https://ijhpm.com
Int J Health Policy Manag 2026;15:9480

OPEN ACCESS

doi 10.34172/ijhpm.9480

IJHPM
International Journal of Health Policy and Management

Original Article

Household Out-of-Pocket Spending on Medicines in Poland: Modest and Unequal Effects of the Medicines 75+ Program

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Abstract

Background: Out-of-pocket payments for medicines are the main driver of financial hardship for households in most countries in Europe, particularly in Central and Eastern Europe (CEE). The aim of this study was to analyze household spending on medicines in Poland and assess the effects of the Medicines 75+ program, implemented to improve access to medicines for older people.

Methods: We utilized 2013-2021 data from household budget surveys conducted on a representative sample of Poland's population. A two-part model was employed to identify factors associated with paying for and amount spent on medicines. We evaluated the effect of the Medicines 75+ program using a difference-in-differences (DID) analysis for cross-sectional data covering the years 2013-2019 (pre-pandemic years). Our treatment group included households headed by people aged 75-85, which was compared to the control group, ie, households headed by individuals aged 65-74.

Results: The results show that out-of-pocket expenditure on medicines increased over the analyzed years and remains the primary driver of household health spending. Ability to pay and age are strong predictors of the likelihood of paying for medicines and expenditure levels, with their effects being cumulative. The average annual per capita spending in the treatment group decreased from PLN 1282 in the pre-intervention period (2013-2016) to PLN 1221 in the post-intervention years (2017-2019), while the control group's spending increased from PLN 930 to PLN 969. The DID analysis showed that the program of free medicines reduced the annual out-of-pocket spending by an average of PLN 71 (2019 US $18), which is relatively modest given the high expenditure in this age group. The decrease was also not observed across all consumption quintiles, with no significant improvement among the poorest households.

Conclusion: Poland should reconsider its policies for equitable access to medicines, placing greater emphasis on low-income groups and addressing both prescription and over-the-counter (OTC) medicines.

Keywords: Out-of-Pocket Payments, Medicines, Policy Evaluation, Quasi-experimental Study, Poland

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Citation: Tambor M, Pavlova M, García-Ramírez JA.. Household out-of-pocket spending on medicines in Poland: modest and unequal effects of the Medicines 75+ program. *Int J Health Policy Manag.* 2026;15:9480. doi:10.34172/ijhpm.9480

Article History:
Received: 19 September 2025
Accepted: 7 September 2026
ePublished: 21 September 2026

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Background

Medicines constitute an essential element of healthcare systems. They bring significant health benefits and improve quality of life through prevention, treatment, and alleviation of disease symptoms. At the same time, substantial resources are needed to develop new medicines, which is eventually reflected in high and increasing spending on pharmaceuticals, not only by governments but also by patients.[1,2]

Patient out-of-pocket payments for pharmaceuticals are common across countries, regardless of their wealth.[3,4] In many European countries, particularly in Central and Eastern Europe (CEE), spending on medicines dominates household health budgets, sometimes even exceeding public expenditure on this purpose.[5,6] The predominant role of medicines in household health budgets results, on the one hand, from the relatively common use of medicines when compared to other health services. Households use not only prescribed pharmaceuticals but also over-the-counter (OTC) medicines that are directly accessible and may provide an alternative when access to medical professionals is limited. On the other hand, the incomplete public coverage of medicines shifts the financial burden onto patients. In all European countries, patients co-pay for covered medicines, while some pharmaceuticals, such as OTC medicines, might not be covered at all, resulting in patients paying the full price.[7-9] This price is rarely regulated by the government and is not necessarily lowered through market competition.[10,11]

Hence, it is not surprising that medicines have been shown to significantly contribute to household financial hardship due to out-of-pocket payments for healthcare. The analysis of 40 World Health Organization (WHO) European region countries revealed that payments for outpatient medicines account, on average, for 38% of catastrophic out-of-pocket payments (ie, payments higher than 40% of household capacity to pay).[9,12] The role of pharmaceuticals in the financial burden is more pronounced in less affluent countries, including CEE

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Key Messages

Implications for policy makers

- Ability to pay should be considered when designing protection mechanisms against out-of-pocket payments. Age alone, as a proxy for health needs, might not be sufficient to protect the poorest households, who face the greatest barriers to accessing medicines and bear the heaviest financial burden.
- Given the rapid expansion of the over-the-counter (OTC) medicines and dietary supplements market, effective policies to reduce the financial burden of medicines require a comprehensive approach that goes beyond prescription products and price-reduction measures. This may include stronger oversight of distribution and advertising, as well as public education initiatives.
- Policies aimed at improving access to medicines, such as the Medicines 75+ program, should be periodically evaluated with regard to both the financial burden on households and the persistence of unmet needs across different socioeconomic groups.

Implications for the public

Out-of-pocket payments for medicines are the main reason for catastrophic payments among European households, particularly in Central and Eastern Europe (CEE). Our study looked at Poland's household spending on medicines between 2013 and 2021 and assessed the impact of the Medicines 75+ program, which provides free medicines for older people. We found that while the program slightly reduced overall spending on medicines, saving households an average of PLN 71 per year, it did not benefit everyone equally. The poorest older people, who face the greatest barriers to accessing medicines, experienced no significant improvement. These results highlight the need for policies that better support low-income groups and address the growing burden of over-the-counter (OTC) medicines and supplements.

countries, where households experience financial hardship due to out-of-pocket payments more frequently, and also among poorer households.[9] Furthermore, financial and other barriers may result in unmet needs for medicines, with poorer households being disproportionally affected.[13]

To improve access to medicines and mitigate their burden on household budgets, countries apply various protection measures such as exemptions and reductions in co-payments for vulnerable population groups, or caps on total out-of-pocket payments.[7,9,14,15] The design of such mechanisms varies greatly depending on economic factors, administrative capacity, or political pressure, but they are usually targeted at two broad categories of vulnerable groups, ie, those with low ability to pay and those with high health needs.

