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Enhanced medication counselling for polypharmacy in a tele-pharmaceutical setting

Abstract

Introduction: Polypharmacy carries a high risk of medication-related problems (MRPs). This study is the first to evaluate the implementation of the new pharmaceutical service (pDL), focusing on the setting of an online pharmacy.

Methods: A retrospective analysis of 152 patients (median age 75 years, 11 medicines, prescription and over-the-counter). Counselling was provided via tele-pharmacy (video/telephone) by qualified pharmacists in the patients' home environment, using a digital medication record.

Results: A total of 363 adverse drug interactions (ADIs) were detected (mean 2.38 per patient). The most common issues concerned potential interactions (96.1%) and adverse effects (56.6%), followed by dosing anomalies (26.3%) and adherence problems (21.1%). The recruitment rate was 44.2%, demonstrating the high level of acceptance of the digital consultation model.

Discussion: Telepharmaceutical medication reviews are highly feasible and effective within standard clinical practice. They offer low-threshold, high-quality access to AMTS optimisation, particularly for immobile patients with a high medication burden.

Keywords

Medication safety, medication-related problems, medication management; polypharmacy, telepharmacy, pharmaceutical services, drug interactions, online pharmacy

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The HARM study (2011) demonstrated for the first time in Europe the significant link between medication errors and avoidable hospital admissions (1, 2). Since then, the focus has been on medication safety (AMTS). Key obstacles here are medication-related problems (MRPs) – events that jeopardise treatment goals (e.g. interactions, dosing errors, adverse effects) (3). The prevalence of ABPs rises sharply among older, multimorbid patients on polypharmacy (4–6). Polypharmacy is usually defined as the long-term use of five or more medicines (7). In Germany, this affects approximately 25 per cent of adults and around 55 per cent of those over 70 (8). In addition to multimorbidity, causes often include a lack of interprofessional communication or prescribing cascades (7). The consequences are serious:

• Increased risk of adverse effects and clinically relevant interactions (6)

• Association with falls, cognitive impairment and increased mortality (8–10)

• Reduced adherence due to complex treatment regimens (11). Structured medication reviews identify ABP at an early stage and optimise treatment safety (12). Since June 2022, 'Extended medication counselling for polypharmacy' has been a reimbursable pharmaceutical service in Germany (13). It is based on a Type 2a medication review (14) and can reduce ADEs by up to 70 per cent (15). The aim is to improve adherence and health literacy, particularly in cases of high medication burden (11, 16).

Telepharmacy: new care models

>> Telepharmacy approaches enable location-independent care via video or telephone consultations (7, 17, 18). Advantages include the ability to monitor medication directly in the familiar and stress-free home environment (including refrigerated medicines) and to address gaps in care (19). Systematic reviews show that telepharmacy can significantly reduce ABP and increase adherence by 10–35 % (12, 20, 21).

To the authors' knowledge, this study is the first systematic evaluation of the standard pharmaceutical service 'medication review for patients on multiple medications' in Germany. The primary objectives were to evaluate an online pharmacy with regard to: 1. patient acceptance of the service; 2. feasibility within a telepharmacy setting; 3. structured recording and analysis of the frequency of ADEs.

In cases of high medication burden (>10 active ingredients), the telepharmacy approach facilitates the structured identification of interactions and inappropriate medication without the need for a physical visit to the pharmacy – thereby closing gaps in AMTS provision (19). In future, claims data from the Health Research Data Centre (FDZ) will be used to analyse AMTS risks such as prescription cascades or gender-specific differences in polypharmacy (22).

Methodology

Study design and patient cohort This retrospective study investigated the implementation of the pharmaceutical service (pDL) 'Extended medication counselling for polypharmacy' at the online pharmacy DocMorris N.V. The study included N = 152 adult patients who utilised the pDL between 1 July 2023 and 31 December 2024.

