Brasenose College, Oxford
8 -10 September

UNDERSTANDING INAPPROPRIATE EMERGENCY ADMISSIONS: EVIDENCE FROM A STUDY IN BOLZANO (ITALY)
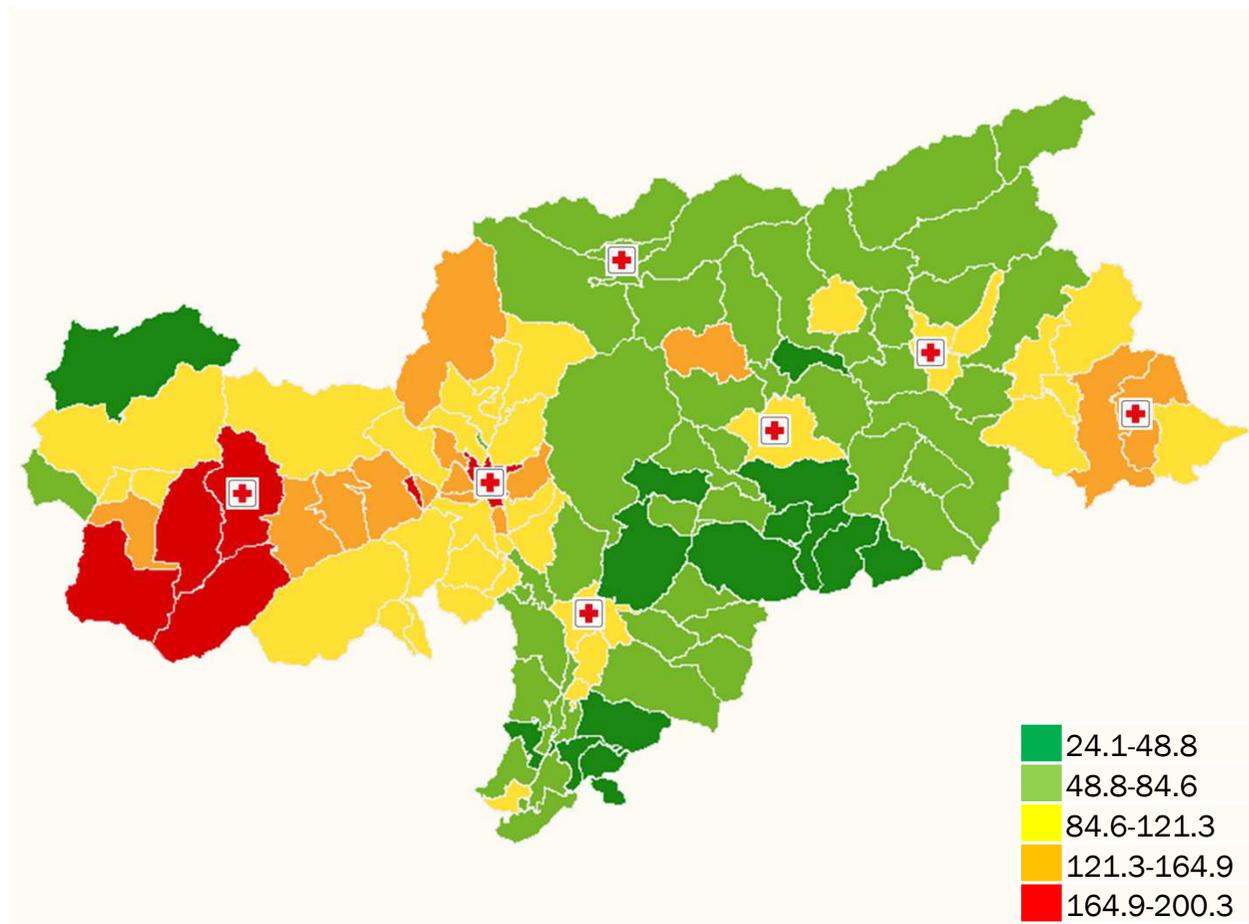
Mirko Bonetti, MSc[1]; Chiara Seghieri, PhD[2]

[1] Health Department Province of Bolzano (Italy)
[2] Management and Health Lab, Institute of Management,
L'EMbeDS Sant'Anna School of Advanced Studies (Italy)

