Optimizing the Breakthrough Series Model for General Practice

Improving drug prescription practice through medication review

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Abstract

Introduction: Quality Improvement (QI) initiatives in healthcare aim to continuously improve care towards best available knowledge. The Institute of Healthcare Improvement has established the Breakthrough Series (BTS) collaborative model as a framework to spread QI initiatives throughout healthcare institutions. As a result, Quality Improvement Clusters (QICs) have been formed in many countries to improve different aspects of healthcare. Most research on QICs is done in hospital settings, but scientific literature from general practice settings is increasing and results so far are promising. QI initiatives usually target a specific change in clinical practice. In the current study, we investigate the effect of implementing a model based on the BTS model to improve drug prescription practice among GPs in a Norwegian municipality.

Methods: All 27 regular GPs or their substitutes in a mid-size municipality in Norway were invited to participate. The QI intervention consisted of three peer group meetings where participants planned and followed up their QI projects according to the model for improvement. Meetings were spread apart by 3-4 months, and participants were encouraged to test changes in medical practices between meetings. Evaluation data were extracted from three sources. Evaluation forms from the participating GPs were used to assess self-rated improvement, reported medication review reimbursement codes (MRRCs) were used as a process measure and dispensed Potential Inappropriate Drugs (PIDs) to patients aged 65 years or older from pharmacies in the intervention municipality was used as an outcome measure.

Results: 26 of the invited GPs started and 25 completed the intervention. According to evaluation forms, 67% of participants had introduced changes that improved their drug prescription practice, and 76% reported learnt practical QI skills considered to be useful in the next 3 months. Statistical process control revealed a significant positive shift in the number of MRRCs reported from the month of the intervention to at least four months after the intervention. Additionally, dispensed PIDs from pharmacies were significantly lower in the intervention municipality in all seven months during the intervention period compared with the national average (-11.5 vs. -2.33 per 1000 persons aged 65 years or older, p=.008). We found a 7.1% decrease in dispensed PIDs in the last intervention month in the intervention municipality compared with no change in the national average data. For the individual drug classes, we found significantly lower dispensed drugs for urinary frequency and incontinence (-.1.53 vs. + .54 per 1000 persons 65 years or older, p=.003). We estimated the annual cost reduction of around 95,000 NOK due to the cost of this drug class alone, matching the cost of the intervention.

Discussion: The investigated model for QI resulted in significantly positive effects when engaging GPs in a Norwegian municipality. Furthermore, the model seems to meet the triple aim framework established by the IHI; improving experienced care for the individual patient, improving population health and reduce healthcare cost. The model is possible to spread nationwide and can provide an arena where GPs acquire both updated clinical knowledge and practical QI skills. These skills might also be applicable to other clinical areas. To achieve sustainability, the model should be included in a broader infrastructure including meeting arenas where stakeholders, key healthcare professionals and patients plan and follow up QI initiatives in primary care.

Abbreviations

ADR: Adverse Drug Reaction

ATC: Anatomic Therapeutic Chemical

BTS: Breakthrough series

CME: Continuous Medical Education

NDPA: Norwegian Data Protection Authority

EMR: Electronical Medical Record

EPOC: Effective Practice and Organization of Care

GP: General Practitioner

MCMO: Municipality Chief Medical Officer

MRRC: Medication Review Reimbursement Code

NMA: Norwegian Medical Association

NHEA: Norwegian Health Economics Administration

NorPD: Norwegian Prescription Database

NRPHC: Norwegian Registry for Primary Health Care

QI: Quality Improvement

QIc: Quality Improvement cluster

RCMHRE: Regional Committee for Medical and Health Research Ethics

rGP: regular General Practitioner

PID: Potential Inappropriate Drug

SKIL: Centre for Quality Improvement in Medical Practices (Norwegian: Senter for kvalitet i legekontor).

Introduction

Available knowledge

The science of quality improvement in healthcare

We expect heath care services to be of excellent quality and in accordance with the most updated medical knowledge. However, it is human to do mistakes, and healthcare professionals are no exemption. In 2000, the US Institute of Medicine (IOM) published the book "To err is human: Building a safer health system". They estimated that as many as 98,000 people died every year caused by medical errors in United States hospitals (1). The book contains recommendations for improving patient safety, including learning from mistakes, building leadership and error reporting systems and spreading quality improvement (QI) knowledge throughout healthcare institutions. In spite of this, more recent research still reveal that iatrogenic harm still commonly occurs in healthcare institutions (2–4). In later years, overdiagnosis and -treatment has emerged as one of the causes of both harm and unnecessary cost in healthcare (5). Patient harm is also relatively common in primary care, although there is less research on this topic compared with the evidence from hospitals. A non-systematic scan of research in this topic by the UK Health Foundation found 72 relevant studies and estimated that 1-2% of primary care consultations may result in harm, however with a range between less than 1% to 24% (6). In primary care, most harm seems to be related to drug prescription among elderly patients (7).

It is generally reported a lag of 17 years before new clinical knowledge and guidelines are established as standard delivered care, depending on definitions (8). There may be several causes for this lag. A study among Norwegian general practitioners reported the main causes to be guideline overload, inaccessibility and a mismatch between guidelines and individual patients' needs (9).

Quality improvement science can be described as continuously improving care towards the scientifically proven best practice. As a result, the organization becomes a learning organization (10). Batalden and Davidoff proposed QI to be defined as "the combined and unceasing efforts of everyone—healthcare professionals, patients and their families, researchers, payers, planners and educators—to make the changes that will lead to better patient outcomes (health), better system performance (care) and better professional development (learning)" (11).

A more basic question is: What is quality in healthcare? IOM defined six aims for delivered health care in their book "Crossing the Quality Chasm" almost 20 years ago (12). The six aims were: safety (patients should not be harmed), effectiveness (unnecessary costs should be avoided) , patient-centeredness (patients should be involved in decisions made about their health), timeliness (care

should be delivered when necessary), efficiency (care should be useful), and equity (care should be equally available to everyone).

The Institute for Healthcare Improvement (IHI) was founded in 1991 by a group working the preceding decade on a national project promoting QI in US health care. The project's aim was to redesign care into a system without errors, waste, delay and unsustainable costs. Later, IHI has developed a triple aim framework as an approach to optimize health systems performance (13). The framework suggests that new designs in healthcare should pursue three dimensions simultaneously:

- Improving the patients experience of care
- Improving the population health
- Reducing the per capita cost with healthcare

This aim therefor goes beyond only focusing on individual patients' experience, but also considers population health and healthcare costs to ensure that designed care is sustainable from a community perspective.

Origins of QI science

Today's most used tools for QI in health care were adopted from other industries in the former half of the 20th century. The American engineer, physicist and statistician Walter Shewhart is by some considered to be the father of statistical quality control and developed a model for quality check and improvement. This model was later called the "Shewhart cycle" by William Edwards Deming, an American engineer and management consultant (14). The model later evolved to the Plan-Do-Study-Act cycle also known as Deming's Cycle (15). Deming is best known for his fourteen points for quality improvement which he himself described as the theory of profound knowledge's four points (16). The PDSA methodology was later incorporated in the Model For Improvement (MFI) by Associates in Process Improvement (API). The MFI is a relatively simple yet useful tool to accelerate improvement in organizations(17). It is not constrained to healthcare but can be used to improve almost any process. The model consists of three questions used to plan the improvement process, and uses the PDSA-cycle for rapid testing of changes.

The Breakthrough series collaborative model as a framework for QI initiatives

The IHI established the Breakthrough Series (BTS) collaborative model to roll out system changes to a whole healthcare system (18,19). The key elements of the BTS collaborative model are as follows:

1. Find an important area for improvement, recruit a faculty of experts and develop a framework and change concepts based on best available knowledge.
2. Enrol participants to the collaborative forming Quality Improvement Clusters (QICs), where participants complete pre-work before attending.

3. Arrange three learning sessions, where participants plan and follow up their QI project based on the prework and one-page reports measuring practice.

Since participants meet multiple times, they can follow up how changes at their workplace affects measurements. The model has proven effective, and as a result QICs have been formed in many countries and different settings. Some key factors for success and cost-effectiveness have been identified (20), predominantly choosing an important subject, preparing and involving participants in teams, focus on mutual learning, ensure teams have access to and can interpret data, plan for continuous learning and spread.

QICs in General Practice settings

QICs are most commonly used in hospital settings, but the number of scientific publications from general practice settings is increasing. A recent systematic review of QICs in healthcare found 64 studies meeting the Cochrane Effective Practice and Organization of Care (EPOC)-criteria (21). Of these studies, 20 were conducted in an ambulatory care or general practice setting and 17 of these reported significant improvements of care. Only one of the reported QICs focused mainly on medication treatment (antidepressant prescription), reporting a 23% reduction of antidepressant prescription in the intervention group (22). An interesting finding was that GPs did not refer more patients to secondary health care, but rather used low intensity intervention to manage depression among their patients. A study from Norway not included in the review reported a significant reduction of potentially inappropriate prescriptions in a general practice QIC setting, using an existing general practitioner (GP) peer group infrastructure (23,24). The effect size in this study was reported to be a reduction of 10.3% potential inappropriate prescriptions per 100 patients aged ≥ 70 compared to a control group. In another Irish study, GPs received an intervention incorporating academic detailing including a review of medicines with web-based pharmaceutical treatment algorithms and recommended alternative treatment options. This also resulted in a significant reduction of potential harmful drugs in the intervention group compared with controls (25). Spreading effective improvement strategies from local QI projects to nationwide or large-systems sustainable changes is also important, and requires infrastructure ensuring systematic transfer of knowledge, an environment facilitating the uptake of ideas and a policy framework and infrastructure for spread (26).

Rationale

Challenges in establishing a framework for QI initiatives in Norwegian general practice

In Norway, all inhabitants are entitled to have a regular GP (rGP) through the rGP scheme. The rGP scheme was introduced in 2001 and gives individual GPs responsible of delivering medical services to a certain number of inhabitants, defined as their rGP list. The municipalities are responsible for

delivering enough rGP services, and most municipalities to this by contracts with the individual rGPs. Most rGPs work together in medical practices typically consisting of three or four GPs. Number of patients enrolled in a rGP lists can be up to 2500 although the mean length of rGP lists is 1072 patients. Norwegian rGPs follow up most medical conditions, including cancer, pre-/postnatal care, rheumatoid diseases and psychiatric disease (27). Health secretaries work in almost all rGP practices, while registered nurses work in relatively few practices. Other health professionals or administrative staff are seldom hired in rGP practices.

Most rGPs are remunerated by a mix of capitation (based on the number of inhabitants they serve) and fee for service (the number of services they provide) (28). A minority of rGPs are salaried, especially in rural areas but also in some larger cities. Patients pay a co-payment with an annual ceiling of around 230 euro. There are some specific fees to target prioritized activities including Medication Review (MR), but there are no pay-for-performance schemes coupled to quality indicators per se. All Norwegian rGPs are required to either be or undertake training to become GP specialists. The training usually takes five years after completion of medical school, and includes a wide range of activities, including clinical theme-based CME accredited courses. Thereafter, specialist GPs need to renew their status as specialists every five years through CME-accredited courses and activities.

