Successful implementation of an automated medication dispensing and telecommunication service reduces healthcare costs among home care clients

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BACKGROUND

- Automated combined medication dispensing and telecommunication services (MDTS) have the potential to reduce the need of physical home care visits related to medication dispensing for home care customers. The addition of an integrated telecommunication service, in the automated medication dispenser, further may allow for some physical home care visits to be replaced by phone or video contacts.
- The impact of an MDTS on healthcare resource utilisation has not been evaluated in large-scale studies. Evidence from small pilot studies suggests that MDTS may reduce the number of nurse visits[1].

[1]Lithedahl & Vikström, 2021 Käyttäjäkokemuksia Smila lääkerobotin pilotoinnista Jyväskylän kaupungin kotihoidossa

AIM

The overarching aim of the study was to assess the impact of a **medication dispensing and telecommunication service** (**MDTS**) on home care and healthcare contacts and costs, compared to controls not using an MDTS.

RESULTS

Cohort Of 27,318 home care customers, 147 MDTS users who met the inclusion criteria were matched to 441 non-user controls. Baseline demographics were similar between groups after matching (**Table 1**): both MDTS users and controls were on average 78–79 years old and predominantly women.

Baseline MDTS users and controls had comparable healthcare utilization (634 vs 651 contacts/patient year), with home care accounting for approximately 95% of all contacts in both groups. Baseline costs were similar between groups (~€32 000 per patient year; **Figure 1–2**).

Post MDTS resource use In-person home care visits increased among controls, while remaining stable in MDTS users. Total healthcare contacts followed the same pattern, increasing in controls but not in MDTS users. Among MDTS users, remote home care electronic contacts (e-contacts) were the only contact type to increase, indicating substitution of physical visits with remote support (**Figure 1**).

Post MDTS costs Cost trajectories diverged after MDTS initiation (**Figure 3**). Mean HCRU costs increased by 6% in controls, from €31,853 (95% CI: €29,703–34,157) at baseline to €33,847 (95% CI: €31,568–36,292), but decreased by 13% in MDTS users, from €32,898 (95% CI: €29,436–36,767) to €28,524 (95% CI: €25,525–31,876) per patient-year. Overall, MDTS use was associated with 18% lower total healthcare costs versus controls (p = 0.021), corresponding to €5,323 saved per patient-year (**Table 2**).

Table 1. Characteristics of MDTS users and non-users after matching.

Characteristic	MDTS users	Non-user controls	p-value
Number of home care customers	147	441	
Age (years), mean SD	78 (10)	79 (12)	0.12
Male, N (%)	47 (32%)	145 (33%)	0.8
Follow-up length (days), mean SD	458 (359)	430 (358)	0.2
Charlson Comorbidity Index			>0.9
0	52 (35%)	156 (35%)	
1	12 (8.2%)	41 (9.3%)	
2	51 (35%)	148 (34%)	
3	13 (8.8%)	37 (8.4%)	
4	13 (8.8%)	34 (7.7%)	
5+	6 (4.1%)	25 (5.7%)	
Time from home care start to index (days)[1]	690 (605)	696 (590)	0.9
Index year			>0.9
2020	4 (2.7%)	11 (2.5%)	
2021	4 (2.7%)	14 (3.2%)	
2022	19 (13%)	51 (12%)	
2023	33 (22%)	99 (22%)	
2024	87 (59%)	266 (60%)	

[1]presented as mean and standard deviation (SD), PPY - per patient-year.

Figure 2. Mean cumulative cost trajectories (euro) during baseline and follow-up of MDTS users and controls split by home care, primary healthcare, specialty healthcare and total cost. The p-value indicates the significance of the costs from the difference-in-difference model comparing baseline and follow-up costs across MDTS users and controls.

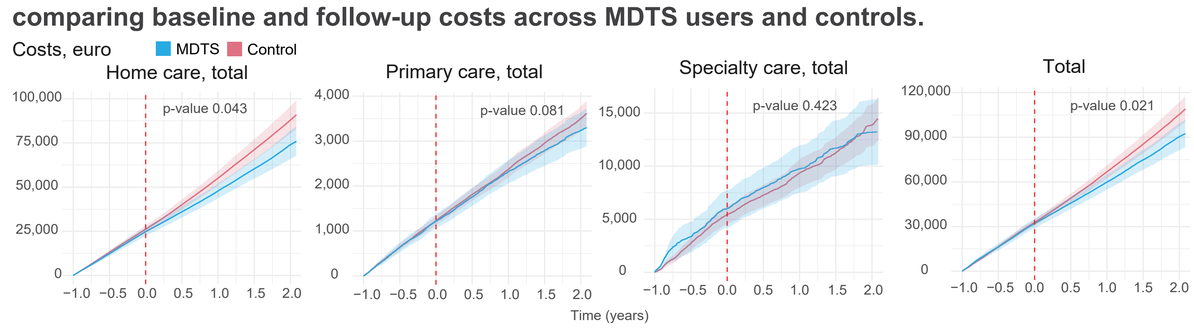


Figure 3. Healthcare costs of MDTS users and non-user controls during baseline (one year before index) and annually after index based on the mean cumulative function estimates. Numbers presented as annual mean per patient-year costs with 95% confidence interval.