2025 Wennberg International Research Meeting

AUTONOME PROVINZ
BOZEN - SÜDTIROL
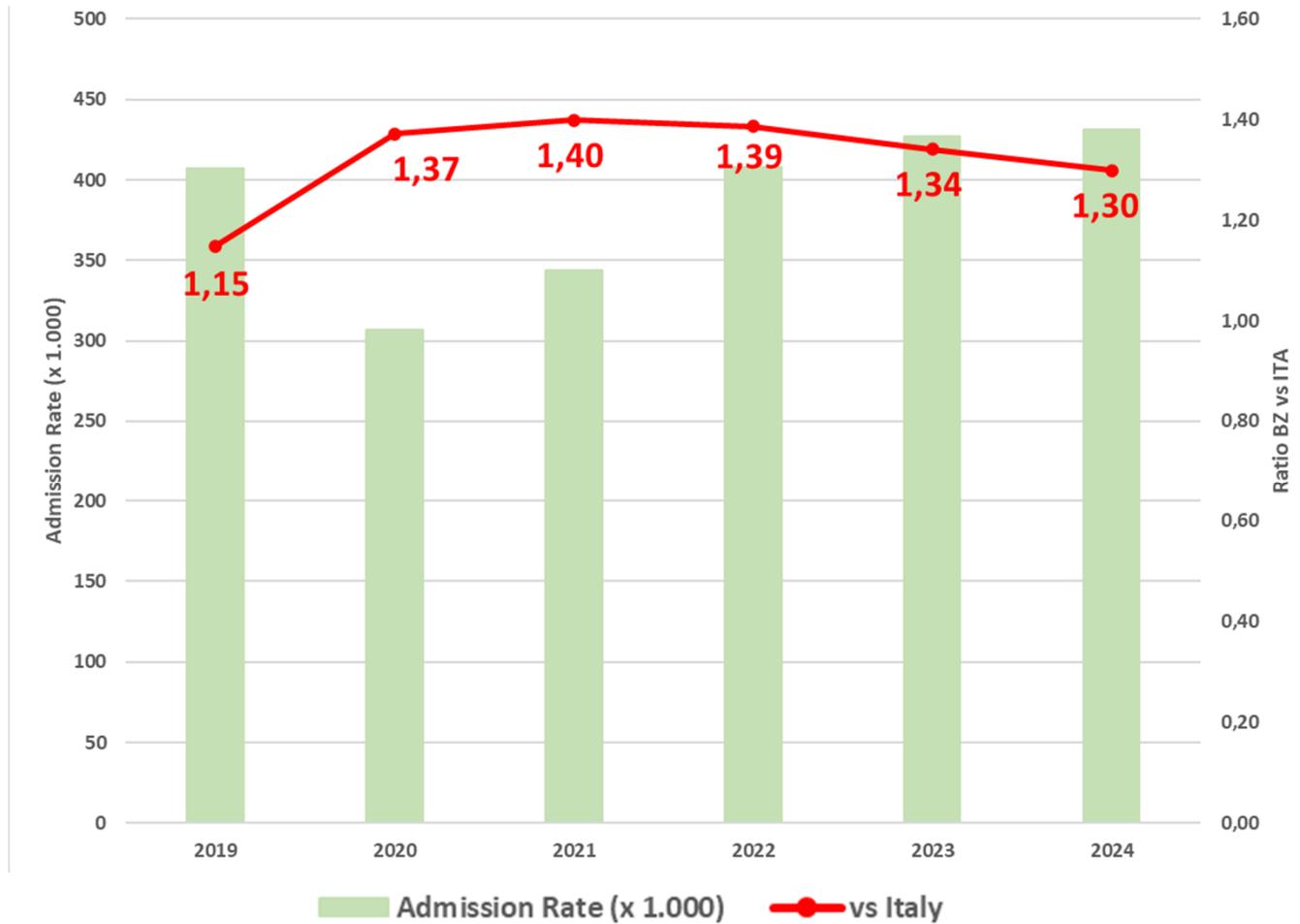Abteilung 23 - Gesundheit

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Department 23 - Health

Understanding Inappropriate Emergency Department Admissions:
Evidence from a Study in Bolzano (Italy)

PREVIOUSLY ON WIC....

