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# Pharmaceutical technical assistants on hospital wards: Qualitative interdisciplinary perspectives

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ABSTRACT

*Aim:* To explore (1) the experiences of pharmaceutical technical assistants (PTAs) and pharmacists regarding the implementation of PTAs in ward-based pharmaceutical care, and (2) interprofessional perspectives of PTAs, pharmacists, and nurses to identify opportunities for improved collaboration and work processes.
*Method:* A two-phased qualitative descriptive study was conducted: (1) semi-structured interviews with PTAs and pharmacists involved in ward-based medication dispensation (October 2023–June 2024); (2) focus groups with PTAs, pharmacists, and nurses to explore interprofessional perspectives. Participants were purposively sampled and data analysed using thematic analysis in NVivo 1.6.1.
*Results:* Semi-structured interviews ($n = 12$) revealed five main themes: (1) role and responsibilities, (2) continuity of pharmaceutical technical assistants' allocation to nursing wards, (3) competences and education, (4) uniformity and standardized procedures, and (5) communication and interprofessional collaboration. Participants emphasized that clearly defined roles and consistent assignments were essential for successful integrating PTAs into ward-based pharmaceutical care. Standardized procedures and ongoing education were also considered important to improve coordination and support interprofessional collaboration. Pharmacists highlighted the valuable contribution of PTAs in medication distribution and stock management, improving overall efficiency. Focus group ($n = 3$) participants ($n = 20$) expressed a need for structured communication processes and clearly defined roles to support collaboration. Effective communication was regarded as critical for fostering mutual understanding, reducing errors, and enhancing medication safety and care quality.
*Conclusion:* This study shows that unclear roles, fragmented communication, and limited clinical preparation hinder pharmaceutical technical assistants in ward-based care, while fixed ward allocation, structured communication, and targeted training can improve collaboration and medication safety.

## 1. Introduction

Pharmaceutical Technical Assistants (PTAs) are integral memebers of healthcare teams, particularly in hospital settings where medication management is critical. PTAs are trained professionals who perform a variety of tasks within a healthcare setting, including medication preparation, dispensing, inventory management, and patient education.[1] Delegating medication tasks from nurses to PTAs, healthcare

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systems can streamline workflows and enhance efficiency.[2] Their role has gained importance in response to rising patient numbers, increasing care complexity, and significant staff shortages. These pressures highlight the need for innovative staffing solutions to ensure the safe and efficient care delivery.[3] The implementation of PTAs on hospital wards becomes relevant as an alternative staffing solution, releasing nurses from specific medication-related tasks, and enabling them to focus more on direct patient care [2,4].

Nowadays, several medication management tasks on hospital wards are delegated from nurses to PTAs.[2] However, the scope of PTA tasks varies considerably across countries. In Belgium, PTAs are recognized paramedical professionals working under the supervision of a hospital pharmacist. Their training includes a vocational programme with at least 300 h of practical internship and is classified as AQF level4/ISCED level 4.[5] PTAs are authorised to receive and register prescriptions, prepare and dispense medications, provide medication information to patients, and support ward-based medication processes [6].

Similarly, in Denmark, PTAs primarily prepare and dispense medications for the following day.[4,7] In contrast, in the United Kingdom, PTAs take on more clinically oriented, including preparation and administration of intravenous medicines, performing second checks of high-risk medications, restocking medications, and supporting the preparation of discharge prescriptions.[8–11] In the United States, PTAs frequently collect medication histories, an essential step in preventing medication errors.[12–14] In Australia, they assist in preparing discharge medications, contributing to safer transition of care.[15–17] These international differences reflect variations in healthcare organisation and training requirements, which shape the scope of practice and level of tasks PTAs can. Overall, PTAs can streamline medication processes, reduce medication-related errors and strengthen patient care.

This variation in tasks highlights the need to understand how the PTA position is perceived by stakeholders - PTAs, nurses, and pharmacists – and how their involvement influences ward-based medication management and patient safety. A recent Belgian study reported that nurses generally viewed PTA involvement positively, appreciating the increased efficiency and additional time for direct patient care.[7] However, this study captured only nurses' perspectives. Little is known about how PTAs experience their collaboration with nurses, or how hospital pharmacists view the deployment of PTAs on hospital wards, even though their presence on the ward requires a reallocation of tasks within the pharmacy. Understanding these perspectives is essential to identify both challenges and opportunities associated with implementing PTAs on hospital wards.

As healthcare systems continue to face increasing demands and workforce shortages, the integration of PTAs into hospital teams becomes increasingly relevant. Before evaluating their effectiveness, it is important to understand how PTAs, pharmacists, and nurses perceive the PTAs role, which challenges they encounter and which factors support a successful collaboration.

**Therefore, the aim of this study was twofold:** (1) to explore the individual experiences and perceptions of PTAs and pharmacists regarding the implementation of PTAs in ward-based pharmaceutical care, with a focus on perceived impact, interprofessional collaboration, and key facilitators and challenges; and (2) to explore interprofessional perspectives of PTAs, pharmacists, and nurses to identify opportunities for improving collaboration and optimizing work processes in this context.

## 2. Methods

### 2.1. Study design and setting

A two-phased qualitative study was conducted to explore the involvement of PTAs in pharmaceutical care on nursing wards and their interprofessional collaboration with nurses and pharmacists. The two-stage design was intentional: individual interviews first allowed in-depth exploration of personal perspectives, followed by interdisciplinary focus group interviews to refine and expand these insights. This study was designed and reported in accordance with the COREQ (Consolidated Criteria for Reporting Qualitative Research) guidelines.[18]

Phase one consisted of individual semi-structured interviews with PTAs and pharmacists to capture personal perceptions of their roles, collaboration and work environment, free from group influence. Phase two involved interdisciplinary focus group interviews (with nurses, PTAs, and pharmacists) to further discuss key themes identified in phase one and in a previous study involving nurses.[7] The previous study identified themes such as the importance of clear role definitions, structured communication, continuity in ward allocation, concerns regarding oversight and accountability, and gaps in PTA training for clinically oriented tasks; these themes are summarised here to provide contextual background for the present study. These focus groups also explored future needs for improving interprofessional collaboration. Combining interviews and focus groups provided both depth and breadth in the data.

An inductive thematic analysis approach underpinned this study, which aligns with qualitative research aimed at identifying patterns and themes in participant experiences.[19] This method allowed for a structured yet flexible analysis of the data, ensuring that findings emerged naturally from the participants' perspectives rather than being imposed by predefined theoretical frameworks.

This study was conducted at a Vitaz hospital in Belgium, across internal, surgical and geriatric wards. In Belgium, PTAs are recognized paramedical professionals supervised by pharmacists. At the study hospital, PTAs were introduced on the wards at in 2020 and work weekdays for approximately two hours per day per ward on stock management and medication dispensing for the subsequent 24 h. Nurses remain responsible for medication verification and administration.

