Effect of a medicines management model on medication-related readmissions in older patients admitted to a medical acute admission unit

A randomized controlled trial

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Effect of a Medicines Management Model on Medication-Related Readmissions in Older Patients Admitted to a Medical Acute Admission Unit – a Randomized Controlled Trial

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Running Title:

Medicines Management in Older Admitted Patients

Key Words

Healthcare, health services research, patient-centered care
Abstract

Rationale, aims and objectives: Medication-related problems are frequent and can lead to serious adverse events resulting in increased morbidity, mortality and costs. Medication use in frail older patients is even more complex. The aim of this study was to investigate the effect of a pharmacist-led medicines management model among older patients at admission, during inpatient stay and at discharge on medication-related readmissions.

Method: A randomized controlled trial conducted at the acute admission unit in a Danish hospital with acutely admitted medical patients, randomized to either a control group or 1 of 2 intervention groups. The intervention consisted of pharmacist-led medication review and patient interview upon admission (intervention ED) or pharmacist-led medication review and patient interview upon admission, medication review during inpatient stay, and medication report and patient counselling at discharge (intervention STAY).

Results: In total 600 patients were included. The pharmacist identified 920 medication-related problems with 57% of the recommendations accepted by the physician. After 30 days 25 patients had a medication-related readmission, with no statistical significant difference between the groups on either primary or secondary outcomes.

Conclusions: This study showed that a clinical pharmacist can be used to identify and solve medication-related problems, but this study did not find any effect on the selected outcomes. The frequency of medication-related readmissions was low, leaving little room for improvement. Future research should consider other study designs or outcome measures.
**Introduction**

Medication-related problems such as medication errors, inappropriate prescribing and compliance problems are frequent\(^1,2\) and can lead to serious adverse events resulting in increased morbidity, mortality and costs\(^3–7\). It is estimated that 2-30% of all hospital admissions are medication-related\(^2,8–10\) and that up to 10% of all medication-related adverse events could be life-threatening or fatal\(^11\). In a Swedish study these adverse events caused almost 10% of all direct healthcare costs in the study population\(^12\).

Medication use in frail older patients is even more complex because of factors such as age-related changes in body composition, use of more medications with increasing age\(^13\), and as this patient group often suffers from multiple morbidities\(^14\). Therefore the risk of adverse events related to medication increases with increasing patient frailty\(^15\).

Two meta-analyses demonstrated that about half of the medication-related adverse events might be prevented, especially among the older\(^3,4\). In many hospitals, clinical pharmacists identify and solve medication-related problems during medicines management as an attempt to prevent medication-related adverse events. This practice has evolved over the last few decades, but is in Denmark not yet offered throughout the country, and the procedure and elements such as medication history, medication reconciliation, medication review and patient counseling often varies from ward to ward\(^16\).

Recent systematic reviews on medicines management in hospitals\(^17–19\) have shown a tendency towards improvement in medication use, health service use and
costs, but the evidence is not consistent. More research is therefore needed both on
the effect of medicines management for older inpatients and on the different parts of
medicines management.

Hence, the aim of this study was to investigate the effect of a pharmacist-led medicines
management model among older patients at admission, during inpatient stay and at
discharge on medication-related readmissions.

Methods

Study Design and Setting

This was a randomized controlled study, where older patients aged 65 years or above
were randomized to either a control group or 1 of 2 groups receiving pharmacist-led
interventions.

Patients were included from the medical acute admission unit at a Danish hospital. A
ward-based pharmacist had not previously been available here. Upon admission, a
nurse met the patient and graded the severity of the illness in a Triage system ranging
from 1 (extremely ill) to 5 (not acutely ill). Within half an hour after admission patients
were examined by a senior physician, including decisions about treatment level, and
within 4 hours a junior physician examined the patient and a treatment plan was
agreed on. Patients were transferred to a specialized department if their inpatient stay
was expected to exceed 48 hours. The remaining patients stayed on the acute
admission unit until their discharge.(20)
The hospital introduced electronic patient records in March 2013. This system includes correspondence with primary health care, notes from all health care professionals during inpatient stay, medication lists and laboratory tests. Furthermore a shared electronic platform for medication use (FMK)(21) exists in Denmark. Until February 2014 it was an online system with an overview of all prescriptions for the last 2 years. Hereafter the FMK system was integrated into the electronic patient records as a list of the current medication used by the patient. As this new feature is not fully validated yet, the physicians still combine information from the system with patient interview to obtain the medication history.