ED Inappropriate Admission Rates (x 1,000) (2023)

The 11th Fall Research Meeting Oslo, Norway
September 11th to September 13th

AN ANALYSIS OF EMERGENCY DEPARTMENT
INAPPROPRIATE ADMISSIONS
IN THE PROVINCE OF BOLZANO (ITALY)

Mirko Bonetti, MSc[1]; Giuseppe D'Orio, MSc[2]; Chiara Seghieri, PhD[2]

[1] Health Department Province of Bolzano (Italy)
[2] Management and Health Lab, Institute of Management,
L'EMbeDS Sant'Anna School of Advanced Studies (Italy)

- Higher Risk of inappropriate admissions
- Geographic variation between
  the municipalities (internal variability)
- Closer the ED, higher the rates
- Lack of GPs

Legend:
- 24.1-48.8
- 48.8-84.6
- 84.6-121.3
- 121.3-164.9
- 164.9-200.3

ED Admission Rates (per 1,000 inhabitants) 2019-2024

EDs Inappropriate Admissions: Objectives

ED inappropriate admissions

- o *delays in treating seriously ill patients*
- o *increase of the costs due to unnecessary investigations*

✓ To <u>analyse</u> and <u>compare variations</u> among the province of Bolzano

✓ To explore determinants of inappropriate ED admissions
- o Count regression model

Selection Criteria:

✓ ED Admissions (2019-2024) by resident patients

✓ **Inappropriate admissions** are defined as
- o Triage: Level 4 (less urgent)/Level 5 (non urgent)
- o No Diagnosis of Trauma
- o Arrival Time from 8 a.m to 8 p.m. (week-end and Public Holidays excluded)
- o by Private Transport
- o Discharge Home

Understanding Inappropriate Emergency Department Admissions:
Evidence from a Study in Bolzano (Italy)

EDs Inappropriate Admissions (%)
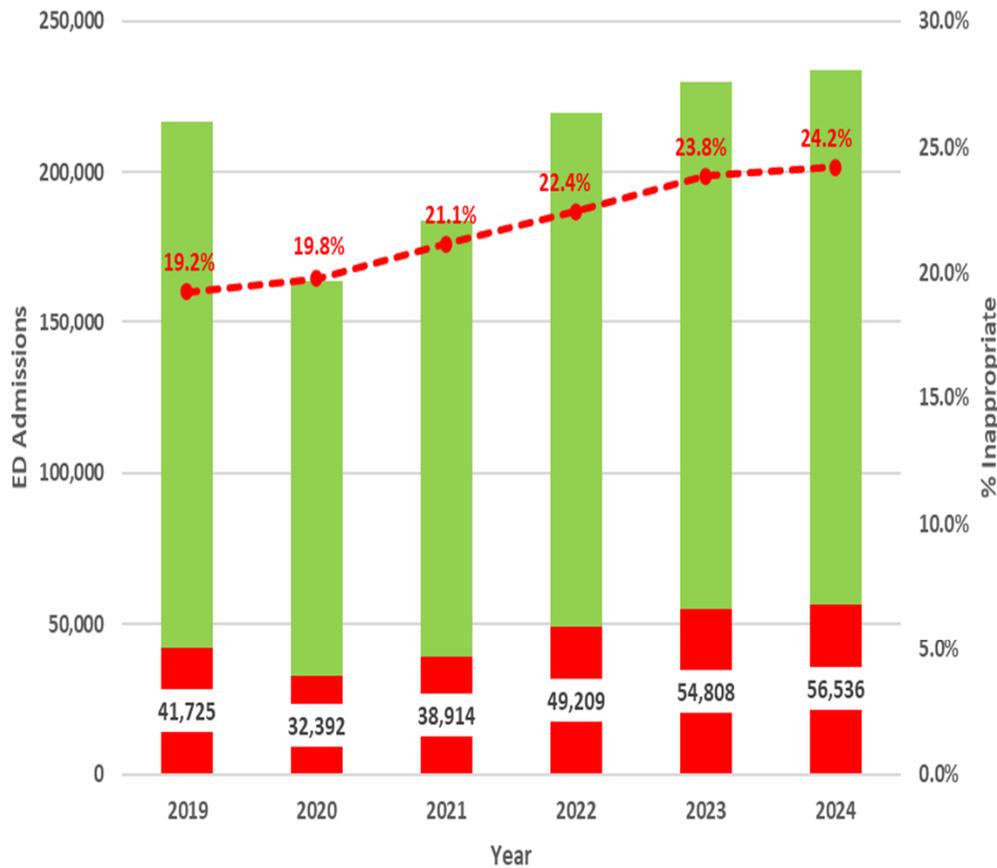
Costs (tariffs) of EDs Inappropriate Visits (%)
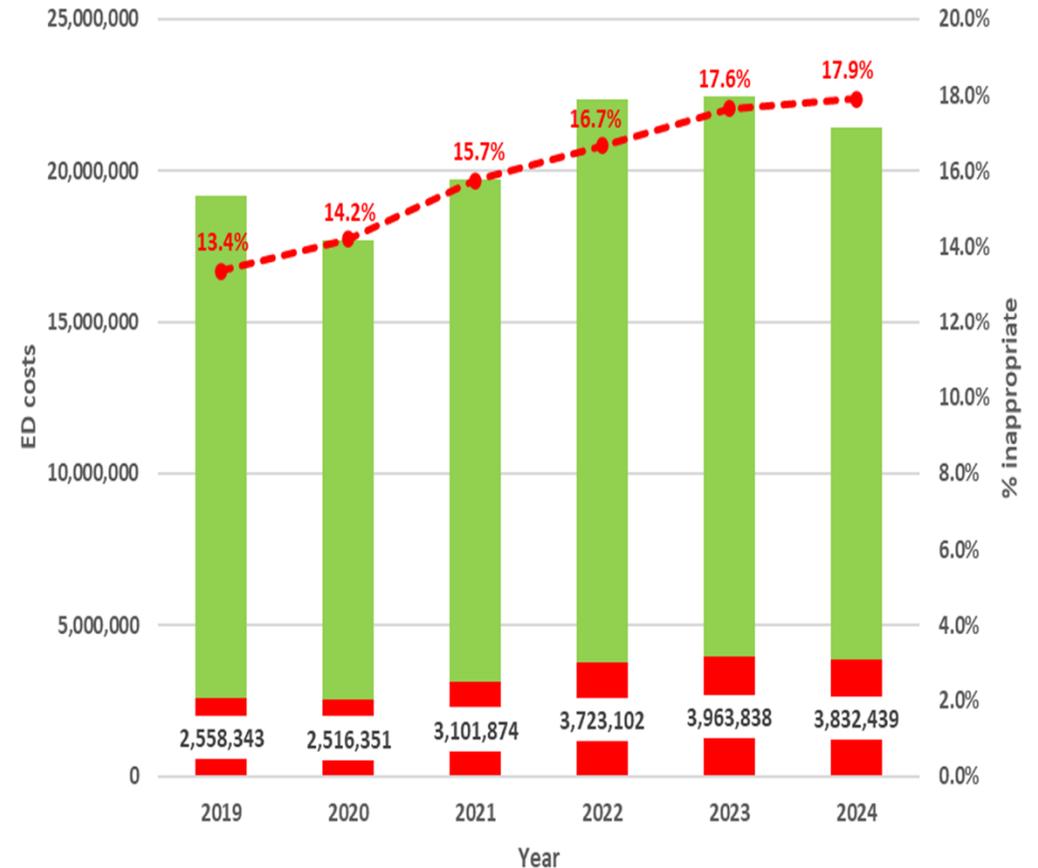
ED Inappropriate Admissions: Diagnosis

