



ORIGINAL ARTICLE

GPs' prescription routines and cooperation with other healthcare personnel before and after implementation of multidose drug dispensing

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Abstract

Background: This study addresses GPs' attitudes towards multidose drug dispensing before and after implementation and their perceived experience of how multidose drug dispensing affects prescription and communication routines for patients in the home care services. This study contributes to a method triangulation with two other studies on the introduction of multidose drug dispensing in Trondheim. **Methods:** A controlled before-and-after study carried out in Trondheim (intervention) and Tromsø (control). A questionnaire was distributed to all GPs in the two towns in 2005 with a follow-up questionnaire in 2008. **Results:** The GPs in Trondheim showed a positive attitude to multidose drug dispensing both before and after the implementation. Increased workload was reported, but still the GPs wanted the system to be continued. Most of the GPs reported a better overview of the patients' medication and a supposed reduction in medication errors. The GPs' prescription- and communication routines were changed only for the multidose drug users and not for the other patients in the home care services. **Conclusions:** **The study supports the results presented in two previous publications according to GPs' positive attitude towards multidose drug dispensing, their better overview of the patients' medications, and improved cooperation with the pharmacy. This study adds to our understanding of prescription routines among GPs and the use of the medication module in the electronic health record.**

Key Words: Care coordination, electronic health records, general practice, home care service, multidose drug dispensing

Background

With multidose drug dispensing (MDD), patients receive their drugs in machine-dispensed dose units, packed in disposable bags. The dose unit bags are labelled with patient data, drug content data, and time for intake [1–3]. For patients receiving multidose-dispensed drugs, all prescriptions issued by the patients' GPs are ordered through a local pharmacy, which electronically forwards the total orders to an MDD supplier. Dispensed drugs are returned to the pharmacy, and home care services deliver the dose units to the patients [4]. For patients using home

care services, each supply of drugs usually covers 2 weeks of use. In 2011 there were about 53,000 users of multidose-dispensed drugs in Norway. Three out of four of these users were patients using home care services [5].

Residents in Norway are entitled to a regular GP [6]. Formally, these GPs are required to keep updated medication records for all their patients, including changes that derive from visits to hospitals or other physicians. Home care services offer assistance with medication for patients living at home; this makes

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Table I. Themes in the questionnaires and example questions.

Theme	Example question	Response categories
Responsibility	Does the EHR clearly indicate that the home care services handle the medication for the patient?	Always, mostly, sometimes, never
Prescription management	Are the drug requisitions from home care services cross-checked against the medication record in the EHR?	Routinely, only when in doubt
Communication	Does the patient get a copy of the medication record in the EHR when changes have been made during the consultation?	Always, mostly, sometimes, never
Expected/experienced changes	Overview of the patient's drug use	More, unchanged, less

EHR, electronic health record.

the nurses in the home care services responsible for the administration and observation of patients' drug use. However, GPs and home care services are separate organisations in primary care in Norway. They are usually not located together and they keep separate medication records. To avoid adverse drug events, home care services rely on close collaboration with GPs and pharmacies [7–9]. The need for cooperation between different groups of health personnel and coordination of tasks related to medications is even stronger under the MDD system [1,10–12].

Medication errors are any errors in the process of prescribing, transcribing, dispensing, or administering a drug [13]. Research shows that errors resulting in preventable adverse drug events most often occur at the stage of ordering [14]. The prescribing of drugs includes prescribing decisions and prescription writing, and errors occur in both parts of this process [15]. In this study, we focused on the prescription writing part of the process.

Aims

The aims of this study were to investigate (1) GPs' attitudes and experiences gained in relation to the introduction of MDD, and (2) GPs' prescribing, communication, and collaborative work routines before and after the implementation of the system. This study contributes to a method triangulation, i.e. checking the validity of the findings from two other studies by cross-checking them with another.

Materials and methods

The introduction of MDD in Trondheim (intervention) was organised by the municipal healthcare management and gradually adopted in 2006. Unlike most other municipalities in Norway using MDD, Trondheim decided to use the GPs' medication record in the electronic health record (EHR) as the master medication record. Hence, other health personnel had to manually update the medication record in their own EHR in accordance with the GPs'.

According to the local routines, only the patients' regular GP was allowed to prescribe drugs for inclusion in the patient's multidose drug packages.

