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Application of the GheOP$^3$S-tool in nursing home residents: acceptance and implementation of pharmacist recommendations

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**ABSTRACT**

**Background and objective:** The prevalence of potentially inappropriate prescribing (PIP) among nursing home (NH) residents is high. This study aimed to investigate the acceptance and implementation of pharmacist recommendations based on a screening tool for PIP, the Ghent Older People’s Prescriptions community Pharmacy Screening (GheOP$^3$S)-tool.

**Setting and method:** Prospective observational study in NH residents ($\geq$ 70 years, using $\geq$ 5 medications) with a 3-month follow-up period. A pharmacist screened the medication lists using the GheOP$^3$S-tool and formulated recommendations to reduce PIP. The acceptance of recommendations discussed during face-to-face pharmacist-general practitioner (GP) meetings was recorded. Implementation was examined by comparing baseline and follow-up medication lists. A pre-post comparison of the number of chronic medications and GheOP$^3$S-criteria; the anticholinergic and sedative burden quantified by the Drug Burden Index (DBI); and medication costs was performed.

**Results:** Screening with the GheOP$^3$S-tool resulted in 168 pharmacist recommendations for 50 NH residents, mainly to stop (78.0%) and to substitute (14.3%) medications. Ninety-three % (156/168) of recommendations were considered relevant. GPs acceptance rate was 44.9%. Fifty-four % of all accepted recommendations were implemented. At follow-up, the number of chronic medications ($p = 0.007$), and DBI scores ($p = 0.004$) significantly differed from baseline. There was no significant decrease in the number of GheOP$^3$S-criteria ($p = 0.075$) and medication costs ($p > 0.05$).

**Conclusion:** The acceptance and implementation of pharmacist recommendations were relatively low. Future studies should increase the involvement of patients and all health-care providers. Interdisciplinary collaboration with sufficient education for all disciplines and patients is essential.

**Introduction**

The number of nursing home (NH) residents with multimorbidity and care dependency is rising in most countries [1]. Due to age-related pharmacological changes, multiple comorbidities and polypharmacy (frequently defined as taking $\geq$ 5 medications [2,3]), these older NH residents are more vulnerable to drug related problems (DRPs) [4]. Potentially inappropriate prescribing (PIP) is often referred to as suboptimal medication use and can be categorized into overprescribing (prescribing more medications than clinically indicated), misprescribing (incorrectly prescribing indicated medications) and underprescribing (not prescribing indicated medications) [5]. PIP has been associated with adverse drug events [6], hospitalizations [7] and mortality [8]. Morin et al. (2016) reported an estimated PIP prevalence of 49.0 % in European NHs [9]. A recent trial conducted in 54 Belgian NHs reported an even higher prevalence of over- or misprescribing (88.3%) and underprescribing (85.0%) [10]. Hence the quality of medication therapy is an important issue to be addressed in this setting. Community pharmacists can play an active role in reducing PIP by reviewing medication and formulating recommendations to general practitioners (GPs) in an interdisciplinary team [9,11].

Different tools to assess PIP have been developed and published over the recent years. The American Beers criteria [12], the European Screening Tool of Older People’s Prescriptions (STOPP) and the Screening Tool to Alert doctors to Right Treatment (START) [13] are commonly used, but cannot be fully applied in the community pharmacy setting in Belgium because of the need for clinical data. To tackle this barrier, the Ghent Older People’s Prescriptions community Pharmacy Screening (GheOP$^3$S)-tool, an explicit screening tool to detect PIP with high clinical relevance for older people in the community pharmacy setting, was recently developed [14] and validated [15]. This tool can be easily applied on medication dispensing data available in the community pharmacy. Since medication reviews are not systematically performed in Belgian community pharmacies (which
are predominantly responsible for the delivery of medications in NHs), this tool can facilitate the initiation of a medication review. The GheOP\textsuperscript{S}-tool consists of 5 lists regarding overuse, misuse, underuse, drug-drug interactions (DDIs) and pharmaceutical care-related criteria. For each criterion, an alternative treatment is proposed to support recommendations towards GPs. These recommendations can be discussed, ideally face-to-face [16,17], with the GP to confirm or to refute the clinical relevance for the patient.

