CHAPTER 17

We Are No Better Than the Weakest Link: Nurses' Experiences With Medication Management in Primary Healthcare

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Abstract: Today patients are discharged earlier from hospital, and consequently, an increasing number of seriously ill patients are being followed up by the primary healthcare services, and use various medications. Errors in pharmaceutical treatment, which cause deaths and adverse events, are among the errors most frequently reported. In this study, we explored experience, competence and competence needs related to medication management among nurses in primary healthcare. One hundred and ten nurses working in four municipalities in southeastern Norway were invited to fill in a paper-based questionnaire, and 87 responded (79%). Bivariate and cross-table analyses were performed.

Of these, 84% considered their medication management competence to be good or very good, but 70% of the nurses did not feel confident about drug interaction, and 45% were not confident about the effects and side effects of medication. Further, 55% had administered medication incorrectly or to the wrong patient (35%). The most common adverse event was to administer medication at the wrong time. The most common way to update one's knowledge was by reading the Norwegian Pharmaceutical Product Compendium (95%), and through dialogue with colleagues and doctors (94%). Most of the nurses (75%–85%) expressed a need for more knowledge. There was little difference between nurses working in home nursing care and in nursing homes. Despite reporting a low incidence of errors, few

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nurses have taken part in formal training after qualifying. Our findings indicate a special need for structural measures to increase nurses' competence related to medication and medication management in primary healthcare.

Keywords: Nursing, competency, medication management, medication administration, primary healthcare services

Background

Since the coordination reform (St.meld. nr. 47, 2008–2009), patients are discharged from hospital sooner, and the primary healthcare services are given greater responsibility for health and care services. The increased responsibility for treatment, and the increasing proportion of patients who are seriously ill, place heavy demands on the knowledge and skills of nurses in the primary healthcare services (Bing-Jonsson et al., 2015; Norheim & Thoresen, 2015; Tyrholm et al., 2015). Many elderly patients have comorbidity and use multiple medications. This increases the risk of medication errors, side effects and unfortunate drug interactions (Storli et al., 2016). Focus on safety and proper use of medication is important to the health of elderly people, and has a bearing on their quality of life (Romskaug et al., 2020).

The World Health Organization (2017) has defined medication safety as a global patient safety challenge. Incorrect use of medication can put life, health, and quality of life at risk. Patient safety is about protection against unnecessary injury as a result of the services performed by the healthcare service, or their failure to provide services (World Health Organization, 2017). The Norwegian patient safety program, "In Safe Hands", puts particular emphasis on the importance of safe medication management to avoid harm to patients (Norwegian Directorate of Health, 2019). Medication errors in hospitals is one of the error categories most commonly reported to the Norwegian Board of Health Supervision, and errors in double-checking are often cited as an important factor (Norwegian Directorate of Health, 2018). In Norway, 190 deaths and 160,000 adverse patient events are caused by medication every year (Olsen & Devik, 2016).

Regulations for medication management for healthcare organizations and personnel are intended to ensure appropriate and good medication management, and they stipulate professional responsibility requirements for all who provide healthcare (Helse- og omsorgsdepartementet, 2014). A survey conducted in 2019 by the Norwegian Nurses Organization showed that three out of ten nurses, on a weekly basis, are afraid of making a mistake that could harm a patient, and they link this to heavy workloads and inadequate training, among other factors (Helmers, 2019). A Belgian cross-sectional study found that nurses experience several barriers to safe medication management in nursing homes (Dilles et al., 2011). A recent systematic review that focused on identifying methods for measuring and describing nurses' medication administration skills found that medication management requires complex competence (Luokkamäki et al., 2021). The review highlights the need to address and develop nurses' competence in this field, and safe medication administration was defined as comprising nine areas: (1) safe ordering, handling, storing, and discarding of medications; (2) preparing of medications; (3) the administration of medications to patients; (4) documentation; (5) evaluation and assessment of medication-related issues; (6) drug calculation skills; (7) cooperation with other professionals; and (8) with the patients; and (9) reporting of medication information.