## Study Participants

A pharmacist was present Monday to Friday between 7.30 am and 5 pm. Every day the pharmacist screened patients admitted to the ward for inclusion. Patients could be included if they were 65 years of age or above, acutely admitted, medical patients (not surgical), able to give informed consent, able to speak and understand Danish, and holding a Danish personal registration number. Patient were excluded if they were extremely ill (i.e. Triage 1), terminal, had not been seen by either a nurse or physician yet, were not accessible, or had previously been included in the study.

The patients were randomized using a 1:1:1 allocation ratio to 1 of 3 groups in blocks of 15 (each block contained 5 patients from each group) using the opaque closed envelope technique. The randomization process was performed at Odense University Hospital. The patients were included consecutively. The pharmacist opened the envelope at the bedside after patient consent was obtained, and the patient was
informed immediately about allocation. The group allocation was not blinded to the patient, the pharmacist or other health care professionals present at the ward.

**The Interventions**

The 3 groups consisted of a control group named Control (usual care), and 2 intervention groups named ED (basic intervention) and STAY (extended intervention). All patients received usual care including medication history, medication reconciliation and medication review by a physician without any structured instrument as part of the normal procedure. The Control group was not offered any pharmacist-led intervention. Both the ED group and the STAY group received a pharmacist-led medication review (including patient interview and medication reconciliation) on admission. Furthermore, patients in the STAY group transferred to a specialized ward received a medication review during inpatient stay together with patient counselling and a medication report at discharge. All pharmacist-led interventions during the study were performed by the same pharmacist, who had 3 years of clinical experience.

**Medication Review and Patient Interview**

The medication review on admission followed a systematic procedure previously described in detail(22). Briefly, the procedure consisted of 5 steps. First, patient data was collected from the electronic patient record. Secondly, information about the patients’ medical treatment and medication history was collected from the patient record and FMK, if available. Next an interview with the patient was conducted at the bedside in order to collect information about the patients’ use of medicines, and to identify whether the patient had experienced medication-related problems. Next a critical examination of the patient’s medical treatment focusing on the entire treatment
(including medication reconciliation) and on every single medication was conducted by the pharmacist. Recommendations about changing regimens for economic reason were only conducted if it would affect the patient. Finally, the recommendations for medical changes were reported to the physician electronically in the patient record, and supplemented with dialogue with the physician whenever possible. The second medication review for patients in the STAY group followed the same procedure, but medication history and patient interview was omitted, because this had been performed for all intervention patients upon admission.

Medication Report at Discharge
The medication report created for the patients’ discharge consisted of a note in the electronical medical record where the pharmacist listed all changes to the patient’s medication use during inpatient stay. Reasons for change and further recommendations to the patient’s general practitioner were also listed. The medication report was only used as a reminder to the physician at discharge, who could choose to mention the content of the medication report in the electronic discharge summary to the general practitioner.

Patient Counselling at Discharge
At discharge, the patients in the STAY group were offered counselling on their medical treatment. The counselling should identify if the patient were given a new list of medications to use after discharge, and if they had any questions about changes in the medications or to the treatment in general.

Pilot Study
A pilot study consisting of a feasibility test was performed. The test included 9 patients with testing of the data collection forms and logistics of the study. None of the pilot study patients was included in the results.

**Data Collection and Analysis**

*Patient Characteristics*

Patient characteristics were collected from the patient record. The same source of information was used for all study patients, even if more information was available for intervention patients after the patient interview.

*Process Data*

Process data recorded during the study period included time spent on each part of the intervention, the number of medication-related problem identified, and the physicians’ acceptance of the recommendations. The medication-related problems were scored using The PCNE Classification V 6.2(23) modified with 2 new categories Medication Reconciliation and Technical Error (see Appendix 1).

All data on patient characteristics and process data were entered directly into EpiData EntryClient (version 1.3.1.1, EpiData Association, Denmark).

