

# BMJ Open Medication management for patients with hip fracture at a regional hospital and associated primary care units in Norway: a descriptive study based on a survey of clinicians' experience and a review of patient records

Ben Tore Henriksen <sup>1,2,3</sup>, Maria Krogseth <sup>4,5,6</sup>, Caroline Thy Nguyen,<sup>1,7</sup>  
Liv Mathiesen <sup>3</sup>, Maren Nordsveen Davies,<sup>1</sup> Randi Dovland Andersen <sup>8,9</sup>,  
Yvonne Andersson <sup>10</sup>

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For numbered affiliations see end of article.

## Correspondence to

Ben Tore Henriksen;  
[ben.tore.henriksen@sykehusapotekene.no](mailto:ben.tore.henriksen@sykehusapotekene.no)

## ABSTRACT

**Objective** Patients with hip fracture are at high risk of medication errors due to a combination of high age, comorbidities, polypharmacy and several care transitions after fracture. The aim was to study medication management tasks concerning patient safety: medication reconciliation, medication review and communication of key medication information in care transitions.

**Design** Descriptive study comprising a self-administered clinician survey (MedHipPro-Q) and a retrospective review of hospital medical records of patients with hip fracture.

**Setting** Regional hospital and the associated primary care units (South-Eastern Norway).

**Participants** The survey received responses from 253 clinicians, 61 medical doctors and 192 nurses, involved in the medication management of patients with hip fracture, from acute admittance to the regional hospital, through an in-hospital fast track, primary care rehabilitation and back to permanent residence. Respondents' representativeness was unknown, introducing a risk of selection and non-response bias, and extrapolating findings should be done with caution. The patient records review included a random sample of records of patients with hip fracture (n=50).

**Outcome measures** Medication reconciliation, medication review and communication of medication information from two perspectives: the clinicians' (ie, experiences with medication management) and the practice (ie, documentation of completed medication management).

**Results** In the survey, most clinicians stated they performed medication reconciliation (79%) and experienced that patients often arrived without a medication list after care transition (37%). Doctors agreed that more patients would benefit from medication reviews (86%). In the hospital patient records, completed medication reconciliation was documented in most patients (76%). Medication review was documented in 2 of 50 patients (4%). Discharge summary guidelines were followed fully for 3 of 50 patients (6%).

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This study combined two medication management perspectives supplementing each other (ie, clinician experiences and documented practice).
- ⇒ The questionnaire used (MedHipPro-Q) has been validated and feasibility tested for the setting.
- ⇒ Low response rate and unknown representativeness entailed a risk of selection and non-response bias.
- ⇒ The patient records review only detected documentation of tasks completed.

**Conclusion** Our study revealed a need for improved medication management for patients with hip fracture. Patients were at risk of medication information not being transferred correctly between care settings, and medication reviews seemed to be underused in clinical practice.

## INTRODUCTION

Medications are important to prevent, treat or manage diseases. However, use of medications often involves risks, such as adverse drug reactions (ADRs). Older persons are particularly vulnerable to ADRs, as they often have reduced reserves and decreased resilience to stressors.<sup>1 2</sup> Patients with hip fracture are typically older<sup>3</sup> and multimorbid,<sup>4 5</sup> with polypharmacy.<sup>6-9</sup> They receive treatment and care in several settings, including hospitals and rehabilitation institutions. The transition of patients between care settings poses a risk of errors and is a patient safety concern due to the need for correct communication of medication information.<sup>10</sup> The hip fracture patient pathway was described in a recent study and involved three to five transitions within and

between care settings.<sup>11</sup> Multiple care transitions illustrated the importance of correct transfer of information, in addition to the need for optimal pharmacotherapy, to avoid ADRs and medication discrepancies. Thus, for patients to be prescribed and administered medications with best possible outcome and lowest risk, healthcare professionals are accountable for medication management, which comprises particularly these three specific tasks: medication reconciliation, medication review and correct transfer of medication information in care transitions.<sup>10 12</sup>

Medication reconciliation is defined by the Institute for Healthcare Improvement as 'the process of creating the most accurate list possible for all medications a patient is taking—including drug name, dosage, frequency, and route—and comparing that list against the admission, transfer, and/or discharge orders'.<sup>13</sup> In Norway, medical doctors are responsible for medication reconciliation, which should be performed shortly after receiving the patient from the previous care setting.<sup>10 12–14</sup> Furthermore, a medication reconciliation should include conversation with patients or those responsible for the administration of medications, in addition to written sources of information.<sup>10 14 15</sup> Medication reconciliation is essential, as discrepancies may lead to irreversible deterioration or death if not corrected.<sup>16</sup> Studies have identified discrepancies in the medication lists in up to 80% of hospitalised orthogeriatric patients<sup>17</sup> and in 50% of patients with hip fracture.<sup>6</sup>

With a correct medication list available, each patient should have their pharmacotherapy optimised through a medication review, that is, 'a structured, critical examination of a person's medicines with the objective of reaching an agreement with the person about treatment, optimising the impact of medicines, minimising the number of medication-related problems and reducing waste',<sup>18</sup> in particular older patients with polypharmacy.<sup>12</sup> Polypharmacy has been associated with an increased fall risk and subsequent fractures.<sup>19–21</sup> Hip fractures should be prevented due to potential complications, reduced quality of life, increased care need and mortality.<sup>22–24</sup> However, almost 90% of patients with hip fracture had at least one fall-risk-increasing drug prescribed prior to falling.<sup>25</sup> Medication review may help patients reduce the number of potentially inappropriate medications (PIMs)<sup>26 27</sup>—including fall-risk-increasing drugs<sup>25</sup>—subsequently the risk of ADRs<sup>28–30</sup> and medication-related rehospitalisation.<sup>7 31</sup>

