BMC Health Services Research

RESEARCH

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Patterns of outpatient proton–pump inhibitors use among older adults in a duplicative health system: comparing public and private prescribing

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Abstract

Background Proton-pump-inhibitors (PPIs) are overprescribed, posing challenges to patients and healthcare systems. In Portugal, the public National Health Service (NHS) provides universal coverage and reimburses medication regardless of prescription origin, i.e., public or private. This study aimed to compare PPIs outpatient prescription patterns and costs among older adults in the private and public sectors.

Methods A nationwide retrospective ecological study was conducted on PPIs prescribed for older adults in Portugal from 2020–2022. Data on defined daily doses (DDDs) and prices were obtained from a national public database by healthcare sector, sex, and age group (65–74, ≥ 75 years). The market share of DDD per 1000 older adults per day and the mean price per DDD (€/DDD) for all PPIs substances were compared between the public and private sectors.

Results PPIs-DDDs accounted for 5.3% of all outpatient DDDs prescribed in the private sector and 5.9% in the public sector. The private sector prescribed PPIs at a 20% higher price (0.126 €/DDD) than the public (0.106 €/DDD), with greater differences among the most expensive substances (rabeprazole, lansoprazole and esomeprazole). Omeprazole (cheapest) was mostly prescribed in the public sector. In the private sector, a similar pattern was observed among those aged ≥ 75 years, whereas esomeprazole was most prescribed for those aged 65–74 years.

Conclusions Given the widespread prescription of PPIs and the associated cost, it is crucial to reinforce incentives to promote rational PPIs prescription and encourage deprescription when necessary, in both sectors. Since the NHS also reimburses medications prescribed in private units, implementing monitoring measures and financial incentives to promote responsible prescribing in this sector should also be considered.

Keywords Proton-pump inhibitors, Patterns, Overprescribing, Rational prescribing, Public, Private

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Background

Older people constitute the fastest growing population group in Europe [1]. In the coming decades, the number of older people is expected to grow, leading to increased medication use, which in turn raises the risk of adverse drug events (ADEs), drug-related hospitalizations, and higher health expenditures [1–3]. Potentially inappropriate prescribing, as one of the main risk factors for ADEs in older adults, represents a threat not only for patients but also a source of inefficiency for health systems [4, 5]. Compared to males and younger individuals, females and older individuals appear to have a greater likelihood of exposure to potentially inappropriate prescribing, thereby contributing to healthcare inequalities [6–8].

Proton-pump inhibitors (PPIs), acid-suppression medicines, are among the leading contributors to potentially inappropriate prescribing among older people [9–11]. Several recommendations and clinical guidelines have been issued to support quality prescription, dose reduction or deprescribing of PPIs [12, 13]. However, evidence suggests overprescribing and long-term use, imposing an economic burden on patients and healthcare systems, which are struggling with limited budgets and multiple demands [14–16]. In Portugal, in 2021, retail pharmaceutical expenditure—which includes wholesale and retail margins, and value-added tax from outpatient prescription and nonprescription medicines—accounted for 14.5% of total health spending [17]. In the same year, direct out-of-pocket payments by households for retail pharmaceuticals accounted for about 45% of the total health expenditure, a value higher than the Organization for Economic Co-operation and Development (OECD), average of 39% [18].

The Portuguese healthcare system is structured mainly in two sectors [19]. The first is the public sector, a nationwide tax-based National Health Service (NHS) sector offering universal coverage and accounting for approximately two-thirds of total health expenditures. The second is a private sector, mostly funded through voluntary private health insurances and out-of-pocket payments, that overlays the NHS and is responsible for the remaining one-third of total health expenditures [19–22].

Over the last decade, the private healthcare sector has grown substantially in both health professionals and equipment, predominantly serving populations that can afford to pay [23, 24]. By 2021, 32% of the Portuguese population held supplementary voluntary private health insurance [18]. Individuals utilizing the private sector pay unregulated prices, which gives them greater freedom of choice and easier access to medical assistance, including shorter waiting times for consultations, exams and surgeries (via duplicate insurance) [19, 20]. Notably, the NHS employs an internal reference price system and reimburses prescribed medicines through a cost-sharing mechanism with patients, regardless of whether the prescription is issued in the public or private sector.

