

ORIGINAL RESEARCH

Medical Student Opinions on their Training in Clinical Pharmacology and Therapeutics

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ABSTRACT

Problem-based learning (PBL) in medical school curricula have de-emphasized over-arching disciplines such as clinical pharmacology and therapeutics (CPT). Since McMaster's medical curriculum is at the forefront of PBL, there is a unique interest in gauging the adequacy of CPT training at the institution. The objective of this study was to capture opinions of McMaster medical students towards provision of CPT training in their curriculum. A self-administered survey was conducted at the end of the CPT review class for licensing exams in years 2007–2009. The survey had the following three components: (i) demographics, (ii) description of the medical school, and (iii) response themes assessment. The average age of the sample was 26.4 ± 4.0 years and 68.5% of respondents were female ($n=149$). For importance of learning in CPT, 73.1% to 100% of students rated 11 out of 12 CPT domains to be important. The majority of respondents (73.3%) indicated a poor rating of their training in CPT. 33% of students reported that their training in clinical pharmacology was most likely to occur during clerkship. 63% of students reported the same for their training in therapeutics. Moreover, students who did not find their prescription writing training to be adequate were much less likely to rate their overall CPT education as "good."

Collectively, the results indicate that McMaster students did not find CPT training to be adequate, despite the majority of students citing it as an important aspect of their training. Based on these results, a more integrated approach to CPT education and training is recommended.

BACKGROUND

Prescribing medication is one of the most important activities of all physicians; regardless of the specialty.¹ Adverse events arising from medication-related errors are frequent in hospitals and are a serious concern for patient safety.^{2,3} In the UK and US, an estimated 1–2% of patients are harmed by medication errors, which include errors in both prescribing (decisions regarding which drug to use and how) and prescription (process of writing prescriptions properly and accurately).^{3,4} Prescribing mistakes are also a common cause of medical malpractice claims, occasionally resulting in physician removal from practice.⁵ Spending on drugs represents the second largest category of health care expenditure in Canada.⁶ Rising drug costs and demand continue to make

limited healthcare resource allocation more challenging. In addition, medication safety is increasingly recognized as a major patient safety issue. For these reasons, safe and cost-effective use of drug therapies has become a major concern for the public and policymakers.

Medical trainees must be adequately trained to meet the therapeutics and prescribing challenges. There have been concerns internationally that undergraduate education and training in CPT may be insufficient to meet the subsequent work demands.^{7,9} Here, clinical pharmacology refers to the theoretical knowledge relating to the use of drugs in humans, whereas therapeutics refers to the set of skills required for safe and effective prescribing. Historically, pharmacology and therapeutics were taught in a didactic format and were

considered essential for all physicians to master. The shift to a more integrated and problem-based style of learning among medical schools has not kept the same emphasis on adequate CPT training.^{8,10} Evidence has shown that lack of adequate CPT training is associated with prescribing errors later on in practice. Two prospective studies done in the UK and US showed that 59% and 29% of medication errors made by doctors were ascribed to inadequate training in related knowledge and skills, respectively.³ In light of recent research demonstrating lack of CPT training in medical students, the medical education regulatory bodies in the UK now require mandatory CPT training and examination in medical curricula.¹¹

The undergraduate program at the Michael G DeGroot School of Medicine at McMaster University is considered the innovator of problem-based learning in medicine.^{12,13} Though the current curriculum offers lectures and electives in CPT, they are not mandatory. Clinical pharmacology is a very small division in the faculty of health sciences but has been lobbying for many years for a more prominent role for therapeutics training in the undergraduate and residency curriculum. As a first step towards investigating both the nature and extent of the aforementioned issue, McMaster medical students were surveyed to determine their perception of the CPT training in their curriculum.

OBJECTIVE

The objective of this study was to investigate McMaster medical students' opinions on their CPT education and training.

METHODS

A self-administered questionnaire, adapted from a survey developed by Heaton, was constructed to measure medical students' opinions about CPT education and training.⁷ Details of the questionnaire development have been described elsewhere.⁹ A stepwise approach was used to determine the basic demographics, domains of CPT, and response themes that are important to assess, and how they should be measured. A focus group meeting was then conducted to gather feedback for further revision of the survey tool.⁹ The final questionnaire consisted of three parts: (i) demographics (gender; date of birth; initials; educational background; presence of pharmacology/pharmacy background), (ii) description of the medical school (undergraduate year level; whether CPT training is part of core curriculum; and if they attended that training), and (iii) response themes assessment (importance of CPT; training adequacy of CPT; and perception of where learning occurs both within and outside the curriculum; their ranking of CPT training provided*; and their confidence level in prescribing skills). It is of note that additional questions were added in the survey administered in 2008 and 2009 only. Specific components of the clinical pharmacology training addressed were: drug modes of action, pharma-

cokinetics, therapeutic uses of drugs, drug safety and harm, drug development, and drug cost and coverage. Similarly, the skills parameters used to assess training in therapeutics include: drug history taking, prescription writing, drug adherence assessment, dosage calculation, treatment monitoring, critical appraisal of therapy evidence. The complete survey is attached in Appendix I.