*Outcome Data*

The primary outcome was number of patients with a medication-related readmission within 30 days from discharge. Data about all readmissions were collected from the Danish National Patient Registry(24) and for the first unplanned readmission within 30
days, the pharmacist extracted data from the patient record with all clinical notes, a medication list and laboratory results from the first days of the readmission. It was ensured that the intervention was not mentioned in the extracted data. Two researchers, with expertise in clinical pharmacology and geriatrics, individually conducted the analysis of the primary outcome. Information about group allocation was blinded to these researchers. The assessment of whether a readmission was medication-related or not followed a strict procedure based on WHO-UCM international agreed criteria for causality and Hallas' criteria for contribution (25, 26). Any discrepancies in the assessment were resolved and consensus obtained. The selected timeframe for readmission was based on a review where the majority of studies have defined readmissions as within 30 days from discharge (27).

Secondary outcomes included mortality (overall, during index admission, within 30 days after discharge or 31-180 days after discharge), patients with readmissions (acute and planned, both including medication-related readmissions) within 30 days after discharge and number of visits to the emergency department, the hospital or a general practitioner within 180 days after discharge. These data was collected from the nationwide registers from the Danish Health Authorities: the Civil Registration System (28), the National Health Insurance Service Registry and the National Patient Registry (24).

**Sample Size and Statistical Methods**

Estimation of sample size was based on results from two Swedish studies (29, 30) in which the frequency of medication-related readmissions was reduced from 24% to 4.9% and from 12% to 5.6%, respectively. The sample size was based on comparison
between the Control and ED groups, as it was assumed, that nearly half of the patients in the STAY group would be discharged directly from the acute admissions unit, and therefore not eligible to receive the interventions during stay and at discharge. For this reason, the analysis of the STAY group was mostly explorative.

Based on a readmission frequency similar to the largest study (24%), 176 patients had to be enrolled in each group to detect a reduction as in the most conservative study (50%) with 80% power. To compensate for drop-out the number was increased to 200 patients in each of the 3 groups.

All analyses were performed using Stata v.13.0 (StataCorp, College Station, TX, USA). Numerical data are represented by median and percentiles (range if medians are zero or one) and compared using Kruskal-Wallis test, whereas categorical data are represented by number and frequency and compared using Chi^2 test. All analyses were of the type intention-to-treat.

**Ethical approval**

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards(31) and Danish legislation. Informed consent was obtained from all individual participants included in the study. The study protocol was approved by the Danish Data Protection Agency and the Regional Scientific Ethics Committees for Southern Denmark (registration number S-20110161). This article is consistent with the CONSORT statement and the extension for trials assessing non-pharmacologic
Furthermore, the intervention is described using the Template for Intervention Description and Replication (TIDieR) guide.

Results

Recruitment of Patients

From April 2013 to December 2014 the pharmacist was present on the ward 267 days. In total 3855 patients were excluded by the pharmacist with the main reason age below 65 years (n=2072, 54%). The pharmacist asked 786 patients to participate in the study, and 600 patients accepted. Patient flow can be seen in Figure 1. Patients declined participation because of fatigue (n=62, 33%), finding no need for the intervention (n=36, 19%), not wanting to sign the consent form (n=31, 17%), ready for going home (n=15, 8%) or other reasons (n=42, 23%). Each patient was followed 180 days after discharge from the index admission.

Patient Data

In Table 1 patient characteristics at baseline for the 3 groups can be seen. The median age for all patients was 74 years and 51% were males. The mean age for the patients in the Control, ED and STAY groups was 75.9, 74.8 and 75.4 years, respectively. The groups were well balanced in all aspects.

Process Data

In Figure 1 is the number of patients actually received the interventions shown. Details of the interventions are shown in Table 2.
At admission, the pharmacist identified 1138 medication-related problems. For 243 problems, no recommendations for change was suggested as the physician was only informed, and 67 problems were not relevant to solve after all (e.g. due to problem not present anymore). Hence the pharmacist recommended 828 changes in medication.

During inpatient stay and at discharge additional 145 medication-related problems and 92 recommendations for change were identified. For 38 problems, the physician was only informed, and 15 problems were not relevant to solve after all.

