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# Factors influencing pharmacists' clinical decision making in pharmacy practice

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## ABSTRACT

**Background:** Pharmacists' clinical decision-making is considered a core process of pharmaceutical care in pharmacy practice, but little is known about the factors influencing this process.

**Objective:** To identify factors influencing clinical decision-making among pharmacists working in pharmacy practice.

**Methods:** Semi-structured interviews were conducted with pharmacists working in primary, secondary, and tertiary care settings in the Netherlands between August and December 2021. A thematic analysis was conducted using an inductive approach. The emerged themes were categorized into the Capability–Opportunity–Motivation–Behaviour (COM-B) model domains.

**Results:** In total, 16 pharmacists working in primary care (n = 7), secondary care (n = 4) or tertiary care (n = 5) were interviewed. Factors influencing pharmacists' capability to make clinical decisions are a broad theoretical knowledge base, clinical experience, and skills, including contextualizing data, clinical reasoning, and clinical judgment. The pharmacy setting, data availability, rules and regulations, intra- and interprofessional collaboration, education, patient perspectives, and time are mentioned as factors influencing their opportunity. Factors influencing pharmacists' motivation are confidence, curiosity, critical thinking, and responsibility.

**Conclusions:** The reported factors covered all domains of the COM-B model, implying that clinical decision-making is influenced by a combination of pharmacists' capability, opportunity, and motivation. Addressing these different factors in pharmacy practice and education may improve pharmacists' clinical decision-making, thereby improving patient outcomes.

## 1. Introduction

Pharmaceutical care has become more complex in recent decades due to factors such as the aging population and an increasing number of patients with multimorbidity and polypharmacy. As pharmaceutical care becomes more demanding, pharmacists are needed to play a more clinical role in supporting patients who require pharmaceutical care.<sup>1,2</sup> Already in many countries, pharmacists are expected to be active members of the healthcare team with direct responsibility for designing, implementing and evaluating therapeutic treatment plans.<sup>3</sup> In order to provide high-quality pharmaceutical care in a clinical role, clinical decision-making is considered a core process.<sup>1,4</sup>

Clinical decision-making (CDM) in pharmacy practice is

conceptualized as a set of cognitive processes and abilities that enables pharmacists in all practice settings to make patient-centred, therapeutic decisions.<sup>5</sup> Pharmacists usually interact with patients and health professionals when a diagnostic label has been assigned but drug treatment may not yet have been started or has limited efficacy.<sup>5</sup> By making appropriate decisions related to drug treatment, pharmacists can optimize medicine use and improve patient outcomes.<sup>6</sup> In comparison to pharmacy, CDM in medical research and education is more extensively investigated and focuses on diagnostics rather than therapeutics.<sup>7,8</sup>

When attempting to improve decision-making, individual's decision-making attributes and contextual factors, in addition to elements of the immediate clinical problem such as complexity, must be considered.<sup>9</sup> In pharmacy, little is known about pharmacists' attributes and contextual

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factors influencing clinical decision-making. Understanding more about what pharmacists need, what hinders and facilitates them in clinical decision-making would help address this in pharmacy practice and education, thereby improving this process and patient outcomes. Therefore, this study aims to identify factors influencing clinical decision-making among Dutch pharmacists working in primary, secondary and tertiary care.

## 2. Methods

### 2.1. Study setting

In this qualitative study, semi-structured interviews were conducted among practicing pharmacists working in clinical roles in primary, secondary, and tertiary care settings in the Netherlands. In this country, there are approximately 1900 community pharmacies and 90 outpatient pharmacies (primary care), with 1.5 full time equivalent (FTE) pharmacists supervising a pharmacy team of approximately 5 technicians and some supporting staff.<sup>10</sup> Outpatient pharmacies are located in hospitals but serve outpatients, such as at hospital discharge or after an outpatient clinic visit.<sup>11</sup> In addition, several expensive drugs that are part of the hospital budget can only be dispensed through outpatient pharmacies.<sup>11</sup> In the Netherlands, hospital pharmacists, several also with additional training as a clinical pharmacologist, provide inpatient care within teams of multiple pharmacists and technicians in approximately 60 general hospitals at 100 locations (secondary care) and 6 academic hospitals (tertiary care).<sup>11</sup> In all types of care settings, Dutch pharmacists are non-prescribing health professionals and considered a member of multidisciplinary healthcare teams. Direct pharmaceutical care activities, including patient encounters, have increased in all levels of care over the years, alongside tasks like dispensing medication.<sup>12</sup> For example, as in other countries, hospital pharmacists are becoming more prevalent on hospital wards and (specialized) clinics.<sup>13</sup>

### 2.2. Study design

Based on the literature, including the authors' previous conducted scoping review, an interview guide was developed to elicit factors influencing pharmacists' clinical decision-making.<sup>5</sup> This interview guide contained questions asking participating pharmacists what they need to conduct CDM, as well as what hinders and facilitates them, also when learning and teaching this process. After the first two interviews, the interview guide was evaluated, and minor adjustments were made to ensure comprehensibility of the questions. [Appendix 1](#) contains the final interview guide in English.

### 2.3. Participant recruitment

Pharmacists were purposely recruited through the research team's professional network to ensure participants of both from primary, secondary and tertiary care and with different years of experience, and snowball sampling was used. Potential participants received a Participant Information Sheet outlining the purpose of the interview and study objectives by email and given opportunity to ask questions about the research before signing the Consent Form. Participating pharmacists could withdraw from the study at any time and they received no incentive for participating.

### 2.4. Data collection

Interviews were conducted face-to-face between August and December 2021, mostly in-person or online using Microsoft Teams. The interview was scheduled at a time the pharmacists perceived to be convenient and free of interruptions. In-person interviews were conducted in a private room at the pharmacists' workplace. All interviews were audio-recorded and lasted approximately 45–60 min. To ensure

consistent data collection, all interviews were conducted by the main researcher (JM). As pharmacist and educator, JM was able to deepen the questioning by anticipating to responses using prior experience and knowledge of pharmacy practice and education. She also completed a training on qualitative interviewing. Audio-recordings were transcribed verbatim by an undergraduate Master of Pharmacy student (SB). Transcripts were reviewed for accuracy at random intervals by JM.