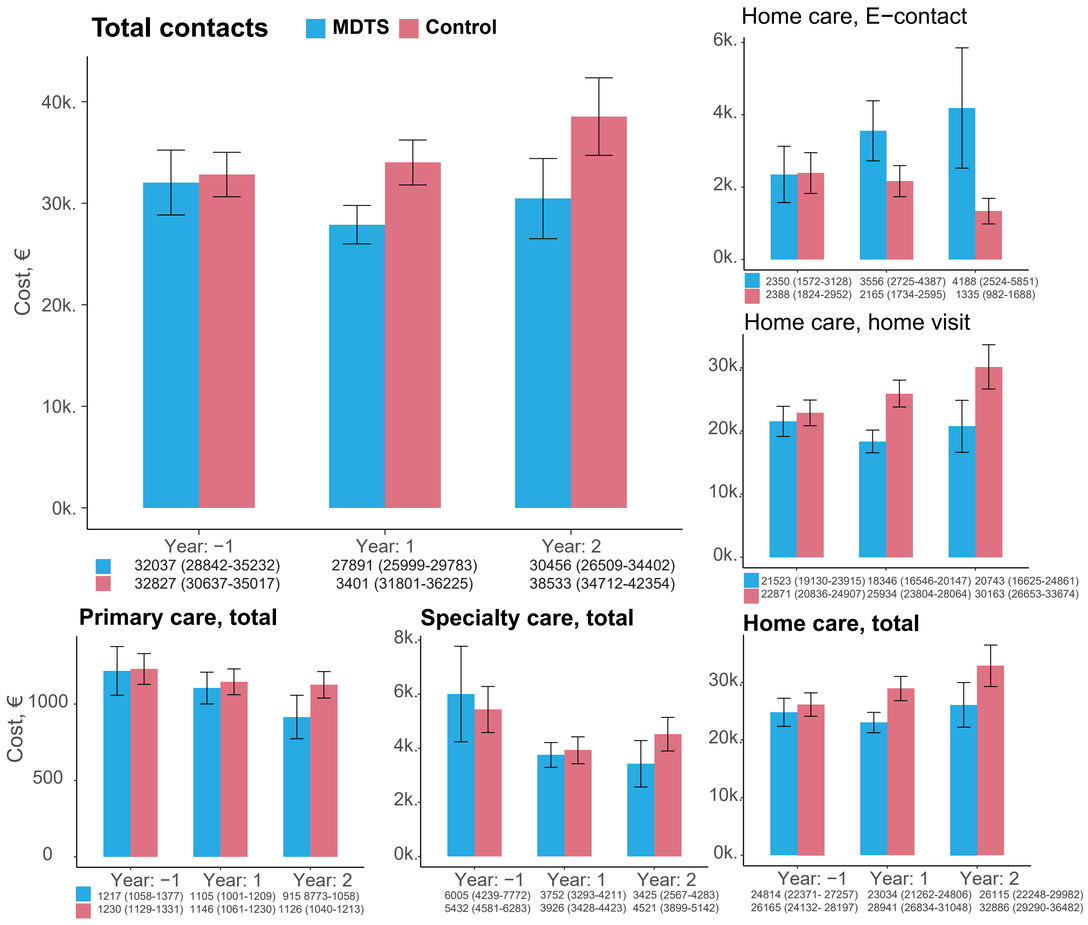
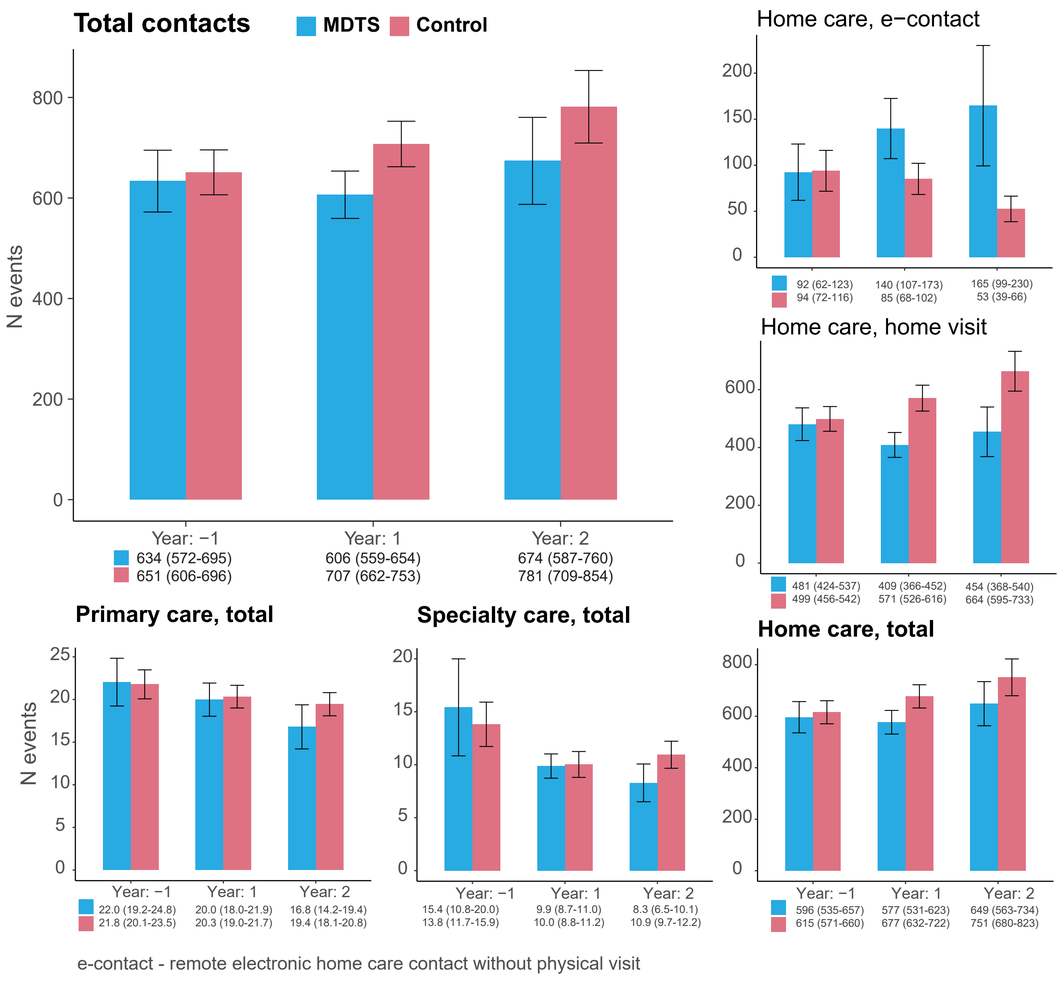