Finally, correct medication information needs to be effectively communicated to the next care setting; that is, medication lists should be included in hospital discharge summaries detailing newly initiated, changed, unchanged and discontinued medications, in accordance with guidelines from the WHO<sup>10 15</sup> and National Institute for Health and Care Excellence.<sup>12 32</sup> However, medication lists in discharge summaries have been reported to be of poor quality, which may compromise patient safety.<sup>33–35</sup>

Patients with hip fracture are in a vulnerable situation, which requires complex medication management by clinicians (ie, nurses and medical doctors) in all care settings. Notwithstanding the evident need for optimised medication management, involved clinicians have a high workload in healthcare systems where resources often are limited.<sup>36</sup> However, the literature is scarce regarding medication management perspectives throughout the hip fracture patient pathway. Thus, there is a need to explore different perspectives of medication management for patients with hip fracture to assure their safety. First, the clinician perspective, due to the first-hand insights into the current situation; their knowledge and experience are key to detect factors that exert pressure on clinicians, and to contribute towards solutions that assure the safety of patients with hip fracture. Second, a process perspective; medication management tasks are documented and a review of patient records may provide insights into the delivered medication-related healthcare. Together, the two perspectives may supplement each other and provide a more comprehensive understanding of current medication management for patients with hip fracture.

Thus, the aim was to study two perspectives of the medication management tasks: medication reconciliation, medication review and communication of key medication information, throughout the hip fracture patient pathway. The first objective was to increase knowledge of how nurses and medical doctors experienced medication management. The second objective was to characterise documented medication management tasks in patient records.

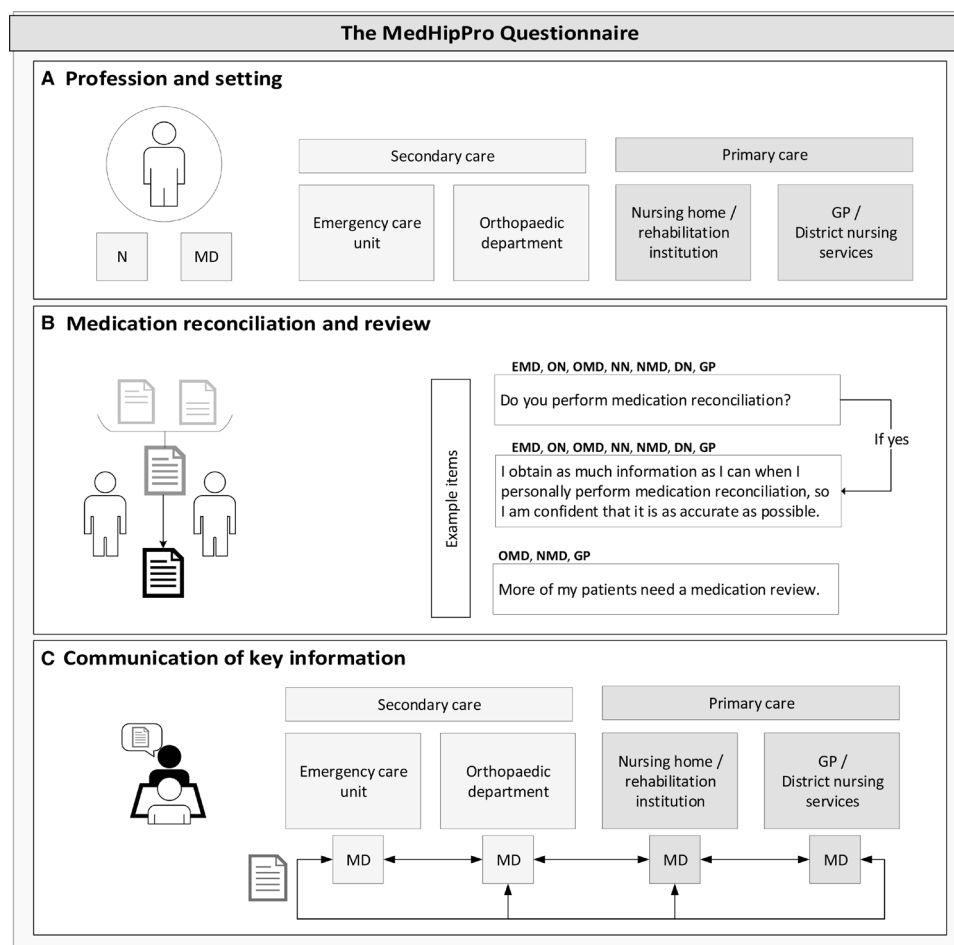
## METHODS

### Study design

This descriptive study comprised a self-administered clinician survey, and a retrospective review of hospital records of patients with hip fracture. The study is reported using the Checklist for Reporting of Survey Studies.<sup>37</sup>

### Setting and sample

The study setting was a hip fracture patient pathway in a region in South-East Norway, from acute admittance to the hospital, through an in-hospital fast track, rehabilitation and back to permanent residence. The hospital fast track specified patient flow and included preferred time before surgery, responsibilities and tasks for all involved professionals, across all hospital departments, such as radiology, anaesthesia and orthopaedic. After the acute post-surgery period, patients were discharged to a short-term rehabilitation institution in primary care, with 24-hour nursing service. Post-rehabilitation, patients were discharged to permanent residence (long-term nursing home or private home with or without home care nursing services by district nurses). District nurses visited the patients in their home in accordance with individual needs, ranging from weekly visits to several times daily and included, in some instances, full responsibility