Poland is one of the CEE countries that share challenges similar to those of other countries in this region when it comes to spending on medicines.[6] Poland's patients pay for prescribed and covered medicines in the form of fixed co-payments (PLN 3.20) or percentage co-payments (30% or 50% of reference price) and payments above the reference price.[7,16] In 2021, the overall co-payment rate for covered medicines was 26%.[17] Patients also pay the full price for all OTC medicines, as these are not covered. They also bear the full cost of prescription medicines that are either not reimbursed or used outside the approved medical indications for which reimbursement is granted.[18] As indicated by the European Health Interview Survey (2019), the use of medicines is relatively high, with nearly 50% of respondents reporting the use of prescribed medicines and 45% the use of non-prescribed medicines or dietary supplements.[19,20] Out-of-pocket payments constitute about 64% of the total expenditure on pharmaceuticals in the country (2021), but over 80% of these payments go to OTC medicines and dietary supplements.[21] Payments on medicines account for the biggest share of household spending on health and are the main driver of catastrophic health spending.[7,22-24]

To improve affordability of medicines, Poland implemented the Medicines 75+ program in September 2016, providing free medicines for all individuals aged 75 and older. The list of free-of-charge products included prescription medicines that had been previously provided to the 75+ age group with patient co-payments. Initially, the list covered 1129 medicines (68 different molecules) but was gradually expanded, reaching 2029 items at the end of 2019, 2095 items at the end of 2021 (nearly 50% of all reimbursed outpatient medicines), and 2691 items as of January 2025 (66% of all covered outpatient medicines).[25] The withdrawal of patient co-payments for older people was the first major protection mechanism against out-of-pocket payments for medicines, as previously only small population groups (war and military veterans, blood and organ donors) had benefited from some exemptions. Before the program was implemented, nearly 50% of retirees' households reported that purchasing prescribed medicines was a significant financial burden for their households.[26] The change was also politically grounded, as free medicines for older people were a flagship program of the ruling party in the 2015 parliamentary election. Nevertheless, the lack of protection mechanisms based on the ability to pay and relying solely on age as a proxy for need have raised concerns about its effectiveness in protecting those most affected by out-of-pocket payments. In 2023, the program was extended to cover all people from the age of 65, and another list of free medicines for children was implemented,[7] while low-income people from other age groups remained unprotected.

The effects of the Medicines 75+ program have not been thoroughly analyzed. The aggregated data of the National Health Fund showed that spending on prescribed and publicly covered medicines by people aged 75 and older decreased between 2015 and 2017 by nearly 45% (from PLN 860.6 million to PLN 479.9 million),[27] which indicates that the program might have been effective in reducing household payments for covered medicines. However, little is known about whether the program caused the reduction of total out-of-pocket payments for medicines among older people. In this study, we aim to fill this gap by analyzing out-of-pocket spending on medicines using the household budget survey data for the 2013-2021 period. We investigate the effectiveness of the program in reducing total out-of-pocket payments for medicines for older people using a quasi-experimental

research design based on pre-pandemic data from 2013-2019. We also have a more in-depth look at the determinants of paying for and amount spent on medicines. We specifically focus on age and ability to pay as the two main characteristics that are relevant to creating effective protection mechanisms.

Methods

This study uses anonymized data from nine cross-sectional household budget surveys conducted by Statistics Poland (*Główny Urząd Statystyczny*) between 2013 and 2021. The surveys are carried out on a representative sample of Poland's population, selected through a two-stage random sampling method, with stratification applied at the first stage.[28] Data collection occurs continuously throughout the year, with a monthly replacement of participating households. Over the course of a month, each participating household records its income, spending, and consumption in a diary. Additional interviews with households are conducted quarterly to capture infrequent expenditures, with one-third of their value incorporated into the household budgets. Extensive validation procedures, including logical, arithmetic, and completeness checks are employed to ensure the quality of data. To correct for over- or under-representation of particular groups in the survey, the data are weighted using statistics from the National Population and Housing Census. More details about the sampling and data collection can be found in *Główny Urząd Statystyczny* (2024).[28]

The survey collects data on the value of monthly household spending following the Classification of Individual Consumption According to Purpose (COICOP).[29] This includes expenditure on health (COICOP 06) that breaks down into expenditure on outpatient medicines (06.1.1), medical products (06.1.2, 06.1.3), outpatient care (06.2.1), dental care (06.2.2), diagnostics and lab (paramedical services) (06.2.3), and inpatient care (06.3).

The survey covered 37 181 households in 2013, 37 215 in 2014, 37 148 in 2015, 36 886 in 2016, 36 655 in 2017, 36 166 in 2018, 35 923 in 2019, 33 529 in 2020, and 30 867 in 2021. Households reporting no food expenditure were excluded from this study, specifically 1 household in both 2014 and 2015, 5 households in 2018, 16 households in 2020, and 10 households in 2021.

Analysis of Household Spending on Medicines and Its Associated Factors

In this study, we focus on household expenditure on outpatient medicines. In the first part of our analysis, we investigated data on annual per capita spending on medicines and factors associated with these payments. For this purpose, monthly household spending on medicines was multiplied by 12 to obtain an annual amount, which was then divided by household size. We present descriptive statistics on the level of this spending, as well as its share in total household consumption expenditure and total out-of-pocket health expenditure over the 2013–2021 period.

To examine the factors associated with paying for and amount spent on medicines, we estimated a two-part model using the Stata *twopm* command and data for the most recent year (2021).[30] The two-part model was selected due to the substantial proportion of zero observations. In the first part, a binary response model was estimated to model the probability of paying versus not paying for medicines. Conditional on paying for medicines, the second part estimated annual per capita medicine spending using only observations with nonzero values. A probit model was employed in the first part, while the second part was estimated using a generalized linear model with a log link and gamma distribution to accommodate the positive skewness of the expenditure data. Robust standard errors were additionally used to account for potential heteroskedasticity. To facilitate interpretation, adjusted predictions of medicine expenditure across values of the explanatory variables of interest were computed using post-estimation margins based on the combined results of the two-part model.

When analyzing factors associated with paying for and amount spent on medicines, particular attention was paid to two determinants: age and ability to pay. Age refers to the household head's age. Ability to pay is measured through consumption expenditure, as it is generally considered a more adequate measure than income, which is more frequently underreported by households.[31] We determined consumption quintiles based on total household consumption, adjusted for household size and composition. For this purpose, we used the Organisation for Economic Co-operation and Development equivalence scale with a weight of 1.0 assigned to the first adult, 0.7 to each additional person aged 14 and over, and 0.5 to each child aged under 14. Since it can be expected that age and ability to pay do not independently affect spending on medicines, ie, the effect of age varies by the ability to pay, and the effect of ability to pay differs by age groups, we also present the model with the interaction term between these two variables. Other factors that may influence out-of-pocket health expenditure, as suggested by the literature,[32-34] were also included in the model, ie, the gender and education level of the household head, the household's primary source of income, the number of children under 14, the place of residence, and the household head's disability status. The two-part model was estimated in Stata 18 using survey weights constructed from census population distributions, based on 30 848 households after excluding 9 households with missing data on disability status.

