

# How Discrepancies in Medication Records Affect the Creation and Trust in a Shared Electronic Medication List in Norway

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## Abstract

A shared electronic medication list is being piloted in Norway. By use of interviews and comparing medication records, we investigate how errors in current paper-based medication lists affect the creation of the shared electronic list. Of 367 patients, 88 % had discrepancies in their records between the GP, the home care service and dispensing pharmacy prior to start-up. Though the GPs experienced the medicines reconciliation and creation of the shared list very time consuming, the home care service and the pharmacy reported many errors in the first list created. Increased communication during the start-up will probably facilitate the trust in and use of the shared electronic medication list with further implementation.

## Keywords

Patient safety, Medication reconciliation, Shared medication list, Multidose drug dispensing

## 1 INTRODUCTION

Medicines play an important role in the treatment and prevention of disease. However, medication errors, low adherence to prescribed treatment and adverse drug events can also cause increased morbidity and mortality [1-4]. In Norway, information about patients medicines use are stored in many different systems, with little automatic transfer of information between them. This is especially a challenge for clinicians, as they do not have immediate access to an up-to-date list of the patients' medications. Lack of access to such information increases the risk of medication errors [5].

Digital medicines management has the potential to increase efficiency and safety of medicines management by making information accessible. The Norwegian health authorities are currently piloting the use of a shared electronic medication list ("Pasientens Legemiddelliste" in Norwegian- hereafter shortened "PLL") [6, 7]. The first patients to get a PLL, are patients who receives home care services, and who get their medicines dispensed as multidose (e.g. patients who get medicines machine dispensed into unit bags for each dose occasion; a service commonly used by home care services in Norway. For more information about the multidose-system see [7]). These patients are typically elderly patients with difficulties handling and administering their own medicines, in addition to using several regular medicines [8-10].

Before the implementation of PLL, there are at least three separate medication lists for each of these patients; one in the general practitioners' (GP) electronic medical journal, one in the home care service journal system, and one at the multidose dispensing pharmacy. Even though most prescriptions in Norway are electronic [11], the multidose prescriptions are still paper based. This creates an additional challenge for sharing medicines information for these patients. Previous studies have shown that up to 90 % of patients have one or more discrepancy in their

medication list when comparing the list in the GPs electronic medical journal and the list at the home-care-services [12-16]. When PLL is implemented, the PLL will be uploaded electronically to the Norwegian Prescription Mediator. This Prescription Mediator is a well established database, which is currently used for transferring electronic prescriptions. It is accessible for all doctors and pharmacies in Norway. In time of writing, the home-care services do not have access, though there are plans to give them access within a few years[17]. The PLL, though uploaded to the Mediator, is not considered a valid prescription that can be used for dispensing of medicines. This means that patients who receive a PLL will still need electronic prescriptions in addition to the PLL.

The pilot testing of PLL for patients receiving home care services started in 2014. Further testing of PLL for other prescription recipients starts in 2020 [17]. The aim of this study is to investigate how errors and discrepancies in existing medication records affect the implementation of PLL for patients receiving multidose drug dispensing in Norway.

## 2 METHODS

This study combines qualitative and quantitative methods with inspiration from mixed methods [18]. The main focus is on the quantitative part which investigates the occurrence of discrepancies in the medication records between the pharmacy, home care service and GPs before the creation of the PLL. With the purpose of expanding the results [19] we have also performed qualitative interviews with these three groups of health professionals about how the discrepancies affected the creation and use of PLL.

The official routines for creating the PLL was that the pharmacy sent a printout of their medication lists to the GPs, approximately 1 month prior to start-up. After comparing this list to their own record, the GP created and sent the PLL to the Prescription Mediator. The pharmacy

then deleted the medicines in their own system and started dispensing based on the PLL and the electronic prescriptions.

The data collection of the paper-based medication lists in this study was done approximately 2 months before the initial send-out from the pharmacy, while the interviews were performed 3 months after the first dispensing based on PLL.

The study was approved by the Data Protection Officer at the University Hospital of North Norway (UNN), and the Regional Committee for Medical Research Ethics (REK) has given approval to collect the medication lists. Patient identifying data was stored separately from the anonymous medication list in a secure research server at UNN.

**2.1 Discrepancies in medication records:**

In the municipality which was about to start using PLL, we contacted 15 GP offices, the home care service and the delivering pharmacy, to ask for participation in the study. Those who accepted the invitation, received a list of patients and a generated serial number, together with instructions to print out the medication lists for these patients, replace patient identifying information with the serial number, and send the lists to the researcher via post. Lists from all three groups were collected within the same week.

