Exploring computer simulation to assess counseling skills amongst pharmacy undergraduates

Pereira D.V[1] and Cavaco A.M*[2]

[1] Department of Social Pharmacy, Faculty of Pharmacy, University of Lisbon, Portugal.
[2] iMed.UL, Faculty of Pharmacy, University of Lisbon, Portugal.

Submission Date: 5-12-2013; Accepted Date: 21-1-2014

ABSTRACT

Pharmacists are considered medicine specialists referring to minor ailment treatment and self-medication counseling. Although increasingly important in pharmacy training, there are limited initiatives comprising the use of computer simulation. The study objective was to explore minor ailment counseling skills from Portuguese pharmacy undergraduates through an experimental virtual patient methodology.

This study followed a prospective cross-sectional design, with all students from Portuguese higher education pharmacy institutions being invited to use a virtual interactive simulator for over-the-counter medication advice giving. Data analysis comprised descriptive and regression statistics.

Seven hundred and seven students replied from eight Portuguese pharmacy schools. Older students (≥22 years) and those with previous pharmacy practice experience presented significantly better overall counseling performance. Regression results confirmed therapeutic counseling success to be a function of years of education, with a significant better performance for 4th, 5th and internship students, while all cohorts presented equivalent simulator acceptance.

As a conclusion, one can say that pharmacy degrees in Portugal seem to address counseling training needs of future pharmacists. Results suggested advantages in advice-giving skills if contact with practice occurs during undergraduate education. Knowing the present relevance of electronic means in education, ways of providing computer standardized training and practice assessment should be implemented and consistently used.

Keywords: Virtual patients, Self-medication counseling, Computer simulation, OTC advice giving, Electronic assessment.

INTRODUCTION

According to the World Health Organization, pharmacists' role comprises of guaranteeing population access to quality medicines as well as professional tasks such as helping citizens with self-care and minor ailment treatment.[1] Pharmacy education needs to prepare pharmacy professionals for their patient counseling role.[2,3] In what concerns pharmacy practice education, patient-centered communication and counseling have been placed as main training objectives.[4]

Patient communication and counseling

Patient counseling is regarded as an important pharmacists' professional responsibility, as described by the International Pharmaceutical Federation (FIP – *Fédération Internationale Pharmaceutique*). According to FIP, the role of pharmacists when dispensing non-prescription medicines is "to ensure that all necessary information and advice is given to encourage safe and effective use of medicines".[5,6] In this sense, patient counseling activities allow pharmacists to identify and solve drug-related problems, empower patients to adopt positive self-management behaviors, increase patient satisfaction and, ultimately, optimize the quality of care given to patients. The relevance of patient counseling is strengthened by the fact there is an increasingly knowledgeable customer that are responsible and capable of making decisions about their own health and self-medicating frequently.[7,8] To ensure patients

DOI: 10.5530/ijper.48.1.4

Address for correspondence
Cavaco A.M*
iMedDepartment of Social Pharmacy, Faculty of Pharmacy, University of Lisbon
Address: Av. Prof. Gama Pinto 1649-003. Lisbon, Portugal.
Phone: +351217946456
Fax: +351217946470
E Mail: acavaco@ff.ul.pt

www.ijper.org

understand how to make an optimal use of medicines and improve their quality of life, information exchange with the pharmacist is central to selecting the appropriate drug treatment as well as to implement a safe and effective drug use.[9,10]

To fulfill pharmacists' advice giving role for minor ailments, there have been guidelines and protocols emphasizing mostly their professional judgment in meeting the specific needs of each patient.[11] Pharmacists should ask a series of questions to collect the necessary information, such as the patient's understanding of their health problem (mainly symptoms) and previous patient's actions (e.g. medication already taken).[12,13] Effective patient-pharmacist communication is needed to ascertain key patient information, to provide counseling related to the medication selected and appropriate usage, and also to achieve the outcome that the patient desires.[14] In addition to drug related information, effective communication comprising relational competencies is also an essential element in pharmacy practice and education.[15] Actually, most pharmacy schools have incorporated communication skills in undergraduate and postgraduate curricula.[16]

Virtual patients and pharmacy education

Computer simulation is currently used for training professionals, such as pilots, managers and healthcare providers, and is an effective learning technique that has the ability to evaluate knowledge-based applications from real-world scenarios.[17] At universities, computers are presently used in virtual laboratories for the training of basic sciences,[18] in multimedia simulation,[19,20] and as a virtual patient technology.[21] Virtual patients have been successfully used in medical and pharmaceutical education, benefiting particularly students' clinical reasoning and communication skills.[22,23]