### 2.2. Research team, reflexivity, and relationship with participants

The research team consisted of professionals in pharmacy and nursing with experience in qualitative research methodology. The interviewers (MDG, JH) were familiar with the hospital context but did not hold any supervisory roles over the participants. This helped to minimize power dynamics and encouraged open discussions. Interviews were conducted in private rooms where confidentiality was emphasized.

A reflexive approach was maintained throughout the study. The research team held regular meetings to reflect on potential biases and their influence on data collection and interpretation. Reflexive journaling and peer debriefing further supported credibility.

Member checking occurred in two stages: participants reviewed their interview transcripts, and preliminary results were presented during a feedback session. They were allowed to comment on the findings and suggest additions or corrections. No substantial changes were required, indicating that the interpretations resonated with participants' experiences.

Phase one: semi-structured interviews regarding PTAs' and pharmacists' experiences.

### 2.3. Participants and sample procedure

PTAs and pharmacists were recruited through purposive sampling to ensure relevant experience and expertise to provide valuable insights into the research topic.[20] Inclusion criteria required PTAs to have at least six months of experience in dispensing medication on hospital wards, while pharmacists needed to be actively involved in PTA implementation. Participants were informed about the study through written and oral communication (e-mail, telephone, and face-to-face). Data saturation was reached after 12 interviews.

### 2.4. Data collection

The interview guide was based on a previous study with nurses experiences and supplemented with PTA- and pharmacist-specific topics from the literature.[7] It included recurring topics such as communication and information transfer between professionals, collaboration, workflow and medication management processes, role clarity, and perceptions of the PTA's contribution to ward-based care. Additional topics relevant to PTAs and pharmacists were included, such as role development, boundaries of responsibility, clinically oriented tasks, and medication dispensing processes. Open-ended and semi-structured questions encouraged participants to discuss organizational structure, work environment, collaboration, role development, and perceived benefits of PTA implementation. Interviews were conducted between April and June 2023 by MDG in a separate, quiet room. Demographic data (gender, age, educational background, years of work experience and employment status) were collected.

### 2.5. Data analysis

Interviews were audio-recorded, transcribed verbatim, and checked by two researchers. Inductive thematic analysis was performed using NVivo 1.6.1. Two researchers (MDG, JH) independently coded the data, after analysing the first three interviews, a cross-check meeting was held to align coding strategies. Subsequent iterative research team meetings refined the coding and ensured analytic consistency. Final themes were agreed upon once data saturation was confirmed. Throughout the process, validation and collaborative interpretation, ensured rigor and reflexivity.

Phase two: interdisciplinary focus group interviews regarding key themes emerging from the individual interviews.

### 2.6. Participants and sample procedure

Three focus groups were conducted with 20 participants selected through stratified purposive sampling to ensure representation of nurses, PTAs, and pharmacists across internal, surgical and geriatric wards. This method was particularly important to capture the diverse perspectives of each group on the implementation and collaboration of PTAs within the hospital ward.[21] Some participants also took part in phase one, providing continuity, while new participants offered additional perspectives.

### 2.7. The sample was stratified to ensure a balanced representation of the internal, surgical, and geriatric wards

Within each ward, participants selection considered professional roles and experience with medication dispensing and interprofessional collaboration. For instance, nurses with experience of night shifts were included for their insights into specific workflow challenges. Similarly, PTAs and pharmacists were chosen based on their involvement in the medication dispensing process and their role in the implementation of PTAs on the wards.

All participants had at least six months of relevant ward-based experience. Data saturation was reached after the third focus group.

### 2.8. Data collection

Focus groups took place between February and June 2024, lasted approximately 60 min and were moderated by MDG. A flexible interview guide addressed experiences and future needs related to communication and collaboration among nurses, PTAs and pharmacists. Follow-up questions explored emerging ideas in more detail.[22] These topics were derived from the main themes that emerged from the interviews with PTAs and pharmacists, as well as the previous individual interviews with nurses.[7] Demographic information (gender, educational background, years of work experience, employment status) was collected from all.

### 2.9. Data analysis

Focus groups were audio recorded, transcribed verbatim and analysed using thematic analysis in NVivo 1.6.1. Two researchers (MDG and JH) coded independently and resolved discrepancies through discussion. Final themes were selected based on relevance and recurrence.

### 2.10. Ethical considerations

Participants received written and verbal study information and provided informed consent. This study was designed and reported in accordance with the Declaration of Helsinki.[23] Participants could withdraw at any time. Confidentiality was ensured through pseudonyms assigned to individuals in the transcripts and any subsequent publications. Ethical approval was granted by the Ethics Committee of VITAZ (EC/22054 and EC/24002).

## 3. Results

### 3.1. Semi-structured individual interviews

In total, 12 PTAs were invited to participate, of whom 10 agreed to be interviewed. Two PTAs declined participation because they did not feel comfortable taking part in an interview. Both pharmacists who were invited agreed to participate. The PTAs and pharmacists were interviewed for a total of 332 min, with a mean duration of 27,7 min (range 17–41) per interview. At the time of the study, only women were employed in these roles at this hospital; therefore, all interviewees were female. The mean age of participants was 35.8 years, and 10 (83,3%) had more than five years of work experience (Table 1).

### 3.2. Overall experience

PTAs and pharmacists had a positive perception of the implementation of PTAs to support the process of medication management on hospital wards. Participants unanimously believed that the medication dispensation by PTAs reduced nurses' workload in medication management and perceived that it led to a lower risk of medication errors, specifically in the number of omitted doses for patients. The analysis identified five main themes within the interprofessional collaboration between PTAs, pharmacists and nurses: (1) role and responsibilities, (2) continuity of PTA allocation to nursing wards, (3) competences and education, (4) uniformity and standardized procedures, and (5) communication and interprofessional collaboration (Fig. 1, Table 2).

**Table 1**
Individual Interview Participants' Characteristics.

| Characteristics Participants ($n = 12$) | N (%)/ Mean (Range) |
|---|---|
| Gender, Female | 12 (100) |
| Age, mean (range), y | 35.8 (24–50) |
| Educational level | |
| PTA (EQF & ISCED-P* level 4) | 10 (83) |
| Pharmacist (EQF & ISCED-P* level 7) | 2 (17) |
| Work experience | |
| 6 months - < 5 y | 2 (17) |
| 5–10 y | 3 (25) |
| >10 y | 7 (58) |
| Employment status | |
| 100% | 6 (50) |
| 80% | 4 (33) |
| 70% - 75% | 2 (17) |

* EQF: European Qualification Framework and ISCED: International Standard Classification of Education 2011.