A recent study demonstrated that for 97% of all included NH residents, screening with the GheOP\textsuperscript{S}-tool revealed at least one potentially relevant GheOP\textsuperscript{S}-criterion with a median (IQR) of 4 (2–6) GheOP\textsuperscript{S}-criteria per NH resident [18]. The most prevalent detected criteria involved the long-term use of psychotropics, anticholinergic medications and the underuse of osteoporosis prophylaxis [18]. Addressing these criteria in consultation with the patient’s GP to avoid DRPs is therefore important. However, a pharmacist-led medication review using the GheOP\textsuperscript{S}-tool followed by face-to-face pharmacist-GP meetings to discuss recommendations for NH residents, has not been studied yet.

**Aim of the study**

We performed a prospective observational study to evaluate the acceptance and implementation rate of a pharmacist’s recommendations resulting from a screening of NH residents’ medication lists with the GheOP\textsuperscript{S}-tool. Reasons for non-acceptance and non-implementation were investigated. In addition, a pre-post comparison of the number of chronic medications and GheOP\textsuperscript{S}-criteria; the anticholinergic and sedative burden quantified by the Drug Burden Index (DBI); and medication costs was performed.

**Ethics approval**

The ethical committee of Ghent University Hospital granted ethical approval.

**Methods**

**Design, setting and participants**

A prospective observational study was performed from March 2017 to August 2017 in one NH (136 beds) in Belgium. Most Belgian NHs are not illness specific and are populated with residents having a wide range of medical problems. Each Belgian NH must assign one coordinating physician who is, in team with the head nurse(s), responsible for the organization and coordination of the medical care in the NH. Each NH resident has his own GP who has diagnostic and therapeutic freedom. However, the GP is encouraged to follow the therapeutic policy of the NH. Medication delivery is usually performed by community pharmacies that are chosen by the NH.

The coordinating physician of this NH took the initiative for this study. All NH residents ≥ 70 years and taking ≥ 5 chronic medications were eligible for participation. Exclusion criteria were terminal illness and the NH resident’s GP not willing to participate. The head nurses of the NH invited eligible NH residents for participation. All NH residents or their legal representatives provided written informed consent.

**Intervention**

A medication review type 1 (a simple medication review based on the available medication history, according to Pharmaceutical Care Network Europe typology of medication reviews [19]) was performed by a pharmacist (KF) who received accredited training in medication review including communication skills, identification of DRPs, treatment guidelines and designing pharmaceutical care plans. Lists 1 to 4 of the GheOP\textsuperscript{S}-tool were used to screen the NH resident’s medication list. List 1 of the GheOP\textsuperscript{S}-tool contains potentially inappropriate medications, independent of diagnosis; list 2 contains potentially inappropriate medications, dependent of diagnosis; list 3 contains potential prescribing omissions; and list 4 contains DDIs of specific relevance for older people. The intervention consisted of 4 steps: (1) collection of the current medication list from the patient record in the NH for each resident; (2) screening of these lists using the GheOP\textsuperscript{S}-tool and formulation of recommendations for every detected GheOP\textsuperscript{S}-criterion; (3) face-to-face pharmacist-GP meetings to discuss the pharmacist recommendations, resulting in an agreed action plan for every resident; (4) a final meeting between the pharmacist, head nurses and coordinating physician to communicate these plans.

**Data collection**

**Intervention characteristics**

Age, gender, fall incidents (within 12 months before inclusion) and medication use for every NH resident were collected at baseline. Medication screening with the GheOP\textsuperscript{S}-tool resulted in a list of GheOP\textsuperscript{S}-criteria for each NH resident and the corresponding pharmacist recommendations. We were not able to screen for the GheOP\textsuperscript{S}-criterion ‘the patient has an elevated risk for osteoporosis and is not prescribed calcium/vitamin D supplementation’ at baseline, due to unavailability of residents’ body weight and length (necessary for osteoporotic risk calculation with the FRAX-tool [20]) at the moment of patient inclusion. During the pharmacist-GP meetings, the relevance of each recommendation for the individual patient was discussed and recorded. Subsequently, the GP’s acceptance of pharmacist recommendations was recorded and classified into 3 categories:
fully accepted, partially accepted (e.g. GP accepts dose tapering but no full stop; or recommendation accepted but GP proposed another medication; or GP accepts dose tapering but proposed different tapering scheme; or in case of a combined recommendation, only one recommendation was accepted (e.g. tapering of 2 benzodiazepines was recommended, but GP only wanted to taper one)) and not accepted. Reasons for not accepting pharmacist recommendations were also listed. Three months after the pharmacist-GP meetings, the actual implementation of pharmacist recommendations was assessed by comparing baseline and 3-month medication lists. This also resulted in 3 categories: fully implemented, partially implemented (e.g. GP accepted tapering to full stop, but medication was only tapered and not stopped; or in case of a combined recommendation, only one recommendation was implemented (e.g. tapering of 2 benzodiazepines was recommended, but GP tapered only one)) and not implemented. Reasons for not implementing pharmacist recommendations were collected retrospectively by the head nurses of the NH after the 3-month follow-up period. Acceptance and implementation rate were calculated as the ratio of the number of relevant pharmacist recommendations that were fully or partially accepted/implemented by the GP to the total number of relevant pharmacist recommendations.

