Title

Quality of medication information in discharge summaries from hospitals – an audit of electronic patient records

ABSTRACT

Background Low quality of medication information in discharge summaries from hospitals may jeopardize optimal therapy and put the patient at risk for medication errors and adverse drug events.

Objective To audit the quality of medication information in discharge summaries and explore factors associated with the quality.

Setting Helgelandssykehuset Mo i Rana, a rural hospital in central Norway.

Method For each month in 2013 we randomly selected 60 discharge summaries from the Department of Medicine and Surgery (totally 720) and evaluated the medication information using eight national quality criteria.

Main outcome measure Mean score per discharge summary ranging from 0 (lowest quality) to 16 (highest quality).

Results Mean score per discharge summary was 7.4 (SD 2.8; range 0-14), significantly higher when evaluating medications used regularly compared to mediations used as needed (7.80 vs. 6.52, $p<0.001$). Lowest score was achieved for quality criteria concerning generic names, indications for medication use, reasons why changes had been made and information about the source for information. Factors associated with increased quality scores are increasing numbers of medications and male patients. Increasing age seemed to be associated with a reduced score, while type of department was not associated with the quality.

Conclusion In discharge summaries from 2013, we identified a low quality of medication information in accordance with the Norwegian quality criteria. Actions for improvement are necessary and follow-up studies should be performed to monitor quality.

INTRODUCTION

Good and comprehensible communication between health care sectors is crucial for ensuring continuity of therapy after hospitalization, for which the discharge summary serves as the most important means (1). Research suggests that discharge summaries often have deficiencies, especially when it comes to secondary diagnosis, diagnostics, pending laboratory tests and medication information (1-4). Research also indicates that low quality discharge summaries may increase re-hospitalizations and visits to the emergency room, in addition to having a negative influence on patient follow-up (1, 5). Low quality of discharge summaries seems to be a challenge across departments, hospitals and countries (3).

Poor communication about medications may contribute to medication errors (MEs) (6), which may cause adverse drug events (ADEs), wrong therapy and even death (7). The World Health Organization reports that MEs cause 12-25% of all hospital admissions in Europe, for which more than half is avoidable (8, 9). In the United Kingdom (UK), MEs are estimated to have an annual cost of £ 1-2.5 billions (10). Many research studies have identified low quality discharge summaries from hospitals, but few have applied explicit criteria. One exeption is Hammad *et al.* who applied explicit criteria to 3444 discharge summaries across six UK hospitals, evaluating information regarding dose, frequency, route of administration, formulations, and therapy duration for medications initiated at the hospital (11). They also evaluated information regarding therapy alterations including explanation(s) for the alterations. They identified 67.2% adherence to criteria

concerning general medication information, but only 48.9% adherence to criteria concerning therapy changes (11).

A Norwegian study from 2009 showed that medication lists from departments of medicine were satisfactory in 90% of 184 surveyed discharge summaries (12). Conversly, data from a survey from 2015 among Norwegian general practitioners (GPs) indicate that GPs are worried about lacking or wrong medication information (13). In 2011, a Norwegian scoring tool comprising eight criteria to evaluate information about medications in discharge summaries was published (Table 1) (14). The criteria resemble those applied by Hammad *et al.* and include i) source of information, ii) description of changes, iii) explanations to changes, iv) trade names, v) generic names, vi) dosages, vii) indications for use, and viii) categories [refers to the AICSD categories; A (as before) – I (initiated) – C (changed) – S (short course) – D (discontinued). One category should be stated behind each medication].

AIM OF THE STUDY

The aim of this study was to audit the quality of medication information in discharge summaries from a rural hospital in central Norway, and to explore whether the factors sex, age, number of medications and type of department (Medicine or Surgical) were associated with the quality of the discharge summaries.

ETHICS APPROVAL

This study was approved by the Norwegian Centre for Research Data. There were no patient identifiable information available during the evaluation process.

METHODS

Helgelandssykehuset Mo i Rana is a small, rural hospital in central Norway serving a population of around 33700 inhabitants (15). In 2013, a total of 3703 discharge summaries were written. According to procedure, discharge summaries are written by physicians and sent electronically to primary care physicians after discharge. Discharge summaries are stored in the electronic patient journal and a hard copy is normally given to the patient at discharge or sent by ordinary mail when finalized. We used discharge summaries from 2013 with corresponding admission notes from the electronic patient journal records written by the Department of Medicine and Surgery, the only two hospital departments except the Psychiatric Department which was excluded. We applied Research Randomizer to randomly identify discharge summaries for 30 male patients and 30 female patients for each month, in total 720 (19.4% of all discharge summaries from 2013) (16). We only included discharge summaries from patients who had been fully admitted, and not patients visiting the outpatient clinic. We excluded discharge summaries from patients who did not use medications, as verified in both the admission note and the discharge summary. Data collection was performed during January – April 2014.

