Comparative Effectiveness and Safety of Angiotensin-Converting Enzyme Inhibitors (ACEIs) and Angiotensin Receptor Blockers (ARBs) in Older Adults with Type 2 Diabetes

First published: 04/01/2022

Last updated: 02/07/2024

Study Finalised

Administrative details

EU PAS number

EUPAS44899

Study ID

44900

DARWIN EU® study

No

Study countries

☐ United States

Study description

Angiotensin-converting enzyme inhibitors (ACEIs) and angiotensin receptor blockers (ARBs) are widely used blood pressure lowering drugs which work by inhibiting the renin-angiotensin system. There are several head-to-head trials assessing the relative effectiveness of these two drug classes. However, the available evidence is limited by small sample size and real-world evidence is conflicting. Therefore, it is necessary to perform a high-quality real-world study to assess the comparative effectiveness of ACEIs to ARBs. More than one-third of the adults with diabetes are currently aged 65 years or older and both ACEIs and ARBs are recommended as first line therapy in type 2 diabetes with hypertension. Thus, to reduce bias and achieve better baseline comparability in real-world study, we propose to assess the comparative effectiveness of ACEIs to ARBs in older adults with type 2 diabetes. We aim to 1) estimate absolute and relative rate and risk of in cardiovascular outcomes and all-cause mortality in Medicare beneficiaries with type 2 diabetes (T2D) initiating ACEIs or ARBs. 2) identify subgroups of Medicare beneficiaries with T2D that are more likely to benefit from ACEI’s or ARBs to prevent cardiovascular outcomes and all-cause mortality using machine learning-based heterogeneous treatment effect analysis. We will conduct active-comparator, new-user cohort using a 20% random sample of Medicare data including patients with ≥1 prescription dispensing claim for ACEI or ARB between January 01, 2007, and December 30, 2019. We will assess the following outcome: (i) hospitalization of Heart failure (HHF) (ii)composite endpoint of inpatient myocardial infarction (MI), inpatient stroke or all-cause mortality (Major Cardiovascular Events, MACE outcome) (iii) the composite of MACE plus HHF. (iv) All-cause mortality. (v) end stage renal disease and dialysis.

Study status

Finalised

Research institutions and networks

Institutions

University of North Carolina at Chapel Hill

First published: 01/02/2024

Last updated: 01/02/2024

Institution

Contact details

Study institution contact

Til Stürmer sturmer@unc.edu

Study contact

sturmer@unc.edu

Primary lead investigator

Til Stürmer

Primary lead investigator

Study timelines

Date when funding contract was signed

Planned: 01/08/2017

Actual: 01/08/2017

Study start date

Planned: 29/12/2021

Actual: 29/12/2021

Date of final study report

Planned: 29/12/2021

Actual: 29/12/2021

Sources of funding

- Other

More details on funding

National Institute on Aging at NIH

Study protocol

ACEI v ARB_RWE protocol_30DEC2021.pdf (594.66 KB)

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:

Disease /health condition

Human medicinal product

Study type:

Non-interventional study

Scope of the study:

Drug utilisation

Effectiveness study (incl. comparative)

Safety study (incl. comparative)

Data collection methods:

Secondary use of data

Main study objective:

1. To estimate absolute and relative rate and risk of in cardiovascular outcomes and all-cause mortality in Medicare beneficiaries with type 2 diabetes (T2D) initiating ACEIs or ARBs. 2. To identify subgroups of Medicare beneficiaries with T2D that are more likely to benefit from ACEI’s or ARBs to prevent cardiovascular outcomes and all-cause mortality using machine learning-based analysis.

Study Design

Non-interventional study design

Cohort

Other

Non-interventional study design, other

Active-comparator, new-user (ACNU) design

Study drug and medical condition

Anatomical Therapeutic Chemical (ATC) code

(C09AA) ACE inhibitors, plain

ACE inhibitors, plain

(C09CA) Angiotensin II receptor blockers (ARBs), plain

Angiotensin II receptor blockers (ARBs), plain

Medical condition to be studied

Type 2 diabetes mellitus

Population studied

Short description of the study population

1. Medicare FFS enrollees ≥65 years of age with T2D having continuous coverage in fee-for-service Medicare plans A (inpatient services), B (physician and outpatient services) and D (prescription drugs)

2. The base population for the analysis will consist of all beneficiaries with ≥1 prescription dispensing claim for ACEI or ARB between January 01, 2007, and December 30, 2019.

We will exclude the following patients:

1) To ensure new use of either ACEIs or ARBs, we will exclude all individuals who do not have at least 12 months of continuous enrollment (inpatient, outpatient, and prescription coverage) in the appropriate insurance database prior to the first prescription dispensing claim (12-month baseline period), during which no use of any of the study drug classes compared is detected.

Age groups

- Adults (65 to < 75 years)
- Adults (75 to < 85 years)
- Adults (85 years and over)

Special population of interest

Hepatic impaired

Immunocompromised

Other

Renal impaired

Special population of interest, other

Type 2 diabetes mellitus patients

Estimated number of subjects

100000

Study design details

Outcomes

The primary outcomes are (i) Hospitalization of Heart failure (HHF) (ii) composite endpoint of inpatient myocardial infarction (MI), inpatient stroke or all-cause mortality (Major Cardiovascular Events, MACE outcome) (iii) the composite of MACE plus HHF. (iv) All-cause mortality (v) end stage renal disease or dialysis, Secondary outcomes include individual components of the MACE outcome (non-fatal MI, stroke, and HHF), and MACE plus invasive cardiac procedures (stents, revascularization, bypass surgery).

Data analysis plan

We will estimate 2-year risks of outcomes of interest, risk differences (RD) and ratios (RR) for ACEIs vs. ARBs after weighting by IPTW and IPCW. Confidence intervals will be derived from 2.5th and 97.5th percentiles of estimates from 500 bootstrap resamples of the study population (random resampling with replacement). When estimating risks of cardiovascular outcomes in older Medicare patients, censoring those who died prior to having the outcome of interest, as commonly done in survival analyses, could bias the risks. To avoid this, we will use Aalen Johansen (AJ) estimators to estimate risks.

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), other

Medicare Fee-for-Service (FFS) Database

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