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# Effectiveness of interventions to optimize medication in nursing home residents – Review of the literature

Annexe au rapport final sur le projet de base progress ! La sécurité de la médication  
en EMS (décembre 2016 - décembre 2018)



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## Annexe au rapport final

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### Content

<b>1</b>	<b>Aim</b> .....	<b>2</b>
<b>2</b>	<b>Abbreviations</b> .....	<b>2</b>
<b>3</b>	<b>Review</b> .....	<b>3</b>
3.1	Part 1: Review of single intervention studies in Switzerland .....	3
3.2	Part 2: Review of international systematic reviews .....	3
<b>4</b>	<b>Results</b> .....	<b>4</b>
<b>5</b>	<b>Discussion</b> .....	<b>12</b>
5.1	Part 1 .....	12
5.2	Part 2 .....	12
<b>6</b>	<b>Conclusion</b> .....	<b>13</b>
<b>7</b>	<b>References</b> .....	<b>13</b>

## 1 Aim

To provide an overview on existing evidence of the effectiveness of interventions to optimize medication in nursing homes. By „optimize“, we mean to reduce PIM and polypharmacy in order to reduce harmful outcomes. In part 1, single intervention studies in Swiss nursing homes are summarized. In part 2, existing evidence from international systematic reviews are sampled.

## 2 Abbreviations

ADE = adverse drug event

ADR = adverse drug reaction

(C)CDSS = (computerized) clinical decision support system

DRP = drug related problem

PIM = potentially inappropriate medication

PIP = potentially inappropriate prescription/prescribing

RCT = randomized controlled trial



### 3 Review

#### 3.1 Part 1: Review of single intervention studies in Switzerland

Study inclusion criteria: a) all types of intervention studies, b) investigating the effect of c) interventions to optimise medication (meaning by reducing PIM or polypharmacy or to reduce their harmful outcomes), d) performed in nursing homes or similar institutions (residential aged care facilities, long-term care facilities, care homes) e) in Switzerland

Study exclusion criteria: other types of studies than intervention studies, including not only nursing home residents, including only end of life residents, protocols, studies about the use of specific therapies, studies at transitions of care, guideline implementation studies, reviews on experiences of health care professionals, studies with medication being no subject of the intervention or the outcome, conference reports, economical studies. No limit was applied to the publication date.

Search strategy in Medline: (nursing home[MeSH Terms]) AND (intervention OR optimi\*) AND (medication OR drug) AND Switzerland on 6.12.2018: 13 results, 11 excluded.

Results: Studies are summarized in table 1.

#### 3.2 Part 2: Review of international systematic reviews

Study inclusion criteria: studies being a) systematic reviews with/without meta-analysis, b) investigating the effect of c) interventions to optimise medication (meaning by reducing PIM or polypharmacy or to reduce their harmful outcomes), d) performed in nursing homes or similar institutions (residential aged care facilities, long-term care facilities, care homes).

Study exclusion criteria: other types of reviews than systematic reviews, including not only nursing home residents or including only end of life residents, prevalence studies, protocols, studies about the use of specific therapies, studies at transitions of care, guideline implementation studies, reviews on experiences of health care professionals, studies with medication being no subject of the intervention or the outcome. No limit was applied to the publication date.

Search strategies: Different search strategies were applied on 3.12.2018:

- a) Medline, (nursing home[MeSH Terms]) AND (medication review) AND (systematic reviews) with filter for systematic reviews: 27 results, 21 not relevant leaving 6 relevant studies (1-6)
- b) Medline, (nursing home[MeSH Terms]) AND (deprescri\*), with filter for systematic reviews: no result
- c) Medline, (nursing home[MeSH Terms]) AND (intervention) AND (systematic reviews) with filter for systematic reviews: 38 results, 36 not relevant, 1 duplicate, leaving 1 result (7)
- d) Cochranelibrary.com, \*nursing home medication polypharmacy appropriate intervention with filter for cochrane reviews: 23 results, 22 not relevant, 1 duplicate, leaving no additional result
- e) Screening of the literature database of the progress! program, resulting in 4 additional results (8-11)

Results: Systematic reviews are summarized in table 2.



## 4 Results

Table 1: overview of intervention studies in Swiss nursing homes found for part 1.