We evaluated each discharge summary based on the eight criteria defined by the Norwegian Safety Program, see Table 1 (14). Each criterion could achieve 0, 1 or 2 points, depending on whether the requested information was available for *none* of the medications, *some* of the medications or *all* medications, respectively. Quality criterion 1, 2 and 4 could only achieve 0 or 2 points. To score quality criterion 2 and 3, we compared the discharge summary with the admission note. All discharge summaries were scored separately with regards to i) all medications, ii) medications used regularly and iii) medications used as needed. Non-applicable quality criteria achieved full score. For

instance, if no changes in medications had been made, we would not expect explanation of changes in the discharge summary, and quality criterion 3 was consequently not applicable.

Table 1 Scoring tool for evaluation of medication information in discharge summaries developed by the Norwegian Patient Safety Program (translated from Norwegian) (14)

Quality criteria	Yes	Partly	No
1. Is the source for medication information stated?	2 points	*	0 points
2. Are medication changes accounted for?	2 points	*	0 points
3. Are reasons for changes stated?	2 points	1 points	0 points
4. Are trade names stated?	2 points	*	0 points
5. Are generic names stated?	2 points	1 points	0 points
6. Are dosages stated?	2 points	1 points	0 points
7. Are indications for use stated?	2 points	1 points	0 points
8. Are categories stated?#	2 points	1 points	0 points
Maximum score	**16 points**		

*Only 0 or 2 points could be achieved
refers to the AICSD categories; A (as before) – I (initiated) – C (changed) – S (short course) – D (discontinued), where one of the options is to be stated behind each medication in the medication list. Recently this has been changed to ICSD.

We used Microsoft® Excel 2010 and IBM® SPSS Statistics 25 for data management and analysis. Results are expressed with means and standard deviation (SD) and minimum and maximum values. A p-value of <0.05 was considered significant. We applied an independent sample *Student's* t-test to compare mean scores between groups. We used a linear regression model to explore the association between mean score and the factors sex, age, number of medications and type of department (Medicine or Surgical). For validity testing, we randomly selected sixty discharge summaries and asked an independant person to score them. Inter-observer agreement was calculated by Cohen´s kappa (κ), where κ-values ≥ 0.75 represented excellent agreement (17). Non-applicable quality criteria were excluded from agreement calculations in order not to falsely increase the level of agreement.

RESULTS

We evaluated 586 discharge summaries, as 134 (19%) were excluded because the patient did not use medications. Out of 4688 quality criteria, 322 (6.9%) were not applicable. Male patients represented 294 (50.2%) of all summaries, the mean age of patients was 65.3 (SD 20.7; range 1-100) and the mean number of medications used at admission was 7.5 (SD 5.4; range 0-29). The mean number of medication used regularly and as needed was 6.4 (SD 4.6, range 0-25) and 1.1 (SD 1.7, range 0-10), respectively. There was no significant difference in the number of medications used by males and females (p=0.055). Medications for regular use and for use as needed was included in 550 (97.2%) and 350 (59.7%) summaries, respectively. Sixteen summaries (2.7%) included only medications for use as needed, while 236 (40.3%) included only medications for regular use.

Out of the total 4688 criteria, 42.0% (n=1970) achieved a score of 0, 23.8% (n=1116) a score on 1 and 34.2% (n=1602) a score of 2. Lowest score was achieved by quality criterion 1, as most summaries did not include information about the source of medication information (e.g. patient, next of kin, nursing home, GP). Highest score was achieved by quality criterion 4 and 6 because trade names and dosages were stated for most of the medications. We identified profound improvement potentials for quality criteria 3, 5, 7, and 8 because information was partly complete for many summaries, and consequently only one point was given (Figure 1).