In order to assess the influence of MDD on medication practices from a professional perspective, a questionnaire survey for comparison was carried out. The city of Tromsø was strategically selected as a control. Tromsø (67,000 inhabitants) and Trondheim (170,000 inhabitants) are two medium-size towns in Norway. They both have a large university hospital and are the administration centres in their respective regions. Both towns have been in the forefront of introducing information and communication technology in primary care. However, the one important difference was that Tromsø had not planned to implement MDD.

When MDD was implemented in the home care services, Trondheim was organised in 27 home care units, compared to eight units in Tromsø. In total, about 1800 patients received assistance with the handling of drugs in Trondheim and approximately 800 patients in Tromsø. Five out of 17 pharmacies in Trondheim were involved as multidose drug providers. Tromsø had six pharmacies.

Questionnaires

A questionnaire was distributed to all GPs in Trondheim and Tromsø in 2005/2006 and in 2008. In Trondheim the total number of GPs was 123 (2005/2006) and 137 (2008), while in Tromsø the number of GPs was 52 in both years. The questionnaires had questions about prescription routines and communication and cooperation with home care services and pharmacies regarding medication (Table I).

The questionnaires had a multiple-choice design including optional free-text comments. The questionnaires were identical for both towns; however, only GPs in Trondheim (the intervention group) were questioned about experiences and expectations of MDD. In 2008, the GPs in Trondheim were asked separate questions in relation to their routines for follow up of patients with MDD and with ordinary prescriptions (OP).

Table II. Response rates and characteristics of the GPs in Tromsø and Trondheim in 2005 and 2008.

	Before intervention (2005)			After intervention (2008)		
	Trondheim	Tromsø	<i>p</i> -value	Trondheim	Tromsø	<i>p</i> -value
Response	82 (67)	39 (75)	0.37 ^a	91 (66)	29 (56)	0.18 ^a
Age (years)	46±10	44±10	0.35 ^b	48±11	48±12	0.82 ^b
Patients	1447±283	1273±289	0.003 ^b	1385±327	1280±254	0.08 ^b
Years in general practice	15±10	13±10	0.34 ^b	16±11	17±11	0.65 ^b
Specialists in general practice	50 (61)	27 (69)	0.50 ^a	58 (64)	22 (76)	0.26 ^a
Gender						
Women	Not asked	Not asked	–	24 (26)	12 (41)	0.13 ^a
Men			–	67 (74)	17 (59)	

Values are *n* (%) or mean±SD. ^aFisher's Exact test for difference in proportions. ^bTwo-sample t-test for difference in mean values.

In Trondheim, the first questionnaire was distributed at a professional meeting, while the second one was sent and collected by mail. In Tromsø, both questionnaires were handed out and collected at the GPs' offices. One reminder was given after 3 weeks. All the responses were kept anonymous.

Statistical analysis

Descriptive and statistical analyses were completed using SPSS. Mean values and absolute and relative frequencies (%) are presented. A two-sample t-test was used to compare mean values of characteristics between the GPs in Trondheim and Tromsø. Fisher's Exact test was used to compare the distribution of categorical factors (proportions) between the years of assessment (2005 vs. 2008) and between towns (Trondheim and Tromsø). An ordinary logistic regression analyses was used to examine whether the difference in odds of changing routines (e.g. updating of medication records) from 2005 to 2008 differed for Trondheim (intervention area) and Tromsø (control area), technically represented by an interaction term in the statistical model. Separate analyses were performed for responses that related to MDD patients and patients with OP, respectively (defined for Trondheim only). *p*-values <0.05 were considered statistically significant.

Approval

The study was approved by the Regional Committee for Medical Research Ethics (REK) and the Norwegian Social Science Data Services (NSD).

Results

The response rates and characteristics from the GPs are listed in Table II. The only significant difference between Trondheim and Tromsø is the number of

patients per GP in 2005. Out of 1800 patients in the home care services, 1500 were enrolled in the MDD system by the end of the study. This gave a mean of 11 multidose drug patients per GP.

Expectations and experiences

Table III shows a great concurrence between the GPs' expectations before and experiences after the implementation of MDD. There was only one significant difference before and after. Many GPs experienced the workload after the implementation of MDD to be heavier than expected.

Most GPs both expected and experienced MDD to give a better overview of the patients' medication and contribute to a reduction in medication errors. Cooperation with both home care services and pharmacies improved, and this was also expected beforehand.