**Potential impact of the intervention**

The potential impact of the intervention was explored by comparing the following measures (per NH resident) at baseline and at follow-up:

1. The number of chronic medications.
2. The number of GheOP^3S-criteria.
3. The DBI score of all oral chronic medications (defined as medications without a stop date). The DBI is a pharmacological risk assessment tool that can be used to quantify the burden of medications with anticholinergic and sedative properties in older adults [21]. It was used as a proxy for safe medication use in NH residents [22], as literature demonstrates its association with impaired cognitive and physical function, as well as an increased frequency of falls [23,24]. Scores were calculated using the formula $DBI = \sum D / (D + \delta)$, where $D$ is the daily dose of every anticholinergic or sedative medication used by the resident and $\delta$ is the minimum recommended daily dose as listed by the Belgian Commented Medications Repertory [25]. Medication was considered anticholinergic when present on Table 1 of the GheOP^3S-tool (based on Duran et al. [26]), or sedative based on ATC-code (N01A, N02A, N05, N06A, N07CA and R06).

- Medication costs per day (in euro) were calculated for both the NH resident (out-of-pocket medication cost) and the Belgian health-care insurance system (National Institute for Health and Disability Insurance, NIHDI) (third party reimbursement). Topical agents and as needed medications were excluded.

**Data analysis**

Statistical analysis was performed using SPSS® Statistics version 25. A Wilcoxon signed rank test was used to compare the medians of 2 discrete variables (number of chronic medications and number of GheOP^3S-criteria). A paired t-test was used to compare the means of 2 (paired) continuous variables (DBI scores and medication costs). A McNemar’s chi-square test was used to compare paired categorical variables (comparison of most prevalent GheOP^3S-criteria and NH residents with at least one GheOP^3S-criterion). Comparisons were made between data at baseline and at follow-up. A two-tailed $P$-value of < 0.05 was considered significant.

**Results**

**Sample characteristics**

Figure 1(a) shows the flow of participants through the study. Ninety-six NH residents were eligible for

### Table 1. Baseline characteristics of the study population (n = 50).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Baseline</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD)</td>
<td>85.7 (5.7)</td>
<td>85.6 (5.9)</td>
</tr>
<tr>
<td>Age ≥ 85 years, n (%)</td>
<td>31 (62.0)</td>
<td>30 (62.0)</td>
</tr>
<tr>
<td>Female gender, n (%)</td>
<td>39 (78.0)</td>
<td>38 (79.0)</td>
</tr>
<tr>
<td>Number of chronic medications, mean (SD)</td>
<td>9.3 (3.18)</td>
<td>9.3 (3.18)</td>
</tr>
<tr>
<td>Number of chronic medications, median (IQR)</td>
<td>9 (7–11)</td>
<td>9 (7–11)</td>
</tr>
<tr>
<td>NH residents with ≥ 10 medications, n (%)</td>
<td>20 (40.0)</td>
<td>20 (40.0)</td>
</tr>
<tr>
<td>NH residents with ≥ 1 fall within previous year, n (%)</td>
<td>18/36 (50.0)</td>
<td>18/36 (50.0)</td>
</tr>
<tr>
<td>Top 10 most frequently used chronic medications, n (%) of NH residents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anticoagulant and anti thrombotic agents (B01)</td>
<td>30 (60.0)</td>
<td></td>
</tr>
<tr>
<td>Diuretics (C03)</td>
<td>29 (58.0)</td>
<td></td>
</tr>
<tr>
<td>Drugs for constipation (A06)</td>
<td>29 (58.0)</td>
<td></td>
</tr>
<tr>
<td>Beta blocking agents (C07)</td>
<td>27 (54.0)</td>
<td></td>
</tr>
<tr>
<td>Drugs for acid related disorders (A02)</td>
<td>24 (48.0)</td>
<td></td>
</tr>
<tr>
<td>Analgesic drugs (N02)</td>
<td>23 (46.0)</td>
<td></td>
</tr>
<tr>
<td>Psychoanalactics (N06)</td>
<td>23 (46.0)</td>
<td></td>
</tr>
<tr>
<td>Vitamins (A11)</td>
<td>22 (44.0)</td>
<td></td>
</tr>
<tr>
<td>Mineral supplements (A12)</td>
<td>17 (34.0)</td>
<td></td>
</tr>
</tbody>
</table>

