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Analysing the effects of healthcare payment policies in conjunction with tax-benefit policies: A microsimulation study with real-world healthcare data

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Keywords: Microsimulation, health systems, patient fees and charges, pharmaceuticals, affordability, poverty, social assistance

Abstract

In Europe, many people experience financial hardship due to healthcare payments despite (near-)universal healthcare systems. In Finland, as well as in many other countries, austerity has further widened the gaps in coverage through increases in patient payments. However, the distributional analyses of austerity have concentrated on the effects of tax-benefit policies alone. We present a method for examining how health payment policies and tax-benefit policies affect household incomes in conjunction, to evaluate the total effect of implemented and planned policies. We linked the national tax-benefit microsimulation model, *SISU*, and its nationally representative 15% sample of households in Finland in 2017 (n=826,001) with administrative real-world healthcare data (Finnish Institute for Health and Welfare Care Register for Health Care, *HILMO*; and Social Insurance Institution of Finland, *Kela*, National Health Insurance reimbursement registers). As a case example, we analysed the effects on relative poverty risk and poverty gap during two government terms. We found that between 2011 and 2015, tax-benefit policies contributed to decreasing relative poverty, and health payment changes had no measurable effects. In 2015–2019, the poverty risk rate and average gap increased due to tax-benefit policies, and health payment changes strengthened the effects by 10% to 20%. Health payments, and their increases, mainly deteriorated the position of older adults; nevertheless, their poverty risk mostly remained below the population average. Social assistance had an important buffering effect among under 65-year-old population. Health payment increases thus exacerbated the effects of austerity on the oldest age-groups, who, based on tax-benefit analyses alone, were relatively well protected.

Introduction

Direct health payments (also known as out-of-pocket costs, cost sharing, user charges, co-payments, etc.) refer to costs that users are obliged to pay directly for healthcare at the time of use. When health payments are high in relation to people's ability to pay, they can cause financial hardship to those who use healthcare goods or services and/or hamper access to healthcare [1,2]. Nevertheless, all health systems use direct payments in some form, and their negative effects are dependent on the allocation and level of payments, as well as the protective mechanisms in place.

The global financial crisis hit many European countries in 2008, and was followed by varying responses, many of which affected household incomes either through discretionary changes of tax-benefit policies or through automatic stabilisers [3,4]. In Finland, as in many other European countries, increases in health payments are a common feature of austerity [5,6]. Problems accessing healthcare also increased in Europe; however, these effects could be attributed to several causes besides health payments, including the effects of rising unemployment on disposable incomes and the decrease in available services due to direct cuts on spending [7–9].

There have been many distributional analyses of policy responses during the financial crisis (e.g. [10–13]), but they exclusively concentrate on tax-benefit policies and disregard health payments. Healthcare, and other in-kind transfers are typically excluded from these studies owing to methodological issues [14,15]. Accordingly, previous studies have noted that coinciding changes in patient payment policies might have negatively affected households' economic situation, but they were unable to measure them [10,16,17]. Other studies, mostly conducted in non-European settings, have analysed the economic effects of health payments and health insurance policies on households, individuals, and the insured; however, they mainly relied on surveys, or synthetic or imputed data on healthcare use [18–29].

In this study, we demonstrate a holistic approach to analysing the distributional effects of policy responses by combining these two policy spheres. We used tax-benefit

76 microsimulation, which allows isolating the effects of policies from the effects of population
77 characteristics and macroeconomic changes [30]. We supplemented the model with a health
78 payment module relying entirely on detailed real-world microdata to avoid bias related to
79 attrition, small samples, recalling errors, and short collection periods and to encompass the
80 full spectrum of cases with detailed information on the types of health-related services and
81 goods consumed by each individual. We focussed on at-risk-of-poverty indicators, which are
82 income-based measures of relative poverty commonly used in high-income countries [31].
83 In health policy research, the most-used metrics of financial protection are variations
84 of catastrophic or impoverishing health spending [32–36]. Access problems are often
85 addressed using subjective measures, such as unmet needs or perceived economic burden
86 [37,38]. The World Health Organisation currently recommends using both approaches for
87 European analyses [2]. However, these indicators may lack the sensitivity needed to identify
88 context-specific mechanisms behind access problems [34,39]. Financial protection is typically
89 measured using survey data, which lacks information on the specific care used and the unmet
90 needs; for example, whether problems were related to the payments for covered care being
91 too high or the individual needing or wanting care that was not covered at all. Moreover, all
92 direct health payments, including discretionary, complementary and alternative treatments,
93 are given the same value to put health systems responsible for all types of utilisation [2].
94 Finland, like many other European high-income countries, universally offers a wider
95 range of health care services and goods than deemed essential in the global context.
96 Nevertheless, all systems need to make prioritisation decisions, and for policymakers who
97 balance between equity and sustainability, patients' access to treatments that is deemed the
98 standard of care is of utmost importance. Therefore, we focussed on one specific mechanism
99 behind access problems, namely patients' payments for healthcare goods and services that
100 are covered in the benefit package, also referred to as the *depth* dimension of coverage
101 [40,41]. Acknowledging that health systems need to account for all gaps in coverage to provide
102 strong financial protection, our approach was intended to be a supplement to the repertoire of
103 available methods rather than a replacement.

