Clinical reasoning by pharmacists: fostering clinical decision-making and interprofessional collaboration in pharmacy practice and education

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SUMMARY

Clinical reasoning is a core competence for pharmacists and forms the foundation for effective clinical decision-making (CDM)–a complex interplay of cognitive processes and skills that enable pharmacists to make patient-centered clinical decisions in the pharmacy practice. However, the conceptualization of clinical reasoning remains unclear, and its application in pharmacy practice is less studied compared to other health professions. This lack of clarity presents challenges for effectively teaching and learning clinical reasoning and CDM within pharmacy education. Furthermore, understanding and integrating the clinical reasoning approaches of professionals from other health professions, such as physicians, are important for strengthening interprofessional collaboration (IPC). Therefore, this thesis aims to enhance the understanding of clinical reasoning by pharmacists, identify the cognitive processes involved in CDM, examine influencing factors, and evaluate educational interventions designed to foster CDM and IPC.

Chapter 2 presents a scoping review that maps and examines the existing literature on pharmacists' clinical reasoning. The review identified 13 primary research studies analyzing cognitive processes in pharmacists. Findings indicate that pharmacists employ both analytical and intuitive reasoning processes, sometimes separately, but often combined as dual processing. Studies on medication reviews reported a predominance of analytical reasoning, whereas those on diagnosis formation in primary care revealed no distinct cognitive patterns, particularly in self-care scenarios. Pharmacists' clinical reasoning is conceptualized as a context-dependent cognitive process that integrates knowledge and experience to interpret clinical data. This conceptualization informed the development of a pharmacy-specific CDM model, explicitly outlining clinical reasoning as a separate step within the decision-making process.

Chapter 3 explores pharmacists' CDM through semi-structured interviews with 16 pharmacists across community, outpatient, and hospital settings. Analysis of these interviews identified 21 cognitive processes, which were structured into eight steps within the adapted CDM model: problem and healthcare need consideration, information collection, clinical reasoning, clinical judgment, shared decision-making, implementation, outcomes evaluation, and reflection. Pharmacists emphasized the importance of correctly identifying the patient's problem and collecting relevant information, often moving back and forth between steps. Clinical reasoning emerged as particularly challenging, with difficulties in contextualizing problems within the patient's circumstances. Additionally, limited attention was given to evaluating

patient outcomes and reflecting on decisions—key steps necessary for refining and improving CDM.

Chapter 4 examines the factors influencing CDM, as identified through interviews with the same 16 Dutch pharmacists. These interrelated factors were mapped using the Capability–Opportunity–Motivation–Behaviour (COM-B) model. Pharmacists' capability to make clinical decisions was shaped by their theoretical knowledge base, clinical experience, and skills. Opportunities for engaging in CDM were influenced by the practice setting, data availability, rules and regulations, intra- and interprofessional collaboration, patient perspectives, and time constraints. Motivation was driven by confidence, curiosity, critical thinking, and a sense of responsibility. These findings underscore the importance of addressing individual and systemic influences to strengthen CDM.

Chapter 5 includes the CDM model developed in this thesis, accompanied by a learning guide and educational strategies tailored for clinical and academic educators. The learning guide explicitly integrates the cognitive processes identified in our earlier study and provides structured support reasoning across diverse scenarios, settings, and training level.

Chapter 6 evaluates pharmacy students' and pharmacists' perceptions of the educational value of the model and learning guide when addressing patient cases. A survey study with 159 participants revealed that most agreed the model supported their CDM, particularly in considering the patient's healthcare needs and context, and exploring all available options. Key learning outcomes and self-development opportunities included collecting sufficient relevant information and maintaining a broad perspective. Survey item agreement and identified themes were largely consistent between undergraduate and postgraduate participants. Undergraduates particularly valued the model for providing a clear structure and fostering critical thinking, while postgraduates appreciated its role in decelerating the decision-making process to ensure thoroughness, effectiveness, and avoidance of premature closure. Postgraduates also emphasized the value of evaluating outcomes as part of the decision-making process. Feedback from continued implementation in both undergraduate and postgraduate education is helping to refine the educational resources and activities, ensuring their ongoing relevance and applicability.

Chapter 7 evaluates the impact of educational program focused on pharmacotherapy, designed to strengthen IPC as pharmacists and physicians in practice. The program included three mandatory activities of increasing complexity, embedded with both

curricula at the Leiden University Medical Center (LUMC). Due to the larger number of medical students compared to pharmacy students, medical students participated in both interprofessional (IPE) and uniprofessional (UPE) activities, while pharmacy students exclusively participated in IPE activities. A mixed-methods study evaluated the program's impact on self-perceived competence levels, learning outcomes, and attitudes toward IPC. Results from the Interprofessional Collaborative Competency Attainment Scale (ICCAS) revealed significant improvements across all 21 competency items for both UPE and IPE activities. However, while UPE demonstrated small effect sizes across all items, IPE showed medium effect sizes for six items and large effect sizes for two items. Overall, students rated themselves as more capable of IPC after IPE compared to UPE, underscoring the added value of interprofessional learning. Additionally, competence development appeared to improve with an increased number of IPE activities. Pharmacy students reported slightly higher post-activity scores than medical students, potentially reflecting greater exposure to or emphasis on IPC within their education. Both student groups highlighted learning outcomes, with medical students often focusing on the patient perspective and pharmacy students providing complementary, subject-specific content that aligned with the learning outcomes noted by medical students. Qualitative findings further demonstrated that the program fostered a deeper understanding of professional roles and enhanced appreciation for collaborative work. Future efforts will aim to expand IPE activities and train educators to better support IPC competence development.

Synthesizing the thesis findings through the CDM model, **Chapter 8** discusses the findings and highlights their implications for future research, (post)academic education, and pharmacy practice. Although the research largely relies on self-reported data, the integration of theoretical insights with practice-based findings, supported by multidisciplinary expertise, reinforces the rigor and relevance of its findings. In conclusion, this thesis enhances our understanding of pharmacists' CDM by conceptualizing clinical reasoning, identifying the cognitive processes involved, and examining the factors that influence them. The evidence-informed CDM model and learning guide provide practical tools to foster CDM in pharmacy students and pharmacists. Furthermore, the IPE program shows promise in fostering IPC competencies. Collectively, these contributions have the potential to advance pharmacy education and practice, ultimately improving patient care outcomes.