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Blinded manuscript:

The impact of a co-payment increase on the consumption of type 2 antidiabetics – A nationwide interrupted time series analysis

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Highlights

- A co-payment increase in type 2 antidiabetics was associated with decreased consumption.
- No simultaneous increase in insulin consumption was detected.
- There was a decreasing trend in the average antidiabetic purchases in 2014−2018.

Abstract

International literature suggests that co-payment increases are associated with decreased medicine use, although the effects depend on context. We examined the impact of a co-payment increase on the consumption of type 2 antidiabetics in Finland, a country with a comprehensive health and social security system including ceiling mechanisms aiming to protect patients from high co-payment expenditures.

We used administrative register data on all reimbursed purchases of antidiabetics during 2014−2018. An interrupted time series design with segmented regression was used to examine the mean monthly purchase per person, measured as Defined Daily Doses (DDDs), before and after the co-payment increase.

At baseline, the mean monthly purchase per person of type 2 antidiabetics was 105 DDDs (95% CI 103.8; 106.0;p<0.001) and there was a decreasing trend of 0.2 DDDs per month (95% CI -0.23;-0.13;p<0.001). A statistically significant decrease of 5.6 DDDs (95% CI -7.3;-3.8;p<0.001) was detected after the reform;

however, no significant change in the trend was observed. No significant increase was detected in the mean monthly per person purchase of insulins.

The results suggest that a co-payment increase decreases consumption of necessary medicines despite the presence of a medicine co-payment ceiling mechanism. Whether the decrease was associated with negative health effects remains to be further investigated.

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Introduction

Globally, type 2 diabetes is one of the key public health priorities among non-communicable diseases, and its increasing costs form a significant part of overall healthcare spending (1-3). One of the drivers in growth of antidiabetic expenditure has in recent years been the uptake of novel medicines (4). At the same time, policies aiming to curb the increase in pharmaceutical expenditure have been implemented in European countries. These include interventions both on the supply and the demand side, such as increases in medicine co-payments and policies aiming to increase the use of generic medicines. (5.)

Previous studies have shown that the implementation of or increase in co-payment is associated with decreased use of even necessary medicines, particularly in vulnerable populations (6−9). A large part of the evidence derives from the United States and Canada, where pharmaceuticals are not reimbursed on universal grounds and the relative burden of co-payments is greater than in many European countries. Related to antidiabetics, studies from the US have shown decreases in the use of type 2 antidiabetics after an increase in co-payments (10) and an increase in the use of and adherence to antidiabetics after a co-payment decrease (11). In the latter study, a coinciding decrease in emergency department visits was observed. A higher co-payment has also been shown to have a negative effect on the initiation of secondary prevention medications, including glucose-lowering medicines (12).

Finland is a European country with comprehensive and universal tax-funded social security and healthcare systems. Pharmaceuticals assessed as reimbursable by national criteria are reimbursed via the public National Health Insurance (NHI). Prices of reimbursable pharmaceuticals are highly regulated and their wholesale prices are evaluated nationally. While co-payments apply to all reimbursable purchases, their level depends on the product and on the treated illness. Additionally, a ceiling mechanism protects individuals from very high cumulative co-payment expenditures. Nevertheless, in comparison to comparable countries in Europe, the high cost-sharing of prescription medicines, together with user fees in other areas of healthcare, are criticized for undermining the progressivity of healthcare funding (13).

Novel antidiabetic medicines are adopted relatively quickly in Finland, both in the national treatment guidelines and in reimbursement scheme (14,15). The uptake of novel antidiabetics heavily influences the growth in reimbursement expenditure (4). In 2017, the Finnish government implemented a series of austerity policies, including reforms targeted at the NHI pharmaceutical budget. Among them, the co-payments of non-insulin medicines used for type 2 diabetes (hereafter: type 2 antidiabetics) were increased by lowering their reimbursement rate (hereafter: the reform). Before the reform, the co-payment was a fixed fee of €4.50 per item per dispensing, and after the reform, 35% of the retail price of the product; e.g., €35 for a product with a retail price €100.