**Figure 1** The MedHipPro Questionnaire with dimensions and outline of content. (A) The dimension ‘profession and setting’ addressed clinicians’ qualifications, experience and medication management tasks related to setting. (B) The dimension ‘medication reconciliation and review’ addressed the extent of medication reconciliation and review (eg, the number of patients and frequency), and content of medication review. (C) The dimension ‘communication of key information’ covered the transfer of medication list and treatment plan to the next care setting. An important aspect was how to ensure the medication list’s quality before sending it. DN, district nurse; EMD, emergency care MD; GP, general practitioner; MD, medical doctor; N, nurse; NMD, Nursing home MD; NN, nursing home nurse; OMD, orthopaedic department MD; ON, orthopaedic department nurse.

for medication administration. The region (total population of approximately 250 000) has one regional hospital, with 550 beds, serving seven primary care units (which included rehabilitation institutions, nursing homes and district nursing services). All data were collected from August 2018 to January 2019. In 2018, 478 patients received hip fracture surgery at the regional hospital.<sup>38</sup>

All clinicians involved in the medication management of patients with hip fracture in the region were eligible for inclusion in the questionnaire survey (all clinicians), that is, clinicians in the hospital’s emergency care unit and orthopaedic department, and, in each primary care unit, nursing homes/rehabilitation institutions, district nursing services, and general practitioners (GPs). In all settings, medical doctors were responsible for prescribing medication, medication reconciliation, medication review and writing the medication information of the electronically transferred discharge summary to the next care level.<sup>11 14</sup> Nurses were responsible for medication preparation, administration, observation and reporting

effects.<sup>11 39</sup> Nurses used about 20% of their time on medication management activities, and spent, in some settings, more time than doctors in direct contact with patients.<sup>39 40</sup>

The review of the patient records was performed after the patients were discharged from the hospital. All patients following the hip fracture fast track at the regional hospital from 1 June until 31 August 2018 were eligible for inclusion. Exclusion criteria were age <18 years, terminally ill patients (life expectancy less than 1 week), patients who died during hospitalisation and non-fast-track patients (eg, fracture in already hospitalised patients). Due to limited resources, half of all eligible patient records were selected using a random number generator (Mersenne Twister).

### Clinician survey

We used the digital MedHipPro-Q, with its supported face and content validity,<sup>11</sup> via Questback 2018<sup>41</sup> to investigate how clinicians throughout the patient pathway experienced medication management of patients with

**Table 1** Characteristics of survey respondents of the MedHipPro Questionnaire

Characteristic	Respondents	
Total, n (%)	253	(100)
Female sex, n (%)	210	(83)
Profession		
Medical doctor	61	(24)
Nurse	192	(76)
Age group in years, n (%)		
<33	78	(31)
33–37	40	(16)
38–47*	60	(24)
48–57	50	(20)
58–68	25	(10)
Work experience in years, n (%)		
0–5	79	(31)
6–10†	50	(20)
11–20	65	(26)
21–30	39	(15)
≥31	20	(8)
Affiliation, n (%)		
Emergency care unit	42	(17)
Orthopaedic department	47	(19)
Nursing home/rehabilitation	60	(24)
GP office	31	(12)
District nurse	73	(29)

\*Median birth year category: 1971–1980.  
†Median experience: 10 years.  
GP, general practitioner.

hip fracture (figure 1). The MedHipPro-Q contained questionnaire items addressing three dimensions: profession and setting, medication reconciliation and review, and communication of key information. The response options were categorical (34 ordinal and 21 nominal). Of the ordinal scale response options, 17 were on a 5-point Likert scale, ranging from strongly disagree to strongly agree. The questionnaire has been validated for the setting and was tailored to each respondent, with a selection of items based on profession, setting and medication management responsibilities.<sup>11</sup> The branching logic caused unequal denominators (as seen in questionnaire results) due to respondents being provided a subset of questionnaire items based on their profession, medication management responsibility and previous answers. All questionnaire items relevant to the respondent were mandatory, causing no missing items.

The anonymous and voluntary survey was distributed via email from leaders or clinicians with extended functions. The participants could choose to add their contact details if they wished for further participation in the study, such as potential follow-up interviews. Two reminders

**Table 2** Affiliation for the recipients of the MedHipPro Questionnaire

Target population	Recipients (n)	Respondents (n)	Response rate (%)
Secondary healthcare	165	89	54
Emergency care unit			
Medical doctor	20	9	45
Nurse	68	33	49
Orthopaedic department			
Medical doctor	31	15	48
Nurse	46	32	70
Primary healthcare	690*	164	24*
Nursing home/rehabilitation			
Medical doctor	34*	6	18*
Nurse	297*	54	18*
GP office			
Medical doctor	205	31	15
District nurse			
Nurse	154*	73	47*

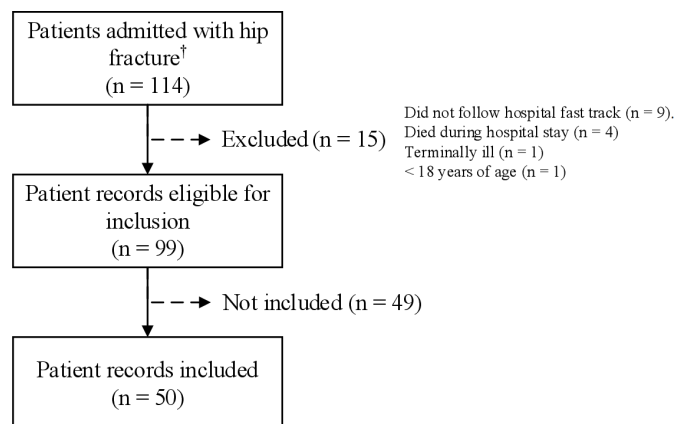
Response rate=(n[respondents]/n[recipients])×100.  
\*Exact number of recipients is not available for nursing home/rehabilitation institution and district nurses due to method of distribution. The confirmed numbers of recipients are provided in the table.  
GP, general practitioner.

were sent, each with a 3-week deadline. Additionally, a survey invitation was posted in the GP monthly bulletin from the hospital. The distribution method caused a non-exact number of recipients of district nurses and clinicians in nursing homes/rehabilitation institutions. As an incentive to participate in the survey, participants were entered into a raffle where five randomly selected individuals received a gift parcel or scratch lottery tickets.