All healthcare institutions, including rGP practices are required by regulation to organize QI activities. Norwegian municipalities are additionally required to ensure that QI is taking place in rGP practices. The latter years, however, Norwegian rGPs workload has increased and resulted in a serous lack of recruitment to rGP offices, and some municipalities rely on short-time substitutes to deliver necessary primary care services to their residents. A recent evaluation of the rGP scheme also revealed that rGP offices lack necessary resources and time to prioritize QI activities (29).

Another challenge is the lack of a clear leadership structure in rGP practices, where GPs formally registered as Chief Executive Officers have little or no real authority in their practice (30). Moreover, there are few regular meeting arenas both within rGP practices as well as between rGP practices and other health care institutions. Most meetings between rGPs and other health care professionals revolve around single patients' cases, not on planning collaboration in general. As a result, team organization between important partners in healthcare is challenging.

Lastly, Norway's geography is challenging due to many scarcely populated and remote areas. This results in rGP offices being spread and further difficulties in organizing regular meetings between rGPs to plan and follow up QI initiatives.

Centre for Quality Improvement in Medical Practice (SKIL)

The Centre for Quality Improvement in Medical Practices (Norwegian: Senter for kvalitet i legekontor, SKIL) was established by the Norwegian Medical Association (NMA) in 2014. SKIL's main aim is to offer tools for and training in quality improvement (QI) to ambulatory clinical settings, including rGP practices. Additional aims are to promote QI research and cooperate with Norwegian health authorities. To achieve these tasks, SKIL has developed a framework based on the BTS collaboration model and previous projects mainly led and founded by the NMA.

To increase recruitment to SKILs model and given above mentioned challenges, meeting time was reduced to a minimum and QI interventions were made to count as CME accredited activities. As a result, a QI initiative consisting of three meetings lasted around 12 hours in total over a 8 month period. Every QI initiative is arranged as a course around a specific clinical theme (every themed course consisting of three meetings each). Participants can currently choose from four different clinical themes; MR, antibiotics prescription, safe pathways for vulnerable patients and choosing wisely (avoiding overdiagnosis and/or -treatment). Several considerations are made when establishing a clinical theme. Firstly, it must be an important patient safety issue or an area where there is a wish to spread important clinical knowledge. Secondly, it must be an area where there is an important improvement potential for many GPs. Thirdly, the clinical theme should preferably be broad. For instance, the MR theme is focusing on drug prescriptions in general, not a single disease. For each clinical theme, SKIL develops an indicator set made available as reports to the participants through collaboration with a software producing reports based on data fetched from the rGPs' Electronical Medical Records (EMRs).

Initially, clusters were formed by the rGPs themselves, consisting of either a rGP office or already established peer groups. The last few years, SKIL has also offered a collaboration model to Norwegian municipalities. In the collaboration model, the municipality covers the expense for their GPs to participate in the course. Additionally, SKIL recently started to organise yearly half-day meetings with collaborating municipalities, where the Municipality Chief Medical Officer (MCMO) and rGPs together discuss the quality of healthcare in the municipality and how QI initiatives may improve this. After the half day meetings, the municipality receives an aggregated report describing the QI activities in the municipality. The theme investigated in the current paper is medication review (MR), further described in the methods section.

The figure below summarises the model developed by SKIL

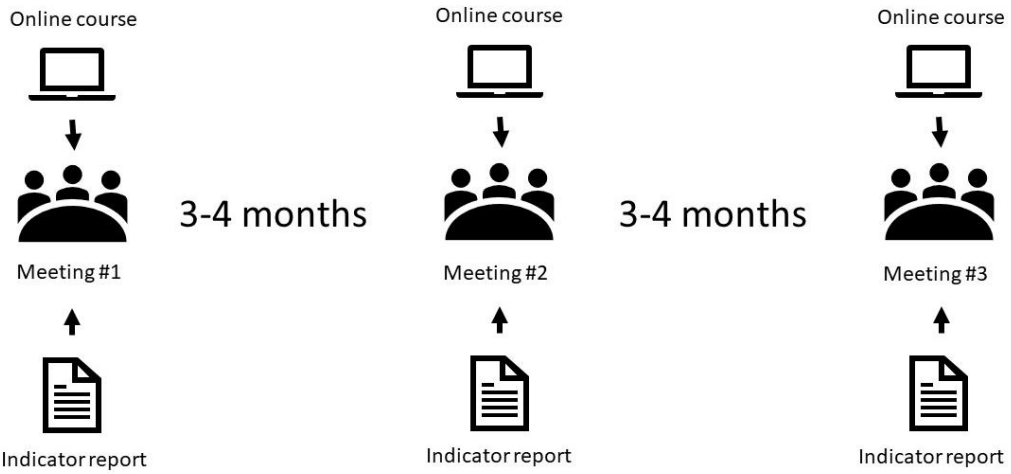


Figure 1 In the intervention, the participants join a total of three meetings (duration 3hrs each) where they plan and follow up quality improvement. Before each meeting, they take an online course on the actual clinical theme.

Problem description

Adverse drug reactions as a patient safety issue

Adverse drug reactions (ADR) are one of the most common iatrogenic causes of disease and harm caused by healthcare professionals and are probably under-reported. Edwards and Aronson defined ADR's as "an appreciably harmful or unpleasant reaction, resulting from an intervention related to the use of a medicinal product, which predicts hazard from future administration and warrants prevention or specific treatment, or alteration of the dosage regimen, or withdrawal of the product" (31). Hazell and Shakir found 37 studies on under-reporting of adverse drug reactions and found median under-reporting to be 94% (32).

It is reported that a significant proportion of hospital admissions are caused by ADRs, rising with age (33). In a French prospective study from the late 90's, ADRs were estimated to cause 3.2% of all hospital admissions, and 4.1% of all hospital admissions of persons aged 65 years or older (34). A prospective study from the UK estimated 6.5% of hospital admissions two large general hospitals to be caused by ADRs, which could cost up to 847mUSD per year for the whole NHS (35). In another prospective study from the Netherlands, ADR related admissions were reported to represent 5.6% of all hospital admissions, which of half were considered preventable (36). A study of all hospitalizations due to ADR among people aged 65 years or older in North America found that persons aged 80 years and up represented half of the cases and that relatively few medications or medication classes

caused a vast majority of the hospital admissions. These were warfarin, insulins, oral antiplatelet agents and oral hypoglycaemic agents (37).

Both pharmacokinetic and pharmacodynamic mechanisms change with increasing age (38). Pharmacokinetics can be defined at how the body affects the medication, including how the medication is absorbed, distributed, metabolized and cleared from the body.

Main causes for altered pharmacokinetics in the elderly are:

- Reduced Glomerular Filtration Rate (GFR) due to reduced renal function with age (Fliser, 1997). This is probably partly due to diseases in the elderly commonly causing deteriorating kidney function. Studies have shown that a large majority of persons over the age of 65 years have at least two chronic conditions (Violan et al, 2014).
- Reduced liver function both reducing first pass metabolism and reduced drug clearance, which is highly variable between individuals (39).
- A reduced relative volume of water and hence distribution volume results in a higher serum concentration (40).

Pharmacodynamics can be defined as how the medication affects the body, which changes with age mainly due to altered homeostatic reserves. This causes elderly to be more vulnerable for ADRs with a given circulating concentration of certain medications compared with younger individuals.

Several works have been made to define a list of potential inappropriate drugs (PID) in the elderly as well as potential harmful drug combinations, including the Beers criteria (41) and Start-Stop criteria (42). A Norwegian set of PIDs and drug interactions has also been developed, the Norwegian GP (NorGEP) indicators (43).

MR as a process for improvement

MR is a thorough evaluation of each medication on a patients' medication list. The evaluation should investigate drug treatment indication, side-effects, need for blood tests, potential drug-drug interactions and patient preferences. Before undertaking MR, the clinician needs to make sure that the drug list contains the actual drugs used by the patient. After MR the clinician should provide an updated drug list to the patient, including generic names, indications and exact dosages for each drug. If necessary, the list should be sent to other health care professionals, such as the home nurse service or nursing home. The intentions of MR are to ensure that patients are using necessary drugs, and not using drugs that have doubtful or potential harmful effects. Norwegian rGPs are required by regulations to perform MR in their patients as often as necessary.

An important question is whether MR by itself influences important outcome measures, for instance quality of life. Most studies have used surrogate measures, mostly number of potential inappropriate drug prescriptions. However, a recent Norwegian study reported significantly better quality of life measures in elderly after medication review by geriatricians compared to controls (44).

Specific aims

We investigated the effect of implementing SKIL's MR theme to all rGPs in a Norwegian medium sized municipality. The aim of this paper is to answer the following three questions:

1. Do most participating rGPs report improvement in appropriate prescriptions after participating in the intervention?

2. Does the number of performed medication reviews increase significantly in the intervention municipality?

2. Does the number of potential inappropriate drugs dispensed by pharmacies decrease significantly in the intervention municipality?

Methods

Setting

As a part of a municipality collaboration with SKIL, all rGPs of a medium-sized municipality in Norway were invited to participate in SKIL's MR-themed QI initiative. All 27 rGPs in the municipality or their substitute were invited. Two rGPs had substitute doctors working in their practices, while one of the senior rGPs had a senior contract with a junior rGP, where the latter joined the initiative. A senior contract means that the junior rGP gradually takes over the senior rGP' s practice.

Total number of patients on the rGPs' lists were 30,550 according to The Norwegian Health Economics Administration (NHEA). At the same time, the intervention municipality had 27.001 residents in total (third Quarter 2018 data, Statistics Norway). The investigated municipality is surrounded by smaller municipalities, and it is probable that some of the inhabitants of the smaller municipalities have chosen to attend a rGP in the intervention municipality. Some central characteristics of the participants in the intervention compared with the national average are shown in table 1.

	Participating GPs (n=27) Mean (SD)	National average Mean (SD)
Mean patients on rGP list	1133 (259)	1072 (373)
Mean rGPs list limit	1132 (258)	1117 (349)
Female: male ratio	.333 (0,471)	.443 (.497)
Years of experience in current practice	9 years 1 month (6 years 7 months)	8 years 9 months (7 years 3 months)
Specialist ratio	.778 (0,416)	.598 (.490)

Table 1 Characteristics of rGPs assigned to groups compared with the national average.

In total, 27 rGPs or substitutes were assigned to totally five different peer groups. The four largest rGP offices formed a group each, while the two smallest offices formed a joined group. The first meeting was held on October 1st, 2018 and the last meeting was held in May 27th, 2019 (see table 2 for exact meeting dates). Valid peer group meeting completion was defined as both participation and completion of a mandatory online worksheet described below in further detail. According to these criteria, 26 GPs participated in at least one group meeting (participation rate 96%), and 25 GPs completed the intervention (completion rate 93%).