Assessment of the Effects of the Medicines 75+ Program

The second part of our analysis focuses on the effect of the Medicines 75+ program on household spending on outpatient medicines. To identify this effect, we employed a difference-in-differences (DID) analysis. This analysis assumed that, without the program, the difference in the outcome variable (household spending) between the targeted (treatment) group and comparable (control) group would remain constant over time (the parallel trend assumption). The treatment group consisted of households where the household head is aged 75-85 (targeted by the program), while the control group included households headed by individuals aged 65-74 (not yet targeted by the program). These groups were selected based on robustness checks in which we assessed the plausibility of

the parallel trends assumption. A statistically significant post-intervention change in the difference between groups, also known as the average treatment effect on the treated (ATET), was interpreted as the effect of the intervention.[35,36]

The analysis was performed in the software package Stata 18, applying the DID model for repeated cross-sectional data by fitting a linear model with time and group fixed effects using *didregress* command.[37] The inclusion of these fixed effects controls for systematic differences between groups and over time that may affect the outcome, allowing the treatment effect to be estimated. The model is specified as follows:

$$y_{ist} = \gamma_s + \gamma_t + z_{ist}\beta + D_{st}\delta + \varepsilon_{ist}$$

where y_{ist} is the outcome of an observation unit (eg, household) in group s at time t; γ_s are group fixed effects that account for all time-invariant differences between groups by controlling for any characteristics that remain constant within each group over time but may differ between groups; γ_t are time fixed effects that account for factors that vary over time but affect both the treatment and control groups (eg, economic growth, inflation); z_{ist} are covariates, including household size, sex, residence place (rural/urban), disability degree (no, mild, moderate, severe), children aged under 14 (none, one or two, three and more), education (primary, secondary, tertiary), and household consumption quintiles; β are the coefficients of the covariates; D_{st} is the treatment indicator that varies at the group and time levels, taking the value of one for treated units in the post-intervention period and zero otherwise; δ is the coefficient of the treatment indicator (ATET); and ε_{ist} are the residual errors.

Our DID analysis covered all years in the period 2013-2019. We excluded the years 2020-2021 due to the impact of the COVID-19 pandemic, which significantly altered patterns of out-of-pocket payments. Thus, the time variable in our model, used to estimate time-fixed effects, represents individual years from 2013 to 2019. As the program was implemented in September 2016, we defined the years 2013-2016 as the pre-intervention period, and the years 2017-2019 as the post-intervention period (the follow-up period). The grouping variable is the household head's age in single years, which is used to construct group fixed effects.

We excluded households with members aged 75 and older from the control group (1774 observations) to eliminate the potential spillover effect of the policy on this group. Additionally, 14 observations with missing information on disability degree were excluded. Consequently, the DID analysis was performed on a sample of 61 695 households in total.

In our main analysis, the outcome variable was annual per capita household spending on medicines, expressed in nominal terms. Additionally, we performed an analysis of household spending on medicines expressed as a share of household consumption (See Supplementary files 1-5).

Given the paper's focus on age and ability to pay, we performed the DID analysis both for the full sample and separately across consumption quintiles, in order to assess how the program affected households with varying levels of ability to pay.

We tested the assumption of parallel trends through graphical analysis and parallel trend test using available Stata 18 post-estimation tools (*estat trendplots*, *estat ptrends*).[37] The graphical analysis is performed by plotting the means of the outcome over time and the results of the linear-trends model for the treatment and control groups. Also, the parallel trend test estimates a coefficient for the differences in linear trends between the two groups prior to intervention.

Our data are observational and cross-sectional, which indicates possible differences both between and within the treated and control groups and may question their comparability. Therefore, as a robustness check, we performed a DID analysis with kernel propensity-score matching for repeated cross-sectional data, using the Stata *diff* command,[38] and the same sample and variables. In this method, observed covariates are used in a probit model to estimate a propensity score for each household, representing its likelihood of being treated. Using the Gaussian kernel function, each household is assigned a weight based on the similarity of its propensity score to the average propensity score of the treated group in the post intervention period. Since we use cross-sectional data, the kernel weights are calculated for the control group at the baseline (pre-intervention period), the control group in the follow-up period, and the treated group in the baseline period. The reweighted observations are used for DID estimation.[38]

Due to possible variation in post-intervention years (2017-2019) resulting from the gradual program extension (including more medicines), we also conducted a heterogeneous DID analysis using the Stata 18 command *hdidregress*.[37] We used an extended two-way fixed effects estimator, which fits a model for the outcome of interest, allowing for heterogeneity at the time level. The model included the same list of covariates as in the DID analyses described above.

Results

Household Spending on Medicines and Its Associated Factors

Table 1 presents the weighted population statistics on household spending on medicines in 2013-2021. The share of households having any out-of-pocket payments for medicines has been increasing over the years, reaching 79% in 2019, and dropping slightly during the COVID-19 pandemic. These payments are more common among older people's households, with the highest rates occurring in the 75+ age group (86% in 2021). The incidence of payments also increases with households' ability to pay (consumption quintiles). Nevertheless, the poorest households experienced the most significant increase in the incidence of payments over the years, rising from 62% in 2013 to 69% in 2021.

Between 2013 and 2021, the average per-person spending on medicines increased by 33% in nominal values, ie, from PLN 395 to PLN 526 (Table 1). However, after adjusting for inflation, the growth was 12%. At the same time, the share of medicine spending in total household consumption slightly increased, from 3.2% in 2013 to 3.5% in 2021.

Medicine expenditure increases with age and is by far the highest among households headed by individuals aged 75

Table 1. Out-of-Pocket Payments for Outpatient Medicines by Age of the Household Head and Consumption Quintiles, Poland, 2013-2021[a]