Medication management is one of the key responsibilities of nurses. However, research shows that nurses lack knowledge of how to administer medication (Hagesæter et al., 2016; O'Shea, 1999; Simonsen et al., 2011), and Johansen (2019) points out that nurses' knowledge of generic substitution is also inadequate. Inadequate mathematical knowledge is one of the factors linked to medication errors (O'Shea, 1999; Sulosaari et al., 2010). An integrative review by Kerari and Innab (2021) provides strong evidence that occurrences of medication errors are directly associated with level of education, training courses and extent of experience. In a qualitative systematic review Schroers et al. (2021) found that fatigue and complacency were personal factors described as reasons for medication errors, while knowledge factors related to lack of medication knowledge. Two smaller Norwegian studies also suggest the same thing. Wannebo and Sagmo (2013) found that nurses have a great need for

more knowledge on age-related physiological changes and pharmacology. Måløy et al. (2017) found that, among a sample of 262 nurses, 30% rarely or never read medical literature, and half have never attended a course or taken further education.

A review by Brady et al. (2009) pointed out the importance of management responsibility for systems of reporting and follow-ups of pharmaceutical treatment, in addition to the importance of the nurses' individual mathematical skills. Andreassen et al. (2011) found that there is little focus on drug calculation in practice. Schroers et al. (2021) emphasize the importance of contextual factors in medication administration, which are often underlying personal and knowledge-based factors. Contextual factors involve workload, interruptions, poor communication, lack of support, physical working conditions, and unsafe practice norms. There is little systematic competence building in the field of practice, and according to Storli et al. (2016), medication management training is not taken sufficiently seriously in the Norwegian context.

Nurses working in primary healthcare have a great responsibility for medication management, but we do not know enough about how they characterize their experience, competence, and competence needs relating to medication management. The aim of this chapter was to study nurses' experience of medication management in nursing homes and home nursing care, and how they perceive their own medication management practices. We asked the following research questions:

- How do nurses, working in nursing homes and home nursing care, rate their own knowledge and competence in the field of medication management?
- How do nurses update their own knowledge, and what training do they think they need?
- How well do nurses in nursing homes and home nursing care know the medication management procedures in their own workplace?
- Are there differences in knowledge, knowledge needs and knowledge of medication management procedures, which depend on the nurses' experience and on whether they work in a nursing home or in home-based services?

Method

Questionnaire

We conducted a quantitative questionnaire survey in order to obtain answers to our questions. We could not find a suitable questionnaire, so we developed one with seven background questions (part I), and 16 questions about medication management (part II). The background questions came with pre-defined answer alternatives with variables for place of work, experience, percentage of a full-time position, further education, and gender. Respondents could answer the question on further education in their own words. Part II consisted of questions about the experience of making errors, understanding the doctors' prescription, handling of non-conformities, and medication management procedures. Four questions focused on how confident nurses felt, their knowledge needs, and updating of their own knowledge. Fifteen of the questions had fixed responses, but the question about how nurses update their knowledge was open to answer in their own words. See the enclosed questionnaire for details (Appendix 1).

Recruitment

We approached the heads of eight entities, four in home-based services (home nursing care) and four in nursing homes, in four municipalities in eastern Norway, with information about the study. They all approved our request for participation. The criterion for participating was that the entity employed authorized general nurses in full-time or part-time positions. The entities in question employed a total of 110 nurses who met the inclusion criteria. The questionnaires were distributed to the institutions around the turn of the year 2017–2018. Eighty-seven completed questionnaires were returned (79%).

Ethics

The nurses received an information letter describing the objective of the study, accompanied by the questionnaire and anonymous envelopes to

submit their responses. They were informed that participation was voluntary and that their responses would be anonymous. Since the study was anonymous and did not involve processing personal data, the Norwegian Centre for Research Data (NSD) was not notified. The municipalities and institutions in the study are anonymized. In addition, as very few nurses in the sample and in nursing in general are male, we eliminated gender in the analysis to protect informants' identity. The questionnaire was paper-based, and nurses consented to taking part by completing the questionnaire and submitting it in a sealed envelope in a pigeonhole in the department.