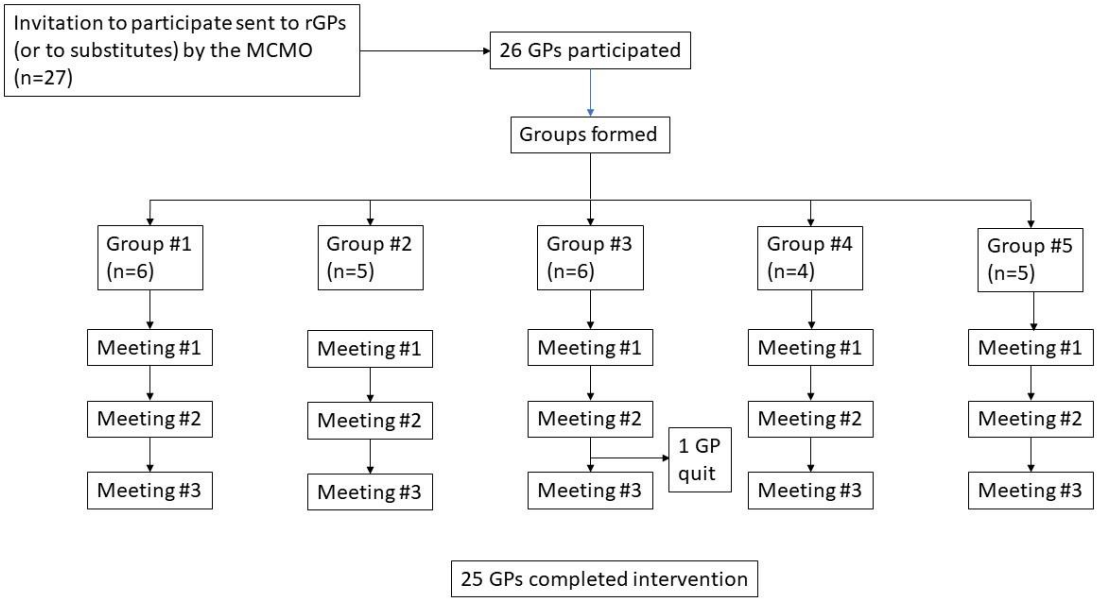


Figure 2 Figure shows the procedure including how many GPs were invited, who participated and completed the intervention. MCMO: Municipality Chief Medical Officer.

Group #	Number of medical practices	Number of participants	1st meeting	2nd meeting	3rd meeting
1	1	6	03.10.18	10.01.19	09.05.19
2	1	5	24.10.18	23.01.19	03.04.19
3	1	6	06.11.18	22.01.19	08.04.19
4	1	4	01.10.18	18.02.19	27.05.19
5	2	5	20.11.18	29.01.19	30.04.19

Table 2 The table shows number of participants in the different groups, and the time when each meeting was held. Date format DD.MM.YY.

Intervention

The main parts of the QI model by SKIL are three peer group meetings each lasting 3 hours. These are normally led by a supervisor and held 3-4 months apart. As pre-work to each meeting, participants complete 1-hour online courses around the actual clinical theme. During meetings, rGPs discuss the contents of the online courses and investigate their own practice through the indicator reports. Then, participants plan and follow up improvement projects, while they are encouraged to test changes in their practices between the meetings.

SKIL has also developed a web portal logging all participants' attendance to every meeting. At the meetings, participants are required to fill in a worksheet in the same portal, meant to promote the different necessary steps to plan and follow up their improvement project.

Like the other themes, the MR theme consisted of three peer group meetings preceded by online courses. All groups were supervised by the same MCMO, who had received a one-hour information session by video explaining the course structure and completed a 3-hour online course focusing on QI theory relevant for GP offices developed by SKIL. Additionally, the MCMO completed the same online courses as the participants.

Ten months before the start of the current intervention, the same MCMO had led another intervention targeting reduced prescriptions of benzodiazepine derivates and benzodiazepine-related drugs. As a result of this, the prescription of these drugs had already been reduced to some extent (unpublished QI project). All peer group meetings were held after regular business hours, within the rGPs' clinics.

The specific drug-related for the three online courses before the respective meetings were; (1) use of a checklist for MR, (2) common challenges in medication treatment of elderly patients, including high ADR-risk drugs, and (3) correct use of and common pitfalls in anticoagulant treatment. As for the online courses, there are specific QI science topics for each of the peer group meetings; (1) The model for improvement, focusing on setting aims for the QI project and planning changes for improvement, (2) The Plan-Do-Study-Act-cycle, focusing in follow-up of changes tested between meetings 1 and 2, and (3) Planning for sustainability in achieved changes, including establishing arenas for continuous improvement and possible data-sources for QI.

The quality indicator report used by the participants in the MR theme was developed as a collaboration between SKIL, researchers at the University of Bergen and Norwegian University of Science and Technology, The Norwegian Medicines Agency and the Norwegian Organization for Quality Improvement of Laboratory Examinations. A complete list of the MR theme's quality indicator set is presented in appendix A.

Study of the intervention

We used the Standards for QUality Improvement Reporting Excellence (SQUIRE)-guidelines to study and report our findings, considering special circumstances when studying QI interventions. A draft of the guidelines were originally published in 2005, later being revised and re-published as the SQUIRE-2 guidelines (45,46). The study design was a prospective non-randomized intervention study

involving rGPs in the current municipality. Measurements were performed before and after the intervention, and the described changes in prescribing is compared with the national average.

Measures

Quality improvement measures are divided into three types:

- Outcome measures: measuring how the system impacts the health, wellbeing and values of patients as well as impacts on payers, employees and the community.
- Process measures: measuring whether individual steps or parts of the system are performed as planned.
- Balancing measures: measuring if the system for improvement causes new problems to other parts of the system.

We use three different data sources for evaluation:

- As a subjective outcome measure, we used evaluation data from participants.
- As an objective process measure, we used total Medication Review Reimbursement Codes reported in the municipality drawn from the Norwegian Registry for Primary Health Care (NRPHC). The register contains all diagnoses and reimbursement codes from Norwegian rGPs.
- As an objective outcome measure, we used dispensed PIDs patients aged 65 years or older according to the Norwegian Prescription Database (NorPD). The NorPD contains data about all dispensed drugs by Norwegian pharmacies.

Not at any stage did we handle any data on individual patients.

Evaluation data from participants

In order to receive CME credits, all participants must fill in a worksheet that consists of three parts; (a) follow-up questions to repeat key topics in the preceding online course, (b) questions regarding the rGPs QI project, and (c) an evaluation form.

In the current paper, data from the third meeting's worksheet are used for evaluation purposes. The worksheet totally consists of 43 questions, and the following 11 questions were reported in this study:

- Have you been in clinical practice since the last peer group meeting? (Possible answer categories yes; no)
- Have you experienced any positive changes in clinical practice concerning medication review? (Possible answer categories yes; no)

- Have any of the changes involved other healthcare professionals? In case of yes: who? (Free text). For this question we analysed how many participants answered something else than "no".
- Will you be using the indicators actively later? (Possible answer categories: yes; no)
- How do you agree to the following statements? (Possible answer categories: totally disagree; partly disagree; neither agree nor disagree; partly agree; totally agree).
    - The online courses gave me updated knowledge on correct drug prescription
    - The data reports assisted me to find improvement potentials
    - The data reports assisted med to follow-up my improvement project
    - Through this course I have introduced changes which have improvement my drug prescription practice
    - The course gave med practical knowledge in quality improvement which I probably will use during the next 6 months.
- Think about performed MR the last 3 months: How is the number of drugs on the patient's medication list affected by the process? (Possible answer categories: No change in number of drugs; 1-2 less drugs; 3+ less drugs; 1-2 more drugs; 3+ more drugs).

Medication review reimbursement code

Among the rGP reimbursement codes is a code for completing MR of around 16EURO. This code, the MRRC may be taken up to three times per year for patients using at least four regular drugs. However, the MRRC cannot be combined with a better paid reimbursement code used for consultation length of more than 20 minutes. Therefore, a free-text search for MR was also used to report MR in the participants indicator reports. All reimbursement codes are available online through NRPHC's website. Through this website, we fetched the MRRCs for the investigated municipality.

Data from the Norwegian prescription database (NorPD)

The NorPD includes every prescription dispensed by Norwegian pharmacies. We used these data to investigate how the intervention affected dispensed PIDs among patients aged 65 years or older in the intervention municipality. The list of PIDs was developed as a collaboration between researchers and experts from various Norwegian research institutions, led by the Research Unit for General Practice in Bergen, Norway. The main criteria for drugs to be on the list were; (a) they are commonly used by elderly patients and (b) the drug commonly causes potentially serious ADRs among elderly patients. The PID-list and common side effects are presented in table 3. It was presented to the

participating rGPs in the online course before the second meeting and in the indicator report used in all meetings. Although anticoagulants represent a major ADE-risk, this group was not included due to a considerable shift in prescriptions from warfarin to other coagulants in Norway in general.

We here summarise the list of PIDs, including common side effects by each drug:

Drug class	ATC-code(s)	Individual medications in groups available as registered drugs in Norway	Common adverse effects caused by medication group.
Non-selective monoamine reuptake inhibitors	N06AA	Amitriptyline, Doxepin, Clomipranine, Nortriptyline, Trimipramine	Anticholinergic properties, sedation, cognitive impairment, confusion, agitation, cardiac arrhythmias, obstipation, urinary retention, dry mouth, caries and blurred vision.
Selective Serotonin Reuptake Inhibitors (SSRI)	N06AB	Citalopram, Escitalopram, Fluoxetine, Fluvoxamine, Paroxetine, Sertraline	Anticholinergic and sedation properties (less than for TCA), hyponatraemia, increased risk of upper respiratory tract bleeding.
Other Antidepressants / Selective Noradrenergic Reuptake Inhibitors (SNRI)	N06AX	Mianserin, Mirtazapine, Bupropion, Venlafaxine, Reboxetine, Duloxetine, St. Johns' wort, Vortioxetine	As above
An tipsychotics	N05A	N05AA: Levomepromazine N05AB: Perphenazine, Prochlorperazine N05AD: Haloperidole, Droperidol N05AE: Sertrindole, Ziprasidone, Lurasidone N05AF: Flupentixol, Chlorprotixene, Zuklopenthixol N05AH: Loxapine, Clozapine, Olanzapine, Quetiapine N05AL: Amisulpride N05AX: Risperidone, Aripiprazole, Paliperidone Cariprazine, Brexpiprazole	Anticholinergic properties, extrapyramidal symptoms, sedation, dizziness, orthostatic hypotension.
Benzodiazepine derivates	N05BA, N05CD	N05BA: Diazepam, Oxazepam, Alprazolam N05CD: Nitrazepam Midazolam	Addiction, sedation, instability, fall, obstipation.