Main author, publication year, title, reference	Study design and year of conduct	Canton	Population included	Interventions included	Outcomes and Results	Conclusion
Blozik E (2010), Reduction of inappropriate medications among older nursing-home residents: a nurse-led, pre/post-design, intervention study. (12)	Before after study, 2006-2007	Bern	≥60 years old residents of one nursing home, 204 residents	<p>Medication review with an adapted version of Beers criteria, written PIM notification by investigator handed over to the physician by nurses. If PIM was stopped, this was marked on the notification. Physicians were reminded to stop the PIM if not stopped within 2 months.</p> <p>Additional education of physicians, director of nursing and psychiatrists by a geriatrician about PIM, deprescribing and the conduct of the study. The director of nursing taught their staff.</p>	<p>Outcomes: Drugs per resident, number of PIM per resident, measured by Beers criteria after a 4-month intervention phase and after 1 year.</p> <p>The PIM prescription rate decreased from 14.5% pre-intervention to 2.8% post-intervention. The risk of PIM prescription increased nonsignificantly in the 1-year followup period to 4.4% compared to the post-intervention phase. However, the risk of PIM prescription when the pre-intervention and the 1-year postintervention populations were compared showed a statistically significant decrease. Patients had a mean of 7.8 and 8.3 medicines pre- and 1-year postintervention.</p>	The intervention is effective to reduce PIM prescription. Multi-disciplinary approaches, involving not only physicians but also nurses in the prescribing process, are important.



## Annexe au rapport final

<p>Brulhart MI (2011), Multidisciplinary medication review: evaluation of a pharmaceutical care model for nursing homes. (13)</p>	<p>Observational study, 2007-2009</p>	<p>Jura</p>	<p>All residents, including palliative cases of one nursing home, 329 residents</p>	<p>Medication review of five residents each in monthly 1-hour multidisciplinary meetings including pharmacist, physician and one or two nurses. The medication was reviewed by the pharmacist prior to the meeting, focusing on drug indication, risk of medication error (e.g. incomplete transcriptions), dosing, side effects, elimination and interactions. DRPs were identified and proposed actions and decisions were documented.</p>	<p>Outcomes: Pharmaceutical interventions measured by PCNE classification, medication changes, drugs per resident, satisfaction of nurses and physicians.</p> <p>A mean of 3.7 DRP per resident were detected by the pharmacist. The 1146 implemented interventions (93% of all interventions) were divided into 803 medication changes (70%, half of them were stops). Number of drugs on a daily basis was significantly reduced from 9.8 to 9.1 per resident.</p> <p>All physicians and nurses highly valued the new service and saw numerous benefits.</p>	<p>Continuous medication review was well accepted and improved drug therapy. The multidisciplinary approach including the nurses was of importance.</p>
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## Annexe au rapport final

**Table 2: Overview of systematic reviews.** Firstly, reviews are ordered by the included studies, and secondly by the publication date. \*Given ages may mean that included studies were restricted to studies including single residents only if aged >65years, or to studies having a population with a mean age of >65years, or to studies having a population with a majority of residents aged >65years.

Main author, publication year, title, reference	Study designs and years included	Countries of primary studies if mentioned	Population included*	Interventions included	Outcomes and Results	Conclusion
<b>Reviews including only RCTs</b>						
Allred DP (2016), Interventions to optimise prescribing for older people in care homes. (7)	RCTs up to 2015, 12 studies	AU, UK, SE, NL, US, CA, NZ, IL, ES, FI	Residents ≥65years old	Interventions optimising prescribing: <ul style="list-style-type: none"> <li>- Reviews (10 studies)</li> <li>- Multidisciplinary case conferencing (4)</li> <li>- Education (5)</li> <li>- CDSS (1)</li> </ul>	Outcomes: ADE, hospitalization, mortality, quality of life, DRP, medication appropriateness, medication costs.  Promising effects were shown through the interventions, although of low certainty: shorter hospitalisation, identification and resolution of DRP, better medication appropriateness. It is uncertain if the interventions affect ADE, mortality, quality of life and costs.	DRPs were identified and authors therefore interpret that potential to optimize prescribing is prevalent. Multidisciplinary teams play a significant role in optimising prescribing for residents and this was reflected in the studies; usually with pharmacists conducting medication reviews. Effectiveness on clinical outcomes has not been sufficiently demonstrated.



