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Italiadomani
PIANO NAZIONALE DI RIPRESA E RESILIENZA

UNIVERSITÀ DEGLI STUDI DI GENOVA

Telehealth for chronic diseases: Addressing the needs of vulnerable populations in Liguria

Aprile 2025

Tasks

T2.1. Telemedicine users' demand analysis	• OK per ASL 4	- Ottenuti i dati amministrativi di un'altra realtà del territorio
T2.2. Indicators for economic impact assessment	• OK per ASL 4	
T2.4. Cost-effectiveness analysis of telemedicine services outcomes	• Work in progress	- Banditi 2 contratti occasionali - Rassegna della letteratura
T3.5. Production cost analysis and remuneration system elaboration	• Work in progress	

Introduction

- **Future sustainability of healthcare systems:** progressively aging population along with growing budget constraints → Management of chronic conditions

- **Role of telemedicine**: improves accessibility via digital means → during/after the COVID pandemic

- The **share of adults who have received services from doctors via telemedicine** since the start of the pandemic has increased in most countries (Leporatti and Montefiori, 2024).

- Before the pandemic, **Denmark** had the highest share of remote consultations via phone or video (45 %), whereas most countries had percentages lower than 10 %. By mid-2020, almost one in three adults had utilized remote consultation, and by early 2021, this ratio accounted for nearly one in two (OECD, 2021).

- Given the increasing budget pressures on healthcare systems in Western countries, can or will telemedicine help? How?

Objective

Analyze the effects of telemedicine on chronic patients in Liguria, focusing on:

- **Resource utilization**: impact on NHS resource consumption and costs
- **Substitute or complement**: Does telemedicine replace or supplement traditional visits?
- **Health outcomes:** adherence to drug therapy (mortality?)

Relevance of the case study:

- **Geographical conformation**: mountainous inland with extensive coastal region (Istat, 2021)
- **Demographic setting**: highest over-65s population in Europe, predicting future trends (Eurostat, 2020)
- **COVID-19 pandemic**

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Research Questions

RQ1: Does TeleHealth serve as a substitute for or complement to traditional healthcare services?

RQ2: Can higher adherence reduce the utilization of healthcare services?

RQ3: How does the consumption of healthcare resources relate to adherence and TeleHealth?

Related Literature

Telemedicine:

- *Benefits*: increased life expectancy (Bernstein et al., 2010); improved health (Singh et al., 2019); reduced costs (Patel et al., 2023)
- *Risks*: lower-quality treatments (Dahlgren et al., 2024); more follow-ups (Zeltzer et al., 2023); no cost savings (Snoswell et al., 2020)

Telemonitoring:

- *Benefits*: reduced hospitalizations (Agboola et al., 2015); better doctor-patient relationship (Miranda et al., 2023); improved quality of life (Voeller et al., 2022)
- *Risks*: temporary benefits (Agboola et al., 2015); false positives/misinterpretation (Hanley et al., 2018); no cost savings (Vasquez-Cevallos et al., 2018)

Related Literature

- ***Zeltzer, D., Einav, L., Rashba, J., & Balicer, R. D. (2023a). The Impact of Increased Access to Telemedicine. Journal of the European Economic Association.***: increased telemedicine access is associated with a modest, 3.5% increase in the utilization of primary care. While access to telemedicine is associated with a slight increase in the number of follow-up visits, such visits are predominantly with the same physicians who provided the initial visit. Visits involve fewer prescriptions and more follow-ups, but no evidence of missed diagnoses or adverse outcomes

- ***Dahlgren, C., Spånberg, E., Sveréus, S., Dackehag, M., Wändell, P., & Rehnberg, C. (2024). Short- and intermediate-term impact of DTC telemedicine consultations on subsequent healthcare consumption. European Journal of Health Economics:*** DTC telemedicine users increased their healthcare consumption more than controls. The effect seemed to be mostly short term (within a month), but was also present at the intermediate term (2–6 months after the initial consultation).

- **Conflicting evidence**: The literature does not agree on whether telemedicine services effectively substitute traditional in-person visits.