Statistical Analysis

The data were analyzed using SPSS version 24.0. The transfer of data from the completed questionnaire forms to the data matrix was checked by a third party. Univariate analysis was used, and the variables were presented as frequencies and percentages. Bivariate analysis with contingency tables was used to identify relationships between variables. Among other things, we looked at whether self-reported practice, knowledge and skills depended on the nurses' place of work and work experience (practice, knowledge and skills as dependent variables). We made dummy variables for questions one and 14 in part II, where we assigned the value 0 to "Never" and the value 1 to the answers "1–4 times" and "more than 5 times" for question one. For question 14, we assigned the value 0 to "Yes" and 1 to "No" and "Uncertain". All the significance tests are two-sided, and $p \leq 0.05$ was considered significant. We used Pearson's chi-square test to test the significance level. Some cells where we found significant differences had the value 0, and they were checked using Fisher's test. This test produced the same result as the chi-square test, $p < 0.005$.

Results

Of the nurses in our sample, 56.3% were working in nursing homes, 81.6% were working in rotating shifts, and 88.5% were employed in more than 60% of a full-time position (Table 1). The proportion who had less than

4 years' work experience was 35.6% overall, with a somewhat higher percentage in home nursing care than in nursing homes. Of the nurses who worked in nursing homes, 28.6% had taken further education, while the corresponding percentage for those in home nursing care was only 10.5%.

Table 1. The sample with the number (percentage) who responded in different categories and with the given significance level (p value) and calculation of effect size (Cramer's V) for the correlation between the sample's workplace and the relevant variables

		Total (N = 87)	Nursing home N = 49 (56.3%)	Home nursing N = 38 (43.7%)	p values[a]	Cramer's V
Years of work experience	0–4 years	31 (35.6%)	15 (30.6%)	16 (42.1%)	0.420	0.18
	5–10 years	21 (24.1%)	11 (22.5%)	10 (26.3%)		
	11–15 years	17 (19.5%)	10 (20.4%)	7 (18.4%)		
	16 years or more	18 (20.7%)	13 (26.5%)	5 (13.2%)		
Further education		18 (20.7%)	14 (28.6%)	4 (10.5%) (sig. diff.)	0.060[b]	0.22
Percentage of full-time position	21–40%	3 (3.4%)	2 (4.0%)	1 (2.6%)	0.046[c]	0.23
	41–60%	7 (8.0%)	6 (12.3%)	1 (2.6%)		
	61–80%	19 (21.8%)	12 (24.5%)	7 (18.4%)		
	81–100%	58 (66.7%)	29 (59.2%)	29 (76.4%)		
Rotating shifts	No rotating shifts	16 (18.4%)	11 (22.4%)	5 (13.2%)	0.010	0.32
	Two-shift system	63 (72.4%)	30 (61.3%)	33 (86.8%)		
	Three-shift system	8 (9.2%)	8 (16.3%)	–		

[a]The two-sided chi-square test is used unless otherwise specified.
[b]Fisher's exact test is used.
[c]The chi-square test was performed on the binary outcome 100% or not 100% of a full-time position. This was done because the high number of cells with few answers posed a problem.

We found a significant correlation between place of work (nursing home or home nursing) and percentage of a full-time position ($p = 0.046$) and rotating shifts ($p = 0.010$), respectively, and the power of both these correlations was moderate with Cramer's V of 0.23 and 0.32, respectively. The correlation between place of work and further education was almost significant ($p = 0.060$), and the power of the correlation was moderate

(Cramer's V = 0.23). We found no statistically significant relationship between place of work and years of work experience (p = 0.420).

Table 2. How Informants Update Their Knowledge of Medication

	Place of work		Experience	
	Nursing home (N = 49)	**Home nursing (N = 38)**	**0–4 years' experience (N = 31)**	**More than 5 years' experience (N = 56)**
Norwegian Pharmaceutical Product Compendium	47 (95.9%)	36 (94.7%)	29 (93.5%)	54 (96.4%)
Conversations with colleagues	46 (93.9%)	36 (94.7%)	28 (90.3%)	54 (96.4%)
Contact with doctors	36 (73.5%)	28 (73.7%)	21 (67.7%)	43 (76.8%)
Specialist literature	26 (53.1%)	21 (55.3%)	17 (54.8%)	30 (53.6%)
Professional meetings	8 (16.3%)	9 (23.7%)	4 (12.9%)	13 (23.2%)
In-house courses	12 (24.5%)	12 (31.6%)	5 (16.1%)	19 (33.9%)
External courses	12 (24.5%)	7 (18.4%)	5 (16.1%)	14 (25%)
Further education	4 (8.2%)	3 (7.9%)	2 (6.5%)	5 (8.9%)

Furthermore, 96% of nurses updated their knowledge of medication by reading the Norwegian Pharmaceutical Product Compendium, and 94% did so through conversations with colleagues (Table 2). Contact with doctors was mentioned by 73.5%, and 53% read specialist literature to keep up to date. Experienced nurses and those employed in home nursing care cited professional meetings as a source of knowledge update to a greater extent than nurses working in nursing homes.