Use of the electronic health record

Table IV presents information about how the GPs use the EHR when prescribing drugs to patients in home care services. Both in 2005 and in 2008, the GPs in Trondheim updated medication records in the EHR to a greater extent than their colleagues in Tromsø. The change in updating routines was not significant in either of the two towns, and neither was the difference in change showed by the interaction *p*-value.

In the second round, we also asked if the GPs in Trondheim recorded the information that the patient was a MDD user. The latter question indirectly gave the information that the patient got assistance with medication from home care services, since only patients in home care services used MDD at the time. In Tromsø, we found a significant increase over the study period of GPs who "always" or "usually" recorded in the EHR which patients received

Table III. Reported effects of multidose drug dispensing among GPs in Trondheim.

	Before intervention (2005)	After intervention (2008)	<i>p</i> -value
Overview of the patients' medications			
More	65 (82)	71 (80)	0.64 ^a
No change	14 (18)	17 (19)	
Less	0 (0)	1 (1)	
Medication errors			
More	6 (8)	4 (5)	0.14
No change	13 (17)	26 (30)	
Less	56 (75)	56 (65)	
Cooperation with homecare services			
More	42 (56)	46 (52)	0.76
No change	29 (39)	36 (40)	
Less	4 (5)	7 (8)	
Cooperation with the pharmacy			
More	Not asked	69 (78)	–
No change		20 (22)	
Less		0 (0)	
Workload for the GP			
More	41 (55)	75 (83)	0.001 ^a
No change	30 (40)	14 (16)	
Less	4 (5)	1 (1)	
Workload for the medical secretary			
More	23 (31)	38 (43)	0.21
No change	42 (57)	38 (43)	
Less	9 (12)	12 (14)	

Values are *n* (%). Fisher's Exact test for difference in proportions. ^aTwo last categories combined to avoid frequency below five in the cross tabulation.

assistance. This was not the case in Trondheim for patients with OP, only for MDD users (Table IV).

More GPs in Trondheim reported that they consulted the EHR when prescribing to home care patients in 2008 than in 2005. The increase was significant only for MDD patients. In Tromsø the percentage consulting their EHR was higher at start than in Trondheim, but the percentage stayed the same. This made the change in routine in Trondheim significant compared to Tromsø.

The routines providing patients with a medication record printout changed in both towns, giving no significant change in the intervention group compared with the control group.

Other findings

The majority of GPs in Trondheim (81%) always or usually contacted the pharmacy when medication changes were made for multidose drug users. However, only 28% of the GPs did the same for patients with OP. The GPs in Tromsø did not communicate medication changes directly to the pharmacy in 2005 or in 2008.

Concerning which physicians should be allowed to prescribe multidose-dispensed drugs, 53% of the GPs in Trondheim indicated that only GPs should be allowed

to do so. The other half would accept MDD prescriptions from physicians in hospitals, nursing homes, private specialists, or a combination of the above.

The majority of the GPs in Trondheim (69%) wanted MDD to be continued, while 7% (all men) did not, and 24% were uncertain. No differences were seen with regards to the age of the GPs, the number of patients on their lists, or whether the GPs were specialists in general practice.

Discussion

GPs in Trondheim reported an improved overview of their patients' medications and increased collaboration with other healthcare personnel after the implementation of MDD. Improved prescription routines were reported in both the intervention and the control group. The changes in prescribing routines reported for MDD users did not always apply to patients using home care services with OP. Despite the increased workload, most of the GPs wanted MDD to be continued.

Triangulation

This study contributes to a method triangulation. Table V shows what findings in this study are

Table IV. Reported routines related to the use of electronic health record (EHR) before and after implementation of multidose drug dispensing.

	<i>n</i> (%)	OR (95% CI)	Interaction <i>p</i> -value, Trondheim vs. Tromsø
Updating the medication record in EHR			0.81
Trondheim			
2005	36 (43.9)	1.00 ^a	
2008	50 (61.7)	1.64 (0.90–3.00)	
Tromsø			
2005	6 (15.4)	1.00 ^a	
2008	6 (20.7)	1.44 (0.59–3.47)	
Recording in EHR that the home care services handle the patient's medication			OP: 0.032; MDD: 0.051
Trondheim			
2005	29 (35.8)	1.00 ^b	
2008 OP	39 (45.3)	1.49 (0.80–2.77)	
2008 MDD	79 (88.7)	14.17 (6.37–31.51)	
Tromsø			
2005	20 (51.3)	1.00 ^b	
2008	24 (82.9)	4.56 (2.02–10.28)	
Consulting the EHR when prescribing to patients in home care services			OP: 0.54; MDD: 0.005
Trondheim			
2005	44 (53.7)	1.00 ^c	
2008 OP	57 (64.0)	1.54 (0.83–2.84)	
2008 MDD	78 (85.7)	5.18 (2.50–10.75)	
Tromsø			
2005	28 (73.7)	1.00 ^c	
2008	22 (75.9)	1.12 (0.51–2.47)	
Providing printouts of medication records in the EHR when changes are made during consultation			OP: 0.071; MDD: 0.10
Trondheim			
2005	26 (31.7)	1.00 ^b	
2008 OP	44 (48.4)	2.02 (1.08–3.75)	
2008 MDD	45 (50.6)	2.20 (1.18–4.11)	
Tromsø			
2005	6 (15.4)	1.00 ^b	
2008	14 (48.3)	5.13 (2.30–11.45)	