### Patient records review

To supplement clinicians' experience in the survey response, we extracted data from hospital medical records of patients with hip fracture. Data were collected on patient characteristics (age and sex) and process measures. The process measures comprised documented completion of medication reconciliation (in the paper medication chart or admission journal), documented completion of medication review (patient discussed in the interdisciplinary orthopaedic-geriatric meeting, a supervision by a geriatrician after referral or as an independent medication review) and communication of key medication information (whether the discharge summaries contained medication information in accordance with international guidelines<sup>10 15</sup> and local requirements). For the discharge summaries to fulfil requirements according to international guidelines and local procedures, the medication information needed to indicate new, changed or stopped medication, reasons for changed medication during hospitalisation and details on follow-up (eg, duration of short course, monitoring, responsibility).





**Figure 2** Flow chart describing the inclusion of patient records. †Patients with hip fracture (fractura colli femoris, fractura pertrochanterica femoris or fractura subtrochanterica femoris) admitted to the regional hospital, 01 June 2018–31 August 2018.

## Patient and public involvement

Our study was planned and developed with involvement from healthcare stakeholders, such as management and clinicians, and patient representatives.

## Data analysis

Data were managed with EpiData, V.4.6.0.2,<sup>42</sup> and analysed with Stata software, V.16.1.<sup>43</sup> Descriptive statistics were used to describe patient data and questionnaire response. Normally distributed, continuous variables were presented using mean, SD and/or range, and median and IQR for non-normally distributed data. The Likert scale was treated as a non-normally distributed, ordinal variable. On three occasions, we compared responses to statements by using Wilcoxon signed-rank test to test for differences in ranks for paired questionnaire data due to non-normal distribution. P values of  $\leq 0.05$  were considered as statistically significant.

## RESULTS

### Clinician survey

In total, 253 clinicians responded, whereof 61 doctors and 192 nurses (table 1). The response rate was approximately 33% overall, 54% in secondary care and below 24% in primary care (table 2). The majority of respondents were district nurses (n=73 of 253, 29%), younger than 33 years of age (n=78 of 253, 31%), with a median number of clinical experience of 10 years (IQR 4–19 years). Doctors in the orthopaedic department were the respondents with most experience (median 18 years, IQR 6–30). For a detailed presentation of questionnaire items and responses, see (online supplemental tables S1–6).

Half the GPs (n=15 of 31, 50%) did not agree that the hospital requested an updated medication list when a patient with hip fracture was admitted to the hospital (online supplemental table S1). Furthermore, 37% (n=51 of 137) of clinicians expressed that patients often arrived at their care setting without a medication list.

A majority of clinicians claimed to perform medication reconciliation (n=199 of 253, 79%). They reported obtaining as much information regarding current medications as possible (from information sources such as electronic prescription database, GP's list, etc) when performing medication reconciliation (n=175 of 199, 88%). When the emergency care unit had documented completion of medication reconciliation, the orthopaedic department had more trust in the medication list (median agree), compared with when this was not specified (median disagree) ( $p < 0.0001$ ). Overall, more than half of clinicians agreed that most patients had the correct medication list available (n=114 of 191, 60%).

Doctors agreed that more patients would benefit from a medication review being performed (n=45 of 52, 87%) (online supplemental table S2). However, there was no clear opinion among them on whether they should perform the medication reviews themselves, or if it should be performed by another healthcare professional (both statements' median: neither agree, nor disagree). Doctors who stated that they personally performed medication reviews (n=44 of 52, 85%) (online supplemental table S3) were GPs (n=31 of 44, 70%), doctors in nursing home/rehabilitation (n=6 of 44, 14%) and in the orthopaedic department (n=7 of 44, 16%). Drug–drug interactions (n=38 of 44, 86%), discontinuing treatment without indication (n=35 of 44, 80%), considerations regarding medication appropriateness for older persons (n=34 of 44, 77%) and ADRs (n=31 of 44, 71%) were most frequently included in doctors' medication reviews. Two-thirds of responding doctors (n=29 of 44, 66%) stated that a 'comprehensive medication review' (ie, where doctors also considered medications initiated by other prescribers) was performed for  $\geq 60\%$  of patients (online supplemental table S4). Doctors in primary care performed a medication review two to six times per year for each patient (n=21 of 44, 48%), while hospital-based doctors had no clear opinion on the frequency. More than two-thirds of doctors suggested allocating more time for each patient to increase the number of patients receiving medication reviews (n=36 of 52, 69%) (online supplemental table S5).

When patients with hip fracture were transferred to the next care setting, most doctors (n=36 of 52, 70%) expressed that they spent time assuring the quality of the medication list, before transition (online supplemental table S6). Doctors in the orthopaedic department reported using  $\geq 6$  min writing the medication part of the discharge summary when following guidelines (n=9 of 14, 64%), and  $< 5$  min if not following guidelines (n=12 of 15, 80%) (median 6–10 min vs 3–5 min,  $p = 0.004$ ). Half of the doctors in the orthopaedic department (n=8 of 15, 53%) stated that a minority of patients (ie, 1%–30%) were discharged without a medication list. GPs (n=31) indicated that medication information transferred from nursing home/rehabilitation institutions was more often correct (n=15 of 31, 48%), compared with medication information received from hospital at discharge (n=10

**Table 3** Patient characteristics from the patient records review

Characteristic	Patients	
Total, n (%)	50	(100)
Female sex, n (%)	26	(52)
Medication management characteristics, n (%)		
Medication reconciliation at admittance*	38	(76)
Medication review in hospital†	2	(4)
Number of information sources used in medication reconciliation‡, n (%)		
1	21	(60)
2	12	(34)
3–4	2	(6)
Medication lists at discharge in accordance with guidelines§, n (%)		
Fully	3	(6)
Partially	6	(12)
Not in accordance with guidelines	41	(82)

\*Documented in the paper medication chart or admission journal.