In addition to the methodological contribution, this study provides new evidence on the effects of health payment reforms in the context of a comprehensive social security system. Countries vary in their emphasis on providing financial security through transfers in cash and in kind [42], and generous cash benefits seem to buffer the negative effects of increases in patients' payments to healthcare access [43,44]. Although the analyses are done in a Finnish setting, the mechanisms of financial protection share similarities across systems. High-income countries are continuously reforming their health systems, and accumulated evidence from distinct reforms can form a knowledge base to help in planning better policies in the future [45].

Healthcare settings in Finland

Finland has a universal healthcare system, with public, tax-financed healthcare services organised by regional units (municipalities). Public healthcare offers comprehensive services, including preventive, primary, secondary, and tertiary care, as well as dental care to all residents. National Health Insurance (NHI), financed by taxes and tax-like insurance contributions, reimburses outpatient medicines and clinical nutrients, as well as health-related travel costs, on universal grounds.

The Finnish system is unique in that primary healthcare is provided in parallel with the public system through two other systems that also receive public funding [46,47]. First, the majority of employed persons receive their primary medical care through employer-organised occupational healthcare financed by employers and tax-like insurance contributions through NHI. Second, the NHI universally offers direct reimbursements for individuals who use private healthcare and private dental services.

Finnish healthcare system, and healthcare payment policies have been described in more detail in recent reports [47,48].

Aims of the study

In this study, we provided an example of how the distributional analysis of tax-benefit policies can be extended to cover the interplay between tax-benefit policies and health payments. We developed a model that can be used in *ex ante* and *ex post* analyses and can identify patient and population groups at risk for cumulative negative effects. The method isolates the effects of health payments from the effects of tax-benefit legislation, and demographic and macro-economic factors, e.g., ageing and unemployment, thus providing specific information to guide policymaking and to evaluate the effects of implemented policies.

As a case study, we estimated the effects of health payment policies between 2011 and 2019, during which the consequences of the global financial crisis led to the implementation of austerity policies increasing health payments by two consecutive Finnish governments: Prime Ministers Katainen/Stubb (2011–2015, mixed coalition government) and Prime Minister Sipilä (2015–2019, centre-right government). Both governments also implemented various other tax-benefit policies that may have affected households' ability to pay [17,49]. We asked how accounting for health payments impacts at-risk-of poverty rates, which population groups are most affected and how means-tested social assistance buffers the effect. In terms of these outcomes, we tested whether the effects of health payments on poverty risk indicators strengthen or weaken over time.

Materials and methods

Health payments

We focussed on the payments users pay directly for received care, services or products belonging to the range of healthcare services financed, at least partly, from public funds (public municipal healthcare and costs eligible for Kela reimbursements). The term *patient charges* refers to costs incurred in public healthcare, and *co-payments* for the patient's contribution towards the costs reimbursed by the NHI (prescription medicines, private services and travel costs). *Health payments* refer to patient charges and co-payments combined. The

157 types of health payments examined in this study, and their changes between 2011 and 2019,

158 are presented in Table 1.

159

160 **Table 1. Payments (user charges and co-payments) for healthcare goods and services**

161 **financed at least partly from public funds in Finland in 2017, with policy changes and**

162 **adjustments between 2011 and 2019.**

Healthcare good or service		**Payment type**	**Payment in 2017**	**Legislative changes¶**	**Index / tariff adjustments**
Public health care services (Act on social and health care client fees & Government Decree)					
Public outpatient services	Outpatient doctor	Fixed fee	€20.90 max 3 times or €41.70 / year*	2015(+), 2016(+)	Biennial
	Night/weekend visit	Fixed fee	€28.70 / visit*	2015(+), 2016(+)	Biennial
	Physiotherapy	Fixed fee	€11.50 / visit	2015(+), 2016(+)	Biennial
	Serial treatments	Fixed fee	€11.50 / visit max 45 times/year	2015(+), 2016(+)	Biennial
	Outpatient specialist	Fixed fee	€41.70 / visit*	2015(+), 2016(+)	Biennial
	Ambulatory surgery	Fixed fee	€136.80 / visit*	2015(+), 2016(+)	Biennial
Public inpatient services (excl. long-term)	Short term inpatient care (max 7 days)	Fixed fee	€49.50 or €22.80 /day*	2015(+), 2016(+)	Biennial
	Day patient	Fixed fee	€22.80*	2015(+), 2016(+)	Biennial
	Inpatient rehabilitation	Fixed fee	€17.10*	2015(+), 2016(+)	Biennial
	Outpatient & inpatient services (excl. dental)	Annual ceiling	€691.00 / year / person incl. children		Biennial
Public dental services	Oral hygienist/ dentist/specialist	Fixed fee	€10.30/€13.30/€19.40*	2016(+)	Biennial
	Procedures, imaging, prosthetics	Based on tariff	€8.50–€225.50*	2016(+)	Biennial
	Material costs	Realised costs			
National Health Insurance reimbursement policies (Health Insurance Act & Government Decrees)					
Prescription medicines	Annual deductible	Deductible	Max €50 / year*	2016 (+)	
	Basic reimbursement	%-based	60% of retail price	2013(+), 2016(-)	
	Disease-based special reimbursement (lower)	%-based	35% or retail price	2013(+)	
	Disease-based special reimbursement (higher)	Fixed fee	max €4.50 / item / max 3 months' supply	2016(+), 2017(+)	
	Reimbursable medicines	Annual ceiling	€605.13 / year / person	2013(-), 2014(-), 2019(-)	Annual
	Charge after exceeding annual ceiling	Fixed fee	max €2.50 / item / max 3 months' supply	2016(+)	
Travel costs	Co-payment/trip	Fixed fee	max €25 or €50/one-way trip	2013(+), 2015(+), 2016(+), 2018(+)	
	Travel costs	Annual ceiling	€300 / year / person	2013(+), 2015(+), 2016(+)	
Private health care services	Doctor fees	Cap	Costs exceeding tariff	2013(0), 2016(+)	2013, 2014, 2015
	Examination and treatment	Cap	Costs exceeding tariff	2013(+), 2015(+), 2016(+)	2011, 2013, 2014, 2015
	Examination	Cap	Costs exceeding tariff	2013(0), 2015(+), 2016(+)	2013, 2014, 2015