		2013	2014	2015	2016	2017	2018	2019	2020	2021
		N = 37 181	N = 37 214	N = 37 147	N = 36 886	N = 36 655	N = 36 161	N = 35 923	N = 33 513	N = 30 857
Households with any payments for medicines (%)		75.04	75.92	76.69	78.76	78.83	78.70	79.02	76.72	78.33
Age	16-29	61.44	62.13	65.17	67.71	66.94	65.38	67.67	62.55	66.70
	30-39	72.61	74.33	74.79	76.27	77.13	75.79	76.29	71.55	75.09
	40-49	70.30	71.15	71.89	76.15	76.35	76.88	76.15	73.47	75.05
	50-59	72.60	73.02	73.92	75.68	76.70	76.53	77.12	76.11	77.57
	60-74	82.45	82.97	82.94	83.91	83.03	84.07	84.18	82.61	82.73
	75+	89.69	89.29	88.97	89.22	88.67	87.26	87.69	87.32	86.32
Consumption quintiles	1st quintile (poorest)	61.87	62.33	64.64	67.36	68.21	68.79	69.48	66.50	68.74
	2nd	74.17	75.44	75.46	78.14	78.53	78.51	78.51	75.76	76.48
	3rd	78.13	79.64	80.23	81.78	81.14	81.05	82.03	78.80	80.32
	4th	80.17	81.39	81.59	82.71	82.80	82.77	82.85	81.30	82.56
	5th quintile (richest)	80.86	80.81	81.55	83.82	83.47	82.40	82.26	81.24	83.56
Average annual per capita spending on medicines (PLN, nominal values)		395.18	388.84	400.10	419.71	427.64	444.74	471.94	488.16	525.60
Age	16-29	216.41	224.12	245.85	253.41	259.35	276.68	309.89	303.47	320.11
	30-39	259.49	261.12	273.41	285.04	283.45	294.18	311.54	316.86	352.93
	40-49	226.56	221.74	235.75	255.57	277.61	294.73	309.60	312.27	352.69
	50-59	343.77	333.42	338.94	360.27	380.05	384.16	412.50	433.99	467.09
	60-74	733.03	707.40	699.03	720.90	731.93	766.28	813.33	863.50	899.81
	75+	1200.77	1128.87	1120.63	1134.65	1087.57	1129.48	1218.82	1303.21	1339.41
Consumption quintiles	1st quintile (poorest)	164.19	166.19	173.54	201.35	211.34	216.25	236.90	230.44	245.64
	2nd	307.08	311.55	324.17	340.89	347.76	369.38	389.44	398.29	430.56
	3rd	428.94	433.61	438.47	443.41	452.59	475.86	510.42	519.05	559.52
	4th	537.54	521.75	533.44	549.05	550.98	576.94	601.46	641.90	677.50
	5th quintile (richest)	692.12	656.50	674.17	685.92	678.67	695.75	734.87	799.58	865.66
Average annual per capita spending on medicines (PLN, real values, 2021 base year[b])		468.93	459.27	466.42	488.86	489.47	502.85	517.91	513.84	525.60
Age	16-29	256.80	264.71	286.60	295.16	296.85	312.84	340.07	319.43	320.11
	30-39	307.91	308.41	318.74	332.00	324.43	332.62	341.88	333.53	352.93
	40-49	268.84	261.90	274.82	297.68	317.74	333.25	339.75	328.69	352.69
	50-59	407.92	393.81	395.13	419.62	434.99	434.36	452.68	456.82	467.09
	60-74	869.83	835.52	814.90	839.67	837.76	866.42	892.55	908.92	899.81
	75+	1424.86	1333.33	1306.39	1321.58	1244.81	1277.08	1337.54	1371.78	1339.41

Table 1. Continued

		2013	2014	2015	2016	2017	2018	2019	2020	2021
		N = 37 181	N = 37 214	N = 37 147	N = 36 886	N = 36 655	N = 36 161	N = 35 923	N = 33 513	N = 30 857
Consumption quintiles	1st quintile (poorest)	194.83	196.29	202.31	234.52	241.90	244.51	259.97	242.56	245.64
	2nd	364.39	367.98	377.91	397.05	398.04	417.65	427.37	419.24	430.56
	3rd	508.99	512.15	511.15	516.46	518.03	538.04	560.13	546.36	559.52
	4th	637.85	616.25	621.87	639.51	630.64	652.33	660.04	675.67	677.50
	5th quintile (richest)	821.28	775.41	785.92	798.92	776.79	786.67	806.45	841.65	865.66
Spending on medicines as a share of household consumption (%)		3.23	3.13	3.18	3.22	3.15	3.25	3.27	3.49	3.45
Age	16-29	1.75	1.72	1.90	1.94	1.84	1.98	2.06	2.19	2.31
	30-39	2.21	2.17	2.30	2.29	2.21	2.25	2.30	2.42	2.44
	40-49	2.04	1.94	2.04	2.12	2.18	2.27	2.27	2.35	2.47
	50-59	2.76	2.68	2.65	2.73	2.79	2.82	2.80	3.02	2.95
	60-74	5.24	5.09	4.87	4.83	4.76	5.04	5.06	5.50	5.23
	75+	8.96	8.45	8.56	8.43	7.91	8.05	8.10	8.79	8.36
Consumption quintiles	1st quintile (poorest)	3.10	3.07	3.14	3.40	3.39	3.49	3.53	3.43	3.37
	2nd	3.66	3.60	3.73	3.76	3.69	3.90	3.88	3.97	3.97
	3rd	3.82	3.78	3.79	3.73	3.66	3.86	3.92	4.04	4.00
	4th	3.57	3.42	3.46	3.48	3.40	3.57	3.53	3.85	3.76
	5th quintile (richest)	2.57	2.44	2.48	2.50	2.43	2.42	2.44	2.79	2.78
Spending on medicines as a share of household total out-of-pocket health expenditure (%)		61.05	60.06	57.87	57.79	54.99	62.40	61.17	63.54	59.43
Age	16-29	50.28	50.84	47.99	53.19	44.10	56.09	55.62	59.03	59.49
	30-39	52.63	51.96	49.55	50.56	48.81	54.50	53.92	54.96	52.98
	40-49	51.95	52.28	50.15	49.76	48.23	55.94	54.11	55.51	50.65
	50-59	58.91	57.38	54.99	55.99	54.34	62.17	60.68	62.11	59.56
	60-74	69.33	66.77	64.15	62.72	60.54	68.92	67.71	71.35	65.50
	75+	74.44	74.05	75.31	72.21	67.56	71.71	71.02	75.19	72.87
Consumption quintiles	1st quintile (poorest)	76.17	75.49	73.91	74.46	71.20	85.72	85.07	86.54	82.84
	2nd	72.31	71.41	70.25	69.41	67.61	78.66	78.33	80.46	76.29
	3rd	69.57	68.15	66.29	66.10	63.43	71.90	72.04	75.48	72.84
	4th	62.61	61.55	58.93	59.32	56.34	65.15	62.46	67.14	62.43
	5th quintile (richest)	47.65	46.31	43.88	43.50	40.84	44.46	43.16	44.88	41.48

[a] The data are weighted using statistics from the National Population and Housing Census; [b] Using gross domestic product price index.

and older, who spent 4 times more than households of the youngest people (16-29), and 1.5 times more than households of people aged 60-74. The two oldest age groups also allocate a significantly larger portion of their budget to medicines compared to other households. Yet, they are characterized by the smallest increase in spending over the years analyzed. In fact, after accounting for inflation, expenditure on medicines among the oldest households (75+) fell by 6% between 2013 and 2021. In 2017, which was the first year after the implementation of the program of free medicines, spending on medicines in this age group decreased by 4% in nominal terms and 6% in real terms.

Payments on medicines also increase with consumption quintiles, with the richest quintiles spending much more than the others. Still, in all years analyzed, this spending has the lowest share of total consumption among the richest households (2.4%–2.8%), and the highest in the second and third quartiles (3.6%–4%). As with the incidence of payments, it is the poorest quintile that has seen the most significant increase in spending between 2013 and 2021 (ie, by 50% in nominal terms and 26% in real terms).

Medicines account for nearly 60% of total household out-of-pocket spending on health (2021). This share is higher among older population groups, reaching 73% in households aged 75 and over, and among less wealthy households. In 2021, 83% of health expenditure among the poorest households was for medicines (up from 76% in 2013), compared with 41% for the richest households (down from 48% in 2013).

The two-part model was used to examine factors associated with the probability of paying for medicines (first part) and the level of expenditure conditional on any spending (second part). We present results from two models (See Table 2). Model 1 serves as a baseline specification, estimating the average association between the explanatory variables and medicine expenditure. Model 2 extends the analysis by including interaction terms between age groups and consumption quintiles, capturing potential heterogeneity of the age effect across quintiles.