DIAGNOSIS		2024	%
Chap. 13	Diseases of the Musculoskeletal System and Connective Tissue (710-739)	9,854	17.4%
Chap. 6	Diseases of the Nervous System and Sense Organs (320-389)	9,723	17.2%
Chap. 16	Symptoms, Signs, and Ill-Defined Conditions (780-799)	8,014	14.2%
Chap. 9	Diseases of the Digestive System (520-579)	5,799	10.3%
Chap. 8	Diseases of the Respiratory System (460-519)	5,498	9.7%
Chap. 12	Diseases of the Skin and Subcutaneous Tissue (680-709)	3,195	5.7%
Chap. V	External causes of Injury and Supplemental Classification (V01-V82)	2,848	5.0%
Chap. 1	Infectious and Parasitic Diseases (001-139)	2,771	4.9%
Chap. 10	Diseases of the Genitourinary System (580-629)	2,758	4.9%
Chap. 7	Diseases of the Circulatory System (390-459)	2,215	3.9%
Chap. 5	Mental Disorders (290-319)	910	1.6%
Chap. 17	Injury and Poisoning (800-999)	806	1.4%
Chap. 11	Complications of Pregnancy, Childbirth, and the Puerperium (630-677)	740	1.3%
Chap. 14	Congenital Anomalies (740-759)	671	1.2%
Chap. 3	Endocrine, Nutritional and Metabolic Diseases, and Immunity Disorders (240-279)	338	0.6%
Chap. 2	Neoplasms (140-239)	220	0.4%
Chap. 4	Diseases of the Blood and Blood-Forming Organs (280-289)	128	0.2%
Chap. 15	Certain Conditions originating in the Perinatal Period (760-779)	48	0.1%
	TOTAL	56,536	100.0%