Related Literature

The European Journal of Health Economics (2024) 25:157–176
https://doi.org/10.1007/s10198-023-01572-z

ORIGINAL PAPER

Check for updates

Short- and intermediate-term impact of DTC telemedicine consultations on subsequent healthcare consumption

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Table 1 Potential mechanisms for the impact of DTC telemedicine on subsequent healthcare consumption

Mechanism	Expected impact	Time perspective
Technology: DTC telemedicine is not sufficient for solving the problem, physical examination is necessary	More subsequent face-to-face consultations for DTC telemedicine users	Short term
Provider incentives: DTC telemedicine providers are reimbursed based on a payment per contact principle, whereas the dominating reimbursement model for primary healthcare centres is capitation. DTC telemedicine providers, therefore, have stronger financial incentives to offer additional consultations	More subsequent DTC telemedicine consultations for DTC telemedicine users	Short term
Case mix: DTC telemedicine users can be expected to be healthier than face-to-face users because of the lower thresholds for accessing healthcare	Fewer subsequent consultations (DTC telemedicine and face-to-face) for DTC telemedicine users	Short term
Patient behaviour: DTC telemedicine users adapt their healthcare-seeking behaviour and increase their use of DTC telemedicine	More subsequent DTC telemedicine consultations for DTC telemedicine users	Intermediate term

Related Literature

Adherence & COVID-19:

- Reduced adherence, particularly among patients with chronic conditions (Di Novi et al., 2022; Bitar & Alismail, 2021)

Adherence & telemedicine:

- Addressing unmet healthcare needs, particularly in the post-pandemic period (Huerne & Eisenberg, 2024)
- Improved communication, minimizing therapy discontinuity (Basit et al., 2020; Miller, 2002; Gadkari & McHorney, 2012).

Institutional context

- In November 2020, Regione Liguria initiated a large-scale expansion of telemedicine adoption.
- In 2021, the regional council approved a project called "**Tigullio Luogo di Salute**" (TLS) within ASL4.
- TLS was launched as a **pilot project** aimed at systematizing, standardizing, and integrating telemedicine tools into patient care services, maximizing the opportunities provided by new technologies and prioritizing a "patient-centered" approach.
- Two primary areas of intervention:
  - ✓ Televisits for diabetic patients
  - ✓ Telemonitoring for cardiovascular patients

Dataset Overview

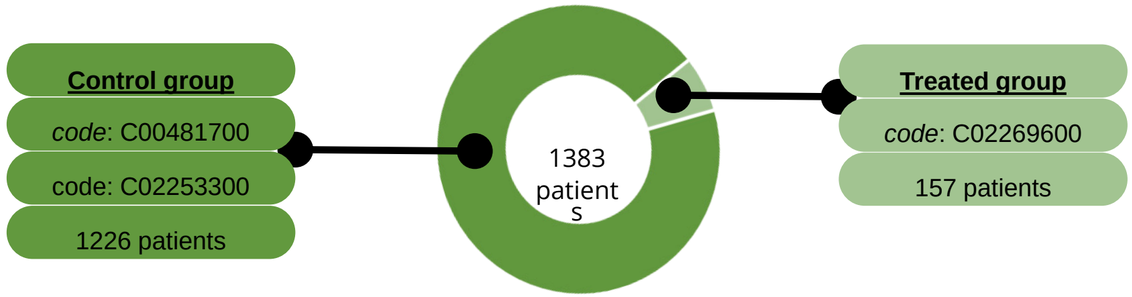
- **Source**: healthcare administrative data from ASL 4
- **Time period**: 2019-2022
- **Data streams**:
  - ED visits
  - Drug records
  - Demographic data
  - Exemption records
  - Specialist services
  - Discharge data

- **Limitations**: no access to death/transfer data
- **Privacy Compliance**: data pseudonymized; aggregated age categories (0-45; 46-65; 65+)
- **Panel dataset**: annually and semester panels

Inclusion criteria

Patients with severe cardiac conditions requiring pacemakers, defibrillators, loop recorders, or CCM

- **Identification**: specialist service codes during hospitalization or follow-up
- **Exclusion**: non-residents to prevent data inconsistencies due to high tourist influx



Patients with Type 1 and Type 2 diabetes

Three criteria:

- primary recovery codes for hospital admissions and emergency department admissions (i.e. 285, 294, 295, 250)
- the use of specific drugs coded A10A*, N03AX16 or N03AX12,
- exemptions 013.250

6486 patients

- 6205 subjected to several/no traditional visits
- 281 had access to telemedicine as a second visit or remote control of devices.

Treated and control groups: a comparison

	Control	Treated
Age class		
< 45	3.76%	11.75%
45-64	14.25%	21.20%
65+	81.99%	67.05%
Male	50.52%	51.58
CCI	0.89	0.94
Coastal Municipality	70.55%	68.19%

The treated patients are on average younger but have a higher CCI.

