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ORIGINAL ARTICLE

'Working outside the box'—an interview study regarding manipulation of medicines with registered nurses and pharmacists at a Swedish paediatric hospital

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Abstract

Aim: Studies on frequencies of manipulated medicines in paediatric care are common, but there is little knowledge of experiences of pharmacists and registered nurses in this area. The aim of this study was to explore registered nurses' and pharmacists' reasoning in the manipulation of medicines to paediatric inpatients.

Methods: Semistructured interviews with twelve registered nurses and seven pharmacists were performed at a Swedish paediatric university hospital. The interviews were transcribed verbatim and analysed using content analysis.

Results: Four major categories emerged from the analysis of the interviews: medicines management, knowledge, consulting others and organisation. Medicines management involved the process of drug handling, which is prescribing, reconstitution or manipulation and administration. Knowledge concerned both the knowledge base and how healthcare personnel seek information. Consulting others involved colleagues, registered nurses and pharmacists, between registered nurses, pharmacists and physicians and between registered nurses, pharmacists and caregivers. Organisation covered documentation, time and working environment.

Conclusion: Both pharmacists and registered nurses stated that manipulation of medicines to paediatric patients was often necessary but felt unsafe due to lack of supporting guidelines. Pharmacists were natural members of the ward team, contributing with specific knowledge about medicines and formulations.

KEYWORDS
alteration of dosage form, medicines, paediatric care, pharmacists, registered nurses

Abbreviation: RN, registered nurse.

1 | BACKGROUND

Manipulation of medicines is common in the paediatric setting, due to lack of child-friendly dosage forms and strengths. Manipulations can be made either to facilitate drug administration or to fragment a dose when the dose of the intact tablet or capsule is too high. Examples of manipulations include the splitting of tablets, crushing and dissolving tablets in liquids, opening capsules and cutting suppositories.[1] Most studies on the manipulation of medicines in the paediatric setting are observational studies for short time periods with results ranging from 10% to 57% of all administrations being manipulated.[2–5] A study conducted in a Swedish paediatric university hospital concluded that there is still a lack of suitable dosage forms and strengths for paediatric patients.[6]

Medicines management involves the entire process of drug handling, that is, prescribing, reconstitution or manipulation and administration. These steps are more complicated in the paediatric setting due to the lack of suitable strengths and dosage forms.[7] There are currently no guidelines on which medicines are safe to manipulate, posing major problems for healthcare personnel, as well as for patients and caregivers.[2,8] Risks with manipulated medicines include incorrect doses resulting in either under or overdosing, altered pharmacokinetics and environmental risks.[9,10] Splitting or crushing tablets may expose bitter taste leading to a potentially negative experience for the child, which may lead to refusal in taking the medicine.[11] Manipulation of medicines not supported by summary of product characteristics or guidelines is regarded as off-label use of medicines, and registered nurses (RNs) can be held legally accountable for negative effects due to such manipulations.[12]

Registered nurses and caregivers are often the ones responsible for the administration of medicines to patients, but the medication handling process involves many different healthcare professionals, for example physicians prescribe, and pharmacists dispense (in some countries on the wards, but in most countries at the pharmacies dispensing prescriptions). In many countries, clinical pharmacists and ward pharmacists are valued and recognised members of the medical team.[13] Due to the complexity of dosage form problems in the paediatric setting, pharmacists can be particularly useful in identifying medication errors.[14–16] Pharmacists reviewing electronically written prescriptions in a paediatric hospital in the Netherlands found dosing errors, as well as problems relating to dosage form, for example a prescription for 9 mg clopidogrel to be administered from a 75-mg tablet.[15]

Registered nurses are trained to follow the rule of the 5Rs when administering medicines: right patient, right drug, right dose, right time and right route. However, it has been argued that this may be insufficient to achieve complete patient safety.[17] In paediatric settings, the right dose can be difficult to achieve from available dosage forms and strengths, requiring further reconstitution and manipulation of the drug, which may still result in an incorrect dose being given.[18] One study found that 55% of paediatric RNs experienced problems with improper dissolution of tablets in liquids and 45% felt that splitting tablets resulted in improper dosing.[11]

Key Notes

- Studies on frequencies of manipulated medicines in paediatric care are common, but there is little knowledge of pharmacists' and registered nurses' experiences.
- Both professions expressed feelings of working outside the box, due to lack of supporting guidelines and suitable dosage forms, and that pharmacists are natural members of the medical team.
- Further research would need to include how physicians experience the manipulation of medicines in paediatric care.

