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Mapping chronic diseases in Italy: Trends from the last 20 years

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ABSTRACT

Chronic diseases are among the main responsible of disease and death worldwide. An increasing share of annual healthcare expenditures is devoted to chronic conditions. Due to the ageing phenomenon, chronic diseases are among the most important health problems in Europe, and, in particular, in Italy. Data from Multiscopo survey system carried out by The Italian National Statistical Office (ISTAT) that report detailed information on the state of health of the Italians, on chronic illness, on health-risk factors and demographic and relative socioeconomic characteristics for the years 2000, 2005 and 2013 was used. Descriptive statistic was used to analyze population-based prevalence and trends of chronic conditions across age, sex, and geographical location considering 16 chronic conditions.

Le malattie croniche sono tra i principali responsabili delle malattie e della morte in tutto il mondo. Una quota crescente della spesa sanitaria annuale è dedicata alle malattie croniche. A causa del fenomeno dell'invecchiamento, le malattie croniche sono tra i più importanti problemi di salute in Europa e, in particolare, in Italia. Sono stati utilizzati i dati del sistema di indagine Multiscopo dell'Istituto Nazionale di Statistica Italiana (ISTAT) che riportano informazioni dettagliate sullo stato di salute degli italiani, sulle malattie croniche, sui fattori di rischio per la salute e sulle caratteristiche demografiche e socioeconomiche relative agli anni 2000, 2005 e 2013. La statistica descrittiva è stata utilizzata per analizzare la prevalenza basata sulla popolazione e l'andamento delle condizioni croniche per età, sesso e localizzazione geografica, considerando 16 condizioni croniche.

Keywords: Chronic diseases, multimorbidity, health trends, health risks, Italy

1 - Introduction

Chronic diseases, defined by the World Health Organization (WHO) as those diseases with long duration and slow progression (WHO, 2016), are among the main responsible of disease and death in Europe (Busse, Blümel, Scheller-Kreinsen, & Zentner, 2010) In fact, the 68% of all the deaths in 2014 was caused by chronic diseases (World Health Organization, 2015), which are the main responsible for morbidity, disability and mortality (Busse et al., 2010; Marcelli et al., 2017). Chronic diseases are widespread worldwide.

In particular, in Europe, they are characterized by both positive trends and new challenges (Brennan *et al.*, 2017). In fact, while there has been a huge increase in life expectancy over the last years, major health disparities still exist in Europe (Brennan *et al.*, 2017). This is particularly true in high income countries, where the incidence of chronic diseases is higher with respect to low income countries (Busse *et al.*, 2010).

Chronic conditions are relevant for the healthcare systems, as well, since they are associated with an increase in social and economic costs (Chan, 2011; Marcelli *et al.*, 2017). More specifically, between 7% and 11% of GDP expenditure in Europe is devoted to healthcare (EU, 2016), and, particularly in US, 86% of annual healthcare expenditures is devoted to chronic conditions (Gerteis *et al.*, 2014). These costs do not only refer to the increase in the price of treatments, but they include also societal costs that arise when the disease affect the patients' ability to be involved in societal activities (Busse *et al.*, 2010; Brennan *et al.*, 2017).

In addition, the chronic disease condition is even worsened when considering that the link between chronic conditions and age. Previous studies demonstrated that older people are the most affected by chronic diseases (Busse *et al.*, 2010). Rothenberg and Koplan, in 1990, affirmed that the ageing population trend was increasing, the economic issues were becoming relevant to the occurrence of the management of chronic diseases that, in turn, should be considered in a context of continuously rising costs of healthcare, and, finally, that the major measures of burden and progress in chronic diseases should be improved (Rothenberg and Kaplan, 1990). They also affirmed that the current pattern of chronic diseases is not likely to change spontaneously in the near term (Rothenberg and Kaplan, 1990). Subsequently, other scholars confirmed that, even in the 2000s, the incidence of chronic diseases is still dramatically increasing (Horton, 2005; Andersen and Gudnason, 2012).

Additionally to ageing phenomenon, multimorbidity – defined as the condition in which people are affected by two or more diseases (Barnett *et al.*, 2012) – is one of the most important challenges that have to be faced by healthcare systems and governments around the world (Organization, 2011). Given that multimorbidity is more common with age (Walker 2016; Van Aken 2005; Salisbury et al. 2011), the ageing trend that is characterizing the last and the future years is enlarging the need for an accurate management of multimorbidity.

Previous studies found that a better understanding of the occurrence of multimorbidity could be useful to prevent and reduce it, and to design healthcare services that are tightly close to patients' needs (Barnett *et al.*, 2012).

Chronic diseases are among the most important health problems worldwide. This trend is particularly relevant in Italy, where they affect more than 2 million people (Massucci *et al.*, 2010; Marzulli, 2017). In particular, studies confirmed that there will be an increasing ageing trend it in the Italian country and, therefore, people could be more subject to diseases associated with aging (ISTAT, 2018).

The objective of this study is twofold. First, it aims at investigating the role played by age in chronic conditions patterns in Italy, by considering the differences across diseases (e.g. fatal versus non-fatal). Second, this study aims at advancing some knowledge related to the co-occurrence of chronic disease in the analyzed context by contributing to the current debate related to the most recurrent combinations of chronic conditions.

In order to analyze the aforementioned themes, descriptive statistics of the trends of (co)occurrence of chronic conditions based on the analysis of the survey "Indagine Multiscopo

sulle Famiglie, Condizioni di salute e ricorso ai servizi sanitari", for the years, 1999-2000, 2004-2005, and 2012-2013, are presented.

