Prevalence and characterization of patients on polypharmacy across the three Area Vasta of the Tuscany Region (POLY-TUSC)

First published: 01/07/2026

Last updated: 01/07/2026

Study Finalised

Administrative details

EU PAS number

EUPAS1000001044

Study ID

1000001044

DARWIN EU® study

No

Study countries

Italy

Study description

Population aging and multimorbidity increase polypharmacy (≥5 concurrent drugs) and hyper-polypharmacy (≥10 drugs) prevalence, exposing frail adults to drug-drug interactions (DDIs), adverse events, prescribing cascades, and hospitalizations. Monitoring this regional phenomenon is key for health planning. Tuscany, divided into three "Area Vasta" territories (Central, North-West, South-East), represents a highly relevant setting due to its healthcare structure and ongoing 2023–2025 prescriptive appropriateness initiatives.
The aims of te study are to: (1) quantify polypharmacy prevalence among Tuscan residents aged ≥40 during 2023–2025, describing demographic profiles and therapeutic combinations by Local Health Authority (ASL) aggregated by Area Vasta; (2) characterize polypharmacy patients in nursing homes (RSA), integrated home care (ADI), and those with exemptions for chronic cardiovascular, rheumatological, or gastroenterological diseases. Additionally, (3) evaluate exposure to potentially inappropriate medications (PIMs) and severe DDIs in patients aged ≥65 using the 2023 AGS Beers Criteria.
The study is a retrospective descriptive observational cohort study using Tuscany's administrative databases (registry, outpatient prescriptions, direct distribution, exemptions) from 2023–2025. Residents aged ≥40 on Dec 31 each year with ≥3 years of observation will be included. Polypharmacy and hyper-polypharmacy are defined as dispensing ≥5 or ≥10 distinct ATC 4th-level drugs in the same month for ≥3 months/year. Descriptive statistics will be stratified by ASL (aggregated by Area Vasta) and age (40–64, 65–84, ≥85 years). PIMs and DDIs for patients ≥65 will be mapped via ATC codes. Mapping polypharmacy patterns will support regional health programming and economic sustainability. Evidence on PIMs and DDIs will provide tools for structured deprescribing and therapeutic optimization, improving safety for elderly and fragile patients.

Study status

Finalised

Research institutions and networks

Institutions

Agenzia regionale di sanità della Toscana (ARS Toscana)

Italy

First published: 01/02/2024

Last updated: 23/03/2026

Institution | EU Institution/Body/Agency | ENCePP partner

University of Siena

First published: 01/02/2024

Last updated: 01/02/2024

Institution

University Hospital of Pisa

First published: 01/02/2024

Last updated: 01/02/2024

Institution

University of Pisa

First published: 01/02/2024

Last updated: 01/02/2024

Institution

Networks

Centro Regionale di Farmacovigilanza della Toscana

Contact details

Study institution contact

Sandra Donnini sandra.donnini@unisi.it

Study contact

sandra.donnini@unisi.it

Primary lead investigator

Sandra Donnini 0000-0001-6617-1644

Primary lead investigator

ORCID number:

0000-0001-6617-1644

Study timelines

Date when funding contract was signed
Planned: 02/03/2026

Actual: 02/03/2026

Study start date
Planned: 06/07/2026

Actual: 02/03/2026

Data analysis start date
Planned: 03/08/2026

Actual: 30/06/2026

Date of final study report
Planned: 18/09/2026

Actual: 30/06/2026

Sources of funding

- No external funding

Regulatory

Was the study required by a regulatory body?

No

Is the study required by a Risk Management Plan (RMP)?

Not applicable

Methodological aspects

Study type

Study type list

Study topic:

Other

Study topic, other:

Polypharmacy

Study type:

Non-interventional study

Scope of the study:

Drug utilisation

Study design:

Observational cohort study to identify and describe patients on polypharmacy and hyper-polypharmacy within each of the three Tuscan Area Vasta over the 2023–2025 period.

Main study objective:

Primary:

- To quantify the number of patients on polypharmacy by ASL grouped by reference Area Vasta, and to describe their demographic profile, chronic disease copay exemption status, and most frequent drug combinations.