Previous studies described a frequent need to manipulate medicines in paediatric care.[4,8] There are only a few studies describing healthcare professionals' experiences on handling these manipulations in paediatric care.[19,20] The aim of this study was to explore RNs' and pharmacists' reasoning in the manipulation of medicines to paediatric inpatients. To our knowledge, this is the first study to include the experiences of both RNs and pharmacists in a Swedish paediatric setting.

2 | METHOD

2.1 | Design

A qualitative approach was used to gain a deeper exploration of how manipulations of medicines to paediatric patients were perceived by RNs and pharmacists. Information was gathered through individual semistructured interviews with RNs and pharmacists working in paediatric wards.

2.1.1 | Setting

The study was performed in a Swedish paediatric university hospital in Stockholm. The hospital generally admits patients from 0 to 18 years of age and includes specialities such as surgery, orthopaedic, oncology, intensive care, neonatology and acute medicine. At the time of the present study, the paediatric hospital had a capacity of 250 beds and 2000 employees and offered care to approximately 25% of all children in Sweden. In Swedish hospitals, medicines are ordered from the hospital pharmacy in whole drug packages and sent to the wards where they are reconstituted by RNs or ward pharmacists. Ward pharmacists are a relatively new addition to the paediatric medical team and started out as a project at the current paediatric hospital in 2014. Their tasks include reconstitution of drugs, drug ordering, developing routines and guidelines and training RNs in drug handling and reconstitution. As the focus of the present study was manipulation of orally and rectally administered

drugs, the neonatal and intensive care wards were excluded in the selection of RNs for the present study, as these wards mostly handle intravenous medicines. The emergency departments were also excluded as manipulation of medicines is relatively infrequent in these settings.[6]

2.1.2 | Sampling

Interviews were performed Monday to Friday. Consent was obtained from all nursing managers in the included wards. In several cases, the ward pharmacist identified which RNs would be particularly suitable candidates to interview based on the number of medicines their patients had. In other cases, the RNs were selected based on willingness to participate. The interviewer spent 2–3 h with the designated RN, in the medicine room to observe medicine management. These data are not included in this study.

The RNs who participated in interviews were from four different wards treating children of all ages and with a wide range of diagnoses. In total, 13 RNs were asked to participate and 12 accepted, resulting in three RNs per ward.

All seven ward pharmacists working at the paediatric hospital during the study period agreed to participate in the interviews.

2.2 | Data collection

An interview guide was developed as an aid for the interviewer to ask open-ended questions and to allow the interviewer to explore participants' responses further. This tool was pilot-tested twice before being used in the interviews and revised to include questions on risk assessment and communication for the interviews with the pharmacists. The modified guide was pilot-tested once. No further changes were made after the pilot study.

Individual semistructured interviews were performed with RNs from February to March 2020 until saturation was obtained. Saturation was recognised when no new information was being introduced in the interviews and with the repetition of categories.

From October to November 2020, interviews were performed with the ward pharmacists. A paediatric pharmacist (ÅCA) employed by the Paediatric Drug Therapy Group with prior knowledge of paediatric drug management performed all the interviews with RNs as part of her PhD project. The interviewer and the RNs did not have any prior relation before the study. A female pharmacy student (DO) was present at five of the twelve interviews. The ward pharmacists were interviewed by a female pharmacy student (SC), as they were previously known to the PhD student (ÅCA). Neither of the two interviewers had previous experience in interviewing.