In this register-based nationwide study, we examined the impact of a co-payment increase on the consumption of type 2 antidiabetics. Further, we examined the consumption of insulins for spillover effects. The study offers current information on the impacts of medicine co-payment increases in comprehensive, universal healthcare systems. Additionally, the study adds to the understanding of these impacts in systems where novel medicines are included rapidly in the guidelines of care. It also contributes to the discussion on how co-payment increases affect the consumption of and choice between different antidiabetics, even in the presence of ceiling mechanisms.

Materials and methods

Study context

Finnish pricing and reimbursement policies for medicines

In Finland, all permanent residents are entitled to reimbursements for outpatient prescription medicines from the NHI. Reimbursements apply to medicines on the national positive list (reimbursable medicines), based on the assessment of the Pharmaceuticals Pricing Board, operating under the Ministry of Social Affairs and Health. (16.) In addition to approving products' reimbursement status and reasonable wholesale price based on an evaluation of, e.g., clinical value and cost-effectiveness, PPB also assigns products to disease-based higher reimbursement categories (see below). PPB may also restrict reimbursements to patients meeting specific clinical criteria. Reimbursements for novel, expensive pharmaceuticals are often restricted. Patients pay full price for medicines not included on the national positive list.

The universal basic reimbursement rate is 40% of the retail price, which consists of the wholesale price (regulated), a pharmacy margin and a pharmacy dispensing fee (both regulated), as well as Value Added Tax (VAT). Thus, patients pay 60% as co-payment. Patients with chronic and severe diseases can be entitled to reduced co-payments under disease-based higher reimbursement schemes with two categories: a) the 100% reimbursement (with a €4.50 fixed fee per product per dispensing for up to 3 months' supply), which applies to, e.g., cancer and epilepsy medicines; and b) the 65% reimbursement (with a 35% co-payment), which applies to, e.g., asthma, hypertension and coronary disease medicines. To gain access to the reduced co-payments, patients need to apply for an entitlement based on a Doctor's Certificate (see e.g. 17).

The reimbursement categories described above apply after patients meet an initial annual deductible of €50 (children and youth aged 18 or under are exempt). Adult patients thus pay full price for their medicines out-of-pocket up to an amount of €50 within a calendar year. All co-payments (deductible, fixed fees, percentage co-payments) count towards the annual co-payment ceiling, protecting patients from high

cumulative co-payment expenditure. After exceeding the ceiling (€605.13 in 2018), a fixed fee (€2.50 per product per dispensing for up to 3 months' supply) applies until the end of the calendar year.

The reform

The total reimbursement expenditure for type 2 antidiabetics had more than doubled between 2010 and 2016 in Finland, from €50 million to €108 million (from 4% to 8% of the total reimbursement expenditure respectively) (18). Prior to 2017, all antidiabetics were reimbursed in the 100% reimbursement category. Since the 2017 reform, type 2 antidiabetics have been reimbursed in the 65% category, while insulins remain in the 100% reimbursement category. In the Government Decree (19), the reform was justified by the requirement to cut spending and the fact that other cardiometabolic medicines were reimbursed in the 65% category.

Since the prices of pharmaceuticals are regulated, the reform directly affected only the shares of prices paid by the NHI and the patient. However, the reform's impact on individuals' co-payment expenditures varied greatly. Individual-level effects were thus evaluable prospectively only by using legislative microsimulation techniques, based on actual pre-reform dispensing data (for method, see 20). Based on the simulations, almost 30% of patients with type 2 diabetes were expected to face an increase of €100 or more in their annual co-payment expenditure. Before the reform, patients with diabetes, paid an average of just over €300 in their annual co-payment, making their co-payment higher than average (€200) even before the reform. (21.)