## Annexe au rapport final

<p>Nazir A (2013), Systematic review of interdisciplinary interventions in nursing homes. (11)</p>	<p>RCTs 1990-2011, 27 studies</p>	<p>US, AU, UK, NL, TW, DE, SE, NZ, DN, AT</p>	<p>Residents &gt;65years old</p>	<p>Interdisciplinary interventions with different scopes (see also very diverse outcomes). Most interventions included formal team meetings, communication or coordination in teams. Furthermore education, case conferences, environmental modifications, resident assessments, but also exercise, therapy and supplements. Six studies targeted medication use, of which one targeted antipsychotic drug use.</p>	<p>Outcomes: medication use, weight decrease, falls, restraint use, behaviour, mobility etc.</p> <p>18 of 27 studies had a positive effect. Participation of the resident's own physician or pharmacist was a factor for success, as well as formal team-based care, communication, coordination, leadership. Antipsychotic drug use was positively affected, while the five studies targeting other medication use had mixed results.</p> <p>2 studies had negative outcomes, one with formal team meetings.</p>	<p>The interventions showed an overall promising effect, however medication use was not always positively affected. Interdisciplinarity may be a good method to enhance outcomes in nursing homes. Involving the resident's own physician and a pharmacist could be promising. However, if interdisciplinary teams are not well organized, they can even have harmful effects.</p>
<p>Forsetlund L (2011), Effect of interventions to reduce potentially inappropriate use of drugs in nursing homes: a systematic review of randomised controlled trials. (4)</p>	<p>RCTs up to 2010: 21 publications of 20 studies</p>	<p>not systematically stated (DE, US, CA, AU, UK, SE)</p>	<p>Older residents in nursing homes</p>	<p>Different interventions:</p> <ul style="list-style-type: none"> <li>- Educational outreach initiatives (2 studies)</li> <li>- Educational meetings alone (5) or with at least one additional intervention (3)</li> <li>- Medication review by different professionals (7)</li> <li>- Geriatric assessment and care teams (1)</li> <li>- Early psychiatric intervention (1)</li> <li>- Activity program interventions for residents (1)</li> </ul>	<p>Outcomes: drug use assessed with implicit or explicit criteria. Secondary: falls, hospital admission, physical restraints, mortality.</p> <p>All forms of education may lead to small reductions in drug use. So do geriatric assessments and care teams. Reviews may lead to small reductions in drug use, and possibly have a positive effect on number of falls. Early psychiatric intervention and activity programs had no effect.</p>	<p>Medication review by a pharmacist and education may in some circumstances lead to a small change in use of drugs in nursing homes. However, the quality of the evidence for all of the measured health-related outcomes is too low to draw any conclusions.</p>



## Annexe au rapport final

Marcum ZA (2010), Interventions to improve suboptimal prescribing in nursing homes: A narrative review. (10)	RCTs 1975-2009, 18 studies	not systematically stated (CA, UK)	Residents ≥65years old	Different interventions: <ul style="list-style-type: none"> <li>- Educational approach (7 studies)</li> <li>- CDSS (2)</li> <li>- Clinical pharmacist intervention, mostly medication review (5)</li> <li>- Multifaceted (2) and multidisciplinary approach (2)</li> </ul>	Outcome: process measure or ADE  15 of 18 studies reported positive effects on process measures. Possibly, there is an effect through interdisciplinary and a pharmacist-led approach. No evidence shown for the effect on clinical outcomes, possibly due to methodological reasons.	Studies were too heterogenous to draw an overall conclusion. There might be interventions effective to improve process measures related to prescribing.
<b>Reviews including controlled studies</b>						
Wallerstedt SM (2014), Medication reviews for nursing home residents to reduce mortality and hospitalization: systematic review and meta-analysis. (3)	Controlled studies 1990-2012, 12 studies of which 7 RCT. Meta-analysis	US, AU, UK, IE, IL, SE	Residents with drug treatment	Medication reviews by a multidisciplinary team (3 studies), pharmacists (3), physicians (1), geriatricians and geriatric nurses (1). Studies tested technical (1) or educational (1) support for reviews.	Outcomes: mortality, hospitalisation  No effect was found in the meta-analysis.	Included studies were underpowered, no effect of medication reviews on mortality and hospitalizations was found.
Loganathan M (2011), Interventions to optimise prescribing in care homes: systematic review. (5)	Controlled studies 1990-2010: 16 studies, of which 13 RCTs	UK, NO, US, AU, SE, CA	Residents >65years old	Any intervention to optimise inappropriate prescribing: <ul style="list-style-type: none"> <li>- Staff education (8 studies)</li> <li>- Pharmacist medication review (3)</li> <li>- Interdisciplinary meeting (3)</li> <li>- CDSS (2)</li> </ul>	Outcomes: appropriate prescribing  Staff education was effective in 6 of 8 studies with interactive elements. Interdisciplinary meeting and CDSS might be effective, however pharmacist medication review showed no effect.	Education including academic detailing seems to be most promising. Combinations of intervention strategies are likely to be required.