Outcome variables

Proxies for **resource consumption** and associated costs

- Number of ED visits
- number of hospitalisations
- Number of traditional specialistic visits
- Cost of hospitalisations
- Cost of specialist visits

Adherence to drug therapy

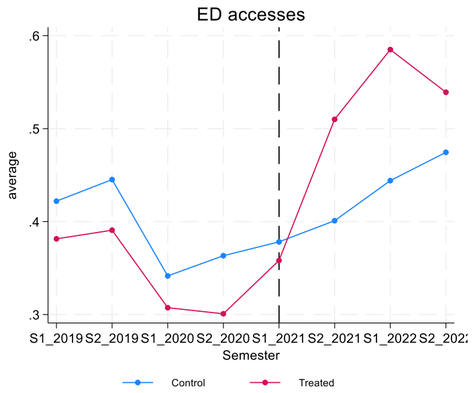
Medical Possession Rate

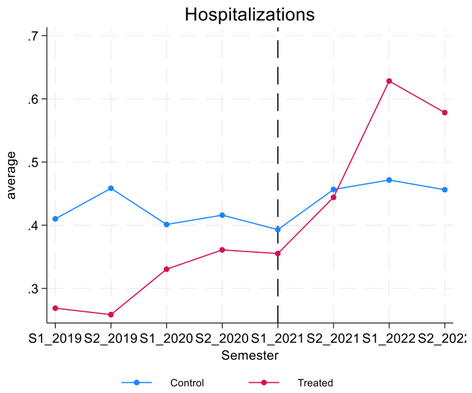
$$MPR = \frac{number\ of\ days'\ supply\ in\ the\ period}{last\ fill\ date - first\ fill\ date}\ x\ 100$$

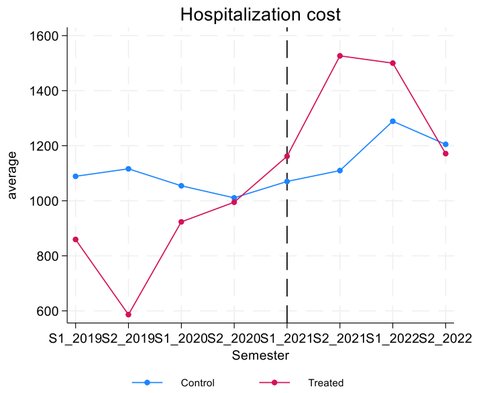
- Diabetes: the 2 most consumed drugs in category A: Alimentary tract and metabolism (ATC A02BC02, A10BA02)
- Cardiovascular diseases in category C : the 2 most consumed drugs in A: Alimentary tract and metabolism (C03CA01 and C07AB07)

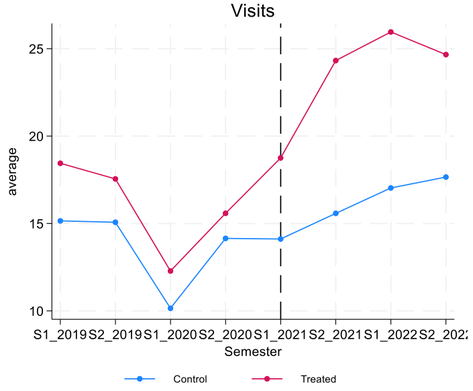
Trend in outcome variables

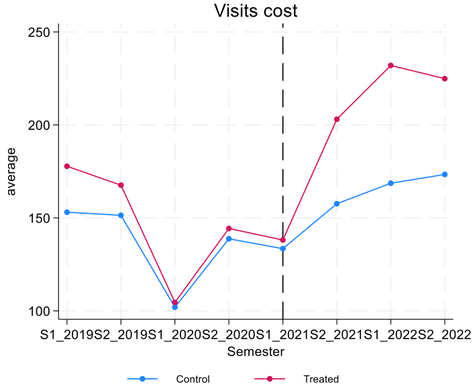
Proxies for **resource consumption** and associated costs