When asked how they rated their own medication management skills, 46% of the nurses responded that they were good, 38% that they were very good, and only 3% that they were fair. The nurses' practice and knowledge of medication management procedures are shown in Table 3. This shows that 34% have given medication to the wrong patient, and 34.7% of nurses in nursing homes and 39.5% of nurses in home nursing care have administered an incorrect dose. Only one nurse reported having administered medication that caused harm to a patient, while 30.6% in nursing homes and 28.9% in home nursing care stated that they have administered medication that had unexpected side effects. As many as 79.6% of nurses working in nursing homes and 76.3% of nurses in home nursing

Table 3. Self-reported practice and knowledge of medication management procedures by place of work

Background variable	Nursing home N = 49			Home nursing N = 38			Pearson's chi square
	Yes (%)	No (%)	Don't know (%)	Yes (%)	No (%)	Don't know (%)	Significance
Self-reported practice							
Have you at any time in your career:							
Administered an incorrect dose of medication	17 (34.7)	32 (65.3)	–	15 (39.5)	23 (60.5)	–	0.498
Administered medication incorrectly	29 (59.2)	20 (40.8)	–	19 (50)	19 (50)	–	0.694
Administered medication to the wrong patient	17 (34.7)	32 (65.3)	–	13 (34.2)	25 (65.8)	–	0.962
Administered medication at the wrong time	39 (79.6)	10 (20.4)	–	29 (76.3)	9 (23.7)	–	0.714
Administered medication that had an unexpected effect/side effect	15 (30.6)	24 (69.4)	–	11 (28.9)	27 (71.1)	–	0.933
Made a mistake that caused harm to a patient	0 (0)	49 (98.0)	1 (2)	1 (2.6)	33 (86.8)	4 (10.5)	0.119
Administered medication without the patient's consent	29 (59.2)	29 (49.8)	0	13 (34.2)	23 (60.5)	2 (5.3)	0.030*
Disagreed with the doctor's prescription and contacted another doctor	20 (40.8)	29 (59.2)	0	19 (50)	19 (50)	0	0.393
Are pill organizers double-checked?	47 (95.9)	1 (2)	1 (2)	37 (97.4)	1 (2.6)	0	0.666
Knowledge of medication management procedures							
Are procedures for reporting non-conformities in place in your workplace?	43 (87.8)	5 (10.2)	1 (2)	33 (86.8)	3 (7.9)	2 (5.3)	0.680
Have you ever reported a medication-related non-conformity?	42 (85.7)	7 (14.3)	0	35 (92.1)	3 (7.9)	0	0.254
Are you familiar with your place of work's medication management guidelines?	47 (95.9)	2 (4.1)	0	36 (94.8)	1 (2.6)	1 (2.6)	0.491
Do you know who is responsible for medication management at your place of work?	36 (73.5)	8 (16.3)	5 (10.2)	34 (89.5)	0	4 (10.4)	0.032*
Are you aware of the narcotic drugs inventory frequency?	49 (100)	0	0	27 (71.1)	7 (18.4)	4 (10.5)	0.000*
Do you know who the advisory pharmacist is?	16 (32.7)	31 (63.2)	2 (4.1)	22 (57.9)	14 (36.8)	2 (2.3)	0.048*

care had administered medication at the wrong time. In addition, 87% of nurses stated that they were familiar with non-conformity procedures and division of responsibility, while 85.7% of nurses in nursing homes and 92.1% of nurses in home nursing care had reported non-conformities. There were no significant differences associated with place of work in these areas. Of the nurses working in nursing homes, 59.2% had administered medication without the patient's consent, a significantly higher percentage than in home nursing care (34.2%)

In nursing homes, 33% of nurses knew who the advisory pharmacist was, compared to 58% in home nursing care (Table 3). Corresponding figures for whether they knew who was responsible for medication management were 73.5% and 89.5%, respectively. In both these areas, nurses working in home nursing care knew significantly more than those working in nursing homes. The opposite was true of knowledge of the narcotic drugs inventory frequency. Significantly more nurses in nursing homes (100%) possess this knowledge compared to those working in home nursing care (71%).