### 2.5. Data analysis

As literature is limited, collected data was thematically analysed using a general inductive approach that was open and exploratory in nature. Themes were identified through systematically (re)reading, and independent parallel coding (JM and student SB or MU) using qualitative data analysis software (ATLAS.ti version 22). Discrepancies in coded text passages and code names were resolved through discussion together or with a third researcher (EK) experienced in qualitative research. Codes were placed in categories, and categories were later conceptualized into broad themes with subthemes. The emerged (sub) themes were discussed and further refined with the other researchers with pharmacy practice experience in primary care (MB) and secondary and tertiary care (VD) and medical experience (TvG). Interviews were conducted until data saturation occurred, when additional incoming interview data provided no new information related to the research objective, i.e. no new themes for at least two interviews. During data analysis, the authors realized that the Capability Opportunity Motivation - Behaviour (COM-B) model would be a useful framework for categorizing emerged themes.<sup>14</sup> The COM-B model states that behaviour results from the interaction between the individuals' capability, opportunity and motivation.<sup>14</sup> These components can also be influenced by behaviour.<sup>14</sup> The COM-B model is frequently used to identify barriers and facilitators in behaviour and was therefore selected for this study to categorize emerged factors influencing CDM reported by the participating pharmacists.<sup>15–17</sup>

### 2.6. Ethics and privacy

Approval for this study was granted by the Institutional Review Board of the University of Utrecht (UPF2111). Results were reported according to the COnsolidated criteria for REporting Qualitative research (COREQ) guidelines ([Appendix 2](#)).<sup>18</sup> Participants anonymity was ensured by removing identifying information in the transcripts and assigning a pseudonym to the names of each participant in all data.

## 3. Results

In total, 16 Dutch pharmacists were sequentially approached for participation, and all agreed. After interviewing five pharmacists working in a community pharmacy, two in an outpatient pharmacy, four in secondary care settings, and five in tertiary care settings, the research team decided on data saturation as no new themes emerged in final three interviews. The demographic characteristics of the participants are listed in [Table 1](#).

[Fig. 1](#) summarizes how the emerged themes of factors influencing CDM perceived by participants are categorized into the COM-B model domains. These themes are discussed accordingly in the paragraphs below and illustrated with quotes.

### 3.1. Capability

The emerged themes related to pharmacists' individual capability to conduct clinical decision-making include knowledge, clinical experience and skills.

#### 3.1.1. Theme: broad theoretical knowledge base

According to the participating pharmacists, sufficient theoretical

**Table 1**  
Demographic characteristics of the study participants.

| Participant characteristic        | Number (n = 16) |
|-----------------------------------|-----------------|
| Gender                            |                 |
| Female                            | 10              |
| Male                              | 6               |
| Pharmacy discipline               |                 |
| Community pharmacy                | 5               |
| Outpatient pharmacy               | 2               |
| Hospital pharmacy                 |                 |
| Secondary care                    | 4               |
| Tertiary care                     | 5               |
| Additional degree                 |                 |
| PhD                               | 8               |
| Years of clinical work experience |                 |
| 0-5                               | 5               |
| 6-10                              | 6               |
| 11-15                             | 2               |
| >15                               | 3               |

knowledge on medical and pharmaceutical concepts is a prerequisite for making clinical decisions. Especially knowledge of pharmacokinetic and pharmacodynamic concepts is considered important.

‘When I use an information source I just look at the pharmacokinetics of medication. [...] Pharmacokinetic information is a very important factor to consider in your decision-making. [...] And if a patient experiences a lot of side effects, what does this patient apparently need less? Considering this patients’ experience, what do you have to try to avoid with receptor occupation? [...] I think it would be good to integrate this more in daily morning reports and education.’ – Sanne, hospital pharmacist, 5 years of clinical work experience

Following their pharmacy education, pharmacists reported having general knowledge of pharmacology as well as specific therapeutic groups. Moreover, they were able to retrieve additional information

when needed. A broad theoretical knowledge base was stated as being required for pharmacists in order to deal with a wide range of questions.

‘You need to know something about everything, because you are asked such a large range of questions. You can look up the details. As a pharmacist, you have to be an allrounder.’ – Christel, community pharmacist, 8 years of clinical work experience

Being a generalist is valued, but it can lead to superficial knowledge, which can impede clinical decision-making according to several pharmacists.

‘That’s the problem of our profession: it’s so terribly broad. I can advise a rheumatologist about DMARDS, but a rheumatologist knows much more about that, which is sometimes difficult and that is something I run into.’ – Tom, hospital pharmacist, 3 years of clinical work experience

They stated lifelong learning as essential for keeping this broad knowledge base up to date.

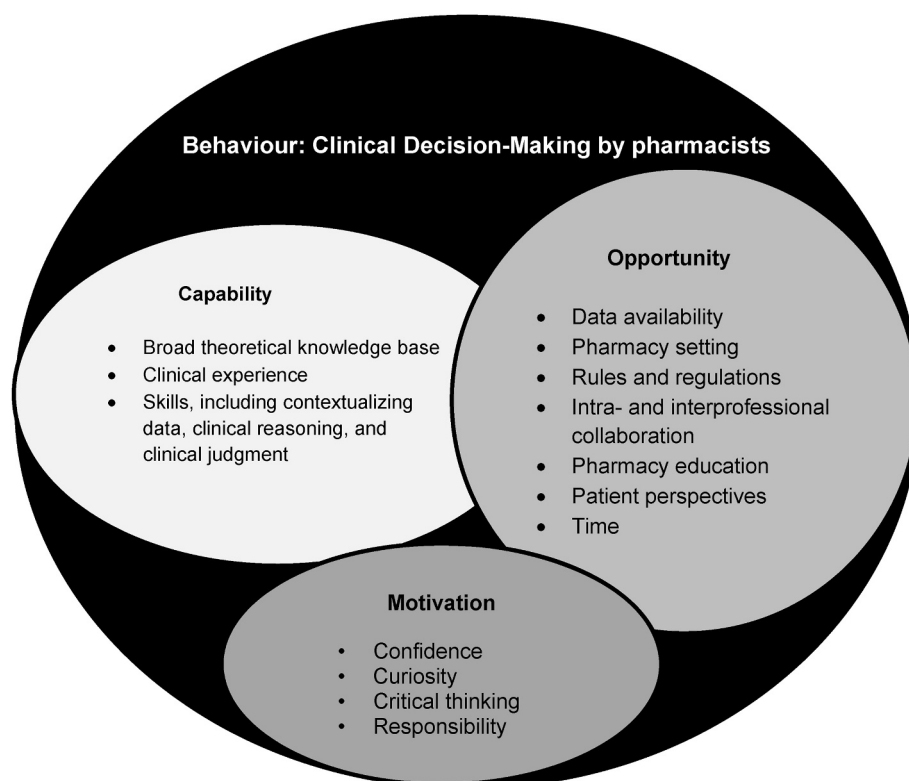
‘Like nowadays, that ferrous fumarate should be used twice a week instead of twice daily, that’s interesting. So you have to keep up your knowledge base all the time.’ – Elizabeth, community pharmacist, 21 years of clinical work experience

### 3.1.2. Theme: clinical experience

In addition to theoretical knowledge, clinical experience was reported to increase efficiency when making clinical decisions.