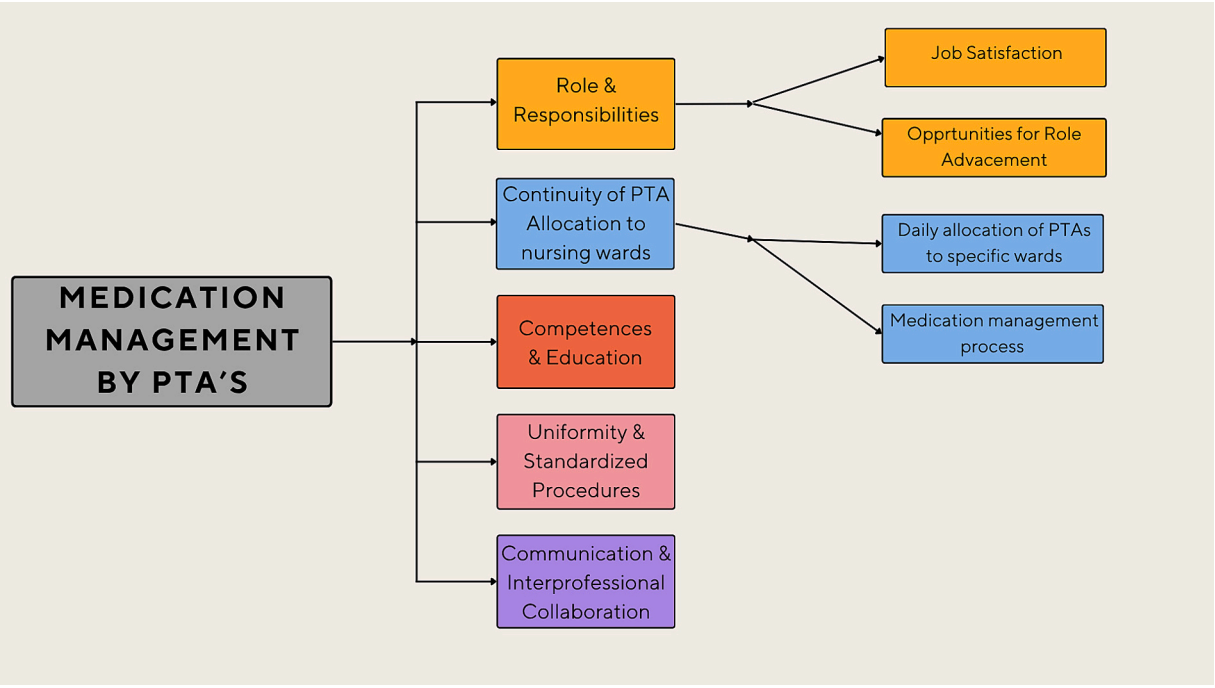


**Fig. 1.** Main themes of PTAs' and pharmacists' perception of the implementation of PTAs to support the medication management process on hospital wards.

**Table 2**
Summary of Themes and Key Insights.

| Theme | Key Insights |
|---|---|
| 1. Role and Responsibilities | Expanded PTA roles enhance job satisfaction through autonomy and nurse collaboration and may drive interest in broader clinical responsibilities. |
| 2. Continuity of PTA Allocation to nursing wards | PTA ward allocation affects workflow and planning: fixed enhances continuity; rotation enables flexibility. |
| 3. Competences and Education | Variations in pharmacological knowledge, influenced by prior experience, underscore the need for continuous, targeted training programs for PTAs. |
| 4. Standardized Procedures | Clear, shared protocols for medication dispensation and stock management are essential to enhance consistency, improve efficiency, and reduce errors." |
| 5. Communication & Collaboration | Structured communication and joint training are essential to strengthen interprofessional collaboration and reduce situational variability |

## 4. Role and responsibilities

### *4.1. Job satisfaction*

All PTAs perceived the expansion of their responsibilities to include medication dispensation on hospital wards as meaningful and motivating development in their professional role, reporting a notable increase in job satisfaction. This role expansion provided greater autonomy and enhanced task variety, which PTAs found to be key contributors to their sense of fulfilment. Moving from routine pharmacy tasks to dynamic ward-based activities introduced new challenges and strengthened pharmacological knowledge. Applying and reinforcing this knowledge made work more stimulating and purposeful, while task variety reduced monotony. Furthermore, PTAs consistently described their experience on hospital wards as refreshing, with the opportunity to collaborate directly with nursing staff. This strengthened interdisciplinary collaboration, mutual respect, and overall job satisfaction and work experience.

**PTA 3:** *"I needed a new challenge, and I felt that staying in distribution alone didn't provide that. I wanted to expand my knowledge, especially about medications. When you finish school, you know your medications and when to administer them, but over time, that knowledge fades. Now, we can put it into practice again and refresh our expertise."*

**PTA 4:** *"Yes, I think for us as assistants, it's really rewarding to step out of the pharmacy and actively engage with the nursing staff on the wards. The nursing staff are also very appreciative of what we do."*

Autonomy also emerged as an important factor influencing their job satisfaction. Most PTAs valued independent task management, fostering a sense of ownership and accomplishment. They felt that trust from other healthcare professionals reinforced the relevance and importance of their role and further enhanced work satisfaction.

**PTA 8:** "What I find most rewarding is the independence of the role. You manage your tasks on your own, and when you're finished, you move on to the next shift. It's the autonomy that I really value."

### *4.2. Opportunities for role advancement*

While all PTAs expressed satisfaction with the recent expansion of their roles, PTAs and pharmacists acknowledged further growth potential. Current responsibilities focused mainly on the logistical medication management (e.g. medication preparation and distribution). However, some PTAs expressed interest in more clinically oriented tasks, such as medication-related counselling to patients, supporting medication administration and taking medication histories, to increase involvement in patient care in a more direct, clinical capacity. Pharmacists recognized these aspirations, highlighting the value of PTAs' existing expertise

while also emphasizing the potential for competency development, that would further enrich their roles.

**PTA 8:** *"For me personally, having contact with the patient would not necessarily be interesting/ That is not something I miss. I am satisfied with how things are now, and I'd gladly keep it this way."*

**PTA 2:** *"I would love to go beyond simply dispensing medications. For instance, assisting during patient admissions by gathering information about the medication they take at home. That's something PTAs could excel at, and it would also be a great opportunity to further improve our knowledge."*

## 5. Continuity of PTA allocation to nursing wards

### 5.1. Daily allocation of PTAs to specific wards

PTAs expressed mixed views on the principle of ward allocation. Some highlighted potential benefits of structured assigning PTAs to improve workflow efficiency through familiarity with medication locations and improving stock management, as well as stronger relationships with nursing staff via consistent contact. Others preferred flexibility and variety across multiple wards, contributing to a more dynamic role.

**PTA 4:** *"I think having a regular ward would be easier because you get a better understanding of what's in the medication cabinet and what's not. Plus, having a consistent point of contact for the nursing staff could be helpful, as they would recognize a familiar face. That said, I don't mind the variation; working across different wards is also rewarding."*

Pharmacists noted that structurally allocating poses organizational challenges, particularly in staff planning. While clustering wards (e.g. geriatrics, surgery, and internal medicine) may be feasible, staff absence creates issues when replacements lack ward-specific familiarity.

An alternative approach to achieve structural assignment, as indicated by the pharmacists, would be for PTAs to take on more responsibilities on the hospital wards, thus becoming an integral member of ward teams. In this scenario, PTAs would be considered part of the ward staff rather than pharmacy staff, and the ward itself would need to manage staffing shortages without relying on the pharmacy for replacements.