Results from Model 1 indicate that higher consumption quintiles and older age increase the probability of paying for medicines and are associated with higher levels of medicine expenditure. Compared with the lowest consumption quintile, both the likelihood and the level of medicine spending increase progressively across quintiles. Similarly, older individuals are more likely to pay for medicines, and the three oldest age groups exhibit significantly higher medicine expenditure than the youngest age group. The analysis also confirms that other household characteristics included in the model are significantly associated with either the likelihood of paying for medicines or the level of this expenditure.

Results from Model 2 suggest some heterogeneity in age-related expenditure patterns across consumption quintiles. In particular, among older age groups, higher consumption quintiles (especially the fourth and fifth quintiles) are associated with both a higher probability of medicine spending and higher expenditure levels.

The predictive margins derived from Model 2 highlight the growing disparity in medicine expenditure across consumption quintiles with increasing age (See Figure). These predictions represent model-based expected values of medicine expenditure, obtained by combining the results of both parts of the two-part model and accounting for the distribution of other covariates in the sample. While predicted expenditure is nearly 2.5 times higher between the lowest and highest consumption quintiles among the youngest households (PLN 273 vs. 672), this gap widens to nearly four-fold among the oldest households (PLN 479 vs. 1904). Figure illustrates these patterns, while the corresponding predicted values for each age group and consumption quintile combination are provided in Supplementary file 1.

Effects of the Medicines 75+ Program

We used a DID analysis to estimate the causal effects of the program of free medicines for people aged 75 and over

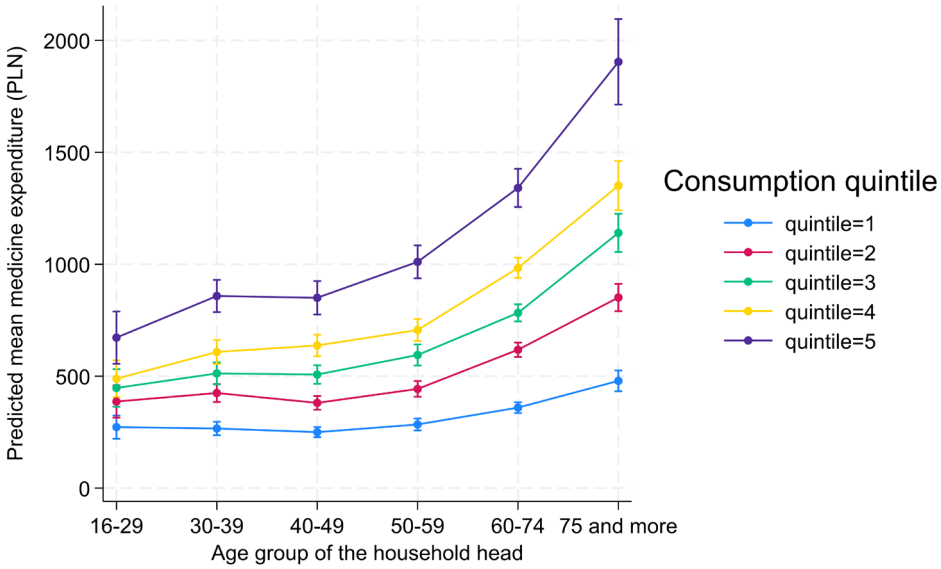

Figure 1. Predicted Annual Per Capita Medicine Expenditures by Age Groups and Consumption Quintiles (Combined Expected Values From the Two-Part Model With 95% Confidence Intervals).

Table 2. Factors Associated With Paying for Medicines and Annual Per Capita Spending on Medicines: Results of the Two-Part Model on Data for 2021

	Model 1		Model 2	
	Part I: Probit Model (Paying vs. Not Paying)	Part II: Generalized Linear Model (Level of Spending)	Part I: Probit Model (Paying vs. Not Paying)	Part II: Generalized Linear Model (Level of Spending)
	Coeff. (Robust Standard Error)	Coeff. (Robust Standard Error)	Coeff. (Robust Standard Error)	Coeff. (Robust Standard Error)
Gender				
Male (ref.)				
Female	0.033 (0.019)	0.112*** (0.014)	0.033 (0.019)	0.112*** (0.014)
Age				
16-29 (ref.)				
30-39	0.142** (0.046)	0.056 (0.042)	0.059 (0.098)	-0.058 (0.093)
40-49	0.199*** (0.044)	0.009 (0.040)	0.076 (0.094)	-0.131 (0.088)
50-59	0.331*** (0.045)	0.107** (0.041)	0.219* (0.096)	-0.077 (0.091)
60-74	0.383*** (0.049)	0.387*** (0.044)	0.189* (0.095)	0.173* (0.088)
75 and more	0.513*** (0.059)	0.675*** (0.047)	0.261* (0.107)	0.425*** (0.093)
Education[a]				
Primary (ref.)				
Secondary	-0.055 (0.036)	0.003 (0.023)	-0.067 (0.036)	-0.007 (0.023)
Tertiary	-0.153*** (0.040)	0.028 (0.028)	-0.164*** (0.040)	0.020 (0.027)
Disability				
No (ref.)				
Mild	0.155 (0.080)	0.217*** (0.047)	0.156 (0.080)	0.217*** (0.047)
Moderate	0.153** (0.054)	0.214*** (0.031)	0.153** (0.054)	0.213*** (0.031)
Severe	0.291*** (0.074)	0.306*** (0.039)	0.299*** (0.074)	0.308*** (0.039)
Residence place				
Urban (ref.)				
Rural	0.040* (0.020)	-0.058*** (0.015)	-0.038 (0.020)	-0.059*** (0.015)
Children[b]				
None (ref.)				
One or two	0.264*** (0.025)	-0.347*** (0.022)	0.257*** (0.025)	-0.348*** (0.022)
Three and more	0.347*** (0.060)	-0.530*** (0.045)	0.330*** (0.060)	-0.542*** (0.045)
Main source of household income				
Employees (ref.)				
Self-employed	-0.092** (0.032)	0.026 (0.032)	-0.089** (0.032)	0.031 (0.032)
Retirees	0.230*** (0.033)	0.336*** (0.026)	0.236*** (0.033)	0.335*** (0.025)

