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Pilot of a joint bed-side teaching course for medical and pharmacy university students

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Background and aim: Interprofessional education of medical and pharmacy students may improve competence-based university teaching. *Investigations:* We developed a joint bed-side teaching to improve patient-related competencies in identifying drug-related problems in hospitalized patients at a university cardiology department. Students were randomly allocated in mixed teams of medical and pharmacy students (1:3). The concept consisted of four parts: (i) kick-off session (day 1), (ii) file analysis and bed-side patient interview (day 2), (iii) medication analysis (free time management), and (iv) presentation of the acquired results (day 3). Expectations and competencies, predefined in 10 categories and 10 assessment levels (0-none to 10-maximum), were evaluated before and after the course (degree of fulfillment of the expectations reported after the course). *Results:* Overall, 12 students participated, eight of whom were female. Median age was 23 years (Q25/Q75: 22/24). The median time at university was 8 semesters (Q25/Q75: 7/9). The competencies were assessed by the students before and after the course in the following categories: Competencies in "Treatment of diseases" (median rating before/after the course: 6/7; n.s.), "Diagnostics of diseases" (4.5/5; n.s.), "Future physician-pharmacist cooperation" (6/8; p=0.005), "Interaction with patients" (6.5/7; n.s.), "Cardiology" (5/7; p=0.012), "Interprofessional student communication" (6.5/9; p=0.005), "Dealing with patient-oriented questions" (6.5/8; n.s.), "Future professional life" (5/7.5; p=0.012), "Practical problem solving" (6/7; p=0.027), "Scientific work" (6/7.5; n.s.). Expectations before the course were highest (median of 10) in the categories "Future physician-pharmacist cooperation", "Dealing with patient-oriented questions", "Future professional life", and "Practical problem solving". The highest levels of expectation fulfilment were reported after the course for the categories "Future physician-pharmacist cooperation" and "Interprofessional student-communication". In the free text, interprofessional collaboration was frequently mentioned as a particularly positive aspect of the course. *Conclusions:* A pilot joint bed-side teaching course for medical and pharmacy students was feasible and an early interprofessional collaboration during medical and pharmacy studies may improve several competencies particularly regarding competencies in physician-pharmacist cooperation and in interprofessional student communication.

1. Introduction

The collaboration of physicians and pharmacists can improve patient-related outcomes (Bardet et al. 2015; Meid et al. 2023; Suwa et al. 2021). The advantages of these two professionals' complementary knowledge and skills have been repeatedly described previously (Capiau et al. 2022). However, recent reviews discuss the lack of studies showing measurable benefits of a collaboration in everyday practice (Reeves et al. 2017). There is a need to investigate the effects of structured interprofessional collaborations. It is incompletely known whether an implementation at an early professional stage, i.e. during university education, is feasible. An early interprofessional collaboration may theoretically positively affect the student's future professional practice. Consequently, the training of pharmacy students by experienced physicians is already standard practice at many universities, and pharmacy students regularly take part in medical ward rounds (Lyons et al. 2013). Such concepts are intended to bring pharmacists closer to clinical processes and enable them to make clinical decisions, which may become essential to their future professional lives (Charrois et al. 2023). International studies have investigated interprofessional education involving medical and pharmacy students in a comprehensive pretest-posttest control group design (Jung et al. 2020). In addition to bed-side teaching, specific interprofessional education concepts, such as a collaborative reviewing of medical literature, have been published (Guy et al. 2022). However, it is not known whether a joint practical bed-side training including pharmacy and medical students as mixed teams is feasible.

In summary, close cooperation between physicians and pharmacists is essential for drug therapy safety in professional patient-related activities. However, the current versions of the German professional regulations for physicians and pharmacists do not yet include such directly interprofessional teaching activities in the respective curricula. Therefore, we designed a teaching project that aimed (i) to develop and implement a new elective course for advanced students and (ii) evaluate the expectations and competencies of the students before and after course participation.