The interviews with the RNs took place on the same day as the observations in all cases but two, where it was performed on an adjacent day. The interviews were held in a separate room at or near the wards during the participants' shift. All interviews were recorded as audio files and background data regarding age, working experience and educational level were collected. The interviews lasted 6–23 min, mean 12.5 min, for RNs and 30–60 min, mean 43 min, for pharmacists.

2.3 | Data analysis

All interviews were transcribed verbatim into text files by DO and SC using the web app oTranscribe (MuckRock Foundation, Massachusetts, USA). All transcripts were cross-checked against recordings by the first author. Interview transcripts were read several times to get a sense of the whole and subsequently analysed using manifest qualitative content analysis with an inductive approach[21] by a pharmacist (ÅCA) and an RN (UF).

The condensation of the text into meaning units and codes was performed separately by ÅCA and UF and separately for RNs and pharmacists. The condensation of codes into subcategories and main categories from both professions was made together by ÅCA and UF, going back and forth between the whole and the meaning units several times. All authors discussed the emerging findings until agreement was reached.

2.4 | Ethical consideration

The chosen RNs and pharmacists were informed verbally and in writing, and consent was obtained using a written consent form. All participants were given the option to withdraw from the study for any reason. All transcribed interviews received a number to replace name or initials to protect confidentiality, and quotations were chosen to protect the identity of the individual participant.

This study was approved by the Ethical Review Agency in Uppsala on 1 July 2019 (number: 2019-02811).

3 | RESULTS

All RNs were females with a mean age of 34 years. The highest educational level was a one-year master's or nursing specialist postregistration qualification (advanced educational level), and the basic educational level corresponded to a nursing certificate (undergraduate level) or a bachelor's degree in nursing. Years of working experience ranged from less than a year (8 months) to 23 years. All pharmacists were registered pharmacists with a master's degree and a mean age of 36 years. Background variables regarding age and working experience are shown in Table 1. It should be noted that working experience for pharmacists was in this specific setting, that is a paediatric ward in a Swedish hospital. All pharmacists had some previous working experience either from pharmacies and/or hospital pharmacies.

The condensation of codes into categories and subcategories generated four main categories, with subcategories (Table 2). All categories will be explained in detail and exemplified with participant quotes.

TABLE 1 Demographic data.

	Nurses ($n=12$)	Pharmacists ($n=7$)
	n	*n*
Female	12	7
Age group (years)		
20–30	3	0
30–40	7	6
40–50	2	1
Working experience (years)		
<2	2	1
2–5	2	6
>5–10	5	0
>10	3	0
Educational level		
Basic[a]	7	0
Advanced[b]	5	7

[a]Certificate or Bachelor of Nursing.

[b]Master or specialist postgraduate qualification/registered pharmacist.

TABLE 2 Categories with subcategories.

Categories	Subcategories
Medicines management in paediatric care	Working outside the box
	Strategies to avoid manipulations
	It all comes down to the child
Knowledge of manipulation of medicines	Knowledge base
	Written information
Consulting others	Colleagues
	Registered nurses and pharmacists
	Physicians
	Caregivers
Organisational factors	Time
	Documentation
	Working environment

3.1 | Medicines management in paediatric care

The lack of child-friendly dosage forms and strengths required RNs and pharmacists to work outside the box and develop effective strategies for and alternatives to manipulation or how to manipulate in the most suitable way. In the end, it all came down to the child, what the child would accept and what strategy was suitable for the individual patients.

3.1.1 | Working outside the box

Both RNs and pharmacists expressed that the way they reconstituted and manipulated medicines to be able to administer the prescribed dose to children was not always in accordance with, for example, the summary of product characteristics. They further explained that they did not have any other alternative and were thus required to work without evidence-based recommendations, which was often unnerving.

