

Statistics for innovation
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**THE RISK OF AVOIDABLE HOSPITALIZATIONS
IN DIABETIC PATIENTS:
A RETROSPECTIVE COHORT STUDY
IN THE PROVINCE OF BOLZANO (ITALY)**

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INTRODUCTION (1)

- **Chronic diseases**

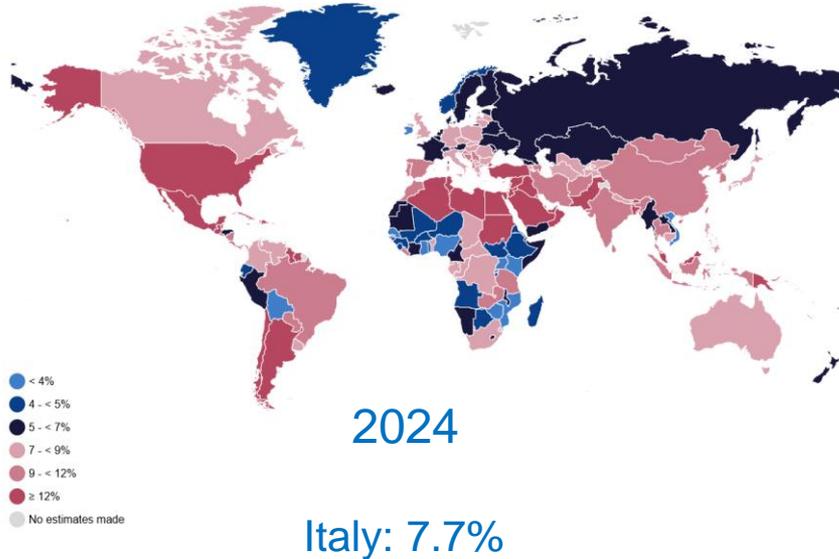
- ✓ *as the life expectancy grows, the number of people with chronic diseases, increase, significantly worsening their quality of life*
- ✓ *Managing the increasing number of individuals with chronic diseases requires a different organization of care, including investing in strengthening the role of Primary Care (PC) which is the first point of contact people and patients have with the health system*
- ✓ *diabetes is one of most common chronic disease*

INTRODUCTION (2)