‘I occasionally spend 15 minutes on a case, where a colleague that has done it already ten times is done within five minutes. I do not have the experience, so I do not dare take the risk and want to make sure I do it right, and then I am just another fifteen or thirty minutes down the road.’ – Tom, hospital pharmacist, 3 years of clinical work experience

Pharmacists with more experience reported approaching cases more



**Fig. 1.** An overview of how the emerged themes of factors influencing CDM are categorized into the domains of the COM-B model.

intuitively, especially when the cases were less complex and dealt with frequently.

‘I almost say I conduct it as an “automatic pilot”. Often with the less complicated things, because you have to deal frequently with the same drug safety monitoring signals from your information systems.’  
– Daphne, hospital pharmacist, 10 years of clinical work experience

In general, pharmacists perceived that the more clinical experience they had, the more accurate the decision, although some pharmacists were also aware of potential bias in their approach as experience grows, such as availability bias and the negativity effect.

‘I believe you grow from knowledge and experience. That you build it up, and once you’ve had a particular case a number of times, of course it’s never going to be exactly the same case, but then you get a little more feel for it, and you might know a little bit more what the risks of a decision might be. Look, after you’ve given advice and someone develops, for example terrible neutropenia [...], then you will be much more cautious the next time. So I believe that also plays a significant role.’ – Sanne, hospital pharmacist, 5 years of clinical work experience

Several pharmacists reported that limited patient contact resulted in a more theoretical approach to cases.

‘I think what’s wrong with a lot of pharmacists and with me, is that, we have limited patient contact. [...] So you have a lot of theoretical knowledge about medication. [...] You know that this side effect can occur, but patients go more often with symptoms to their physician. Then as pharmacists, you don’t know how it presents in practice, within how many days ... [...] Which makes it difficult to make a decision and to advice a patient or physician.’ – Rose, community pharmacist, 5 years of clinical work experience

Following up on patients’ clinical outcomes after therapeutic decisions could help pharmacists gain more clinical experience. However, according to the pharmacists in this study, follow-up of the clinical course after a consultation is not a common practice for pharmacists.

‘I would prefer to follow-up patients more often. I do not do that. It just doesn’t work in time. I would like that.’ – Iris, hospital pharmacist, 10 years of clinical work experience

### 3.1.3. Theme: skills

Aside from theoretical and experiential knowledge, a variety of skills was mentioned influencing CDM. Interviewed pharmacists emphasized the importance of communication skills, such as when contacting patients or physicians to collect information. They indicated that questions from both patients and physicians are not always straightforward. As a result, they had to rely on their communication skills combined with knowledge to figure out what was wrong.

‘You need to be able to figure out the question behind the question. [...] So I believe communication is essential. But you can only figure out the question, I think, if you have enough knowledge.’ – Brian, hospital pharmacist, 11 years of clinical work experience

Academic skills such as using sources and filtering relevant information were also mentioned as influencing pharmacists’ CDM capabilities. These skills were aided by research as a PhD-candidate. Participating pharmacists described extensive use of guidelines and protocols in their decision-making, particularly at the start of their careers. When experience has grown, guidelines and protocols are used less frequently and specifically with more complex cases.

‘I was used to do it with a conversation protocol. And now, you don’t necessarily need that conversation protocol anymore. [...] Because you’ve done it more than 100 times, it’s pretty much in your head. So you actually just go into the conversation yourself with these

questions in mind and sometimes it goes a little differently than you ... one time is different from the next, so to speak. – Sophie, community pharmacist, 8 years of clinical work experience

Cognitive processes are also named important, such as critical thinking, clinical reasoning and clinical judgment. Within clinical reasoning, whereby pharmacists must apply and integrate knowledge and clinical experience to interpret all available clinical data, several participants reported to reason starting upon their theoretical knowledge of medication.

‘I reason very much from the medication. And I think a physician almost never does that. He thinks- well maybe at the very bottom of the differential diagnosis maybe it says “due to drug use” and for me it starts with that.’ – Louise, hospital pharmacist, 18 years of clinical work experience

Contextualizing data – from theory to practice – was deemed difficult, especially when clinical experience, patient data and clinical data were lacking.

‘If you actually get that piece of patients’ clinical data, I think a lot of our theoretical considerations are nonsense. Then you think “oh god”, there is so much going on and then I’m going to say “get rid of the benzodiazepine”. I will just keep my mouth shut. [...] Then it helps to think “how important is it really to mess with the patient’s medication.” – Elizabeth, community pharmacist, 21 years of clinical work experience

Furthermore, clinical judgment is regarded as an important cognitive skill in clinical decision-making because it requires pharmacists to weigh the benefits and drawbacks of potential therapeutic options and choose the best option for a specific patient. However, selecting the best option and making the actual decision is considered difficult, especially when the best option is not evident.

‘If there are several correct answers, I sometimes find it very difficult to make the decision. Because that’s what I miss in pharmacy education: decision-making.’ – Tom, hospital pharmacist, 3 years of clinical work experience

## 3.2. Opportunity

The emerged themes associated with the opportunity of pharmacists to conduct CDM include data availability, pharmacy setting, rules and regulation, intra- and interprofessional collaboration, education, patient perspectives, and time.

### 3.2.1. Theme: data availability

Data availability to pharmacists was mentioned as critical for CDM; however, pharmacists reported that data was frequently limited. When patient or clinical data, such as indications, lab values, and clinical state, were missing, it was deemed difficult to contextualize the problem and decide on the most appropriate therapeutic option for that patient in that specific context. Community pharmacists specifically mentioned the need for data on indications when performing medication reviews. According to participants working in an outpatient pharmacy or a hospital pharmacy, access to medical records, provided sufficient data to make a clinical decision in most cases. Participants, however, reported relying on other health professionals for data, such as the clinical state of the patient.

‘We stand relatively far from the patient. You only have textual information on the patient - that is not always accurate and complete - to make a good decision.’ – James, hospital pharmacist, 2 years of clinical work experience

Pharmacists stated that their CDM process is initiated and supported by information systems software. In addition to their information

software, pharmacists frequently used resources such as guidelines and databases, whereby more resources are available in secondary care, particularly databases containing primary literature. Furthermore, several participants reported being aware of the available information systems' suboptimal performance. For instance, drug alerts are not generated when treatment is omitted, which could lead to overseeing potential pharmacotherapeutic problems. When there is a lack of supporting information from their software or evidence from literature, making a decision becomes more complex.