EHR, electronic health record; MDD, multidose drug dispensing; OP, ordinary prescriptions. ^aOR for response category “Always”. ^bOR for response category “Always” and “Usually”. ^cOR for response category “Routinely”.

supported by findings in the two previously published studies [16, 17]. The use of both qualitative and quantitative methods is advocated to help explain findings. This approach may be particularly appropriate for the evaluation of patient safety interventions [18].

The GPs reported an improved overview of the patients' drugs. This finding corresponds to findings in the parallel quantitative study of medication records showing a reduction in discrepancies between medication records at the GP's office and in the home care services when MDD was introduced [17]. This may be explained by MDD's capability of encouraging enhancement of communication between other healthcare personnel and GPs about prescriptions. The improved flow of information from home care nurses and pharmacists to GPs was confirmed in the qualitative study about trust between the collaborating partners [16].

The GPs in Trondheim were better at updating medication records in the EHR than their colleagues in Tromsø even before the implementation of MDD. The high initial level of updating could explain why the reported improvement in the updating of medication records in this study did not become statistically significant. Still, the study of discrepancies in medication records in Trondheim showed a reduction in discrepancies during implementation [17]. In 2003, a study from Trondheim was published that showed a great number of discrepancies between the medication records held by GPs and home care services for the same patients [19]. The study drew a lot of attention to medication errors in Trondheim just prior to our study and may have contributed to our results. Given all this earlier attention, one may assume the possible room for improvement was somewhat reduced.

Table V. Findings in the different studies contributing to the triangulation method.

Findings	Study I (controlled before–after study of discrepancies in medication records) ¹⁷	Study II (qualitative study based on focus group interviews) ¹⁶	This study (controlled before–after questionnaire study among GPs)
Improved updating of medication records by the GPs during implementation of MDD	Yes	Yes	No
Increased overview of the patients' medications	Yes	Yes	Yes
Increased cooperation between the GPs and the pharmacy concerning the medicating of MDD patients	Yes	Yes	Yes
Improved communication between health personnel regarding prescriptions in the MDD system	–	Yes	Yes
GPs assumed greater responsibility for the medications of their patients when enrolled in the MDD system	–	Yes	Yes
The GPs trusted the MDD system	–	Yes	Yes
The GPs wanted the MDD system to remain in use	–	Yes	Yes
Increased workload for the GPs	–	Yes	Yes

–, Not asked.

The increased involvement of the GP and improved routines in the handling of medications for MDD users, according to our findings, did not necessarily apply to patients in home care services with OP, neither in terms of consulting their EHR nor in collaborating with the pharmacy. For patients with OP, nurses in home care services can make changes in medications based on other physicians' prescriptions without involving and consulting the patient's regular GP. This implies that the introduction of MDD forced the GPs to assume greater responsibility for the medication of their patients. This finding agrees with our qualitative study, in which both GPs and pharmacists experienced a greater influence and improved quality in the handling of drugs after the implementation of MDD [16]. Changes in routines with the use of MDD seem to support the view that it leads GPs to pay more attention to the complete medication record rather than just single prescriptions [10]. On the other hand, the finding that 47% of the GPs reported that other physicians should be able to provide prescriptions to their MDD patients somewhat contradicts this.

Strengths and limitations

This study has examined an intervention at the organisational level, which meets the criteria designating a complex intervention [20]. The methods and statistics commonly preferred in connection with interventions are difficult to apply to complex interventions in large organisations. It is also recommended that one should be flexible and adapt the

protocol to local conditions [20]. The results presented stem from a single implementation and should thus only be generalised with great caution. The strength of the study lies in the use of method triangulation.