Private dental services	Dentist fees	Cap	Costs exceeding tariff	2013(0), 2015(+) 2016(+)	2013, 2014, 2015
	Treatment	Cap	Costs exceeding tariff	2013(0), 2015(+) 2016(+)	2013, 2014, 2015

* Children under 18 years exempt (for medicines, exemption until the end of the year when the child turns 18)

¶ Main effect of the change on patient's share of costs: increase (+), decrease (-), neutral (0)

In public healthcare, national legislation defines the services that municipalities must offer free of charge and services that are subject to patient charges, and the maximum charges. In this study, we exclude social services, such as home care, including domestic services and home nursing, as well as income-based charges for long-term institutional care, since these fees also incorporate costs related to housing and living.

The NHI universally reimburses outpatient prescription medicines on the national positive list. Travel cost reimbursements apply to expenses of trips made to public or private healthcare units (e.g. car, public transport, patient transport vehicle, emergency patient transport by ambulance/helicopter). Reimbursements for private services (e.g. GP, dentist, and medical specialist visits, treatments, imaging, and dental care) are capped by procedure-specific tariffs, which define the maximum public payer share, after which the patient pays the excess fully as co-payment with no annual ceiling.

In addition, payments for prescribed medicines, public health, and public dental care can be covered as part of social assistance, a last-resort cash benefit. If a household's net income after specific costs, such as housing and health payments, is less than the basic amount, the difference up to the basic amount is paid as social assistance. The basic (monetary) amount, expected to cover basic everyday needs, is dependent on household size (€487.89 per month for persons living alone in 2017).

Policy changes affecting different types of healthcare payments are listed in Table 1. The maximum fees for public services increased twice in 2015 and 2016. Medicine reimbursements were targeted with savings reforms in 2013, 2016, and 2017 and travel cost

reimbursements in 2013, 2015, 2016, and 2018. Reimbursements for private healthcare services were cut in 2013, 2015, and 2016. The absence of reforms and adjustments has also affected payments, for example, the long-term decision not to increase or adjust reimbursements for private healthcare services has led to the deterioration of their real value.

Healthcare goods and services that are funded 100% from private sources are outside the scope of this analysis, as are payments and premiums related to private voluntary health insurance. In 2017, 25% of the total health expenditure was financed privately, with the largest part coming directly from households (19%). Voluntary health insurance accounted for 3%, and employers for 2%, of health expenditure. The largest healthcare functions that were financed 100% from private sources (almost entirely directly by households), were eyeglasses and other products for vision, over-the-counter medicines, and non-covered prescription medicines [50].

Tax-benefit microsimulation model and data

The national microsimulation model SISU is maintained by Statistics Finland and is described in detail elsewhere [51]. The SISU model includes all main legislative sections (earnings and capital income taxation and social contributions, property taxation, sickness allowance, unemployment benefits, national pensions, disability benefits, family benefits, student benefits, housing allowances, and social assistance).

In the current study, we used SISU micro data for 2017, which includes detailed register-based information of a representative 15% cross-sectional sample of the population (N= 826,001 persons).

Health payment data

Data on public healthcare utilisation were derived from the national care registers (HILMO) maintained by the Finnish Institute for Health and Welfare (THL), which collects national data on outpatient visits and inpatient care based on care notifications collected from

public healthcare units. Health payments are simulated based on event-level visit information and individual characteristics. We considered that some municipalities charge lower-than-maximum payments by using municipal-level payment information for 2017. Data on NHI reimbursements and respective health payments for reimbursed medicines, health-related travel costs, and private health care services were derived from the Kela registers. Results and development reports of the early versions of the health payment simulation tool have been published as working papers [52]. A sub-model for medicine reimbursements was developed based on earlier models [53].

In the linked data, 79% of individuals and 92% of households had made at least some health payments (Table 2). Of the individuals, 47% had paid for public healthcare services and 15% had paid for public dental services. Thirty-four percent had paid for NHI reimbursed private health care services, 18% for private dental services, 68% for reimbursed prescription medicines, and 10% for health-related travel costs. In the lowest-income quintile, payments for public health and dental care were more prevalent than among individuals in the highest-income quintiles, who, in turn, had more often paid for private services.

Table 2. Prevalence of health payments (% of individuals) in the 2017 data, by healthcare type and income quintile.

	Lowest income quintile	Highest income quintile	Total
Public health care	51	40	47
Private health care	20	50	34
Public dental care	16	11	15
Private dental care	8	32	18
Prescription medicines	63	72	68
Travel costs	15	6	10
All payments	73	85	79

Price adjustments and data

To account for the changes in the real value of benefits and tax parameters even in the absence of legislative changes, all monetary parameters are adjusted for inflation using

the consumer price index (CPI). However, policies also affect health payments through price regulation (or the lack thereof) when the patient pays a share of the retail price. To test and account for trends deviating from the CPI, we used item-specific price indices (IPI) for medicines, private healthcare, and travel costs.