Table 4 shows how nurses regard their knowledge and skills, when asked about how confident they were about their different skills, and what they needed more knowledge about. When asked whether they were confident about their own skills, 89.8% of nurses in nursing homes and 84.2% of nurses in home nursing care responded that they felt confident about the use of generic medications. There were similarly high figures for the question on whether the nurses were confident about the rules and procedures relating to expiry dates and documentation. As regards drug calculation, 83.7% of nurses in nursing homes and 78.9% of nurses in home nursing care stated that they were confident. However, 45% and 42% replied that they were not confident when it came to the effects and side effects of medication, and about 70% of nurses in both nursing homes and home nursing care stated that they were not confident about drug interactions. There was a significant difference for place of work in the responses to the question about procedures for changing the form of medication, as 83.7% of nurses in nursing homes felt confident, while the same was true of only 60.5% in home nursing care.

Table 4. Self-reporting and knowledge and skills by place of work

	Nursing home (N = 49) (n = %)		Home nursing care (N = 38) (n = %)		Pearson's chi square
	Yes (%)	No/Don't know (%)	Yes (%)	No/Don't know (%)	Significance
Knowledge					
Are you confident when it comes to ...?					
Using the Norwegian Pharmaceutical Product Compendium	46 (93.9)	3 (6.1)	37 (97.4)	1 (1.1)	0.441
Drug calculation	41 (83.7)	8 (16.3)	30 (78.9)	8 (9.2)	0.573
The effects and side effects of different medications	27 (55.1)	22 (44.9)	22 (57.9)	16 (42.1)	0.794
Medication dosage	45 (91.8)	4 (8.2)	36 (94.7)	2 (5.3)	0.596
Drug interactions	14 (28.6)	35 (71.4)	12 (31.6)	26 (68.4)	0.761
Administering generic medications	44 (89.8)	5 (10.2)	32 (84.2)	6 (15.8)	0.437
Procedures for changing the form of medication	41 (83.7)	8 (16.3)	23 (60.5)	15 (39.5)	0.015*
Rules for storage of medication	44 (89.8)	5 (10.2)	32 (84.2)	6 (15.8)	0.437
Rules and procedures relating to expiry dates	44 (89.8)	5 (5.7)	35 (92.1)	3 (7.9)	0.712
Rules and procedures relating to documentation	45 (91.8)	4 (8.2)	33 (86.8)	5 (13.2)	0.448
Need for knowledge	**Nursing home (N = 49) (n = %)**			**Home nursing care (N = 38) (n = %)**	
I need more knowledge about:	**Yes (%)**	**No (%)**	**Don't know (%)**	**Yes (%)**	**No (%)**	**Don't know (%)**	**Significance**
Age-related physiological changes and pharmaceutical treatment	41 (83.7%)	6 (12.2%)	2 (4.1%)	33 (86.8%)	4 (10.5%)	1 (1.1%)	0.900
General pharmacology	36 (73.5%)	11 (22.4%)	2 (4.1%)	29 (76.3%)	7 (18.4%)	1 (2.3%)	0.880
Medication's side effects and mechanisms of action	39 (79%)	9 (18.4%)	1 (2%)	30 (78.9%)	7 (18.4%)	1 (2.6%)	0.983
Different forms of medication	21 (42.9%)	25 (51%)	3 (6.1%)	18 (47.4%)	19 (50%)	1 (2.6%)	0.716
Routes of administration	18 (36.7%)	29 (59.2%)	2 (4.1%)	15 (39.5%)	21 55.3%)	2 (2.3%)	0.921
Drug calculation	19 (38.8%)	28 (57.1%)	2 (4.1%)	16 (42.1%)	19 (50%)	3 (7.9%)	0.669
The Norwegian Pharmaceutical Product Compendium	6 (12.3%)	42 (85.7%)	1 (2%)	10 (26.3%)	26 68.4%)	2 (5.3%)	0.152

When asked about their need for more knowledge, 83.7% in nursing homes and 86.8% in home nursing care stated that they needed more knowledge about age-related physiological changes and medication. More knowledge about general pharmacology was needed by 73.5% of nurses in nursing homes and 76.3% in home nursing care, while 79% in both groups needed more knowledge about medication side effects and mechanisms of action. More knowledge about different forms of medication was needed by 42.9% of nurses in nursing homes and 47.4% in home nursing care, while 36.9% and 39.5%, respectively, needed more knowledge about their routes of administration. The need for more knowledge about the Norwegian Pharmaceutical Product Compendium was reported by 12.3% of nurses in nursing homes and 26.3% of nurses in home nursing care. There was no difference between nursing homes and home nursing care in the nurses' need for knowledge.