For the 920 recommendations for medication change, the main causes of the medication-related problem was medication selection (n=424, 46%), medication reconciliation (n=239, 26%), and dose selection (n=117, 13%). The overall acceptance rate was 57% (accepted by the physician), 3% was rejected by the physician and 40% was unknown (no evaluation or action from the physician neither orally or written in the record). See Appendix 1 for the PCNE-classification of all the recommendations.

**Outcome Data**

**Medication-Related Readmissions (Primary Outcome)**

A total of 9 patients were excluded from the analysis of the primary outcome (7 patients died during inpatient stay and 2 patients died during 30-days follow up). Four patients had an acute readmission before they died within 30 days and they were hence included in the analysis (see Figure 1).

Eleven Control patients, 9 ED patients and 5 STAY patients had a medication-related readmission, with no statistical significant difference between the groups (see Table 3). The reasons for readmission were side effects (n=11, 44%), therapeutic failure
(n=8, 32%) and untreated indication (n=6, 24%). Of the medication-related readmissions, 10 (40%) were assessed as preventable, 13 (52%) as non-preventable and 2 cases had not enough data to be assessed. Most of the medication-related readmissions had a possible causality with medications partly contributing to the readmission (n=14, 56%).

**Secondary Outcomes**

The secondary outcomes are shown in Table 3. There were no significant differences in any measures between the groups at 30 days or 180 days follow up.

**Patients Who Declined to Participate**

Of the 186 patients who declined to participate, 13 patients died within 30 days after discharge. Of the remaining 173 patients, 57 (33%) had an acute or planned readmission within 30 days after discharge.

**Discussion**

In this study, the pharmacist was able to identify and solve medication-related problems for the majority of the intervention patients. The present study did not show any effect of pharmacist-led medicines management for older patients on medication-related readmissions or any secondary outcomes though. This is in contrast to other studies, where a comprehensive pharmacist-led intervention led to a reduction in medication-related readmissions(29,30) and preventable medication-related visits(35). One study also showed an effect on readmissions of all causes(36) whereas other studies did not(29,37–40).
There could be several reasons for not finding an effect on the primary outcome. In the calculation of the study size, a control rate for medication-related readmissions of 24% was used. However, in this study only 6% of the control patients had a medication-related readmission, indicating that the study was not powered to detect a possible difference between the groups. This low rate is consistent with another study (35), which found a rate of medication-related visits of 8% in the control group. As this study is older and from the US, it was not expected to reflect the Danish healthcare system as much as the two recent Swedish studies (29,30).

Another reason could be selection of the healthiest older patients in the study due to the inclusion criteria. Also the most morbid patients could have declined to participate. However, the frequency of readmissions of all causes was 33% in patients who declined to participate compared to 29% for the included patients, indicating that the latter is not the case.

This study is evaluated using hard endpoints. It is not known, if the intervention could have had an effect on other outcomes. It has been suggested, that complex interventions like pharmacist-led medicines management should be evaluated with patient-related endpoints (41) as the purpose of the intervention is benefit for the patient.

Only a reduced fraction of the interventions during inpatient stay and at discharge were delivered, making the intervention at admission the primary intervention in this study.
However a recent meta-analysis showed, that comprehensive medication reconciliation at admission significantly reduced readmissions of all causes (19).

As the pharmacist was present on the acute admission unit, it was a challenge to find the physicians on other wards to orally present the recommendations from the medication review during hospital stay. Therefore only a few recommendations were discussed with a physician on other wards. This did not seem to affect the acceptance rate of the recommendations though, as this is slightly higher during inpatient stay.

An automatic transfer of the pharmacist’s medication report to the general practitioner was preferred, but this was not technically possible during the study period. From study start, the medical report on discharge was printed and given to the physician in charge of the patient. But due to logistical challenges this was changed after inclusion of 1/3 of the patients. Thereafter, the medical report was written in the patient record instead. This made the intervention easier to deliver, but could have limited the physician’s focus on the intervention and the chance to orally discuss the report.

The pharmacist in the study only had a few years of clinical experience, which could have affected the results. In a Swedish study the pharmacist was more experienced (29) and this study showed a significant effect on medication-related readmissions.

The pharmacist was only present on weekdays, so the interventions were not offered during evenings, nights, and weekends. Only one hospital and only one pharmacist participated in the study, which restricts the generalizability. On the other side, the
reproducibility of the interventions was higher with only one pharmacist performing all interventions.