2. Investigations and results

2.1. Setting

A new elective joint bed-side teaching course was designed, implemented, and evaluated at the Medical Faculty of Leipzig University. The course was offered to both advanced medical and pharmacy students, simultaneously. The course coordinators and lecturers from both degree programs designed, implemented, and evaluated the course in equal parts. The course took place at the Department of Cardiology at the Leipzig University Hospital. The department offer the full spectrum of treatment for patients experiencing heart and circulatory diseases such as heart failure, coronary artery disease, hypertension, and cardiac arrhythmias. Patients were invited if their pharmacotherapy was complex enough to complete a medication analysis, i.e. more than five medications including typical cardiovascular treatments were prescribed. All patients agreed in advance to get visited and interviewed by the students. Non-anonymized patient data were allowed to be used only within this teaching course, had to be handled confidentially, and were not allowed to be passed on to third parties. The pilot project was methodically supervised by the Medical Didactic Center of the Faculty of Medicine, Leipzig University.

2.2. Development and implementation of a new elective course

The elective course was developed by experienced physicians (specialized in cardiology and directly involved in patient care) and pharmacists (specialists in drug information and clinical pharmacy), and consisted of the following parts:

(i) In a *kick-off session (day 1, date fixed by agreement)*, a cardiologist presented the interprofessional concept and the basics of the content. The mixed teams of medical and pharmacy students were allocated.

(ii) In a *second session (day 2, date fixed by agreement)*, the mixed teams of medical and pharmacy students visited and interviewed the assigned patients and reviewed patient files for medical history and concomitant medication.

(iii) In an *intermediate phase* (*free time management by the students)*, the interprofessional mixed students teams were asked to perform a medication analysis by using the information obtained. For this purpose, drug-related databases, national and international guidelines, specialist literature and literature data bases should be primarily used. The recorded patient data were analyzed within the interprofessional mixed students teams with regard to appropriateness and possible drug-related problems. An exemplary extract of a medication analysis based on a patient file and interview is shown anonymized in Table 1. The medication of this patient example is presented in Table 2. The students were asked to summarize their results in a final presentation. Open questions with the need for clarification should also be addressed, and solutions to the identified drug-related problems should be suggested, where possible.

(iv) In a *third session (Day 3, date fixed by agreement)*, all teams presented their assessment results in a 15-minute presentation focusing on the patient's medical history, including a medication analysis, followed by a discussion about solutions addressing drug-related problems and about remaining open questions which occurred during the process.

The course was offered as an elective course for both medical and pharmacy students. Participation by all students was voluntary and had no influence on their further studies. The number of participating students was limited to 12 due to the organizational requirements of the medical faculty to ensure participant-individual support. Due to the greater number of participating pharmacy students, the final ratio for the mixed teams was defined as three pharmacy students to one medical student. The team constellations were allocated randomly during the kick-off session by selecting candy with three different colored wrappers. The exact dates were scheduled so that there were no overlaps with other courses for either the medical or pharmacy students.

Example of a patient assessed as part of the newly developed interprofessional education concept.

A 72-year-old female patient was hospitalized due to acute sepsis caused by cholangitis and was initially treated in a gastroenterology ward. The patient suddenly developed shortness of breath, without typical angina pectoris symptoms, and was present with severe pleural effusion on ultrasound. The electrocardiogram indicated a tachyarrhythmia absoluta based on known persistent atrial fibrillation. High-sensitive troponin T was elevated and rated as type II non-ST-elevation myocardial infarction (NSTEMI). The patient was transferred to the coronary care unit (CCU) in the acute setting for monitoring and recompensation purposes. At the time of observation, the patient was on apixaban (novel oral anticoagulation; NOAC), metoprolol (beta-blocker), empagliflozin (sodium-glucose cotransporter-2 inhibitor; SGLT2i), spironolactone, metamizole and hydromorphone (patient-controlled analgesia by known history of breast cancer) and received intravenous loop diuretics. Additional concomitant medication: amitriptyline, levetiracetam, calcium, macrogol, l-thyroxine, and romosozumab.

Table 1: Drug-related and medical problems of a patient assessed as part of the newly developed interprofessional education concept.

Drug-related/ medical problem	Examples/description
Drug-drug interactions (according to drug-databases)	• Furosemide: hyponatremia in combination with other drugs lowering sodium levels • Amitriptyline and levetiracetam: increased adverse drug reactions possible • Spironolactone and ramipril: risk of hyperkalemia, avoid high doses of spironolactone
Contraindications/indications (according to the drug label and guidelines)	• Spironolactone (problem: use in patient with GFR < 30ml/min) • Amitriptyline (problem: use in patient with heart insufficiency) • Calcium (problem: use in patient with renal insufficiency) • Metoprolol (problem: use in patient with low blood pressure) • Torasemide (problem: use in patient with low blood pressure) • Romosozumab (problem: indication unclear)
Drug use in older patients (according to *Beers* and *Forta* List)	• Amitriptyline (problem: questionable therapeutic appropriateness/therapeutic necessity) • Pregabalin (problem: questionable therapeutic appropriateness/therapeutic necessity
Drug handling and administration (according to drug label)	• Administration of hydromorphone as 1/2 capsule • L-thyroxine administration during breakfast • Macrogol not administered at least 1h apart from levetiracetam and piracetam
Other drug-related problems	• Antibiotics terminated after 5-14 days of use • Reevaluation of pain therapy • Was physiotherapy applied?