In the spring of consecutive years from 2007 to 2009, the questionnaire was administered to groups of medical students attending a lecture on CPT in preparation for the Medical Council of Canada Qualifying Examination (MCCQE) Part 1. All responses were entered into a statistical software, PASW version 18.0 and verified. All responses were analyzed and compared using PASW version 18.0 and Microsoft Excel 2003. In situations when the respondent provided more than one response in error, a single response was randomly selected using the method described in Appendix II. A logistic regression analysis was also performed to test if the overall rating of CPT training by respondents was predicted by any of the following variables: gender, participation in CPT lectures/module/courses, students' rating of adequacy of training in therapeutic uses of drugs and prescription writing, and whether their learning in therapeutic uses of drug as well as drug safety and harm in CPT lectures/electives. P-values of <0.05 were deemed statistically significant.

RESULTS

Part 1: Demographics

Table 1. Demographic characteristics of participants (n=149)

Characteristic	
Age, years (mean (SD))	26.4 (4.0%)
Female (n (%))	102 (68.5%)
Male (n (%))	45 (30.2%)
Missing	2 (1.3%)
Educational Background (n (%))	
Bachelor in progress/completed	125 (83.9%)
Masters in progress/completed	21 (14.3%)
PhD in progress/completed	1 (<1%)
Missing	2 (1.3%)
Medical School (n (%))	
McMaster	143 (96.0%)
Other	6 (4%)
Level (n (%))	
Year I	0
Year II	0
Year III	143 (96.0%)
Other	2 (1.3%)
Missing	4 (2.7%)

Overall, 149 medical students completed the survey (Table 1). The average age of the sample was 26.4±4.0 years.

68.5% of the respondents were female, which is representative of the students enrolled in those years (61.1%). Only 14% of the participants had a Masters or PhD level of education, which is also representative of students enrolled in those years (12.4%). All except for 6 (4%) participants attended the Michael G. DeGroote School of Medicine at McMaster University. All were in Year III except for 6 (4%) participants. Response rate for the survey could not be calculated as this was a drop-in class and attendance was not recorded.

Part II: Description of the CPT Curriculum in Medical School

Students provided mixed responses on their understanding of the core curriculum. When asked whether their core curriculum offered lectures, modules, or courses in CPT: 64.1±0.1% responded 'yes', 35.1±0.1% responded 'no.' When asked if they participated in those learning modules, 84.4±0.01% said 'yes,' and 12.2±0.01% said 'no' (Figure 1). These figures were relatively consistent across the years.

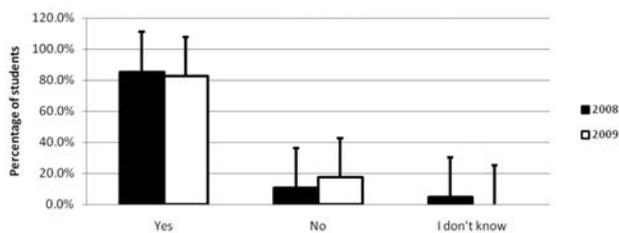


Figure 1. Percentage of students who participated in CPT training modules offered in the course of their training (Years 2008, 2009. n=93).

Part III: Opinions Assessment Importance of CPT Education and Training

For 11 out of 12 domains of CPT learning, a minimum of 73.1% to a maximum of 100% of students rated the domain as important or extremely important to their education as a medical student. This was not the case for the Drug Development domain. Two domains: Therapeutic Uses and Drug Safety and Harm, were unanimously rated as important/extremely important (Figure 2).

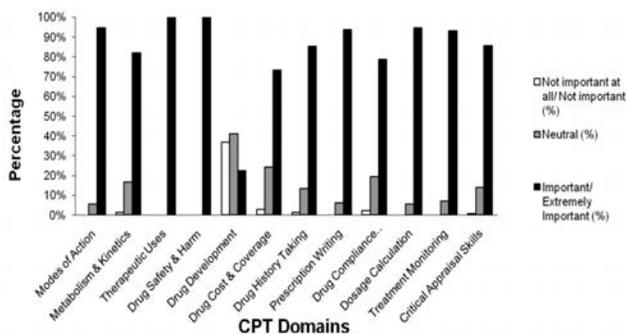


Figure 2. Percentage of students ranking the importance of various domains of CPT knowledge and skills (n=145).