Table 2. Continued

	Model 1		Model 2	
	Part I: Probit Model (Paying vs. Not Paying)	Part II: Generalized Linear Model (Level of Spending)	Part I: Probit Model (Paying vs. Not Paying)	Part II: Generalized Linear Model (Level of Spending)
	Coeff. (Robust Standard Error)	Coeff. (Robust Standard Error)	Coeff. (Robust Standard Error)	Coeff. (Robust Standard Error)
Pensioners	0.101 (0.054)	0.322*** (0.037)	0.106 (0.055)	0.319*** (0.037)
Farmers	0.197*** (0.051)	0.075 (0.040)	0.192*** (0.051)	0.068 (0.039)
Living on social benefits	-0.016 (0.066)	0.160** (0.055)	-0.023 (0.066)	0.158** (0.055)
Living on other non-earned sources	-0.270** (0.103)	0.225* (0.110)	-0.258* (0.103)	0.235* (0.109)
Consumption quintile				
1st (ref.)				
2nd	0.252*** (0.027)	0.359*** (0.022)	0.165 (0.127)	0.257* (0.114)
3rd	0.404*** (0.028)	0.554*** (0.022)	0.327** (0.124)	0.326** (0.118)
4th	0.522*** (0.028)	0.716*** (0.022)	0.322** (0.123)	0.417*** (0.110)
5th	0.636*** (0.030)	1.004*** (0.025)	0.301** (0.117)	0.745*** (0.114)
Age # Consumption quintile				
16-29 # 1st			(ref.)	(ref.)
16-29 # 2nd			(ref.)	(ref.)
16-29 # 3rd			(ref.)	(ref.)
16-29 # 4th			(ref.)	(ref.)
16-29 # 5th			(ref.)	(ref.)
30-39 # 1st			(ref.)	(ref.)
30-39 # 2nd			0.072 (0.144)	0.088 (0.129)
30-39 # 3rd			-0.032 (0.141)	0.181 (0.133)
30-39 # 4th			0.162 (0.140)	0.190 (0.125)
30-39 # 5th			0.253 (0.133)	0.183 (0.127)
40-49 # 1st			(ref.)	(ref.)
40-49 # 2nd			0.095 (0.139)	0.035 (0.124)
40-49 # 3rd			0.085 (0.137)	0.192 (0.128)
40-49 # 4th			0.175 (0.136)	0.300* (0.121)
40-49 # 5th			0.292* (0.130)	0.230 (0.126)
50-59 # 1st			(ref.)	(ref.)
50-59 # 2nd			0.030 (0.142)	0.100 (0.126)
50-59 # 3rd			0.073 (0.140)	0.252 (0.130)
50-59 # 4th			0.170 (0.138)	0.307* (0.121)

Table 2. Continued

	Model 1		Model 2	
	Part I: Probit Model (Paying vs. Not Paying)	Part II: Generalized Linear Model (Level of Spending)	Part I: Probit Model (Paying vs. Not Paying)	Part II: Generalized Linear Model (Level of Spending)
	Coeff. (Robust Standard Error)	Coeff. (Robust Standard Error)	Coeff. (Robust Standard Error)	Coeff. (Robust Standard Error)
50-59 # 5th			0.303* (0.132)	0.308* (0.125)
60-74 # 1st			(ref.)	(ref.)
60-74 # 2nd			0.104 (0.136)	0.166 (0.119)
60-74 # 3rd			0.103 (0.133)	0.278* (0.123)
60-74 # 4th			0.289* (0.133)	0.365** (0.115)
60-74 # 5th			0.506*** (0.129)	0.304* (0.120)
75 and more # 1st			(ref.)	(ref.)
75 and more # 2nd			0.230 (0.152)	0.167 (0.123)
75 and more # 3rd			0.305* (0.153)	0.329** (0.128)
75 and more # 4th			0.235 (0.153)	0.426*** (0.122)
75 and more # 5th			0.543*** (0.169)	0.383** (0.128)
Constant	-0.017 (0.069)	5.729*** (0.057)	0.205* (0.093)	5.958*** (0.084)
Observations	30 848	24 142	30 848	24 142
Pseudo R-squared	0.038		0.039	
Wald chi2	1063.83***		1090.73***	
Log-Pseudolikelihood	-87 655 682		-87 640 184	
AIC	6696.67		6696.12	
BIC	9 289 811		9 276 652	

Abbreviations: AIC, Akaike information criterion; BIC, Bayesian Information Criterion.
*** $P \leq .001$, ** $P \leq .01$, * $P \leq .05$.
[a] Primary education refers to levels 0-2 of the International Standard Classification (ISCED), secondary education to ISCED 3-4, and tertiary education to ISCED 5-8; [b] Number of children aged 13 and less in the household.

on household spending on medicines. Table 3 presents information on the size of the treatment and control groups, as well as their average per capita spending on medicines. The data are also broken down by years and consumption quintiles. The treatment group included 22 687 households of individuals aged 75-85, 12 847 in the pre-treatment period (years 2013-2016) and 9840 in the post-treatment years (2017-2019). The control group is composed of households of individuals aged 65-74, including 20 151 households in the pre-intervention years and 18 857 in the post-intervention period. The average annual per capita household spending on medicines in the treatment group was PLN 1282 in the pre-intervention years and decreased to PLN 1221 in the years following the program implementation. The decline was evident in households of the second and fifth consumption quintiles. In contrast, expenditure in the control group increased from PLN 930 to 969 between the two periods, with the increase observed across all quintiles. The descriptive statistics with socio-demographic factors used in the model as controlling variables are presented in Supplementary file 2.

The DID analysis conducted using the Stata 18 *didregress* command indicates that the program decreased annual per capita spending on medicines for households of people aged 75-85 by PLN 71, corresponding to 2019 US $18 and 2019 Int$42, after adjustment using the 2019 gross domestic product Purchasing Power Parity conversion factor (See Table 4). This finding is statistically significant at $P<.001$, though the level of uncertainty of the estimated value is relatively high, with the 95% confidence interval ranging from -103 to -39. The results of the parallel trends test do not allow us to reject the null hypothesis of parallel trends. Also, the graphical analysis suggests that the trends in medicine spending between the treatment and control groups before the intervention were parallel (See Supplementary file 3). The results of DID analysis performed separately for each quintile show that the program reduced spending on medicines for households in the second quintile (by PLN 94) and the fifth quintile (by PLN 173), having no significant effects on other quintiles. The parallel trend test confirmed that pre-intervention trends in spending between the groups were parallel for all quintiles except the fourth (Table 4, Supplementary file 3).