In pharmacy education, the Accreditation Council for Pharmacy Education (ACPE) defined simulation as an activity or event that replicates pharmacy practice, and has encouraged the use of innovative teaching methods to further develop critical thinking and problem-solving skills.[20] The instructional process of replacing real patient encounters with virtual ones, have been adopted by several pharmacy schools because of the advantages of practice and repetition of clinical skills in a controlled environment (no risk to patients), standardized assessment (the same situation in the same setting), the potential reduction of the number of errors and a greater confidence in performing advanced tasks, such as medication therapy management.[24–27] The most obvious disadvantage is that there is an "incomplete" interaction, no matter how advanced and sophisticated the technology might be. Humanistic factors such as emotions and personality, as well as environmental distractions, are not conveyed or portrayed as they happen in the real world.[28,29] Nevertheless, computer simulation has been frequently used to teach pharmacy students in communication and therapeutic skills.[23,30]

The pharmaceutical education curriculum in Portugal is comprehensive and challenging, covering chemical, biological, biomedical, clinical and pharmaceutical sciences, focusing on the mechanism of knowledge application. Following the higher education harmonization between European countries (known as the Bologna process[31]), the Portuguese pharmacy degree corresponds to a masters program (5 years) with 2 cycles (3 years to Bachelor plus 2 years to Master), including a final 6 month period of pharmacy internship. This internship allows translating knowledge into practice by consolidating a broad range of specific attitudes, skills and behaviors, which support clinical and professional roles.[32,33]

Portuguese higher education institutions have incorporated into their curricula one or more courses, which are generally taken in the final years of the program, addressing therapeutic and communication competencies in over-the-counter medication (Table 1). Without aiming to make comparisons and acknowledging differences in pedagogical processes from school to school, it is possible to say that Portuguese pharmacy graduates are trained for OTC patient counseling. However, initiatives to explore patient communication and counseling training through virtual environments are unknown, apart from pilot initiatives in medical education at University of Beira Interior.

Acknowledging that computer interactive simulation can be valuable in pharmacy education, the main goal of this study was to explore counseling skills of Portuguese pharmacy undergraduates through the use of a pharmacy virtual patient, including an evaluation of the impact of education and practical experience variables. Concurrently, the students' acceptance of the computer simulation as an assessment method for patient counseling competencies was gauged.

MATERIALS AND METHODS

This study followed a descriptive, cross-sectional design. The study population was comprised of pharmacy undergraduates, as well as internship students, in continental Portugal, accessed by their institutional email addresses. No other data (e.g. detailed deographics) was possible to collect systematically at this point from participating pharmacy schools.

Research instrument

The instrument for data collection was based on a virtual patient simulator, SAF (*Simulador de Atendimento*

Table 1: Pharmacotherapy and Communication Courses of Participating Portuguese Public and Private Pharmacy Schools' Curriculum

Pharmacy School	Pharmacotherapy (year)	Communication (year)
FFUL[1] (Public)	Pharmacotherapy I (4th year) Pharmacotherapy II (5th year) Non-prescription pharmacotherapy (elective) (5th year)	Pharmacy Lab (5th year)
FFUC[2] (Public)	Pharmacotherapy (4th year)	Pharmaceutical intervention in self-care and health (5th year)
FFUP[3] (Public)	Physiopathology and pharmacotherapy I (4th year) Physiopathology and pharmacotherapy II (5th year)	–
ISCSEM[4] (Private)	Pharmacotherapy I (4th year) Pharmacotherapy II (5th year)	Communication and health information (3rd year)
ULHT[5] (Private)	Pharmacotherapy (4th year)	Communication and pharmaceutical practice (5th year)
ISCSN[6] (Private)	Physiopathology and pharmacotherapy I (4th year) Physiopathology and Pharmacotherapy II (5th year)	–
UAlg[7] (Public)	Pharmacotherapy I (4th year) Pharmacotherapy II (4th year)	–
UBI[8] (Public)	Prevention and therapeutics (4th year)	Health sociology (3rd year)

1. *Faculdade de Farmácia da Universidade de Lisboa*
2. *Faculdade de Farmácia da Universidade de Coimbra*
3. *Faculdade de Farmácia da Universidade do Porto*
4. *Instituto Superior de Ciências da Saúde Egas Moniz*
5. *Universidade Lusófona de Humanidades e Tecnologias*
6. *Instituto Superior de Ciências da Saúde Norte*
7. *Universidade do Algarve*
8. *Universidade da Beira Interior*

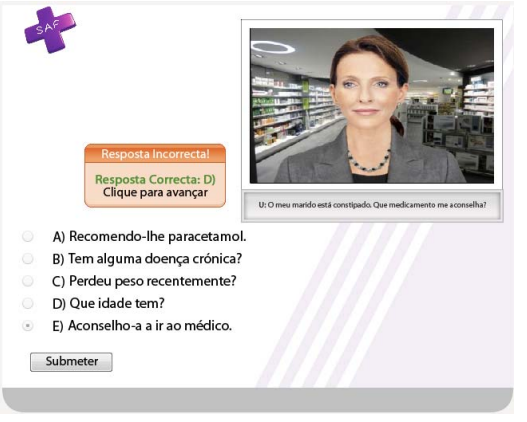
Farmacêutico). This in-house developed product is a user-friendly interactive multimedia software designed to mimic an OTC (Over-the-Counter drug) counseling episode, occurring between a pharmacist and a patient at the pharmacy counter. SAF was developed in *Adobe Captivate* 5®, in which the operator (here the study participants) plays the role of the pharmacist, while the customer is represented by a 3D-Flash audio animation, with image movements and sounds reproducing a customer's dialogue. After each customer utterance, the operator replies by choosing one option from five possible items/questions. The complete interaction comprises a total of 10 counseling steps in the format of multiple-choice questioning (Figure 1).