Discussion

The findings of this study show that the vast majority of nurses in primary healthcare services deem their own medicine management competence to be good or very good. Nearly half of them state that they are not confident about the effects and side effects of medication, and two out of three state that they do not feel confident about drug interactions. The most important sources of knowledge are use of the Norwegian Pharmaceutical Product Compendium (*Felleskatalogen*) and dialogue with colleagues and doctors. The percentage of nurses who have attended formalized training courses appears to be somewhat higher among nurses who have been working for more than five years. However, the differences were not statistically significant. Few nurses have made serious medication errors that have harmed a patient. Generally speaking, the most commonly reported error relates to the time of administration. Half of the nurses had administered medication incorrectly or to the wrong patient. As regards competence-raising needs, a majority state that they need more knowledge, particularly about age-related physiological changes and pharmaceutical treatment, general pharmacology, side effects, and mechanisms of action. Half of the nurses call for more

knowledge about different forms of medication, routes of administration and drug calculation.

There is little difference between nurses working in home nursing care and in nursing homes, but a significantly higher percentage of nurses in nursing homes have further education and longer work experience. When it comes to medication procedures, nurses in nursing homes are more familiar with the advisory pharmacist scheme and narcotic drugs records. However, nurses in home nursing care know more about the division of responsibility for medication management. The majority of nurses who took part in the study were familiar with the non-conformity reporting system and have reported non-conformities.

The differences in medication practices between nursing homes and home nursing care could be related to differences between their respective fields of practice. Nurses in nursing homes work within a single institution, and probably have more routine work practices and a common system for all patients. In home-based services, the patients live at home, and many use the multi-dose packaging system and are more involved in organizing their own medication. Nurses are further away and have less opportunity to observe their patients than in nursing homes, for example when it comes to effects and side effects of medication. This could explain why nurses in home nursing care have not administered medication without the patient's consent. The community nurses have to address any questions to the individual patient's regular GP in the municipality, and this can be assumed to raise their awareness of responsibility. This could be one explanation for why the study showed that community nurses were more aware of the division of responsibility.

Otherwise, the differences between nurses working in home-based services and nursing homes were minor, but both groups express a need for more competence when it comes to drug interactions. It also appeared that a majority of nurses in home nursing care felt less confident about changing forms of medication. This can be interpreted in line with Johansen (2019), a study on the use of substitution lists among nurses working in hospitals, where the nurses were found to have inadequate knowledge of generic substitution. The vast majority of nurses in our study rank their overall medication management skills as good or very

good, while they also want to raise their competence. This finding agrees with Norheim and Thoresen (2015), who interviewed nurses working in home nursing care, in relation to competence in more general terms. They found that the nurses felt that they had the competence they needed to deal with the challenges that arose, while nevertheless describing their competence as inadequate and expressing a wish to improve it. The fact that nurses generally feel competent, but still wish for increased knowledge and competency may be understood as an indication of the nurses' professional responsibility.

Based on Johansen's (2019) study on generic substitution and nurses' lack of insight into their own inadequate competence, it is important to question whether the knowledge and competence reported by the nurses themselves are representative of their actual medication management competence. It is common for nurses to work alone, both in nursing homes and in home nursing care. This offers few opportunities for discussion, guidance and feedback from colleagues if needed, because the nurses do not see each other in relevant work situations, which is also described by Schroers et al. (2021). Bjørk (1999) demonstrated how weak professional practices become routine for newly qualified nurses precisely because they perform the procedures alone, with no one to discuss them with. If nurses are unaware that they lack competence or do things incorrectly, this could contribute to incorrect practices continuing if they remain undetected.