As the patients, staff and pharmacist were not blinded to the group allocation, there was a risk of performance bias. It could have affected the acceptance rate, but is unlikely to affect the primary or secondary outcomes. Detection bias with the subjective assessment of medication-related readmissions was sought prevented by blinding the reviewers to the allocation of the patients, though it could have affected the overall rate of medication-related readmissions.

The acute admission unit was unaccustomed to the presence of a clinical pharmacist. This meant that the physicians did not make use of the pharmacist for counselling in the beginning of the study period, but after a few months the staff was expecting the pharmacist to be present and started asking questions about medication. Also the presence of the pharmacist could have affected the physicians’ behavior with more focus on appropriate medication for all patients. In this way, the study contains a great risk of contamination bias, which is impossible to prevent when patients are randomized within the same ward. Outside a study setting contamination bias (or educational bias as it also is called) could be most desirable. An Australian study showed, that the ward-based pharmacist often will be asked, when the staff seek advice about medications(42) which will improve the competences for both. But in a research setting, bias of this type could be overcome in future studies by cluster-randomization or other designs such as before-and-after study.

Conclusions
In conclusion, this study showed that a clinical pharmacist can be used to identify and solve medication-related problems, but this study did not find any effect on the selected outcomes. The frequency of medication-related readmissions was low, leaving little room for improvement. Future research should consider other study designs or outcome measures.
**Acknowledgements**

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**Contributions of Authors**

TG, MHC, TK and LA participated in the study concept and design. TG carried out the inclusion of patients, data collection, data analysis, and preparation of the manuscript. UH and MBC analysed the primary endpoint of medication-related readmissions. All authors revised the manuscript critically and approved the final version.
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Figure legends

Figure 1: Flow Diagram of the Participants in the Study
Table 1: Baseline Demographics and Clinical Characteristics of the Included Patients

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Control (n=200)</th>
<th>ED (n=200)</th>
<th>STAY (n=200)</th>
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<tbody>
<tr>
<td>Male gender, n (%)</td>
<td>102 (51)</td>
<td>104 (52)</td>
<td>100 (50)</td>
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<tr>
<td>Age in years, median (IQR)</td>
<td>75 (70-82)</td>
<td>74 (69-80)</td>
<td>74 (69-80)</td>
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<td>Day of admission patient were included, median (range)</td>
<td>1 (1-2)</td>
<td>1 (1-3)</td>
<td>1 (1-7)</td>
</tr>
<tr>
<td>Number of medications on admission, median (IQR)</td>
<td>6 (3-10)</td>
<td>6 (3-10)</td>
<td>6 (3-10)</td>
</tr>
<tr>
<td>Triage at admission b</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Triage 2, n (%)</td>
<td>5 (2.5)</td>
<td>5 (2.5)</td>
<td>4 (2.0)</td>
</tr>
<tr>
<td>Triage 3, n (%)</td>
<td>79 (40)</td>
<td>75 (38)</td>
<td>73 (37)</td>
</tr>
<tr>
<td>Triage 4, n (%)</td>
<td>116 (58)</td>
<td>120 (60)</td>
<td>123 (62)</td>
</tr>
<tr>
<td>Triage 5, n (%)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
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<tr>
<td>Subspecialty</td>
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<tr>
<td>Neurology, n (%)</td>
<td>23 (12)</td>
<td>38 (19)</td>
<td>29 (15)</td>
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<tr>
<td>Cardiology, n (%)</td>
<td>85 (43)</td>
<td>69 (35)</td>
<td>78 (39)</td>
</tr>
<tr>
<td>General medicine, n (%)</td>
<td>92 (46)</td>
<td>93 (47)</td>
<td>93 (47)</td>
</tr>
<tr>
<td>Medication administration before admission c</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient alone and/or private help, n (%)</td>
<td>149 (75)</td>
<td>158 (79)</td>
<td>157 (79)</td>
</tr>
<tr>
<td>Assistance from home nurse, n (%)</td>
<td>36 (18)</td>
<td>32 (16)</td>
<td>29 (15)</td>
</tr>
<tr>
<td>Automatized dose dispensing, n (%)</td>
<td>5 (2.5)</td>
<td>4 (2.0)</td>
<td>6 (3.0)</td>
</tr>
</tbody>
</table>