Inclusion criteria

• Age ≥ 18 years

• Polypharmacy (regular use of ≥ 5 systemically active medicines for > 28 days)

• Recruitment focus: patients aged ≥ 75 years taking ≥ 10 medicines (in accordance with the guidelines of the KNMP and NHG (23)).

Recruitment was primarily carried out by pharmacists on the basis of prescription data, and in isolated cases through patients' own initiative.

Qualifications and procedure

The service was provided by registered pharmacists who had successfully completed further training in accordance with the BAK curriculum (24), in line with the requirements of Section 129 of the German Social Code, Book V (SGB V) (25).

The consultation was conducted via telemedicine (telephone or video) in the patient's home environment. The process was struc-

tured in accordance with BAK guidelines (26) as follows: 1. Preparation: providing information by telephone, obtaining written consent and instructing patients to have all medicines (including refrigerated items) and documents ready

2. Data collection: standardised medical history (BAK guidance documents (27)) covering socio-demographic data, clinical parameters (e.g. blood pressure, BMI), medication history (including self-medication), adherence and expectations.

Pharmaceutical AMTS assessment

The medication analysis was carried out using software and in accordance with guidelines regarding medication-related problems (MRPs) as defined by the BAK (13). The analysis covered, amongst other things:

- Duplicate medicationand interactions
- Administration errors, adverse effects and storage issues
- Dosage anomalies and the suitability of self-medication.

The study primarily included patients with a high medication burden. A large proportion of the participants were taking more than ten different medicines, which resulted in a correspondingly high level of complexity in the medication analyses. Nevertheless, the approach used enabled a structured and reliable analysis even in cases of extensive and complex medication regimens.

Intervention and conclusion

The results were summarised in a written counselling report (patient letter), which contained individual recommendations and risk assessments. During a final consultation, the interventions were explained and an updated medication plan was provided.

The study setting enabled a high standard of medical history-taking , as patients had direct access to their home medicine supplies, allowing for direct verification of expiry dates and storage conditions. In addition, the medication history from the online pharmacy (complete medication records in accordance with Dutch standards) was cross-referenced with submitted laboratory results and doctors' reports.

Key features of the tele-pharmacy model

DocMorris N.V., based in the Netherlands, supplies patients in Germany with prescription-only medicines and over-the-counter products upon presentation of a valid prescription. All products purchased from the online pharmacy are recorded in a medication record.

Data analysis and ethics

The analysis was carried out anonymously in compliance with the GDPR and ethical standards. In addition to socio-demographic data and ABP, recommendations for lifestyle changes were also recorded. The statistical analysis was carried out descriptively (frequencies, medians, percentages) using Microsoft® Excel 2019.
Results

Recruitment and participation

During the study period, 344 patients were identified for the pharmaceutical service (pDL). Of these, five participants (1.5%) initiated the consultation independently. In total, 152 patients (44.2%) completed the full process from the initial consultation through to the final discussion, including receipt of the counselling letter (Fig. 1).

This means that almost half of the invited patients (44.2%) took part in the pDL. The recruitment rate is a key indicator of the practical feasibility and acceptance of the pDL within standard care.