In our study, nurses reported that they feel confident performing most tasks relating to medication management, at the same time as they need more knowledge in major areas such as general pharmacology and age-related changes. Nurses have a responsibility as healthcare personnel to keep up to date professionally, and it is reassuring that the nurses state that they need more competence. At the same time, only half of them report reading medical literature to keep up to date. This is slightly higher than in the study by Måløy et al. (2017), in which the figure was only one in three.

Few of the nurses who have worked for a short time have taken part in professional meetings and further education to update their knowledge, and they keep up to date professionally through dialogue with colleagues

and doctors. This means that medication information is communicated, and training provided, in less formalized forms. Despite this, the nurses responded that their place of work facilitates safe and secure medication management. Sadeghi (2020) describes challenges associated with informal and unstructured training in the workplace. She points out that in the absence of targeted training, tacit knowledge is produced that could lead to inexpedient or even incorrect practices. Informal learning is not suited to keeping abreast of rapid developments and changes, for example in the field of medication. Formal training (in the form of courses) should form a basis and a condition for informal training. Adapted training in the workplace is therefore deemed to be important in ensuring good and correct learning, and thereby also good practice (Sadeghi, 2020). The findings in our study indicate that nurses have limited access to formal training and courses. This is cause for concern and indicates shortcomings at the system level. There is reason to emphasize the importance of training and competence-raising measures in the workplace as structural measures to maintain sound professional practice (Schroers et al., 2021). Sound medication practices involve a complex chain of skills (Luokkamäki et al., 2021), and weak links in this chain can lead to errors and adverse events that cause harm to patients.

It is particularly worrying that our results show that employees with short work experience state that they have received little training. Sulosaari et al. (2010) point out that there is an attitude that newly graduated nurses are expected to have learnt everything they need to know. This is cause for concern, both in relation to workloads in primary healthcare and rapid developments in the pharmaceutical industry. This supports Wannebo and Sagmo (2013), who conclude in their study that repeated in-house courses, with concrete learning objectives and subject matter related to the needs of the employees, are important in the field of medication and medication management. They point out that medication management skills require continuous updates, and that all employees with medication management responsibility should be offered competence-raising measures. Based on the fact that nurses often find medication errors to be multifactorial and interconnected, Schroers et al. (2021) argue for an emphasis on changing the system.

The introduction of the coordination reform brought changes to the tasks and complexity of the primary healthcare services, as well as new and greater demands in terms of the knowledge required to meet patients' needs. Heads of entities, and in some cases pharmacists, have been delegated the responsibility for medication management by doctors. Greater importance should be attached to this area of responsibility in order to improve the knowledge culture and attitudes towards developing and updating knowledge among nurses. Systematic training and reporting of non-conformities are important factors that can help to prevent errors from being repeated, ensure that knowledge is updated, and that nurses are reassured and procedures changed. The regulations for management and quality improvement in the health and care services (2017) instruct enterprises to facilitate safe and secure medication management. Considering that medication management errors make up the biggest group of errors reported to the Norwegian Board of Health Supervision, the findings from this study provide grounds for questioning whether enough has been done at the structural level to ensure safe medication practices in primary healthcare.

Methodology discussion

The high response rate (79%) and the fact that the study included nurses working in four different municipalities are the clear strengths of this study. Nevertheless, 87 informants is a relatively small sample, and this makes it difficult to demonstrate significant relationships and differences.

We developed the questionnaire that was used ourselves, and it has not been validated. One may question whether self-reporting of competence produced reliable answers, and whether the participants gave honest answers. The reliability of self-reporting of experience that, for some of the participants, goes back as far as 20 years, can also be questioned. Despite these weaknesses, we consider the material to be satisfactory overall, and find that it provides important indicators and answers to the study's research questions. We also consider the study to be an important recommendation for interesting issues relating to medication management in primary healthcare.

Conclusion

The results of this study show that the majority of nurses in primary healthcare services deem their own medicine management competence to be good or very good, and that few have made serious medication errors. At the same time, only half of them state that they are confident about the effects and side effects of medication, and two out of three state that they do not feel confident about drug interactions. The most important ways in which they update their professional knowledge is by using the Norwegian Pharmaceutical Product Compendium and through dialogue with colleagues and doctors, while only half of them use specialist literature for this purpose. Few have attended formal medication management training. A vast majority of the nurses state that they need more knowledge, particularly about age-related physiological changes and pharmaceutical treatment, general pharmacology, side effects, and mechanisms of action. Half of them also want more knowledge about different forms of medication, their routes of administration, and drug calculation. The vast majority of nurses are familiar with the non-conformity reporting system and have reported non-conformities, but nurses in nursing homes are less aware of the division of responsibility for medication management than those working in home nursing.