'Because you never have all of the information, you try to give the best substantiated advice you can in the face of uncertainty.' – Iris, hospital pharmacist, 10 years of clinical work experience

### 3.2.2. Theme: pharmacy setting

Several factors associated with the pharmacy setting are reported by the pharmacists to influence CDM. Most patient consultations of community pharmacists are ad hoc, which may impede data collection because they are dependent on the pharmacist's and the patient's time, and also on the ability to use consultation rooms for patient consultations.

'The pharmacy setting is sometimes difficult [...] Sometimes patients experience poor privacy in the pharmacy [...] So you have to make an appointment with these patients or take them separately. It would be very nice if this could change.' Rose, community pharmacist, 5 years of clinical work experience

In the Dutch pharmacy setting, pharmacists supervise a team of pharmacy technicians and pharmacy consultants who have more patient contact and make clinical decisions under your responsibility, which was described as difficult at times to supervise.

'You just don't stand behind the counter all day. You join in with the team of pharmacy technicians when it is very busy or when the presence of a pharmacist is required.' – Elizabeth, community pharmacist, 21 years of clinical work experience

### 3.2.3. Theme: rules and regulations

Rules and regulations were also mentioned to hamper pharmacists' CDM process at times. Most medical data are unavailable to pharmacists due to privacy laws and regulations. To have medical data relevant to pharmacists' CDM available, they need patients' approval and the cooperation of physicians to exchange this data. This is mentioned as a barrier to clinical decision-making, particularly in primary care. The dependence on patients' approval, which must be done actively by the patient in order to exchange dispensing data with community pharmacies, is regarded as a barrier, particularly in outpatient pharmacies.

'A lot of patients in the outpatient pharmacy are not regular patients. So in this case, we didn't know how long the patient was using citalopram and other medication. Dispensing data from the community pharmacy are not always accessible. You need the patients' approval for this.' – Arif, outpatient pharmacist, 6 years of clinical work experience

As Dutch pharmacists lack prescribing rights, they are dependent on prescribers to alter prescriptions. Some community pharmacists reported that this limitation impedes clinical decision-making, particularly when it comes to helping patients quickly.

'Because often you need the physician to really make a decision. If something in the medication needs change, you already need a physician, because we can't just change that ourselves.' – Sophie, community pharmacist, 8 years of clinical work experience

Despite these rules, pharmacists reported altering prescriptions themselves in a few cases. In these cases, an agreement with physicians was made that pharmacists were allowed to alter specific prescriptions,

for example adding laxatives when patients are using opioids, or when things were "very obvious", for example with antibiotic treatment dosages for children.

'Changing the amoxicillin dosage for children in an antibiotic treatment. I'm not going to call [the physician] every time for this anymore. Or in the case of nystatin suspension. The very logic things. When it is that obvious that the prescription isn't right, I alter it.' – Elizabeth, community pharmacist, 21 years of clinical work experience

Furthermore, although the extensive use of guidelines and protocols, pharmacists also emphasized the importance of thinking beyond guidelines and protocols and deviating when necessary.

'Within the protocol you have the freedom to deviate from protocol based on your expert opinion as pharmacist. So, I think you should do that.' Tom, hospital pharmacist, 3 years of clinical work experience

In addition, reimbursement of clinical services provided by pharmacists is also said to have an impact on their process. Patient consultations, for example, are frequently unpaid or underpaid, which may lead to the participants or the institution failing to prioritize these activities.

'This clinical service is unpaid, but you do it anyway. So you have to make it visible to the hospital. However, that is very difficult.' – Iris, hospital pharmacist, 10 years of clinical work experience

### 3.2.4. Theme: inter- and intraprofessional collaboration

According to pharmacists, good collaboration is required both within the pharmacy organization (intraprofessionally) and with other health professionals (interprofessionally). However, multiple participants reported poor collaboration with other health professionals, mainly physicians, which had a negative impact on their CDM. They struggled with feelings of dependency, limited and difficult contact, a lack of mutual trust and an overall negative attitude towards pharmacists both in primary and secondary care.

'It is sometimes hard, because you think: why don't you follow my advice? But that is just the case then, and I will tell that to the patient.' – Christel, community pharmacist, 8 years of clinical work experience

On the other hand, several participants noticed a positive change in physicians' attitude towards pharmacists over the years and reported good interprofessional collaboration.

'I also think that with the new generation [physicians], collaboration is much more paramount than before. The complexity also makes it necessary.' – Brian, hospital pharmacist, 11 years of clinical work experience

'In the case I suspect a side effect of medication, physicians in our setting are very accessible and it is easy to briefly decide on this together.' – Gerard, community pharmacist, 3 years of clinical work experience

The advantages of working in a team with multiple pharmacists were emphasized by participants. The ability to seek assistance and input from other pharmacists, also interdisciplinary pharmacists or those from other pharmacies, is greatly valued. When a pharmacist was the only pharmacist on-site, colleagues were desired.

'You can evaluate this on a patient level and on a higher level with colleague pharmacists. That was valuable to me. In the first years of my professional career I didn't have colleague pharmacists with whom I could evaluate this.' – Christel, community pharmacist, 8 years of clinical work experience

Although the possibility of peer consultation was considered as valuable, it was not done frequently.

‘I’ve occasionally asked a colleague, for example, to prepare the same medication review [...] When it’s really complicated, and if there is time, I walk over to one of the hospital pharmacists to think along. But it could happen more frequently for me.’ – Charlotte, outpatient pharmacist, 7 years of clinical work experience

According to the interviewed pharmacists, peer consultation requires a working environment where people can make mistakes and help each other to improve their skills.

‘I think you get feedback if you ask it yourself during the daily handover or from your supervisor or just some conversational sparring with a colleague.. but really on your decision-making. It happens, but limited. I think we can learn a lot there and improve. [...] I hope that we can be more accessible and say ‘hey, why have you done this? [...] That you dare to ask questions and be more vulnerable.’ – Sanne, hospital pharmacist, 5 years of clinical work experience

### 3.2.5. Theme: education

During their pharmacy education, pharmacists stated that they gained the necessary knowledge and skills that served as the foundation for clinical decision-making.

‘Of course, as a pharmacist, you just have a certain expertise and completed pharmacy education and a lot of knowledge about medication. As a result, you rely on that knowledge to advice the patient.’ – Sophie, community pharmacist, 8 years of clinical work experience

Pharmacists emphasized the significance of learning in (simulated) clinical practice, although training in CDM differed per pharmacy. The lack of having didactic methods to guide themselves and others in clinical decision-making was reported by several participants. Learning from peers, supervisors and other health professionals was highly valued and could be expanded in academic and clinical settings.