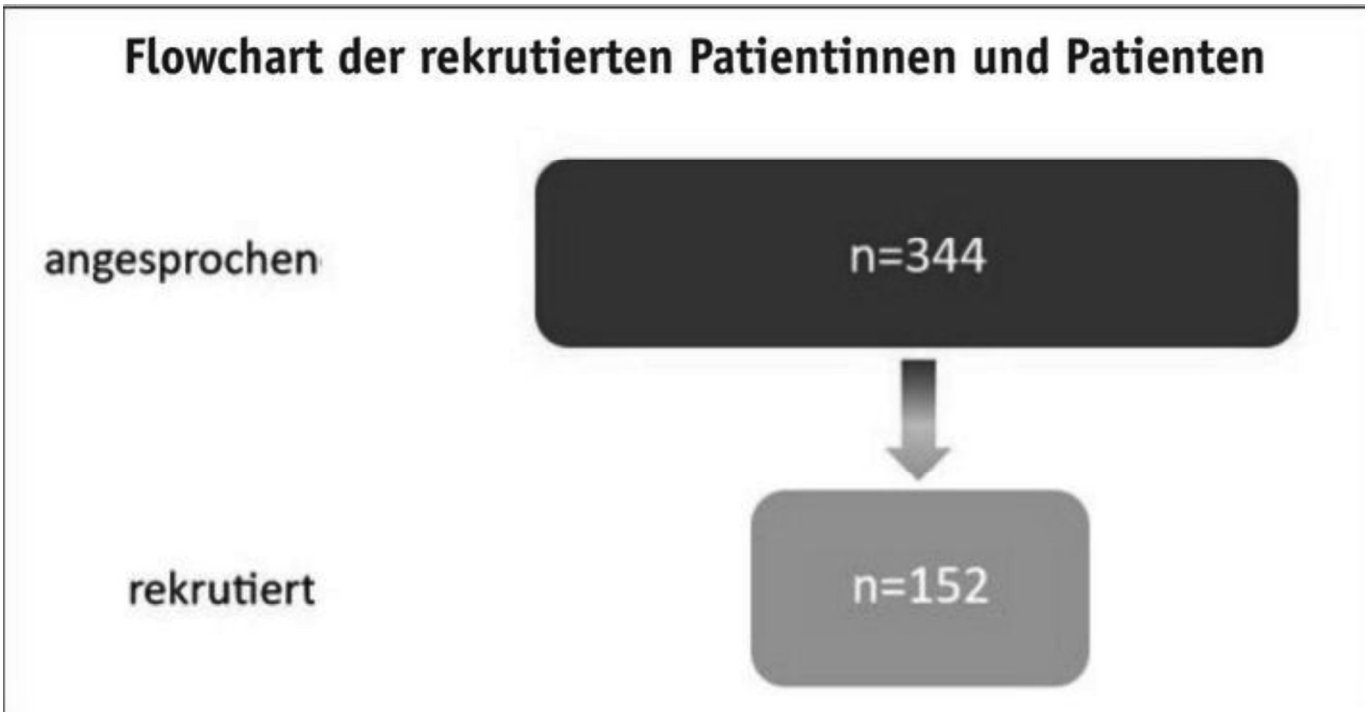


Fig. 1: Flowchart of the recruited patients.

Soziodemografische Daten und Arzneimittelgebrauch nach Alterskohorten							
	Alterskohorte n (Altersmedian gesamt 75)						
Teilnehmende/Geschlecht (n, %)	**30–39**	**40–49**	**50–59**	**60–69**	**70–79**	**80–89**	**90–98**
Gesamt (N=152)	1	4	6	31	62	45	3
Männlich (n=98, 65%)	1	3	3	21	39	28	3
Weiblich (n=54, 35%)	0	1	3	10	23	17	0
Median Arzneimittel Rx (Spanne)							
Median allgemein	5	10 (8-15)	8 (5-12)	9 (5-18)	11 (6-22)	11 (6-17)	11 (9-11)
Median männlich	5	8 (8-12)	7 (5-8)	10 (5-18)	9 (5-22)	11 (6-17)	11 (9-11)
Median weiblich	0	15	9 (8-12)	8 (5-16)	12 (8-17)	10 (6-13)	0
Median OTC-Präparate (Spanne)							
Median allgemein	2	1 (0-2)	2 (1-7)	1 (0-7)	1 (0-9)	1 (0-7)	2 (0-2)
Median männlich	2	1 (0-2)	1 (1-2)	1 (0-7)	1 (0-9)	1 (0-6)	2 (0-2)
Median weiblich	0	1	4 (2-7)	2 (0-4)	1 (0-6)	1 (0-7)	0

Table 1: Sociodemographic data and medication use by age cohort, with n = 142 (92.1%) statutory health insurance (GKV) and n = 12 (7.9%) private health insurance (PKV) policyholders.