Benzodiazepine related drugs	N05CF	Zopiclone, Zolpidem	Addiction, sedation, instability, fall, obstipation.
First generation Antihistamines (including diphenylmethane derivatives)	N05BB, R06AB, R06AD, R06AE03, R06AE05	N05BB: Hydroxyzine R06AB: Dexchlorpheniramine R06AD: Alimemazine, Promethazine R06AE03: Syklizine R06AE05: Meclozine	Anticholinergic properties.
Opioids	N02A	N02AA: Morphine, Hydromorphone, Oxycodone N02AB: Ketobemidone, Pethidine, Fentanyl N02AE: Buprenorphine N02AG: Ketobemidone (+ antispasmodics) N02AJ: Codeine (+ paracetamol), Tramadol (+ paracetamol) N02AX: Tramadol, Tapentadol	Addiction, sedation, instability, fall, obstipation.
Drugs for urinary frequency and incontinence	G04BD	Oxybutunin, Tolterodine Solifenacin, Darifenasin, Fesoterodine, Mirabegron	Anticholinergic properties.
Anti-inflammatory and antirheumatic Products, non-steroids	M01A	M01AB: Diclofenac, Ketorolac, Diclofenac (+misoprostol) M01AC: Piroxicam, Meloxicam M01AE: Ibuprofen, Naproxen, Ketoprofen, Dexketoprofen, Naproxen (+esomeprazole) M01AG: Tolfenamic acid M01AH: Celecoxib, Parekoxib, Etoricoxib M01AX: Nabumetone, Glucosamine	Gastrointestinal bleeding, myocardial infarction, stroke, heart- and kidney failure, oedema, hypertension, asthma.

Table 3 The list of Potential Inappropriate Drugs (PIDs) used for evaluation purposes in the current study. ATC=Anatomic Therapeutic Chemical

Analysis

First, we used descriptive statistic methods to describe relevant characteristics of the participating rGPs compared with the national average. Evaluation form data were analysed using descriptive statistic methods.

Statistical Process Control (SPC) was used to investigate how reported MRRCs in the intervention municipality was affected by the intervention. Data were plotted in a run chart to determine whether the intervention imposed special cause variation to the data set, in contrast to common cause variation. Common cause variation is an integral part of every process and expresses the natural rhythm of the process. For instance, we expect fewer reported MRRCs during summer holiday months. In contrast, special cause variation is caused by external factors affecting the process. A significant shift in the process is defined by at least 6 measurements on the same side of the median. The use of SPC has been reported in general to be useful to measure and improve the quality of delivered services (47).

NorPD data were first analysed using descriptive statistics, comparing data for the intervention municipality with the national average. Due to considerable seasonal variation in the data, SPC was not considered suitable to analyse these data. Participants started with the intervention in October 2018, we expected effects of the intervention to be evident from November 2018. Therefore, we calculated the difference in dispensed prescription from November 2018 until May 2019, compared with the respective month one year before. Hence, we calculated the difference in dispensed prescription between November 2018 and November 2017, between December 2018 and December 2017 and so on. Differences for each month compared with the previous year in the intervention municipality were compared with national average data. Independent samples t-tests was conducted to compare changes in the intervention community and the national average. P-values below .05 were considered significant and p-values between 0.05 and 0.1 were considered as near-significant. Analyses were done for each of the drug groups individually, as well as for the all the drug groups together.

Ethical considerations

Before starting data collection for QI purposes, SKIL contacted the Norwegian Data Protection Authority (NDPA) for advice on necessary precautions and sent a formal registration of SKIL's quality database to the NDPA. To protect individual participants data from being exposed, a decision was made that no data should be presented on less than 10 participants from at least two different offices, if no special agreement is made. All participants signing up to SKILs activities are informed of and consent to SKIL´s data handling procedures, in accordance with the General Data Protection Regulations (GDPR).

For the purpose of data handling in this study, the Regional Committee for Medical and Health Research Ethics (RCMHRE) was consulted. They concluded that according to the Norwegian Act on Medical and Health Research, the study did not require approval from the RCMHRE because data

were originally gathered as a part of a QI initiative and not primarily for research purposes. The Data Protection Officer at SKIL approved the procedure for handling the data before data handling was performed. Not at any time did SKIL extract or store any data points or information concerning individual patients.

Results

Evaluation data from participants

Results are shown in table 4. The worksheet during the last meeting was filled in by 25 of the 26 participating participants (response rate 96%). Of these, 24 participants (96%) had been in clinical practice since the previous meeting. Twenty participants (87%) reported having experienced positive changes in their clinical practice during the intervention period, and nine participants (38%) involved other health care professionals in their improvement projects. The health care professionals mentioned were community nurses, the MCMO, other colleagues in the rGP practice, pharmacists, patients' next of kin and private practicing specialists. Twenty-four participants (96%) reported that they will use the indicators actively later. Twenty participants (80%) both reported that the offered online courses provided updated knowledge and that the indicator reports helped to find improvement potentials, and 18 participants (72%) reported that the indicator reports also were useful to follow up their improvement project. Sixteen participants (67%) partly or strongly agreed that they had introduced changes that improved their drug prescription practice, while 19 participants (76%) reported having received practical QI knowledge that would be useful during the next 3 months. Twenty-two (88%) reported reducing the number of drugs on the patient's list by 1-2 drugs per patient after MR performed the last three months.

Question	Answer category	
Have been in clinical practice since last peer group meeting	Yes	96% (24/25)
Experienced positive changes	Yes	87% (20/24)
Involved other persons	Yes	38% (9/24)
Will use indicators actively later	Yes	96% (24/25)
Online courses provided updated knowledge on medication prescription	Partly or strongly agree	80% (20/25)

Indicator reports helped to find improvement potentials	Partly or strongly agree	80% (20/25)
Indicator reports were useful to follow up quality project	Partly or strongly agree	72% (18/25)
I have introduced changes that has improved my drug prescription practice	Partly or strongly agree	67% (16/24)
I received practical quality improvement knowledge that will be useful during next 3 months	Partly or strongly agree	76% (19/25)
Change in patient's number of medications after medication reviews last 3 months:	1-2 more medications per patient	4% (1/25)
	No change in number of medications per patient	8% (2/25)
	1-2 less medications per patient	88% (22/25)

Table 4 Results from selected questions in the evaluation form filled in by participants at the last (third) peer group meeting (n=25)

Medication review reimbursement code (MRRC)

According to the NRPHC, the total number of reported MRRCs in the intervention municipality increased substantially from the month the intervention start compared with earlier months. A run chart with total number of MRRCs per month is shown in figure 3. Before the intervention start, the number of MRRCs per month vary between 76 and 143, the lowest number found in July.

In October 2018 (the first month of the intervention), a near four-fold increase was observed compared with September 2019 (399 vs. 115 reported MRRCs). Thereafter, a significant shift in the process was observed with 9 measurements over the median. The occurrences then again drop in July and August 2019, still being slightly higher than in the respective months the year before (97 vs. 76 MRRCs and 116 vs. 90, respectively). In September 2019, the number of reported MRRCs increase to more than three-fold than September 2018 (343 vs. 115 reported MRRCs).

Month	Tarif for medication review (Number of times taken)
January 2018	137
February 2018	134
March 2018	98
April 2018	132
May 2018	124
June 2018	143
July 2018	76
August 2018	90
September 2018	115
October 2018	**399 – intervention start**
November 2018	243
December 2018	397
January 2019	202
February 2019	213
March 2019	200
April 2019	171
May 2019	270
June 2019	304
July 2019	97
August 2019	116

Table 5 Total number of reported MRRCs in the intervention municipality per month from January 18 to August 2019. Intervention started in October 2018.

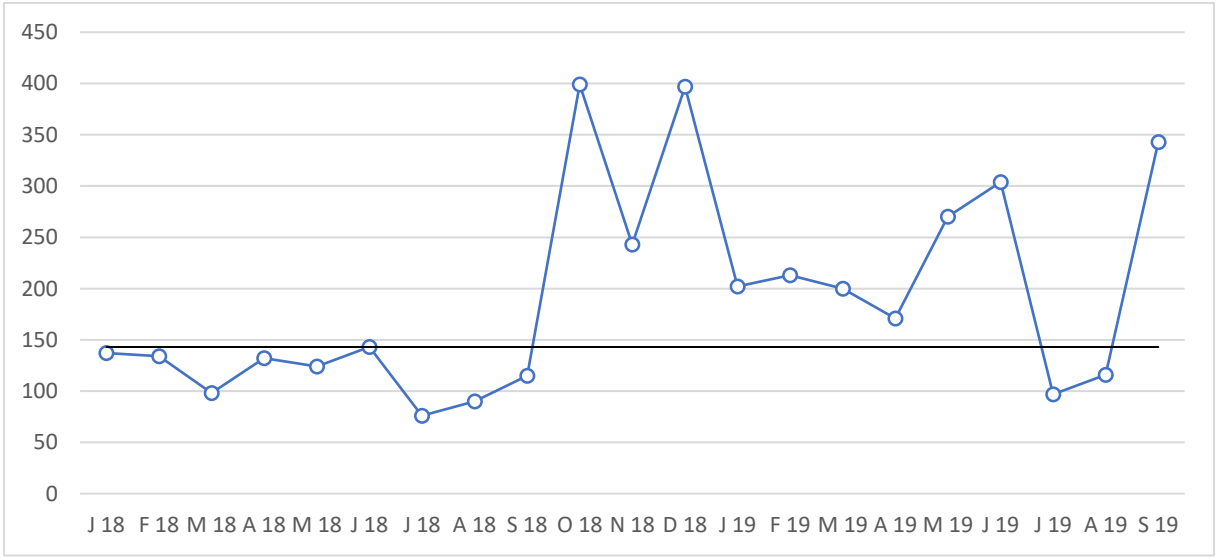
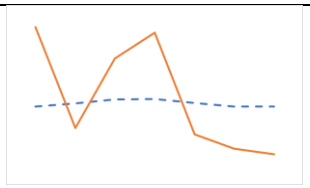
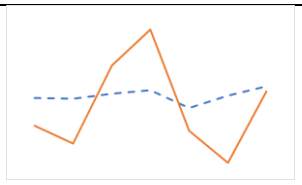
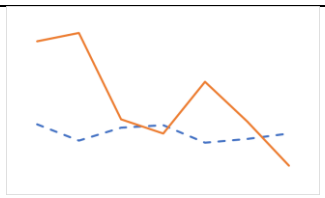
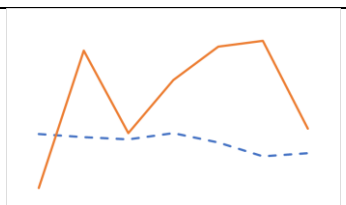


Figure 3 Run chart plotting number of times the medication tariff has been registered per month in the intervention community. The median is shown by the horizontal line. Period January 2018 – September 2019.

Data from the Norwegian prescription database (NorPD)

Results from the data extracted from the NorPD are shown in table 6 (for all drug classes individually and all drug classes in total) and figure 4 (total numbers only). Data from the NorPD revealed significantly less dispensed PIDs among patients aged at least 65years in the intervention municipality compared with the national average (-11.5 vs. -2.33 per 1000 persons aged 65years or older, p=.008). For the individual drug classes, significant differences between the intervention municipality and national average was found for drugs for urinary frequency and incontinence (-.1.53 vs. + .54 per 1000 persons 65 years or older, p=.003). Near-significant differences were found for antipsychotics (increased prescription), benzodiazepine derivates (reduced prescription), benzodiazepine-related drugs (reduced prescription) and anti-inflammatory and antirheumatic products (reduced prescription). In the last month of the intervention (May 19), there was a 7.1% decrease in dispensed PIDs in the intervention municipality compared with no change in the national average the same month. Absolute numbers for dispensed drugs per 1000 municipality residents for all drug classes before and after the intervention are shown in appendix B.