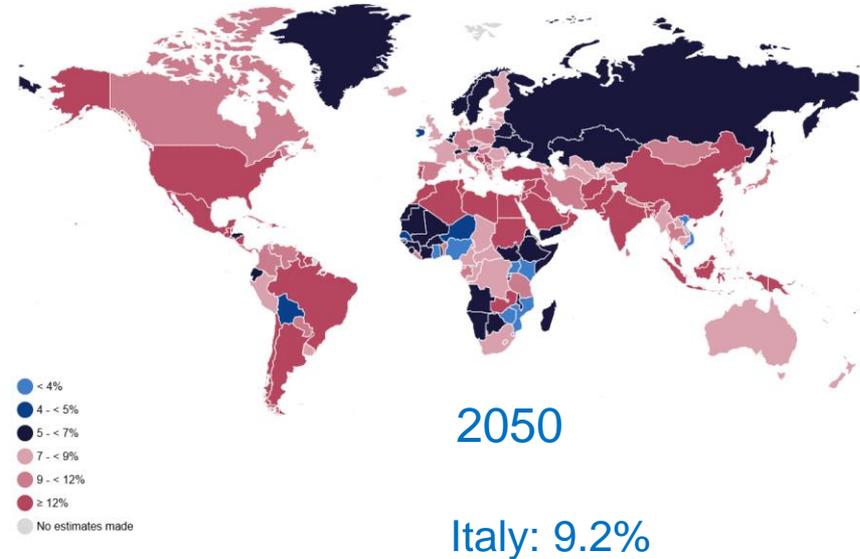
- **Diabetes: numbers**

- *IDF estimates: about 1 case every 8 adults by the year 2050 (20-79 years)*

Age-standardised prevalence of diabetes, % by Country/Territory

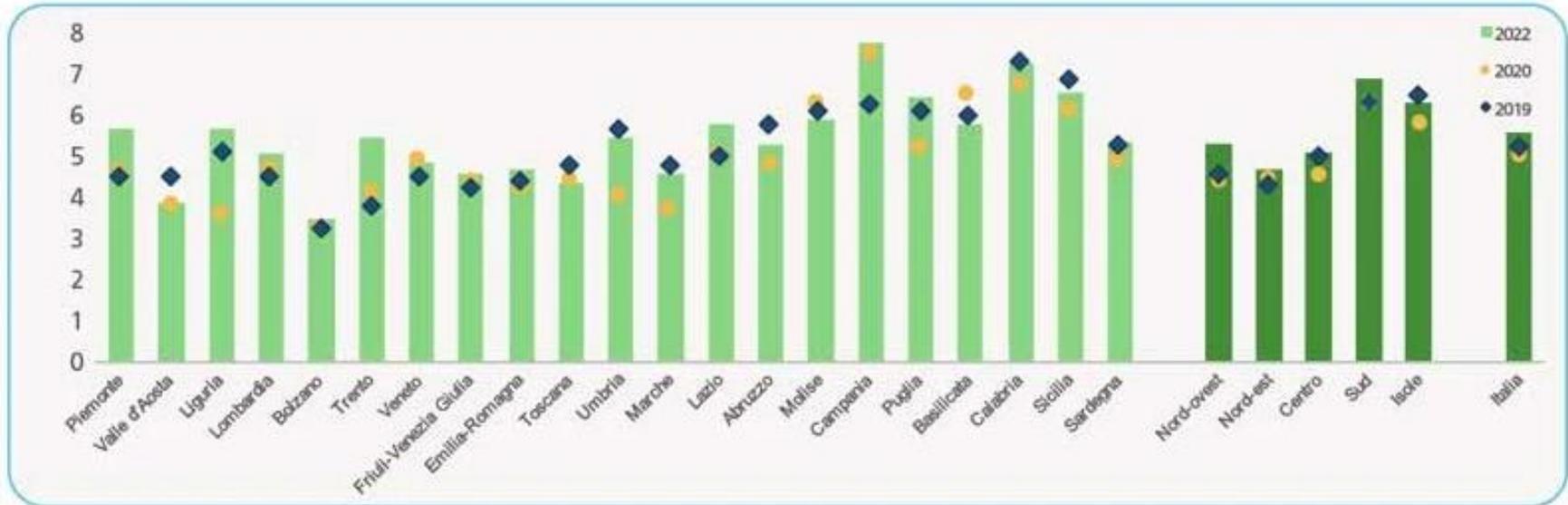


Age-standardised prevalence of diabetes, % by Country/Territory



INTRODUCTION (3)

- Diabetes: numbers in Italy**



INTRODUCTION (3)

- **Diabetes: management of patients**

- ✓ *Risk factors: urbanization, an aging population, lack of physical activities, overweight and obesity*
- ✓ *Although a national strategy for improving the management of patients with diabetes, there remains unwarranted geographical variations across and within Italian regions (Seghieri et al, Eur J Health Econ, 2023)*
- ✓ *Significant inter and intra-regional variations might be explained by either individual and system factors such as the different prevalence, the higher waiting times for an outpatient visit, the availability of hospital beds and the lack of GPs (Rosano et al, Italian Journal of Public Health, 2011)*



PROVINCE OF BOLZANO IN FIGURES (2023)



Local health authorities: **1**

Health districts (HDs): **4**

Health Sub-districts: **20**

Public Hospitals: **7 + 10** (*private structure*)

Population: 534,147

Area: 7,398 km² (mainly mountainous)

Mean age: 43.5 yrs. (vs 46.4 Italy)

Life expectancy: 84.2 yrs. (vs 83,0 Italy)