The DID analysis with the kernel propensity-score matching, performed as a robustness check, yielded comparable results with the average treatment effect of -83 ($P<.001$) for the

Table 3. Descriptive Statistics of the Sample Included in the Difference-in-Differences Analysis

	Treatment (Age 75-85) (N = 22 687)		Control (Age 65-74) (N = 39 008)	
	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention
Number of households	12 847	9840	20 151	18 857
Year 1 (2013)	3193		4542	
Year 2 (2014)	3189		4798	
Year 3 (2015)	3225		5137	
Year 4 (2016)	3240		5674	
Year 5 (2017)		3333		5868
Year 6 (2018)		3252		6306
Year 7 (2019)		3255		6683
1st quintile	2671	2426	3450	3420
2nd quintile	2975	2288	4267	4017
3rd quintile	2916	2199	4444	4134
4th quintile	2575	1763	4365	3944
5th quintile	1710	1164	3625	3342
Household annual per capita spending on medicines (PLN), mean (SD)	1281.59 (1239.15)	1221.00 (1290.43)	929.68 (1006.87)	968.84 (1067.73)
Year 1 (2013)	1328.16 (1270.14)		951.16 (1061.38)	
Year 2 (2014)	1273.55 (1226.76)		927.63 (1037.95)	
Year 3 (2015)	1262.88 (1218.49)		917.54 (952.93)	
Year 4 (2016)	1262.24 (1240.15)		925.21 (982.60)	
Year 5 (2017)		1172.18 (1236.61)		924.31 (1022.92)
Year 6 (2018)		1200.15 (1289.87)		964.29 (1042.92)
Year 7 (2019)		1291.82 (1341.28)		1012.24 (1126.22)
1st quintile	632.81 (675.21)	649.40 (688.13)	450.82 (571.63)	473.01 (572.70)
2nd quintile	1053.07 (892.85)	998.98 (901.07)	737.89 (741.94)	777.51 (777.50)
3rd quintile	1331.30 (1069.90)	1336.38 (1138.03)	939.48 (880.35)	970.04 (948.21)
4th quintile	1640.92 (1334.64)	1658.38 (1463.63)	1127.18 (1028.33)	1184.06 (1130.15)
5th quintile	2066.70 (1800.75)	1968.27 (2039.09)	1361.34 (1399.70)	1450.73 (1472.96)

Abbreviation: SD, standard deviation.

entire treatment group, -87 for the second quintile ($P<.01$), and -205 ($P<.01$) for the fifth quintile, and no significant effects for other quintiles (See Supplementary file 4).

To see the effects of the program for each year after its implementation, we performed a heterogeneous DID analysis. The results show that the program decreased spending on medicines on average by PLN 68 in 2017, 88 in 2018 and 63 in 2019, indicating that the effect was the greatest in the second year after program implementation (See Table 4).

The analysis of the program's effects on medicine spending relative to total household consumption yields comparable results (See Supplementary file 5). The program reduced the share of the household budget devoted to medicines by an average of 0.61 percentage points ($P\leq.001$), with the most significant decrease observed in the second year after the program's implementation (-0.74 percentage points) (Table S5.2, Supplementary file 5). The greatest benefits were seen among households in the second consumption quintile (-1.10 percentage points, $P\leq.001$), who also spent the highest share of their consumption on medicines in the pre-intervention period (10.1%) (Table S5.1, Supplementary file 5). Significant effects were also observed in the fifth quintile and, to a lesser extent, in the third quintile.

Discussion

The aim of this study was to analyze the level and determinants of out-of-pocket spending for pharmaceuticals in Poland and the effects of the Medicines 75+ program on this spending. The results show the growing role of pharmaceuticals over the years analyzed (2013-2021) as more households are paying for medicines, and the average spending on medicines, as well as the proportion of the household's budget devoted to medicines, have increased. Payments for medicines continue to be the primary driver of household health spending. Ability to pay and age are strong determinants of medicine expenditure, influencing both the likelihood and level of expenditure. The Medicines 75+ program was associated with a relatively small reduction in the annual per capita spending on medicines among households of people aged 75-85 (by an average of PLN 71), as well as in the share of the household budget spent on medicines (by 0.61 percentage points). However, this effect was not observed across all quintiles, suggesting that the financial benefits of the program may not have been equally distributed.

The policy aimed at reducing household financial hardship and improving access to medicines in Poland primarily relies on age as the criterion for exemption from payments, without taking households' ability to pay into account.[6,16] Our results, however, show that both factors are associated with spending on medicines, and their influence is cumulative. The widening gap in medicine expenditure between the poorest and wealthiest households in old age, which we observed in our study, suggests that the ability to pay becomes increasingly important at older ages, potentially reflecting financial barriers and unmet needs for medicines among poorer older households. The 2019 European Health Interview Survey revealed that, in Poland, 20% of people aged 75 years and older in the poorest quintile reported unmet needs for prescribed medicines due to financial reasons, the highest rate in the European Union.[13] In addition, the analyses of financial protection in Poland[7,9,24] show that although poor households spend less on health, they experience catastrophic payments more frequently. Together, these findings indicate that older adults with lower socioeconomic status remain particularly vulnerable to medicine-related financial barriers despite existing protection mechanisms. Therefore, additional measures may be needed to improve access to outpatient medicines among low-income households

Table 4. The Effects of the Medicines 75+ Program on Annual Per Capita Spending on Medicines: Results From the Difference-in-Differences Analysis

	Coeff. (Robust Standard Error)	95% Confidence Interval
DID analysis – ATET	-71.00*** (15.22)	[-102.72, -39.22]
1st quintile	-7.90 (20.05)	[-49.73, 33.92]
2nd quintile	-93.78***(22.48)	[-140.67, -46.88]
3rd quintile	-18.77 (20.12)	[-60.74, 23.19]
4th quintile	-21.97 (59.88)	[-146.86, 102.93]
5th quintile	-173.19* (62.00)	[-302.53, -43.86]
Heterogeneous DID analysis – ATET		
Year 5 (2017)	-67.56** (21.78)	[-112.98, -22.13]
Year 6 (2018)	-87.64*** (22.89)	[-135.38, -39.90]
Year 7 (2019)	-62.77* (27.95)	[-121.07, -4.46]
Parallel trends test		
F statistic, Prob > F	0.26, P = .6138	
1st quintile	0.03, P = .8620	
2nd quintile	0.18, P = .6750	
3rd quintile	0.05, P = .8219	
4th quintile	4.32, P = .0507	
5th quintile	0.37, P = .5485	
Observations (N)	61 695	

Abbreviations: DID, difference-in-differences; ATET, average treatment effect on the treated.
*** $P\leq.001$, ** $P\leq.01$, * $P\leq.05$.

and ensure that financial protection mechanisms reach those facing the greatest affordability barriers. Protection mechanisms targeted specifically at low-income individuals, such as income-related caps on co-payments, are still not commonly applied in European countries.[9] Yet, although they may pose administrative challenges, they represent a sound policy option because they have been shown to reduce the risk of catastrophic health payments and improve household financial protection.[14]

Our analysis revealed that the program of free medicines for people aged 75+, introduced in Poland at the end of 2016, had limited effectiveness in reducing out-of-pocket spending for medicines. The estimated reduction in annual per capita spending (PLN 71) corresponds to approximately 5%-6% of medicine spending in our treatment group and among households headed by individuals aged 75 and over overall. This reduction appears modest in economic terms and suggests that the program did not substantially alleviate the financial burden for older households. Furthermore, no significant effects were observed for the poorest older people, raising concerns about the program's potential to improve financial protection for those most in need. It is possible that the program affected the use of medicines, reducing unmet needs, which we did not analyze in this study. However, the European Health Interview Survey data show only a rather small decrease in the share of people aged 75 years and older reporting unmet needs for prescribed medicines due to financial reasons (from 13.5% in 2014 to 11.4% in 2019).[39]