Training Adequacy of CPT

Overall, the medical students clearly indicated that the medical school did not provide adequate education and training in CPT. Specifically, ≥70% of the respondents indicated inadequacy in the following domains: Modes of Action, Metabolism and Kinetics, Drug Safety and Harm, Drug Development, Drug Cost and Coverage, Drug Adherence Assessment, Dosage Calculation and Treatment Monitoring (Figure 3). The majority of respondents (73.3%) indicated a poor or very poor rating of their overall education and training in clinical pharmacology and therapeutics (data from 2008 and 2009 survey only).

Even for those domains where medical students were the most comfortable with their training, less than half believed it to be adequate (Therapeutic Uses of Drug (35.9%), Drug History Taking (54.5%), Prescription Writing (40.6%) and Critical Appraisal Skills (39.7%)).

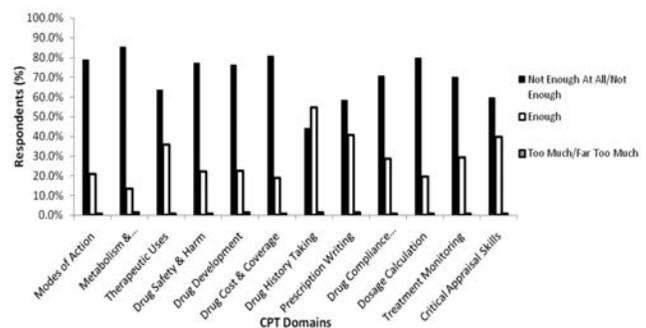


Figure 3. Ratings of adequacy of training in the different CPT domains (n=148).

Perception of Where Learning Occurs

33% and 63% of students reported that their training in clinical pharmacology and therapeutics, respectively, was most likely to occur during their clerkship experience (Figure 4).

With respect to learning outside the curriculum, the most commonly used clinical pharmacology resources for clinical knowledge were tertiary references (e.g. reference books), followed by secondary references (e.g. textbooks). Senior medical house staff or attending physicians were the most commonly used CPT resources for therapeutic skills.

Predictors of rating of CPT learning at the medical school

Initially, a multinomial logistic regression analysis was performed to determine if any of the six following variables predicted the respondents' overall rating of their CPT learning: (i) gender; (ii) participation in CPT lectures/module/courses (pCPT); (iii) students' rating of training in therapeutic uses of drugs (AdTUD); (iv) students' rating of CPT training in prescription writing (AdPW); (v) whether their learning in therapeutic uses of drug occurred in CPT lectures/electives (TUDCPT); and (vi) whether their learning in drug safety and harm occurred in CPT lectures/electives (DSHCPT). Two of

the variables (AdTUD and TUDCPT) were found to correlate with others using the Spearman's correlation test and were dropped from the model due to higher investigational value of other variables. In terms of scientific significance, AdTUD and AdPW answer very similar questions. (The former deals with the knowledge component of CPT and the latter with skills in CPT). As a result, AdTUD will not be included in the model due to its similarity with AdPW and multi-collinearity with other variables. Since DSHCPT correlates with TUDCPT, the former will be included in the final model as DSHCPT relates to overall agenda of patient safety and hence, is more of an interest than TUDCPT.

In the first regression analysis, all predictors were significantly correlated ($p < 0.05$) with the rating of CPT learning except for DSHCPT ($p = 0.35$). Thus, in the subsequent model, this variable was removed and the independent variable was dichotomized (average/good vs. poor) and binary logistic regression analysis was performed. Consequently, odds ratios for gender and AdPW were 8.00 (95% CI: 2.46, 25.78) (i.e. females were eight times more likely to rate their CPT training as "good") and 0.19 (95% CI: 0.06, 0.61) respectively (i.e. students who did not find their prescription writing training to be adequate were much less likely to rate their overall CPT education as "good").

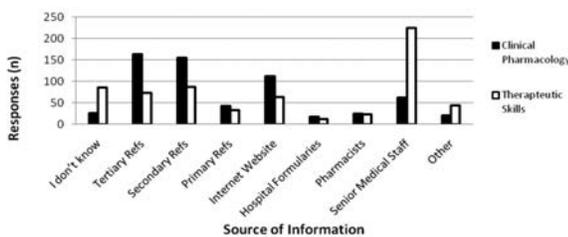


Figure 4. Number of responses for each domain of CPT training (n=139).

DISCUSSION

This pilot survey of one Canadian medical school's graduating classes highlight several themes related to education in CPT. First, the surveyed students perceived their training in this discipline to be important to their education as physicians. The two domains that all students thought to be important were 'therapeutic uses of drugs' and 'drug safety and harm.' Second, most students believed that the education and training provided by their medical school curriculum was inadequate, particularly in the domains of 'metabolism and kinetics', 'drug safety and harm', 'drug cost and coverage and dosing.' Third, CPT learning most commonly occurred at the very end of medical school during clinical clerkship. Fourth, male students and students who were not satisfied with their prescription writing abilities, were most likely to rate the overall adequacy of CPT teaching at McMaster to be poor.