The reform was widely criticized in the media because of concerns over patients' ability to afford necessary medicines. From the clinical perspective, concerns were raised over patients switching from type 2 antidiabetics to insulins for economic rather than clinical reasons, as the reimbursement rate of insulins was not decreased in the reform. (E.g. 22.) In the context of non-insulin-dependent diabetes, insulin is in most cases recommended only in the later lines of treatment, e.g. to control difficult hyperglycaemia or for patients showing signs of insulin deficiency (23,24). The clinical justifications for preferring non-insulin treatments include: administration route (oral vs. intramuscular), risk profiles (e.g., hyperglycaemia and weight gain), more frequent need for blood glucose monitoring; and the potential negative effects of these factors on adherence. (23,25-27.)

Data

To assess the consumption of antidiabetics, we used administrative register data from the Prescription Register maintained by the Social Insurance Institution of Finland (Kela). The register holds records of all outpatient prescription medicines reimbursed from the NHI. From the register, we extracted reimbursed

purchases of medicines belonging to the anatomical therapeutic chemical (ATC (28)) class A10B (type 2 antidiabetics) and A10A (insulins) between January 2014 and December 2018. Since insulin consumption was examined for spillover effects, i.e., whether its consumption increased among non-insulin dependent diabetes patients, we excluded insulin purchases made by patients who did not, at any time between January 2014 and December 2018, purchase medicines belonging to ATC class A10B. Also these patients were excluded.

For each purchase, we collected the following variables, representing; a) the patient: unique identifier of the patient (pseudonym); b) the pharmaceutical product: ATC class, strength and package size; and c) the purchase: date and number of packages dispensed. Further, we collected the number of Defined Daily Doses (DDD) (28) available in the dataset, calculated based on the ATC- and administration route-specific DDD's assigned by the WHO Collaborating Centre for Drug Statistics Methodology using established principles (28). At the product level, DDDs are calculated by multiplying the unit strength by the number of units and dividing it by the WHO-assigned DDD.

Outcome variable

As outcome variable, we used the mean monthly per person purchase in DDDs (hereafter: mean purchase) of patients making a purchase in any given month, calculated separately for type 2 antidiabetics (A10B) and for insulins (A10A). We did this by taking the mean of the summed monthly DDDs purchased by each patient in any given month. Of note, in Finland the maximum reimbursed dispensing quantity is 3 months' supply. As this is also generally the least expensive option for patients, patients with chronic diseases typically purchase the maximum supply. All patients are thus not likely to be represented in the data each month, and the observed monthly per patients purchases are likely to translate closer to a quarterly rather than a monthly supply of medicines.

The DDDs for each purchase were defined as the number of DDDs in the dispensed package multiplied by the number of packages dispensed. For combination products, however, the WHO-assigned DDDs deviate from the main principles of the DDDs, which could affect our outcome variable should the share of sales of combination products change over time. We thus accounted for these differences by recalculating DDDs for products in the ATC class A10BD (Combinations of oral blood glucose lowering drugs) based on the dispensed amount of single active ingredients and the WHO-assigned DDDs for the respective ATC-classes. In terms of DDDs, combination products were thus treated as if the patients had purchased the same strength and number of active ingredients as separate single-ingredient products (e.g., when a patient purchases a combination product with 100 tablets containing 1g of metformin and 50mg of sitagliptin (ATC A10BD07), we recalculate DDDs as if the patient had purchased 100 tablets containing 1g metformin (ATC A10BA02) and 100 tablets containing 50mg sitagliptin (ATC A10BH01)).

Statistical analyses

Following Wagner et al. (29), we used segmented linear regression analysis within an interrupted time-series design to examine the trend and level of the mean purchase expressed in DDDs before and after the reform. We used separate models for purchases of type 2 antidiabetics and insulins. In both models, we used monthly data for 36 months before and 24 months after the reform.