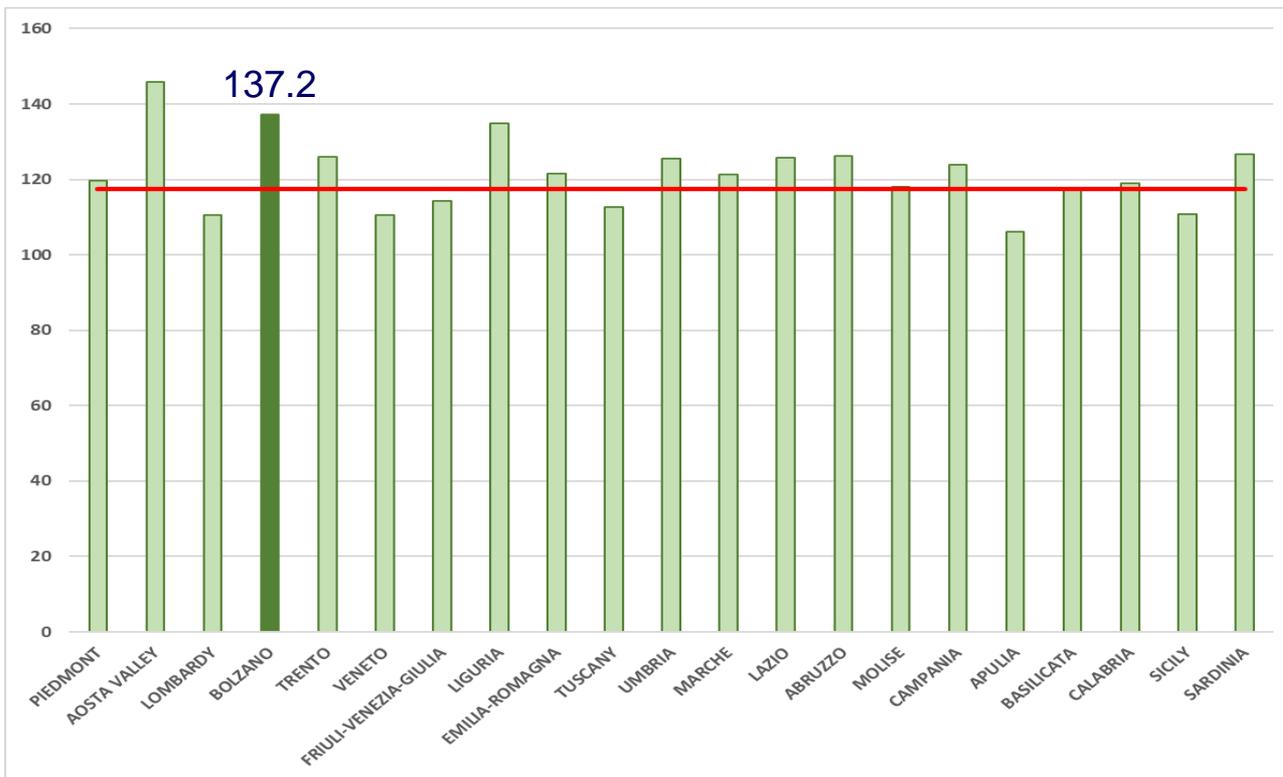
% over 65 yrs.: 20.3 (vs 24.0 Italy)

GPs per 1,000: 0.53 (vs 0.69 Italy)



PROVINCE OF BOLZANO IN FIGURES (2023)

Overall Hospitalization Rate (x 1,000)