On the one hand, medical doctors in the private sector—mostly hospital specialists—benefitting from better working conditions, may be in a more favourable position to optimize their prescribing practices, as long patient lists and time constraints are frequently reported barriers to medication review by those working in the public sector [25–27]. On the other hand, public primary care doctors—general practitioners and family doctors, who are the main prescribers in the NHS [28, 29]—are subject to performance measures covering various dimensions and indicators summarized into a "Team Performance Indicator", with incentives that do not apply in the private sector. The average prescription expenditure and the medication dispensing cost per patient are two indicators within a broad list [30]. These evaluations may impact the number and cost of prescribed medicines, while the private sector, out of this framing and expectably treating a population with a higher willingness to pay, may tend to prescribe more and more expensive medicines [20].

Comparative studies and national guidelines for acid suppression therapy suggest that there is no clinical evidence of superiority among the various available PPIs substances in equivalent doses on the market [31–33]. Thus, in addition to a desirable reduction in PPIs prescription, a measure of efficiency is the preferential prescription of the substance with the lowest cost per defined daily dose (DDD) [33, 34]. Therefore, we aimed to compare outpatient prescription patterns and costs of PPIs among older adults in the private and public healthcare sectors from 2020 to 2022, overall, by sex and age group.

Methods

Study design, population, and data collection

This was a retrospective, drug-prescription ecological study. Data on outpatient PPIs prescriptions to people aged 65 years or older in mainland Portugal were obtained from the official System of Information and Monitoring of the Portuguese NHS (SIM@SNS) public-access platform, which was developed by the shared services of the Ministry of Health [35]. This database provided aggregated and anonymized data on public and private outpatient electronic prescriptions at the national level. Data were extracted in January 2023, reflecting yearly prescription records from 2020 to 2022. The annual data included total outpatient prescribed DDD (using the ATC/DDD system developed by the WHO Collaborating Center for Drug Statistics Methodology [34]) for each PPI substance and total estimated prescription prices, stratified by prescription sector (private and

public) and further segmented by sex (female or male) and age group (65–74 and ≥75 years). Notably, the platform ceased to be available to the public in mid-2023, thereby hindering the inclusion of 2023 data in our analysis.

The following substances (ATC codes) available in Portugal were analysed: omeprazole (A02BC01), pantoprazole (A02BC02), lansoprazole (A02BC03), rabeprazole (A02BC04), and esomeprazole (A02BC05). The total price of prescribed medicines is determined based on the prescription process. When medicines are prescribed by international non-proprietary name, the system considers the third cheapest price within the same National Code for Electronic Prescription of Medicines (CNPEM) of the prescribed medicine. The CNPEMs are formulated based on the international non-proprietary name, pharmaceutical form, dosage, and unit count. When the prescription is specifically made by brand, the system considers the retail price of the exact medication prescribed [36].

The annual data regarding the size and characteristics of the population aged 65 or older in mainland Portugal were obtained from the Portuguese Institute of National Statistics [37]. The data were analysed aggregate over the 3-year study period. Additionally, a year-by-year analysis was conducted to assess the consistency and variability of the results across each year and is detailed in the supplementary material.

Study outcomes

For the aggregated 3-year period, the assessed outcomes for individuals aged 65 years and older were as follows:

Volume: a) Total prescribed PPIs-DDDs and their accumulated share (%), calculated as the ratio of PPIs-DDDs to the total number of prescribed medication DDDs (both overall and by healthcare sector individually); b) Mean PPIs-DDD per 1000 inhabitants per day (overall and by PPIs-substance) [34], calculated by healthcare sector. For each year, the calculation took into account the resident population [37]; c) PPIs-DDD per 1000 inhabitants per day market share (%) by PPI substance for each healthcare sector, with absolute variation (in percentage points) between the public and the private sectors; d) Ratio of the prescribed PPIs-DDD per 1000 inhabitants per day between females and males and between age groups ≥75 and 65–74 years, within each healthcare sectors.