Secondary:

- To describe the demographic and clinical profile of polypharmacy patients receiving care in RSA and/or ADI by Area Vasta.
- To describe the demographic and clinical profile of polypharmacy patients by Area Vasta, restricting the analysis to patients with cardiovascular, rheumatological, or gastroenterological diseases.
- To perform a qualitative and quantitative assessment of elderly polypharmacy patients exposed to PIMs or drug-drug interactions, according to the 2023

American Geriatrics Society Beers Criteria.

Study Design

Non-interventional study design

Cohort

Cross-sectional

Study drug and medical condition

Medical condition to be studied

Chronic disease

Cardiovascular disorder

Rheumatic disorder

Inflammatory bowel disease

Population studied

Short description of the study population

For each calendar year between 2023 and 2025 (the study period), a cohort of subjects enrolled in the Regional Health Service as of December 31 (the index date) will be selected. Exclusion criteria for this initial population include a baseline observation period of less than 3 years prior to the index date and an age under 40 years at the index date. Within this final study population, patients on polypharmacy will then be identified for each year of the study period.

Age groups

- **Adult and elderly population (≥18 years)**
  - Adults (18 to < 65 years)
    - Adults (18 to < 46 years)
    - Adults (46 to < 65 years)
  - Elderly (≥ 65 years)
    - Adults (65 to < 75 years)
    - Adults (75 to < 85 years)
    - Adults (85 years and over)

Special population of interest

Frail population

Other

Special population of interest, other

Adults affected by chronic diseases on (hyper)-polypharmacy

Study design details

Setting

The study population consists of all individuals covered by the Regional Health Service (Servizio Sanitario Regionale) of the Tuscany Region, Italy. The analysis targets the population distributed across the various regional Local Health Units (Aziende Sanitarie Locali, ASLs), which are aggregated into the three regional administrative healthcare areas known as Area Vasta (Central, North-West, and South-East Area Vasta).

The study covers a three-year period from 2023 to 2025. Cohorts are defined annually, selecting subjects enrolled in the registry as of December 31st (index date) for each calendar year of interest.

Inclusion Criteria: Subjects must be aged 40 years or older at the index date and must be registered with the Tuscan Regional Health Service.
Exclusion Criteria: Individuals with a baseline observation period of less than 3 years prior to the index date are excluded.
Within this final population, patients on polypharmacy and hyper-polypharmacy are identified. Polypharmacy is defined as the dispensation of ≥5 different active substances (at the 4th level of the Anatomical Therapeutic Chemical [ATC] classification) within the same month for at least 3 out of the 12 months preceding the index date. Hyper-polypharmacy is defined using the same timeframe requirement but with a threshold of ≥10 different 4th-level ATC codes.
Since this is a descriptive study, there are no randomized treatment arms.

Comparators

The study is an observational study.
The population of interest is stratified by the following variables to evaluate variations in prescribing models:
Age Groups: Stratified into three specific bands: adults (40–64 years), elderly (65–84 years), and very elderly (≥ 85 years).
Geographical Areas: Stratified by ASL and grouped by the three regional Area Vasta (Center, North-West, South-East).
Setting of Care: patients receiving community-based care versus highly frail patients defined as having at least 1 day of care within a Nursing Home (RSA - Residenze Sanitarie Assistenziali) and/or Integrated Home Care (ADI - Assistenza Domiciliare Integrata) during the year of interest.
Clinical Comorbidities (Chronic Disease Exemptions): Sub-analyses are restricted to patients with specific exemption codes for chronic cardiovascular, rheumatological, or inflammatory bowel diseases (IBD), recorded during the second and third year preceding the index date.

Outcomes

The primary outcome is the annual prevalence of polypharmacy and hyper-polypharmacy among patients aged 40 years or older in the Tuscany Region during the 2023–2025 period. This outcome will be reported overall and stratified by ASL grouped into the three regional Area Vasta (Central, North-West, South-East), as well as by predefined age groups (40–64, 65–84, ≥ 85 years).