In the Finnish setting, the purchases of reimbursed medicines follow a specific seasonal pattern, as the total amount purchased peaks at the end of the year and is consistently lower than average at the beginning of the year. This is due to the behavioral effects of cumulative reimbursement mechanisms (deductible and co-payment ceiling) fixed to the calendar year. The year-end peak in medicine purchases was observed in each year of our data for both type 2 antidiabetics and insulins. To control for this seasonal variation, we included two dummy variables in our model. The dummy for December controls the year-end peak in purchases, while the dummy for January controls the lower level of purchases in the beginning of a year.

Our final specification of the model takes the following form:

$$Y_t=\beta_0+ \beta_1 x \text{ time} + \beta_2 x \text{ intervention} + \beta_3 x \text{ time after intervention} + \beta_4 x \text{ dummy} + \beta_5 x \text{ dummy2} + v_t$$

where

Y_t = mean purchase of medicine in DDDs in month t

time= continuous variable reflecting time from the start of the observation period in months

intervention= 0 before the reform; 1 after the reform

time after intervention = 0 before the reform; after the reform, a continuous variable indicating time in months after the reform

dummy = dummy for December (1 if December, 0 otherwise)

dummy2 = dummy for January (1 if January, 0 otherwise)

β_0 = estimate of baseline mean purchase

β_1 = estimate of monthly change in purchase before the reform

β_2 = estimate of monthly change in purchase immediately after the reform

β_3 = estimate of monthly change in purchase after the reform, compared with the monthly trend before the reform

β_4 = estimate of the effect of the month of December

β_5 = estimate of the effect of the month of January

v_t = error term consisting of an autoregressive error part and a random error part ε_t .

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Following Jandoc et al. (30), we checked the normality, stationarity and heteroscedasticity of the residuals with graphic analysis and statistical tests, and found them not to be a problem. We also tested our models for multicollinearity and found none. We applied the Durban-Watson test to detect autocorrelation related to e.g. seasonality, and as autocorrelation was detected, applied autoregressive error models with autoregressive parameters up to 12 months meeting the elimination criteria of a significance level of 0.10.

To further investigate the impacts of specific features of the study design, we conducted sensitivity analyses using the quarter-yearly, rather than monthly, development, and including all insulin purchases. Results of sensitivity analyses are discussed briefly under *Strengths and limitations*.

All statistical analyses were performed with SAS version 9.4 (31).

Results

Our data consists of 9.3 million purchases of antidiabetic medicines between 2014 and 2018, 8.4 million of which are purchases of type 2 antidiabetics and 0.9 million purchases of insulins (Table 1).

(Table 1 here.)

Figure 1 shows the development in the mean purchases of type 2 antidiabetics and insulins during the study period. For 2014−2018, the fitted models are presented. Additionally, for 2017 and 2018, the contrafactuals predicting the mean purchase based on pre-reform observations (2014−2016) are presented. A vertical line at January 2017 indicates the reform time point.

(Figure 1 here.)

The baseline level of the mean purchase of type 2 antidiabetics was 105 DDDs (95% CI 103.8;106.0;p<0.001) (Table 2; Figure 1). Immediately after the reform, there was a statistically significant (p<0.001) decline in the level. This indicates that the mean purchase was 5.6 DDD's lower after the reform (95% CI -7.3;-3.8) than expected based on data on the months before the reform. There was also a statistically significant declining trend (slope -0.18; 95% CI -0.23;-0.13;p<0.001) in the mean purchase before the reform. The reform did not affect this trend as the change in slope after the reform was not statistically significant (p>0.05) and the confidence interval includes zero.

(Table 2 here.)

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The baseline level of the mean purchase of insulins was 152 DDDs (95% CI 151.7;152.7; p<0.001) (Table 3; Figure 1). After the reform, we observed a statistically significant (95% CI -3.0; -1.4; p<0.001) decline of 2.2 DDDs in the mean purchase. As for type 2 antidiabetics, there was a statistically significant declining trend (slope -0.26; 95% CI -0.3;-0.2; p<0.001) in the mean purchase of insulins before 2017. After 2017 there was a small but significant upward turn in the trend (95% CI 0.01;0.12;p<0.05) implying that the decline became less pronounced after 2017.