Price: a) Mean price per DDD (€/DDD) for all prescribed PPIs and for each PPI substance, calculated by dividing the total price by the total DDDs [38], both overall and by healthcare sector individually; b) Ratio and absolute variation (in percentage points) in the price per DDD (€) between the public and private sectors. All prices per DDD were reported in euros.

Results

Overall, between 2020 and 2022, PPIs-DDDs represented 5.7% of all outpatient DDDs prescribed for people aged 65 years or older in mainland Portugal, with 5.9% for the public sector and 5.3% for the private sector. On average, the public healthcare sector accounted for approximately 77.1% of all PPIs-DDDs prescribed over the 3-year study period.

DDD per 1000 inhabitants per day

The mean prevalence of PPIs prescriptions over the 3-year study was 343.3 DDD/1000 inhabitants/day (264.7 in the public sector and 78.6 in the private sector). Across both healthcare sectors, the prevalence was higher for females than for males and for individuals aged 75 or older than for those aged 65–74 (Fig. 1).

When analysing the female-to-male ratio and the ratio of individuals aged 75 and older to those aged 65–74 in terms of DDD/1000 inhabitants/day within the same healthcare sector, greater differences were observed in the private sector compared to the public sector. Noteworthy, individuals aged 75 and older exhibited a 1.8 times higher prevalence of PPI prescriptions in the private sector, whereas this prevalence was 1.3 times in the public sector (Table S.1. in the supplementary material).

Analysis by substance

Among the five available PPIs substances in Portugal, omeprazole (the lower-cost option and reference substance) was the most frequently prescribed in terms of DDD/1000 inhabitants/day for both sectors, followed by pantoprazole and esomeprazole (Fig. 2). The greatest difference between the public and private sectors was observed in the prescription share of esomeprazole, with the private sector prescribing approximately 5.8 percentual points more than the public sector (see Table S2. supplementary material for year analysis).

Omeprazole was the most prescribed substance for females, whereas pantoprazole was most frequently prescribed for males in the public sector across both age groups. In the private sector, this pattern held for individuals aged ≥75 years, whereas esomeprazole was most commonly prescribed for those aged 65–74 years, as shown in Fig. 3.

Prescription costs

Over the 3-year study period, the private sector prescribed PPIs at 1.2 times higher price (0.126 €/DDD) than the public sector (0.106 €/DDD). Across both sexes and healthcare sectors, the 65–74 age group presented