> You study to become a pharmacist and learn the basics–why a tablet looks the way it does and all ingredients and then you start working in the hospital and you know that this tablet is supposed to be swallowed intact with plenty of water by a patient standing … or sitting. And then you come here, and the children are lying in their beds, they cannot swallow tablets, and we must administer their medicines. That is very much outside the box.
>
> Pharmacist 3

> I wonder how this is going to turn out. It is not completely by the book, you can understand that, but you think I hope it did not cause too much harm.
>
> Nurse 3

Both RNs and pharmacists not only understood that working outside the box may lead to the administered dose differing from the prescribed dose but also expressed that in most cases a slight deviation from the prescribed dose was acceptable.

The RNs mentioned certain situations where the dosing accuracy needed to be more precise, such as in very young children, where the doses are often low and therefore particularly difficult to reconstitute.

> If I dissolve a tablet and then I am supposed to extract the dose from the sludge…
>
> Nurse 10

3.1.2 | Strategies to avoid manipulations

Manipulations were very common due to lack of child-friendly dosage forms. The reasons for manipulations were fractional dosing (taking a lower dose from a tablet or capsule), swallowing difficulties or administration in an enteral feeding tube. Both RNs and pharmacists had strategies to avoid manipulations, such as administering a more suitable strength or changing the dosage form. One manipulation that was no longer part of their daily practice was splitting of suppositories. Instead, RNs rounded off the dose to the nearest whole suppository or combined two suppositories with different strengths. These strategies were sometimes used by the RNs without consulting a pharmacist or physician.

> After nine years of working with children, I now know what works when it comes to giving medicines to children, but when you're new at the job it's really difficult.
>
> Nurse 7

Pharmacists mentioned that there were situations when they could not take responsibility for the prescribed manipulation. Their strategy in these situations was to find alternative dosage forms or alternative medicines such as unlicensed products or extemporaneous preparations. These alternatives were almost always discussed with a physician. In cases where the physician could not consider switching to another product, the pharmacist requested that the physician took responsibility in writing in the electronic health record.

> ... if I wasn't comfortable mixing something...then I don't do it. I always think to myself: Would I be ok with it if this was to be administered to my own child. If I'm not, then I don't want to mix it.
>
> Pharmacist 4

3.1.3 | It all comes down to the child

The individual needs and capabilities of each patient were important factors in deciding how to manipulate medicines. Even when medicines had been manipulated according to individual needs and capabilities, both RNs and pharmacists expressed that the individual child's preferences greatly affected whether the medicine would be accepted or not.

> In the end, it's about whether the child gets their medicine, and if you have to mix it with food or syrup—even if you're not supposed to—then that's what you have to do.
>
> Pharmacist 3

3.2 | Knowledge of manipulation of medicines

Knowledge that was referred to consisted of what each profession had learnt during their education and gaining new knowledge from written information.

3.2.1 | Knowledge base

The RNs expressed that they lacked sufficient knowledge of which medicines were appropriate to manipulate and how to manipulate, which lead to feelings of insecurity. Both RNs and pharmacists acknowledged that pharmacists have specific knowledge regarding medicines, chemistry and dosage forms, and questions relating to these areas were therefore deferred to pharmacists.

> It's hard to find information about which tablets can be split, or whether it's ok to dissolve in liquid or not.
>
> Nurse 2

> ... You look at what kind of substance it is, what is the molecule size, does it look like anything else that I recognise? You can always look up information about the substance and pH-value. There is lots of information around, so I still need to use my pharmaceutical knowledge and think logically.
>
> Pharmacist 3

3.2.2 | Written information

In situations where consulting a colleague was insufficient, various sources of written information sources were used. Information sources used by RNs were mainly paediatric drug instructions,[22] and the Pharmaceutical Specialties in Sweden (FASS). Paediatric drug instructions were a commonly used source of information for intravenous medicines, but few RNs had reflected that there could be instructions for oral medicines. Some RNs expressed feeling that the physician was responsible for the prescription and did not feel it was their responsibility to search for written information.

Pharmacists had knowledge of and access to several additional sources, such as national, and international web pages. Pharmacists more often based their decision to manipulate on the characteristics of the medicine in combination with their knowledge and available sources.