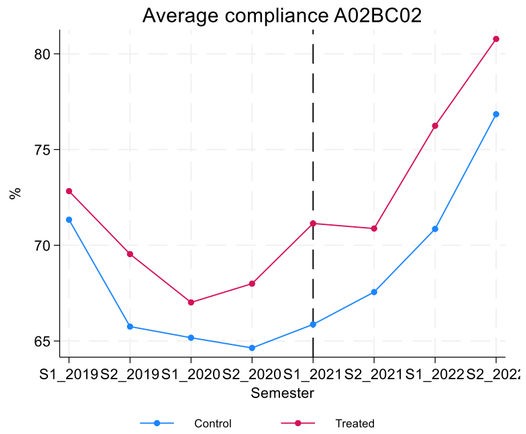


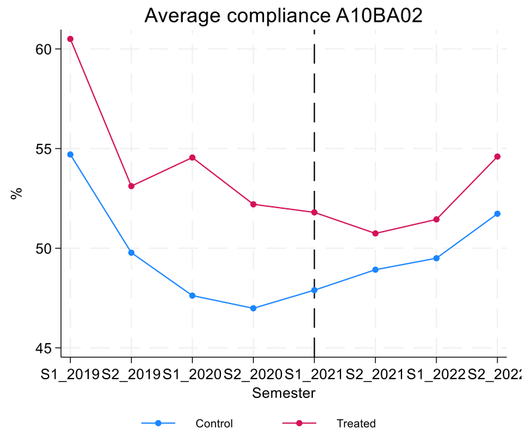


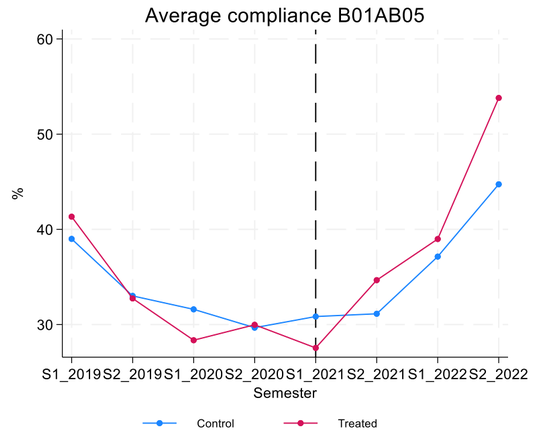


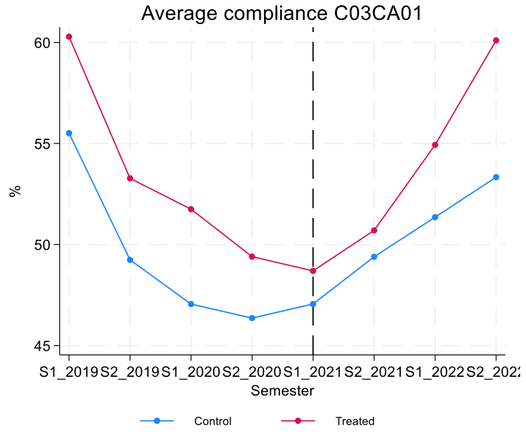
Trend in outcome variables

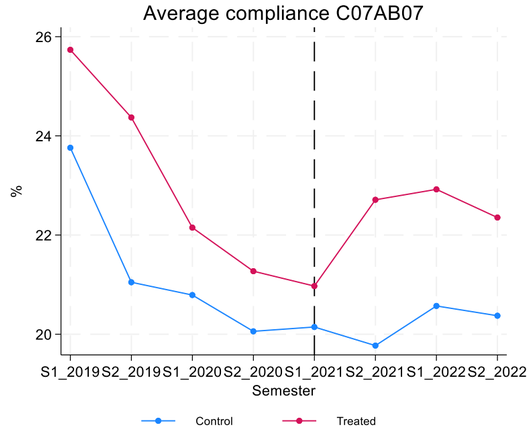
Adherence to drug therapy











RQ1: Does TeleHealth serve as a substitute for or complement to traditional healthcare services?

- **Empirical strategy**:

- Difference in Difference

$$Y_{it} = \beta_0 + \beta_1 Telemedicine_i + \delta_{DiD} Telemedicine_i * Post_t + \tau_t + \beta_1 X_{it} + \varepsilon_{it}$$