These findings are consistent with findings from other studies, and support the need to raise competence and strengthen medication management practices in primary healthcare. The absence of formal training in the form of in-house and external courses reveals a particular need for structural competence-raising measures relating to medication and medication management. There is reason to believe that strengthened and structured training can help to reduce the proportion of adverse events, and even deaths, reported as a result of errors relating to the use of medication outside a hospital setting.

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Appendix 1: Questionnaire

I. Background questions

1. I work in:

A nursing home ☐ Home-care services ☐

2. Years of work experience as a nurse

0-4 years ☐ 11-15 years ☐

5-10 years ☐ 16 years or more ☐

3. Do you have further education?

Yes ☐ No ☐

If yes, please elaborate:_____

4. For how long have you been working in the workplace where you work today?

0-4 years ☐ 11-15 years ☐

5-10 years ☐ 16 years or more ☐

5. What is the percentage of full-time equivalent today?_____

6. What rotation shifts do you work?

Two-shift system ☐ Three-shift system ☐

Not working shift ☐

7. Gender

Male ☐ Female ☐

II.

1. Have you at any time in your career as a nurse:
(if you don't remember exactly, you can estimate)

		Never	1- 4 times	5 times or more
a	- administered an incorrect dose of medication	☐	☐	☐
b	- administered medication incorrectly	☐	☐	☐
c	- administered medication to the wrong patient	☐	☐	☐
e	- administered medication at the wrong time	☐	☐	☐
f	- administered medication that had an unexpected effect/side effect	☐	☐	☐

		Yes	No	Do not know
2	Have you at any time in your career made a mistake that caused harm to a patient	☐	☐	☐
3	Have you at any time in your career administered medication without the patient's consent	☐	☐	☐
4	Have you at any time in your career disagreed with the doctor's prescription and contacted another doctor	☐	☐	☐
5	Are procedures for reporting non-conformities in place in your workplace?	☐	☐	☐
6	Have you ever reported a medication-related non-conformity?	☐	☐	☐
7	Are you familiar with your place of work's medication management guidelines?	☐	☐	☐
8	Do you know who is responsible for medication management at your place of work?	☐	☐	☐
9	Are you aware of the narcotic drugs inventory frequency?	☐	☐	☐
10	Are pill organizers double-checked in your workplace?	☐	☐	☐
11	Do you know who the advisory pharmacist is?	☐	☐	☐

		Very good	Good	Poor	Very poor
12	In your experience, how do you describe the state of your work-place as regards safe medication management:	☐	☐	☐	☐
13	How would you describe your own ability in medication management:	☐	☐	☐	☐

14. Are you confident when it comes to …?

		Yes	No	Uncertain
a	- using the Norwegian Pharmaceutical Product Compendium	☐	☐	☐
b	- drug calculation	☐	☐	☐
c	- the effects and side effects of different medications	☐	☐	☐
d	- medication dosage	☐	☐	☐
e	- drug interactions	☐	☐	☐
f	- administering generic medications	☐	☐	☐
g	- procedures for changing the form of medication	☐	☐	☐
h	- rules for storage of medication	☐	☐	☐
i	- rules and procedures relating to expiry dates	☐	☐	☐
j	- rules and procedures relating to documentation	☐	☐	☐

15	I need more knowledge about:	Yes	No	Do not know
a	- age-related physiological changes and pharmaceutical treatment	☐	☐	☐
b	- general pharmacology	☐	☐	☐
c	- medication's side effects and mechanisms of action	☐	☐	☐
d	- different forms of medication	☐	☐	☐
e	- routes of administration	☐	☐	☐
f	- drug calculation	☐	☐	☐
g	The Norwegian Pharmaceutical Product Compendium	☐	☐	☐

16 How do you update your knowledge of medication?

Norwegian Pharmaceutical Product Compendium	☐
Conversations with colleagues	☐
Contact with doctors	☐
Specialist literature	☐
Professional meetings	☐
In-house courses	☐
External courses	☐
Further education	☐