For ambulance and taxi services, we adjusted prices (IPI) based on the decrees regulating reimbursement tariffs. After 2018, a joint competitive tender by Kela set the reimbursed taxi prices. The CPI by commodity group for gasoline was used to adjust for the price of reimbursed travel costs from using a personal car.

For private healthcare and private dental care, we used the Kela public statistics and calculated procedure-specific price trends for the 40 most common procedures. For the other procedures, we used the average price trend of these 40 procedures.

For medicine prices, we used aggregated sales statistics obtained from the Finnish Medicines Agency Fimea, classified based on the Anatomical Therapeutic Chemical (ATC) system and the Defined Daily Doses (DDD) as measuring unit for pharmaceutical consumption [54]. To account for both price trends and therapeutic changes [55], we calculated price indices specific to the therapeutic class (ATC 3-digit level) as average wholesale price per DDD, for sales of products with calculable DDDs. We excluded classes with marked shares (over 30%) of sales derived from products with no assigned DDDs or over-the-counter products and classes that had less than 50 reimbursement recipients in any of the years between 2010 and 2019 (based on national reimbursement statistics). After these exclusions, we calculated class-specific price indices for 40 ATC classes, which represented over 80% of the total costs and of the co-payment expenditures of all reimbursed medicine purchases in 2017. For products in these classes, we used the class-specific price indices, and for other products, we used the volume-weighted (based on DDDs) mean index of these 40 classes.

Outcomes: Relative poverty risk and poverty gap

We used standard social indicators [56–58]: relative at-risk-of-poverty rate (hereafter, poverty risk rate) and relative median at-risk-of-poverty gap (hereafter, poverty gap). The poverty risk rate is the share of people having an equivalised disposable income after social transfers below the threshold, which is tied to the national median equivalised disposable income after social transfers. As thresholds, we used 60% and 50% of the national median. To measure the further impoverishing effects on people already below the threshold, we measured the poverty gap, that is, the median equivalised disposable income of people below the threshold as a percentage of the threshold.

Microsimulation analyses

We calculated the effects based on fixed population structure, healthcare utilisation, and household market incomes from 2017, varying the taxation and benefit legislation to represent the years 2011–2019. Similar tax-benefit simulations, based on the Shorrocks-Shapley decomposition method, are commonly used to measure the relative effects of legislative and policy changes on relative poverty [30,58].

The SISU model simulates the income items in three steps: 1) non-means-tested social benefits, 2) taxes and social contributions, and 3) housing benefits and social assistance. For social assistance, eligibility was calculated after applying all other tax-benefit legislation. The model assumes full take-up of means-tested benefits although non-take-up is relatively common [59].

After the simulation, household disposable income is adjusted for household size using the modified OECD (Organisation for Economic Co-operation and Development) equivalence scale [60]. This income concept, representing income after cash transfers, forms the baseline scenario for our estimates. To estimate the effect of health payments on poverty, we calculated the indicators using an alternative income concept, where we deducted household members' health payments (accounting for prices by IPI) from household disposable income, and accounted for health payments when simulating social assistance (buffering effect of social

assistance). The difference between these indicators represented the total effect of health payments.

To examine the effect of price developments that differed from the CPI, we produced alternative simulation scenarios in which we calculated the indicators by adjusting healthcare prices using the CPI. To estimate the buffering effect of social assistance, that is, the difference between social assistance paid before and after health payments, we produced simulation scenarios in which we calculated the indicators without accounting for health payments when simulating social assistance.

All results were extrapolated to the population level using the SISU model sample weights. Simulations were carried out based on the tax-benefit and health payment policies in December of the given policy year. Simulation models were programmed, and simulations were conducted using SAS Enterprise Guide (version 7.15, SAS Institute, Cary, NC).

Ethics statement

According to the General Data Protection Regulation of the EU (GDPR) and the Finnish national legislation, the secondary use of administrative register data is permitted for specific purposes, including scientific research, without acquiring informed consent. An ethical review statement is also not required for studies based entirely on administrative register data.

Appropriate permissions to use data were obtained from the relevant authorities: Statistics Finland (TK-53-725-19), Finnish Institute for Health and Welfare (THL/2258/5.05.00/2018) and Social Insurance Institution (146/522/2019). In compliance with legislation and regulations protecting data security, all data linkages requiring direct identification of individuals, were conducted by Statistics Finland. The researchers involved in this study, with permission to use data, had access to pseudonymised data in the secure remote access system of Statistics Finland (Fiona).

The SISU model code is open access and is freely available from Statistics Finland [51]. However, the SISU microdata used in this study are subject to permissions available only

via Statistics Finland, and healthcare data are considered sensitive and thus strictly regulated by national and EU legislation and regulation on data protection; thus, we cannot share our data openly.

Results

Health payments and price adjustments

The mean annual sum paid for healthcare was €491 per paying user in 2017 (Table 3). In terms of the types of healthcare, the mean annual payments per paying user were highest for private services (€300 for private dental and €287 for private health services in 2017) and lowest for travel costs (€99 in 2017). The reforms between 2011 and 2019 increased the average payments for all types of healthcare in real terms. Overall, mean payments grew by 21% between 2011 and 2019, when prices were adjusted by CPI, and slightly less (19%) when observed prices were used for medicines, travel costs, and private services. The growth was slightly faster during the latter government period (11% between 2015 and 2019) than during the prior period (8% between 2011 and 2015).