†Documentation of patient discussed in the interdisciplinary orthopaedic-geriatric meeting, a supervision by a geriatrician after referral or as an independent medication review.

‡There were three medication reconciliations documented without any information sources declared.

§Indication of new, changed or stopped medication, reasons for changed medication during hospitalisation and details on follow-up (eg, duration of short course, monitoring, responsibility).

of 31, 32%); however, the difference was non-significant (both medians were ‘neither agree, nor disagree’,  $p=0.18$ ).

### Patient records review

During the study period, 114 patients were admitted with hip fractures, with 99 patient records eligible for inclusion. Of these, 50 patient records were randomly selected to be included in the patient records review (figure 2).

The mean age of the patients was  $84\pm 8.9$  years (range 56–99), and 26 were female (table 3). At admission, completion of medication reconciliation was documented in 76% of the patient records. In the great majority of patient records ( $n=33$  of 35, 94%), one or two sources of information were documented used in performing the medication reconciliation. Two patients (both male) had a documented completion of medication review. The medication information in patient discharge summaries was fully in accordance with international guidelines for 3 patients (6%) and was not in accordance for 41 patients (82%).

### DISCUSSION

A majority of clinicians stated that they performed medication reconciliation, which was supported by the number of documented medication reconciliations in patient records, although these were based on a suboptimal number of information sources. Clinicians described suboptimal communication between care settings and

reported receiving incorrect medication lists at transition between care levels. Few patients had their pharmacotherapy optimised through a medication review during hospitalisation. To improve this number, clinicians primarily suggested more time with each patient.

To the best of our knowledge, this was the first study reporting the proportion of patients with hip fracture for whom a medication reconciliation was documented. Medication reconciliation was frequently performed, but half of the documented medication reconciliations were completed using fewer than the WHO recommendation of two or more information sources.<sup>10 15</sup> Although we did not explore medication discrepancies in this study, it is reasonable to believe that the use of too few information sources may have resulted in discrepancies in the reconciled medication list. Other studies have estimated discrepancies to be 50% in patients with hip fracture, of which 19% were ‘potentially severe in a long-term perspective’, and may lead to ADRs, prolonged hospital stay and readmissions.<sup>6 44 45</sup> Many clinicians in our survey experienced that patients had an incorrect medication list. We believe that our study supports medication reconciliation still being a weak link in patients’ care transitions.<sup>13 46 47</sup>

Most doctors said they always spent time assuring the quality of the medication list before sending it to the next care setting. This is important because an updated medication list needs to be transferred to the next care level, for example, through the hospital discharge summary. Many patients with hip fracture experience a permanent increased care need after discharge, with new clinicians responsible for prescribing and administering.<sup>48 49</sup> Thus, incorrect medication information transfer for these patients may result in a permanent consequential error. However, the majority of discharge summaries in the patient records review were not in accordance with guidelines.<sup>10 15</sup> Our results are comparable with a previous study reporting complete medication information in only 4% of orthopaedic patients.<sup>35</sup> An explanation may be that following guidelines was considered more time-consuming. Eriksson and colleagues asked doctors about the time used ‘related to medications at discharge’ finding a median of 15 min.<sup>50</sup> In addition, our survey results indicated that a medication list was sometimes lacking in discharge summaries. Incorrect transfer of medication information has been identified as a concern by healthcare professionals,<sup>51</sup> and is a focus in international initiatives.<sup>10 13</sup> Adherence to guidelines increases quality of medication lists,<sup>10 15</sup> and it would be reasonable to believe that correct and clearly communicated medication information in the discharge summary would save time in the next care level as less time would be spent on medication reconciliation and correcting errors.

In our retrospective patient records review, we found that almost none contained a medication review, although it would be clearly beneficial for a majority of these multimorbid and polypharmacy patients.<sup>7 8 25 52</sup> To illustrate, doctors’ medication review may reduce PIMs,<sup>53</sup> which, if not stopped, may lead to

ADRs,<sup>54 55</sup> hospitalisation,<sup>56 57</sup> increased mortality,<sup>58</sup> and new falls and fractures.<sup>8</sup> A majority of doctors considered PIMs when they performed a medication review, but needed more time to be able to complete medication reviews for more of their patients. We believe our study results were strengthened by supplementing the aspect of patient records review with clinicians' experience in the survey response, thus gaining a more complete understanding of hip fracture medication management. An example was medical doctors in the survey who expressed that more patients needed medication review. This was supported by the hospital patient records review by quantifying the proportion of patients (4%).