## Annexe au rapport final

<p>Verrue C (2009), Pharmacists' Interventions for Optimization of Medication Use in Nursing Homes. (6)</p>	<p>Controlled studies 1987-2008, 8 studies, of which 7 RCTs</p>	<p>SE, UK, AU</p>	<p>Residents ≥65years old with a range of diseases</p>	<p>Intervention provided by multidisciplinary team (3), intervention by pharmacist only (4), intervention by pharmacist and additional team conferences (1)</p> <ul style="list-style-type: none"> <li>- Case conferences or interdisciplinary meetings (3)</li> <li>- Medication review (2)</li> <li>- Care transition and case conference (1)</li> <li>- Education (1)</li> <li>- Whole clinical pharmacy programme (1)</li> </ul>	<p>Outcomes: drug use, appropriateness, number of drug changes, falls, hospitalisations, mortality. Knowledge of health care professionals.</p> <p>Mixed results were found. There is some evidence that pharmacists can improve drug use and knowledge of health care professionals. It is unclear if medication-appropriateness is affected. Clinical effects were only shown in two studies.</p>	<p>Pharmacists may play an important role in optimizing drug use. However, studies often lack suitable outcome measures.</p>
<p>Nishtala PS (2008), Psychotropic prescribing in long-term care facilities: impact of medication reviews and educational interventions. (9)</p>	<p>Controlled studies 1980-2007, 11 studies, of which 6 included in meta-analysis</p>	<p>UK, AU, SE, US, NO</p>	<p>Residents ≥65years old</p>	<p>Intervention involving a physician and/or a pharmacist:</p> <ul style="list-style-type: none"> <li>- Medication review plus education (4 studies, of which 2 were analyzed in the meta-analysis)</li> <li>- Education alone (e.g. academic detailing, providing articles, face-to-face meetings,7)</li> </ul>	<p>Outcomes: residents using at least 1 psychotropic (hypnotic or antipsychotic) drug. Cognition, depression, behaviour, falls.</p> <p>Hypnotic prescribing, but not antipsychotic prescribing, was lowered through the interventions. Evidence for clinical outcomes is lacking.</p>	<p>Hypnotic prescription may be reduced by medication review and/or education. Evidence on clinical outcomes is lacking.</p>



## Annexe au rapport final

Reviews including all types of studies						
Hoyle DJ (2018), Clinical and Economic Outcomes of Interventions to Reduce Anti-psychotic and Benzodiazepine Use Within Nursing Homes: A Systematic Review. (8)	Studies up to 2017, 14 publications of which 4 RCTs, of 12 studies	UK, US, CA, AU	Residents	Interventions to reduce antipsychotics, benzodiazepines: <ul style="list-style-type: none"> <li>- Educational intervention (e.g. meetings, material, educational outreach, audit and feedback, 8 studies)</li> <li>- Multicomponent intervention (e.g. antipsychotic review, social interaction, exercise, relaxation, 3)</li> <li>- Psychiatric support (1)</li> </ul>	Outcomes: medication use, clinical outcomes nursing staff and/or healthcare system.  7 studies reported significant reductions in medication use. Behavioural symptoms generally remained stable or improved marginally in 9 studies. 3 studies showed worsening of symptoms. Lower healthcare use was reported.	Reducing antipsychotic and benzodiazepine use is generally safe. However there is conflicting evidence showing that clinical outcomes may be worsened when drugs are stopped.  Combination of interventions seems reasonable.
Marasinghe KM (2015), Computerised clinical decision support systems to improve medication safety in long-term care homes: a systematic review. (1)	Studies up to 2014: 7 studies, of which 5 RCTs	Not stated	Older residents	Different (C)CDSS interventions were tested, e.g. alerts for renal injury, psychotropic medication, drug interactions, detection of ADRs.	Outcomes: proportion of appropriate prescriptions, injury risk (e.g. number of ADE, ADR), appropriate actions taken by the physician.  3 of 5 RCTs found positive results, although only small differences versus control groups.	CDSS is not widely studied in nursing homes. CDSS may have a positive impact, but evidence is still weak.