Table 3. Simulated mean annual health payments per user in 2011–2019, and change between 2011–2015 and 2015–2019, by healthcare type.

Healthcare type	Price index*	Mean payment / recipient (2017 euros)									2011-2015	2015-2019
		2011	2012	2013	2014	2015	2016	2017	2018	2019		
Public healthcare		143	140	138	145	157	188	186	183	181	10 %	16 %
Private healthcare	IPI	243	242	250	253	257	280	287	291	293	6 %	14 %
	CPI	259	262	267	268	268	287	287	288	286	4 %	7 %
Public dental care		107	104	102	108	108	133	133	130	128	2 %	19 %
Private dental care	IPI	237	237	238	243	268	294	300	303	306	13 %	14 %
	CPI	256	258	257	258	279	302	300	301	301	9 %	8 %
Prescription medicines	IPI	149	142	154	153	155	173	173	165	157	4 %	1 %
	CPI	138	138	152	152	152	168	173	173	170	10 %	12 %
Travel costs	IPI	48	47	69	68	76	99	99	95	94	59 %	24 %
	CPI	46	45	67	67	76	100	99	95	94	64 %	24 %
All payments	IPI	399	390	405	412	429	487	491	483	476	8 %	11 %
	CPI	400	399	415	421	434	488	491	487	483	8 %	11 %

Simulations were conducted by using 2017 data.

*For medicines, private services, and travel costs, results were simulated by using alternative price adjustments: Consumer Price Index (CPI) and item-specific prices indices (IPI).

In terms of public health and public dental services, for which patient charges are not directly affected by prices, health payments grew more rapidly during the latter government period than during the prior period. In terms of travel costs, the mean co-payment expenditures were lower than those for other types of healthcare; however, their relative growth was highest, as they doubled between 2011 and 2019. The growth was more rapid during the prior period than the latter period, regardless of the price adjustment method.

In terms of private services and prescription medicines, a comparison of mean co-payment expenditures between simulations adjusting for IPI and CPI revealed the effects of price regulation. When using observed prices (IPI), medicine co-payment expenditures seemed to exhibit a decreasing trend apart from the years when co-payment increases were implemented, which can be attributed to the effects of ongoing regulation, price competition, and multiple policies targeting prices. Decreasing prices counterbalanced the effects of co-payment increases, leading to a slower growth rate in the mean co-payment expenditure than would have been expected based on the CPI (5% vs 23% between 2011 and 2019). Co-payment expenditure growth was more rapid during the prior government period than the latter when using the IPI, whereas assuming that prices followed the CPI suggested the opposite.

Conversely, observed prices grew notably faster than would have been expected based on the CPI for private healthcare services (21% vs. 10% between 2011 and 2019) and private dental services (29% vs. 18% between 2011 and 2019), reflecting a lack of price regulation for these services. Co-payments for private health services grew faster during the latter government period regardless of the price adjustment method. For private dental services, co-payment growth was slightly faster during the prior period when using observed prices, whereas when the CPI was used, it seemed slightly faster during the latter period.

Overall, growth in mean payments during each government period was relatively similar, regardless of the price adjustment method used. However, at the individual level, the effects of prices varied depending on the mix of healthcare that each individual used. For the results to follow, we used the IPI to adjust for prices of private dental and health services, medicines, and travel costs.

Effects of health payment policies on poverty risk rate and poverty gap

Table 4 presents the effects of health payments on the poverty risk rate (60% of the population median) and the poverty gap. We examined the entire population, and older adults (over 64 years), because the effects of health payments are strongly skewed towards the older age groups.

Table 4. Poverty risk rates and gaps in 2011–2019 simulated with tax-benefit and health payment legislations, and decomposition of the effects of health payments on social assistance.

		2011	2012	2013	2014	2015	2016	2017	2018	2019	2011-2015*	2015-2019*
Poverty risk rate (60% of the population median)												
All	Rate after tax-benefit legislation, %	15.3	14.2	13.8	13.7	12.8	12.9	13.5	13.6	13.7	-2.5	0.9
	Rate after tax-benefit legislation & health payments, %	15.6	14.4	13.9	13.9	13.0	13.2	13.8	13.9	14.0	-2.6	1.0
	Total effect of health payments & prices incl. SA, ppts	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.0	0.1
	Effect of health payment policies & prices (IPI), ppts	0.4	0.4	0.4	0.4	0.5	0.6	0.6	0.5	0.5	0.0	0.1
	Effect of social assistance (SA), ppts	-0.2	-0.2	-0.3	-0.3	-0.2	-0.3	-0.2	-0.2	-0.2	0.0	0.0
≥65 years	Rate after tax-benefit legislation, %	13.3	12.6	12.1	12.1	11.5	11.8	12.5	12.5	12.8	-1.8	1.3
	Rate after tax-benefit legislation & health payments, %	15.3	14.4	13.9	13.9	13.4	14.1	14.8	14.7	15.0	-1.8	1.5
	Total effect of health payments & prices incl. SA, ppts	1.9	1.8	1.9	1.9	1.9	2.3	2.3	2.2	2.2	0.0	0.3
	Effect of health payment policies & prices (IPI), ppts	1.9	1.8	1.8	1.8	1.9	2.2	2.3	2.2	2.1	0.0	0.2
	Effect of social assistance (SA), ppts	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
Poverty gap (60% of the population median)												
All	Gap after tax-benefit legislation, %	15.8	14.9	14.4	14.6	14.6	14.7	15.3	15.3	15.3	-1.2	0.7
	Gap after tax-benefit legislation & health payments, %	15.7	14.8	14.4	14.6	14.6	14.7	15.3	15.3	15.3	-1.2	0.8
	Total effect of health payments & prices incl. SA, ppts	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
	Effect of health payment policies & prices (IPI), ppts	0.4	0.3	0.4	0.4	0.3	0.4	0.4	0.4	0.5	-0.1	0.1
	Effect of social assistance (SA), ppts	-0.5	-0.4	-0.4	-0.4	-0.3	-0.4	-0.4	-0.4	-0.4	0.1	-0.1
≥65 years	Gap after tax-benefit legislation, %	10.2	9.8	9.5	9.5	9.4	9.2	9.9	9.8	10.0	-0.8	0.6
	Gap after tax-benefit legislation & health payments, %	11.3	10.9	10.5	10.6	10.5	10.7	11.2	11.1	11.3	-0.8	0.8
	Total effect of health payments & prices incl. SA, ppts	1.1	1.1	1.1	1.1	1.1	1.5	1.3	1.3	1.3	0.0	0.2
	Effect of health payment policies & prices (IPI), ppts	1.1	1.0	1.0	1.1	1.0	1.5	1.3	1.3	1.3	0.0	0.2
	Effect of social assistance (SA), ppts	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