In other instances, the survey results indicated a higher level of medication management than were documented in patient records. Take medication reconciliation as an example; most clinicians (88%) reported using sufficient sources, but the review of patient records showed less than half of the medication reconciliations were performed using more than one source. The survey format may have introduced self-reporting bias and social desirability bias, which may inflate respondents' reporting of their own quality and productivity, as well as the general perceived quality of the health service they are involved in.<sup>59–63</sup> Another possibility for discordant data may have been clinicians' different definition of medication reconciliation, thereby underestimating what is implied, and the accuracy needed, for a thorough medication reconciliation, which may reflect a lack of training.<sup>64 65</sup> One study showed, however, that self-reporting on time related to medication tasks coincided well with observation.<sup>61</sup>

We chose to distribute the questionnaire to all clinicians in the patient pathway to maximise the number of potential respondents. Despite efforts to ensure optimal response rate, such as pre-notification contacts, reminders and providing incentives,<sup>66 67</sup> we achieved a low response rate, particularly for primary care. In hindsight, choosing one representative primary care unit and focusing on maximum respondents would have been preferable. Nevertheless, we chose to present the results for primary care with its 164 respondents, despite a low response rate, due to a topic where the literature is scarce. Substantial effort was put into finding the exact denominator for nursing home clinicians and district nurses, without fully succeeding. The inexact response rate may be compared with online surveys that do not report a response rate.<sup>68 69</sup> Our study has a risk of selection and non-response bias due to its low response rate, particularly for primary care, with an unknown representativeness of respondents. We were aware of our study's risk of bias, and extrapolating findings should be done with caution.

The development and initial validation of the MedHip-Pro-Q focused on balanced questionnaire wording and representativeness; we found this to reduce information bias.<sup>11</sup> This study still provides insight into clinicians' experiences of hip fracture medication management, a topic where the literature is scarce but needed; the

number of patients with hip fracture will likely increase in the future.<sup>6–8 70–72</sup>

Another limitation was the use of patient records as a source, which only detects documentation of tasks completed and may differ from what was actually performed.<sup>73</sup> It addressed neither the quality, such as undiscovered discrepancies in medication reconciliation, nor the content in medication reviews. However, documentation of tasks is an important part of clinical practice and often used in clinical research,<sup>73 74</sup> particularly when reporting process measures—an important part of research on health service quality.<sup>75</sup> A strength of the patient records review was the randomised selection and the study sample being representative of the population in terms of age and sex,<sup>76</sup> which we found to reduce the chance for selection bias.

Future studies should evaluate solutions to the challenges discovered in this study, particularly the low number of patients with a documented medication review, which may reduce the number of PIMs including medication with fall risk. One solution may be medication reviews by geriatricians, which increased health-related quality of life and medication appropriateness, and contributed to the reduction of PIMs.<sup>77 78</sup> Additionally, including geriatricians in the treatment of patients with hip fracture reduced mortality and complications.<sup>79 80</sup> Another possible solution could be a task shifting strategy where a clinical pharmacist is incorporated into the hip fracture patient pathway. A clinical pharmacist was not involved in the current team responsible for medication management. Clinical pharmacists may take over tasks such as medication reconciliation, review and producing a medication list in accordance with international guidelines prior to care transitions.<sup>50 81 82</sup> This strategy may reduce clinicians' workload and free time to perform their specialised tasks, while clinical pharmacists use their specialisation to ensure optimal pharmacotherapy and seamless transition of medication information, supporting patient safety for every patient with hip fracture.<sup>12 36 83</sup> A recent study showed an increase in overall survival for multimorbid patients who received a clinical pharmacy service.<sup>83</sup> This strategy would also be in accordance with a European Union report that recommended task shifting to be directed towards essential patient safety tasks for best possible healthcare delivery.<sup>36</sup>

## CONCLUSION

Clinicians reported challenges with medication management of patients with hip fracture. Patients were at risk of medication information not being transferred correctly and consequently receiving potentially harmful medications, since medication reviews were underused in clinical practice.

## Author affiliations

<sup>1</sup>Tonsberg Hospital Pharmacy, Hospital Pharmacies Enterprise, South Eastern Norway, Tonsberg, Norway



<sup>2</sup>Division of Surgery, Vestfold Hospital Trust, Tonsberg, Norway

<sup>3</sup>Department of Pharmacy, Faculty of Mathematics and Natural Sciences, University of Oslo, Oslo, Norway

<sup>4</sup>Old Age Psychiatry Research Network, Telemark Vestfold, Vestfold Hospital Trust, Tonsberg, Norway

<sup>5</sup>Department of Nursing and Health Science, Faculty of Health and Social Sciences, University of South-Eastern Norway, Drammen, Norway

<sup>6</sup>Department of Internal Medicine, Telemark Hospital Trust, Skien, Norway

<sup>7</sup>Department of Pharmacy, Faculty of Health Sciences, UiT The Arctic University of Norway, Tromsø, Norway

<sup>8</sup>Department of Research, Telemark Hospital Trust, Skien, Norway

<sup>9</sup>Research Centre for Habilitation and Rehabilitation Models & Services (CHARM), Faculty of Medicine, University of Oslo, Oslo, Norway

<sup>10</sup>Department of Research, Hospital Pharmacies Enterprise, South Eastern Norway, Oslo, Norway

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**Contributors** Conceptualisation—BTH, MK, LM, MND and YA. Project protocol—BTH, MK, MND and YA. Data collection/clinician survey—BTH. Data collection/patient records review—CTN. Data analysis and interpretation—BTH, MK, LM, RDA and YA. Writing the manuscript—BTH. Review and editing—BTH, MK, CTN, LM, MND, RDA and YA. BTH is responsible for the overall content as guarantor. All authors have approved the final version.