Characterization of Frail Populations: The annual prevalence, clinical-demographic profile (sex and age distribution), and chronic disease burden among polypharmacy patients in RSA and/or ADI.

Characterization of Chronic Disease Sub-cohorts: The prevalence and clinical-demographic description of patients on polypharmacy with specific exemptions for chronic cardiovascular, rheumatological, or IBD.

Prevalently Dispensed Therapeutic Patters: Identification and distribution (frequencies and percentages) of the top 5 most frequently used active molecules (5th-level ATC dispensed ≥3 times a year) and the top 10 most common drug combinations (grouped by 4th-level ATC codes) within the polypharmacy cohorts.

PIMs: In the subset of polypharmacy patients, the frequency and percentage of individuals exposed to PIMs (e.g., anticholinergics, NSAIDs, antipsychotics, long-acting sulfonylureas, digoxin, and sliding-scale insulin) independent of comorbidities, identified via ATC codes from the 2023 AGS Beers Criteria.

Potential DDI: In the subset of polypharmacy patients, the frequency and percentage of individuals exposed to high-risk therapeutic regimens involving DDI (oral anticoagulants + NSAIDs; ≥3 concurrent anticholinergic drugs; ACE inhibitors/ARBs + NSAIDs + diuretics; antiplatelets + NSAIDs without a proton pump inhibitor), identified according to the 2023 AGS Beers Criteria.

Data analysis plan

This is a descriptive drug-utilization study. Therefore, endpoints are reported as pharmacological and appropriateness metrics (prevalence, drug combination frequencies, and PIM exposure criteria) derived from regional administrative healthcare databases.
The distribution of continuous variables will be expressed as mean (standard deviation, SD) and/or median (interquartile range, IQR). Categorical variables will be reported as frequencies and percentages.
The trend in the annual prevalence of patients on polypharmacy within each Area Vasta will be observed over the study period (2023-25). The annual prevalence of patients on polypharmacy will be calculated as the number of patients on polypharmacy in the year of interest divided by the reference covered population in the same year.
Patients on polypharmacy identified over the 2023–2025 period will be characterized in terms of sex, age, care setting (≥1 day in a RSA and/or ADI during the year of interest), presence of chronic disease exemptions in the 2nd and 3rd year prior to the index date, most frequently used drugs, and combinations of drugs grouped according to the 4th level of the ATC/DDD classification system. The analysis will be stratified by the patient's ASL, and ASL will be grouped and categorized according to the three regional Area Vasta.
In secondary analyses, the same descriptive approaches outlined above will be applied to specific subsets of the study population, namely: i) patients with at least 1 day in an RSA and/or ADI during the reference year, and ii) patients with a recorded cardiovascular, gastroenterological, or rheumatological chronic disease exemption in the 2nd and 3rd year prior to the index date, respectively.
Finally, among patients on polypharmacy aged ≥ 65 years, those exposed to PIMs independent of comorbidities and to therapeutic regimens at risk of potentially drug-drug interactions will be identified, according to the 2023 AGS Beers Criteria.

Summary results

As of the current registration date, data extraction and statistical analyses have not yet been finalized.

The results of study will provide:

annual and stratified (by age group, Local Health Authority, and Area Vasta) prevalence rates of polypharmacy and hyper-polypharmacy among the Tuscan population aged ≥ 40 years for the 2023–2025 period; demographic and clinical characterization of complex patient subgroups, specifically individuals in RSA, ADI, or with specific chronic disease; Frequency and distribution of top therapeutic regimens, potential DDI, and exposure to PIMs based on the 2023 AGS Beers Criteria.

Data management

ENCePP Seal

The use of the ENCePP Seal has been discontinued since February 2025. The ENCePP Seal fields are retained in the display mode for transparency but are no longer maintained.

Data sources

Data source(s)

ARS Toscana

Data sources (types)

Administrative healthcare records (e.g., claims)

Use of a Common Data Model (CDM)

CDM mapping

No

Data quality specifications

Check conformance

Unknown

Check completeness

Unknown

Check stability

Unknown

Check logical consistency

Unknown

Data characterisation

Data characterisation conducted

No