‘I learned it in practice. I think that all my tools were given in my pharmacy education, but I think that in clinical practice and all of the moments with my supervisor and the way we talk to each other about daily patient care has made me use all those tools properly.’ – Brian, hospital pharmacist, 11 years of clinical work experience

### 3.2.6. Theme: patient perspectives

Participating pharmacists were unequivocal in their belief that patient needs and wishes influence CDM. If the decision remained responsible, all participants attempted to include patient wishes and preferences in a clinical decision. Whereas interviewed community pharmacists directly involve the patient in the process; hospital pharmacists mostly involve patient perspectives through physicians, nurses or the medical record. Participants, however, reported that contextualizing data was difficult when they had indirect patient contact or when data was missing.

‘Sometimes you have to do it with very limited information, without patient consultation, and then you might go too fast, and you pass the fact that there is a person behind it.’ – Charlotte, outpatient pharmacist, 7 years of clinical work experience

According to the participants, particularly community pharmacists, the pharmacist-patient relationship influenced clinical decision-making as well. Community pharmacists mentioned the importance of a good relationship with the patient as both important for data collection and shared decision making.

‘I hope that my previous patient consultations have established a trusting relationship. [...] I try to maintain an equal relationship with the patient, so that they feel comfortable coming to you when they are not well.’ – Christel, community pharmacist, 8 years of clinical work experience

Pharmacists in all levels of care regret having limited contact with patients. In comparison to the physician and nurses, they report feeling more distant from the patient. However, one hospital pharmacist stated that patient contact must remain relevant and efficient while not complicating the care team because the patient is being seen by multiple health professionals.

‘On the one hand, I’d like to have contact more frequently than I have been. On the other hand, if the pediatrician can easily consults us about a specific clinical question and I don’t have to stand at the front of the bed, then that’s completely fine with me.’ – Yousef, hospital pharmacist, 20 years of clinical work experience

### 3.2.7. Theme: time

When there is enough time, each step in the process is carried out more thoroughly. However, according to the participants, decisions must often be made under time constraints. A community pharmacist stated that she struggles with the large number of patients who require care in her pharmacy.

‘If you have time and thoroughly check each prescription, you can ask a question about each patient. So sometimes I get a little stuck in that myself.’ – Elizabeth, community pharmacist, 21 years of clinical work experience

Other pharmacists emphasized the importance of time balance.

‘You just don’t have the time to check everything. Because if you really want to do it properly, it takes 2 hours to retrieve all relevant information, ask everything to the physician ... that just takes a lot of time, time that you do not have.’ – Tom, hospital pharmacist, 3 years of clinical work experience

## 3.3. Motivation

The emerged themes associated with automatic or reflective cognitive processes to influence CDM among pharmacists are confidence, curiosity, critical thinking, and responsibility.

### 3.3.1. Theme: confidence

The majority of pharmacists expressed “a need for certainty” as well as difficulty dealing with uncertainty in decision-making. They struggled when the decision was not supported by evidence and remained “in the grey area”.

‘The decision always remains an educated guess.’ – Brian, hospital pharmacist, 11 years of clinical work experience

When they were unsure or feeling unconfident, pharmacists interviewed said they needed assurance that their clinical decision did not expose the patient to unnecessary risks.

‘I only deliver when I’m 100% certain it has no risk.’ – Arif, outpatient pharmacist, 6 years of clinical work experience

As a result, pharmacists reported to conduct a more thorough literature search, as well as contact other health professionals for advice and shared decision-making.

‘It has to be 100% sure and if there is any doubt then you definitely show that doubt. While of course physicians say when in doubt, well, if it’s about 70% sure, then this is the plan. So we are a bit more uncertain about that. We may be a bit more honest, but I think that

really suits our profession.’ – Sanne, hospital pharmacist, 5 years of clinical work experience

Several pharmacists reported that their confidence grew over time, in part due to follow up on clinical decisions. One hospital pharmacist suggested that dealing with uncertainties and delivering your advice with confidence be addressed more in pharmacy education.

‘How can you bring your advice with confidence? Because doctors learn that too and we learn that little. We are much more concerned with the doubt in our rhetoric.’ – Tom, hospital pharmacist, 3 years of clinical work experience

### 3.3.2. Theme: curiosity

Being genuinely interested in the well-being of patients and the perspectives of other health professionals has been mentioned as influencing CDM.

‘I think you should be genuinely interested in someone, to be intrinsically motivated to help someone.’ – Sophie, community pharmacist, 8 years of clinical work experience

Additionally, curiosity, for example in case of abnormal patterns in medication use, was frequently reported to influence CDM, particularly data collection. However, pharmacists have also stated that their curiosity sometimes led to an excessive efforts of data collection. As a result, finding a balance between gathering enough information to make an informed decision and avoiding gathering unnecessary data would be critical.

‘First of all I think curiosity is of influence, because you come across a lot of things that you just don’t know and you have to be curious. And I think, and that is difficult, that you have to find a balance between on one hand gathering enough information to formulate a good advice, but you have to do that within a certain amount of time.’ – James, hospital pharmacist, 2 years of clinical work experience

### 3.3.3. Theme: critical thinking

Pharmacists described critical thinking as both an academic skill and an attitude that influences CDM. Being critical of others’ decisions, such as treatment selection, is cited as an important factor in pharmacists’ decision-making that increased over time.

Because you have more experience, I believe you are more likely to question things more quickly, to be more critical of them, or to ask more questions.’ – Daphne, hospital pharmacist, 10 years of clinical work experience

Furthermore, being critical and reflecting on the decision-making process helps the participants in improving their competencies. Interviewed pharmacists stated that they fostered this critical attitude in students and residents as they learned to make clinical decisions.

‘A kind of supervisor-dwarf on your shoulder that asks questions all the time. [...] Why does this patient get an antibiotic, why this one, [...] how clinically relevant is the drug-drug interaction?’ – Brian, hospital pharmacist, 11 years of clinical work experience

### 3.3.4. Theme: responsibility

When it came to dispensing medication to patients, most participants were clear that this was their autonomous decision and responsibility. Pharmacists frequently reported asking themselves, “Can I hand over the medication responsibly?”. When in doubt, so related to confidence, pharmacists reported that they would like confirmation of the prescriber that they could hand over the medication responsibly.