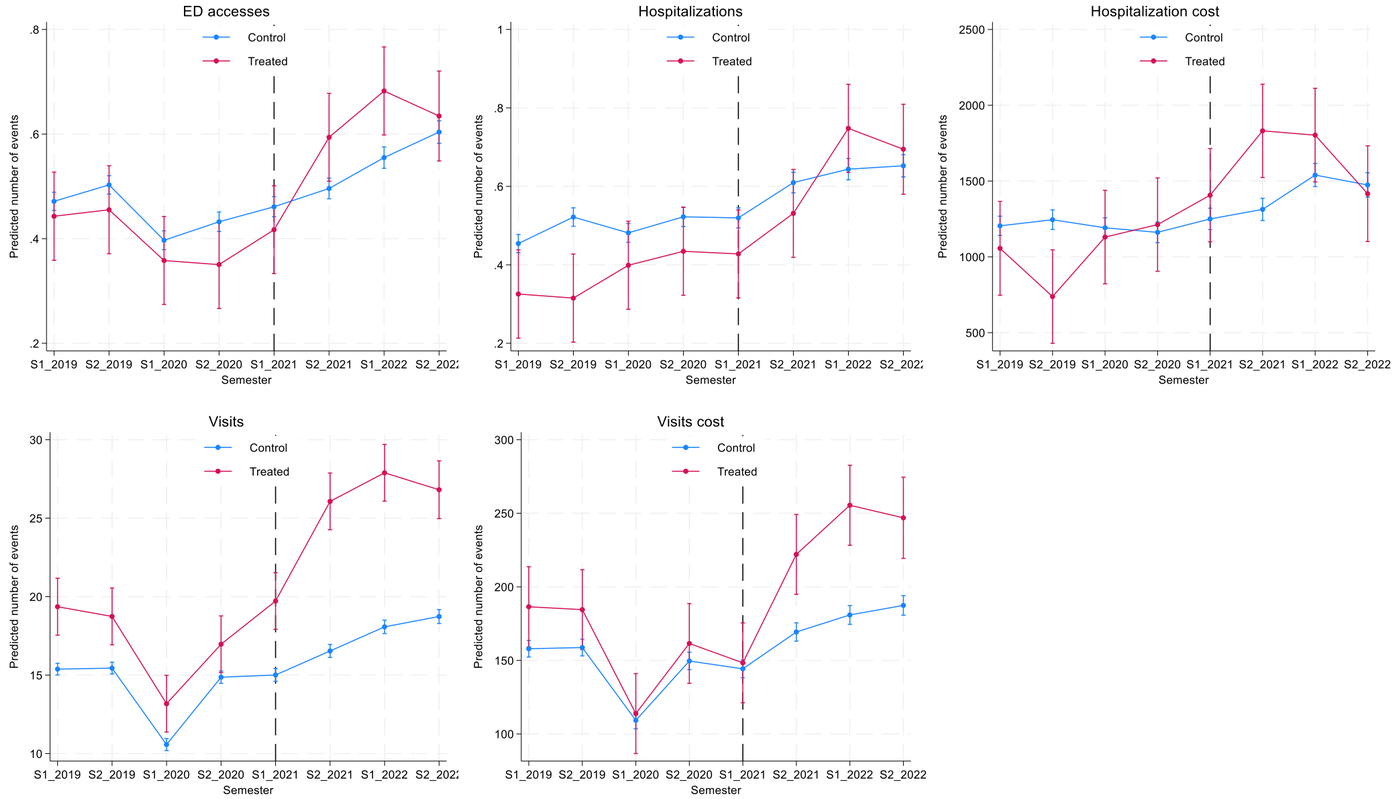
Treatment

- **Interaction between Treatment dummy and Post treatment dummy**
- **Interaction between Treatment and time periods (Dynamic)**

Controls

- **Demographics**: gender, age group
- **Health status**: exemptions, comorbidities

RQ1: Does TeleHealth serve as a substitute for or complement to traditional healthcare services?



Resource consumption positively affected by:

- Sex (Male)
- Charlson Comorbidity Index
- Age

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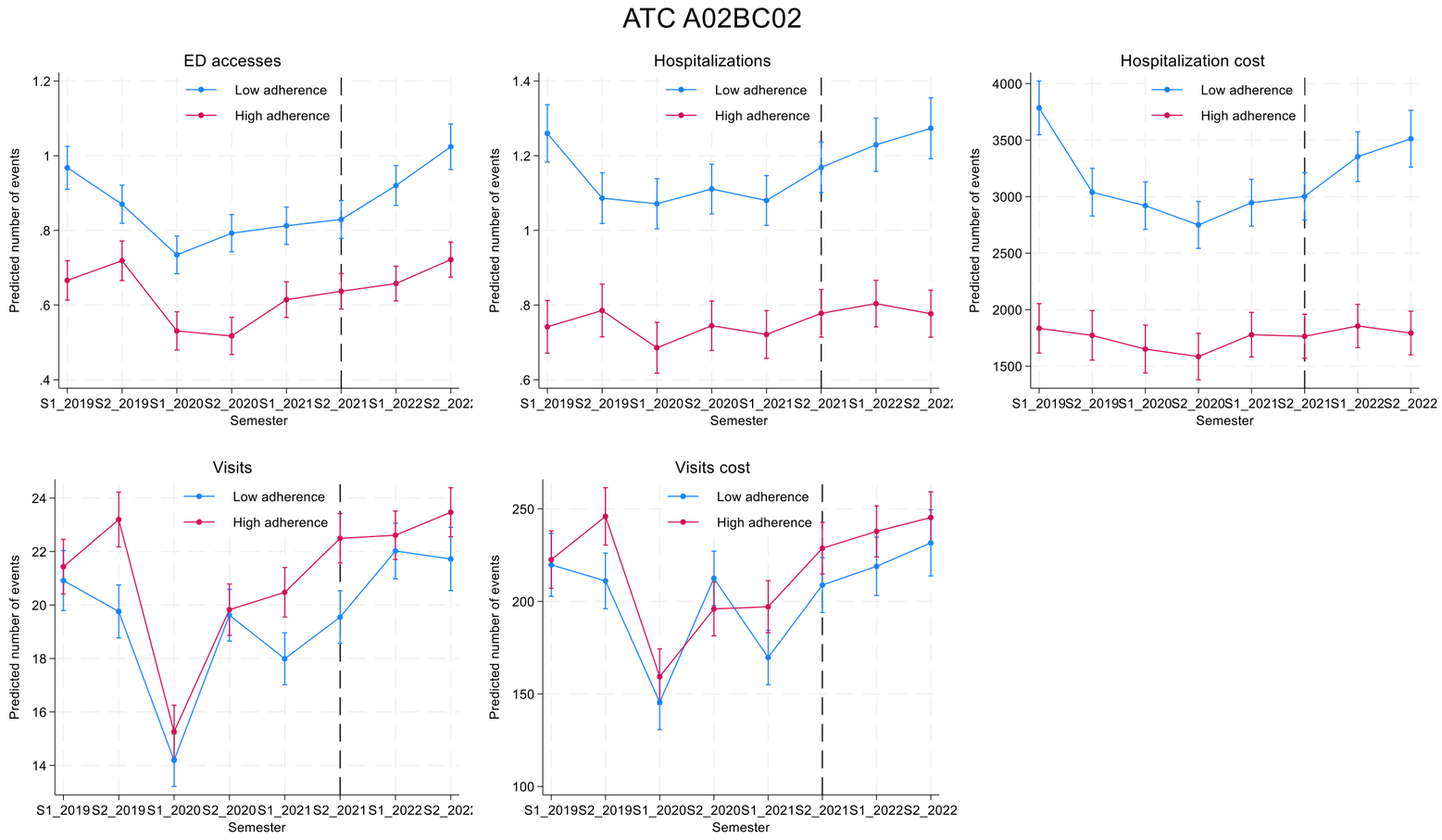