ED Inappropriate Admission Rates (2024) – District level (n = 4)
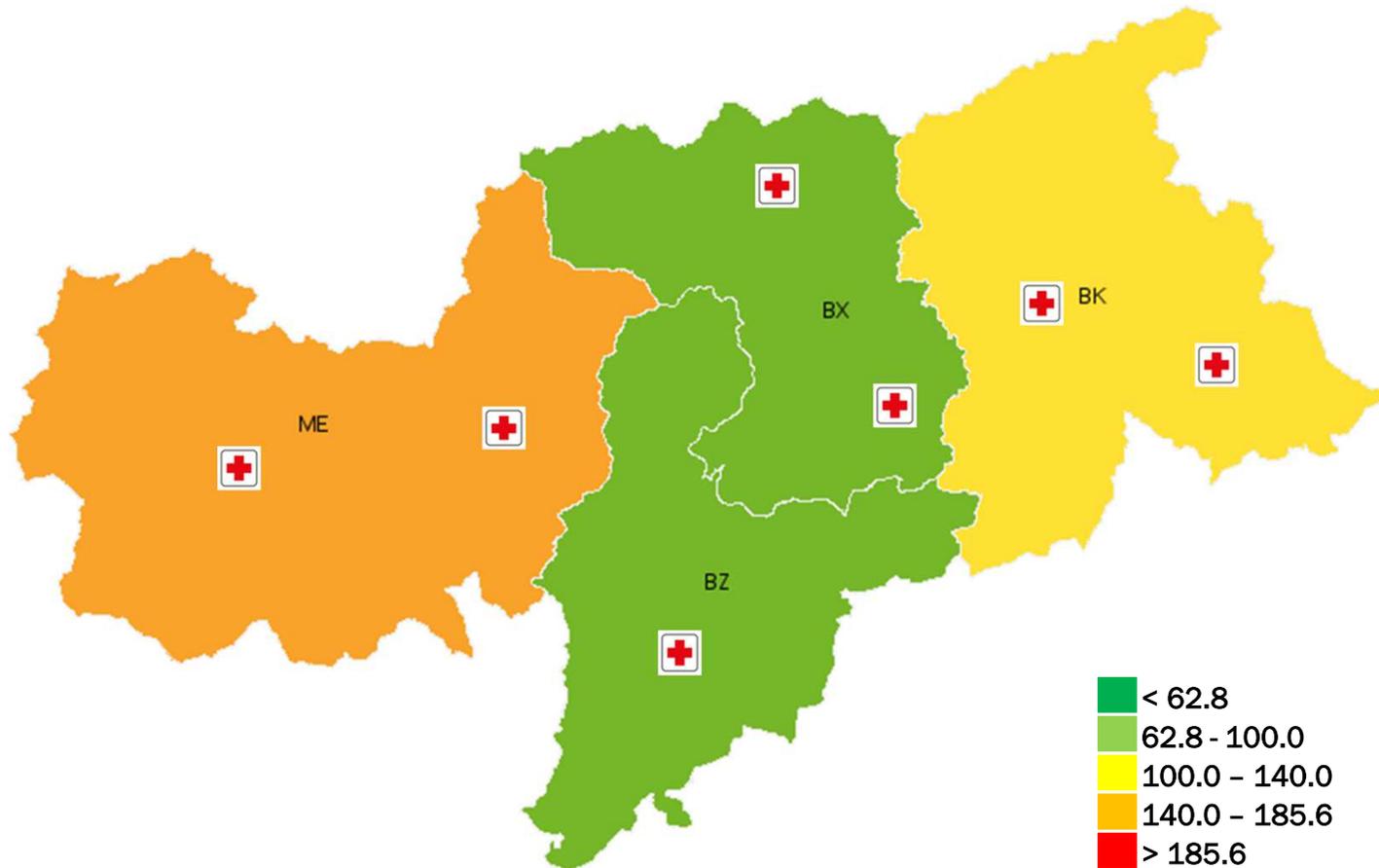
	2024
RATE	104.9
MIN	77.4
MAX	141.5
(High/Low)	1.8
SCV	4.8 (medium)

Legend:
- < 62.8
- 62.8 - 100.0
- 100.0 – 140.0
- 140.0 – 185.6
- > 185.6

ED Inappropriate Admission Rates (2024) – Sub District level (n = 20)