Medication (ATC group)	**Mean Change Intervention group (SD)**	**Mean Change National average (SD)**	**t-value**	**Two-sided significance level (p)**	**Trend line from November 18 to May 19 Solid line: Intervention municipality Dotted line: National average**
Non-selective monoamine reuptake inhibitors	.043 (.65)	.86 (.090)	t(6)=.069	.95	
Selective Serotonin Reuptake Inhibitors (SSRI)	-.93 (1.34)	-.61 (.24)	t(6)=.610	.56	
Other Antidepressants / Selective Noradrenergic Reuptake Inhibitors (SNRI)	2.01 (2.58)	.30 (.41)	t(6)=-1.74	.13	
Antipsychotics	1.54 (1.81)	.1 (.33)	t(6)=-2.07	.084	

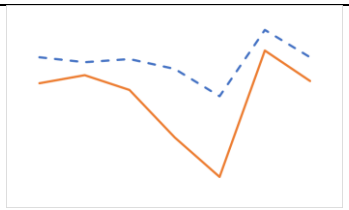
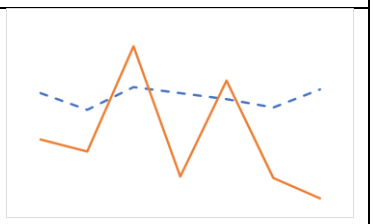
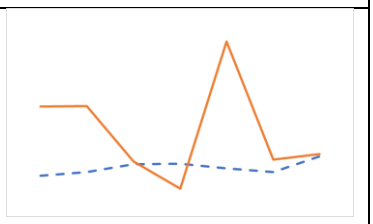
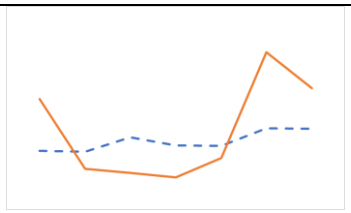
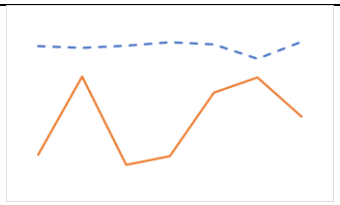
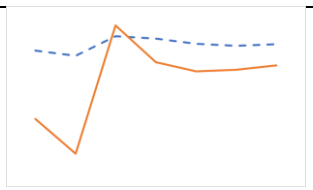
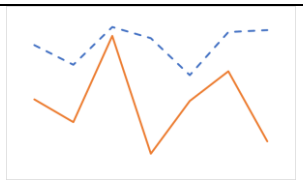
Benzodiazepine derivates	-5.41 (4.46)	-1.37 (2.06)	t(8)=2.17	.061	
Benzodiazepine related drugs	-4.03 (4.88)	-.21 (.72)	t(6)=2.05	.087	
First generation Antihistamines (including diphenylmethane derivatives)	.91 (1.12)	.11 (.17)	t(6)=-1.86	.11	
Opioids	.24 (2.80)	-.21 (.79)	t(7)=-.41	.69	
Drugs for urinary frequency and incontinence	-1.43 (1.06)	.54 (.16)	t(6)=4.95	**.003**	
Anti-inflammatory and antirheumatic products, non-steroids	-4.41 (4.12)	-1.06 (.68)	t(6)=2.13	.077	
All medication groups combined	-11.5 (6.32)	-2.33 (3.13)	t(9)=3.42	**.008**	

Table 6 Mean change of dispensed drugs compared with the previous year, from November 2018 to May 2019. The trend-line to the right shows the trend for the same period. SD=standard deviation.

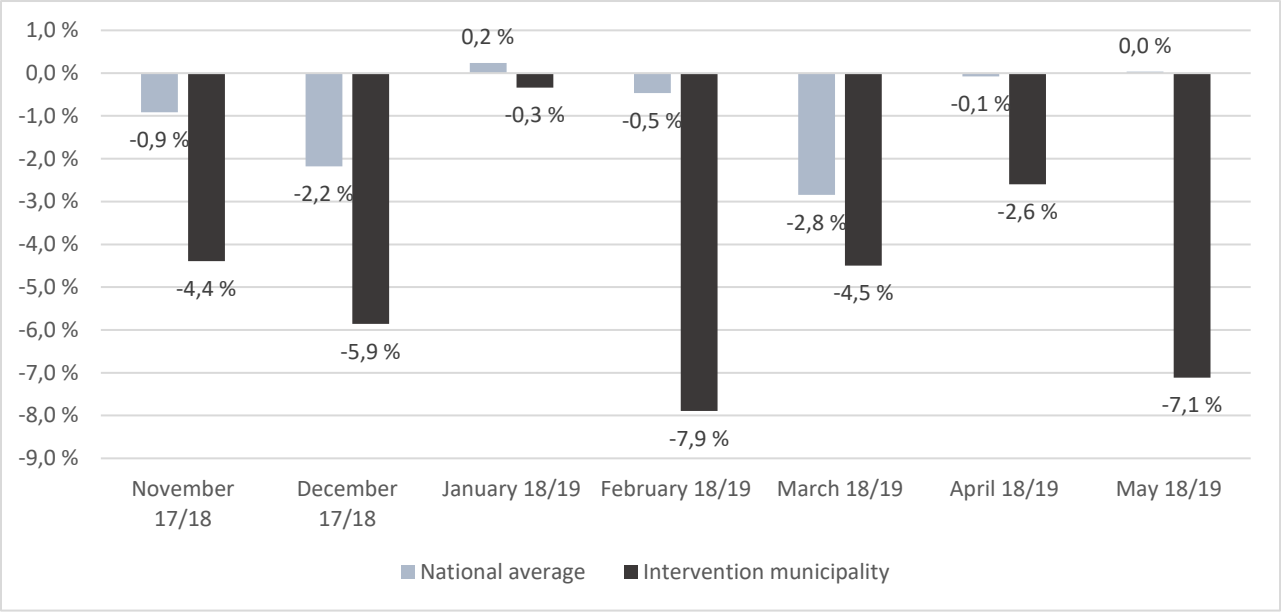


Figure 4 Mean change of dispensed drugs for all inappropriate drug groups from the previous year, comparing the intervention municipality with the national average, from November 2018 to May 2019. Changes are shown in percentages.

Since dispensed drugs for urinary frequency and incontinence were significantly reduced compared to the national average, we subsequently estimated the cost reduction caused by reduced dispersion of this drug class. First, we calculated the average price per DDD for the drug category in Norway by using national data from the NorPD from 2018: The total cost of dispersed drugs for urinary frequency and incontinence was 224 MNOK (around 22,4 MEUR) and the total number of dispersed DDDs was 20,393,882. This results in an average of 11NOK (or approx. 1EUR). We then calculated the reduced number of dispersed DDDs in the intervention community adjusting for the national average and finally multiplied by the price/DDD to estimate saved costs (table 7).

		November 17/18	December 17/18	January 18/19	February 18/19	March 18/19	April 18/19	May 18/19
National average	Before intervention	1178379,7	1372708,4	907772,7	943758	1106497,6	1104963,7	1136214
	After intervention	1249422,9	1430294,7	957697,3	1009950,4	1147217,9	1145756,9	1224023
	Difference (%)	6,0 %	4,2 %	5,5 %	7,0 %	3,7 %	3,7 %	7,7 %
Intervention municipality	Before intervention	5847,3	5356,3	4444,6	5169,7	4193,7	5271,4	5548,9
	After intervention	5042,7	5488,7	3988,7	4470,8	4153,7	4871,4	4828,9
	Difference (DDD)	-804,60	132,40	-455,90	-698,90	-40,00	-400,00	-720,00
	Adjusted difference (DDD)*	1157	92	700	1061	194	594	1149
	Cost reduction (NOK)**	12713	1014	7695	11663	2135	6533	12622

*Table 7 Cost reduction calculated using the number of DDDs dispensed by pharmacies in the intervention municipality. *Adjusted using the change in the national average data. **Cost reduction calculated by multiplying the adjusted difference with 11NOK*

Using these calculations, the total cost reduction caused by reduced dispersed drugs for urinary frequency and incontinence on the 7 examined months was 54,375NOK (approx. 5400EUR).

To estimate annual cost reductions for a whole year, we found the total dispensed DDDs in Norway in the persons 65years of older during the 12-month between November 17 and October18 (13,546,545 DDDs) and divided this number by the total DDDs during the 12-month period between November17 and May18 (7,750,295 DDDs). The resulting number (1.748) was then multiplied with 54375NOK, which resulted in an estimated annual cost reduction of 95,048NOK (approx. 9500EUR).

Discussion

Summary

After completing our QI initiative, most participating rGPs in the intervention municipality reported an improved drug prescription practice. Moreover, they reported having acquired QI skills that would be useful soon. Data from the NRPHC showed a significantly positive shift in the monthly number of MRRCs in the intervention municipality after intervention start until four months after end of the intervention. There was also a significant decrease in dispensed PIDs from the municipality's pharmacies to patients 65 years or older, being reduced by 7.1% in the intervention municipality compared with no change in national average data in the last intervention month. Drugs for urinary

frequency and incontinence was also found to be significantly reduced by itself. Moreover, we found near-significantly reduced prescription of benzodiazepine derivates, benzodiazepine-related drugs, anti-inflammatory and antirheumatic products (non-steroids). Reduced dispensed DDDs of drugs for urinary frequency and incontinence among patients aged 65 years or older alone was estimated to cause a cost reduction of 95,048 NOK in the municipality.

Relation to other evidence

Compared with the few previous QI interventions targeting harmful prescriptions in general practice, the reduction in dispensed PIDs was somewhat less than previously reported (22,23,25).

However, these studies are not directly comparable to ours due to several reasons. Our study recruited a whole municipality's GPs to look at effects from a community health perspective. Secondly, previous studies measured a before-after effect while we compared monthly dispensed drugs starting from the month after intervention start until the last month of the intervention. As can be seen in figure 4, the effect was somewhat larger in the four last months compared with the three first months. Thirdly, we included younger patients in our analyses compared with, and it is, arguably, easier to find potential harmful prescriptions with increasing age. Finally, the current QI intervention had a wider focus than just reducing PID prescriptions. Additionally, a major aim of the current intervention is to acquire practical QI skills where participants are encouraged to themselves find improvement potentials in their data, set goals, measure, find and follow up changes according to the model for improvement(17).