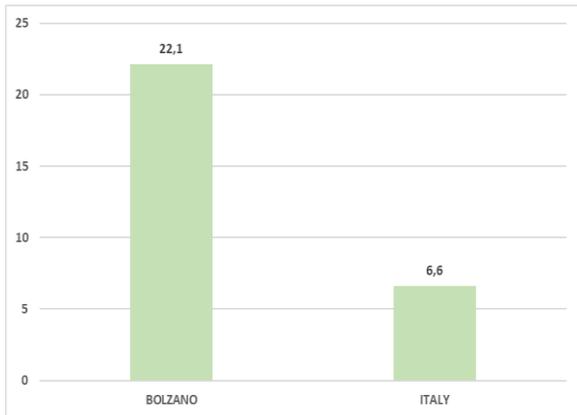
Italy: 117.4



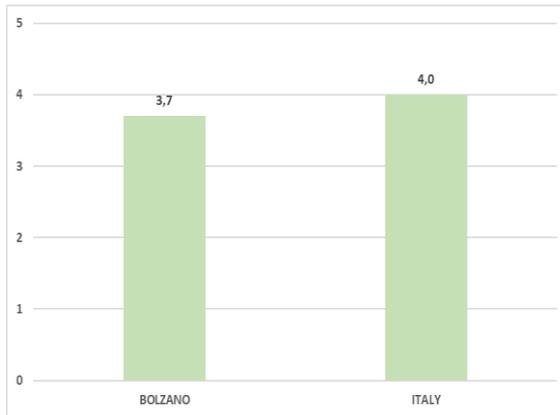
PROVINCE OF BOLZANO IN FIGURES (2023)

Hospitalization Rate (x 100,000) (≥ 18 years)

Diabetes (without complications)



Asthma



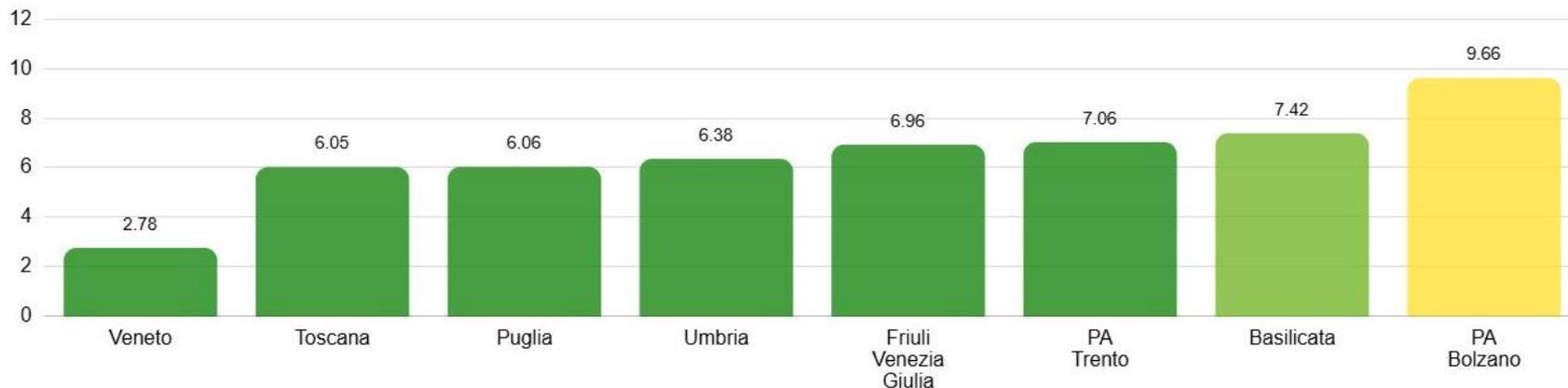
Heart Failure



Source: Ministry of Health(Italy), Italy National Hospital Discharge Database 2023

PROVINCE OF BOLZANO IN FIGURES (2023)

Hospitalization rates for Ambulatory Care Sensitive Conditions (x 1,000)



Source: Mes Lab Sant'Anna School of Advanced Studies, Italian Regional Performance Evaluation System (IRPES)

- **Aim of the study**

- ✓ *To analyze geographic variations and identify the determinants of the risk of avoidable hospitalizations for a cohort of diabetic patients of the province of Bolzano (Italy)*

- **Cohort (selection criteria)**

- ✓ *Data comes from the “Mapping the chronic diseases” (based on health administrative data)*
- ✓ *Prevalent patients with Type 2 diabetes at the end of 2020*
- ✓ *Age: 35-100 years*
- ✓ *Exclusions:*
 - ✓ *patients with diagnosis of diabetes-related complication (stroke, heart failure, acute myocardial infarction, retinopathy, diabetic foot syndrome) either in the three years prior (2018-2020) the observation period and during 2021-2023*
 - ✓ *patients who died during 2021-2023*