> As a pharmacist it is easier to find out information. I know where to look, but if you ask one of my nursing colleagues, they will say that it is pretty hard to understand whether they can or cannot manipulate a medicine. Because the information they have access to isn't the same [as the information I have].
>
> Pharmacist 1

3.3 | Consulting others

3.3.1 | Colleagues

Asking a colleague was a common way of finding information, so was consultation between RNs and pharmacists, between RNs, pharmacists and physicians, as well as with caregivers.

RNs often asked a senior colleague present at the same shift about medicine management. Pharmacists had access to networks on local, national and international levels. Furthermore, pharmacists had access to online discussion groups specialised into, for example, paediatric oncology or neonatal care.

> I ask colleagues that are familiar with or know about how this could be done.
>
> Nurse 9

3.3.2 | Registered nurses and pharmacists

Interactions between pharmacists and RNs occurred naturally and frequently on the wards and in the medicine dispensing room. They referred to each other as colleagues. Pharmacists had an educational role in the interactions and were frequently consulted by the RNs regarding compatibility and divisibility. Pharmacists also instructed new RNs on medicines management on the wards.

Pharmacists expressed that they were conscious of how they spoke to RNs, as their presence could be intimidating and perceived as if they were controlling what RNs were doing. Registered nurses expressed a feeling of safety when the pharmacist was present on the ward, which was acknowledged by the pharmacists.

> I was just passing through my regular ward one day to collect something when I was spotted by a nurse who expressed she just felt safe from seeing me there. It made me think about what an important role we have on the wards as pharmacists.
>
> Pharmacist 2

3.3.3 | Physicians

Both RNs and pharmacists expressed that they would appreciate more frequent interaction with physicians concerning medicines management and that this was prevented by the physician not always being present on the wards. Registered nurses consulted their colleagues and pharmacists more often than physicians, as they thought that pharmacists had better knowledge of manipulations of medicines than physicians.

> It varies, there are physicians who consult the pharmacist on what to do, and other physicians who just prescribe without thinking it through. In these situations, we have a role in supporting the nurses on what to do.
>
> Pharmacist 2

Both pharmacists and RNs stated that there is a difference between physicians' knowledge of medicines management, where senior physicians were more likely to ask questions or write instructions on how to manipulate or handle a certain medicine. Pharmacists also expressed that they felt more comfortable interacting with more senior physicians compared to those with less experience.

Compared with the interactions between RNs and pharmacists, the interactions between pharmacists and physicians were more infrequent, and no regular meetings were held to facilitate the transfer of knowledge and information between the professions.

> To try to make them [physicians] understand that they need to change a prescription to something appropriate, would take too long, and they would never do that. It's not worth it—It's not my hill to die on.
>
> Pharmacist 4

3.3.4 | Caregivers

Both pharmacists and RNs stated that caregivers were an important source of information for understanding what works best for their children. The interaction with caregivers sometimes revealed incorrect handling, but if it did not affect the desired effect of the treatment, this was overlooked. Pharmacists' interactions with caregivers were to teach them how to handle and administer medicines at home. Some pharmacists stated that they did not have as much interaction with caregivers as they would have liked to.

> Then I often ask how they do it themselves, because then they will get approximately the same dose as at home, assuming it has worked at home.
>
> Nurse 5

> I don't have any contact with caregivers at all which is a pity because I think it adds value, especially in children with multiple diagnoses and many medicines upon discharge. Perhaps it would be better that a pharmacist check the medicines with the parents instead of the nurse.
>
> Pharmacist 5

3.4 | Organisational factors

The category organisational factors consist of three subcategories: time, documentation and working environment, which are important components ensuring the safety of medicines management and manipulations.

3.4.1 | Time

Lack of time was often expressed by RNs as a complicating factor in the safe and effective medicine management. The pharmacists generally had more time to either check for and collect an alternative medicine within the hospital, reconstitute a medicine or document instructions on manipulations in the patients' electronic health record.