‘Where I always find that very difficult is with the QT-extension. Because we don’t feel it at all. I call a lot about this with

physicians, because I don’t want to burn my fingers on that.’ – Elizabeth, community pharmacist, 21 years of clinical work experience

When the pharmacist felt that the treatment needed to be changed or considered, they advised prescribers to change the treatment, which was not always agreed upon.

‘I don’t feel like playing a cop. So, I give advice and how compelling it is depends on the high-risk drug and the situation.’ – Louise, hospital pharmacist, 18 years of clinical work experience

The importance of knowing your responsibility as pharmacist was stated as well as knowing and respecting each other’s responsibilities, which was not always felt.

‘I think that it is a bit pharmacist-specific, that we often feel a bit subordinate to physicians.’ – Charlotte, outpatient pharmacist, 7 years of clinical work experience

However, most pharmacists emphasized the benefits of the shared physician-pharmacist responsibility on the patient’ treatment.

‘You have to do it together. That’s also part of the fun. You are never truly solely responsible; you share responsibility.’ – Arif, outpatient pharmacist, 6 years of clinical work experience

## 4. Discussion

Clinical decision-making in pharmacy is described by pharmacists in this study as a complex process, influenced by a wide range of factors covering the interconnected domains of capability, opportunity and motivation. Many of the factors influencing pharmacists’ CDM are similar to those influencing the CDM of other health professionals.<sup>9,19–22</sup> The ability to detect and comprehend how factors influence CDM is required in learning and teaching making appropriate clinical decisions.<sup>9</sup>

According to pharmacists, integrating theoretical knowledge, skills, and clinical experience is important to their capability to conduct effective CDM. This emphasizes that CDM is more than just applying theoretical knowledge or performing technical skills.<sup>20</sup> When learning and teaching the integration of these aspects, contextualization should be addressed more, as pharmacists found this difficult. Pharmacokinetic and pharmacodynamic concepts, for example, should be taught and learned sufficiently because this is a specific knowledge area of pharmacists and is valuable to other health professionals because physicians, for instance, are assumed to have limited knowledge in this field.<sup>23–26</sup> Additionally, implementing these concepts in a clinical context is important to support pharmacists making connections between the abstract properties of a drug and patient characteristics and specific conditions in order to decide on the most appropriate pharmacotherapy. Addressing contextualization aligns with the current shift in the pharmacy profession and education from product-oriented to patient-oriented.

The development of CDM in practice settings, as pharmacists in this study emphasized, supports the implementation of experiential learning in undergraduate pharmacy education, in which students apply integrated knowledge to a real-world setting and reflect on it.<sup>27</sup> Other studies also emphasize the importance of incorporating the practical context into the CDM process.<sup>28–30</sup> Real-world cases or situational activities in academic course material can introduce students to the ambiguity, uncertainty, and complexity of clinical practice, preparing them for experiential learning.<sup>31</sup> Aside from students’ real-world experiences, the role of educators in academic and clinical settings is critical as a student learns from their CDM by sharing observations and explaining one’s thought process.<sup>30,31</sup> Supporting educators in both settings with didactic methods and training to foster CDM is necessary.<sup>30,32,33</sup> Furthermore, following up on the patients’ clinical course, evaluating

outcomes and reflecting on the process can enhance pharmacists' and pharmacy students' CDM, which can be accomplished through self-reflection, peer-reflection, and through dialogue and inquiry from peers, educators, and other (future) health professionals.<sup>31</sup> This dialogue and inquiry could be aided by the development of a model that provides educators and pharmacy students with a well-articulated process that includes explicit terminology for discussing process steps and justifying clinical decisions.

Considering that CDM occurs in a multidisciplinary team, learning about, with and over each other will contribute to this process.<sup>34</sup> Interprofessional education is considered a strong stimulus for future collaboration between pharmacists and other health professionals.<sup>35</sup> This type of education has a positive impact on learners' opinions, satisfaction and attitudes towards other health professions, thereby also improving knowledge on and respecting each other's responsibilities.<sup>35</sup>

The opportunity for pharmacists to conduct CDM is hindered by a lack of relevant patient and clinical data through patients, other health professionals and information systems. In part this is the result of unconnected information systems, partly due to privacy laws protecting patient health information. Community pharmacists reported the lack of data more often than pharmacists working in an outpatient or hospital pharmacy, mostly because they have access to medical records. Increasing the amount of relevant patient and clinical data available through patient monitoring, interprofessional collaboration, and connected information systems could improve data availability, and therefore, CDM. It should be noted, however, that clinical decisions are fraught by uncertainty since not all of the information required to make decisions is or can be known,<sup>9</sup> so pharmacists must deal with uncertainties. However, these findings suggest that pharmacists are unconfident when faced with uncertainty and risks, leading to the need for approval from others, all of which are discussed as barrier to pharmacy practice change by Rosenthal et al.<sup>36</sup> This study revealed confidence as an important factor in pharmacists' motivation in CDM, which resulted from: (a) evaluating their level of knowledge, particularly when evidence is lacking and the decision remains "in the grey area"; (b) having experienced success and failure; and (c) knowing the likely responses to interventions, as well as the likelihood and manner in which adverse events occur. Although research with other health professions like physicians has linked confidence to experience,<sup>9</sup> more experienced pharmacists in this study also acknowledged struggling with ambiguity. These findings indicate a need to address dealing with uncertainties and risks, and making the actual decision and taking responsibility for this decision, in both under- and postgraduate pharmacy education. Anakin et al.<sup>37</sup> reported this lack of confidence also when they interviewed community pharmacists in New Zealand about their clinical decision-making. Gregory et al. described in another study that Canadian pharmacists frequently relied on interpersonal relationships to achieve outcomes, and deferred to others' authority to avoid decision-making and potential conflicts.<sup>38</sup> This was also reported by Abuzour et al. that explored factors influencing secondary care pharmacist independent prescribers' CDM in the United Kingdom.<sup>39</sup> In a survey of non-medical prescribers conducted by Cope et al.,<sup>40</sup> nurses and physiotherapists reported prescribing autonomously more frequently than pharmacists, implying that barriers to self-confidence and willingness to take responsibility are more prevalent in pharmacists. Frankel and Austin identified six barriers to pharmacists' self-confidence and responsibility development: hierarchy of the medical system, role definitions, evolution of responsibility, ownership of decisions for confidence building, quality and consequences of mentorship and personality traits upon admission at the university.<sup>41</sup> Addressing these barriers in pharmacy practice and education would improve these factors influencing CDM. To make physicians and students more "comfortable with uncertainties" Ilgen et al. proposed to (1) adopt a deliberately iterative and flexible construction of how patients' problems are defined, approached, and managed, (2) encourage forward planning and monitoring, and (3) encourage clinical preceptors to reflect upon the

underpinnings of their own 'comfort' in uncertain situations.<sup>42</sup> These recommendations may also help pharmacists feel more at ease with uncertainty. Working through problems with a high degree of ambiguity jointly, for example, to arrive at the most appropriate decision improves this aspect in pharmacy students.<sup>31,37</sup> Forward planning and monitoring of patients' clinical course is still uncommon in pharmacy practice, resulting in limited experiences with clinical decision success and failure. However, in the current health system, increasing patient monitoring is hindered at times by the pharmacy setting.