We expected the students to acquire or deepen the following competencies in the course: being able to present a patient focusing on the currently most important medical problems and the medical history, to describe subjective and objective parameters from the patient file and the patient interview, to evaluate the medication, to recognize and analyze drug-related problems and to derive targeted solutions as a plan for the attending physician.

2.3. Evaluation of the expectations and competencies of the students before and after course participation

Questionnaires were used to assess the students' (I.) expectations and (II.) competencies before (I.a/II.a: at the beginning of the kick-off session) and after the course (I.b/II.b: at the end of the third session). Participation of the students was voluntary and anonymous.

Table 2: Medication of a 72-year-old female patient assessed as part of a newly developed interprofessional education concept

Drug	Dosage schedule
Amitriptyline 50 mg	0-0-1/2
Apixaban 2.5 mg	1-0-1
Atorvastatin 40 mg	0-0-1
Calcium/Cholecalciferol	1-0-0
Empagliflozin 10 mg	0-0-1
Metoprolol 95 mg	1-0-1
Ramipril 2.5 mg	1-0-1
Spironolactone 25 mg	1-0-0
Torsemide 10 mg	1-0-0
Ezetimibe 10 mg	0-0-1
Hydromorphone retard 8 mg	1-0-1
Letrozole 2.5 mg	0-1/2-0
Levetiracetam 500 mg	1-0-1
Polyethylene Glycol	1-0-0
Pantoprazole 40 mg	1-0-0
Piperacillin/Tazobactam 4/0.5 g i.v.	1-1-1
Furosemide 40 mg i.v.	1-0-0

For each of the four sections (I.a, II.a, I.b., II.b), the students should provide a rating on a scale ranging from „0“ (not at all) to „10“ (maximum) for each of the following 10 items.

- Treatment of diseases
- Diagnostics of diseases
- Future physician-pharmacist cooperation
- Interaction with patients
- Cardiology
- Interprofessional student communication
- Dealing with patient-oriented questions
- Future professional life
- Practical problem solving
- Scientific work

The order of the items differed randomly between the four sections to avoid bias.

The questionnaire was developed by the authors of this work and reviewed in their working group respectively, in particular to prove the comprehensibility of the questions. The questionnaire served to assess expectations and competencies from the perspective of the participants. For the comparison of the participants' statements before and after the course, the students were asked to provide a fantasy name to enable a person-related assignment of the two questionnaires without revealing the students' identities.

2.4. Data evaluation and statistical analysis

The collected data from the evaluation before and after the course were analyzed in an anonymized matter. The answers to the open questions and predefined answer options in the digital survey are presented in their original text form. We performed descriptive analyses to evaluate the questions from the survey with rating scales. Therefore, median values with 25% and 75% interquartile range (Q25/Q75) were calculated. For the comparison the median values of the self-assessed competencies before and after the course were compared using two-sided Wilcoxon tests. A p-value ≤0.05 (two-sided) was considered statistically significant.

2.5. Characteristics of participants

A total of 12 students, three medical and nine pharmacy students, participated in the elective course. Among those, eight reported to be female, one diverse, and three males. The median age was 23 years (Q25/Q75: 22/25 years). The median number of semesters was 8 (Q25/Q75 7/9). All participating students voluntarily took part in the evaluation questionnaires.