All simulations were conducted using 2017 data. Prices for medicines, private services, and travel costs were adjusted by IPI.

*Change in percentage points

In the general population, tax-benefit policies reduced the poverty risk rate by 1.7 percentage points, from 15.3% in 2011 to 13.7% in 2019. The average poverty gap decreased by 0.5 percentage points, from 15.8% in 2011 to 15.3% in 2019.

For older adults, before accounting for health payments, the poverty risk rate was 1–2 percentage points lower than for the general population, and the poverty gap was 5–6 percentage points lower. Between 2011 and 2019, tax-benefit policies decreased the poverty risk rate for older adults, albeit more mildly than for the general population, by 0.5 percentage points, and poverty gap decreased by 0.2 percentage points, that is, from 13.3% poverty risk rate and 10.2% poverty gap in 2011.

Health payments and the respective buffering effect of social assistance (assuming full take-up) increased the poverty risk rate by 0.2 to 0.3 percentage points annually for the general population, and by 1.8 to 2.3 percentage points for older adults, thus pushing their poverty risk rate close to the population average, and after 2015, slightly above it.

In terms of the poverty gap, health payments and the respective buffering effect of social assistance had almost no effect on the general population. For older adults, deducting health payments increased their poverty gap (i.e. deepened poverty) by 1.1 to 1.5 percentage points annually. Nevertheless, the poverty gap of older adults remained approximately 4 percentage points lower than that of the general population, even after accounting for health payments.

Comparison of the government periods

During the first government period of 2011–2015, tax-benefit changes had a decreasing effect on the poverty risk rate and poverty gap (Table 4): in the general population, the poverty risk rate decreased by 2.5 percentage points and the poverty gap decreased by 1.2 percentage points. The effect of health payments on the poverty risk rate remained relatively constant, and the poverty gap slightly increased in the general population but remained constant for older individuals.

During the second government period of 2015–2019, both the poverty risk rate and the poverty gap increased. In the general population, the poverty risk rate increased by 1.0 percentage point and the poverty gap increased by 0.8 percentage point because of tax-benefit and health payment changes combined, and approximately one-tenth (0.1 percentage point for the rate and the gap) of the increase was due to health payment changes. Among older adults, the poverty risk rate increased by 1.5 percentage points and the poverty gap increased by 0.8 percentage point during the second government period because of tax-benefit and health payment changes combined. Approximately one-sixth (0.3 percentage point) of the increase in the rate and a quarter (0.2 percentage point) of the increase in the gap was due to health payment changes.

Thus, for both the rate and the gap, the effect of health payments slightly increased over time, particularly in 2016 and 2017, when multiple policies that directly increased payments were implemented. In the general population, the change due to health payments was relatively small; however, for older adults, health payment changes were an important contributor.

Buffering effect of social assistance

We also examined the extent to which health payments would increase the poverty risk rate and gap if social assistance would not buffer the effects, that is, if the calculation of social assistance did not account for health payments.

In the general population, the effect of health payments on the poverty risk rate was approximately two times larger (0.4 to 0.6 percentage point) for all years without the buffering effect of social assistance (Table 4). In terms of the poverty gap, the buffering effect of social assistance (0.4 percentage point) largely neutralised the effect of payments. This is because when health payments were deducted from household incomes, some households who were not eligible for social assistance, became eligible, and for others who were already eligible, social assistance compensated most of the health payments.

For older adults, social assistance had no buffering effect. This is attributed to their relatively low poverty gap, meaning that older adults seldom had a low income to qualify for social assistance, even after deducting health payments. The at-risk-of poverty threshold set at 60% of the population median was considerably higher than the income of households eligible for social assistance.

It should be noted that accounting for health payments also decreases the median income and, thus, the relative poverty risk threshold. Consequently, the poverty gap of population groups that are less affected by health payments is reduced. In addition, as the threshold moves downwards, some are lifted above the threshold and thus seemingly out of poverty. Further, those who fall below tend to end up relatively close to the threshold, which may decrease the average relative poverty gap.