**Pharmacist 1:** *"I think it's an issue because we manage medication for various wards, such as surgical and geriatric wards. If we suddenly need to switch to a different ward, the staff might not be familiar with it. The scope of pharmacy services keeps expanding, but we haven't yet been able to organize specific clusters for different areas. While creating these clusters would be valuable, it's still very challenging from an organizational perspective."*

**Pharmacist 2:** *"If we have fixed PTAs assigned to the ward and they are unavailable due to illness or other reasons, we won't be able to send a replacement PTA from the pharmacy. The issue for nursing is that if they require consistent PTAs on the ward and the assigned PTAs are unavailable, we won't be able to provide any substitutes. I believe this could have serious consequences."*

### 5.2. Medication management process

From the PTAs' perspective, the support for medication dispensing on weekends and holidays was not essential, as nurses follow standard protocols. However, discrepancies often occurred after weekends or holidays due to misalignment in medication dispensation start and end times. This sometimes leads to duplicate medication preparation. This underscores the need for clear coordination to avoid redundancy in medication setup.

Additionally, several PTAs mentioned medication stock depletion after weekends or holidays, as nurses were less proactive in stock management. Pharmacists observed increased medication errors (e.g. missed doses) after these periods, although safeguards such as emergency medication cabinets and on-call pharmacists ensure continuity.

**PTA 5:** *"Yes, sometimes when we arrive on Monday, the medication has already been dispensed. Normally, we handle the dispensation ourselves, but the nursing staff may have already done it. This happens quite often and can sometimes be a bit confusing for us."*

**Pharmacist 1:** *"Medication errors include failing to administer medication, and I still see this regularly. When I check on Mondays, I often find that some medications have not been given. (…) The involvement of PTAs has significantly reduced the number of missed medications. However, I can't guarantee that this same level of accuracy is maintained over the weekend. I still notice that nurses sometimes decide to omit medication if they believe it's missing."*

## 6. Competences and education

Pharmacists and most PTAs indicated that competencies, particularly pharmacological knowledge, communication skills, and clinical decision-making abilities, are not fully developed for current responsibilities. These gaps reduce confidence and limit involvement in clinical reasoning and interprofessional collaboration.

Essential pharmacological knowledge included drug indications, dosage forms, administration routes and interaction identification. PTAs from community pharmacies reported higher confidence due to regular exposure (e.g., prescription verification, medication preparation, and patient counselling), whereas those from non-clinical sectors reported limited pharmacotherapy experience and greater uncertainty.

**Pharmacist 2:** *"We notice that PTAs hired from community pharmacies already have a solid knowledge base because they deal with it every day. However, school leavers or those coming from industry, for example, tend to have much less knowledge about pharmacotherapy."*

In addition to pharmacological knowledge, participants emphasized the importance of social and communication skills, particularly in their interactions with nursing staff on the wards. The PTAs mentioned that these skills are crucial for engaging in discussions, seeking advice, and addressing issues related to medication dispensing. Confidence varied, with some PTAs proactive and others more hesitant, particularly when addressing potential medication-related problems. This variation in confidence was linked to previous operational roles with limited clinical interaction.

PTAs and pharmacists noted that limited confidence in clinical decision-making restricts the PTAs' role, particularly in resolving medication discrepancies or clinical reasoning regarding patients' medications.

**PTA 4:** *"When you come from a regular pharmacy, you need to know almost everything in your drawer. I feel that I have less of that knowledge here, as we deal with other things too, and I don't think my understanding of medications is broad enough. It's important to know what I'm dispensing and to identify potential interactions. Sometimes new medications are started, and I don't always know what they're for. I usually ask, but you can't ask about everything, and that's something I don't particularly like."*

Pharmacists emphasized the need for continuous internal training, which is currently under development. Strengthening pharmacological knowledge and clinical reasoning skills was identified as essential for future role expansion.

**Pharmacist 1:** *"We're currently working on having our hospital pharmacists in training provide education, but it's still a work in progress. For example, there was a recent training session on inhalers. I believe we need to establish a dedicated training unit within the pharmacy. The more knowledge PTAs have, the better informed they are, and the more alert they can be on the ward."*

Looking ahead, most PTAs expressed interest in expanding their roles but emphasized the need for adequate training and support. Strengthening pharmacological knowledge and clinical reasoning skills is essential not only for improving their professional competence, but is also seen as essential for confidence, professional development, improved collaboration, and better patient outcomes.

**PTA 4:** *"I think it would be very interesting for us as PTAs to step even more out of the pharmacy and be really involved on the nursing ward. However, proper training will be crucial – Without it, it won't work. I believe this could elevate our role significantly in the future."*

## 7. Uniformity and standardized procedures

Pharmacists and PTAs emphasized the need for clear, standardized guidelines to ensure consistent and efficient medication management across wards. These should include accurate electronic documentation, clear responsibilities and proactive stock management. Both PTAs and pharmacists emphasized that these elements are crucial for fostering collaboration between PTAs and nursing staff, streamlining workflows, and maintaining high standards of medication safety and efficiency.

Furthermore, PTAs and pharmacists highlighted the need to make these guidelines clear and accessible to PTAs and nursing staff, supported by regular training and education to ensure that all team members are familiar with the procedures and to ensure an effective adoption in daily practice.

**PTA 2:** *"Having clear and accessible guidelines really helps ensure we're all aligned. Regular training is important so that everyone is familiar with the procedures and can follow them effectively."*

Adherence to standardized protocols was noted to improve efficiency, reduce medication losses, and streamline communication between pharmacy and nursing staff. While PTAs mainly focused on their core responsibilities, some PTAs occasionally performed additional tasks when needed, supporting collaboration and resource management, and patient care.

**PTA 10:** *"Stock movements are monitored much more effectively now. As a result, there are far fewer patient-specific losses because we manage these five out of seven days a week. When something seems off, we actively investigate by asking, 'Why did this happen?' This improved oversight naturally reduces waste."*

## 8. Communication and interprofessional collaboration

All PTAs indicated that only brief interaction with nurses are required, mainly to exchange essential patient and medication information at arrival and departure. These short communication moments are crucial for efficient task execution.

**PTA 10:** *"There seems to be a bit of discrepancy in communication. Some wads do not want to waste time when we (PTA) arrive, especially during a busy moment like a hand-over. At that moment, the nurses might not want or have time for contact. However, I still think it's valuable to simply show that you're present. If there's something important, it's an opportunity to ask for the latest updates and whether there's anything specific to note. I believe this is a crucial first step in communication."*

PTAs expressed feeling valued by nurses, who often express their appreciation through small, thoughtful gestures, such as offering pastries. Although interactions were generally positive and professional, PTAs and pharmacists described their relationships with nurses as functional rather than deeply collaborative. Lack of structured ward assignment limits continuity, relationship-building and constructive feedback, which can negatively affect the quality and depth of communication and collaboration.