In comparison to the rest of Europe, the Netherlands has few pharmacists per inhabitants providing pharmaceutical care in primary, secondary, or tertiary care settings.<sup>43,44</sup> Furthermore, these pharmacists have significant organizational and logistical tasks, limiting their opportunity to increase patient encounters.<sup>2</sup> The presence of hospital pharmacists on wards and in clinics, for example, may improve pharmacists' CDM and thus patient outcomes by shifting their tasks more towards providing direct pharmaceutical care with more patient encounters. According to a recent study, an outpatient medication consultation with a hospital pharmacist resulted in significantly fewer medication-related problems in liver transplant recipients.<sup>45</sup> Another example is adding a non-dispensing pharmacist to general practitioners teams, where they would have more patient encounters, access to patient records and close collaboration with physicians.<sup>46</sup> This model is currently being investigated for possible implementation in the Netherlands.

#### 4.1. Strength and limitations

Few qualitative studies on pharmacists' clinical decision-making have been conducted, and this is the first study in the Netherlands. The findings are relevant to similar pharmacy care settings, such as those found in Scandinavian countries, because pharmacists working in other settings may experience different factors influencing their CDM. The inclusion of pharmacists working in primary, secondary, and tertiary care with varying years of clinical work experience is considered a strength of this study. Recruitment through the research team's professional network and snowball effect could have induced population bias. For example, a high proportion of pharmacists had conducted research as a PhD-candidate. Based on these findings, it would be interesting to study in depth the impact of clinical work experience in general and in specific domains, as well as other participant characteristics, on each factor. For consistency, this study employed a well-defined guide for the interviews, which were conducted by a single interviewer that was also a pharmacist. Although having a pharmacist as an interviewer gave the interviewer the opportunity to go deeper into the themes, this may have influenced participants' responses, for example by overreporting of socially desirable behaviour.<sup>47</sup> Despite efforts to reassure participants that the interview was not a test of their decision-making ability, this may have resulted in biased responses with intentional or unintentionally erroneous responses. Although answering open questions was more valuable to our research questions, the retrospective reflections of the decision-making processes by the pharmacists may have been impacted by cognitive biases. Further research using think-alouds will strengthen this work. To reduce the impact of researcher bias and preconceptions, data analysis was addressed collaboratively, with the COM-B model serving as the theoretical framework.

## 5. Conclusion

The reported factors covered all domains of the COM-B model, implying that clinical decision-making is influenced by the combination of pharmacists' capability, opportunity, and motivation. Implementing CDM in under- and postgraduate pharmacy education while encouraging the integration of theoretical knowledge, skills, and clinical experience will contribute to pharmacists' capability. Pharmacists' CDM

is hindered by a lack of relevant patient and clinical data, which could be improved by increasing access to relevant patient and clinical data through more patient encounters, collaboration with other health professionals, and connected information systems. However, dealing with uncertainties and risks should be addressed in pharmacy education as well. Furthermore, following up on the patients' clinical course, evaluating outcomes, and reflecting on the process will foster pharmacists to contextualize theoretical knowledge, which was found difficult. Addressing influencing factors in pharmacy practice and education may improve pharmacists' clinical decision-making, resulting in better patient outcomes.

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## Declaration of competing interest

None.

## Appendix 1. Interview guide

(translated to English).

Thank you for giving us the opportunity to interview you for our study on clinical decision-making among pharmacists. The questions I would like to ask during this interview regard how you, as a pharmacist, come to a decision when addressing a patient case: which thinking steps do you make? As a pharmacist, researcher and teacher, I am interested in this topic. There are no right or wrong answers here. The interview will last for about 45 min and consists of a number of questions regarding decision-making.

Your participation in this study is voluntary and your answers will be treated confidentially. You can stop or withdraw from the interview at any time. This interview will be recorded so that the interview is transcribed accurately. The recording will be deleted at the end of the study. Do you have any questions beforehand? Shall we begin?

### A. Professional experience and clinical role

- How many years have you been working as a pharmacist in pharmaceutical patient care?
- Which of your current pharmacy activities are directly related to the patient? (prescription processing, medication review, etc.)

### B. Process of clinical decision-making

- What thinking steps do you take in these activities to come to a clinical decision?
  - Does this process differ between the different work activities? If so, how?
- What do you need to make a decision?
- What do you use to make a decision?
  - Dig deeper: knowledge, skills, attitude, preconditions
  - What would you like to improve?
- What hinders your clinical decision-making?
- What facilitates your clinical decision-making?
- What do you need from the physician to make a decision?
- What does the physician need from you?
- Is the patient involved in your decision making? If so, how?
- What do you need from the patient to make a decision?

### C. Learning and teaching clinical decision-making

- Are you an educator of pharmacists or pharmacy students? If so:
  - How do you teach others to deal with patient cases?
  - How do you rate this among others?
  - What do you think an educator needs to teach this?
    - Dig deeper: knowledge, skills, attitude, preconditions
  - Example of a successful training moment?

Your experience from practice have already been very helpful, thank you. Did I forget to ask something in your opinion, or do you want to add something?

Thank you very much for your time and answers to our questions. We will send you the transcript afterward. If you have any questions or comments regarding our conversation and/or the transcript, please do not hesitate to contact us.

## CRediT author statement

**Josephine Mertens:** Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing- Original Draft, Writing- Review & Editing, Visualization, Funding acquisition. **Ellen Koster:** Conceptualization, Methodology, Validation, Writing- Review & Editing, Visualization, Funding acquisition. **Vera Deneer:** Conceptualization, Writing- Review & Editing. **Marcel Bouvy:** Conceptualization, Writing- Review & Editing, Supervision. **Teun van Gelder:** Conceptualization, Writing- Review & Editing, Supervision, Project administration.