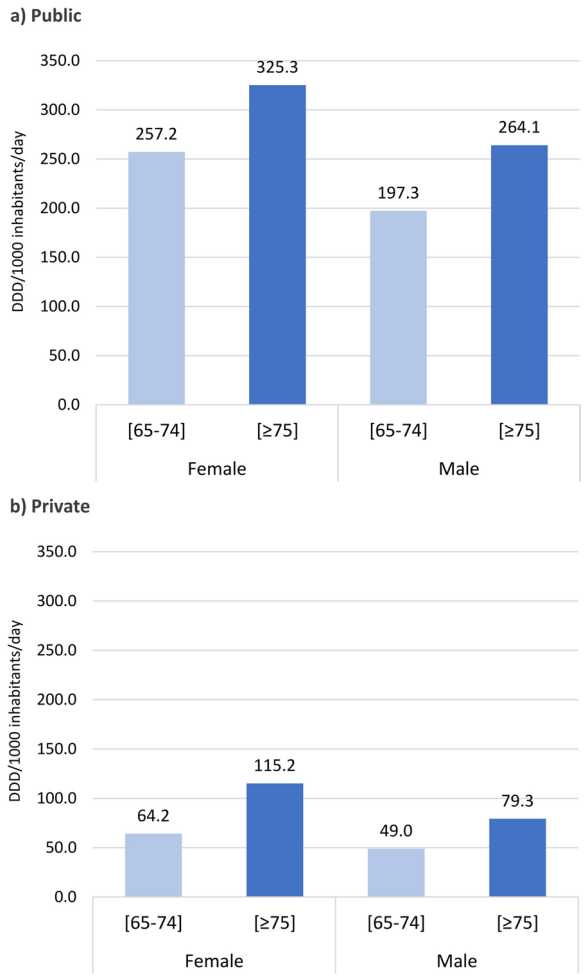

Fig. 1 Mean Prevalence in DDD/1000 inhabitants/day of PPIs prescription in the public and private sectors stratified by sex and age group, for the years 2020 to 2022

a higher price per DDD than the 75 or older age group, with the most pronounced differences observed in the private sector. The younger age group also showed larger price discrepancies between sectors, namely 0.028 € for females and 0.026 € for males. Notably, among females in the private sector, the difference between age groups was particularly noticeable, reaching approximately 0.015 €/DDD. Within the same healthcare sector, both males and females presented similar mean price per DDD (Table 1) (see also Table S.3. supplementary material for additional information).

Analysis by substance

For both healthcare sectors, regardless of sex and age, the substance with the highest cost per DDD was rabeprazole, followed by esomeprazole, lansoprazole, pantoprazole, and omeprazole (Table 2). Compared with the public sector, the private healthcare sector prescribed all the substances at a higher mean cost per DDD, with greater differences among the three most costly substances (rabeprazole + 0.032 €/DDD; lansoprazole + 0.029 €/DDD and esomeprazole + 0.021 €/DDD) (see Table S4. supplementary material).

Discussion

Key findings

Between 2020 and 2022, PPIs accounted for 5.9% of all outpatient DDDs prescribed for people aged 65 years or older in the public sector and 5.3% in the private sector in mainland Portugal. These findings indicate that PPIs continue to be highly prescribed in both sectors, with the public sector accounting for approximately three-quarters of all PPIs-DDD prescriptions in mainland Portugal. However, PPIs prescriptions in the private sector were

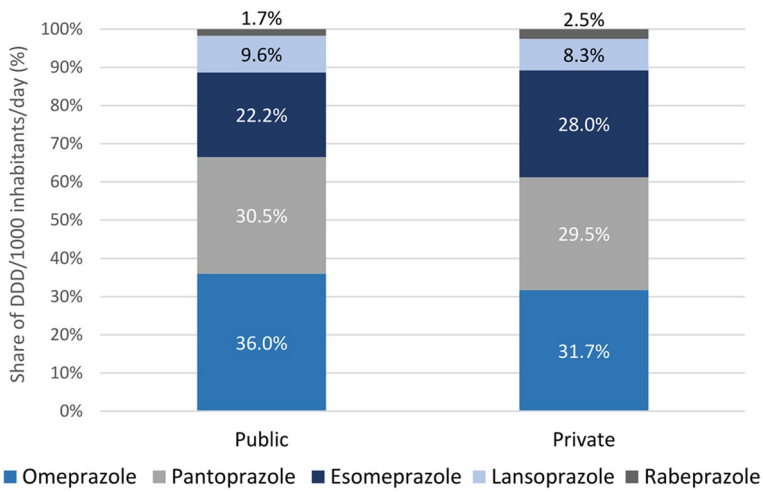

Fig. 2 Mean market share of DDD/1000 inhabitants/day (%) of each PPIs substance prescribed in public and private sectors, for the years 2020 to 2022