**PTA 4:** *"Well, I think sometimes it would be nicer if the interaction could be a bit more casual, rather than distant. But I think that's just because we're not on the wards that much. And, like I said, we're still somewhat separated, so sometimes it's just not possible. They're really busy too. But if I think about it in the future, if we could have me working more on the hospital ward, it could improve things. So, for now, I'm happy with how things are."*

### 8.1. Interdisciplinary focus group interviews

Three focus group interviews were conducted, comprising a total of 20 participants with an equal distribution of nurses and PTAs. The majority of participants were female (85%). All PTAs worked across all nursing wards, while the nurses were distributed more specifically: three worked on a surgical ward, two on a geriatrics ward, and four on an internal medicine ward (Table 3).

**Table 3**
Participants' Characteristics of Interdisciplinary Focus Group Interviews.

| Characteristics of participants ($n = 20$) | N (%)/ Mean (Range) |
|---|---|
| Gender, Female | 17 (85) |
| Educational level | |
| PTA | 9 (45) |
| Nurse | 9 (45) |
| Pharmacist | 2 (10) |
| Work experience of the participants in years | |
| 6 months - < 5 y | 4 (20) |
| 5–10 y | 4 (20) |
| >10 y | 12 (60) |

### 8.2. Communication barriers and their consequences

The participants indicated that miscommunication often arises when communication channels are unclear or inconsistently used. Participants noted that these communication gaps often lead to inefficiencies in workflow and, in some cases, negatively impact patient care. For example, nurses did not always inform PTAs when patients were discharged or temporarily transferred to other wards, leading to unnecessary medication dispensations. Conversely, PTAs occasionally failed to inform nurses about ordered medications or the status of medication dispensation for the following day. Additionally, there were considerable variations in communication styles among staff, further compounding these issues.

**Pharmacist:** *"During our last meeting, we brainstormed about the dispensation process and realized that communication styles vary greatly. Some PTAs call the helpdesk, while others approach the nursing staff. Ultimately, it seems that those who already know someone on the nursing ward are more likely to reach out directly."*

### 8.3. Importance of structured communication and role clarity

All participants emphasized the value of structured communication processes to enhance collaboration between PTAs and nurses and improve patient care (Fig. 2). Clear roles and responsibilities were identified as essential for reducing misunderstandings and improving workflow efficiency. Participants emphasized that role clarity reduces the risk of errors and enables professionals to focus on their expertise and optimize their contribution to medication management and patient care.

Participants underscored the importance of reducing unnecessary back-and-forth communication. Moreover, clearly defined roles were seen to foster mutual respect, as they help team members recognize and value each other's contributions, supporting a more harmonious and collaborative work environment.

**PTA:** *"Pharmacy does its part, and the nursing staff does its part. But we need to align and establish clear agreements on how we work together. With both teams being large, the chance of something going wrong is real. That's why clarity in each other's roles and responsibilities is crucial for effective collaboration, as it helps avoid frustrations caused by misunderstandings."*

### 8.4. Proposed solutions for enhanced communication

#### 8.4.1. Implementation of digital tools

To address these challenges, participants recommended digital communication tools (e.g. internal messaging systems or collaborative digital shared platforms). These tools can provide real-time updates and reduce reliance on face-to-face interactions, which are often impractical in a busy hospital setting. These tools were perceived as improving communication speed and clarity. Additionally, centralized information boards (physical or digital) were proposed to ensure essential patient information, instructions, and protocols are accessible to PTAs and nurses.

**PTA:** *"It might help to clearly outline on the document listing hospitalized*

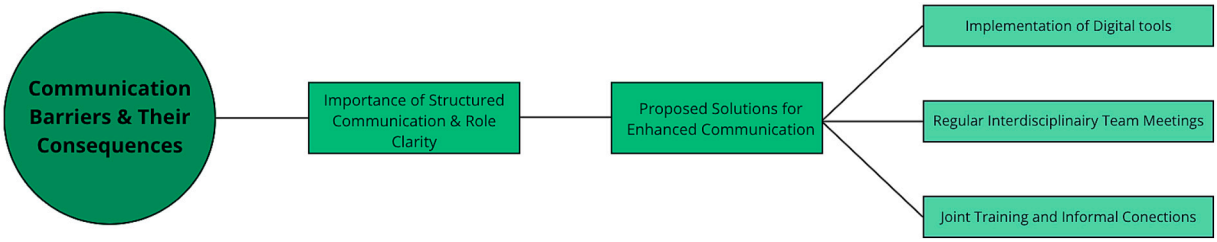


**Fig. 2.** Perceptions of healthcare professionals regarding communication and collaboration between PTAs and nurses, with the formulated proposed solutions.

*patients: point one, where we left off; and point two, which medications still need to be added and for whom. I believe this document is often not discovered quickly by the nurses on the ward. Perhaps using digital communication tools could be a more effective solution. With a digital system, the information would be easily accessible to everyone and less likely to get lost."*

**Head nurse:** "Maybe you could summarize it in 10 sentences for everyone at the hospital—what the PTAs do and what they don't do. A 7-slide PowerPoint, people don't read that anymore. But just putting up a poster alone won't change attitudes."

#### 8.4.2. Regular interdisciplinary team meetings

In addition to technological solutions, participants emphasized the need for interpersonal strategies to strengthen collaboration. Regular interdisciplinary team meetings were considered essential for building a stronger collaboration, structured communication, feedback, and shared decision-making. Participants stressed the need for clear protocols for information transfer during key moments, such as patient transitions or medication management. Well-defined handover guidelines minimize errors and ensure the continuity of care.

**Head nurse:** *"Structured meetings with the PTAs who dispense medication on the ward and representatives of the nursing team—this doesn't always have to be the head nurse. It could also be someone with key responsibilities, someone handling medication distribution. These moments ensure that important points are addressed and improvements can be made."*

**Nurse:** *"Clear communication is key. When someone (PTA) arrives, they could briefly check in or share updates verbally. It's not just on them to come to us; we can also take the initiative. Similarly, when a PTA leaves, they should say something like, 'I've checked your stock, and it's ordered.' This avoids confusion, unlike vague updates such as, 'I marked up to room 17,' which isn't as clear."*

#### 8.4.3. Joint training and informal connections

Participants also highlighted the importance of joint training sessions to improve mutual understanding and communication skills. Such training helps bridge differences in communication styles and facilitates smoother interactions. Addressing these communication challenges through structured channels and shared learning opportunities, PTAs and nurses can work more cohesively to enhance patient care outcomes.

**Pharmacist:** *"PTAs are not trained in the same way as nursing staff are—they've learned to use structured communication techniques like the SBAR principle for brief, organized handovers. This is something we don't know in the pharmacy. I think having an informal connection is crucial, because without it, people might hesitate to actively ask questions if something's wrong. This clearly shows the need for joint training, where both nursing and pharmacy teams can learn together, improving communication and fostering better collaboration."*

## 9. Discussion

This two-phased qualitative study explored the experiences and perceptions of PTAs and pharmacists regarding the role of PTAs in ward-based medication management in a Belgian hospital, as well as the interprofessional perspectives of nurses. Key facilitators for successful integration included role clarity, structured communication, continuity in PTA ward allocation, and educational preparedness. Participants emphasized benefits such as reduced nursing workload and the potential for increased medication safety. However, they also identified systemic and educational barriers limiting the full potential of the PTA role in ward-based medication management. Based on these findings, we identified several themes that require further attention to optimize interprofessional medication management within the hospital context. In the sections below, we discuss these themes, highlight their clinical implications, compare our findings to existing literature, and provide suggestions for improved collaboration and practice.