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#### ORCID iDs

Ben Tore Henriksen <http://orcid.org/0000-0001-7250-7597>

Maria Krogseth <http://orcid.org/0000-0002-6121-9044>

Liv Mathiesen <http://orcid.org/0000-0002-6598-2215>

Randi Dovland Andersen <http://orcid.org/0000-0001-6857-7058>

Yvonne Andersson <http://orcid.org/0000-0003-3528-7171>

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**Medication management for patients with hip fracture at a regional hospital and associated primary care units in Norway: a descriptive study based on a survey of clinicians’ experience and a review of patient records**

**Supplementary file**

Henriksen BT, Krogseth M, Nguyen CT, Mathiesen L, Davies MN, Andersen RD, Andersson Y.  
BMJ Open 2022. doi:10.1136/bmjopen-2022-064868

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## Supplementary file 1 – Response to the MedHipPro-Questionnaire

### General information regarding the MedHipPro-Q

Full version of the questionnaire may be found in Henriksen BT, Andersson Y, Davies MN, Mathiesen L, Krogseth M, Andersen RD: **Development and initial validation of MedHipPro-Q: a questionnaire assessing medication management of hip fracture patients in different care settings**. In: *BMC Health Services Research*. 2022;22(1):240

The MedHipPro-Q contained questionnaire items addressing three dimensions: Profession and setting, Medication reconciliation and review, and Communication of key information. The response options were categorical (34 ordinal and 21 nominal). Of the ordinal scale response options, 17 were on a five-point Likert scale, ranging from strongly disagree to strongly agree. The questionnaire was tailored to each respondent, with selection of items based on profession, setting, and medication management responsibilities. The branching logic caused unequal denominators. In this additional file, the Likert scale categories ‘strongly (dis)agree’ and ‘(dis)agree’ have been merged to (dis)agree. ‘Neither agree, nor disagree’ is presented as ‘neutral’. Median is indicated by grey background.

**Responses to items in the dimension Medication reconciliation and review***Medication reconciliation***Table S1: Responses to the Likert scale items regarding medication reconciliation**

		Likert scale		
		Disagree	Neutral	Agree
		n (%)	n (%)	n (%)
GP (n = 31)				
The hospital always requests an updated medication list when a patient is admitted to hospital with a hip fracture		9 (29.1)	6 (19.4)	16 (51.7)
EMD, EN, OMD, ON, NMD, GP (n = 137)				
It happens often that the patient comes to me/us without a medication list†		69 (50)	17 (12)	51 (37)
EMD, OMD, ON, NMD, NN, DN, GP				
Do you perform medication reconciliation?		Yes, n = 199/253 (78.7 %) ††		
EMD, OMD, ON, NMD, NN, DN, GP (n = 199)				
I obtain as much information as I can when I personally reconcile the medication list, so I am confident that it is as accurate as possible		9 (5)	15 (8)	175 (88)
OMD, ON (n = 47)				
I always trust that the medication chart coming from the emergency care unit is correct even if medication reconciliation is <u>not documented</u> anywhere		27 (58)	9 (20)	11 (22)
OMD, ON (n = 47)				
I always trust that the medication chart coming from the emergency care unit is correct when medication reconciliation is documented somewhere†††		7 (15)	12 (25)	28 (60)
OMD, ON, NMD, NN, DN, GP (n = 191)				
My impression is that most of my patients have a correct medication list		56 (29)	21 (11)	114 (60)
GP (n = 31)				
I always receive correct medication information from the hospital		12 (39)	9 (29)	10 (32)
GP (n = 31)				
I always receive correct medication information after a nursing home stay or rehabilitation		9 (29)	7 (23)	15 (48)

In this table, the Likert scale categories 'strongly (dis)agree' and '(dis)agree' have been merged to (dis)agree. 'Neither agree, nor disagree' is presented as 'neutral'. Median is indicated by grey background.

Abbreviations: **EMD**; Emergency care Medical Doctors, **EN**; Emergency care Nurses, **OMD**; Orthopaedic department Medical Doctors, **ON**; Orthopaedic department Nurses, **NMD**; Nursing home Medical Doctors, **NN**; Nursing home Nurses, **DN**; District Nurses, **GP**; General Practitioners.

<sup>†</sup> For GPs the statement was "It happens often that the patient comes **back** to me without a medication list"

<sup>††</sup> Clinicians who answered "no" were directed to questions regarding medication review or communication of key information, yielding 199 potential responders to the statements. Nurses in emergency care unit (n = 32) did not perform medication reconciliation, but received the statement "It happens often that the patient comes to me/us without a medication list".

<sup>†††</sup> For example on the dedicated stick-on label on the medication chart or in the patient's admission summary [in the electronic medical journal]

*Medication review***Table S2: Responses to the Likert scale items regarding medication review**

	Likert scale		
	Disagree	Neutral	Agree
	n (%)	n (%)	n (%)
<b>OMD, NMD, GP (n = 52)</b>			
More of my patients need medication review	4 (8)	3 (6)	45 (87)
I do not have the opportunity to perform (more) medication reviews myself <sup>†</sup>	23 (46)	7 (14)	20 (40)
I want someone else to perform medication reviews <sup>††</sup>	21 (40)	9 (17)	22 (42)

In this table, the Likert scale categories 'strongly (dis)agree' and '(dis)agree' have been merged to (dis)agree. 'Neither agree, nor disagree' is presented as 'neutral'. Median is indicated by grey background.

Abbreviations: **OMD**; Orthopaedic department Medical Doctors, **NMD**; Nursing home Medical Doctors, **GP**; General Practitioners.

<sup>†</sup>Two missing responses; one GP and one nursing home Medical Doctor.

<sup>††</sup> By the term "someone else" we hereby imply qualified health personnel, such as another physician with the same specialty, another physician with another specialty, clinical pharmacist or similar.