	2024
RATE	104.9
MIN	32.2
MAX	183.5
(High/Low)	5.7
SCV	> 10 (very high)

Legend:
- < 62.8
- 62.8 - 100.0
- 100.0 – 140.0
- 140.0 – 185.6
- > 185.6

ED Inappropriate Admission Rates (2024) – Municipalities level (n = 116)
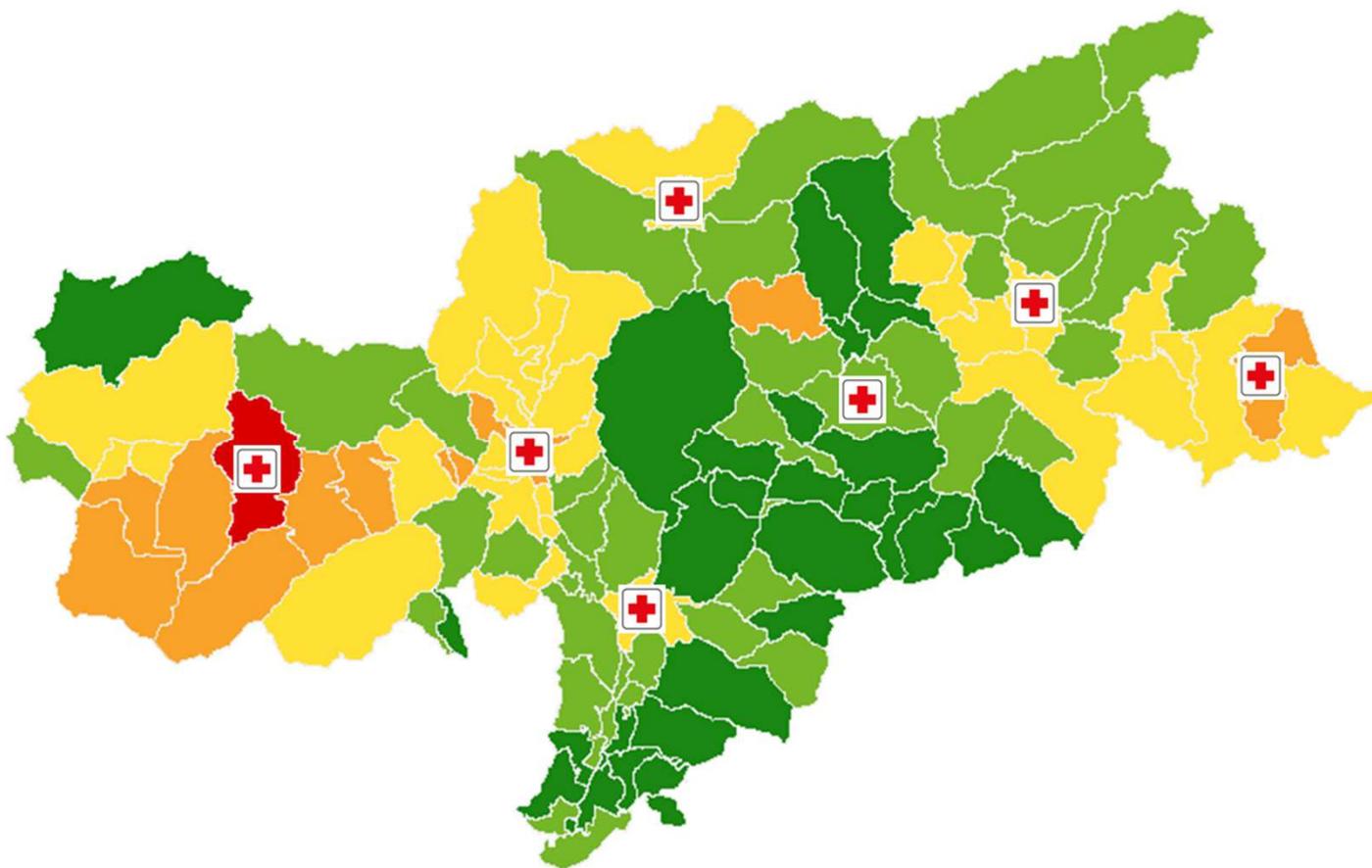
	2024
RATE	104.9
MIN	31.1
MAX	215.9
(High/Low)	6.9
SCV	> 10 (very high)