### 9.1. Role clarity and scope of practice

The findings reinforce longstanding evidence that clarity in professional roles is a foundational component of effective team-based care.[24] Consistent with studies in the UK and Australia, the lack of clarity surrounding PTA responsibilities led to frustration, inefficiencies, and blurred professional boundaries.[10,17] Participants of our study emphasized that clear delineated roles are to reduce misunderstandings, minimize unnecessary communication loops, and allow each professional to focus on their respective areas of expertise. Furthermore, role clarity was perceived as a prerequisite for fostering mutual respect and recognition among team members.

PTAs reported being satisfied with their current, mainly logistics-oriented responsibilities. However, both PTAs and pharmacists acknowledged opportunities to further develop the role, particularly by incorporating clinically focused tasks such as medication counselling and medication history taking. These findings demonstrate that clear responsibilities enhance operational efficiency and foster a more collaborative and respectful interprofessional work environment. This is particularly relevant in a healthcare system where the PTA role is still evolving.[25]

### 9.2. Communication as a systemic challenge

In our study, communication breakdowns emerged as a recurring theme in both interviews and focus groups, particularly concerning handovers, stock shortages, and task overlaps. These issues align with findings from studies in the Netherlands and Australia, where ineffective communication between nurses and pharmacy staff has been linked to medication delays, duplication, and omissions.[26,27] Our study extends this knowledge by showing that even brief and task-oriented roles, like medication dispensation, require intentional integration into broader clinical conversations to avoid communication gaps.

Importantly, our study also highlights how structural factors amplify these communication challenges.[28] Participants pointed to asynchronous schedules, the lack of shared platforms, and insufficient digital tools as factors that contribute to barriers in effective collaboration. These challenges were not simply communication failures, but systemic issues rooted in the healthcare infrastructure.

Based on these findings and supported by international literature, targeted interventions at the system level appear warranted. Potential strategies include implementing shared digital communication tools, scheduling routine interdisciplinary check-ins, and introducing

standardized coordination aids such as centralized whiteboards or task boards. These measures may enhance clarity, alignment, and continuity in medication-related communication across professional groups, thereby strengthening overall medication safety and workflow efficiency.[29]

### 9.3. Continuity in PTA allocation

This study contributes to novel evidence on the significance of fixed or semi-fixed ward assignments for PTAs. While not extensively studied in this professional group, findings from nursing literature support the idea that consistent team allocation enhances care coordination and patient safety. For instance, a meta-analysis by Butler et al. (2019) explored hospital nurse-staffing models and their impact on both patient and staff outcomes. The study concluded that stable nurse staffing improves patient safety and reduces adverse events.[30] Similarly, in our study, participants observed that familiarity with ward-specific procedures and staff led to faster onboarding, more efficient workflows, and greater team cohesion. However, pharmacists also acknowledged that assigning PTAs to fixed wards presents logistical challenges, such as scheduling flexibility.

In light of the current findings and existing evidence, fixed or semi-fixed ward allocation for PTAs can be considered a promising strategy to enhance relational continuity and integration within ward-based care teams. To address potential scheduling challenges, hybrid staffing models—combining consistent assignments with flexible coverage mechanisms—may offer a viable solution. Embedding such adaptable models into staffing policies could strengthen operational resilience while safeguarding continuity and cohesion within interprofessional teams.

### 9.4. Educational preparedness and role development

Participants widely agreed that the current education of PTAs does not fully prepare them for the clinical reasoning, communication, and pharmacological knowledge required in ward-based roles. This is consistent with literature from the UK and US, where the increasing clinical involvement of pharmacy technicians has prompted calls for more advanced and standardized educational pathways.[9,14]

Role preferences varied among PTAs; while some favored engaging in patient-centered tasks such as medication reconciliation and counselling, others indicated a preference to remain focused on logistics-oriented tasks. This heterogeneity suggests the existence of different role identities within the profession and underscores the importance of flexible development pathways.

To support such differentiation, a competence-based framework—such as the NUPHAC-EU framework—may offer a valuable structure for guiding professional development. The NUPHAC-EU framework, developed across 14 European countries, defines nurses' roles and responsibilities in pharmaceutical care and links them to the required competencies.[31] Although originally designed for nursing roles, the framework's structured approach to role definition, interprofessional alignment, and competency mapping makes it highly relevant in contexts where new professional roles—such as that of the PTA in ward-based care—are emerging and evolving. Applying such a model could help align PTA education and practice with the growing clinical expectations of the role. This may also support a clearer task division between PTAs, pharmacists, and nurses, thereby strengthening interprofessional collaboration and promoting the safe, efficient, and patient-centered delivery of pharmaceutical care.

This study and the earlier work by De Graef et al. (2024) offer a complementary perspective on the role of PTAs in ward-based pharmaceutical care.[7] While the previous study focused on the perceptions of nurses, the present study broadens this view by incorporating the experiences of PTAs and pharmacists. Notably, both studies point to similar enabling factors—such as clearly defined roles, structured communication, and continuity in ward allocation—as critical to effective integration. Both studies also highlighted the current inadequacies in PTA education for clinically oriented tasks and the need for enhanced training in clinical reasoning and interprofessional collaboration.

A key divergence, however, lies in how the expansion of the PTA role is perceived. Pharmacists and PTAs generally viewed role development as an opportunity to improve efficiency and patient safety. In contrast, nurses voiced concerns about diminished oversight and blurred accountability, particularly regarding individual medication regimens. This divergence underscores the importance of aligning professional expectations and roles through deliberate implementation strategies and interprofessional dialogue.

Together, the findings from both studies provide a coherent and multi-angled understanding of the current challenges and opportunities associated with the integration of PTAs into clinical practice. They provide a foundation for developing strategies to strengthen interprofessional collaboration and, ultimately, higher quality patient care.

### 9.5. Implications for clinical practice and further research

Compared to international models, the Belgian PTA remains in the early stages of clinical integration. In the UK and USA, advanced pharmacy technician roles have been embedded within ward-based care for over a decade, supported by national training standards.[32,33] In the Netherlands, pharmacy assistants collaborate more directly with nurses in structured medication rounds.[34] The Belgian case thus provides a unique perspective on early-stage implementation, highlighting the importance of adapting role expansion to local regulatory, educational, and cultural contexts rather than directly importing external models.[37] Collaborative models involving PTAs have already been implemented in several healthcare systems, and, more recently, in Belgian hospitals as well.[35,36] However, the effects of these evolving care models remain insufficiently documented, particularly regarding clinical outcomes, workflow integration, and interprofessional dynamics. Future research should evaluate the effectiveness of interventions such as fixed PTA ward assignments, digital communication tools, and interprofessional training programs, focusing on their impact on patient safety, workflow efficiency, and staff satisfaction. Longitudinal and mixed-methods studies would be particularly valuable in capturing the evolution of PTA roles over time and identifying the conditions that support sustainable interprofessional collaboration. Quantitative assessments of communication quality and clinical outcomes before and after implementation can provide objective evidence of effectiveness. Importantly, future studies should incorporate the perspectives of patients, physicians, and nurse managers to gain a more comprehensive understanding of how PTAs contribute to care quality within the broader hospital ecosystem.