Some of the results presented lack statistical significance. An increased number of informants could have changed that. The control group could have been made larger by including other towns, but it would also introduce greater variety and potentially more confounders [20]. In a controlled before-and-after design, one should require a minimum detectable effect size of 30% [21]. This is not seen in any of the non-significant results. Increasing the number of doctors would thus probably not add new information. Recruitment of large comparable organisations is very difficult, and was, moreover, beyond the resources and capabilities of the project.

The questionnaires were distributed differently in Trondheim in 2005 and in 2008, as described in the method section. Nevertheless, the response rates were high on both occasions and there are no indications that this change affected the answers. The wording of the questions is crucial when it comes to valid answers, and we cannot exclude the possibility that some responders may have misinterpreted single questions. Minor changes in layout and wording in the questionnaires may have contributed to this.

As the questionnaires were answered anonymously, it was not possible to directly link the answers from 2005 with those from 2008. The statistical testing is performed with tests on independent samples, even though the GPs were mainly the same.

To our knowledge, no systematic intervention in drug prescribing took place in Tromsø during the study. Still, we observed that some routines seemed to have changed more in Tromsø than in Trondheim (Table IV). Actually, some of the GPs' routines in Tromsø and Trondheim became more similar over the course of the study. This was the case for the routine for handing out printouts of the medication record to the patients (Table IV). Hence, it is possible that other external causes or confounders might have overshadowed some effects of the introduction of MDD. This could have been partly avoided by running the after study closer in time to the implementation, but that would have placed the findings in danger of being influenced by start-up problems. The GPs' change of routines may also be attributed to the Hawthorne effect in both places. This is also one of the reasons why it is important to establish a control group when the results of an intervention are assessed [22].

Regulation of the prescription of multidose-dispensed drugs

In Trondheim, the authorities decided to restrict the power to prescribe drugs for inclusion in the multidose bags to the patients' regular GP. This was in contrast to what has been done in other sites in Norway where MDD has been implemented. After having tried MDD, only half of the GPs were in favour of restricting multidose drug prescribing to GPs. A Swedish study has similarly shown a great variation among GPs in their opinion of who should be responsible for patients' drug lists [23].

However, having more than one physician involved in the patients' care is associated with higher risks of medication errors [24,25]. This has also been the case using multidose-dispensed drugs [26]. Similarly, in a recently published Norwegian questionnaire study with 54 GPs, a majority of the GPs reported an improved overview of patients' drugs in the MDD system, but comments from some of the physicians indicated that MDD works best when the patient's regular GP alone is responsible for the medications [27]. This feedback seems to support the local regulation made in Trondheim restricting the prescription of multidose-dispensed drug to the patient's GP.

The GPs wanted MDD to be continued

It is interesting to note that a majority of the GPs wanted MDD to be continued, even though the GPs experienced an increased workload after the implementation of MDD, which exceeded the GPs' prior expectations. A Finnish study concluded that policies

that reduced job demands and increased job control would probably lead to an increased organisational commitment among GPs [28]. In our questionnaire, the GPs reported increased control, as they experienced a better overview, a supposed reduction in medication errors, and improved cooperation with other health personnel.

The implementation process

The positive attitude GPs in Trondheim reported towards MDD has not been reported in other studies [12,29]. One reason may be that Trondheim was able to involve GPs to a greater extent than in other places where MDD has been introduced. The importance of information work and involvement when implementing new technologies, are highlighted in the literature [30]. It is important to create expectations and responsibility towards the routine changes demanded by the new technology.

We would argue that the pharmacy became an important communication partner within the MDD system. This has also been reported by others [10]. In another study, GPs reported uncertainty over whether the pharmacy or the home care services should be notified of new prescriptions and changes in medications, because the different home care units had different routines [29]. Using a system in a collaborative setting requires a systematic approach by and towards all participants involved. The establishment of common and well-known routines seems to be an important factor in successful MDD implementation, and direct communication should be encouraged.

Conclusion

GPs in Trondheim welcomed MDD despite the increased workload. Implementation of the system improved prescription practices and communication and collaboration between the different healthcare personnel involved. Restricting the right to prescribe multidose-dispensed drugs to the GPs probably made the GPs take a greater responsibility for the patients' medications. The divergence in attitude towards MDD among GPs in different studies needs more attention, and further research may also be needed to refine the process of implementation of MDD.

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