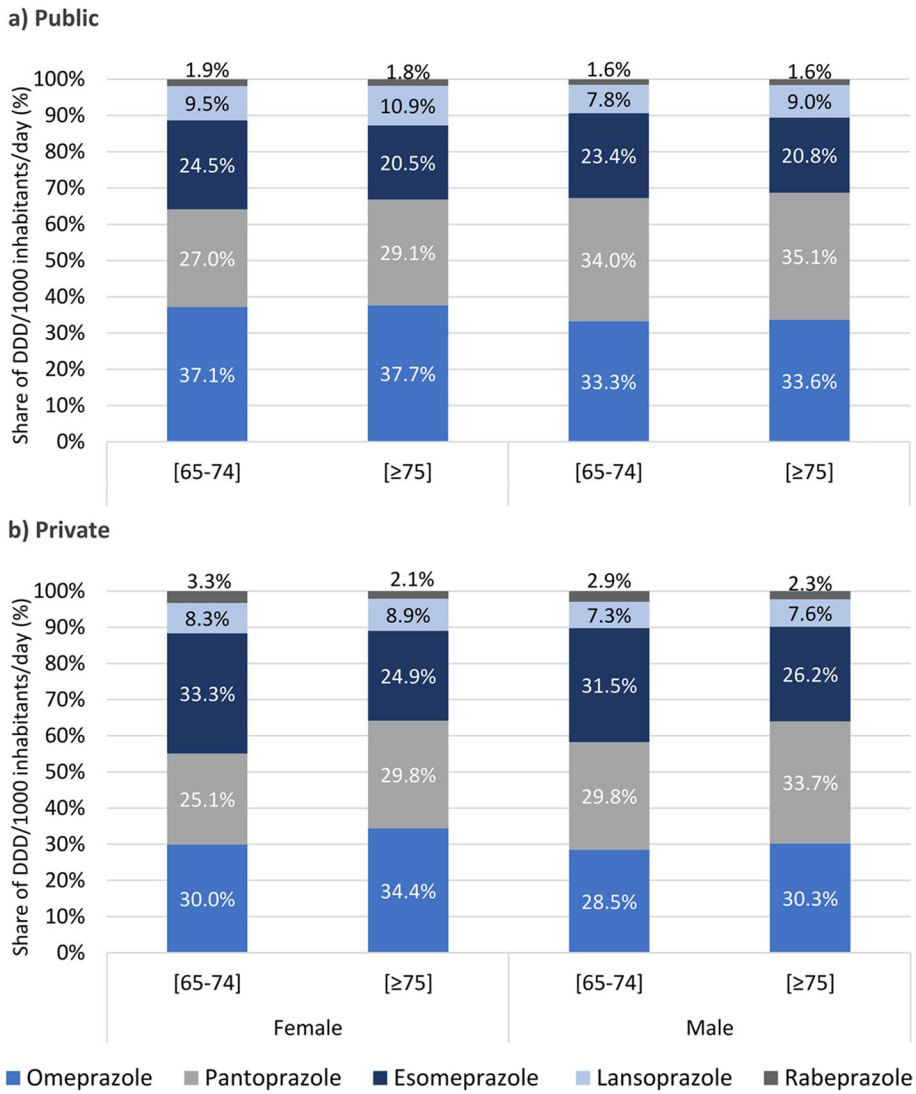

Fig. 3 Mean market share of DDD/1000 inhabitants/day (%) of each PPIs substance prescribed in the public and private sectors, stratified by sex and age groups for the years 2020 to 2022

Table 1 Mean price per DDD (€) of PPI prescriptions in public and private sectors by sex and age groups for the years 2020 to 2022, and absolute differences

Sector	Price *per* DDD (€)						
		Female		Male		Female	Male
	Overall	65–74 y	≥ 75 y	65–74 y	≥ 75 y	Abs difference 65-74 y — ≥ 75 y	
Public	0.106	0.107	0.105	0.108	0.106	0.002	0.002
Private	0.126	0.135	0.120	0.134	0.124	0.015	0.009
Abs difference Private—Public	0.020	0.028	0.015	0.026	0.018	-	-

Legend: Abs - absolute; y - years

Table 2 Mean price per DDD (€) per PPI substance in public and private sectors by sex and age groups for the years 2020 to 2022