(Table 3 here.)

Discussion

We studied the impact that a reform increasing the co-payment for type 2 antidiabetics had on the consumption of antidiabetic medicines in Finland. We used interrupted time series analysis with segmented regression, a strong quasi-experimental method for evaluating longitudinal effects of interventions (29). We found that the mean number of DDDs of type 2 antidiabetics purchased per person per month had declined steadily already before the reform, and this declining trend was not significantly affected. However, we observed a significant drop in the mean purchase, indicating that after the reform, patients purchased on average 5.6 fewer DDDs per month than would have been expected based on the preceding months. We examined whether the consumption of insulins increased as a spillover effect, but found instead a small but significant decrease of 2.2 DDDs in the mean monthly per person purchase. Additionally, a declining trend in the mean insulin purchases seemed to become slightly less pronounced after 2017. As no other simultaneous changes affecting the consumption of medicines took place, the findings of the current study can be attributed to the reform.

Our results indicate that the reform had significant effects on the purchasing behavior of affected patients. We observed a preceding declining trend in the mean purchase of both type 2 antidiabetics and insulins, which may reflect changes in the clinical treatment patterns, e.g., use of newer medicines or earlier initiation of pharmacological treatments. The increasing number of patients purchasing both types of antidiabetics throughout the studied period provides some support for these hypotheses. Regarding changing treatment patterns, the use of SGLT-2 inhibitors increased rapidly during the studied period. In 2016, the most widely used type 2 antidiabetics were biguanides (mainly metformin), DPP-4 inhibitors (and their combinations with metformin), SGLT-2 inhibitors, and GLP-1 analogues (18).Other possible individual-level explanations include, but are not limited to, medication changes to cheaper combinations, deferred or suboptimal medicine use to minimize costs, optimizing purchase intervals, buying smaller batches and stockpiling medicines before the reform (33-34). However, since our data does not contain information on, e.g., glycemic control or the overall use of healthcare services, clinical consequences are beyond the scope of this study.

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As our method was based on the mean monthly purchase, changes in the underlying population size were accounted for. Nevertheless, based on the annual statistics on reimbursement entitlements, the number of diabetes patients with new entitlements, as well as the number of entitlements ended due to death, developed steadily throughout the studied period, and thus it seems unlikely that discontinuities would have been caused by changes in the patient population (35).

We found no evidence of increased insulin consumption among type 2 diabetes patients after the reform. On the contrary, a small decrease in the mean purchase was detected even though the reform did not affect the co-payments for insulins. We did not analyze the purchase patterns at patient level and therefore can only speculate about the reasons behind the observed impacts. A likely explanation is that the reform affected purchasing patterns, and that patients using both type 2 antidiabetics and insulins applied the changed patterns to all of their purchases. E.g., patients were likely to anticipate the reform and purchase particularly large amounts of both types of antidiabetics at the end of 2016. Such precautions are likely, because the reform was widely discussed in the media beforehand. Stockpiling would translate into a reduced need to purchase insulins in the first months of 2017, which could explain the drop in the mean purchase. Stockpiling insulin before a co-payment increase has previously been described in Danish settings (33).

On a smaller scale, the stockpiling of medicines at the end of the year is a known feature of the Finnish system. As the cumulative reimbursement mechanisms (the co-payment ceiling and the annual deductible) are fixed to the calendar year, patients generally face larger co-payments at the beginning of the year. After controlling for the seasonal variation, our results indicated the changes in 2017 being larger than expected based on previous years. However, it should be noted that the implementation of the annual deductible in 2016 could have already strengthened the seasonal variation, which could also explain the decline in the mean insulin purchase and the counterbalancing weakening of the declining trend. Nevertheless, for type 2 antidiabetics, the level change was larger than for insulins, and was not counterbalanced over time by changes in trend. It thus seems unlikely that the results observed for type 2 antidiabetics would have been caused entirely by factors unrelated to the 2017 reform. Additionally, patients facing notably larger co-payments for type 2 antidiabetics could have started purchasing smaller quantities more often in order to pay less at one dispensing, which in turn could have affected the mean monthly purchase.