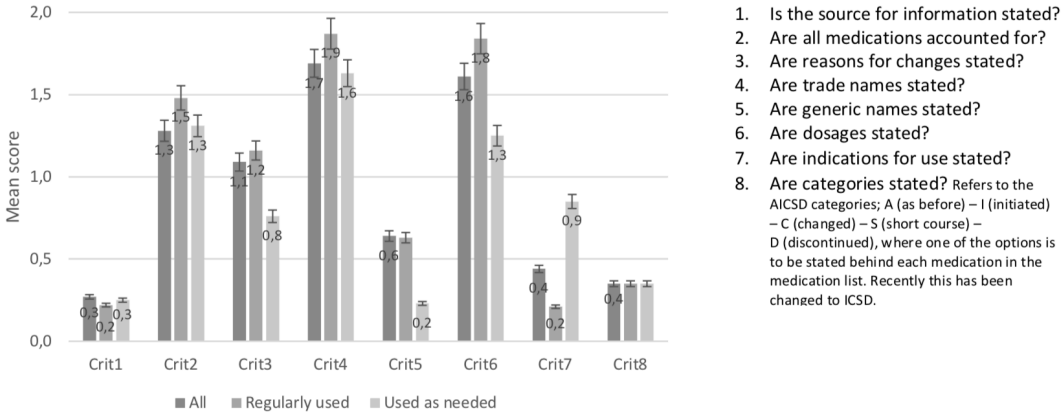

Figure 1: Mean score of discharge summaries per quality criterion
(0 points for no information, 1 point for some information and 2 points for complete information. Quality criteria 1, 2 and 4 could only achieve 0 or 2 points.)

Mean score of discharge summaries when evaluating all medications was 7.4 (SD 2.8, range 0-14), see Figure 2. Discharge summaries that scored 0 points lacked a medication list, even though medication use was stated in the admission notes and no discontinuation was described. When evaluating medications used regularly, mean score was significantly higher than when evaluating medications used as needed (7.80 vs. 6.52, p<0.001), see Table 2.

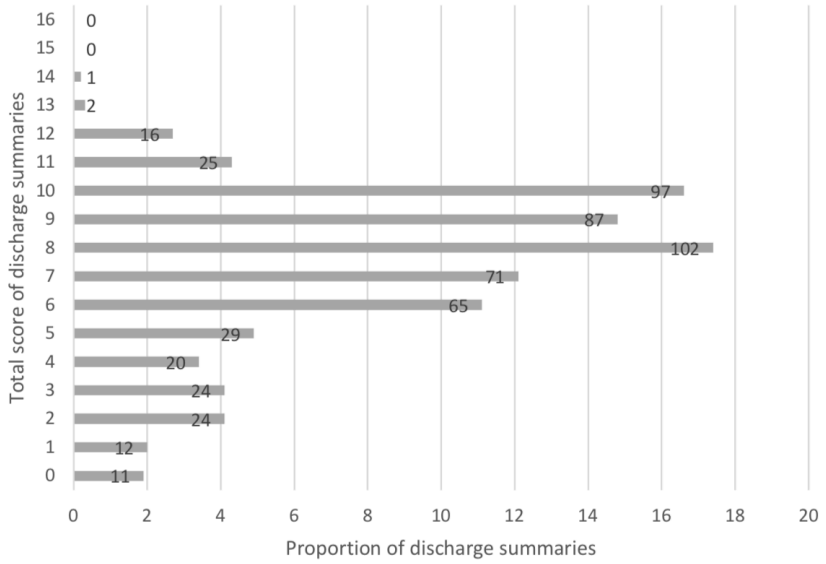

Figure 2: Proportion of discharge summaries with different total scores (the actual numbers indicated in the bars) during the period January – December 2013 at Helgelandssykehuset Mo i Rana

Table 2: Mean score per discharge summary at Helgelandssykehuset Mo i Rana in 2013 as measured by the Norwegian scoring tool for evaluation of medication information in discharge summaries (14)

	All medications (n=586)		**Medications used regularly** (n= 570)		**Medications used as needed** (n=350)	
	Score	(SD)	Score	(SD)	Score	(SD)
Total mean score	7.37	(2.77)	7.80	(2.46)	6.52	(3.59)
Sex						
Female	7.18	(2.92)	7.64	(2.58)	6.32	(3.84)
Male	7.56	(2.60)	7.96	(2.31)	6.72	(3.33)
Departments						
Surgery	7.10	(2.89)	7.52	(2.58)	6.14	(3.71)
Medicine	7.64	(2.36)	8.06	(2.30)	6.86	(3.45)

From univariate tests, we identified that the mean score of discharge summaries for males were significantly higher than for females (7.56 vs. 7.18, p=0.034) and that the mean score of discharge summaries from the Department of Medicine were significantly higher than those from the Department of Surgery (7.64 vs. 7.10, p=0.014). When adjusting for sex, age, type of department and number of medications, the mean score of the departments no longer differed significantly (p=0.075). However, both sex [discharge summaries for males scored 0.548 more points than for females (P=0.018)], age [mean score was reduced by 0.013 points for every increasing year (p=0.035)] and number of medications [mean score increased by 0.103 points for each additional medication (p<0.001)] seemed to be associated with the mean score (Table 3).