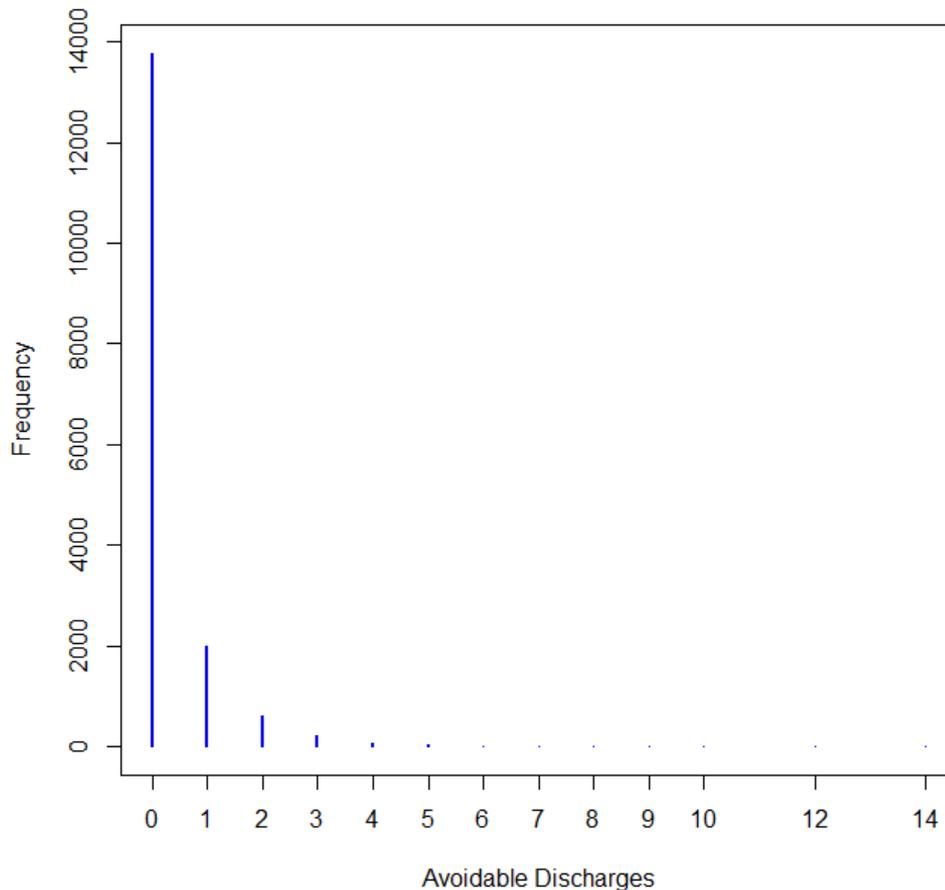
- **Cohort (outcome)**

- ✓ *The cohort was followed from 2021 to 2023 to identify any avoidable hospitalization*
 - ✓ *Discharge from medical ward*
 - ✓ *No COVID-19 admissions*
 - ✓ *No injuries and poisoning*
- ✓ *The 2021-2023 number of avoidable hospitalizations (a non-negative integer) is the target response variable*



• Results

AVOIDABLE DISCHARGES	FREQUENCY (n, %)
0	13,777 (82.5)
1	1,981 (11.9)
2	604 (3.6)
3	212 (1.3)
> 3	133 (0.7)
Total	16,707 (100.0)



• Results

HEALTH DISTRICT	AVOIDABLE DISCHARGES	TOTAL DISCHARGES	%
BOLZANO	1,217	7,962	15.3
MERANO	803	4,575	17.6
BRESSANONE	480	2,222	21.6
BRUNICO	431	1,948	22.1
TOTAL	2,931	16,707	17.5

- ✓ *Data from 2021-2023 show that 18% of the hospitalization for Type 2 diabetes patients were avoidable, potentially saving over 12 million euro that could be reallocated to other services*
- ✓ *Additionally, results show significant geographic variations with a high/low ratio among districts equal to 1.4*