Our results align with previous findings on how co-payment increases decrease the consumption of medicines, extending to the most essential and life-sustaining ones (10,36,37). Cost-containment policies are, however, embedded in the broader health systems and thus their effects are context-dependent (38). There is only limited previous literature assessing the impact of decreased reimbursements on the use of type 2 antidiabetics and none, in recent years, focusing specifically on universal tax-funded healthcare systems. Previously, patients in tax-based systems have been found to seem less sensitive to prescription medicine prices than patients in, e.g., private insurance systems (39). The differences may be attributed to the

complementary effects of other forms of social security. During the financial crisis and the subsequent recession in Europe in the early 2000's, access to healthcare seemed less compromised due to costs in systems with higher income replacement rates of unemployment benefits and pensions (40,41). Various exemption policies may also mitigate the negative effects of co-payments (42−44).

Patients' sensitivity to co-payment changes has been previously observed in Finland (45-49). It is thus likely that the decrease in consumption would have been larger had co-payment ceiling mechanisms not been in place. It is also possible that patients facing financial difficulties due to the reform use other coping strategies to afford medicines, e.g., deferring other necessities or borrowing money (50,51). Furthermore, before the reform, the largest co-payment increases were anticipated to affect patients using newer antidiabetic medicines (GLP-1-analogues, PDD-4-inhibitors) (21,52). It is therefore possible that the reform lead to socioeconomic differences in the use of (novel) antidiabetics. Socioeconomic differences in the use of newer antihypertensive medicines and antidepressants have been described previously in Finland (53,54).

In interpreting the results in an international context, it should be noted that the adoption of new antidiabetic medicines varies between European countries, as does the share of antidiabetics' costs of the total pharmaceutical expenditure (14,21,55−59). Overall, countries use different approaches to limit their pharmaceutical expenditures and place different priorities on access and equity (42). In Finland, the comparatively fast uptake of novel antidiabetics seems at least partly explained by their relatively rapid inclusion in the national clinical guidelines (14,15,23). Unlike in many other countries, in Finland clinical guidelines do not incorporate a cost-effectiveness perspective (14). As the uptake of novel medicines is one of the drivers in growth of antidiabetic expenditure (4), an increased co-payment level can be interpreted as a trade-off for fast access to reimbursed novel antidiabetic medicines. From a policymaking standpoint, this perspective to the current study offers possibilities for considering questions of access and equity in the presence of scarcity.

Strengths and limitations

A major strength of our nationwide study is that it covers all reimbursed purchases of antidiabetic medicines during the study period. It should, however, be noted that as the current analysis investigates the mean amount purchased, it cannot account for the patients who stop purchasing antidiabetics altogether. In other words, if a person does not purchase medicine in a given month, they are not included in the calculation of the mean purchase for that month. Thus, the effects of the reform on purchasing patterns could be even larger, if cessation was accounted for. However, this would require patient-level analysis, and is thus out of the scope of our study. In future, questions such as cessation should be studied with patient-level analysis. The current study provides a population-level description of the overall impacts of the reform. Further

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research is needed to evaluate the effects of the reform on vulnerable groups, and also on the use of different type 2 antidiabetics.

As a method, we have used interrupted time series analysis, a useful method in evaluating population-level impacts of health interventions that have taken place at a clearly defined point in time (60). Despite the method's considerable strengths, the time series form is susceptible to seasonal variation, and possible challenges rising from the form should to be addressed. A general recommendation (e.g. 29) for the number of data points used in the analysis is at least 12 points before and 12 points after the interventions. This would allow for detecting any seasonal variation in the data. As we were able to use 36 time points before and 24 time points after the reform, we could take into account and control for the seasonal variation.