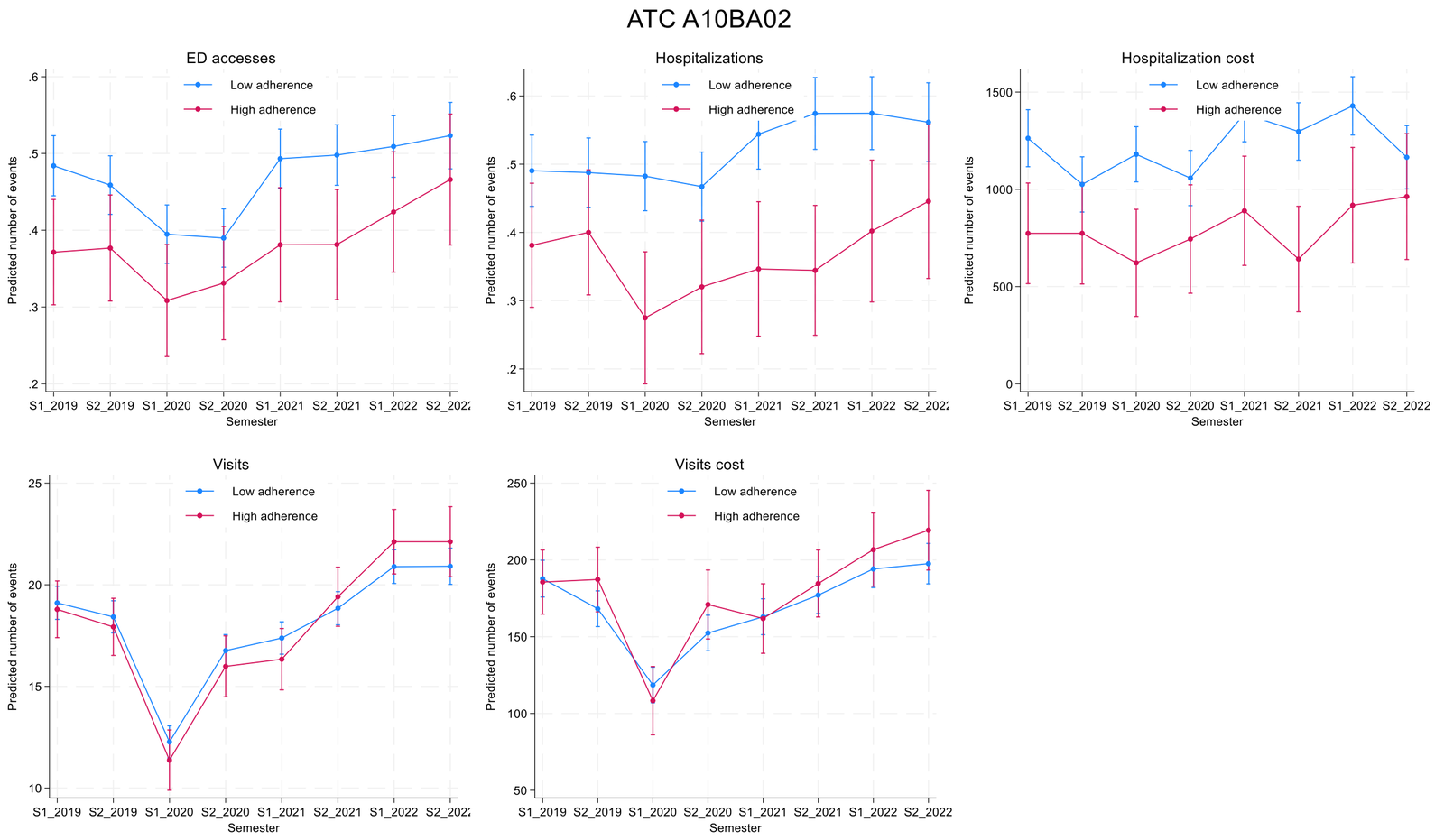
RQ2: Can higher adherence reduce the utilization of healthcare services?