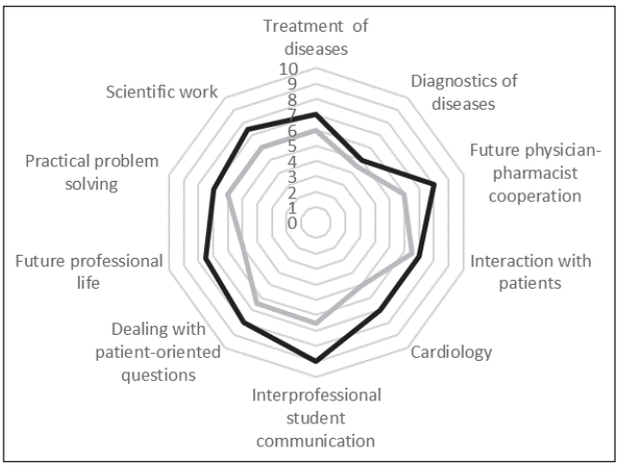

Fig. 1: Competencies (median) reported before the course (light gray) and competencies reported after the course (black); Likert Scale ranging from „0“ (not at all) to „10“ (maximum).

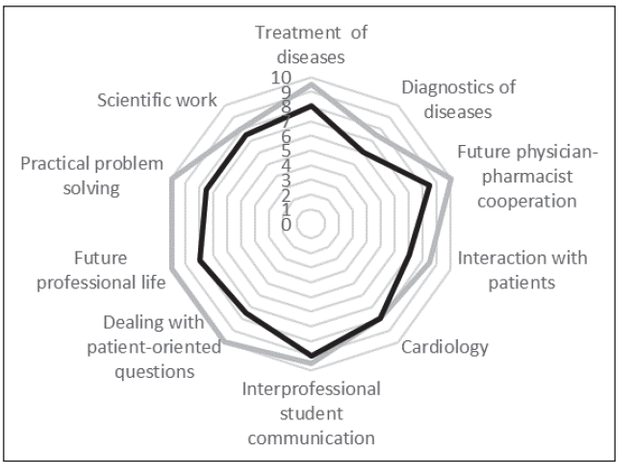

Fig. 2: Expectations (median) reported before the course (light gray) and degree of fulfillment of the expectations reported after the course (black); Likert Scale ranging from „0“ (not at all) to „10“ (maximum).

2.6. Evaluation of the expectations and competencies of the students before and after course participation

The following self-assessed competencies significantly increased in a before-after the course comparison (Fig. 1): "Future physician-pharmacist cooperation" (before: 6 / after: 8; p=0.005), "Cardiology" (5/7; p=0.012), "Interprofessional student communication" (6.5/9; p=0.005), "Future professional life" (5/7.5; p=0.012), "Practical problem solving" (6/7; p=0.027). The participating students expressed the highest expectations for the categories "Future physician-pharmacist cooperation", "Dealing with patient-oriented questions", "Future professional life", and "Practical problem solving" (median rating of each category: 10). The highest levels of expectation fulfilment were reported after the course for the categories "Future physician-pharmacist cooperation" and "Interprofessional student-communication" (Fig. 2). In the answers to the open questions, interprofessional aspects were mentioned most frequently as a particularly positive aspect of the course (n=8; 67% of participants), followed by direct patient contact (n=5; 42%) and working in small groups (n=5; 33%). Additionally, most students highlighted that they would like to spend more time on the course or continue it involving additional patients (n=6; 50%). Further open answers given by the students in the evaluation after the course are presented in Table 3.

Table 3: Qualitative remarks from medical (M1-3) and pharmacy (P1-9) students regarding the questions "What did I particularly like?" and "What could be done better?" after participating in a newly developed interprofessional education concept

Number of participating medical (M) or pharmacy (P) student	What did I particularly like?	What could be done better?
M1	• The mix of medical and pharmacy students. • I benefited greatly from the collaboration.	• Spend more time researching in the hospital information system, for example.
M2	• Supervision by lecturers. • Close communication and work in a small group with pharmacists. • Patient contact.	• List of recommended drug information desirable. • Plan last session a little longer in the future (particularly with more than 3 groups).
M3	• Direct patient contact. • The group size. • Access to all patient records. • Enough time.	• More theory from pharmacy at the beginning of the course.
P1	• The exchange was more informative than I had expected (I was also very much expecting it). • The collaboration was very respectful.	• No statement provided
P2	• The experience of working with other professions directly on the ward on real cases.	• Several examples desirable.
P3	• Solving complex practical problems with researched knowledge and solutions. • Research in a variety of directions. • Recognize areas of application from different point of views.	• In the first session a list with research pages should be provided. • Explain the basic procedure of an anamnesis interview (What to look out for?).
P4	• Communication with patients. • Conducting patients interviews, because this is never a topic in our studies. • Working with physicians because we have different perspectives on the patient and the combination is very exciting.	• Working on another patient case to consolidate what we have learned.
P5	• The mixed teams itself.	• A little more time for elaboration.
P6	• Very motivated group participants. • Good group size (4 people)	• Perhaps 2 pharmaceutical and 2 medical students in the future?
P7	• No statement provided	• No statement provided.
P8	• Very interesting opportunity to go to the ward and "examine" a patient. • Work within the group at eye level. • The anamnesis process was informative.	• No statement provided.
P9	• Real patients instead of simulations.	• No statement provided.