*Median (IQR)*

*b* Median (range)

*a* Median (IQR)
<p>| | | | |</p>
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<tr>
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<tbody>
<tr>
<td>Not using medication, n (%)</td>
<td>10 (5.0)</td>
<td>5 (2.5)</td>
<td>8 (4.0)</td>
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<tr>
<td>Residence before admission&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Own house, n (%)</td>
<td>195 (98)</td>
<td>194 (97)</td>
<td>187 (94)</td>
</tr>
<tr>
<td>Own house in connection to institution, n (%)</td>
<td>4 (2.0)</td>
<td>3 (1.5)</td>
<td>7 (3.5)</td>
</tr>
<tr>
<td>Nursing home, n (%)</td>
<td>1 (0.5)</td>
<td>3 (1.5)</td>
<td>5 (2.5)</td>
</tr>
<tr>
<td>Kidney function&lt;sup&gt;d&lt;/sup&gt;, eGFR (ml/min), median</td>
<td>64 (49-79)</td>
<td>63 (50-78)</td>
<td>69 (52-83)</td>
</tr>
</tbody>
</table>

IQR: interquartile range (25 percentile to 75 percentile). <sup>a</sup>Data available for 582 patients. <sup>b</sup>Triage range from 1 (extremely ill, patients excluded) to 5 (not acutely ill). <sup>c</sup>Data available for 599 patients. <sup>d</sup>Data available for 597 patients. eGFR: estimated glomerular filtration rate, 60 ml/min and above is normal.
<table>
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<tr>
<th>At Admission:</th>
<th>ED n=200</th>
<th>STAY n=200</th>
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<tr>
<td>Patients with FMK used, n (%)</td>
<td>200 (100)</td>
<td>198 (99)</td>
</tr>
<tr>
<td>Patients with POD used, n (%)</td>
<td>51 (26)</td>
<td>63 (32)</td>
</tr>
<tr>
<td>Number of recommendations</td>
<td>399</td>
<td>429</td>
</tr>
<tr>
<td>Patients with recommendations, n (%)</td>
<td>169 (85)</td>
<td>176 (88)</td>
</tr>
<tr>
<td>Patients with recommendations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>discussed with physician, n (%)</td>
<td>66 (33)</td>
<td>55 (28)</td>
</tr>
<tr>
<td>Time used for medication review</td>
<td>38 (24-53)</td>
<td>38 (28-54)</td>
</tr>
<tr>
<td>(minutes), median (IQR)</td>
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<tr>
<td>Time used for patient interview</td>
<td>8 (6-10)</td>
<td>8 (6-11)</td>
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<tr>
<td>(minutes), median (IQR)</td>
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<tr>
<td>Acceptance rate by physician</td>
<td>54%</td>
<td>59%</td>
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**During Inpatient Stay**

<table>
<thead>
<tr>
<th>-</th>
<th>STAY n=71</th>
</tr>
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<tr>
<td>Number of recommendations</td>
<td>-</td>
</tr>
<tr>
<td>Patients with recommendations, n (%)</td>
<td>-</td>
</tr>
<tr>
<td>Patients with recommendations</td>
<td>-</td>
</tr>
<tr>
<td>discussed with physician, n (%)</td>
<td>-</td>
</tr>
<tr>
<td>Time used for medication review (minutes), median (IQR)</td>
<td>-</td>
</tr>
</tbody>
</table>

**Before Discharge**

<table>
<thead>
<tr>
<th>-</th>
<th>STAY n=32</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of recommendations</td>
<td>-</td>
</tr>
<tr>
<td>Patients with recommendations, n (%)</td>
<td>-</td>
</tr>
<tr>
<td>Patients with recommendations</td>
<td>-</td>
</tr>
<tr>
<td>discussed with physician, n (%)</td>
<td>-</td>
</tr>
</tbody>
</table>
Time used for medication report
(minutes), median (IQR) - 16 (12-24)
Acceptance rate - 58%

At Discharge

Time used for patient counselling
(minutes), median (IQR) - 4 (2-5)

STAY n=22

FMK: Shared medication profile. POD: patients own drugs. IQR: interquartile range.
Table 3: Primary and Secondary Outcomes