Each set of medication lists were compared by two pharmacists separately. The number of medicines in each list, as well as any discordant information in the medication lists, was recorded. The categories of discrepancies was: Medication lacking from one of the lists, differences in dosage, prescriptions written as “regular use” in one list and “as required” in the other, lacking reimbursement information, different administration formula and others (see Table 1)

**2.2 User’s experiences**

The Directorate e-Health provided contact details for the health care personnel who were piloting the PLL. Invitations were sent to the home care service, the pharmacy and all three of the GP-clinics, with brief information of the project and the main themes of the interviews. We conducted four interviews: One group interview with seven GPs, one group interview with four pharmacy employees and two individual interviews with nurses and pharmacist in the home care service. The interviews lasted about 45 minutes; they were recorded on tape and later transcribed by a professional agency.

The interviews focused on how electronic prescribing of multidose affected the users work practice, experiences with the transition, measures to facilitate improvement, and experienced risks and benefits with the system. The transcribed interviews were read by two researchers separately, and topics related to the medication reconciliation process (e.g. the process of using different sources of medicines information to create a complete and accurate list of all the medications the patient is using) and the use of the first PLL, were extracted.

**3 RESULTS**

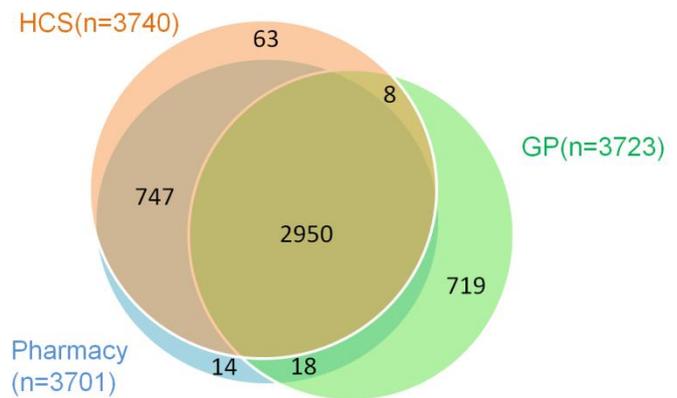
**3.1 Discrepancies in medication records:**

In total, 36 GPs from seven doctor’s clinics participated in the quantitative study, and medication lists for 367 patients were collected. For the GP, the home care service and the pharmacy, the total number of medications listed was 3723, 3740 and 3702, respectively. The median number of drugs was nine for all three lists, however, we see from Table 1 that the distribution of medicines listed as *regular* versus *as required*, differs between the lists. The home care service and the pharmacy had more medicines listed as *regular* and fewer *as required*, than the GPs.

	GP n (median)	HCS n (median)	Pharmacy n (median)
Regular drugs	2397 (5)	2757 (6)	2734 (6)
As required drugs	1066 (3)	773 (2)	759 (2)
Medical devices and consumables	260 (1)	210 (1)	209 (1)
Total	3723 (9)	3740 (9)	3702 (9)

**Table 1** Number of drugs in the general practitioner (GP), the home care service (HCS) and the pharmacy medication lists. N= 367 patients.

If we disregard the dosage (including whether the medicine is listed *regular* or *as required*) there were 4519 unique medications in the lists. Of these, 2950 (65 %) were present in all three lists (Figure 1). From Figure 1 we also see that is a larger degree of overlap between the home care service lists and the pharmacy (3697/3800 = 97 %), than the home care service and the GP-lists (2958/4505 = 66 %).



Congruence = 2950/4519 = 65%

**Figure 1** Venn diagram showing the congruence of prescribed medications between the GPs medical record, the home care service (HCS) record, and the pharmacy medication list (N=367 patients, 4519 unique medications)

In addition to the medications lacking from one of the lists, there were also other types of discrepancies. In total, 1978 discrepancies were found between the home care service and the GP medication lists, affecting 88% of the patients. While 148 discrepancies were found between the home care service and the pharmacy lists, affecting 16 % of the patients. Table 2 shows that the most frequent discrepancy in all lists was that a medication was lacking, followed by differences in dosage.

Type of discrepancy	List comparison		
	GP - Pharmacy	GP- HCS	Pharmacy - HCS
	n (%)	n (%)	n (%)
Medication lacking from one of the lists	1474 (74.5)	1502 (77.8)	85 (57.4)
Dosage	223 (11.3)	253 (13.1)	49 (33.1)
Regular prescription versus as required	133 (6.7)	129 (6.7)	4 (2.7)
Reimbursement	71 (3.6)	NA	NA
Administration formula	31 (1.6)	28 (1.5)	3 (2.0)
Other	46 (2.3)	18 (0.9)	7 (4.7)
Discrepancies	1978 (100)	1930 (100)	148 (100)

**Table 2** Frequency and type of discrepancy in the medication lists. HCS= Home care service. N = 367 patients.

### 3.2 User’s experiences

#### Medical doctors:

The GPs expressed that the start-up had been somewhat challenging, mostly due to technical difficulties. The errors meant that they had to do certain tasks several times, some functions were not possible to perform, and the system was in general very slow. They also commented that they found the information and training prior to start-up insufficient for their needs.