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## Appendix 2. Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

| No                                             | Item                                     | Guide questions/description                                                                                                                              | Check?                                                                                                                                                                                                                      |
|------------------------------------------------|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Domain 1: Research team and reflexivity</b> |                                          |                                                                                                                                                          |                                                                                                                                                                                                                             |
| Personal Characteristics                       |                                          |                                                                                                                                                          |                                                                                                                                                                                                                             |
| 1.                                             | Interviewer/facilitator                  | Which author/s conducted the interviews?                                                                                                                 | JM                                                                                                                                                                                                                          |
| 2.                                             | Credentials                              | What were the researcher's credentials? E.g. PhD, MD                                                                                                     | JM is PharmD                                                                                                                                                                                                                |
| 3.                                             | Occupation                               | What was their occupation at the time of the study?                                                                                                      | Researcher and senior lecturer                                                                                                                                                                                              |
| 4.                                             | Gender                                   | Was the researcher male or female?                                                                                                                       | Female                                                                                                                                                                                                                      |
| 5.                                             | Experience and training                  | What experience or training did the researcher have?                                                                                                     | Training qualitative interviewing                                                                                                                                                                                           |
| Relationship with participants                 |                                          |                                                                                                                                                          |                                                                                                                                                                                                                             |
| 6.                                             | Relationship established                 | Was a relationship established prior to study commencement?                                                                                              | Several participants within professional network, others just with e-mail prior to start study                                                                                                                              |
| 7.                                             | Participant knowledge of the interviewer | What did the participants know about the researcher? e.g. personal goals, reasons for doing the research                                                 | Participants were informed about the research by invitation letter.                                                                                                                                                         |
| 8.                                             | Interviewer characteristics              | What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic                | Researcher introduced herself at the start of the interview. She reported her reasons and interests in the research topic to the participants.                                                                              |
| <b>Domain 2: study design</b>                  |                                          |                                                                                                                                                          |                                                                                                                                                                                                                             |
| Theoretical framework                          |                                          |                                                                                                                                                          |                                                                                                                                                                                                                             |
| 9.                                             | Methodological orientation and Theory    | What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis | At first, grounded theory. However, when themes emerged, COM-B model was considered suitable for the categorization of themes.                                                                                              |
| Participant selection                          |                                          |                                                                                                                                                          |                                                                                                                                                                                                                             |
| 10.                                            | Sampling                                 | How were participants selected? e.g. purposive, convenience, consecutive, snowball                                                                       | Participants were approached through the professional network of the research team.                                                                                                                                         |
| 11.                                            | Method of approach                       | How were participants approached? e.g. face-to-face, telephone, mail, email                                                                              | Participants were approached by e-mail.                                                                                                                                                                                     |
| 12.                                            | Sample size                              | How many participants were in the study?                                                                                                                 | 16                                                                                                                                                                                                                          |
| 13.                                            | Non-participation                        | How many people refused to participate or dropped out? Reasons?                                                                                          | No participants dropped out after inclusion.                                                                                                                                                                                |
| Setting                                        |                                          |                                                                                                                                                          |                                                                                                                                                                                                                             |
| 14.                                            | Setting of data collection               | Where was the data collected? e.g. home, clinic, workplace                                                                                               | The data was collected in the workplace of the participant or in an online setting.                                                                                                                                         |
| 15.                                            | Presence of non-participants             | Was anyone else present besides the participants and researchers?                                                                                        | During 5 interviews the research student was present as well.                                                                                                                                                               |
| 16.                                            | Description of sample                    | What are the important characteristics of the sample? e.g. demographic data, date                                                                        | Pharmacists of both primary, secondary and tertiary care are represented in the sample. Participants differed in gender, age and years of experience.                                                                       |
| Data collection                                |                                          |                                                                                                                                                          |                                                                                                                                                                                                                             |
| 17.                                            | Interview guide                          | Were questions, prompts, guides provided by the authors? Was it pilot tested?                                                                            | The interview guide was not pilot tested, but after the first two interviews evaluation of the interview guide took place together with the research team consisting of community and hospital pharmacists and a physician. |
| 18.                                            | Repeat interviews                        | Were repeat interviews carried out? If yes, how many?                                                                                                    | No                                                                                                                                                                                                                          |
| 19.                                            | Audio/visual recording                   | Did the research use audio or visual recording to collect the data?                                                                                      | Yes, audio-recording was used to collect the data.                                                                                                                                                                          |
| 20.                                            | Field notes                              | Were field notes made during and/or after the interview?                                                                                                 | Yes, JM made field notes.                                                                                                                                                                                                   |
| 21.                                            | Duration                                 | What was the duration of the interviews?                                                                                                                 | The duration of interviews was between 45 and 60 min.                                                                                                                                                                       |
| 22.                                            | Data saturation                          | Was data saturation discussed?                                                                                                                           | Data saturation was discussed with the team after 10 interviews and after 15 interviews.                                                                                                                                    |
| 23.                                            | Transcripts returned                     | Were transcripts returned to participants for comment and/or correction?                                                                                 | A summary of the findings was returned to participants for comment and/or correction if wanted by the participant.                                                                                                          |
| <b>Domain 3: analysis and findings</b>         |                                          |                                                                                                                                                          |                                                                                                                                                                                                                             |
| Data analysis                                  |                                          |                                                                                                                                                          |                                                                                                                                                                                                                             |
| 24.                                            | Number of data coders                    | How many data coders coded the data?                                                                                                                     | Two persons (JM and student) independently coded all transcripts                                                                                                                                                            |
| 25.                                            | Description of the coding tree           | Did authors provide a description of the coding tree?                                                                                                    | The coding tree was inductively developed and is available upon request from the first author.                                                                                                                              |
| 26.                                            | Derivation of themes                     | Were themes identified in advance or derived from the data?                                                                                              | Themes were derived from the data.                                                                                                                                                                                          |
| 27.                                            | Software                                 | What software, if applicable, was used to manage the data?                                                                                               | Atlas.ti version 22 was used to manage the data.                                                                                                                                                                            |
| 28.                                            | Participant checking                     | Did participants provide feedback on the findings?                                                                                                       | No                                                                                                                                                                                                                          |
| Reporting                                      |                                          |                                                                                                                                                          |                                                                                                                                                                                                                             |
| 29.                                            | Quotations presented                     | Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number                          | Participant quotations were presented to illustrate the findings by using a pseudonym.                                                                                                                                      |
| 30.                                            | Data and findings consistent             | Was there consistency between the data presented and the findings?                                                                                       | Yes                                                                                                                                                                                                                         |
| 31.                                            | Clarity of major themes                  | Were major themes clearly presented in the findings?                                                                                                     | Yes                                                                                                                                                                                                                         |
| 32.                                            | Clarity of minor themes                  | Is there a description of diverse cases or discussion of minor themes?                                                                                   | Yes.                                                                                                                                                                                                                        |

Abbreviations: COM-B model = Capability Opportunity Motivation – Behaviour model.

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