> The pharmacist is an amazing help. If I'm working a night or evening shift, I don't always have time to make those calls to the other wards myself.
>
> Nurse 5

Pharmacists expressed that they did not have time to participate in the clinical ward rounds as they usually occurred at the same time as they were needed in the medicine dispensing room. They expressed that their expertise could be put to better use if they were present on the ward rounds to assist physicians with ordering drugs, rather than solve potential problems or medication errors later.

3.4.2 | Documentation

Documentation of manipulation of medicines was considered important, but routines on what should be documented, when, and where, were lacking. Documentation of manipulation was not prioritised by RNs when the workload was too high, even though the information was considered important. Pharmacists and RNs rarely documented when the manipulation was made according to one of the sources of information (paediatric drug instructions or summary of product characteristics). When pharmacists manipulated in an unusual or new way, they expressed that they were careful to document this in the electronic health record and sometimes informed all RNs.

3.4.3 | Working environment

The medication dispensing rooms were the main working areas for the pharmacists. It was mentioned that these rooms were not designed for reconstitution of medicines and thus unsuitable for this purpose. Pharmacists raised concerns around unsafe working environment and were more concerned than RNs and physicians about safety and the risk of exposure when reconstituting and manipulating medicines though RNs working at the children's oncology ward expressed concerns regarding the manipulation of cytotoxic drugs.

> … in certain circumstances we even split cytotoxic tablets which is a bit of big no no, but … we try to at least have a separate tablet splitter for those tablets.
>
> Nurse 1

> I always feel that I put myself at risk while I am preparing medication. Always.
>
> Pharmacist 7

4 | DISCUSSION

This study highlighted both similarities and differences in the way that RNs and pharmacists reasoned around manipulation of medicines in the paediatric inpatient setting. Both RNs and pharmacists expressed feeling that they are working outside the box, due to lack of supporting guidelines and suitable dosage forms and that it all came down to what the children accept. Registered nurses expressed that organisational factors such as lack of time contributed to a suboptimal medicines management and pharmacists expressed concerns about their working environment. These results are similar to other studies in the paediatric setting and suggest that the collaboration between different healthcare professions is important and that patient-related factors are particularly important in the paediatric setting.[19,20]

There are relatively few studies regarding RNs' and physicians' views of manipulations in the paediatric setting, but there are systematic reviews regarding manipulations of medicines in the adult and geriatric setting.[23,24] The paediatric and geriatric settings are in many ways similar, with manipulation often being performed by healthcare professionals or caregivers, both to facilitate swallowing and to fragment doses. A qualitative study with RNs working in geriatric care stated that modifying dosage forms was part of the daily practice. One of the resulting categories called Modifying—a necessary evil, which included feelings of being unsafe relating to, for example, dosing accuracy, and working environment.[25] The RNs working in the geriatric setting expressed similar concerns to the participants of the present study. In both the paediatric and geriatric setting, the individual needs of the patient must be considered in the decision around manipulation.

Swedish RNs and pharmacists are not formally trained in manipulation of medicines during their education as most medicines are designed to be given intact. Information regarding manipulation is lacking in official sources of information, resulting in a knowledge and information gap. Both RNs and pharmacists expressed the importance of the paediatric drug instructions[22] in their daily routine. These instructions are national evidence-based instructions with information about, for example, reconstitution of medicines, normal dosages and administration instructions. When the interviews were conducted in 2020, there were instructions available for intravenous drugs, but few for oral drugs. Since 2020, more focus has been placed on producing drug instructions for oral drugs as well and to include information on the appropriateness of manipulation of different tablets and capsules.[22]

The main difference in the curricula between pharmacists and RNs is that all subjects are related to medicines in some way for pharmacists but it is only part of a much broader training for RNs. In an ethnographic study at a paediatric hospital, pharmacists were considered experts and an important source for medicine information for both RNs and physicians.[16] Furthermore, pharmacists felt that the longer they had been working on a specific ward, the more they were consulted by other professions. They also expressed that it was easier to interact with physicians on their own ward compared with physicians working on other wards. It is important that physicians are aware of the consequences of manipulating medicines and that they make well-informed decisions about the best way to prescribe the intended dose.[26] These findings are confirmed in our study and illustrate that trust and respect between individuals and different professions are important factors for effective interaction regarding medicines management.