Through PDSA-testing, participants are encouraged to achieve new learning through and experimental process, which is one of the strength with using this technique (48). Additionally, suggestions from peers are expected to boost inspiration for change and the improvement process. By setting own aims and finding appropriate changes themselves, participants also take more ownership in their improvement project. Reduction of dispensed PIDs is only one of many possible aims that the participants could have set for themselves. Therefore, the fact that two thirds of the participants reported introducing positive changes and three fourth acquired practical QI skills might be as important as the objective findings reported.

Focus on broad clinical areas and understanding QI in practice might also reduce some of the unintended consequences which may occur when focusing on a more limited area (49). A qualitative study from the United Kingdom found the Quality Outcomes Framework (QOF) to induce four types of unintended consequences (50). The key unintended consequence was reported to be measure fixation, defined as "an inappropriate attention on isolated aspects of care". Another qualitative

study from Denmark reported that a major limitation of an indicator-based approach to be the fact that indicators will never cover the complexity of clinical practice (51).

When comparing the current study with previous research, it is also important to differ a project primarily designed as a research project from a model primarily for implementation of QI. The model established by SKIL is used for multiple clinical themes and designed to be spread nationwide. The low cost of spreading clinical knowledge through online courses, relatively quick training of supervisors and an online portal for additional guidance of the peer group meetings are especially interesting parts of the model, increasing the possibility for national spread, since all municipalities by regulations are requires to have a MCMO. Additionally, the training of and experience by the MCMO could be an important contribution to the QI knowledge in the municipality, especially useful for supporting the QI work in the GP offices. In a Norwegian intervention study targeting antibiotics prescription (52), rGPs considered MCMOs to be acceptable facilitators of QI activities in general practice. However, the same study reported that in some municipalities the relationship between GPs and MCMOs are not trustworthy enough, so that supervision should be made by a trained rGP instead. A national model should therefore take this into account and use GPs as supervisors when this seems a better solution. GPs as supervisors might also get more goodwill since they know the everyday life of other GPs.

Strengths and limitations

A major strength of the study were high participation and completion rates, minimizing the risk of selection bias. Another strength was that we largely complied with the SQUIRE 2-guidelines, by first designing a model for the QI initiative before planned a study to evaluate the model. The use of SPC-analyses on a municipality level is also in line with standard of reporting effects of QI initiatives.

There are several limitations. Since the MRRC cannot be combined with a better rewarded code for consultation duration over 20 minutes, many of the more complex MRs are not registered in the NRPHC. I might also be argued that the intervention made rGPs more aware of the MRRC, and that financial incentives increased the frequency of reported codes. However, the MRRC was introduced in 2013, and data have shown that the code already was in use by most GPs before the intervention start.

Another limitation is the use of the same MCMO to supervise all groups. Since he already had undertaken a QI project the year before, he might be more than average interested and able to motivate rGPs. This intervention has on the other hand been completed by over 250 rGPs led by multiple supervisors, and the subjective data from rGPs seem som be similar between the different groups.

We did not make any power estimations, primarily since the intervention started as a QI initiative, and only measured the outcome variable (dispensed drugs) until the end of the intervention (May 2019). This raises the risk of type II error (non-rejection of a false null hypothesis). Therefore, we also reported near-significant findings defined by a p-value of < 0.1. A larger study sample or data for a longer time period could have resulted in significant results for more drug classes.

As in many other Norwegian municipalities, there was not a total match between the patients registered on the participating rGPs' and the municipality residents. It is assumed that most municipality residents are on the GPs lists, but we cannot rule out the possibility that some municipality residents attend a rGP outside the municipality not receiving the intervention. This might give som attenuation of the results.

Interpretation and future research

The current study reports positive effects by the QI initiative in three separately collected data sources; evaluation forms filled in by rGPs, MRRCs extracted from the NRPHC and dispersed prescriptions extracted from the NorPD. The MRRC data also show sustained effect four months after end of the intervention. The intervention therefore seems to meet all three of the IHI's triple aims; positive consequences for the individual patients, the community health and reduced cost of healthcare. Note that we only estimated the cost reduction due to one of the PID classes found isolated to be significantly reduced. Interestingly, the estimated annual cost reduction of only this PID class was about the same as the cost of the organized peer group meetings in the municipality. Additionally, there are many potential cost benefits of avoiding ADRs, for instance avoided health deterioration and hospital admissions. The established model answers the need for a QI framework considering current challenges in Norwegian general practice, including high work burden and geographical challenges. We believe the fact that the intervention was introduced as a CME-accredited course and the flexibility increased recruitment of rGPs. Additionally, aggregated data on the municipality level give valuable insights about QI activities.

As mentioned, this intervention was preceded by another municipality-led intervention aimed at reducing inappropriate prescription of benzodiazepine derivates and benzodiazepine related drugs. There was an observed near-significant increase in dispensed antipsychotics and antihistamines, which might have been an effect of replacing hypnotics by other drug classes commonly used to treat sleep disorders. This is interesting and emphasises the need for a QI system that includes balancing measures, not focusing on too narrow areas.

The positive results from the evaluation forms might be an effect of "eager to please". Since rGPs might appreciate this model including CME credits, they could give positive feedback to increase the

probability of receive similar offers in the future. Nonetheless, we found an association between the GPs feedback of prescribing fewer drugs after MR and the data extracted from the NorPD, strengthening the validity for the questionnaire data.

It is interesting to discuss two central issues in all QI initiatives, how to spread the change to a nationwide initiative and how to ensure sustainability of achieved results.

Spreading the QI initiative

Improving quality on a local level is an achievement, however, it is more challenging and important to ensure changes to be spread to other healthcare services. Several studies have looked at how organizational change best can be spread across organizations (26,53,54).

Since the establishment of SKIL's MR theme, over 250 rGPs have completed the intervention including the 26 rGPs in the current intervention municipality. In order to spread the model, all components of the model have been designed to be scalable to a national level:

- Knowledge update in important clinical themes: The use of online courses is an easily spreadable method used in the current model. It seems especially useful given the geographical challenges in Norway. There must be a robust system to regularly update these online courses, which is currently under development in SKIL. This could be combined with or given additionally to other channels for clinical updated knowledge, such as academic detailing visits to rGPs(55).
- Spread of practical QI knowledge: In the current intervention, the QI knowledge is spread in three ways. Firstly, the supervisor is given a short training described above and is supposed to facilitate the individual rGPs improvement projects. Secondly, theoretical QI knowledge is included in the online courses. Thirdly, online worksheets are supposed to help participants to reflect, plan and follow-up their improvement projects. Practical QI knowledge requires more resources to spread than the knowledge update of the clinical themes, but fully feasible and a crucial part of the model. Well trained quality improvement advisors could have the role of training and following-up local supervisors leading peer-group meetings. Municipality half day meetings could be a useful arena for improvement advisors to meet the local supervisors.
- Make data for improvement available: In Norway, there are limited ways to achieve data for improvement on the level of an individual rGP or rGP office. The cost of the EMR fetching software used in the intervention usually must usually be covered by either the individual rGP or the municipality. Without this software, cost-free and readily available data for improvement is hardly available. Most rGPs EMR systems give some built-in statistical

functions to summarize diagnostic codes used, as well as prescribed medications. However, this requires some manual work and the experience of using such built-in functions is limited. Additionally, more available data on dispersed medications would probably be useful. In Denmark, where such data are available on individual GPs level, it has proven useful in QI projects, including projects focusing on potential inappropriate prescriptions (56).

Sustaining Quality Improvement

Most QI research has focused on the initial implementation and improvement results, while fewer studies address how these improvements are sustained over time. It is however a common feature that QI initiatives tend to lose their effects after discontinuation. In the studies addressing sustainability, different definitions are used, and the data source used is often self-assessment instead of objective measures (57). A systematic review of sustainability methods for QI initiatives reported a large diversity in how sustainability is planned and evaluated (58). In the absence of a gold standard, the authors still conclude that sustainability of QI initiatives requires throughout planning and attention.

Some key elements to ensure sustainability have been suggested (26,53,59). The ability to modify a programme, the presence of an expert, the integration of the programme with already existing organizational structures, easily recognized benefits by participants and support of stakeholders seem to be important.

We found the reported MRRC's to drop during summer months before again rising in September 2019, four months after cessation of the intervention. This might indicate at least some sustainability of the results using the process indicator. The municipality collaboration model by SKIL is planned to further increase sustainability, including the following two planned initiatives:

- Annual half-day meetings with the MCMOs, rGPs and other healthcare professionals involved in quality assurance of primary care in the municipality. At these meetings, data from various clinical areas are investigated, new projects planned, and previous projects re-evaluated. So far, six such meetings have been held including in the intervention municipality, with promising results.
- Reminders to participants through the online system after certain time intervals, including updated knowledge of the QI project and access to updated QI data on the previous project.

Future research should aim to further optimize the model to spread practical QI skills in general practice as well as primary care in general. For instance, it is interesting to know how important roles each of the central components (online courses, supervised peer group meetings and indicator

reports) play for the achieved improvement. Furthermore, more detailed insights in participant's actual aims and tested changes in additional to facilitating and obstacles to improvement could be used for further improvement of the model. We have qualitative data from the current model which will be used to investigate this. Additionally, a follow-up study investigating sustainability of results and evaluating interventions for sustainability is warranted and planned. It should be kept in mind that the current model is designed for today's situation, and a change to the rGP scheme might create other opportunities to improve the model, of special interest is formation of cross-organizational meeting. These arenas might be very valuable for plan new improvement projects, as well as follow up previous projects. To build good teams for improvement, such meeting arenas also need to involve multidisciplinary teams, including stakeholders, rGPs, MDMOs, other healthcare professionals and patients.

Conclusions

We found that our model for QI intervention for general practice resulted in significantly positive results when measuring medication review and dispensed drugs on a municipality level. Positive effects seem to sustain at least four months after cessation of the QI initiative. The model makes it possible to spread both updated clinical knowledge and practical QI skills on a national level and seems to fulfil the triple aims of improving both patient outcome and community health at a reduced cost. To achieve spread and further sustainability of positive results, the model should be implemented in a national infrastructure involving stakeholders, improvement advisors, key healthcare professionals and patients.

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References

1. Institute of Medicine (US) Committee on Quality of Health Care in America. To Err is Human: Building a Safer Health System. Kohn L, Corrigan J, Donaldson M, editors. Washington (DC): National Academic Press; 2000.

2. Landrigan CP, Parry GJ, Bones CB, Hackbarth AD, Goldmann DA, Sharek PJ. Temporal trends in rates of patient harm resulting from medical care. N Engl J Med. 2010;363(22):2124–34.

3. James JT. A new, evidence-based estimate of patient harms associated with hospital care. J Patient Saf. 2013;9(3):122–8.

4. Makary MA, Daniel M. Medical error-the third leading cause of death in the US. BMJ [Internet]. 2016;353(May):1–5. Available from: http://dx.doi.org/doi:10.1136/bmj.i2139

5. Berwick DM. Era 3 for Medicine and Health Care. JAMA [Internet]. 2016;315(13):1329–30. Available from: https://www.youtube.com/watch

6. The Health Foundation. Evidence scan: Levels of harm in primary care [Internet]. 2011. Available from: https://www.health.org.uk/sites/default/files/LevelsOfHarmInPrimaryCare.pdf

7. De Wet C, Bowie P. The preliminary development and testing of a global trigger tool to detect error and patient harm in primary-care records. Postgrad Med J. 2009;85(1002):176–80.