PPI Substances	Price *per* DDD (€)									
		Public					Private			
		Female		Male			Female		Male	
	Overall	65-74 y	≥75 y	65-74 y	≥75 y	Overall	65-74 y	≥75 y	65-74 y	≥75 y
Omeprazole	0.070	0.070	0.070	0.072	0.072	0.076	0.078	0.074	0.080	0.077
Pantoprazole	0.099	0.100	0.100	0.099	0.099	0.112	0.115	0.110	0.113	0.110
Lansoprazole	0.113	0.112	0.112	0.117	0.114	0.142	0.154	0.133	0.156	0.140
Esomeprazole	0.163	0.162	0.163	0.162	0.163	0.184	0.186	0.182	0.186	0.182
Rabeprazole	0.211	0.209	0.210	0.213	0.212	0.243	0.243	0.242	0.245	0.241

Legend: y - years

20% more costly (0.126 €/DDD) than those in the public sector (0.106 €/DDD). This cost differential may be due to a preference for brand-name and high-cost substances, such as esomeprazole, in the private sector, whereas international non-proprietary name prescriptions and lower-cost substances, such as omeprazole and pantoprazole, are more commonly prescribed in the public sector. Additionally, we observed that females and individuals aged 75 years and older were consistently more likely to be prescribed PPIs in both sectors (Fig. 1).

Interpretation

In addition to severe acid-related disorders such as erosive esophagitis, Barrett's oesophagus and Zollinger-Ellison syndrome, the indications for long-term use of PPIs are limited [30, 36], particularly for older adults. Evidence strongly suggests the need for caution with PPIs use in this population due to potential risks, prompting consideration for avoidance [36]. Despite this, PPIs remain widely prescribed for older adults in Portugal across both healthcare sectors, accounting for 5.9% of all outpatient DDDs in the public sector and 5.3% in the private sector. As a result, it is estimated thar more than 30% of older adults are treated daily with a PPI (343.3 DDD/1000 inhabitants/day). A systematic review by Xu et al. [25] identified time constraints, clinical inertia, concerns about adverse consequences, limited patient understanding, and a lack of integrated care as observed in Portugal, as contributing factors to potentially inappropriate prescribing among older adults [26, 39]. In a recent study conducted within the public primary healthcare sector of central mainland Portugal, Rodrigues et al. (2023) reported that 78.7% of older adults used PPIs beyond the guideline-recommended treatment duration for most pathologies (≤8 weeks) [33, 40], irrespective of demographic characteristics [41]. Additionally, 49.8% were prescribed PPIs in the absence of any digestive system–related diseases [41], indicating a deviation from evidence-based medical guidelines. This pattern underscores inappropriate PPI prescribing practices in public primary care. Given the high observed prevalence, it is essential to implement strategies that promote quality prescribing, conduct regular medication reviews, and facilitate deprescribing practices when appropriate.

In the case of the private sector in Portugal, there is limited evidence regarding the appropriateness of PPI prescribing. However, factors such as practitioners feeling compelled to fulfil direct patient requests, concerns about patient dissatisfaction, and the perceived need to prescribe in response to any clinical complaint, are usually reported as leading to overprescription, as discussed by Jussila et al. [42]. Importantly, the private sector primarily serves individuals with higher education and greater financial means, factors inversely correlated with the prevalence of gastroesophageal diseases [43–45]. Additionally, individuals holding a private insurance and therefore assessing private healthcare enjoy a better health status [20, 46], which may result in a lower clinical need for PPIs use compared to those reliant on the public healthcare sector. It is also noteworthy that in the private sector, particularly among individuals aged 65–74 years, esomeprazole—an (S)-isomer of omeprazole with an identical mechanism of action and therapeutic indication [31] but at a higher cost—was the most frequently prescribed PPI. Given these factors and the high percentage of PPI prescriptions also observed in the private sector, there also appears to be a significant risk of inappropriate and less responsible prescribing in this context in Portugal.

The observed higher mean price per DDD in the private sector, may be due to a possibly greater proportion of costly brand-name medications being prescribed instead of their international non-proprietary name equivalents. Additionally, the higher share of more costly PPI substances, such as esomeprazole, compared to the public sector also contributes to this price difference.