- **Regression model**

- ✓ *Given the existence of excess zeros in the distribution of avoidable hospitalizations in the cohort of diabetic patients coupled with severely skewness we tested the following three different models (Deb, Norton, Annu. Rev. Public Health, 2018):*
 - *Zero Inflated Poisson Model (ZIP)*
 - *Zero Inflated Binomial Model (ZIBN)*
 - *Hurdle count data Model (HM)*
- ✓ *We also tested for health subdistrict (n=20) fixed effects (FE) vs random effects (RE).*
- ✓ *Model performance was compared using the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC)*

• Regression model

✓ *Explanatory variables:*

- *Age*
- *Gender*
- *Number of chronic diseases*
- *Travel distance to the hospital (minutes)*
- *Any drug prescription for diabetes therapy (1 = yes; 0 = no)*
- *Enrolled in the diabetes register, as identified by the hospital centers after a first admission or a visit, or reported by GPs (1 = yes; 0 = no)*
- *Compliance to recommended diabetes guidelines (GCI) (1 = yes; 0 = no)*
(an assessment of glycated hemoglobin and at least two assessments among eye examination, total serum cholesterol and microalbuminuria during each year of observation)
(Golden et al, AHRQ 2023)

AUTONOMOUS PROVINCE OF SOUTH TYROL

VARIABLES	TOTAL DISCHARGES	AVOIDABLE DISCHARGES	NO AVOIDABLE DISCHARGES	p
N, %	16,707	2,931 (17.5)	13,776 (82.5)	
Age (years) Median (range)	71.0 (35.0 – 101.0)	75.0 (35.0 – 101.0)	70.0 (35.0 – 99.0)	a*
Females (n, %)	7,540 (45.1)	1,227 (41.9)	6,313 (45.8)	c*
Chronic diseases (n) Mean (sd)	2.8 (1.3)	3.3 (1.4)	2.7 (1.2)	b*
Travel distance (min) Mean (sd)	19.8 (14.4)	18.7 (14.2)	20.0 (14.4)	b*
Guideline Composite Indicator (n, %)	4,057 (24.3)	599 (20.4)	3,458 (25.1)	c*
Diabetes Register (n, %)	6,282 (37.6)	1,045 (35.7)	5,237 (38.0)	c*
Diabetes Drug Therapy (n, %)				c*
None	2,764 (16.5)	394 (13.4)	2,370 (17.2)	
Only Insulin	475 (2.8)	128 (4.4)	347 (2.5)	
Only Oral	9,358 (56.0)	1,473 (50.3)	7,885 (57.2)	
Only Non – Oral	22 (0.1)	3 (0.1)	19 (0.1)	
Others	4,088 (24.5)	932 (31.8)	3,156 (22.9)	

^a Wilcoxon median test; ^b t-student test; ^c χ^2 test; * statistical significance at the 5% level



- **Regression model (estimates)**

Hurdle count data Model (HM)

+

Random Effects (RE)

was the best specification

VARIABLES	CATEGORY	Coefficients ¹	
		NON ZERO	BINARY
Age	-	0.00525* (0.00196)	0.02640* (0.00206)
Sex	F	-0.10893* (0.04350)	-0.28876* (0.04293)
Chronic Diseases	-	0.11902* (0.01481)	0.29471* (0.01661)
Travel Distance (min)	-	-0.00356* (0.00171)	-0.00682* (0.00271)
GCI	Yes	-0.11686* (0.06516)	-0.35680* (0.06112)
Diabetes Register	Yes	-0.11191* (0.05886)	0.12884 (0.05740)
Drug Therapy	Yes	-0.14035* (0.04906)	0.00524 (0.05276)

Note:

¹ Shows the coefficients and standard errors

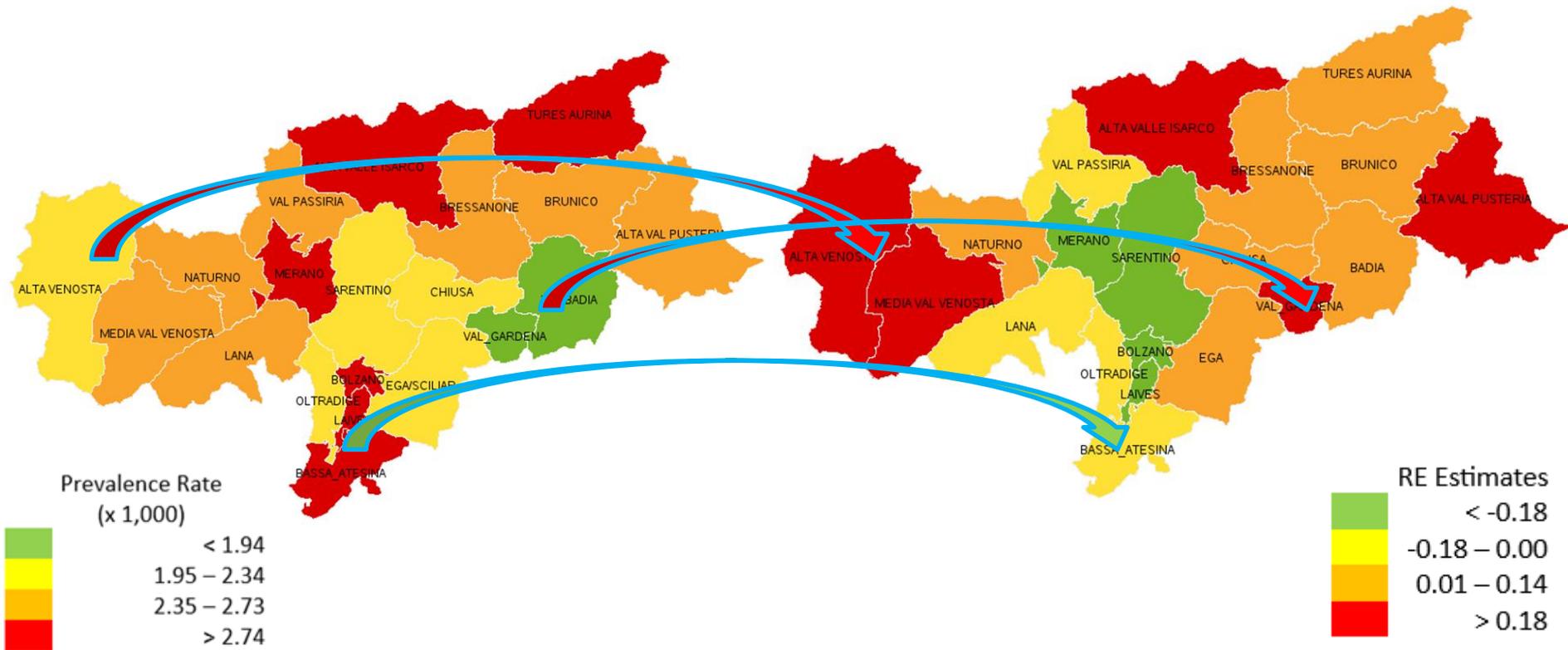
* Statistical significance at the 5% level



RANDOM EFFECTS

Diabetes Prevalence Rate
(x 1,000)

RE Estimates
of the 20 sub-districts





CONCLUSION

- ✓ *For the avoidable hospitalizations, the lack of primary care – such as long waiting lists for a visit or difficulty contacting GPs – plays a significant role and easier access to hospitals increases the likelihood of diabetic patients being admitted for diagnosis, that could be managed in other settings.*
- ✓ *No standard value has been defined for avoidable hospitalizations, however reducing the rate and the geographical variation of these hospitalizations should be a priority.*
- ✓ *Health Department of the Province of Bolzano in collaboration with Local Health Authorities approved guidelines for managing diabetic patients (2024).*
- ✓ *These guidelines aim to integrate primary and specialized care, to ensure continuity of care and include measures for early diagnosis, active participation of diabetics in managing their conditions, systematic monitoring by GPs, and treatment, and diagnosis of complications through coordination among settings.*



*The Risk of Avoidable Hospitalizations in Diabetic Patients:
a retrospective cohort study in the Province of Bolzano (Italy)*

For any questions



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*Thank
you*