According to the simulation, the buffering effect of social assistance weakened slightly from the year 2015 onwards. This is due to a comprehensive reform of housing benefits that substantially reduced the simulated eligibility for social assistance. Before accounting for health payments, the simulated share of households eligible for social assistance was approximately 10%–11% in 2011–2014 and 9% in 2015–2019. Accounting for health payments increased the simulated share of households eligible for social assistance by 0.8 to 0.9 percentage points annually, that is, approximately 22,000–26,000 households.

Population subgroups and at-risk-of poverty thresholds

Table 5 shows the effects of health payments on the poverty risk rate in more detail, using a stricter poverty risk rate threshold (50% of the population median), and distinguishing between further age groups. From the perspective of policies targeted at alleviating poverty, it is of interest to examine the working-age population stratified by their attachment to the labour market. The results of the general population and older adults in relation to the 60% population median threshold are presented in Table 4; thus, they are not repeated in Table 5.

Table 5. Simulated poverty risk rate in 2011–2019 after tax-benefit legislation and health payments, and the effect of health payments, by population subgroup.

		2011	2012	2013	2014	2015	2016	2017	2018	2019	2011-2015[&]	2015-2019[&]
Poverty risk rate (60% of population median)[¶]												
<18 yrs	Rate after tax-benefit legislation & health payments, %	14.5	12.9	12.2	12.3	11.5	11.6	12.0	12.2	12.3	-3.0	0.8
	Total effect of health payments, ppts	-0.5	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6	-0.1	0.0
18-64 yrs at work*	Rate after tax-benefit legislation & health payments, %	4.2	3.8	3.6	3.6	3.0	3.0	3.1	3.2	3.2	-1.2	0.2
	Total effect of health payments, ppts	-0.1	-0.1	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0
18-64 yrs not at work*	Rate after tax-benefit legislation & health payments, %	40.2	37.9	36.7	36.6	34.5	34.7	36.5	36.6	36.7	-5.7	2.2
	Total effect of health payments, ppts	0.0	-0.1	-0.3	-0.3	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	0.1
Poverty risk rate (50% of population median)												
All	Rate after tax-benefit legislation & health payments, %	7.4	6.5	6.1	6.2	5.8	5.9	6.4	6.4	6.5	-1.6	0.7
	Total effect of health payments, ppts	0.1	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.1	0.0	0.0
≥65 yrs	Rate after tax-benefit legislation & health payments, %	4.8	4.3	4.0	4.0	3.8	4.2	4.7	4.6	4.7	-1.0	1.0
	Total effect of health payments, ppts	1.1	1.0	1.0	1.0	1.0	1.2	1.4	1.3	1.3	-0.1	0.3
<18 yrs	Rate after tax-benefit legislation & health payments, %	6.1	5.1	4.7	4.8	4.5	4.6	4.9	5.0	5.0	-1.6	0.5
	Total effect of health payments, ppts	-0.3	-0.4	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	0.1	-0.1
18-64 yrs at work*	Rate after tax-benefit legislation & health payments, %	1.7	1.4	1.4	1.4	1.2	1.2	1.3	1.3	1.3	-0.5	0.1
	Total effect of health payments, ppts	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0
18-64 yrs not at work*	Rate after tax-benefit legislation & health payments, %	23.3	20.7	19.5	19.8	18.7	18.8	20.5	20.6	20.7	-4.6	2.0
	Total effect of health payments, ppts	-0.2	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	0.1	0.0

All simulations were conducted using 2017 data. Prices for medicines, private services, and travel costs were adjusted by IPI.

[¶] Poverty risk rate 60% for all and for ≥65-year-olds, see Table 3.

* At work/not at work = with and without labour market attachment in long term (one year).

[&] Change in percentage points

Older adults were notably better off in relation to the 50% population median threshold than to the 60% threshold, meaning that experiencing deep poverty was rare among them, both before and after accounting for health payments. Among younger population subgroups, poverty risk was low for those with labour market attachment; thus, mainly working-age adults outside the labour market in the long term were at risk of deeper poverty. For children, who predominantly live in households with working-age adults with and without labour market attachment, the poverty risk rate was positioned between these two subgroups of working-age adults. In relation to each other, the position of the subgroups remained largely similar throughout the examined period.

Apart from older adults, health payments had only a minor effect on the poverty risk rate in other population subgroups. As health payments are skewed towards the older population and the buffering effects of social assistance for the younger age groups, accounting for health payments mainly deteriorated the position of older adults and improved the position of other population subgroups in relation to at-risk-of-poverty thresholds.

For adults aged 18 to 64 years with labour market attachment, the poverty risk rate remained at a low level throughout the period. Their poverty risk rate decreased during the first period and increased slightly during the second period due to tax-benefit changes. Accounting for health payments improved their relative position only slightly, and the effect of health payments remained constant over time during both government periods.

For adults aged 18 to 64 years without labour market attachment, the poverty risk rate was relatively high, although it decreased during the first government period and increased slightly during the second period. Accounting for health payments mainly improved the position of this population subgroup; however, this improvement decreased over time, which is likely due to the combined effect of increasing payment expenditures and decreased buffering effect of social assistance, due to increases in other benefits.

With regard to children, accounting for health payments only improved their relative situation, possibly because health payments tend to accumulate in households other than those with underage children, for example, due to the age structure of these households and

because of the buffering effect of social assistance. The effect of health payments on poverty rates remained relatively constant over time; however, there was a small increase (0.1 percentage points) during the first period, and a decrease of similar size during the second government period, when using 50% of the median threshold.