## Annexe au rapport final

Thompson Coon J (2014), Interventions to reduce inappropriate prescribing of antipsychotic medications in people with dementia resident in care homes: a systematic review. (2)	Studies up to 2012: 23 publications of 22 studies, of which 6 RCTs	US, UK, CA, AU, NO, SE	Dementia-affected residents	Different interventions to reduce inappropriate antipsychotic prescribing. 11 educational programs, 4 medication reviews, 5 multicomponent interventions. <ul style="list-style-type: none"><li>- Professional (education, audit and feedback)</li><li>- Organizational (e.g. multidisciplinary teams)</li><li>- Structural (changes in equipment, service delivery, presence of monitoring mechanisms)</li><li>- Regulatory</li></ul>	Outcomes: drug use  There is some evidence that education, in-reach services like a psychiatric team, and reviews lead to benefits in drug use. Long-term studies had conflicting results.	The more robust studies were, the more effective they were in lowering antipsychotic prescription rates. There are some interventions that are promising in reducing antipsychotic drug use, although long-term effects have not been sufficiently studied.
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## 5 Discussion

### 5.1 Part 1

To date, two studies have demonstrated that interventions can effectively optimize drug therapy in Swiss nursing homes. Both were uncontrolled studies, thus in summary the evidence for the studied interventions is weak. The approaches chosen were of multidisciplinary type, and both authors stated the importance of including nurses in the intervention. Furthermore, both groups performed medication reviews. While Blozik et al. limited the review to the use of PIM in residents' drug lists, the reviews used by Brulhart et al. was much more extensive, also reviewing e.g. interactions by a pharmacist (12;13). There is a lack of evidence for other interventions.

### 5.2 Part 2

As there is scarce evidence for Swiss nursing homes residents, international literature may inform decisions on how to optimize their medication. However, most of the studies summarized in the systematic reviews were performed in the US, Australia, Canada and Scandinavian countries. Some countries oblige their nursing homes to provide interdisciplinary care (11). Clinical pharmacy services that are used in many studies are more widely developed in those countries than in Switzerland (14). Applicability of these findings to Switzerland is therefore questionable.

Overall, the systematic reviews show that there are effective ways to optimize medication use in nursing homes. The interventions are very often multidisciplinary and this approach is also often stated as promising. (Clinical) pharmacists are often involved, as well as nurses, and it could be beneficial to involve the patients' own carers (3-7;10;11). Furthermore promising seem to be multimodal approaches, combining different single components, such as education, service delivery change (e.g., new process in prescribing) and medication review (5;7;10). This was also found by a systematic review not included in this overview, investigating behaviour change techniques in intervention studies (15). Hansen et al found that multimodal interventions using interventions in specific clusters (goals and planning; social support; shaping knowledge; natural consequences; comparison of behaviour; comparison of outcomes; regulation; antecedents; and identity) were most effective (15). A critical review of a patient's medication may be a promising approach, although good evidence is lacking (4;7;9).

No single intervention proved to be most effective in our overview, and also head-to-head studies comparing different interventions are lacking. Also lacking are systematic reviews on quality improvement collaboratives for optimizing medication use in nursing homes. A reason may be that altogether, only few intervention studies investigating the effect of quality improvement collaboratives on medication in nursing homes are published, or that existing evidence is not yet summarized in systematic reviews.

Process outcomes are frequently used to prove the effect of interventions. Number or appropriateness of drugs and DRPs can be lowered by interventions. Clinical outcomes (e.g., hospitalizations, mortality) are not



## Annexe au rapport final

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frequently evaluated and if evaluated, were not often significantly changed through the intervention (3;7;10). It is therefore not sufficiently known if and to what extent interventions could be beneficial for Swiss nursing home residents.

## 6 Conclusion

In summary, there is still insufficient evidence for interventions to reduce polypharmacy and PIM and/or to reduce their harmful outcomes in Swiss nursing homes. Data from international systematic reviews and meta-analysis could inform further initiatives in Switzerland. Multidisciplinary and multimodal approaches seem to be effective to change process measures such as rates of prescribed medications and appropriateness of therapy. However, no single intervention component or a defined intervention bundle can be recommended. Clinical effectiveness data is scarce.

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## Annexe au rapport final

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