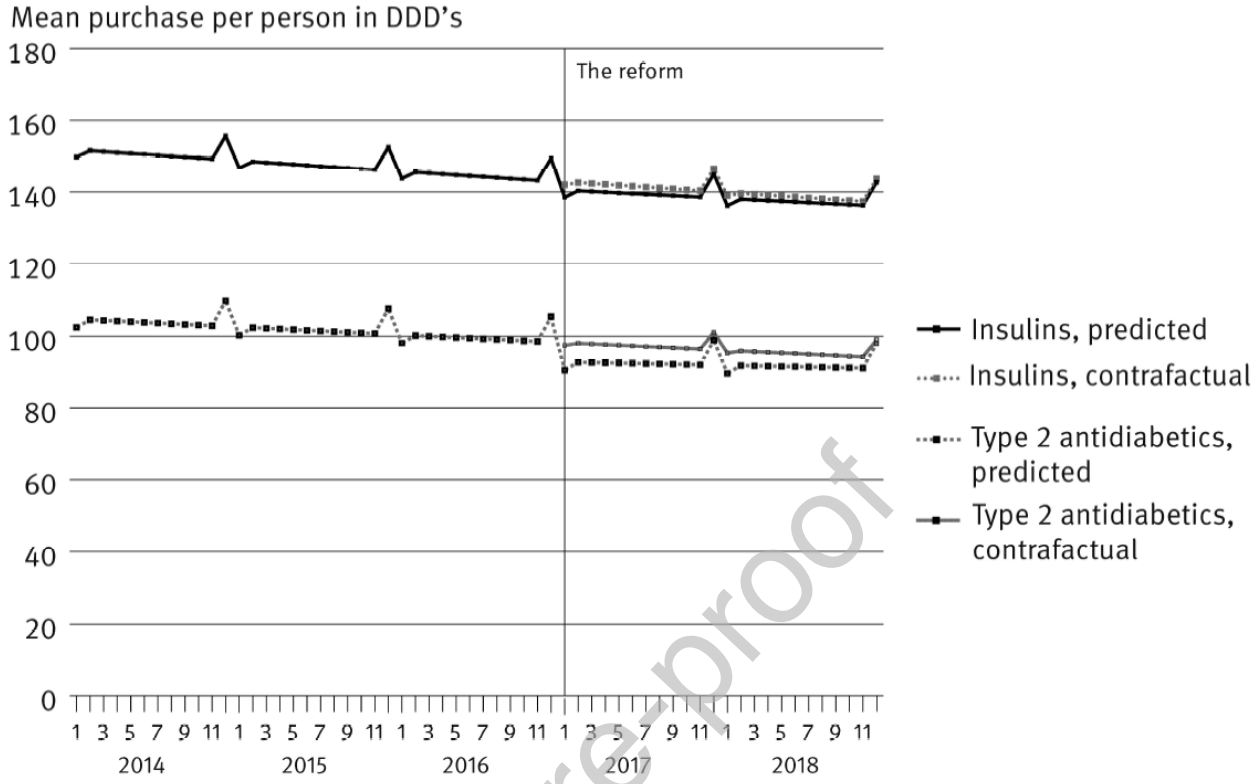
To focus on potential spillover effects on insulin use among type 2 diabetes patients, we excluded insulin purchases made by patients who did not purchase any type 2 antidiabetics during the study period. However, we performed a sensitivity analysis with all insulin purchases (and purchasers) included. While this did not significantly change our results, the impact of the reform seemed less pronounced. This was expected, since the number of excluded patients was relatively small; however, their purchasing pattern was different than that of patients who also used type 2 antidiabetics. These results also provide some support for the explanation suggesting that the changes observed in insulin purchases were influenced by changes in the purchasing patterns of patients using both types of antidiabetics.