Regarding the medication reconciliation, the GPs interviewed said that this had gone well and that the quality of the prescribing was improved after the transition because the steps in the prescribing process was more quality assured. Except for mentioning that the initial creation of the PLL took a long time, estimated 20-30 minutes per patient, the GPs did not mention any specific difficulties related to the discrepancies in the records.

#### Pharmacy staff:

The pharmacy staff expressed that the work during start-up varied greatly between the different GPs. Their impression was that the GPs did not get sufficient training beforehand, and that there was a lack of support during the starting phase. For the GPs that were thorough and experienced few technical difficulties, the pharmacy staff felt that the electronic prescribing was safer and more efficient than the paper-based. However, for those GPs who struggled, they reported using a lot of time and energy on trying to correct the medication lists. Even three months after the start-up, they reported that they were still struggling with certain patients.

*We are more vulnerable if the GP makes an error, because on an ordinary paper [prescription] we could do the change ourselves and ask the GP to sign it afterwards [...]. but now, [...] we need a new e-prescription.*

Regarding the first PLL, the pharmacy staff experienced many difficulties. Particularly, they reported that many prescriptions were expired, prescriptions had too few tablets left, or prescriptions were otherwise not possible to

use for dispensing. Some patients had completely wrong lists, where all the medications the patients had used, including those which had been stopped many years ago, appeared on the list. They also experiences problems when the GPs were trying to renew the prescriptions.

*When renewing [...] instead of keeping the old [dose] they use the “standard dose; one tablet daily”.*

Straight after the start-up, they experienced many phone calls from the home care service, who were wondering whether patients had started with the new system, whether they had valid prescriptions, or were wondering why there were so many changes in the patient’s drug regiments after the first dispensing. Though the calls had started to subside after three months, the pharmacy still experienced that the new system required more frequent contact with both the prescriber and the home care services.

#### Home care services:

The nurses and pharmacist in the home care service were the ones who reported the most problems with the reconciliation process, and the start-up in general. Since they did not have access to the PLL directly, they did not have the opportunity to double check the prescribing before the medicines were delivered to them. Since these multidose bags are usually delivered just a few days before the patients run out of medicines, this left the home care service with very little time to detect and correct errors in the dispensed medicines. They found the process of checking all the multidoses very time consuming due to many errors in the first delivery after start-up. When they received the first delivery based on the PLL and electronic prescriptions, they reported that some patients did not get medicines at all, some were missing certain drugs, and other had many unexpected changes in the doses

*I experienced it as if the medication reconciliation had not been done, because when we got the multidose, [there were so many] differences between what they had been taking and what they were suddenly supposed to use.*

However, also after the start-up, they still experienced many errors. After three months, they still felt that they had been given an increased responsibility with the new system, because they had to check the medicines dispensed more often and more thoroughly than before

*We noticed in this project that we were the ones with the correct information about the dosage.*

## 4 DISCUSSION

This study shows that there is a large degree of discrepancies between the medication records of the GPs, the home care service and the dispensing pharmacy, with 88 % patients having at least one discrepancy in their medication lists. Previous studies have shown discrepancies in 52 % to 90 % of the records [12-16]. The most frequent discrepancies we found in the records were that a prescription was lacking from one of the lists and different dosage, which is also consistent with findings from other studies [12, 15, 16].

As most previous studies have only compared the lists between the GPs and the home care service, our study is one of the first to compare the medication lists between the home care service and the pharmacy. We found that only 16 % of the patients had one or more discrepancy when comparing these two lists. The low number of discrepancies between these two might be because in the municipality included in this study, the pharmacy has an electronic transfer of their medication list to the home care service whenever there are any changes in the pharmacy records. The congruence might thus not be this high in municipalities without this system.

We know from previous studies that insufficient communication between health care personnel about medication use, especially in the transition between primary and secondary care, is a major cause of discrepancies in medication records [20-25]. In the current paper-based prescribing system for multidose, there are many manual processes that can lead to errors. We see from the pharmacy interview, that they report fixing problems on paper prescriptions and getting the change signed by the doctor afterwards. These kinds of procedures make it possible for the doctor to sign a prescription without updating their own medication record, which is a probable cause for some of the errors we find in this study. In the new electronic system however, it will normally not be possible for the pharmacy to change a prescription.