8. Slote Morris Z, Wooding S, Grant J. The answer is 17 years. 2011;510–20.

9. Hetlevik I, Prytz Mjølstad B, Helvik A, Austad B, Helvik A-SR. General practitioners' experiences with multiple clinical guidelines: A qualitative study from Norway. Qual Prim Care [Internet]. 2015;23(2):70–7. Available from: https://www.researchgate.net/publication/279168466

10. Berwick DM. The science of improvement. JAMA - Journal of the American Medical Association. 2008.

11. Batalden PB, Davidoff F. What is "quality improvement" and how can it transform healthcare? Qual Saf Heal Care. 2007;16(1):2–3.

12. Committee on Quality of Health Care in America and I of MS. Crossing the quality chasm: A new health system for the 21st century. National Academies Press, 2001.; 2001.

13. Berwick DM, Nolan TW, Whittington J. The triple aim: Care, health, and cost. Health Aff. 2008;27(3):759–69.

14. Deming WE. The New Economics for Industry, Government, and Education. Deming WE, editor. Boston, MA: MIT Press; 1993.

15. Moen R, Norman C. Circling back: Clearing up myths about the Deming cycle and seeing how it keeps evolving. Qual Prog. 2010;43(11):21–8.

16. Deming WE. Out of the Crisis. Cambridge, MA: Massachusetts Institute of Technology; 1986.

17. Langley GJ, Moen RD, Nolan KM. The improvement guide. Jossey-Bass; 2009.

18. Kilo CM. A Framework for Collaborative Improvement: Lessons from the Institute for Healthcare Improvement´s Breakthrough Series. Qual Manag Health Care. 1998;6(4):1–13.

19. American Diabetes Association. The Breakthrough Series : IHI ' s Collaborative Model. Diabetes Spectr. 2004;17(2):97–101.

20. Øvretveit J, Bate P, Cleary P, Cretin S, Gustafson D, Mcinnes K, et al. Quality collaboratives : lessons from research. Qual Saf Heal Care. 2002;345–51.

21. Wells A, Tamir O, Gray J, Naidoo D, Bekhit M, Goldmann D. Are quality improvement collaboratives effective? A systematic review. BMJ Qual Saf. 2018;27:226–40.

22. van der Feltz-Cornelis CM, Grol RP, Franx G, Koetsenruijter J, Huyser J, Verhaak PF, et al. Implementing guidelines for depression on antidepressant prescribing in general practice: a quasi-experimental evaluation. BMC Fam Pract. 2014;

23. Rognstad S, Brekke M, Fetveit A, Dalen I, Straand J. Prescription peer academic detailing to reduce inappropriate prescribing for older patients: A cluster randomised controlled trial. Br J Gen Pract. 2013;

24. Straand J, Fetveit A, Rognstad S, Gjelstad S, Brekke M, Dalen I. A cluster-randomized educational intervention to reduce inappropriate prescription patterns for elderly patients in general practice - The Prescription Peer Academic Detailing (Rx-PAD) study [NCT00281450]. BMC Health Serv Res. 2006;

25. Clyne B, Smith S, Hughes C, Boland F, Bradley M, Cooper J, et al. Effectiveness of a Multifaceted Intervention for Potentially Inappropriate Prescribing in Older Patients in Primary Care: A Cluster-Randomized Controlled Trial (OPTI-SCRIPT Study). Ann Fam Med [Internet]. 2015;13(6):545–53. Available from: http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emex&NEWS=N&AN=615194826

26. Oldham J. The small book about large systems change. 2004. 1–80 p.

27. Eide TB, Straand J, Björkelund C, Kosunen E, Thorgeirsson O, Vedsted P, et al. Differences in medical services in Nordic general practice: a comparative survey from the QUALICOPC study. Scand J Prim Health Care. 2017;3432:1–10.

28. Olsen KR, Anell A, Häkkinen U, Iversen T, Ólafsdóttir T, Sutton M. General practice in the Nordic countries. Nord J Heal Econ. 2016;4(1):56.

29. Ernst & Young, Vista Analyse. Evaluering av fastlegeordningen. 2019.

30. Spehar I, Sjøvik H, Karevold KI, Rosvold EO, Frich JC. General practitioners' views on leadership roles and challenges in primary health care: a qualitative study. Scand J Prim Health Care. 2017;

31. Edwards IR, Aronson JK. Adverse drug reactions Adverse drug reactions : definitions , diagnosis , and management. 2000;356:1255–60.

32. Hazell L, Shakir S. Under-reporting of adverse drug reactions. Drug Saf. 2006;29(5):385–96.

33. Kongkaew C, Noyce P, Ashcroft D. Hospital Admissions Associated with Adverse Drug Reactions: A Systematic Review of Prospective Observational Studies. Ann Pharmacother. 2008;42(7–8):1017–25.

34. Pouyanne P, Haramburu F, Imbs JL, Bégaud B. Admissions to hospital caused by adverse drug reactions: Cross sectional incidence study. Br Med J. 2000;320(7241):1036.

35. Pirmohamed M, James S, Meakin S, Green C, Scott A, Walley T, et al. Adverse drug reactions as cause of admission to hospital: prospective analysis of 18 820 patients. BMJ. 2004;329:15–9.

36. Leendertse AJ, Egberts ACG, Stoker LJ, Van Den Bemt PMLA. Frequency of and risk factors for preventable medication-related hospital admissions in the Netherlands. Arch Intern Med. 2008;168(17):1890–6.

37. Gnjidic D, Hilmer SN. Emergency hospitalizations for adverse drug events. N Engl J Med. 2012;366(9):859.

38. Davies EA, O'Mahony MS. Adverse drug reactions in special populations - The elderly. Br J Clin Pharmacol. 2015;80(4):796–807.

39. Schmucker D. Liver Function and Phase I Drug Metabolism in the Elderly. Drugs & Ageing.

2012;18(11):837–51.

40. Forbes GB, Reina JC. Adult lean body mass declines with age: Some longitudinal observations. Metab - Clin Exp [Internet]. 1970 Sep 1;19(9):653–63. Available from: https://doi.org/10.1016/0026-0495(70)90062-4

41. Fick DM, Cooper JW, Wade WE, Waller JL, Maclean ; J Ross, Beers MH. Updating the Beers Criteria for Potentially Inappropriate Medication Use in Older Adults Results of a US Consensus Panel of Experts [Internet]. 2003. Available from: www.archinternmed.com

42. O'mahony D, O'sullivan D, Byrne S, O'connor MN, Ryan C, Gallagher P. STOPP/START criteria for potentially inappropriate prescribing in older people: Version 2. Age Ageing. 2015;44(2):213–8.

43. Rognstad S, Brekke M, Fetveit A, Spigset O, Wyller TB, Straand J. The norwegian general practice (NORGEP) criteria for assessing potentially inappropriate prescriptions to elderly patients. Scand J Prim Health Care. 2009;27(3):153–9.

44. Romskaug R, Skovlund E, Straand J, Molden E, Kersten H, Pitkala KH, et al. Effect of Clinical Geriatric Assessments and Collaborative Medication Reviews by Geriatrician and Family Physician for Improving Health-Related Quality of Life in Home-Dwelling Older Patients Receiving Polypharmacy: A Cluster Randomized Clinical Trial. JAMA Intern Med [Internet]. 2019 Oct 16; Available from: http://www.ncbi.nlm.nih.gov/pubmed/31617562

45. Ogrinc G, Davies L, Goodman D, Batalden P, Davidoff F, Stevens D. Standards for QUality Improvement Reporting Excellence 2.0: revised publication guidelines from a detailed consensus process. J Surg Res. 2016;200(2):676–82.

46. Davidoff F, Batalden P, Stevens D, Ogrinc G, Mooney S. Publication guidelines for quality improvement in health care: Evolution of the SQUIRE project. Qual Saf Heal Care. 2008;17(SUPPL. 1):3–9.

47. Thor J, Lundberg J, Ask J, Olsson J, Carli C, Härenstam KP, et al. Application of statistical process control in healthcare improvement: Systematic review. Vol. 16, Quality and Safety in Health Care. 2007. p. 387–99.

48. Reed JE, Card AJ. The problem with plan-do-study-act cycles. BMJ Qual Saf. 2016;25(3):147–52.

49. Bardach N, Cabana M. The Unintended Consequences of Quality Improvement. Curr Opin Pediatr. 2009;21(6):1–8.

50. Lester HE, Hannon KL, Campbell SM. Identifying unintended consequences of quality indicators: A qualitative study. BMJ Qual Saf. 2011;20(12):1057–61.

51. Lippert ML, Kousgaard MB, Bjerrum L. General practitioners uses and perceptions of voluntary electronic feedback on treatment outcomes - A qualitative study. BMC Fam Pract. 2014;15(1):1–9.

52. Sunde M, Nygaard MM, Høye S. General Practitioners' Attitudes toward Municipal Initiatives to Improve Antibiotic Prescribing—A Mixed-Methods Study. Antibiotics. 2019;8(3):120.

53. Kellogg KC, Gainer LA, Allen AS, Sullivan TO, Singer SJ. Developing and spreading quality improvement innovations. Heal Care Manag Rev. 2017;42(4):292–302.

54. Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. Fostering implementation of health services research findings into practice: A consolidated framework for advancing implementation science. Implement Sci. 2009;4(1):1–15.

55. Dyrkorn R, Langaas H. Academic Detailing in Norway—Caring for GPS Where They Are. Clin Ther [Internet]. 2017;39(8):e1. Available from: http://dx.doi.org/10.1016/j.clinthera.2017.05.006

56. Vass M, Hendriksen C. Medication for older people. Z Gerontol Geriatr. 2005;38(3):190–5.

57. Wiltsey Stirman S, Kimberly J, Cook N, Calloway A, Castro F, Charns M. The sustainability of new programs and innovations: A review of the empirical literature and recommendations for future research. Implement Sci. 2012;7(1):1–19.

58. Lennox L, Maher L, Reed J. Navigating the sustainability landscape: A systematic review of sustainability approaches in healthcare. Implement Sci. 2018;13(1):1–17.