### 9.6. Recommendations

To optimize the integration of PTAs in hospital ward-based pharmaceutical care, healthcare institutions should collaboratively develop clearly defined role descriptions with input from pharmacists, nurses, and ward managers. These roles must be supported by standardized protocols for medication documentation, handovers, and stock management to minimize task duplication or omissions. Interprofessional onboarding and ongoing training—emphasizing structured communication tools such as SBAR, medication checklists, and shared documentation practices—can enhance practical collaboration and mutual understanding.[37] Semi-fixed ward assignments may strengthen team cohesion, provided they are balanced with flexible staffing policies to ensure adequate coverage. Additionally, investment in user-friendly electronic communication platforms, integrated into existing clinical workflows, is critical for enabling asynchronous, transparent updates and improving interdisciplinary coordination.

## 10. Strengths and limitations

This study's main strength lies in its robust and consistent qualitative methodology. By combining individual interviews with interdisciplinary focus groups, the two-phase design provided both in-depth insights and broader perspectives on the integration of PTAs in hospital ward-based care. Methodological rigor was ensured through independent coding, thematic triangulation, and member checking, enhancing the credibility of the findings. Moreover, the real-world hospital setting contributed to the practical applicability of the results within current clinical contexts.

However, some limitations must be considered. The study was conducted in a single hospital, which may limit the transferability of findings to other institutions or healthcare systems. The participant group included only female PTAs and pharmacists, possibly overlooking gender-related influences on interprofessional collaboration. Finally, as the PTA role in Belgium is still in development, some of the identified challenges may reflect transitional dynamics rather than fully established role expectations.[6]

## 11. Conclusion

This study provides an in-depth understanding of how pharmaceutical technical assistants (PTAs), pharmacists, and nurses perceive the role and contributions of PTAs in ward-based pharmaceutical care. The findings reveal several key challenges in daily medication-related processes, including unclear role definitions, fragmented communication, and limited clinical preparedness among PTAs. These challenges often obstruct efficient collaboration and may affect medication safety and the continuity of workflows.

At the same time, the study identifies critical factors that facilitate effective interprofessional collaboration, such as fixed or semi-fixed ward allocation, structured communication routines, and enhanced training in clinical reasoning and interprofessional skills. These findings highlight the necessity for targeted strategies to strengthen cooperation between PTAs, pharmacists, and nursing staff, ultimately optimizing medication management processes in hospital wards.

By capturing the perspectives of multiple professional groups, the study contributes to a more comprehensive understanding of how emerging roles can be successfully integrated into existing care teams. Future research should focus on evaluating the long-term impact of PTA involvement on clinical outcomes, patient safety, and team functioning. Particular attention should be placed on implementation strategies that address educational needs, clear role delineation, and interprofessional alignment within the complex and dynamic hospital environment.

## Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work, the authors used Microsoft Copilot to assist with language and readability improvements for short passages. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

## CRediT authorship contribution statement

**Marjan De Graef:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Brecht Serraes:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Jolien Heirman:** Investigation, Formal analysis. **Eibert R. Heerdink:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Tinne Dilles:** Writing – review & editing, Supervision, Methodology, Formal analysis, Conceptualization. **Nienke E. Dijkstra:** Writing – review & editing, Supervision, Methodology, Formal analysis, Conceptualization.

## Declaration of competing interest

MDG, BS and JH are employees of Vitaz (General Hospital – Belgium). The remaining authors have no conflict of interest to declare. The hospital and the University Foundation from Belgium did not play a role in the design of the study, data collection, analyses, interpretation of the results, or the development and submission of the manuscript.

## Data availability statement

The data used to support the findings of this study are available from the corresponding author upon reasonable request.

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## Appendix A. Supplementary data

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## References

1.. International Pharmaceutical Federation. The FIP global roadmap 2030: sustainable advancement for pharmacy worldwide. High-level report by the FIP Bureau. The Hague: International Pharmaceutical Federation; 2022. pp. 25–30. https://www.spemital.it/wp-content/uploads/2022/09/3491-The-FIP-Global-Roadmap-2030-Sustainable-advancement-for-pharmacy-worldwide.pdf.
2.. Cloete L. Reducing medication errors in nursing practice. *Nurs Stand*. 2015;29(20):50–59. https://doi.org/10.7748/NS.29.20.50.E9507.
3. Shaffer FA, Buchan J, Catton H, Shaffer F. *Sustain and retain in 2022 and beyond chief executive officer, international council of nurses*. 2022:4–7. Published Online. 2022.
4. Kjeldsen LJ, Schlünsen M, Meijers A, et al. Medication dispensing by pharmacy technicians improves efficiency and patient safety at a geriatric ward at a danish hospital: a pilot study. *Pharmacy*. 2023;11(3):82. https://doi.org/10.3390/pharmacy11030082.
5.. CEDEFOP. Bachelor or equivalent level (ISCED level 6 – EQF level 6). Accessed December 23, 2024 https://www.cedefop.europa.eu/en/tools/vet-glossary/glossary/bachelors-or-equivalent-level-isced-level-6-eqf-level-6; 2025.
6.. Nieuw Koninklijk Besluit voor de farmaceutisch-technisch assistent. FOD Volksgezondheid. Accessed May 13, 2025 https://www.health.belgium.be/nl/news/nieuw-koninklijk-besluit-voor-de-farmaceutisch-technisch-assistent; 2025.
7. De Graef M, Serraes B, Van Rompay V, Dijkstra NE, Heerdink ER, Dilles T. Implementation of pharmaceutical technical assistants on hospital wards and their impact on patient safety and quality of care: a qualitative study on nurses' experiences and perceptions. Berdida DJ. *J Nurs Manag*. 2024;2024(1). https://doi.org/10.1155/2024/7894331.
8. Sinclair A, Eyre C, Petts H, Shuard R, Correa J, Guerin A. Introduction of pharmacy technicians onto a busy oncology ward as part of the nursing team. *Eur J Hospital Pharmacy*. 2018;25(2):92–95. https://doi.org/10.1136/ejhpharm-2016-000951.
9.. Lloyd M. Comparison of pharmacy technicians' and doctors' medication transcribing errors at hospital discharge. *Eur J Hospital Pharmacy*. 2020;27(1):9–13. https://doi.org/10.1136/ejhpharm-2018-001538.
10. Silverio SA, Cope LC, Bracken L, Bellis J, Peak M, Kaehne A. The implementation of a technician enhanced administration of medications [TEAM] model: an evaluative study of impact on working practices in a childrens hospital. *Res Soc Adm Pharm*. 2020;16(12):1768–1774. https://doi.org/10.1016/j.sapharm.2020.01.016.
11. Rathbone AP, Jamie K, Blackburn J, et al. Exploring an extended role for pharmacy assistants on inpatient wards in UK hospitals: using mixed methods to develop the role of medicines assistants. *Eur J Hospital Pharmacy*. 2020;27(2):78–83. https://doi.org/10.1136/ejhpharm-2018-001518.
12. Uhlenhopp DJ, Aguilar O, Dai D, Ghosh A, Shaw M, Mitra C. Hospital-wide medication reconciliation program: error identification, cost-effectiveness, and detecting high-risk individuals on admission. *Integr Pharm Res Pract*. 2020;9:195–203. https://doi.org/10.2147/iprp.s269857.
13. Kram BL, Trammel MA, Kram SJ, et al. Medication histories in critically ill patients completed by pharmacy personnel. *Ann Pharmacother*. 2019;53(6):596–602. https://doi.org/10.1177/1060028018825483.