Although Portugal has an internal reference pricing system that limits NHS reimbursement for all prescribed PPIs (brand or generic) within the same CNPEM to a reference price [47], regardless of the prescribing sector, the prescription of more expensive substances with higher reference prices—without clinical evidence of superiority – leads to unnecessary expenditures and inefficiencies for the healthcare system. Indeed, the Portuguese NHS equally reimburses medical prescriptions regardless of whether they are issued in public or private units. Consequently, prescribing a more expensive substance in the private sector (e.g. esomeprazole rather than omeprazole) led to increased public expenditures without demonstrated benefits. Importantly, the difference between a medication retail price and the NHS reimbursement—capped by a reference price—is directly covered by the patient. Consequently, medications with higher retail prices (e.g., brand-name medicines) result in greater out-of-pocket expenses, contributing to Portugal being one of the OECD countries with highest direct out-of-pocket payments for retail medications [18].

In this context, the public sector seems to outperform the private sector, possibly due to some monitoring and performance incentives provided to primary care practitioners (general practitioners and family doctors) and healthcare units, which may influence prescribing patterns and are absent in the private sector. While secondary care in the public sector lacks such incentives, its small share of outpatient prescriptions within the NHS may not substantially impact the overall pattern [28]. Evidence from Portugal suggests differences in prescribing practices between primary care practitioners and hospital specialists [48, 49]. In the public sector, most outpatient prescriptions are issued by primary care doctors, whereas, in the private sector, specialists play a larger role. In 2019, 63% of all prescribed medicines were issued by primary care doctors, mainly within the public sector [28]. Thus, the differences between the public and private sectors may also reflect the prescriber's specialty. This potential explanatory factor highlights a major difference between sectors: the absence of any gatekeeping in the private sector, in contrast to the public sector, which serves as the source of additional expenditures in the private.

Another important aspect to consider is that medical doctors' prescribing behaviour in the private sector may be influenced by pressures from both pharmaceutical companies and patients, who have the option to choose the doctor they want and afford the medications they prefer, namely brand-name medicines at higher prices, which are perceived to offer better quality, efficacy, and safety [50]. These findings are mostly in line with those reported by Jussila et al. in Finland, a health system similar to that in Portugal [42].

Moreover, the higher prescription among women and those older than 75 years found in this study, is consistent with other national and international studies [9, 41, 51]. Despite worldwide evidence indicating that females are slightly more at risk of suffering from gastroesophageal reflux disease (GERD) (relative risk = 1.15, 95% CI 1.13–1.17; $p < 0.0001$) [43]), they are also more likely to have nonerosive reflux disease [52, 53] a condition for which clinical practice recommends discontinuing PPIs 4 to 8 weeks after initiation [33, 40]. In contrast, males are more prone to severe complications such as erosive esophagitis and Barrett's oesophagus [54, 55], conditions that require chronic PPIs use [33, 40]. Importantly, although females seek medical care more frequently than males do [56, 57], potentially leading to a higher proportion of GERD diagnoses and PPIs prescriptions, the difference in PPIs prevalence in terms of DDD per 1000 inhabitants per day between sexes and sectors observed in our study (1.3 times higher in the public sector and 1.4 times higher in the private sector) should be analysed with some concern. This finding is particularly important given the nonsignificant difference in GERD incidence between sexes in Portugal [58] and the typically less severe GERD experienced by females.

The greater use of PPIs among individuals aged 75 years and older raises concerns regarding the elevated risk of PIPs in the older population, particularly among the oldest-old population and in the private sector. Although evidence indicates an age-related increase in the prevalence of GERD, for Portugal, the GERD prevalence is estimated to be lower for those aged 80 years or older than for those aged 60–69 years or 70 years or older [58]. Consistently, women and older individuals have a higher prevalence of polypharmacy, a situation that has already been discussed and may contribute to more inappropriate PPIs prescription among these groups [59].