The limited effectiveness of the program might be explained by several factors related to both its design and the characteristics of the pharmaceutical market in Poland. The program is intended to cover prescribed and publicly reimbursed medicines that are most relevant to the health of older people. The list of pharmaceuticals has been broadened over the years. However, at the end of 2019, approximately 50% of all reimbursed outpatient medicines still required co-payments.[25] Furthermore, the program does not cover OTC medicines. While we cannot determine how much older people spend on these medicines, nationwide household expenditure on OTC medicines significantly exceeds spending on prescribed medications.[21] Therefore, OTC medicines may also contribute substantially to pharmaceutical spending among older adults and may partly explain why reductions in reimbursed medicine costs do not necessarily translate into large reductions in total medicine expenditure. They might also have weakened the effects of the Medicines 75+ program in Poland if lower spending on reimbursed prescription medicines led people to spend more on OTC medicines.

The concerns over the quality, safety, and overconsumption of OTC medicines, as well as the insufficient supervision of their distribution and advertising, have been raised in the literature and public debate in Poland.[40-44] The market for OTC medicines and dietary supplements (eg, vitamins and minerals) has been rapidly growing in Poland, with an increasing number of products, some previously available only with prescription, emerging on the market.[40] This reflects a broader global trend, driven by growing consumer preferences for self-medication, the expansion of retail distribution channels, and the rising incidence of communicable diseases.[45] However, the size of the OTC market in Poland, measured in total expenditure, already exceeds the market for prescribed medicines, a pattern not observed in any other EU country for which comparable data are available (19 countries).[46] Poland also has one of the most liberal regulations for OTC medicines in Europe when it comes to pricing, distribution channels, and restrictions on purchasing.[10,47] Poor access to care, particularly specialist care, encourages self-medication in the population.[40,48] Moreover, pharmaceutical companies are employing aggressive marketing strategies, sometimes in violation of existing regulations, to increase the consumption of OTC medicines and dietary supplements, with the two products rarely being distinguished by consumers.[41,49] At the same time, producers are not interested in their OTC products being reimbursed, even though such a possibility was opened by the pharmaceutical law amendment passed in 2023, as this would result in state control and probably reduced prices and margins for producers and sellers.[50] Taken together, these observations suggest that there is scope to further reduce medicine-related financial burden by strengthening regulation of the OTC market and promoting the appropriate use of OTC medicines. Further research is needed to examine the contribution of OTC medicines and dietary supplements to household health expenditure and financial burden in order to inform the development of more effective policies.

Our study adds to the scientific evidence on the effects of protection measures accompanying patient co-payments in European countries.[51-55] Such evidence is particularly scarce and needed in Central and Eastern European countries, which face greater challenges in protecting households from high out-of-pocket payments, particularly for medicines.[6] The findings of this study may be relevant not only for Poland, but also for other countries seeking effective measures to ensure more equitable access to medicines in the context of population ageing and rising medicine costs. The results highlight the ability to pay as a relevant factor that should be considered when designing protection mechanisms. While age-based approaches can provide financial relief, complementary mechanisms that account for socioeconomic vulnerability may be needed to improve equity in access to medicines. In addition, in countries such as Poland, where OTC medicines account for a substantial share of household pharmaceutical expenditure, improving financial protection may require complementary measures addressing this component of household spending.

This study is not without limitations. To assess the effects of the policy of free medicines for older people, we used a quasi-experimental design, which itself has several limitations.[56] The selected DID analysis relies strongly on the parallel trends assumption. The tests we conducted to assess this assumption supported the presence of parallel trends in medicine spending between the overall treatment and control groups. However, when analyzing each consumption quintile separately, parallel trends were not always evident. Furthermore, we can only test trends in the pre-intervention years, assuming that these trends would have remained parallel between the two groups in the absence of the policy. This assumption may be

challenged if there are differences in the characteristics of the groups being compared, as these differences could have led to divergent trends in the subsequent years. For this reason, we also performed a DID analysis with kernel propensity-score matching, and the results did not provide evidence to question the validity of our estimations. Furthermore, our treatment group did not include the entire age range targeted by the policy, as we limited it to individuals aged up to 85 in order to keep the treatment group comparable to the control group. Lastly, we did not analyze medicine consumption or unmet needs, which could have provided additional insight into the effects of the program.

Conclusions

This study shows that household spending on medicines in Poland continues to grow and remains the largest component of household health expenditure. Older individuals are the highest spenders on medicines, allocating the largest share of both their household and health budgets to these expenses. However, the ability to pay significantly influences this spending, with wealthier individuals spending considerably more. This suggests that poorer households may face greater barriers in meeting their needs, a finding that is supported by other available evidence. The program of free medicines for individuals aged 75 and older has helped reduce household spending on pharmaceuticals, but the reduction is relatively modest given the high expenditure in this age group. Moreover, the decrease has not been experienced equally across all consumption quintiles.

Our findings suggest that Poland's policies to ensure equitable access to medicines may require further improvement, with greater focus on the poorest households. As the market for OTC medicines expands and demand for these products increases, stronger oversight of their distribution and advertising is needed. The use and spending on OTC medicines and dietary supplements, as well as unmet needs for medicines, could be the focus of future studies to provide a more comprehensive understanding of access to medicines in Poland.

Disclosure of artificial intelligence (AI) use

AI tools (ChatGPT) were used for language correction (grammar and style) throughout the manuscript.

Ethical issues

Ethics approval and consent to participate were deemed unnecessary according to applicable regulations. The study utilized fully anonymized secondary data and did not involve the collection or use of any personal or identifiable information.

Conflicts of interest

Authors declare that they have no conflicts of interest.

Authors' contributions

Conceptualization: Marzena Tambor, Milena Pavlova, and Jorge Alejandro García-Ramírez.
Data curation: Marzena Tambor and Jorge Alejandro García-Ramírez.
Formal analysis: Marzena Tambor and Milena Pavlova.
Methodology: Marzena Tambor and Milena Pavlova.
Validation: Marzena Tambor.
Writing–original draft: Marzena Tambor.
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Supplementary files

Supplementary file 1. Predicted Annual Per Capita Medicine Expenditures by Age Groups and Consumption Quintiles.
Supplementary file 2. Socio-demographic Characteristics of the Samples Included in the Difference-in-Differences Analysis.
Supplementary file 3. Graphical Analysis of Parallel Trends in Annual Per Capita Spending on Medicines.
Supplementary file 4. The Difference-in-Differences Analysis With Kernel Propensity Score Matching: Annual Per Capita Spending on Medicines.
Supplementary file 5. The Difference-in-Differences Analysis of the Share of Household Consumption Spent on Medicines.

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