Table 3: Linear regression model showing the association between the mean score of the discharge summaries and the factors sex, age, type of department (Department of Surgery or Medicine) and number of medications.

Variable	Coefficient	(95% CI)	P-value
Constant	6.501	(5.51, 7.49)	-
Sex			
Female	Ref.	-	-
Male	0.548	(0.094, 1.002)	**0.018**
Age	-0.013	(-0.025, -0.001)	**0.035**
Department			
Surgical	Ref.	-	-
Medicine	0.077	(-0.042, 0. 889)	0.075
Number of medications	0.103	(0.056, 0.150)	**<0.001**

Validation

In the inter-observer validation, 449 of 480 (93.5%) criteria were applicable. The overall κ-value was 0.9, indicating excellent agreement. Lowest agreement was achieved for quality criterion 3 (κ=0.75) while highest was achieved for quality criterion 7 (κ=1.0).

DISCUSSION

In this audit, we have identified a lower quality of the medication information in discharge summaries than anticipated in a modern health care system. Our results, however, are in accordance with UK findings, and confirm the across-border concern about low quality of medication information (11). As studies have shown that high quality of discharge summaries may improve patient outcomes (1, 5), our results are important because they clearly show the need to improve the quality of medication information in the discharge summaries. This may be done by introducing electronic medication management (EMM) systems, as such systems may increase the completeness and accuracy of the medication information (11, 18). EMM may also improve quality of medication information throughout the health care system (19) . An EMM system is under development for our health care region, and implementation is anticipated during 2018-2020. Handwritten medication charts will then be replaced by electronic systems, and errors related to manually imported data into the electronic discharge summaries may be reduced. However, other problems will most likely be introduced, e.g. errors due to incorrect selection of medications or user entry (2, 4). Involving clinical pharmacists has been shown to improve the quality of medication information in discharge summaries, which may reduce MEs in relation to transfer of information to primary and community care (20, 21).

Even though our results do not comport with the study by Frydenberg *et al.* from 2011, where 90% of all discharge summaries were shown to have "complete" information regarding medications and dosages (12), they support findings from the 2015 national survey showing that GPs are concerned about the quality of medication information in discharge summaries (13). It is unclear whether Frydenberg *et al.* evaluated the completeness of information in comparison with information in admission notes or not. If not, they may have been unable to identify incompleteness as we have done in our study.

It is interesting that the mean score was higher when evaluating medications used regularly compared to when evaluating medications used as needed (7.80 vs. 6.52). This has not been studied before and the explanation to our finding is unclear. It is possible that information is considered more important for medications used regularly compared to medications used as needed. It is also possible that this information was not know at discharge because it was lacking already at hospital admission, which is plausible because studies indicate that medication information in admission notes often are incomplete (12, 22, 23).

The regression model showed that the discharge summary score increased with an increasing number of medications. This is contradictory to results shown by Hammad *et al*., who found that an increasing number of medications was a predictor of low quality (11). We do not completely understand the reason for our findings, but can depict several explanations: i) A long medication list may trigger the need for overview and completeness, not only for the patient and the next care level, but also for the writers themselves. ii) The writers of summaries with long medication lists may differ from writers of summaries with short medication lists. iii) Long medication lists may be more complete than short lists already at admission, which may influence the medication list at discharge.

The regression model also showed a significantly higher score in discharge summaries for males compared to females, for which we see no clear rationale. Our results may be biased by confounding factors that we have not measured. However, it is also possible that men and women differ with regards to the information they supply about their medications and the questions they ask, which finally influences the completeness of

information in the discharge summary. The difference between sexes was not studied by Hammad *et al.* (11) and will have to be further explored in future studies.