In this study, the counseling scenario was of a female customer who visits the pharmacy and asks for a cold medicine for her husband. This situation development was based on a set of non-prescription pharmaco-therapeutic clinical cases, comprising also communication elements that are present during an effective exchange strategy.[26,34] The counseling structure and content followed the OTC counseling mnemonic WWHAM often used by UK community pharmacists,[7] representing the questioning sequence: **W**ho is patient? **W**hat are their symptoms? **H**ow long have the symptoms been present? Any **A**ction already taken? and Any **M**edication already taken? The relevance of the interview strategy was validated by a panel of Portuguese self-medication experts (1 academic and 2 practitioners) through a mini-Delphi process. SAF was also comprised of an initial section, previous to the interaction itself, where participants were required to provide basic demographic and education data.

Throughout the simulation, participants selected one item or question at each step, constructing a meaningful counseling sequence for the proposed clinical scenario. This had to be accomplished within a time limit of one minute at each step, and participants had 2 attempts to select the best item/question within that minute. SAF generates a feedback message at each step, according to the option chosen:

- "Incorrect Item – Try Again", when the operator fails to select the best option.
- "Incorrect Item – Correct Item: X", when the operator fails a second attempt to select the best option.
- "Correct Item", when the operator selects the correct option.
- "Time exceed – Correct Item: X", when the operator does not respond, exceeding the time limit within the allotted time interval.

After the feedback, the software moves on to the next step, with a reply from the virtual patient and a new set



Female customer U: "My husband has got a cold. What medication would you advise?"

Multiple choices:

A) I would recommend paracetamol.

B) Does he have any chronic condition?

C) He lost weight recently?

D) How old is he?

E) I advise you to go to the doctor.

Feedback message (if incorrect):

"Incorrect Answer - Correct Answer D)

Click to proceed"

Figure 1: Example of SAF's interface screen.

of counseling items/questions to choose from, being impossible to return to the previous step.

Participants choosing a complete correct set of questions at a first attempt scored the maximum value of 10 points (1 point for each correct option at each counseling step). Second attempts and no replies were considered failed options and scored zero at each step. Participants' score is also presented as a binary variable (≤7=0 and ≥8=1), to easily interpret undergraduates counseling success, assuming the minimum competency level required was eight correct options out of 10.[34] SAF was piloted amongst a sample of recently graduated professionals (n=10), for applicability testing. The software was hosted in a web server, which received and recorded participants' data and replies, as well as calculating individual counseling scores. At the end there was a final question related to the overall acceptance of the computer simulation as an assessment tool, to which participants responded through a Likert scale, anchored from 1 (completely in agreement) to 7 (completely in disagreement).

Sampling, data collection and analysis

As an exploratory study, no pre-analytical hypotheses were formulated and an open descriptive design was followed with no power sample calculations and statistical representativeness aims. This way, in December 2011, all Portuguese pharmacy undergraduates received an email message with a web link granting access to the research instrument. The email distribution list was obtained from the Portuguese Pharmacy Students Association (APEF) through a national network, which includes all students from eight (out of nine) Portuguese pharmacy schools, both public and private. The 9th school was excluded from the study since their students' association is not a member of APEF. Serving only as an indicator for calculating a general participation rate, there was an estimated population of 5563 undergraduates, corresponding to single institutional email addresses. Data collection took place over a period of two weeks with an email reminder one week after the first sent out. Since no results' representativeness was aimed and a limited number of inferences were drawn from the study, a complete case analysis was followed i.e. only those students who completed all fields, i.e. demographics and in particular all necessary steps of the counseling sequence, were considered for analysis.

The study received previous IRB and ethical approval from the academic institution that hosted the project.

Participation was completely voluntary, assuring participants that SAF results would not have any influence on their academic grades. The data collected was blinded to the research team and kept anonymous, by using an automatic encryption procedure during data reception at the web server.