Sociodemographics and medication profile

The patient cohort (92.1% covered by statutory health insurance) had a median age of 75 years (range: 30–98 years). Males were over-represented, accounting for 65% (n = 98) of the cohort (Table 1).

The medication burden correlated positively with age: Whilst the median number of prescription medicines (Rx) among those aged 30–39 was 5, this rose to 11 Rx medicines (range 5–22) in the group aged ≥ 70 years. Among women in the 50–59 age cohort, the use of over-the-counter (OTC) medicines peaked at a median of 4 preparations, whilst the OTC median across all other groups was 1.

When asked about their primary expectation of the pDL, 91.3% (n = 139) of participants cited the checking of side effects and drug interactions.

Detected medication-related problems (MRPs)

A total of 363 ABPs were identified, corresponding to an average of 2.38 ABPs per patient. Figure 2 illustrates the distribution of the subcategories.

For OTC products, the median was one product in almost all age groups, with a range of between 0 and 9 products. A notable finding was an increased median of 4 OTC products among women aged 50–59.

91.3% (n = 139) of patients stated that they expected and wished the pDL to review side effects and interactions. 11 participants had no specific expectations.

- **Most common ABPs:** potential interactions (96.1%) and side effects (56.6%)
- **Clinically relevant ABPs:** dosing anomalies (26.3%), adherence problems (21.1%), incorrect storage (20.4%) and incorrect timing of administration (19.7%)
- **Knowledge gaps:** 15.8% of participants were unaware of the reason for taking at least one medication.
- **Not observed:** Unsuitable or inappropriate dosage forms, indications unsuitable for self-medication, contraindications for self-medication, self-medication products unsuitable for the indication, and over- or under-dosing in self-medication did not occur in the study population.



Fig. 2: Medication-related problems (MRPs) detected in N = 152 patients.

The case study presented below illustrates the data collection carried out during the structured patient consultation, the results of the analysis, and the recommendations provided by DocMorris Pharmacy. It also highlights which MRPs were identified in this case and thus recorded in terms of the frequency of various detected MRPs (Fig. 2), namely 'interactions' and 'adverse effects'. These reflect the MRPs most frequently detected in the overall cohort, as explained above. Furthermore, due to interactions, the patient was advised against self-medication with the products in use and was given guidance on storage and lifestyle.

Case study

Patient with multiple comorbidities (73 years old, male, BMI: 30, blood pressure: 130/65 mmHg, non-smoker)

The following example illustrates the relevance of pDL in cases of complex polypharmacy, as shown in Table 2 (including treatment for hypertension, atrial fibrillation and glaucoma).

Identified risks and interventions:

1. Serious interaction between a ginkgo supplement and Lixiana® (edoxaban) Taking Lixiana® (edoxaban) and ginkgo capsules at the same time increases the risk of bleeding. It was recommended that ginkgo preparations be discontinued.

2. Serious interaction between Doppelherz Magnesium+Potassium 400 and ramipril

The combination of potassium-containing supplements and ACE inhibitors can cause hyperkalaemia within a few days. Typical symptoms include paraesthesia, muscle weakness, bradycardia and ECG changes; severe cases are life-threatening. The treating doctor was not aware that the patient was taking the potassium supplement. The patient was advised to take mineral supplements only after consulting a doctor and to avoid low-sodium table salt.

3. Side effect: sleep disturbances – possible medicinal causes:

Existing sleep disturbances were identified as a possible side effect of the medication (Simbrinza®, Ramipril, Monoprost®, Lercanidipine). The patient was advised to discuss this with their doctor.

4. Optimisation

Correction of storage conditions for eye drops (change from fridge to room temperature to improve ease of use). Furthermore, storage in the fridge carries the risk of the product being accidentally stored below freezing point.