59. Scheirer MA. Is Sustainability Possible? A Review and Commentary on Empirical Studies of Program Sustainability. Am J Eval [Internet]. 2005 Sep 1;26(3):320–47. Available from: https://doi.org/10.1177/1098214005278752

Appendix

A. Quality Indicator list used in the Medication Review course

Indicator
Percentage of patients on the rGP list using at least 4 regular drugs
Percentage of patients using drugs with high risk of ADE*
Percentage of patients with at least 4 regular drugs where MR is coded or written in the last 12 months
Percentage of patients with 1-3 regular drugs that have received MR the last year
Percentage of patients with at least one drug who has at least one double-prescription**
Number of patients using drugs requiring precautions in case of renal failure
--- Percentage of patients above where renal function is measured in the last year
--- Percentage of patients above where renal function is reported to be lowered***
Percentage of patients aged at least 65 years using at least one drug with high risk of adverse drug reactions: Non-selective monoamine reuptake inhibitors Selective Serotonin Reuptake Inhibitors (SSRI) Other Antidepressants / Selective Noradrenergic Reuptake Inhibitors (SNRI) Antipsychotics Benzodiazepine derivates Benzodiazepine related drugs First generation Antihistamines (including diphenylmethane derivatives) Opioids Drugs for urinary frequency and incontinence Anti-inflammatory and antirheumatic products, non-steroids
Percentage of patients above without any registered doctor visit during the last 12 months
Percentage of patients aged 65 years or older using at least 3 psychopharmacological agents
Percentage of patients aged 65 years or older using at least 5+ regular medications
Percentage of patients aged 65 years or older using at least 10+ regular medications
Number of patients with at least one INR-value of at least 1.5
Spread of measured INR-values last year: - Too low (<1.8) - Could be too low (1.8-1.9) - In common therapeutic area (2.0-3.0) - Lightly elevated / intensive therapeutic area (3.1-3.5) - Moderately elevated (3.6-4.4) - Elevated and should be paused (4.5-6.0) - Considerably elevated (>6.0)
Time between INR measurements: - 1 week - 2 weeks - 3 weeks

- 4 weeks - 5 weeks - 6 weeks - 7 weeks or more
Number of patients using warfarin
Number of patients with registered atrial fibrillation only using anti-platelet agent
Number of patients using either direct thrombin inhibitors or direct factor Xa inhibitors
Number of patients using either direct thrombin inhibitors or direct factor Xa inhibitors that have: - A registered doctor's visit in the last 12 months - Measured renal function in the last 12 months - Measured urine albumin/creatinine ratio in the last 12 months - Measured haemoglobin, leucocyte particle count and thrombocyte particle count in the last 12 months - Measured alanine aminotransferase (ALAT) in the last 12 months

*Here defined as in the Checklist for Medication review published by the Norwegian Medicines Agency: NSAID/COXIBs, Warfarin, DOAK, anti-platelet agents, benzodiazepines, z-hypnotics, opioids, ACE-inhibitors, Angiotensine reseptor blockers, loop diuretics, digoxin, corticosteroids.

**Double-prescription is defined as having at least two similar drugs including the same dosage in the medication list of the EMR.

***Lowered renal function defined as a Glomerular Filtration Rate (GFR) below 45 mg/mmol

INR: International Normalization Ratio

B. Change in all dispensed drugs in intervention municipality and national average

Non-selective monoamine reuptake inhibitors		Nov 17/18	Dec 17/18	Jan 18/19	Feb 18/19	Mar 18/19	Apr 18/19	May 18/19
National average	Before intervention	7,3	7,7	6,4	6,3	7	6,8	7,2
	After intervention	7,3	7,8	6,6	6,5	7,1	6,8	7,2
	Difference	0,0 %	1,3 %	3,1 %	3,2 %	1,4 %	0,0 %	0,0 %
Intervention municipality	Before Intervention	6,1	8,6	6,7	5,6	8,2	8,2	8,2
	After intervention	8,2	7,8	8,1	7,4	7,2	6,7	6,5
	Difference	34,4 %	-9,3 %	20,9 %	32,1 %	-12,2 %	-18,3 %	-20,7 %

Selective serotonin reuptake inhibitors (SSRI)		Nov 17/18	Dec 17/18	Jan 18/19	Feb 18/19	Mar 18/19	Apr 18/19	May 18/19
National average	Before Intervention	20,9	22,8	18,8	18,6	20,2	19,9	20,2
	After intervention	20,2	22	18,3	18,2	19,2	19,3	19,9
	Difference	-3,3 %	-3,5 %	-2,7 %	-2,2 %	-5,0 %	-3,0 %	-1,5 %
Intervention municipality	Before Intervention	19,3	19,7	16,3	15,8	17,4	18,2	17,4
	After intervention	17,8	17,6	16,6	17	15,9	15,7	17
	Difference	-7,8 %	-10,7 %	1,8 %	7,6 %	-8,6 %	-13,7 %	-2,3 %

Other Antidepressants / Selective Noradrenergic Reuptake Inhibitors (SNRI)		Nov 17/18	Dec 17/18	Jan 18/19	Feb 18/19	Mar 18/19	Apr 18/19	May 18/19
National average	Before Intervention	16,7	18,4	16	15,7	17,1	16,8	17
	After intervention	17,5	18,3	16,6	16,4	16,9	16,8	17,3
	Difference	4,8 %	-0,5 %	3,8 %	4,5 %	-1,2 %	0,0 %	1,8 %
Intervention municipality	Before Intervention	15,1	16,8	15,4	16,5	14,5	17,3	17,4
	After intervention	19,9	22,6	16,4	16,8	17,2	18,3	15,9
	Difference	31,8 %	34,5 %	6,5 %	1,8 %	18,6 %	5,8 %	-8,6 %

Antipsychotics		Nov 17/18	Dec 17/18	Jan 18/19	Feb 18/19	Mar 18/19	Apr 18/19	May 18/19
National average	Before intervention	13	13,5	12,7	12,2	13	13	13,1
	After intervention	13,4	13,8	12,9	12,6	13,1	12,6	12,8
	Difference	3,1 %	2,2 %	1,6 %	3,3 %	0,8 %	-3,1 %	-2,3 %
Intervention municipality	Before intervention	12,6	11,5	12,2	10,6	12,1	11,1	11,1
	After intervention	11,1	14,5	12,6	12,5	15,4	14,3	11,6
	Difference	-11,9 %	26,1 %	3,3 %	17,9 %	27,3 %	28,8 %	4,5 %

Benzodiazepine derivates		Nov 17/18	Dec 17/18	Jan 18/19	Feb 18/19	Mar 18/19	Apr 18/19	May 18/19
National average	Before intervention	35,2	36,4	34,8	32,5	35,4	33,6	34
	After intervention	34,3	34,9	33,7	30,5	30,3	35,5	33,1
	Difference	-2,6 %	-4,1 %	-3,2 %	-6,2 %	-14,4 %	5,7 %	-2,6 %
Intervention municipality	Before intervention	40,2	38,5	35,1	34,9	34,5	33,4	32,5
	After intervention	36	35,4	30,7	25,5	21,1	33,2	29,3
	Difference	-10,4 %	-8,1 %	-12,5 %	-26,9 %	-38,8 %	-0,6 %	-9,8 %

Benzodiazepine related drugs		Nov 17/18	Dec 17/18	Jan 18/19	Feb 18/19	Mar 18/19	Apr 18/19	May 18/19
National average	Before intervention	61,4	63,9	61,4	56,2	60,1	57,9	59,1
	After intervention	61,5	62,6	62	56,3	59,7	56,9	59,5
	Difference	0,2 %	-2,0 %	1,0 %	0,2 %	-0,7 %	-1,7 %	0,7 %
Intervention municipality	After intervention	72,9	69,7	62,5	63,1	65,1	64,8	69,2
	Before intervention	68,5	64,4	66,5	56,2	66,3	57,6	59,6
	Difference	-6,0 %	-7,6 %	6,4 %	-10,9 %	1,8 %	-11,1 %	-13,9 %

First generation antihistamines		Nov 17/18	Dec 17/18	Jan 18/19	Feb 18/19	Mar 18/19	Apr 18/19	May 18/19
National average	Before intervention	8,9	9,1	8,9	8,3	8,9	8,7	8,7
	After intervention	8,8	9,1	9,1	8,5	9	8,7	9,1
	Difference	-1,1 %	0,0 %	2,2 %	2,4 %	1,1 %	0,0 %	4,6 %
Intervention municipality	Before intervention	7,8	6,7	9,8	8,2	7,8	8,2	7,6
	After intervention	9,3	8	10,1	7,8	10,8	8,5	8
	Difference	19,2 %	19,4 %	3,1 %	-4,9 %	38,5 %	3,7 %	5,3 %

Opioids		Nov 17/18	Dec 17/18	Jan 18/19	Feb 18/19	Mar 18/19	Apr 18/19	May 18/19
National average	Before intervention	49,9	50,8	48,8	46,1	49,2	48,2	49,4
	After intervention	48,9	49,7	48,9	45,6	48,6	49	50,2
	Difference	-2,0 %	-2,2 %	0,2 %	-1,1 %	-1,2 %	1,7 %	1,6 %
Intervention municipality	Before intervention	36,8	38,5	37,5	39	37,9	31	31,4
	After intervention	39,2	36,6	35,4	36,5	36,7	35,4	34
	Difference	6,5 %	-4,9 %	-5,6 %	-6,4 %	-3,2 %	14,2 %	8,3 %

Drugs for urinary frequency and incontinence		Nov 17/18	Dec 17/18	Jan 18/19	Feb 18/19	Mar 18/19	Apr 18/19	May 18/19
National average	Before intervention	15,3	17	12,4	12,9	14,2	14,4	14,7
	After intervention	15,9	17,6	12,9	13,5	14,8	14,6	15,4
	Difference	3,9 %	3,5 %	4,0 %	4,7 %	4,2 %	1,4 %	4,8 %
Intervention municipality	Before intervention	15,3	14	12,2	12,8	11,3	12,8	13,9
	After intervention	12,6	13,7	9,8	10,5	10,7	12,5	12,5
	Difference	-17,6 %	-2,1 %	-19,7 %	-18,0 %	-5,3 %	-2,3 %	-10,1 %

Anti-inflammatory and antirheumatic products, non-steroids		Nov 17/18	Dec 17/18	Jan 18/19	Feb 18/19	Mar 18/19	Apr 18/19	May 18/19
National average	Before intervention	33,8	35,9	29,1	27,8	31,4	32	34
	After intervention	32,2	33,7	28,9	27,4	30,5	30,9	33
	Difference	-4,7 %	-6,1 %	-0,7 %	-1,4 %	-2,9 %	-3,4 %	-2,9 %
Intervention municipality	Before intervention	33,3	35,4	30,2	30,4	31,5	33,8	31,7
	After intervention	25,4	23,6	30,9	28	28,2	30,4	28,9
	Difference	-23,7 %	-33,3 %	2,3 %	-7,9 %	-10,5 %	-10,1 %	-8,8 %

All drug groups combined		Nov 17/18	Dec 17/18	Jan 18/19	Feb 18/19	Mar 18/19	Apr 18/19	May 18/19
National average	Before intervention	262,4	275,5	249,3	236,6	256,5	251,3	257,4
	After intervention	260	269,5	249,9	235,5	249,2	251,1	257,5
	Difference	-0,9 %	-2,2 %	0,2 %	-0,5 %	-2,8 %	-0,1 %	0,0 %
Intervention municipality	Before intervention	259,4	259,4	237,9	236,9	240,3	238,8	240,4
	After intervention	248	244,2	237,1	218,2	229,5	232,6	223,3
	Difference	-4,4 %	-5,9 %	-0,3 %	-7,9 %	-4,5 %	-2,6 %	-7,1 %