The data was statistically analyzed using SPSS Statistics v17,[36] with a type I error level of $p<0.05$ for all tests. A multiple linear regression was used to calculate background variables that would influence the counseling success, being the SAF score the dependent outcome. No prediction model was aimed, but only an estimation the most relevant variables to explain the outcome variance. All independent covariates entered in the model calculation simultaneously, with dummy variables computed for multinomial predictors, such as educational site, with FFUL (*Faculdade de Farmácia da Universidade de Lisboa*) as the reference category for pharmacy schools, and 1st year of studies as the reference category for education year. Additional independent variables (most dichotomous) were parsimoniously chosen and included age, gender, number of missed subjects/courses, being a pharmacy part-time employed student and having already experienced the pharmacy internship. Severe outliers (ZRed>3*SD, n=7) were excluded from a second model estimation, without influential cases identification due to the exploratory approach. Model assumptions such as residuals' normal distribution (from one sample Kolmogorov-Smirnov test), homoscedasticity (from scatterplot observation of standardized residuals by standardized predicted values) and lack of auto-correlated residuals (from Durbin-Watson statistic, d≈2) were verified, as well as the Variance Inflation Factor (VIF<5) for testing predictors multicollinearity.

RESULTS

A sample of 717 Portuguese pharmacy students participated in the study. Response rates varied from 8.6% to 20.3% per school, considering the pharmacy undergraduate population that received the study invitation.

Demographics and education data

Respondents were mostly female students (79.1%), with a mean age of 21.6 years (SD=2.69, range 17–50), as well as single (98.2%). Overall sample sex and age demographics were not significantly different from the population mean values (p=0.063). The three pharmacy schools with the highest participation within the study respondents were from the public sector: FFUL 33.7%, FFUP (*Faculdade de Farmácia da Universidade do Porto*) 21.6%, and FFUC (*Faculdade de Farmácia da Universidade de Coimbra*) 14.7%. Most participants were students from the 3rd (23.9%), 4th (19.4%) and 5th (32.5%) year of the program, with 63.1% having no record of failed subjects or courses and 41.4% attending some sort of voluntary pharmacy practice experience during their pharmaceutical education (Table 2).

Patient counseling scores

The mean patient counseling score considering all respondents was above the defined cut-off, i.e. 8.03 points (SD=1.25). Table 3 presents respondents' distribution of the scores from the lowest value (5 points) to

Table 2: Participants' Educational Data

Demographics (n=717)			
Pharmacy school	N	n (%[a])	%[b]
FFUL[1] (Public)	1683	241 (14.3%)	33.7
FFUC[2] (Public)	973	105 (9.3%)	14.7
FFUP[3] (Public)	1122	155 (13.8%)	21.6
ISCSEM[4] (Private)	506	47 (9.2%)	6.6
ULHT[5] (Private)	419	55 (13.1%)	7.7
ISCSN[6] (Private)	374	32 (8.6%)	4.5
UAlg[7] (Public)	187	38 (20.3%)	5.3
UBI[8] (Public)	299	43 (14.4%)	6.0
Education year			
1st		73	10.3
2nd		79	11.1
3rd		170	23.9
4th		138	19.4
5th		231	32.5
Internship		20	2.8
Pending/failed courses			
0		443	63.1
1		93	13.2
2		60	8.5
3		51	7.2
4		26	3.7
5		16	2.3
>5		14	1.9
Student worker		52	7.6
Student worker in community pharmacy		20	2.9
Previous pharmaceutical experience		290	41.4
Experience in community pharmacy		215	30.8

a. Response rate from each institution
b. Study sample percentage
1. Faculdade de Farmácia da Universidade de Lisboa
2. Faculdade de Farmácia da Universidade de Coimbra
3. Faculdade de Farmácia da Universidade do Porto
4. Instituto Superior de Ciências da Saúde Egas Moniz
5. Universidade Lusófona de Humanidades e Tecnologias
6. Instituto Superior de Ciências da Saúde Norte
7. Universidade do Algarve
8. Universidade da Beira Interior

those who have completed with no errors the counseling sequence. On average, questions in which participants had shown greater difficulties were Q1 (56.2% correct answers), Q6 (66.7%) and Q10 (40.6%) (Table 4). Participants scoring questions Q1 and Q10 correctly, demonstrated a significant statistical association with the participant's pharmacy school affiliation (respectively, Pearson's Chi^2=16.635, p=0.02 and Chi^2=15.191, p=0.034), with students from the public faculties FFUL, FFUP and FFUC performing better than the students from the other public and private schools. However, when comparing the mean counseling scores between pharmacy schools, no significant statistical differences were found (One-way Analysis of Variance (ANOVA) F=0.923, p=0.488).