As concluded in other studies, pharmacists should be closely involved in the ward team and should take part in decision-making concerning manipulation of medicines.[14,27,28]

Both RNs and pharmacists stated that checking with the caregivers how they handled medicines at home was important to increase the likelihood that the patient would take the medicines. Intellectually disabled paediatric patients are a group where manipulated medicines are frequently used and individually tailored strategies can be particularly helpful.[29] Parents with intellectually

disabled children expressed great difficulty in administering medicines to their children and expressed the need for more guidance from healthcare professionals. In the present study, RNs were the primary source of information and education to caregivers concerning medicines management before discharge. The pharmacists who participated in the present study expressed that they would like to interact with caregivers to a greater extent and to be more involved in the information given to caregivers about medicines upon discharge. Based on the findings from this study and others, dialogues between RNs, physicians and pharmacists regarding which profession that is best suited to discuss, inform and educate patients and caregivers on medicine management should be a routine. The pharmacists in the present study expressed that they wanted to take part in the clinical ward rounds and to consult clinicians when prescribing, instead of correcting prescriptions afterwards. Dialogues concerning medicines management and especially manipulations should be a natural part of the clinical ward rounds. Lack of documentation around manipulation is not specific for this study; approximately 70% of the manipulations in nursing homes were not documented in the electronic patient record.[30] The lack of documentation regarding manipulated medicines and patient's preferences may compromise patient safety and the effectiveness of treatments and is an area for future quality improvement and research.

Both RNs and ward pharmacists on several wards were interviewed, using a semistructured interview guide which allowed the participants to speak freely. All RNs included in this study worked on wards where a ward pharmacist had been employed for at least 2 years. The nature of the interviews focusses on the subjective experiences of the participants enrolled, and it is likely that this greatly influences the data presented and that other perspectives would have been presented if other RNs and pharmacists were included. The number of ward pharmacists employed at the hospital at the time of the study was also limited. However, no new information or categories were introduced in the last interviews for neither RNs nor pharmacists.

Another limitation of the study could be that all interviews were performed by either a pharmacist or a pharmacy student. The interviews with pharmacists were longer, which could be due to the revised interview guide for pharmacists which included additional questions. It may also be due to differences in preunderstanding between the experienced paediatric pharmacist (ÅCA) who performed the interviews with the RNs and the pharmacy student (SC) performing the interviews with the pharmacists. ÅCA had prior knowledge of the paediatric setting, and the medicine management routines, unlike SC, for whom the setting was completely new.

In Swedish hospitals, most medicines are reconstituted on the wards, so the transferability to settings where already prepared medicines for the individual patients are delivered to wards should be done with caution. Further studies regarding manipulations of medicines in paediatric care should include physicians as they were not included in this study.

5 | CONCLUSION

Developing evidence-based guidelines to support manipulation of medicines would support healthcare professionals and caregivers and would enhance patient safety. When considering the methods of manipulation, the individual needs of the patient must be considered. Pharmacists with their specialised knowledge about medicines are natural members of the paediatric multidisciplinary team.

AUTHOR CONTRIBUTIONS

Åsa Cecilia Andersson: Conceptualization; formal analysis; investigation; methodology; project administration; validation; writing – original draft; writing – review and editing. **Synnöve Lindemalm:** Conceptualization; methodology; project administration; resources; supervision; writing – review and editing. **Dilba Onatli:** Data curation; formal analysis; writing – review and editing. **Samia Chowdhury:** Data curation; formal analysis; writing – review and editing. **Staffan Eksborg:** Conceptualization; methodology; project administration; supervision; writing – review and editing. **Ulrika Förberg:** Conceptualization; formal analysis; methodology; project administration; supervision; validation; writing – original draft; writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest.

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