* Fall incidents were not available for all Nursing Home (NH) residents
b Classified according to the Anatomical and Therapeutic Classification (ATC) using the second level (therapeutic main group)
participation of which 52 (54.2%) were included and 50 completed the study. Baseline characteristics of NH residents are presented in Table 1. At baseline, the NH residents used a total of 465 chronic medications with a median (IQR) of 9 (7–11) per NH resident. Most frequently used medications were medications for the nervous system (ATC-code N, 84.0% of NH residents), alimentary tract and metabolism (ATC-code A, 84.0%) and cardiovascular system (ATC-code C, 76.0%).

**Intervention characteristics (Figure 1(b))**

**Pharmacist recommendations resulting from screening with the GheOP³S-tool**

At baseline, the pharmacist detected 168 GheOP³S-criteria in 50 residents, with a median (IQR) of 3 (2–5) per resident. In 90% (45/50) of all residents, at least one GheOP³S-criterion was detected. The most prevalent GheOP³S-criteria (n, % of NH residents) at baseline were the use of (1) intermediate acting benzodiazepines/Z-drugs at full dose or any dose ≥ 30 subsequent days (26, 52.0%), (2) antidepressants ≥ 1 year (19, 38.0%), (3) anticholinergic medication (e.g. antihistamines, antidepressants, antipsychotics and antispasmodics) with constipation (19, 38.0%), (4) combinations of anticholinergic medications (16, 32.0%), and (5) antipsychotics ≥ 1 month (12, 24.0%). The pharmacist formulated five types of recommendations towards the GPs (n, %): stop medication (131, 78.0%), substitute medication (24, 14.3%), therapy monitoring (e.g. monitor glycaemia) (10, 6.0%), optimisation of administration (e.g. separate intake of 2 interacting medications) (2, 1.2%), and start medication (1, 0.6%).

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**Figure 1.** Study flowchart.

GheOP³S: Ghent Older People’s Prescriptions community Pharmacy Screening; GP: General Practitioner
Relevance of pharmacist recommendations for the individual residents

During the pharmacist-GP meetings (with 18 GPs), the majority of pharmacist recommendations (92.9%, 156/168) were considered relevant for the NH residents. Examples of GheOP's-criteria considered irrelevant for a certain resident were: a DDI between an oral bisphosphonate and a polyvalent cation (calcium) when an appropriate timing interval was already applied, or when the GP reported that the medication had already been stopped.

Acceptance of pharmacist recommendations during pharmacist-GP meetings

Of those recommendations deemed relevant, 44.9% (70/156) were accepted by the GP. The recommendation of stopping medication was accepted in 46.8% (58/124) of cases and medication substitution was accepted in 20.8% (5/24) of cases. Reasons for not accepting recommendations are listed in Table 2.

Implementation of pharmacist recommendations at follow-up

Of the accepted recommendations, 54.3% (38/70) were implemented. It is noteworthy that 4 recommendations that were partially accepted by the GPs during the pharmacist-GP meetings, appeared to be fully implemented at follow-up (e.g. to stop anticholinergic medication(s) (n = 3) and to stop tramadol (n = 1)). Additionally, 4 of the not accepted recommendations (all concerning anticholinergic medications) were nonetheless implemented. This results in an implementation rate of 26.9% (42/156). Reasons for not implementing accepted pharmacist recommendations are listed in Table 2.

Potential impact of the intervention

The number of chronic medications and DBI scores per NH resident statistically differed between baseline and follow-up (Figure 2). However, the number of GheOP's-criteria and medication costs remained unchanged (Figure 2).

Sixteen of the 37 (43.2%) chronic medications stopped at follow-up were related to pharmacist recommendations (9 nervous system agents, 7 with various ATC-codes). For another 8 medications (21.6%, 8/37) (of which 5 nervous system agents) the dose was reduced.

The number of NH residents having at least 1 GheOP's-criterion did not statistically differ between baseline (90.0%, 45/50) and follow-up (82.0%, 41/50) (McNemar's test, p = 0.125). No significant difference in the number of most prevalent GheOP's-criteria was seen between baseline and follow-up.