14. Nguyen CB, Shane R, Bell DS, Cook-Wiens G, Pevnick JM. A time and motion study of pharmacists and pharmacy technicians obtaining admission medication histories. *J Hosp Med*. 2017;12(3):180–183. https://doi.org/10.12788/jhm.2702.
15. Hwang E, Withers AP, Gordon LAN. Improving rural hospital clinical pharmacy services through workforce innovation with ward-based pharmacy technicians. *J Pharm Pract Res*. 2021;51(6):488–493. https://doi.org/10.1002/jppr.1755.
16. Elliott RA, Perera D, Mouchaileh N, et al. Impact of an expanded ward pharmacy technician role on service-delivery and workforce outcomes in a subacute aged care service. *J Pharm Pract Res*. 2014;44(3):95–104. https://doi.org/10.1002/jppr.1018.
17. Anderson BJ, Taylor SE, Mitchell SM, et al. Evaluation of a novel advanced pharmacy technician role: discharge medication education technician. *J Pharm Pract Res*. 2021;51(5):396–405. https://doi.org/10.1002/jppr.1752.
18. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care*. 2007;19(6):349–357. https://doi.org/10.1093/intqhc/mzm042.
19. Jowsey T, Deng C, Weller J. General-purpose thematic analysis: a useful qualitative method for anaesthesia research. *BJA Educ*. 2021;21(12):472–478. https://doi.org/10.1016/J.BJAE.2021.07.006.
20.. CEDEFOP. VET in Europe database | Vocational education and training in Europe | Luxembourg. Accessed December 23, 2024 https://www.cedefop.europa.eu/en/tools/vet-in-europe/systems/luxembourg-u3; 2025.
21.. Volksgezondheid FOD. Farmaceutisch-technisch assistent. Accessed December 23, 2024 https://www.health.belgium.be/nl/gezondheid/zorgberoepen/paramedische-beroepen/farmaceutisch-technisch-assistent; 2025.
22. Campbell S, Greenwood M, Prior S, et al. Purposive sampling: complex or simple? Research case examples. *J Res Nurs*. 2020;25(8):652–661. https://doi.org/10.1177/1744987120927206.
23.. Rabiee F. Focus-group interview and data analysis. *Published Online*. 2004. https://doi.org/10.1079/PNS2004399.
24. Wong LP. Medical education Singapore med focus group discussion: a tool for health and medical research. *J (Basel)*. 2008;49(3):256.
25.. World Medical Association. World medical association declaration of Helsinki: ethical principles for medical research involving human subjects. *JAMA Am Med Assoc*. 2013;310(20):2191–2194. https://doi.org/10.1001/jama.2013.281053.
26. Reeves S, Pelone F, Harrison R, Goldman J, Zwarenstein M. Interprofessional collaboration to improve professional practice and healthcare outcomes. *Cochrane Database Syst Rev*. 2017;6(6). https://doi.org/10.1002/14651858.CD000072.PUB3.
27. Mcewan D, Ruissen GR, Eys MA, Zumbo BD, Beauchamp MR. The effectiveness of teamwork training on teamwork behaviors and team performance: a systematic review and Meta-analysis of controlled interventions. *PLoS One*. 2017;12(1), e0169604. https://doi.org/10.1371/JOURNAL.PONE.0169604.
28. Wheeler AJ, Scahill S, Hopcroft D, Stapleton H. Reducing medication errors at transitions of care is everyone's business. *Aust Prescr*. 2018;41(3):73–77. https://doi.org/10.18773/AUSTPRESCR.2018.021.
29. Roughead EE, Semple SJ, Rosenfeld E. The extent of medication errors and adverse drug reactions throughout the patient journey in acute care in Australia. *Int J Evid Based Healthc*. 2016;14(3):113–122. https://doi.org/10.1097/XEB.0000000000000075.
30.. Norman K. Enhancing communication within nursing and multiprofessional healthcare teams. *Nurs Stand*. 2024;39(5):61–66. https://doi.org/10.7748/NS.2024.E12270.
31. Gillespie BM, Chaboyer W, Longbottom P, Wallis M. The impact of organisational and individual factors on team communication in surgery: a qualitative study. *Int J Nurs Stud*. 2010;47(6):732–741. https://doi.org/10.1016/j.ijnurstu.2009.11.001.
32. Butler M, Schultz TJ, Halligan P, et al. Hospital nurse-staffing models and patient- and staff-related outcomes (review). *Cochrane Database Syst Rev*. 2019;2019(4). https://doi.org/10.1002/14651858.CD007019.PUB3.
33. De Baetselier E, Van Rompaey B, Dijkstra NE, et al. The NUPHAC-EU framework for nurses role in interprofessional pharmaceutical care: cross-sectional evaluation in europe. *Int J Environ Res Public Health*. 2021;18(15). https://doi.org/10.3390/IJERPH18157862.
34. Gonzalez-Torres MC, Milverton E, Rowtcliff KH. Expanding the role of pharmacy technicians and foundation rotational pharmacists in delivering patient-centred care at a mental health trust: development of a medicines optimisation intervention track tool. *Eur J Hosp Pharm*. 2023;30(4):196–201. https://doi.org/10.1136/EJHPHARM-2021-002767.
35. Summerlin J, Duvall L, Hopton S, Vasko A, Graham A, Mehta BH. Pharmacy technician development: insight into training, preparedness, and career-path perceptions. *J Am Pharm Assoc*. 2003;64(1):120–125. https://doi.org/10.1016/J.JAPH.2023.09.006.
36. Koehler TC, Bok H, Westerman M, Jaarsma D. Developing a competency framework for pharmacy technicians: perspectives from the field. *Res Soc Adm Pharm*. 2019;15(5):514–520. https://doi.org/10.1016/J.SAPHARM.2018.06.017.
37. Coolen E, Engbers R, Draaisma J, Heinen M, Fluit C. The use of SBAR as a structured communication tool in the pediatric non-acute care setting: bridge or barrier for interprofessional collaboration? *J Interprof Care*. 2020. https://doi.org/10.1080/13561820.2020.1816936. Published online November 11, 2020.