EDs Inappropriate Admissions: Methods

- ***Regression model***

  - ✓ *Given the existence of excess zeros in the distribution of inappropriate admissions we tested the following three different models (Deb, Norton, Annu. Rev. Public Health, 2018):*
    - o *Zero Inflated Poisson Model (ZIP)*
    - o *Zero Inflated Binomial Model (ZIBN)*
    - o *Hurdle count data Model (HM)*

  - ✓ *We also tested for fixed effects (FE) vs random effects (RE)*

  - ✓ *Model performance was compared using the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC)*

EDs Inappropriate Admissions: Methods

Regression model

✓ Outcome

- o EDs Inappropriate Admissions

✓ Explanatory variables:

✓ Individual level

- o Age (years)
- o Gender (1 = F; 0 = M)
- o High Migration Pressure Countries (1 = yes; 0 = no)
- o Chronic conditions (n)
- o Registration with GP (1 = yes; 0 = no)
- o Frequent User (1 = yes; 0 = no)
- o Travel distance to the hospital (minutes)

✓ Municipality level

- o EDs Inappropriate Admissions: Length of Stay (LOS) (median)
- o Chronic patients (%)
- o Over65 patients (%)

VARIABLES	INAPPROPRIATE ADMISSIONS	APPROPRIATE ADMISSIONS	p
Admissions (n, %)	56,531 (24.8)	170,984 (75.2)	
Age (years) Median (IQR)	44.0 (23.0 – 63.0)	44.0 (19.0 – 66.0)	a*
Females (n, %)	29,399 (52.0)	82,235 (48.1)	c*
HMPC (n, %)	9,242 (16.3)	18,467 (10.8)	c*
Chronic conditions (n) Mean (sd)	0.8 (1.5)	1.0 (1.7)	b*
No GP (n, %)	3,640 (6.4)	15,991 (9.4)	c*
Frequent User (n, %)	12,127 (21.5)	32,027 (18.7)	c*
Travel distance (min) Mean (sd)	20.2 (15.8)	21.1 (16.1)	b*
LOS (min) Median (range)	98.0 (55.0 – 170.0)	105.0 (57.0 – 188.0)	b*

[a] Wilcoxon median test; [b] t-student test; [c] χ2 test; * statistical significance at the 5% level

EDs Inappropriate Admissions: Results

- ## _Regression model (estimates)_

  Hurdle count data Model (HM)
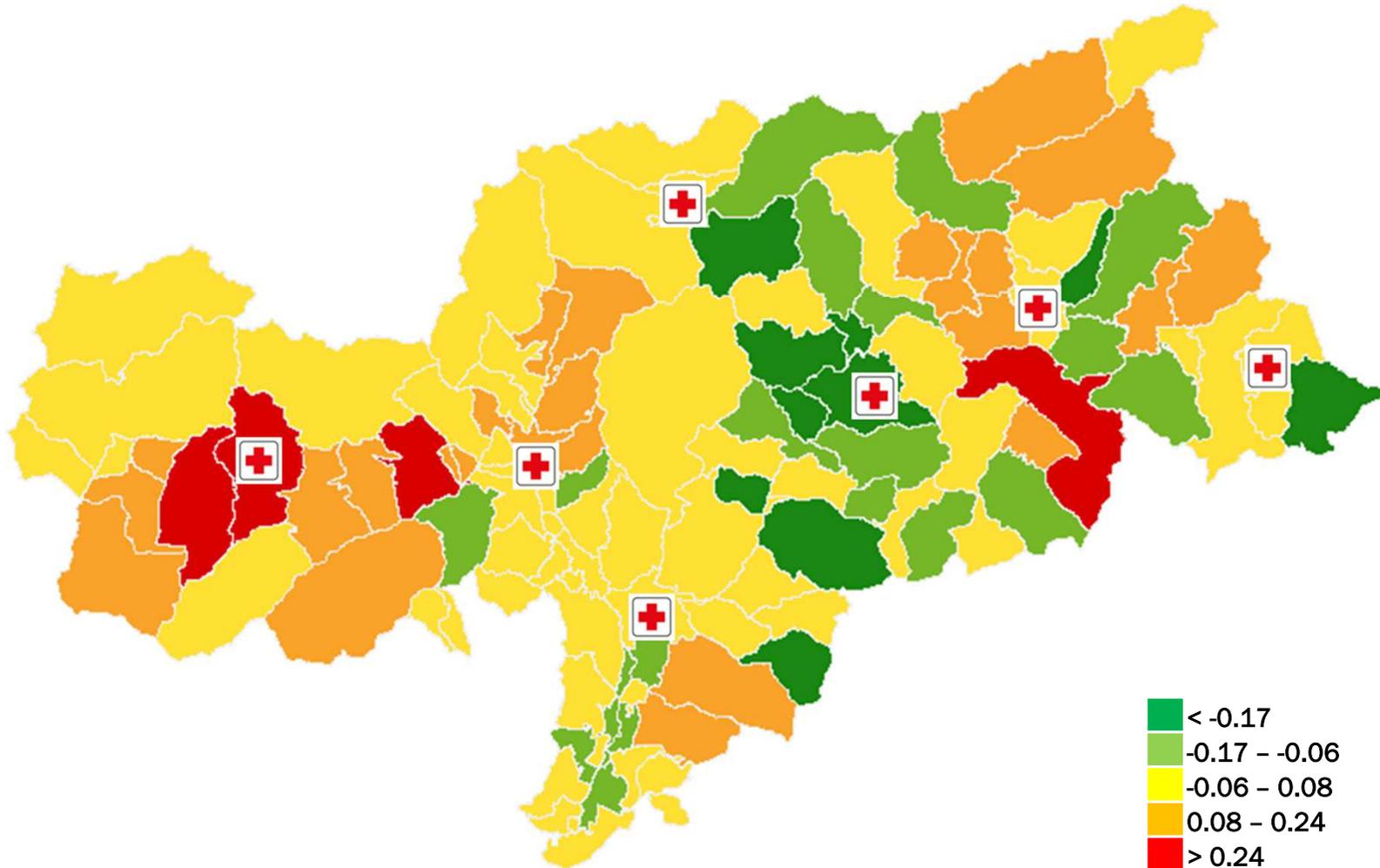 +
  Random Effects (RE)
  → municipalities (n=116)
  is the best specification