3. Discussion

3.1. General considerations

This pilot of a joint bed-side teaching course for medical and pharmacy university students was established for the first time at the Leipzig University with a medical faculty offering both medical and pharmacy courses. The four main results of this joined pilot project are (a) The interprofessional education as an elective course and at an early stage of the career – particularly bed-side teaching – of medical and pharmacy students was feasible. (b) Students had high expectations of interprofessional teaching and most of them were met after the course. (c) The before-and-after evaluation showed that competencies in "Future physician-pharmacist cooperation", "Cardiology", "Interprofessional student communication", "Future professional life", and "Practical problem solving" were improved after the interprofessional teaching course. And (d) The primary objectives of the pilot concept, to improve interdisciplinary cooperation and professional skills, appear feasible.

3.2. Real patients instead of case scenarios

We recently implemented an innovative practical education concept for pharmacy students (Wernecke et al. 2022). In contrast to this concept, we designed the current course as an education strategy for both medical and pharmacy students to enable interprofessional learning. This objective was particularly successful because the students specifically emphasized the part of interprofessional learning in the evaluation. A new strategy compared to the concept published earlier (Wernecke et al. 2022) is involving real patients instead of developing case scenarios. In addition, the previous teaching concept was highly structured and predefined by the teachers. In contrast, our new pilot project focused on a relatively independent and interdisciplinary exchange within the mixed teams, one of our course's novel parts. The teachers were available for requests at any time. The positive development of competencies proves that students should be encouraged to try their skills themselves and not rely solely on frontal supervision.

3.3. Identifying drug-related problems during hospital stay or in the home setting

Other teaching projects describe the training of pharmacy students in direct patient contact during medical treatment (Hertig et al. 2017; Rathbun et al. 2012; Kassam et al. 2013). Particularly interesting is a project in which participating students should identify drug-related problems in home visits (Hertig et al. 2017). In contrast to our project, in which only one patient per group was contacted, Hertig et al. (2017) included a considerable number of 124 patients, visited by 11 participants. Our approach was rather qualitative and was initially intended to be a pilot project. In contrast to Hertig and colleagues, our project was particularly characterized by the interprofessional work carried out by medical and pharmacy students, including direct patient contact.

3.4. Characteristics for interprofessional education fulfilled

We applied several characteristics defined as a standard for an interprofessional education (van Diggele et al. 2020). As one required feature, we used a mixed student group, aiming that students from different disciplines work in their groups together. An additional criterion for interprofessional education being fulfilled in our concept was that the instructors should represent those disciplines as well (van Diggele et al. 2020). We also fulfilled the criterion that most of activities should be group-based according to van Diggele et al. (2020). This part is required to ensure students gain most of the interprofessional experience. Additionally, other previous described criteria such as teamwork, team-based learning, and peer assessment, were used in our concept as well. In contrast to those fulfilled aspects, other characteristics reported by van Diggele et al. (2020) have not yet been implemented by us such as an objective structured clinical examination to make the learning success measurable at the end.

3.5. Online or face-to-face? – Measurable benefits from medical and pharmacy teaching

Chua et al. (2019) examined an evaluating instrument with a 10-point scale (comparable to our rating scale) to show that a workshop where medical and pharmacy students were placed in an authentic context was a promising activity for promoting interprofessional education. Medical and pharmacy students worked together in pairs in another study (Almoghirah et al. 2023) – similar to our intention – to carry out the hospital discharge process. In that study, the students were asked to write a hospital discharge letter and to conduct a consultation. In contrast, in our project the students were asked to prepare and give an oral presentation as a learning assessment at the end of the course. In contrast to our course, Almoghirah et al. (2023) used an online format and a simulated patient while we held an in-person event in which a real patient had to be interviewed. According to these authors, their online intervention provided students with an authentic opportunity to collaborate, but the authors concede that their concept was time and resource intensive. An interesting evaluation on medical and pharmacy teaching has been shown by Abdelhakim et al. (2022). In line with that study, we can draw a similar conclusion for our pilot project: The pharmacy students benefited from the diagnostic competencies of future physicians when analyzing patient files and conducting patient interviews. Conversely, the medical students benefited from future pharmacists when researching drug-related information in databases and guidelines.