Figure 1. Healthcare visits of MDTS users and non-user controls during baseline (one year before index) and annually after index, showing both the total of contacts as well as stratification by primary healthcare, secondary healthcare and home care contacts. Numbers presented as annual mean per patient-year contacts with 95% confidence interval.



e-contact - remote electronic home care contact without physical visit

Table 2. Difference-in-difference analysis of healthcare resources utilisation related costs by type and total in MDTS users and controls. Per-patient year estimates presented as mean estimate and 95% confidence interval.

HCRU type	Variable	Estimate	95% CI	p-value
Home care, Total	Baseline costs - controls	24274	22509-26176	0
	Time after index costs - controls	1.160	1.058-1.273	0.002
	Baseline costs - MDTS users	1.023	0.897-1.166	0.737
	Time after index costs - MDTS users	0.827	0.687-0.994	0.043
Primary Care, total	Baseline costs - controls	1266	1156-1386	0
	Time after index costs - controls	0.939	0.838-1.052	0.281
	Baseline costs - MDTS users	1.037	0.882-1.22	0.657
	Time after index costs - MDTS users	0.816	0.65-1.025	0.081
Specialty Care, total	Baseline costs - controls	6190	5087-7532	0
	Time after index costs - controls	0.686	0.526-0.893	0.005
	Baseline costs - MDTS users	1.066	0.732-1.553	0.738
	Time after index costs - MDTS users	0.805	0.474-1.368	0.423
Total	Baseline costs - controls	31853	29703-34157	0
	Time after index costs - controls	1.063	0.975-1.158	0.167
	Baseline costs - MDTS users	1.033	0.913-1.168	0.607
	Time after index costs - MDTS users	0.816	0.686-0.97	0.021

CONCLUSIONS

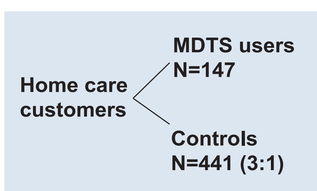
MDTS use reduced home care visits, replaced by remote contacts. Compared with matched non-users, MDTS users had 18% lower healthcare resource utilisation costs during follow-up.

MDTS may help home care services to reallocate resources more efficiently while maintaining patient independence.

Limitations: Results are observational and show association, not direct causation, but provide real-world evidence in support of MDTS use.

METHODS

Design Retrospective matched cohort study using health and home care records from the Wellbeing Service County of Central Finland Jan 2020–Jan 2025 (N = 27,318 clients). A baseline period of 2–12 months before index and minimum follow up of 2 months after index were required. Cohorts were followed until 31.1.2025.



Cohort 147 MDTS users were matched 3:1 to 441 non user controls using propensity score matching. The index date was defined as MDTS initiation for users and randomly assigned to controls based on the MDTS start date distribution. Matching included age, sex, municipality, Charlson comorbidity index, baseline healthcare resource utilization, baseline duration, and index year. Post-matching balance was achieved (standardized mean differences for variables < 0.1).

Analysis Healthcare resource utilization (HCRU) events and costs were estimated using mean cumulative functions. Cost trajectories were compared between groups using a difference-in-difference model. Unit costs applied were: €25.4 per e-contact, €40.5 per home visit, €54.9 per primary care visit, and €374.2 per specialty care visit.