This case study demonstrates how a structured medication review improves medication safety in patients with multiple comorbidities. The identification of potentially critical interactions and the consideration of individual symptoms enable targeted optimisation of treatment – including, and particularly, within the context of telepharmaceutical care provided by the online pharmacy DocMorris N.V.

Ergebnisse der Medikationsanalyse aus der ABP-relevanten Medikation

Wirkstoff / Präparat	Indikation	Dosierung	AMTS-relevante Hinweise
Ramipril 10 mg Tabletten	Arterielle Hypertonie	Jeweils ½ Tablette morgens und abends	Risiko für Hyperkaliämie; regelmäßige Kontrolle von Nierenfunktion und Elektrolyten empfohlen
Lercanidipin 10 mg Filmtabletten	Arterielle Hypertonie	1 Tablette morgens, 15 Min. vor dem Essen	mögliche Nebenwirkung: Müdigkeit, Verzicht auf Grapefruits oder grapefruitartige Früchte
Lixiana® (Edoxaban) 60 mg Filmtabletten	Antikoagulation bei Vorhofflimmern	1 Tablette mittags	Erhöhtes Blutungsrisiko bei gleichzeitiger Einnahme von Ginkgo, Johanniskraut, Ingwer etc.
Pantoprazol 20 mg Tabletten	Magenschutz	1 Tablette morgens	Langzeitanwendung kritisch, Supplementierung mit Vitamin B-12 empfohlen
Simbrinza® (Brinzolamid/ Brimonidin) Augentropfen	Erhöhter Augeninnendruck	2x täglich je 1 Tropfen/Auge	Lagerung bei Raumtemperatur; mögliche systemische Nebenwirkungen (z. B. Müdigkeit)
Monoprost® (Latanoprost) Augentropfen	Erhöhter Augeninnendruck	zur Nacht 1 Tropfen/ Auge	Lagerung bei Raumtemperatur
Ginkgo 70 Kapseln (Selbstmedikation)	Nahrungsergänzung	1 Kapsel morgens	Wechselwirkung mit Lixiana® (Edoxaban) > erhöhtes Blutungsrisiko
Doppelherz Magnesium + Kalium 400 (Selbstmedikation)	Mineralstoffpräparat	1 Tablette täglich	Kaliumretention bei gleichzeitiger Einnahme mit Ramipril möglich

Table 2: Overview of ABP-relevant medication with AMTS-relevant notes.

Discussion

Key findings

This study shows that extended medication counselling for patients on multiple medications can be successfully implemented as part of routine care via telepharmacy within the setting of an online pharmacy. The participation rate of 44.2% indicates that a significant proportion of the patients approached are willing to undergo a structured medication review via telephone or video consultation. The participants' health insurance coverage broadly reflects the reality of approximately 90 per cent of patients insured under the statutory health insurance scheme (GKV) in Germany (28). The average number of 2.38 active pharmaceutical ingredients (APIs) per patient identified in this study falls within the lower to middle range of values reported in the literature. Various studies on structured medication reviews of patients with polypharmacy have found between 1.6 and 8.5 ABPs per patient (29, 30). This comparability suggests that tele-pharmacy settings are also capable of achieving a similarly high identification rate of ABPs as medication reviews carried out in community pharmacies or hospitals (31).

The observed distribution of the detected ADRs, with a focus on potential interactions and adverse effects, is consistent with the findings of international studies on structured medication reviews in patients with polypharmacy. In randomised trials, type 2a medication reviews were found to reduce health problems by up to approximately 70%, whilst also improving health literacy. Against this background, the interactions, dosing issues, storage errors and adherence issues identified in this study appear consistent with the literature and confirm the relevance of this pharmaceutical service in improving medication safety (31).