McMaster students' ratings of the importance of CPT education are consistent with similar surveys of medical student

bodies elsewhere.^{10,14,15} Two UK studies revealed that medical students felt under-prepared to prescribe in a safe and rational manner.^{10,15} Another larger scale survey of both medical students and recent graduates highlighted that students found their CPT training to be insufficient, and hence had a lack of confidence in their prescribing abilities.¹⁴ These findings are consistent with a lack of CPT training highlighted in the literature elsewhere.^{7,8} Altogether, these findings suggest that views of McMaster medical students on the importance of CPT education are consistent with those in other medical schools with similar curricula.

The second and third conclusions as mentioned above point to a number of issues. Firstly, the core rotations, such as pediatrics and internal medicine, where medication-related knowledge and skills are most likely to be taught are limited to six weeks each, creating a major problem with respect to adequate time to learn. A study performed in German medical schools explored the relationship between prescription errors and time spent in internal medicine clerkship (0 weeks, 1-4 weeks and >5 weeks).¹⁶ Students were found to be responsible for 69% of all prescription errors made. Moreover, the number of weeks spent in the internal medicine program (0, 1-4 or >5) did not seem to impact their performance, indicating that five to six weeks of CPT training in internal medicine may well be inadequate.¹⁶ This objective assessment of student performance strengthens the evidence behind McMaster students' perception of inadequacy of CPT training. Similarly, the use of senior medical staff and tertiary references as the two most popular sources of drug information may not be consistent with the school's emphasis on evidence-based medicine. Overall, these results indicate that both the quantity (amount of time spent on CPT training in clerkship) and quality (sources of CPT knowledge and skills) of education provided may be compromised.

Lastly, the relationships identified with CPT training suggest that if students are struggling with certain essential and basic skills in CPT (namely prescription writing), they are more likely to be unsatisfied with their learning in CPT during their undergraduate medical training. This is in contrast with a lack of relationship found with higher-level knowledge like therapeutic uses of drugs. This is perhaps not surprising as students may be more concerned with their 'ability to perform' on a task at this level. The fact that female students are more likely to rate their CPT education as 'good' warrants further investigation. Given that more than half of McMaster's current medical class is female, this is a notable finding.

With respect to limitations of the study, the survey itself was not validated or correlated with prescribing outcomes or objective licensing examinations. Moreover, since convenience sampling of those who attended the lecture was used, there is a risk of selection bias and also self-report bias, and hence the representativeness of the entire class and validity of the answers could not be ascertained entirely. We did not ask students to rate the adequacy of their training in other

disciplines such as cardiology or infectious diseases, thus it is possible, though unlikely, that the dissatisfaction is with wider components of medical school. Furthermore, it is unclear how widely these opinions regarding inadequate training in CPT are generalizable across Canada as a search for similar surveys in other medical schools did not yield any results. Lack of a comparator group further contributes to this limitation. Lastly, 35% of students disagreed with the rest of their peers and suggested that no CPT training is offered in their core curriculum. This finding may be explained by the lack of consistency in the material covered in PBL tutorials among different groups. Moreover, a CPT elective in pre-clerkship is offered in tandem with the core curriculum, and hence, some students may have mistaken this 'elective' teaching as 'core.'

The findings of this survey need validation using objective testing of CPT competencies such as safe and cost-effective prescribing and medication-related communication abilities. The results illustrate that McMaster students are not satisfied with their CPT training and that they feel they are not adequately prepared in CPT skills during their medical school years. Hence, a revision of the curriculum to more formally incorporate CPT knowledge and skills may be warranted to improve the aforementioned outcomes. The inadequacies in training illustrated in the survey are not likely to be limited to McMaster and hence, a national review of CPT curriculum in Canadian medical schools and a survey of students might better inform the future steps to be taken.

CONCLUSION

The results of the survey suggest that McMaster medical students place a high value on education in CPT and the majority of graduates were not satisfied with the adequacy of their CPT education. Since therapeutics and prescribing

knowledge and skills are amongst the most important competencies for all physicians, we suggest that a more consistent component of CPT training be introduced in the current curriculum. †

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Author Biographies

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33% of students reported that their training in clinical pharmacology was most likely to occur during clerkship. 63% of students reported the same for their training in therapeutics. Moreover, students who did not find their prescription writing training to be adequate were much less likely to rate their overall CPT education as "good." Collectively, the results indicate that McMaster students did not find CPT training to be adequate, despite the majority of students citing it as an important aspect of their training. Based on these results, a more integrated approach to CPT educatio