Discussion

The present study on pharmacist-led medication reviews in the NH setting detected a high PIP prevalence, which is in line with previous studies [10,18,27]. Not surprisingly, the most commonly detected GheOP's-criteria concerned the long-term use of benzodiazepines, antidepressants, anticholinergics and antipsychotics. Consequently, most pharmacist recommendations considered stopping medication. This may be inherent to the design of the GheOP's-tool, as most of its criteria pertain to potential overuse of medication.

The face-to-face meetings with the GPs demonstrated that the vast majority of recommendations were considered relevant for the individual resident. Hence, it seems that the GheOP's-tool mainly detects problems that are actually relevant. Despite this, only 45% of the relevant recommendations were accepted by the GPs. Our acceptance rate is comparable to the study of King and Roberts [28] describing a pharmacist-led medication review performed in the NH setting (with an acceptance rate of 38%), but much lower than the study of Furniss et al. [29] with an acceptance rate of more than 90%. Medication reviews in which pharmacists not only use explicit criteria, but also clinical patient data could possibly lead to higher acceptance rates.

Table 2. Reasons for not accepting or not implementing pharmacist recommendations based on medication screening with the GheOP's-tool.

<table>
<thead>
<tr>
<th>Reasons for not accepting pharmacist recommendations (n = 86)</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP perceives medication as necessary or beneficial e.g. resident on antipsychotic medication with signs of psychosis</td>
<td>38 (44.2)</td>
</tr>
<tr>
<td>GP perceives the recommendation to be of inferior priority (but still relevant) during the pharmacist-GP meeting e.g. thiazide/loop diuretics with gout</td>
<td>19 (22.1)</td>
</tr>
<tr>
<td>Previous bad experiences with stopping</td>
<td>12 (14.0)</td>
</tr>
<tr>
<td>Lack of suitable alternative or unwillingness to try alternatives e.g. resident with severe pain in need of an opioid</td>
<td>9 (10.5)</td>
</tr>
<tr>
<td>The medication was initially started by another physician (e.g. a cardiologist) and the GP did not want to interfere</td>
<td>6 (7.0)</td>
</tr>
<tr>
<td>GP perceives that the resident will refuse the recommendation</td>
<td>2 (2.3)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reasons for not implementing accepted pharmacist recommendations (n = 32)</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident refused treatment modification</td>
<td>6 (18.8)</td>
</tr>
<tr>
<td>Treatment modification was postponed</td>
<td>5 (15.6)</td>
</tr>
<tr>
<td>GP changed his mind after the pharmacist-GP meeting</td>
<td>3 (9.4)</td>
</tr>
<tr>
<td>No reason provided to the head nurses</td>
<td>18 (56.3)</td>
</tr>
</tbody>
</table>

GheOP's: Ghent Older People's Prescriptions community Pharmacy Screening; GP: General Practitioner
However, comparison of the acceptance rate is hampered by the different study designs and settings. Most prevalent reasons for rejecting recommendations were the GP’s perception of the necessity or potential benefit of the resident’s medication and the GP perceiving the recommendation of inferior priority. This could be related to the known difficulties during deprescribing such as habit (preference for continuing with the status quo) or patients’ (or family/nurse) refusal to cease or taper medication and lack of support or time of the GP [32]. Furthermore, fear of negative consequences for both the patient (return of previous condition/withdrawal reactions), the prescriber (relationship with patient or other health-care providers (HCP), credibility, workload, and pressure from staff to continue prescribing potentially inappropriate medications) and other HCP (workload, extra safety concerns) have also been reported [33]. Nevertheless, the medications involved remain potentially inappropriate and their use needs to be re-evaluated regularly, as the GP’s perception may change over time.

It should be noted that the most common recommendations in this study were to stop long-term use of psychotropics. The study of Harrison et al. suggests an association between the use of anticholinergic and sedative medications and a lower quality of life in NH residents [34]. Consequently, deprescribing anticholinergics and sedatives is clinically relevant, but
challenging in daily practice [34,35]. Nevertheless, there is evidence that discontinuing chronic use of benzodiazepines/Z-drugs in NH residents is feasible without unfavourable effect on quality of life and with a positive effect on the self-perceived sleep quality [36]. In a recent JAMA viewpoint, Gurwitz and colleagues highlighted multifaceted approaches for reducing antipsychotics (engaging stakeholders; providing guidance, educational and training resources; and public reporting on the use of antipsychotics), that have shown positive results [37]. In addition, a quality improvement initiative for NH residents in Belgium has shown a decrease in the use of psychotropic medications [38]. This initiative included educational courses for all involved parties (i.e. NH staff, NH residents and their relatives), person-centred care, interdisciplinary meetings and focus on non-pharmacological interventions.