Strengths and limitations

A major strength of this study lies in the utilization of a population-based database, encompassing all older adults in mainland Portugal. However, the study is not without limitations. First, the prescription of a medicine does not guarantee effective acquisition and adherence by the patient; however, our goal was to assess the prescription patterns and not consumer adherence. Second, the dataset comprises aggregated data without individual patient-level information, such as health data or the number of refills per patient, precluding an assessment of the clinical indication and duration of PPIs use. Third, the DDD is an approximate unit of measurement that may not precisely reflect the actual daily dose prescribed. Notably, our study was not designed to characterize PPIs use. Instead, our primary aim was to compare

outpatient prescription patterns and costs of PPIs among older adults in the private and public healthcare sectors. Fourth, the data are aggregated by substance without information on the specific dosage, pharmaceutical form, dimension, and retail price of each medicine. This lack of information precludes the comparison of the financial burden supported by patients and the NHS under public versus private prescriptions.

Finally, it is important to note that data stratification by medical specialty would help in understanding the prescription patterns between the private and public sectors. However, our dataset lacks this information; access to new data is no longer possible due to the unavailability of the data source, and no information is publicly available on the specialty distribution of medical doctors in the private sector.

Policy implications

Given the widespread prescription of PPIs in both healthcare sectors and the observed cost, it is crucial to reinforce incentives to promote a responsible prescription of PPIs and encourage deprescription when necessary. The implementation of cross-country multidisciplinary deprescribing protocols can offer a promising strategy in both sectors. Recent evidence highlights positive outcomes from collaborative deprescribing approaches, leading to cost savings for the healthcare system [60, 61]. Moreover, older adults, particularly females and elderly individuals, who are subject to higher prevalence of PPI prescribing, show willingness to have their medications deprescribed if recommended by health professionals [62, 63]. These strategies should focus on both patients and health professionals.

Moreover, to promote more responsible and appropriate PPI prescribing, additional quality indicators and new approaches should be considered. These include large-scale education programs on the responsible use of PPIs for both healthcare professionals and patients, as well as guideline monitoring of PPI prescribing with feedback and alerts to prescribers in both primary and secondary care settings. Regular medication review programs supported by pharmacists could also be beneficial. Since the NHS financially supports medications prescribed in private units, monitoring measures and financial incentives toward rational prescribing should also be applied in this sector.

Conclusion

This study sheds light on the prescribing patterns of PPIs in both the public and private healthcare sectors in Portugal. Despite ongoing national and international safety alerts regarding the overprescription of PPIs, our findings indicate that PPIs continue to be highly prescribed in both sectors. Moreover, private practitioners tend to prescribe more costly medications because their patients can afford them, and there is no incentive for more rationale prescribing. Since the NHS financially supports medications prescribed in private units, monitoring and financial incentives should be considered to encourage more rational prescribing in this sector.

Abbreviations

ADEs	Adverse drug events
CNPEM	National Code for Electronic Prescription of Medicines
DDD	Defined daily doses
GERD	Gastroesophageal reflux disease
NHS	National Health Service
OECD	Organization for Economic Co-operation and Development
PPIs	Proton-pump-inhibitors

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12913-024-12033-5.

Supplementary Material 1.

Authors' contributions

All the authors contributed to the study conception and design. SR: conceptualization, methodology, data analysis, writing—original draft. CT: methodology, writing—review & editing. ATR: methodology, writing—review & editing. JP: conceptualization, methodology, writing—review & editing. All the authors read and approved the final manuscript.

Funding

The authors declare that no funding was received for conducting this research. The present publication was funded by Fundação Ciência e Tecnologia, IP national support through CHRC (UIDP/04923/2020.

Data availability

Data used in this study will be made available upon request.

Declarations

Ethics approval and consent to participate

Not applicable. This manuscript does not contain clinical studies or patient-level data. Data were derived from a publicly open access online platform of the Portuguese NHS; therefore, no access authorization was required.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Received: 10 August 2024 Accepted: 29 November 2024
Published online: 06 January 2025

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