Students with previous pharmaceutical work experience scored statistically better than students without work experience (t=−2.038, p=0.042), respectively, 8.15 (SD=1.18) and 7.95 (SD=1.28). This difference was also noted for students older than 22 years of age (t=−6.121, p<0.001) and was somewhat correlated with the education year. There was a significantly lower mean score in the early studies (1st and 2nd year) when compared with the last years of study (4th, 5th years and internship) (ANOVA F=13.844, p<0.001). Figure 2 illustrates the 3rd year as an interface between

Table 3: Counseling Scores (n=717)[a]

Scores	Number of participants (%)
≤5	18 (2.5)
6	64 (8.9)
7	138 (19.3)
8	229 (32.0)
9	186 (26.0)
10	81 (11.3)

a. Less than 8 points is considered a bad counseling performance

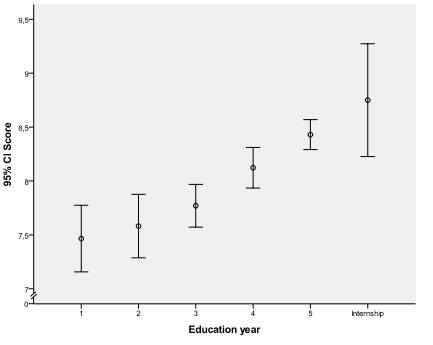


Figure 2: One-way ANOVA of SAF mean scores by education year (n=717).

Table 4: Sequence of Counseling Steps and Correct Question or Item Option Percentage at Each Step (n=717)

	Questions	Correct options (%)
Q0	My husband has got a cold. What medication would you advise?	
Q1	How old is he?	56.2
R1	He is 55 years old.	
Q2	What symptoms has he got?	89.5
R2	He has got a sore throat.	
Q3	What other symptoms has he got?	87.9
R3	Besides the sore throat, he only has cough.	
Q4	How long has he had these symptoms for?	96.1
R4	For two days.	
Q5	Does he have a productive or a non-productive cough?	93.9
R5	He has got a productive cough.	
Q6	How long has he had these symptoms for?	66.7
R6	Since yesterday.	
Q7	Has he taken any medication?	98.5
R7	No.	
Q8	Does he have any chronic condition?	83.8
R8	No.	
Q9	Does he take any other medicines?	89.8
R9	No	
Q10	I would recommend ibuprofen and acetylcysteine.	40.6
R10	Thank you.	

two Bologna studies cycles i.e. 1st and 2nd year vs. 4th and 5th year, including internship. By comparing each study year of the program at each pharmacy school, a significant mean score difference was found in 4 public institutions: FFUL (ANOVA F=7.620, p<0.001), FFUP (ANOVA F=4.803, p<0.001), FFUC (ANOVA F=3.229, p=0.016) and UBI (*Universidade da Beira Interior*) (ANOVA F=3.035, p=0.022). In these schools, students in advanced years obtained significantly better scores than those in earlier years. This result was not possible to verify for the remaining institutions i.e. ISCSEM (*Instituto Superior de Ciências da Saúde Egas Moniz*), ULHT (*Universidade Lusófona de Humanidades e Tecnologias*), ISCSN (*Instituto Superior de Ciências da Saúde Norte*) and UAlg (*Universidade do Algarve*) (p>0.05).

Time to complete the simulation was found to be negatively correlated with completion success (rho=−0.337, p<0.001). When students were asked about their overall acceptance of this methodology as a way to assess student counseling skills, the mean value was 6.01 (SD=0.74) and scores showed no significant differences between schools.

Multiple regression results

Results from multiple linear regression calculations indicated a significant model (F=4.263, p<0.001) explaining 9.9% of the SAF score variance (R^2=0.099). There were some violations of the model assumptions in what concerns residuals normal distribution (K-S p=0.03) and some deviations on the normal P-P plot of standardized residuals, although residuals' mean equaled zero. No residuals' auto-correlation was identified (d=2.028), as well as no multicollinearity issues (VIF<3.7).

From the 7 independent predictors, only the year of studies made a significant contribution to explain counseling performance, i.e. presented significant regression coeficients. Only 4th, 5th and undergraduates in their internship period presented significant t-Test values (respectively, t=3.5, p<0.001; t=5.0, p<0.001; t=3.7, p<0.001), corroborating the results shown in Figure 2.

DISCUSSION

Computer simulation

Virtual patient technology has been considered to be educationally effective when compared to traditional instruction and is being used in pharmacy practice training programs in many countries, although not as extensively as one might expect in the European community.[40] For this reason, the present software was designed and developed as an electronic-based instrument, constructed to provide interactivity between students and a computer simulated patient and to contribute with a customized solution for pharmacy education in Portugal. A combination of inputs from teaching and learning materials currently used in several non-prescription pharmacotherapy courses, as well as OTC counseling protocols, were merged with practical experience to provide a clinical case as close to the Portuguese reality as possible. Thus, participants were not reading from on-line clinical information, but observing an animation that simulated a true pharmacy customer asking for OTC counseling.

The software was also developed as a student assessment tool. No teaching/learning materials were attached or distributed with the software that could have facilitated preparation prior to participation. The performance score obtained at the end was a measure of the participant's actual knowledge and ability to deal with the information disclosed in each counseling step through a previously constructed sequence. This standardized set of questions was considered to be the most relevant in achieving an optimal patient counseling. Although different simulation models may be used in healthcare education, from knowledge and skills assessment to encouraging effective communication and exchange, this study has contributed to the development of a pharmacy virtual patient using limited intramural resources. It has followed the recommendations to implement virtual patients as a mean to increase professional competence by exposing students to practice-like situations.[37] Computer simulated patients used as an educational tool has proven to be a beneficial supplement, enabling the direct application of putting learned theory into practice. As a result, the next step is to carry this project further, e.g. introducing new self-medication scenarios, as well as finding ways to fit this computer interactive simulation in the curricula of Portuguese pharmacy schools.