The importance of telepharmacy

Telepharmacy counselling offers several advantages over traditional face-to-face counselling. On the one hand, it enables immediate access to all medicines in the home environment, which improves the completeness of the assessment and reduces misinformation (32). Secondly, it provides patients with limited mobility or those living in rural areas with low-threshold access to pharmaceutical expertise. This highlights the high relevance of this form of care in the context of demographic change and the rise in chronic conditions. Studies show that tele-pharmacy services improve access to pharmaceutical advice, support adherence and are predominantly rated positively by patients (19, 32). In this study, the home setting was utilised to incorporate medication – including medicines requiring refrigeration – directly into the consultation, which facilitated the checking of expiry dates and the identification of any storage issues.

Health policy context

The results should also be viewed within the health policy context of pharmaceutical services that have been eligible for reimbursement in Germany since 2022. Since June 2022, structured medication analyses for patients on polypharmacy have been reimbursed for both statutory (GKV) and private (PKV) health insurance holders and are established as a Type 2a medication review, as defined by the PCNE, within standard care (33, 34). The present study supplements the implementation research, which has so far focused almost exclusively on community pharmacies, by including an online pharmacy setting, and demonstrates that the statutory and contractual requirements – including qualification in accordance with the BAK curriculum – can also be met through telepharmacy. The study thus provides practical evidence that online pharmacies can make a significant contribution to the nationwide implementation of this form of care. It is therefore incomprehensible that this telepharmaceutical pDL has not yet been reimbursed.

Case study and clinical relevance The case study presented, involving a patient with multiple comorbidities, illustrates

that, as part of a telepharmaceutical medication review, clinically relevant interactions (e.g. ginkgo in combination with edoxaban, which carries an increased risk of bleeding) and potentially dangerous interactions (e.g. the risk of hyperkalaemia when ramipril is taken concurrently with potassium-containing dietary supplements) can be identified. Similar adverse drug interactions are described in guidelines on polypharmacy and in pharmacoepidemiological studies as relevant causes of preventable drug-related complications. The case study also illustrates that telepharmacy counselling is not limited to checking for interactions, but also encompasses lifestyle recommendations, promoting adherence and practical advice on safe use and storage. This is also highlighted in review articles on telepharmacy as a core component of patient-centred pharmaceutical care (32, 35).

Limitations of the study

Despite the positive results, the present study has several methodological limitations. Firstly, it is a retrospective analysis of routine data from a single online pharmacy setting. Patients who agree to participate in a structured medication review often demonstrate higher health literacy or a greater interest in their health than non-participants. This is known from studies on the implementation of medication reviews and polypharmacy programmes and therefore limits the generalisability of the results (33).

Secondly, this study did not collect any hard clinical endpoints such as hospitalisations, A&E visits, morbidity or mortality. Although many randomised trials on medication reviews have demonstrated a reduction in medication-related problems and, in some cases, improvements in surrogate endpoints (e.g. adherence, number of active substances, health literacy), the evidence for a sustained reduction in serious clinical events remains heterogeneous. This study therefore primarily allows conclusions to be drawn regarding feasibility, acceptance and process quality, but not regarding effectiveness in terms of patient-relevant outcomes (31).

Thirdly, the identification and classification of medication-related problems is based on the assessment of the pharmacists carrying out the procedure using standardised BAK tools and pharmaceutical software, meaning that individual variation in assessment cannot be ruled out. The literature repeatedly points out that the identification of medication-related problems can vary depending on training, experience and the classification system used. For future studies, it would be advisable to supplement the findings with second assessments or interdisciplinary panels (36).

Fourthly, the sample size of 152 patients is limited, and the age distribution is significantly skewed towards older individuals with a high medication burden, whilst younger patient groups are under-represented. Although this reflects the target population of typical polypharmacy programmes, it limits the generalisability of the findings to other age groups or to patients with a lower medication burden. Furthermore, the regulatory environment of the online pharmacy under investigation (a German-Dutch context with statutory requirements regarding medication records) is specific, meaning that the results cannot be readily generalised to other countries or healthcare systems (31, 37).