Higher adherence leads to reduced use of emergency departments (EDs) and hospitalizations among diabetic patients.

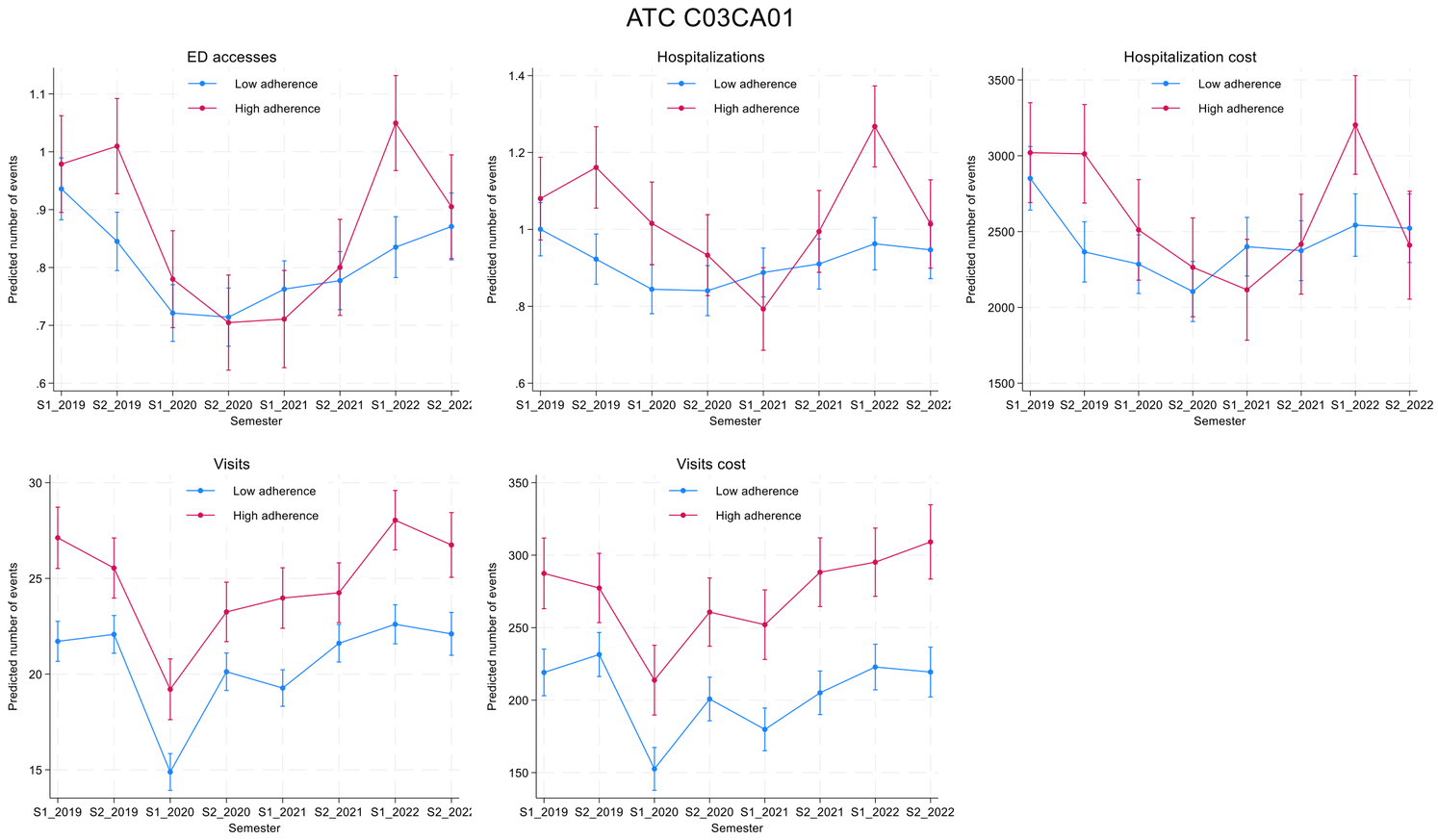


RQ2: Can higher adherence reduce the utilization of healthcare services?



RQ2: Can higher adherence reduce the utilization of healthcare services?

The evidence is weaker for cardiovascular patients. → long run effects?



RQ3: How does the consumption of healthcare resources relate to adherence and TeleHealth?

- **Outcome Variables**: ED visits, hospitalizations → endogenous variable Adherence
- **Empirical strategy**: We use a simultaneous equation model for binary variables. We constructed a joint model of adherence and medical care utilization that we estimated by using a **recursive bivariate probit** model which also takes into account the individuals unobserved heterogeneity which may characterize this relationship.

EQ1: Hospitalizations/ED accesses in the semester (Yes/No)

EQ2: Adherent to drug therapy

$$y*_{1i} = \delta_1 y_{2i} + \alpha_1' z_{1i} + \varepsilon_{1i}$$

$$y*_{2i} = \alpha_2' z_{2i} + \varepsilon_{2i}$$

For reduced form: Instrumental variables for Drug adherence: Number of pharmacy in the municipality

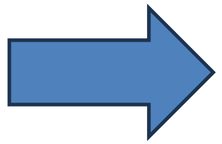
Robustness and further work

Robustness

- Modify temporal dimension (year-month)
- Apply matching techniques
- Heterogeneous difference in differences for month periods
- Modify outcome definitions

Limitations

- **Short implementation period**: only one-two years of data
- **Small groups**
- **Data gaps**: missing death and transfer information
- **Broad age groups**: may impact analysis precision



Extend the analysis

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Policy Implications

Results

- **Increased NHS resource use**: higher service utilization
- **Complementary role**: telemedicine supports, rather than replaces, traditional care
- **Possible indirect effect** via drug adherence

Policy implications

- **Integration with traditional care**: integrate telemedicine with traditional care
- **Targeted programs**: focus on the elderly and those with comorbidities
- **Geographical focus**: invest in telecommunication for regions like Liguria
- **Ongoing evaluation**: support long-term studies to measure impact