Self-medication skills

Regarding the scores obtained, the results were positive overall. Trusting the construct and content validity of SAF, on average the future Portuguese pharmacy practitioners would be able to identify and counsel one of the most frequent OTC conditions. Nevertheless, questions Q1 and Q10 presented the highest missing rates. Q1 ("How old is he?") is an opening question, collecting essential information that will influence the progression of the interview. On the other hand, Q10 ("I would recommend ibuprofen and acetylcysteine.") is the closing question of the interview and is comprised of the most important part of the outcome, the therapeutic advice. This last exchange between the pharmacist and the

virtual patient demands prior pharmaco-therapeutic knowledge that 1st year students might not have. However, when last year students displayed a tendency to fail both these questions, amongst other intermediate steps, it was evident that Portuguese students may have difficulties in initiating the counseling process as well as giving objective therapeutic advice. This raises the question of syllabus organization and the need for a better integration of subjects and knowledge. Some international curricula, particularly in medical education, promote interaction with patients longitudinally i.e. from the 1st to the last year of studies, facilitating knowledge use in practice.[41]

Findings from previous studies suggest pharmacists' performance may be affected by multiple factors, including individual traits (e.g. gender, ethnicity, place of primary qualification) and factors associated with the workplace.[16,17,42] Present findings have not found significant differences in the counseling skills between male and female undergraduate students. The impact of age and gender on practice is unclear, mirroring evidence from other health professions.[12] Further research is needed to confirm any relationships of background variables with students' (as well as professionals') counseling performance.

It was also found relevant the differences between 1st and 2nd cycle students, adopting the Bologna taxonomy.[31] This was observed in particular for the public institutions, namely FFUL, FFUP, FFUC and UBI. Following an equivalent syllabus organization used in most Southern European countries,[43] Portuguese pharmacy degrees present a classical structure from basic sciences (e.g. organic chemistry, cell biology and pharmaceutical technology) in the first three years of the program and applied knowledge in the last two (e.g. pharmacotherapy and clinical pharmacy), including specific practice subjects such as community pharmacy practice and communication skills. Regression results support this curriculum design. While student affiliation did not explain the differences in OTC counseling performance, suggesting homogeneity in self-medication competencies (for instance between public and private universities), differences between studies years should receive additional attention. Of course, a competency gap is somewhat expected between the first and last years due to academic progression. However, such a large difference in performance, while dealing with a very common condition in pharmacy practice, demonstrates a lopsided education progression, especially concerning integration with patient care competencies. This might be one of the reasons justifying the overall weaker clinical skills when pharmacists are compared with other healthcare professionals.[44] Certainly other factors, not studied here, may play a role in explaining differences between student years, but this type of uneven learning, that negates any form of patient interaction, does not favor the development of relational competencies.[45] Moreover, participants with previous practical experience in pharmacy, that was acquired voluntarily and beyond their syllabus, scored better than students without this experience. These findings reinforce the idea of the training benefits received through direct contact with real world situations or at least training with virtual patients. Previous research has shown that practical training and feedback increases the student motivation to learn,[12] thus options such as the development of computer simulation and intermediate internships should be considered in future syllabus reforms.

Taking longer in an assessment situation should also correspond to comprehensive thinking and should produce better end-results. However, a faster patient questioning sequence presented greater overall counseling success. This suggests that following a previously defined framework, with a clear set of relevant questions, might improve OTC counseling performance. In this sense, self-medication protocols could play a role in pharmacists' education and training. The existing protocols follow an optimized structure or interview path, which once assimilated, as it happens with experienced pharmacists, may allow for a complete and rational patient counseling.[11] Additionally, a student higher response time may be related to more doubts, increasing the prospects of mistakes and failure.

As a final note, 1st and 2nd year students perfomance may be interpreted in light of initial years academic content. These students are more exposed to heavy specific subjects, usually away from patient care, such as molecular biology and organic chemistry. Besides clinical abstraction being responsible for poor quality counseling behavior, these undergraduates are submerged in information that has a weak connection with future practice.

Study limitations

The software used in this study was the initial version of an intramural development. Accordingly, some limitations are expected. For instance, the virtual patient counseling sequence is incomplete since there are no treatment directions or opportunities for questioning the patient on possible doubts, both mandatory in good patient counseling. Moreover, although working with a common OTC request, other self-medication conditions would demand different knowledge, further communication and interpersonal skills, such as in the

case of severe or intimate health conditions (e.g. sexual conditions).