To further examine whether the decline in the trend of type 2 antidiabetic purchases was due to patients purchasing smaller quantities of medicines more frequently, we conducted a sensitivity analysis using the mean quarterly per person purchase of type 2 antidiabetics. Based on the results, a decline in DDDs remained, indicating that the observed decline is at least not solely caused by more frequent purchases. It should be noted, though, that the typical dispensing in Finland is 3 months' supply, and thus the detected decline of 5.6 DDDs in the mean monthly *purchase* of type 2 antidiabetics does not translate into a respective decline in monthly *use*. Purchases in any given month represent a mixture of dispensings that can include the supply for any length of time up to the maximum of 3 months' supply.

Conclusions

We studied the impact of a significant co-payment increase in type 2 antidiabetics, implemented as an austerity measure in Finland in 2017. Our findings suggest that the reform led to a small but significant decrease in the consumption of type 2 antidiabetics. A smaller but significant decrease was observed in the consumption of insulins, even though their co-payment was not affected by the reform. The decreasing trend present in the mean purchase of type 2 antidiabetics already before 2017 was not significantly affected by the reform. The declining trend in the mean purchase of insulins, however, seemed to become less pronounced.

after 2017. Further research is needed to investigate the mechanisms behind the decreased consumption and its consequences on health, healthcare use and overall social- and healthcare costs.



Caption for Figure 1:

Mean purchase of type 2 antidiabetics (A10B) and insulins (A10A) per person in DDDs.

Caption for Table 1:

Total number of purchases, patients and Defined Daily Doses (DDD) of type 2 antidiabetics (A10B) and insulins (A10A) in 2014-2018.

Caption for Table 2:

Table 2. Impact of the reform on the mean per person purchase of type 2 antidiabetics (A10B), adjusted for the months of December and January.

Caption for Table 3:

Table 3. Impact of the reform on the mean per person purchase of insulins (A10A), adjusted for the months of December and January.

Acknowledgements

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Conflict of interest

The authors declare that they have no conflict of interest.

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Table 1. Total number of purchases, patients and Defined Daily Doses (DDD) of type 2 antidiabetics (A10B) and insulins (A10A) in 2014-2018.

	2014	2015	2016	2017	2018
Number of purchases[a]					
Type 2 antidiabetics	1,333,686	1,515,511	1,683,281	1,823,500	2,002,265
Insulins	272,500	292,937	314,524	335,855	349,210
Number of patients[b]					
Type 2 antidiabetics	293,733	303,400	312,849	321,918	332,839
Insulins	67,324	71,236	74,255	77,267	79,665
Number of DDDs					
Type 2 antidiabetics	120,722,313	125,680,047	132,715,396	131,089,076	138,244,030
Insulins	34,910,475	36,346,725	36,883,906	37,013,554	37,751,451

[a]For the final analysis set, if a person had several purchases of type 2 antidiabetics or insulins in a month, we summed them up as one monthly purchase of type 2 antidiabetics or insulins.

[b]The same patient can purchase both type 2 antidiabetics and insulins.

Table 2. Impact of the reform on the mean per person purchase of type 2 antidiabetics (A10B), adjusted for the months of December and January.

	Estimate	SE	95% Confidence Interval	P
Intercept	104.9	0.5343	103.8; 106.0	<0.001
Baseline trend	-0.18	0.0249	-0.23; -0.13	<0.001
Change in level of reimbursement rate after the reform	-5.6	0.8729	-7.3; -3.8	<0.001
Change in trend of reimbursement rate after the reform	0.10	0.0549	-0.006; 0.2	NS

Transformed regression R^2 0.9418
Total R^2 0.9552

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Table 3. Impact of the reform on the mean per person purchase of insulins (A10A), adjusted for the months of December and January.

	Estimate	SE	95% Confidence Interval	P
Intercept	152.2	0.357	151.7;152.7	<0.001
Baseline trend	−0.26	0.0166	−0.3; −0.2	<0.001
Change in level of reimbursement rate after the reform	−2.2	0.56	−3.0; −1.4	<0.001
Change in trend of reimbursement rate after the reform	0.06	0.03	0.01;0.12	0.03
Transformed regression R^2 0.9691				
Total R^2 0.9652				

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