The implementation of recommendations was lower than expected. Only 54% of the accepted recommendations were implemented. Different studies suggest that including the patient and other HCP more in the deprescribing process could improve implementation. First, it should be explained to patients (and/or family members) and other HCP why the medication is potentially inappropriate [32,33]. Second, additional support and education for patients and HCP is needed [32,39]. This includes education about non-pharmacological options (e.g. in case of withdrawal symptoms or returning of the condition) and about the staged approach with careful monitoring that deprescribing should follow [39]. Third, this process should be supported by all HCP [32], and should therefore include team meetings to improve interdisciplinary communication [40]. A meta-analysis reported that implementation of pharmacist recommendations was associated with the number of collaborative elements between the GP and the pharmacist [16]. These collaborative elements included clinical pharmacy experience, pharmacist access to medical records, patient interview, referral by a GP, face-to-face meetings between the pharmacist and GP, an action plan and follow-up [16]. Fourth and last, extra follow-up moments (with reminders or extra interdisciplinary meetings) could also improve implementation [16,32]. We also observed a substantial gap between the number of eligible patients (n = 96) and the number of patients in which at least one recommendation was implemented (n = 20). This confirms the need for involvement and education of all disciplines (pharmacist, nurse, GP) and the patient (with his family or caregivers). Several strategies could improve patient participation. The patient’s own GP could perform the recruitment (based on the trust relationship) while providing short and comprehensive information e.g. on expectations, benefits and risks for the patient [41,42]. In addition, financial incentives could further support higher participation and implementation rates.

Despite the limited acceptance and implementation of pharmacist recommendations, this study suggests a potential impact of a pharmacist-led medication screening for NH residents. A limited benefit in terms of the number of chronic medications and medication safety (anticholinergic and sedative burden) was observed. Counterintuitively, the DBI scores were lower at follow-up, but the number of GheOP²S-criteria did not change. This can be explained by the fact that the GheOP²S-tool only detects the presence of a certain criterion or medication (independently of the medication dose) in the medication list. The DBI, on the other hand, also takes dose reductions or substitutions (by medications with lower anticholinergic and sedative burden) into account. These findings should be interpreted with caution, as our study design did not include a control group (as the main goal of the current study was to explore acceptance and implementation of pharmacist recommendations).

This study has some limitations. First, the small sample size (n = 50), the involvement of only one pharmacist and monocentric design limit the generalizability of our results. Second, our intervention included only one contact moment between the pharmacist and GP. This was done for feasibility reasons (to limit workload on GP’s daily schedules), however this may have hampered the acceptance and implementation of pharmacist recommendations. Third, NH residents were not directly involved in the medication review process. Nonetheless, the GPs estimated the NH resident’s willingness to change medication and discussed the intervention with the patient after the pharmacist-GP meeting. Fourth, lack of additional information (e.g. medication indications, medication effectiveness, exact duration of therapy, number of hospitalizations and adverse drug reactions) made it impossible to assess clinical relevance of the pharmacist recommendations or medication appropriateness.

Future studies should determine the impact of interdisciplinary medication reviews with the GheOP²S-tool on patient’s health outcomes such as quality of life, falls, hospitalizations and mortality as well as overall costs (e.g. medication, hospitalization, use of health-care resources) [9,43,44]. Patient interviews should be included to support shared decision making and communication between all parties should be reinforced. This should ideally be done in a larger sampled multicentre randomized controlled trial, on multiple domains (e.g. with education and support for HCP, psychosocial interventions [45]) and with longer follow-up periods.
Conclusion

This study explored the acceptance and implementation of pharmacist recommendations resulting from medication screening with the GheOP3S-tool in the NH setting. Despite the relatively low acceptance and implementation rate, this study suggests a potential impact of a pharmacist-led medication screening with the GheOP3S-tool on the number of medications and safe medication use (quantified by the DBI). Future studies should focus on the impact on clinical outcomes and on strategies to improve the implementation of pharmacist recommendations.

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Compliance with Ethical Standards

Informed consent was obtained from all individual participants included in the study.

Disclosure statement

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