Both quality criterion 1 (is the source of medication information stated?) and 8 (are categories stated?) achieved a very low score, which we expect will improve with time. For criterion 1, because a new procedure for medication reconciliation at hospital admission is under implementation in our health care region. We anticipate that the availability of the information source will increase (24), but do not know whether the quality of the medication information will improve. Studies show that medication reconciliation at hospital discharge is even more crucial in order to reduce medication errors (21). For criterion 8, we anticipate improvements because the AICSD categories have been given more attention during the recent years on a national level.

Even though we identified a high score for criterion 2 (are changes accounted for?), the score for criterion 3 (are changes explained?) was very low. This was also shown by Hammad *et al*. and Tan *et al*., who found that only about 50% of medication changes were explained at discharge (11, 25). Norwegian GPs also stated that reasons for changes were frequently lacking in discharge summaries from hospitals (26). Knowing that the reason for medication changes is crucial for understanding and follow-up of patients at the next care level (1), it is important to implement procedures that ensures that this information is well described in the discharge summaries.

Criterion 4 (are trade names stated?) achieved a far better score than criterion 5 (are generic names stated), which is not surprising because medication lists are hand written without any electronic system ensuring that the generic names are automatically included when trade names are selected. Even though generic prescribing of medications in medication charts was introduced in 2014 (27), we still experience that generic names are lacking. This is partly comprehensible as manually entering medication lists from hand-written medication charts to electronic discharge summaries is time consuming. Including generic names would take even more time, especially if they have to be identified from books or internet resources. For the patients, however, the generic name is important because a generic substitute may be dispensed at the pharmacy, which could cause confusion and misunderstanding if patients are not familiar with generic names from the beginning. In a quality assurance point of view, both names should always be stated, which also will help detecting double prescribing.

Criterion 7 (are indications stated?) achieved a very low score which is alarming as studies show an increased risk of medication errors or non-adherence when indications for medication use are not informed (28). Frydenberg *et al.* found that medication information in admission notes was often insufficient (12). Unfortunately, we did not collect enough data from the admission notes to explore whether this was the case also in our study. However, based on personal communication with our physicians, we suspect that indications for use may have been lacking for many of the medications already at hospital admission. Consequently, including indications for medication use may be a challenge not only for hospitals, but also for primary care.

Strengths and limitations

The main strength of this study is the high number of discharge summaries included, the random selection of these and the application of published national quality criteria. Also, our data represent a whole calendar year which eliminates bias by seasonal variations. We have reduced selection bias by including an equal amount of discharge summaries for both sexes and both hospital departments. We have compared information in the discharge summaries with information in admission notes, which enabled us to identify changes in medication regimes throughout the hospital stay. This has not been possible

in other studies (11, 12). Finally, we found excellent inter-observer agreement during validation.

This study has several limitations. *First*, as a single site study in a rural setting, results may not be generalizable to other hospitals or other settings. *Second*, although there are some mandates and expert opinion-based guidelines for discharge summary content, there is no evidence-base to confirm which information should be present in order to improve patient outcomes. Our scoring tool evaluated the presence of eight medication information dimensions, but each dimension is equally weighted, irrespective of which of the dimensions may be most clinically relevant. *Third*, there are relevant elements lacking in the scoring tool, e.g. dosage frequency. This has been included in the updated version (29). *Fourth*, our data is from 2013, and may not be representative for the present situation. However, new procedures for medication reconciliation and medication safety are slowly being implemented and our 2013 data is important as a reference point when monitoring the quality of the discharge summaries in future studies. *Fifth*, as we did not collect the presence of information in the primary care patient referrals, we may have measured the presence of information that physicans were unable to include as it was not available for them at admission. *Finally,* we did not collect information regarding length of hospital stay, whether hospitalizations were planned or unplanned (emergency), which medications the low scores were related to, the clinical experience of the writer of the summary, patient medical and clinical information, or post-admission complications as collected in other studies (11, 18). Consequently, we were not able to explore whether these factors could be associated with the quality of discharge summaries.

CONCLUSION

According to Norwegian quality criteria defining the presence of essential information in discharge summaries from hospital, we have identified a low quality of medication information in discharge summaries from Helgelandssykehuset Mo i Rana in 2013. The low quality was mainly caused by lack of generic names, indications for medication use, reasons for medication changes, and source of information. Quality seemed to increase by the number of medications and the patient being male, while quality seemed to decrease with the patients´ age. Actions for improvement are necessary and follow-up studies should be performed to monitor quality.

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Conflicts of Interest

None of the authors have any conflicst of interests to be declared.

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