There are no guarantees in relation to the results generalizability and statistical representation. While some pharmacy schools may have suffered from a participation bias due to the variable use of students' institutional emails, a self-selection bias was also possible to occur, since participating students might have been more motivated or willing to please the research team, as well as those with a greater confidence in their training skills, or those with greater comfort using electronic means. Additionally, and due to the exploratory nature of this study, cluster effects of the students nested in their schools were not taken into account during the statistical analysis.

CONCLUSIONS

This exploratory study suggests that pharmacy courses in Portugal seem to address training needs of future pharmacists. Advantages in OTC counseling performance seem to exist if early contact with patients and practice experience takes place during undergraduate education. Public pharmacy schools are apparently dedicating attention to training in self-medication and patient counseling skills, suggesting the use of OTC counseling protocols not only in practice, but also in undergraduate education. Virtual patient initiatives in pharmacy education and training are a feasible option, allowing also the study of educational outcomes from different pharmaceutical science syllabuses.

REFERENCES

1. World Health Organization. *The Role of the Pharmacist in the Health Care System*. Vancouver, 1997. [http://apps.who.int/medicinedocs/pdf/s2214e/s2214e.pdf]
2. Zeind CS, Mccloskey WW. Pharmacists' Role in the Health Care System. *Harvard Health Policy Rev* 2006, 7(1).147–154.
3. Eades CE, Ferguson JS, O'Carroll RE. Public health in community pharmacy: A systematic review of pharmacist and consumer views. *BMC Public Health* 2011, 11(1):582.
4. Wilbur K. Pharmacy student perceptions of public health service roles and responsibilities. *Int J Pharm Pract* 2011, 19(3):179–184.
5. Blom L, Wolters M, Ten Hoor-Suykerbuyk M, van Paassen J, van Oyen A. Pharmaceutical education in patient counseling: 20h spread over 6 years? *Patient Educ Couns* 2011, 83(3):465–471.
6. FIP. *FIP Statement about Pharmaceutical Care*. Hague: 2010. [http://www.fip.org/www/uploads/database_file.php?id=269&table_id=]
7. Bissell P, Ward PR, Noyce PR. Appropriateness measurement: application to advice-giving in community pharmacies. *Soc Sci Med* 2000, 51(3):343–359.
8. Puspitasari HP, Aslani P, Krass I. A review of counseling practices on prescription medicines in community pharmacies. *Res Social Adm Pharm* 2009, 5(3):197–210.
9. Pharmaceutical Society of Australia. Guidelines Consumer Medicines Information and the pharmacist. In *Australian Pharmaceutical Formulary and Handbook*. Canberra; 2006:369–370.
10. Praska JL, Kripalani S, Seright AL, Jacobson TA. Identifying and assisting low-literacy patients with medication use: a survey of community pharmacies. *Ann Pharmacother* 2005, 39(9):1441–1445.
11. Cavaco AM, Pereira PF. Pharmacists' counseling protocols for minor ailments: a structure-based analysis. *Res Social Adm Pharm* 2012, 8(1):87–100.
12. Schafheutle EI, Seston EM, Hassell K. Factors influencing pharmacist performance: a review of the peer-reviewed literature. *Health Policy* 2011, 102(2–3):178–192.
13. Hyvärinen M-L, Tanskanen P, Katajavuori N, Isotalus P. Feedback in patient counselling training--pharmacy students' opinions. *Patient Educ Couns* 2008, 70(3):363–369.
14. Hargie OD, Morrow NC, Woodman C. Pharmacists' evaluation of key communication skills in practice. *Patient Educ Couns* 2000, 39(1):61–70.
15. Shah B, Chewning B. Conceptualizing and measuring pharmacist-patient communication: a review of published studies. *Res Social Adm Pharm* 2006, 2(2):153–185.
16. Mesquita AR, Lyra DP, Brito GC, Balisa-Rocha BJ, Aguiar PM, de Almeida Neto AC. Developing communication skills in pharmacy: a systematic review of the use of simulated patient methods. *Patient Educ Couns* 2010, 78(2):143–148.
17. Curtin LB, Finn LA, Czosnowski QA, Whitman CB, Cawley MJ. Computer-based simulation training to improve learning outcomes in mannequin-based simulation exercises. *Am J Pharm Educ* 2011, 75(6):Article 113.
18. Huang C. Virtual labs: e-learning for tomorrow. *PLoS Biol* 2004, 2(6):734–735.
19. Hussein G, Kawahara N. Adaptive and longitudinal pharmaceutical care instruction using an interactive voice response/text-to-speech system. *Am J Pharm Educ* 2006, 70(2):Article 37.
20. Benedict N. Virtual patients and problem-based learning in advanced therapeutics. *Am J Pharm Educ* 2010, 74(8):Article 143.
21. Gesundheit N, Brutlag P, Youngblood P, Gunning WT, Zary N, Fors U. The use of virtual patients to assess the clinical skills and reasoning of medical students: initial insights on student acceptance. *Med Teach* 2009, 31(8):739–742.
22. Botezatu M, Hult H, Fors UG. Virtual patient simulation: what do students make of it? A focus group study. *BMC Med Educ* 2010, 10:91.
23. Hussainy SY, Styles K, Duncan G. A virtual practice environment to develop communication skills in pharmacy students. *Am J Pharm Educ* 2012, 76(10):Article 202.
24. Chaikoolvatana A, Kitiwongsoonthorn U. Evaluation of a computer interactive multimedia program in smoking cessation counseling (CIMPSCC) for pharmacy students. *J Med Assoc Thai* 2009, 92(11):1516–1523.
25. Maidhof W, Mazzola N, Lacroix M. Student perceptions of using a human patient simulator for basic cardiac assessment. *Currents in Pharmacy Teaching & Learning*. [http://linkinghub.elsevier.com/retrieve/pii/S1877129711000992]
26. Kane-Gill SL, Smithburger PL. Transitioning knowledge gained from simulation to pharmacy practice. *Am J Pharm Educ* 2011, 75(10):Article 210.
27. Battaglia JN, Kieser MA, Bruskiewitz RH, Pitterle ME, Thorpe JM. An online virtual-patient program to teach pharmacists and pharmacy students how to provide diabetes-specific medication therapy management. *Am J Pharm Educ* 2012, 76(7):Article 131.
28. Vyas D, Wombwell E, Russell E, Caligiuri F. High-fidelity patient simulation series to supplement introductory pharmacy practice experiences. *Am J Pharm Educ* 2010, 74(9):Article 169.
29. Bray BS, Schwartz CR, Odegard PS, Hammer DP, Seybert AL. Assessment of human patient simulation-based learning. *Am J Pharm Educ* 2011, 75(10):Article 208.
30. Lin K, Travlos DV, Wadelin JW, Vlasses PH. Simulation and introductory pharmacy practice experiences. *Am J Pharm Educ* 2011, 75(10):Article 209.
31. Kushwaha K, Kushwaha N, Rai A. Recent trends on the future of graduate education in the pharmaceutical sciences and research. *J Young Pharm* 2010, 2(2):206–212.
32. Aranda da Silva JA, Ramos F, Silva I. Implementing a New Model for Admission and Qualification of Portuguese Pharmacists. *Pharmacy education: an international journal for pharmaceutical education* 2004, 4(3–4):123–128.
33. Cavaco A, Chettiar V, Bates I. Achievement Motivation and Self-efficacy Perception Amongst Portuguese Pharmacy Students. *Pharmacy education: an international journal for pharmaceutical education* 2003, 3(2):109–116.