Discussion

This study aimed to develop a method to analyse the distributional effects of health payment policies in conjunction with tax-benefit policies. We did this by supplementing the national tax-benefit microsimulation model with the real-world-data-based health payment module. As a case example, we estimated the combined effects of tax-benefit and health payment changes on the poverty risk rate and poverty gap in Finland during two government periods between 2011 and 2019.

The two government periods were characterised by varying policies and ideas [61–63], although it should be noted that in the Finnish settings of multiparty coalitions and the heavy influence of unions, the development of social policies can only partly be attributed to partisan effects [64]. Prior to our examination period, the government of PM Vanhanen (2007–2011) initially reacted to the global financial crisis with an emphasis on fortifying basic social security [62]. PM Katainen's and PM Stubb's government programmes (2011–2015) were influenced by austerity; however, alongside the traditional redistribution perspective and ideas of social investment. PM Sipilä's Government programme (2015–2019) was characterised by austerity [65].

In 2011–2015, tax-benefit reforms were expansionary and clearly reduced poverty risks and gaps. Although health payments increased during that time, they had only negligible effects on the relative poverty outcomes. Conversely during 2015–2019, tax-benefit reforms were characterised by retrenchment, leading to increases in poverty outcomes mainly driven by tax-benefit policies, but further reinforced by increases in health payments, which accounted for 10% of the poverty risk increasing effect, whereas tax-benefit policies accounted

for the rest (90%). In the older adult population, the role of health payments was greater (20%). Based on the simulations, social assistance buffered half of the poverty increasing effect of the reforms.

The effect of health payments was pronounced among the older population (65+ years), which is in line with previous studies [66]. In turn, studies have found that older adults are relatively well protected from deep poverty [17,49]. Our results shed light on these combined effects. Before accounting for health payments, older adults had a lower risk of poverty and a low poverty gap in relation to the population average, and accounting for health payments brought them closer to, although mostly still below, the average. In the general population, health payments had a small effect on the poverty risk rate and poverty gap, because their level was, on average, moderate. Moreover, among households with the lowest income, they were largely buffered by social assistance. For older adults, social assistance had no buffering effect, because of the relatively low poverty gap in these households.

We also used simulations to examine the effects of price regulation, since many types of health payments in the Finnish system are dependent on market prices. Reimbursed medicines present an example of heavy price regulation, and accordingly, price development seemed to effectively counterbalance the effects of increases in patient payments. Thus, assuming prices to follow a general price index such as the CPI would have led to overestimating their effects. Prices of the fee-for-service-based private services grew notably faster than inflation; thus, using CPI would have led to underestimation of their effects.

Through simulation, we were also able to examine the extent to which social assistance buffers the effects of health payments. The buffering effect was notable, as it largely neutralised the poverty effect of health payments among the under 65-year-old population. However, spillover effects on social assistance can be regarded as negative effects of health payment changes, due to, for example, incentive traps. Nevertheless, the difference between households eligible before and after health payments was small, implying that households requiring social assistance for health payments were anyway predominantly eligible for it.

552 An important future application of the microsimulation method is to prospectively
553 identify specific populations and patient groups at risk of negative effects of health payments.
554 Other important future developments in planning are modelling the behavioural effects of
555 patient payments on take-up and extending the method to examine the distributional effects
556 of in-kind transfers [14,67,68]. In this study, however, our focus was on livelihood and the
557 costs incurred directly by healthcare users.

558 A few limitations of our study should be noted. First, we could not account for care
559 needs, neither in terms of underutilisation nor overutilisation. Access problems may have
560 arisen from issues related to affordability, availability, accessibility and acceptability [69].
561 Second, the simulation of income-tested benefits such as social assistance incorporated many
562 sources of potential measurement errors: they were simulated by assuming full take-up,
563 although prevalent non-take-up has been observed [59]; assets and income from informal
564 sources, counted as income in social assistance, were not observed in the data; simulation
565 was based on average monthly income during a year; therefore, part-year eligibility was often
566 unobserved. Thus, the effects on poverty may have been underestimated in simulations.

567 Further, in terms of applicability, the proposed method—microsimulation of event-level
568 administrative data—is not possible in many contexts where using survey or synthetic data is
569 the only option. However, as healthcare administration is being increasingly digitalised in many
570 countries, the possibilities for distributional policy analyses of healthcare payments will
571 hopefully increase and slowly become a standard procedure for budgetary evaluation.

572

573 Conclusions

574 We supplemented the national tax-benefit microsimulation model with real-world data on
575 healthcare use, to examine the effects of health payments on poverty risk in conjunction with
576 tax-benefit policies in settings of complex and comprehensive social security. We used the
577 model to analyse two government periods in 2011–2015 and 2015–2019. During the first
578 period, tax-benefit policy reforms reduced poverty, and the changes in health payments played

a negligible role. During the latter government period, the poverty risk rate and poverty gap increased due to both tax-benefit policies and health payment changes; however, 80%–90% of the effect was due to tax-benefit policies. The buffering effect of social assistance and the price regulation of medicines counterbalanced the effects of co-payment increases, whereas payments for private services increased due to payment policies and the rapid growth of unregulated prices. Although small when juxtaposed with tax-benefit policies, our analysis revealed the scope of the effect of health payment policies that had been hidden in previous analyses.

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