3.6. Other professional combinations for interprofessional education

In addition to the initiatives reported on cooperation between medical and pharmacy students, there are also surveys on cooperation between pharmacists and nursing staff (Wilbur and Kelly 2015). Indeed, interaction with nursing staff plays an important role for pharmacists in routine care but has hardly been taught as part of university education in Germany until now. In our setting, nursing staff is unfortunately not trained academically, so joint teaching events such as the one reported here are difficult to organize. An interesting approach is also the joint training of pharmacy and physiotherapy students (Jones et al. 2023). The focus in that study was on inhalers as specific drug administration systems. In contrast, our concept included all cardiovascular medications and co-therapies. Finally, there are also reports of interprofessional education between dentistry and pharmacy students (Carlise and Taing 2021) which is also an interesting starting point for future modules in our setting, where dentists and pharmacists are trained at the same faculty.

3.7. Aspects of further development and evaluation

Overall, the students' feedback on the fulfillment of expectations was positive in this pilot project. The free text responses identified that the students request more courses as we offered. Existing knowledge is to be deepened even further and supplemented with practical experience. The results of the evaluation of our pilot course encouraged the continuation and further development of our concept, including a knowledge-led evaluation in the future.

3.8. Strengths

Our project has several strengths. Our structured concept was prepared by an interprofessional team of medical and pharmacy experts including real cardiovascular patients. The project was professionally and organizationally supervised by the university didactics department. The content and methods to be taught were clearly formulated in a course description and met the students' expectations well. The sophisticated evaluation of the course should be mentioned. In line with current teaching concepts, competencies were assessed and their development during the course was evaluated in a pre-post comparison. As further strength of the concept we consider its high level of interactivity, and the participants particularly appreciated the contact to real patients instead of simulations.

3.9. Limitations

There are several important limitations that have to be considered. The number of participants in this pilot evaluation was very small and makes a selection bias likely. The competencies were assessed on the basis of a self-assessment and an oral presentation to experienced teachers. Initially, a one-to-one ratio in the number of mixed teams was planned. However, the interest of the medical students was lower compared to the pharmacy students. The number of participants is too low for subgroup analyses such as the comparison between medical and pharmacy students. Therefore, our findings are descriptive and have to be proven with higher number of participants. While corresponding standards for interprofessional teaching already exist in other countries (Internet Education Collaborative), the project presented here is the first pilot project in this context in pharmacy at a medical faculty in Germany. For this reason, conclusions for an international consideration should be drawn with caution.

3.10. Conclusions

A new type of an interprofessional education course – offered to mixed teams of advanced medical and pharmacy students – was developed and implemented to acquire competencies in interprofessional collaboration. According to the participating students, the concept has improved their competencies in a pre-post comparison. This was particularly the case in those categories addressing interprofessional and practical competencies. These pilot data set the stage for a roll-out of the program to higher numbers of students.

Ethics approval and consent to participate: We hereby confirm that the protocol of the teaching concept (taking into account also data protection and ethical aspects) has been approved in advance by the responsible teaching committee of the Medical Faculty of Leipzig University. We hereby confirm that informed consent has been obtained from all participating patients and students.

Availability of data and materials: The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests: The authors declare to have no conflict of interest with regard to this study.

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able for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Orcid: Tina Stegmann: 0000-0002-9678-6196; Martina P. Neininger: 0000-0002-5208-0888; Ulrich Laufs: 0000-0003-2620-9323; Thilo Bertsche: 0000-0002-4930-6655

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References

Abdelhakim HE, Brown L, Mills L, Ahmad A, Hammell J, McKechnie DGJ, Ng TWT, Lever R, Whittlesea C, Rosenthal J, Orlu M (2022) Medical and pharmacy students' perspectives of remote synchronous interprofessional education sessions. BMC Med Educ 22: 611.

Almoghirah H, Illing J, Nazar M, Nazar H. (2023) A pilot study evaluating the feasibility of assessing undergraduate pharmacy and medical students interprofessional collaboration during an online interprofessional education intervention about hospital discharge. BMC Med Educ 23: 589.