<table>
<thead>
<tr>
<th>Mortality&lt;sup&gt;a&lt;/sup&gt;</th>
<th>In Total</th>
<th>Control</th>
<th>ED</th>
<th>STAY</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall mortality, n (%)</td>
<td>40</td>
<td>16 (8.0)</td>
<td>11 (5.5)</td>
<td>13 (6.5)</td>
<td>0.601</td>
</tr>
<tr>
<td>Death during index admission, n (%)</td>
<td>7</td>
<td>1 (0.5)</td>
<td>1 (0.5)</td>
<td>5 (2.5)</td>
<td>0.099</td>
</tr>
<tr>
<td>Death within 30 days after discharge, n (%)</td>
<td>6</td>
<td>2 (1.0)</td>
<td>3 (1.5)</td>
<td>1 (0.5)</td>
<td>0.603</td>
</tr>
<tr>
<td>Death 31-180 days after discharge, n (%)</td>
<td>27</td>
<td>13 (6.5)</td>
<td>7 (3.5)</td>
<td>7 (3.5)</td>
<td>0.248</td>
</tr>
</tbody>
</table>

At Discharge

<table>
<thead>
<tr>
<th>In Total</th>
<th>Control</th>
<th>ED</th>
<th>STAY</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of stay in days, median (IQR)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2207 2.0 (0.7-5.2)</td>
<td>199 1.9 (0.6-5.0)</td>
<td>199 1.3 (0.7-4.2)</td>
<td>195 4.2</td>
</tr>
</tbody>
</table>

Patients discharged directly from acute admission unit, n (%)<sup>a</sup> | 314 | 99 (50) | 102 (51) | 113 (58) | 0.223 |

At Follow Up 30 Days

<table>
<thead>
<tr>
<th>After Discharge&lt;sup&gt;a&lt;/sup&gt;</th>
<th>In Total</th>
<th>Control</th>
<th>ED</th>
<th>STAY</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients with readmissions (acute and planned), n (%)</td>
<td>172</td>
<td>67 (34)</td>
<td>59 (30)</td>
<td>46 (24)</td>
<td>0.086</td>
</tr>
<tr>
<td>Patients with acute readmissions, n (%)</td>
<td>102</td>
<td>36 (18)</td>
<td>36 (18)</td>
<td>30 (15)</td>
<td>0.722</td>
</tr>
</tbody>
</table>

Primary Endpoint:

Patients with

<table>
<thead>
<tr>
<th></th>
<th>In Total</th>
<th>Control</th>
<th>ED</th>
<th>STAY</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>11 (5.6)</td>
<td>9 (4.5)</td>
<td>5 (2.6)</td>
<td>0.331</td>
<td></td>
</tr>
</tbody>
</table>
medication-related acute readmissions, \( n \) (%)

<table>
<thead>
<tr>
<th>At Follow Up 180 Days After Discharge(^b)</th>
<th>In Total</th>
<th>Control</th>
<th>ED</th>
<th>STAY</th>
<th>( p )</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=560</td>
<td>n=184</td>
<td>n=189</td>
<td>n=187</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of admissions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(acute and planned), ( median ) (range)</td>
<td>661</td>
<td>1 (0-14)</td>
<td>0 (0-9)</td>
<td>0 (0-11)</td>
<td>0.245</td>
<td></td>
</tr>
<tr>
<td>Number of planned</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ambulatory contacts, ( median ) (IQR)</td>
<td>4127</td>
<td>5 (2-10)</td>
<td>4 (2-9)</td>
<td>4 (2-9)</td>
<td>0.254</td>
<td></td>
</tr>
<tr>
<td>Number of acute</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>emergency contacts, ( median ) (range)</td>
<td>149</td>
<td>0 (0-4)</td>
<td>0 (0-3)</td>
<td>0 (0-8)</td>
<td>0.866</td>
<td></td>
</tr>
<tr>
<td>Number of contacts to</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>general practitioner, ( median ) (IQR)</td>
<td>12748</td>
<td>18 (11-34)</td>
<td>17 (10-31)</td>
<td>18 (10-30)</td>
<td>0.899</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\): Tested with Chi\(^2\) \(^b\): Testet with Kruskal-Wallis test
Figures

Figure 1 (uploaded separately)