34. Soares M. *Non-prescribed drugs. Pharmaceutical counseling* (2nd ed). Lisboa: Publicações Farmácia Portuguesa; 2002.
35. Kothari D, Gourevitch MN, Lee JD, Grossman E, Truncali A, Ark TK, Kalet AL. Undergraduate medical education in substance abuse: a review of the quality of the literature. *Acad Med* 2011, 86(1):98–112.
36. Maroco J. *Statistical Analysis with SPSS* (3rd ed). Lisboa: Edições Sílabo; 2007.
37. Cook D, Patricia E, Triola M. Computerized virtual patients in health professions education: A systematic review and meta-analysis. *Acad Med* 2010, 85(10):1589–1602.
38. Orr KK. Integrating virtual patients into a self-care course. *Am J Pharm Educ* 2007 71(2):Article 30.
39. Keele University. 'Virtual Patient' helps train pharmacist of the future. In: Forever Keele Issue 4. Keele: Keele University Alumni Office, 2009.
40. Cavaco AM, Madeira F. European pharmacy students' experience with virtual patient technology. *Am J Pharm Educ* 2012, 76(6):Article 106.
41. von Fragstein M, Silverman J, Cushing A, Quilligan S, Salisbury H, Wiskin C. UK Council for Clinical Communication Skills Teaching in Undergraduate Medical Education. UK consensus statement on the content of communication curricula in undergraduate medical education. *Med Educ* 2008, 42(11):1100–7.
42. Crosier D, Purser L, Smidt H. Trends Y. *University shaping the European Higher Education Area. An EUA report*. [http://www.sowi-due.de/uploads/108.pdf. Accessed February 14, 2012]
43. PHARMINE Consortium. Country Profiles [http://www.pharmine.org/losse_paginas/Country_Profiles/]
44. Lau E, Dolovich L, Austin Z. Comparison of self, physician, and simulated patient ratings of pharmacist performance in a family practice simulator. *J Interprof Care* 2007, 21(2):129–40.
45. Ratzmann A, Wiesmann U, Gedrange T, Kordass B. Early patient contact in undergraduate dental education in Germany--'The Greifswald Model'. *Eur J Dent Educ* 2007, 11(2):93–8.