**Table S3: Responses to questions regarding medication review, part 1**

OMD, NMD, GP (n = 52)		
n	(%)	Do you perform medication review? Yes, n = 44/52 (85%)
44	(100)	Yes
<b>Content:</b>		
38	(86)	Clinically relevant medication interactions
35	(80)	Discontinuing treatment without indication
34	(77)	Inappropriate medication for elderly <sup>†</sup>
31	(71)	Medication-induced side-effect, symptom or altered laboratory test results
28	(64)	Individual assessment of all dosages (dosage adjusted to organ function (reduced renal function and/or liver function), drug allergies, etc.)
22	(50)	Monitoring of medication (i.e. medication where laboratory tests must be taken to assess effect)
18	(41)	Medication management, administration and compliance/adherence
16	(36)	Optimising pharmacological treatment of all diagnosis/indications
15	(34)	Time-limited medication use (correct medication, correct dosage, correct duration)
<b>Frequency:</b>		
4	(9)	5-7 times per week
2	(5)	Once per week
1	(2)	Approximately once a month
21	(48)	App. 2-6 times per year
2	(5)	App. once a year
14	(32)	Other: Completely random (n = 5), At each consultation/visit, but only if there are changes made to the treatment regimen (n = 3), At each consultation/visit, regardless of whether there are changes to the treatment regimen (n = 2), Only when there are changes made to the treatment regimen (n = 1), At admission to a short term stay [in nursing home], (n = 1), continuously during rounds (n = 1), [Left empty] (n = 1)

Medical Doctors in the emergency care unit (who do not perform medication reviews) were directed to questions regarding communication of key information to the next care setting

Abbreviations: **OMD**; Orthopaedic department Medical Doctors, **NMD**; Nursing home Medical Doctors, **GP**; General Practitioners.

<sup>†</sup> Some Medical Doctors use lists of inappropriate medication for elderly, such as the STOPP-list, Beers criteria, NorGEP criteria, or similar, but this is not a requirement to [choose this option]

**Table S4: Responses to questions regarding medication review, part 2**

Question	Response categories <sup>†</sup>		
	Never/ Rarely (≤29%)	Sometimes (30-59%)	Often/ always (≥60%)
	n (%)	n (%)	n (%)
<b>OMD, NMD, GP (n = 44<sup>††</sup>)</b>			
Are you currently performing a comprehensive medication review where you also consider medication prescribed by other Medical Doctors?	7 (16)	8 (18)	29 (65.9)

Median is indicated by grey background.

Abbreviations: **OMD**; Orthopaedic department Medical Doctors, **NMD**; Nursing home Medical Doctors, **GP**; General Practitioners.

<sup>†</sup> Response categories: Never; 'No, this type of medication review is not performed', Rarely; 'Yes, a few patients receive medication reviews (approximately 1-29 % of patients)', Sometimes; 'Yes, some patients receive medication reviews (app. 30-59 % of patients)', Often; 'Yes, most patients receive medication reviews (app. 60-89 % of patients)', Always; 'Yes, every patients receive medication reviews (app. 90 % of patients, or more)'

<sup>††</sup> Medical Doctors who performed medication reviews

**Table S5: Responses to questions regarding medication review, part 3**

Question		
<b>OMD, NMD, GP, n = 52</b>		
Which actions would you suggest would allow more patients to receive a medication review where you also consider medications prescribed by other Medical Doctors?		
<b>n<sup>†</sup></b>	<b>(%)</b>	<b>Option</b>
36	(69)	More time for each patient
31	(60)	Better electronic/digital systems
15	(29)	Better payment (for GPs only)
14	(27)	Regular multidisciplinary meetings (more often)
14	(27)	Getting reminders that it should be done / request from others
13	(25)	Increased knowledge (such as courses)
5	(10)	Other: All prescribers use electronic prescriptions (n = 1), not relevant in nursing homes (n = 1), medication review by geriatrician or pharmacist (n = 1), [Left empty] (n = 2)

Abbreviations: **OMD**; Orthopaedic department Medical Doctors, **NMD**; Nursing home Medical Doctors, **GP**; General Practitioners.

<sup>†</sup> More than one option available

## Responses to items in the dimension Communication of Key Information

**Table S6: Responses to questions regarding communication of key information to the next care setting**

Statement	Likert scale		
	Disagree	Neutral	Agree
	n (%)	n (%)	n (%)
<b>OMD, NMD, GP (n = 52)</b>			
In the discharge summary and/or discharge report: I always spend time double checking that the medication list is as accurate as possible <i>E.g. comparing (or double-checking) the medication list with the medication chart / kardex</i>	11 (21.2)	5 (9.6)	36 (69.2)
Question	Response categories <sup>†</sup>		
	Never/ Rarely (≤29%)	Sometimes (30-59%)	Often/ always (≥60%)
	n (%)	n (%)	n (%)
<b>GP (n = 31)</b>			
If changes in the medication regimen: Do you write a complete medication list for the one who administers medication?	2 (6.5)	4 (12.9)	25 (80.7)
<b>OMD (n = 15)</b>			
How often do you write the medication list in the discharge summary without following the local procedure	5 (33.3)	4 (26.7)	6 (40.0)
<b>OMD (n = 15)</b>			
How often do you write the medication list in the discharge summary following the local procedure	5 (33.3)	4 (26.7)	6 (40)
<b>OMD (n = 15)</b>			
How often do you discharge a patient without including a medication list in the discharge summary?	13 (86.6)	2 (13.3)	0

In this table, the Likert scale categories 'strongly (dis)agree' and '(dis)agree' have been merged to (dis)agree. 'Neither agree, nor disagree' is presented as 'neutral'. Median is indicated by grey background.

Abbreviations: **OMD**; Orthopaedic department Medical Doctors, **NMD**; Nursing home Medical Doctors, **GP**; General Practitioners.

<sup>†</sup> Response categories: Never; 'No, this type of medication review is not performed', Rarely; 'Yes, a few patients receive medication reviews (approximately 1-29 % of patients)', Sometimes; 'Yes, some patients receive medication reviews (app. 30-59 % of patients)', Often; 'Yes, most patients receive medication reviews (app. 60-89 % of patients)', Always; 'Yes, every patients receive medication reviews (app. 90 % of patients, or more)'