		Coefficients	
VARIABLES	CATEGORY	BINARY	NON ZERO
Age	-	0.00113* (0.00028)	0.00024 (0.00049)
Sex	F	0.17117* (0.01182)	0.04198* (0.02043)
Frequent User	Yes	1.56876* (0.02397)	1.95965* (0.02169)
GP	Yes	0.73523* (0.03031)	0.19324* (0.05965)
HPMC	Yes	1.20047* (0.04856)	0.37686* (0.08026)
GP * HPMC	Yes	-0.75166* (0.05194)	-0.18416* (0.08472)
Chronic conditions	-	-0.05370* (0.00505)	0.01491 (0.00802)
Travel Distance (min)	-	-0.00014 (0.00059)	0.00155 (0.00090)
LOS (minutes)	-	0.00134 (0.00105)	-0.00001 (0.00098)
Chronic %	-	0.04479* (0.01458)	0.02507 (0.01387)
Over 65 %	-	-0.00833 (0.01686)	0.00384 (0.01617)

* statistical significance at the 5% level

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RE Estimates

🟩	< -0.17
🟢	-0.17 – -0.06
🟨	-0.06 – 0.08
🟧	0.08 – 0.24
🟥	> 0.24

Conclusions (1)

❖ Higher ED admission rates (Overcrowding) → Higher Risk of inappropriate admissions

❖ High Internal variability across the 116 municipalities

    ❖ H/L = 6.9

    ❖ SCV > 10

❖ Even after taking account patients and context characteristics

Conclusions (2)

❖ **Role of Patients**

- ▪ Low ED LOS → due to specific lane (e.g. Fast Track, GPs working in ED)
- ▪ Frequent User: why more than 4 ED admissions in a year?

- ▪ To have a GP does not significantly reduce the risk of inappropriate ED Admissions
- ▪ Do HPMC citizens prefer to go directly to ED?

  - → Limited access or availability of primary care or self decision?
  - → High Waiting time for a visit?
  - → Better exploring the equity dynamics

Conclusions (3)

❖ **Role of Health Care Managers and Policy makers**

- ▪ To analyze the unwarranted variation and to reduce potentially inappropriate admissions (health care resources as GPs, specialists should be improved)

- ▪ Interventions for reducing the LOS in ED might have an adverse effect of increasing ED Inappropriate Admissions

- ▪ Reduce the waiting times for an outpatient visit (Is an agreement with private structure the solution?)

- ▪ Could an introduction of co-payment reduce inappropriate admissions?

- ▪ May qualitative studies support health policies measures?

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For any questions

mirko.bonetti@provincia.bz.it

Thank you

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