Since not all records were collected on the same day, some of the discrepancies found in this study might be intended changes in the patient's drug regimen, which happened in the days between the collections. However, data extracted from the pharmacy dispensing programme shows that normally 10-12 % of patients in a patient group, have changes every two-week period [26]. This means that even the frequency of discrepancies between the home care service and the pharmacy is higher than expected based on a normal rate of medication changes.

From our results, we only know that there are discrepancies in the medication information, and not in which list the error lays. Because these patients get their medicines dispensed in multidose bags and get help from the home care service to administer their medicines, the pharmacy or home care service list would probably be the list which best represents what the patients have actually been taking. However, from a medical point of view, it is not necessarily the most correct list. Also from the interviews, we see that the home care service feel that their lists is the correct one, and they experienced that the changes that happened in the patient's treatment when starting to use PLL, were errors that happened because the GPs had not done a proper medication reconciliation.

If the first PLL is not identical to the home care service-list, there can however, be several other explanations than the GP not having done a reconciliation. Either there can be normal changes in the patient's medication regimen, which happens to about 10-12 % of the patients each dispensing period. Another possible explanation could be that when doing the reconciliation, the GP also performed a more

thorough medication review, which have led to many deliberate changes to the patient's regimen. If all that is communicated is the PLL, then the home care service would not be able to differentiate between these three reasons for changes. It might thus be necessary that more information is given at the very start, at least specific feedback or conformation that the reconciliation has been performed. Preferably, this report should also comment on why there are changes from the current treatment. Another alternative would be that the home care service was more involved in the reconciliation process. This alternative might imply some practical issues, as well as being quite time consuming. However, as the home care service already reported using a lot of time to double-check the PLL and the multidose bags, this might still be a better alternative.

It is interesting that the GPs in this study did not report reconciliation process as especially problematic, except for the time used to perform it, but that the recipients of the PLL experienced many errors and even commented that they thought the lists had not been reconciled at all. This might however, be due to bias in our interview material, as very few GPs accepted our invitation to participate. The ones included might thus be those with the most positive experience with the transition, and/or the most conscientious.

In our opinion, the discrepancies represent a patient safety problem. We see from Figure 1 that the home care service reported that the patients used 810 medicines that were not present in the GPs' medical record, and the GPs listed another 719 drugs the home care service did not know about. In addition, there were several discrepancies in the dosages of the medicines. The GPs thus risks making inappropriate decisions about the patients' medication therapy, if basing these decisions solely on the information in his or her own journal. The errors in medicines information we have found here have however, most likely been present for a long time, though the users do not seem to have experienced them as a particularly problematic in the paper-based system. With the implementation of PLL, these discrepancies become more visible, and the implementation process forces the users to perform a medication reconciliation. Though this study shows that the reconciliation process was not satisfactory, we see from the pilot of this system that the number of discrepancies seems to be reduced 1 year after the implementation, and the patient safety increased [27, 28]

Even if the discrepancies are reduced, there is still an issue with medication non-adherence, which we have not investigated in the present study. Medication non-adherence occurs for patients using multidose [29], though it seems to be even more common for patients not receiving multidose [30, 31]. We know from previous studies that there is a number of discrepancies between the GPs' medical records and what patients report taking [32-35]. These discrepancies are however more difficult to detect than the ones in our study, as it includes asking each patient about their actual medication use. Nevertheless, this issue should be addressed before PLL is implemented for all prescription users. For the patients in our study, the home

care service did a thorough control of the first PLL, which uncovered many errors. For other prescription recipients there is no formal control of the first list. Any errors in the PLL might thus go undiscovered and unrectified for a long time. We see from our study that the number of errors that were present in the first PLL seems to have reduced the home care services trust in the PLL. If this mistrust persists, it can reduce the use and the net benefits from the PLL.

## 5 CONCLUSION

Discrepancies in medication information between the GPs, the home care services and the dispensing pharmacy, are common, with 9 in 10 patients having at least one discrepancy in their medication lists. These discrepancies pose a challenge in the implementation of the shared electronic medication list (PLL). An unsatisfactory medicines reconciliation process prior to start-up seems to have reduced the home care services trust in the new system. When the PLL is implemented for other prescription recipients however, we risk that the errors go undetected because there is no formal control of the first PLL by the home care service. Before further implementation of PLL, the procedure for performing the medication reconciliation should be improved. The time from the reconciliation to the actual dispensing should be increased, and the communication between the health care personnel involved in the reconciliation process should be improved.

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