend a CM

for most of the conditions listed in the survey instruments. Likewise, analysis of the 2010 and 2011 responses showed that the pharmacy students were more likely to recommend most of the CMs listed in the survey instrument following the course. These findings suggest that the evidence-based CM education in our course positively changed students' professional practice behavior with regard to a range of conditions and a range of products.

The design and findings of our study were similar in many respects to those reported by Evans and Evans in 2006, wherein survey instruments were used to assess pharmacy students' attitudes toward complementary and alternative medicines before and after a required course.[23] Their study demonstrated that inclusion of complementary and alternative medicine education in a pharmacy curriculum influenced students' attitudes, perceptions, and the recommendations that they were willing to make. Many of our survey questions were adapted from those used by these authors in their pre- and post-course survey instruments. While one can draw correlations between these 2 studies, key differences should be noted. The course content and structure were significantly different in that our course focused primarily on evidence to support use of herbal and nutritional medicines sold in pharmacies, whereas the course evaluated by Evans and Evans included therapies that are not available or applicable to pharmacies, such as massage, chiropractic care, hypnosis, meditation, deep-breathing, therapeutic touch, Chinese and Ayuverdic medicine, and homeopathy.[23] Additionally, our study followed 2 cohorts of students over 2 years and had a significantly higher number of survey respondents (n=178 vs. 55) with more diverse ethnic, cultural, and demographic backgrounds than the Evans and Evans' survey.

Several other authors have also conducted studies evaluating the impact of CM education on pharmacy students across various parameters, such as their attitudes, perceptions, knowledge, or confidence regarding CMs.[10,11,22,24,25] These CM courses varied in terms of content, structure, duration, focus, and teaching methods and had meaningful differences in research methodology and analyses used, making an accurate comparison challenging. However, despite these differences, there is a consistent theme in outcomes suggesting that appropriate CM education is well received by pharmacy students and positively influences their attitudes, confidence, and willingness to recommend CM to pharmacy customers. This research also supports the position taken by other investigators who have highlighted the importance of CM education for pharmacy students.[14,15,20]

There are numerous factors that differentiate our study from previous research conducted in this area. This study describes the development, introduction, content, and assessment of the impact of a required evidence-based CM course, rather than an assessment of the impact of an elective course or of CM content incorporated into other required pharmacy courses. This course was designed with a specific focus on CMs that are relevant to pharmacy practice and for which there is scientific evidence to support use. In developing the course, academic staff also focused on taking a practical, patient-focused approach that fell within current pharmaceutical care recommendations. Because our approach to course content included herbal medicines and nutritional/dietary supplements, our research investigates the impact of a range of evidence-based CMs, rather than focusing on only 1 form of CM in a pharmacy course. Another feature of our study was that we conducted both pre- and post-course survey instruments over 2 consecutive years, thus enhancing the significance of our findings. While various other studies conducted on pharmacy students and CM education have addressed some of the elements described in our study, review of the literature suggests that our study is unique in addressing all of these components in a single study.

There were several limitations to our study. Because our survey responses were not identified with a unique respondent identification code, it was not possible to link pre- and post-course responses for each participant. While this design feature offered the advantage of ensuring all responses were anonymous, which may have encouraged participation while still allowing us to assess trends in changes across the 2010 and 2011 cohorts, it prevented us from measuring changes in individual students' attitudes, perceptions, and adoption of CMs. A typographical error (omission of the Likert rating scale) in 1 question of the 2011 survey questionnaires resulted in a lower response rate for that question. Finally, although the survey results suggest an increased willingness by the students to recommend CMs after completion of the course, this finding will not necessarily translate into a sustainable long-term change in either attitude or competence in making appropriate recommendations for use of CMs. Further research into this aspect of our study may be warranted.

Evidence-Based Complementary Medicines is accepted as a core curriculum course within the bachelor of pharmacy degree at Curtin University. The course was taught again in 2012, with all lecture and reading materials having been updated to reflect changes in available evidence on various CMs, revision of information pertaining to safety and patient advice, and with new controversies and areas of topical interest in the literature highlighted.

## SUMMARY

The course in CM was designed to provide students with the understanding, knowledge, and skills required to assess the merits of CMs in the context of a community or hospital pharmacy, allowing them to incorporate CM into their overall pharmaceutical care plan and to support a patient-centered, evidence-based approach. The results of the pre- and post-course survey instruments, conducted over 2 consecutive academic years indicate that many of the initial curriculum objectives were met through the introduction of this course into the undergraduate pharmacy curriculum. By approaching the subject matter from an evidence-based perspective with emphasis on relevance of the CM in a pharmacy setting, the course proved valuable in supporting pharmacy students' ability to make appropriate patient-specific CM recommendations as part of their professional pharmacy practice, taking into consideration evidence on safety, efficacy, and place in therapy. This outcome aligns with the pharmaceutical care educational guidelines for pharmacy students.

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