Furthermore, data collection took place at an early stage following the introduction of the new pharmaceutical services in Germany. Studies on implementation show that, in the initial phase of new care models, learning curve effects and adjustments to workflows may occur. These can influence both the quality of the implemented services and the documented outcomes. It is therefore possible that the effectiveness and efficiency of telepharmaceutical medication counselling may continue to improve or change (38).

Outlook and Conclusion

In light of these limitations, it seems sensible to conduct future studies using a prospective, ideally randomised design, in order to investigate the effects of tele-pharmaceutical medication reviews on clinical endpoints, patient satisfaction and health economic parameters. Multicentre approaches involving both high-street pharmacies and online pharmacies could help to compare different care models and identify success factors for sustainable implementation. Furthermore, systematically recording the implementation of pharmaceutical recommendations by doctors, as well as their impact on patients' actual medication and health status, would be an important step towards comprehensively assessing the contribution of tele-pharmaceutical services to medication safety (39–42). <<

Abbreviations

ABDA: Federal Union of German Pharmacists' Associations ACE inhibitors: angiotensin-converting enzyme inhibitors AMTS: medication safety

ABP: Medication-related problem

BAK: Federal Chamber of Pharmacists

BMI: Body Mass Index

DAV: German Pharmacists' Association (e. V.) GDPR: General Data Protection Regulation

DTS: Drug Therapy Safety

FDZ: Research Data Centre

GKV: Statutory Health Insurance

IA: Interaction

CI: Contraindication

KNMP: Koninklijke Nederlandse Maatschappij ter bevordering der Pharmacie (Dutch Association for the Promotion of Pharmacy) NHG: Het Nederlands Huisartsen Genootschap (Dutch Association of General Practitioners) N.V.: Naamloze Vennootschap (public limited company) OTC: Over-the-counter products pDL: pharmaceutical service

PKV: Private health insurance

PIM: Potentially Inappropriate Medication

RR: blood pressure [mmHg]

Rx: prescription-only medicines

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Author's declaration

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Extended medication counselling for polypharmacy in a telepharmacy setting

Introduction: Drug therapy safety (DTS) in multimorbid patients with polypharmacy presents a key challenge in healthcare. The aim of this study was to evaluate the implementation and effectiveness of the pharmaceutical service 'Enhanced Medication Counselling for Polypharmacy' within an online pharmacy and to determine the detection rate of drug-related problems (DRPs) in a telepharmacy setting.

Methods: In a retrospective analysis, N=152 patients (median age: 75 years; 11 medications, prescription and over-the-counter) were studied who underwent a structured medication review at the online pharmacy DocMorris N.V. between July 2023 and December 2024. Counselling was provided via telepharmacy in the patients' home environment in accordance with BAK (Federal Chamber of German Pharmacists) guidelines. Data collected included a full medication history (prescription and over-the-counter), clinical parameters and individual patient needs.

Results: A total of 363 DRPs were identified (an average of 2.38 per patient). The most common issues involved potential interactions (96.1 per cent) and adverse effects (56.6 per cent), followed by dosage anomalies (26.3 per cent) and lack of adherence (21.1 per cent). A case study was used to illustrate two severe interactions detected between medicinal products and dietary supplements. The recruitment rate was 44.2 per cent, demonstrating a high level of acceptance of telepharmaceutical care.

Discussion: The results demonstrate that structured medication reviews in a telepharmaceutical setting are an effective means of identifying DTS risks. Direct access to patients' home medication stocks and cross-referencing with digital medication records enable targeted pharmaceutical care. Furthermore, the high participation rate among elderly patients demonstrates that digital care is a valuable, location-independent supplement to standard care for the early identification of critical interactions and side effects in complex polypharmacy.

Keywords

Drug Therapy Safety, Drug-related problems, Medication Management, Polypharmacy, Telepharmacy Pharmaceutical Services, Drug Interactions, Online Pharmacy

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