Bardet JD, Vo TH, Bedouch P, Allenet B (2015) Physicians and community pharmacists collaboration in primary care: A review of specific models. Res Social Adm Pharm. 11: 602–22.

Capiau A, Mehuys E, Dhondt E, De Backer T, Boussery. (2022) Physicians' and pharmacists' views and experiences regarding use of direct oral anticoagulants in clinical practice. Br J Clin Pharmacol. 88: 1856–1865.

Carlisle C, Taing MW (2021) Interprofessional education between dentistry and pharmacy students: delivery, barriers and facilitating implementation. Aust Dent J 66: 351–357.

Charrois TL, Sewell HD (2023) Clinical decision-making by fourth-year pharmacy students: Towards an understanding of their uncertainty. Curr Pharm Teach Learn 15: 779–786.

Chua SS, Lai PSM, Sim SM, Tan CH, Foong CC (2019) Acceptance of interprofessional learning between medical and pharmacy students in a prescribing skills training workshop: pre-post intervention study. BMC Med Educ 19: 101.

Guy JW, Claus E, Witsken C, Oestreich JH (2022) Delivery of interprofessional education through a co-curricular journal reviewing medical literature. Curr Pharm Teach Learn 14: 1053–1059.

Hertig R, Ackerman R, Zagar B, Tart S (2017) Pharmacy student involvement in a transition of care program. Curr Pharm Teach Learn 9: 841–847.

Interprofessionnel Education Collaborative [Internet]. IPEC Core Competencies for Interprofessional Collaborative Practice: Version 3 [2023; cited 2024 Mar 15]. Available from: http://www.cdc.gov/ncidod/index.htmhttps://ipec.memberclicks.net/assets/core-competencies/IPEC_Core_Competencies_Version_3_2023.pdf

Jones CA, Li JC, Hall M, Bertholet R, Turk T, Sadowski CA (2023) Interprofessional peer-assisted learning for pharmacy and physical therapy students using inhalers and inhalation devices. BMC Med Educ 23: 301.

Jung H, Park KH, Min YH, Ji E (2020) The effectiveness of interprofessional education programs for medical, nursing, and pharmacy students. Korean J Med Educ 32: 131–142.

Kassam R, Kwong M, Collins JB (2013) Promoting direct patient care services at community pharmacies through advanced pharmacy practice experiences. Int J Pharm Pract 21: 368–377.

Lyons KJ, Giordano C, Speakman E, Isenberg G, Antony R, Hanson-Zalot M, Ward J, Papastrat K. (2013) Jefferson interprofessional clinical rounding project: an innovative approach to patient care. J Allied Health 42: 197–201.

Meid AD, Wirbka L, Moecker R, Ruff C, Weissenborn M, Haefeli WE, Seidling HM; ARMIN study team (2023) Mortality and hospitalizations among patients enrolled in an interprofessional medication management program. Dtsch Arztebl Int 120: 253–260.

Rathbun RC, Hester EK, Arnold LM, Chung AM, Dunn SP, Harinstein LM, Leber M, Murphy JA, Schonder KS, Wilhelm SM, Smilie KB (2012) Importance of direct patient care in advanced pharmacy practice experiences. Pharmacotherapy 32: e88-97.

Reeves S, Pelone F, Harrison R, Goldman J, Zwarenstein M (2017) Interprofessional collaboration to improve professional practice and healthcare outcomes. Cochrane Database Syst Rev. 6:CD000072.

Suwa S, Tsujimura M, Yumoto A, Iwata N, Shimamura A (2021) Multidisciplinary pharmacotherapy collaboration for home-based older adults with dementia: a study focusing on physicians, pharmacists, and nursing professionals. Psychogeriatrics 21: 749–762.

van Diggele C, Roberts C, Burgess A, Mellis C (2020) Interprofessional education: tips for design and implementation. BMC Med Educ. 20 (Suppl 2): 455.

Wernecke K, Hintzer K, Rockenbauch K, Bertsche T, Schiek S (2022) Medication review in multi-morbid geriatric patients: A training program for pharmacy students in Germany. Curr Pharm Teach Learn 14: 1274–1282.

Wilbur K, Kelly I (2015) Interprofessional impressions among nursing and pharmacy students: a qualitative study to inform interprofessional education initiatives. BMC Med Educ 15: 53.