2 - Chronic Diseases and Multimorbidity in Italy

Given the rising demand for expensive healthcare interventions, all European national governments have to deliver sustainable health services (Brennan *et al.*, 2017). Due to the ageing phenomenon, chronic diseases are among the most important health problems in Europe, and, in particular, in Italy, where more than 2 million people live in conditions of disability, which testify a radical change in the epidemiological conditions of Italians in the last years (Massucci *et al.*, 2010; Marzulli, 2017). As intelligible from the data of ISTAT represented in Figure 1, there will be and increasing ageing trend it in the Italian country, as demonstrated by the ageing index, intended as the ratio between population aged 65 or more, and population aged 0-14, multiplied by 100 (ISTAT, 2018).

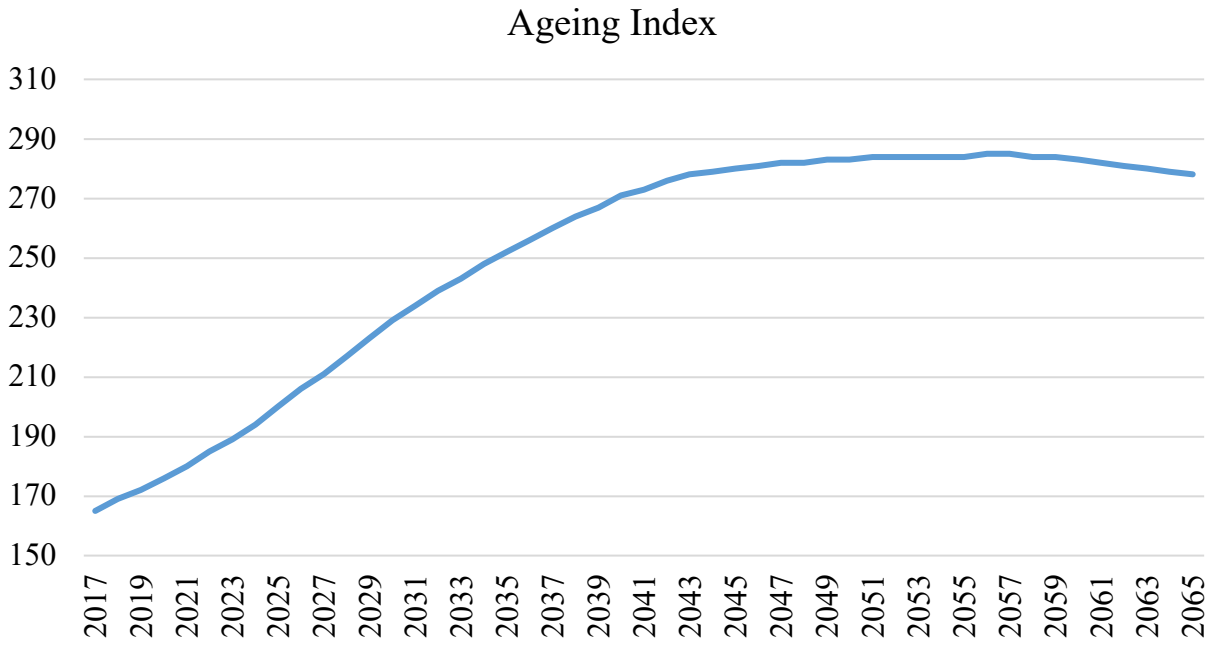

Figure 1 - Italian Ageing Index
(Source: ISTAT – Previsioni demografiche
Available at: http://dati.istat.it/Index.aspx?DataSetCode=DCIS_INDDEMOG1&Lang)

Since chronic conditions are expected to increase with the population aging, Italy has the necessity to adopt new approaches to healthcare management system to tackle the increasing demand caused by the presence, in the country, of the biggest over the age of 65 European population (Massucci *et al.*, 2010). Additionally, this urgency of this need is accelerated by the rise of multimorbidity. As supported by previous studies, older people usually need services with high clinical complexity, given also by the prevalence of multimorbidity (Lattanzio *et al.*, 2010). Despite previous studies found a lower multimorbidity in Italy compared to other countries (Menotti *et al.*, 2001), further investigation of the association between different chronic conditions is needed.

3 - Objectives of the paper

According to previous studies, a better understanding of the trends of chronic diseases and, particularly, of multimorbidity is necessary in order to reduce the exacerbated consequences due to multiple medical and social problems caused by the emergence of many different conditions (Wolff, Starfield and Anderson, 2002; Broemeling, Watson and Black, 2005; Starfield, 2011). Additionally, this is particularly important when chronic conditions are expected to increase because of the ageing phenomenon.

For this reason, this retrospective cohort study has a variety of aims.

First, analyzing the population-based prevalence and trends of chronic conditions across age, sex, and geographical location. Despite many studies analyzed the trend of chronic diseases in Italy, they are mainly related to a single specific health condition (e.g. Bellentani et al. 1994; De et al. 2011). Even if in Italy there is a public healthcare system, the organization and the provision of services varies a lot across regions (Lattanzio *et al.*, 2010). Therefore, different living in different geographical areas is expected to have an impact on chronic conditions trends across years. Second, differences in the diseases prevalence across genders have been widely identified in the literature (e.g. Brennan *et al.*, 2017; Matud, 2017). This study will investigate the differences across gender associated with the chronic disease distribution. Finally, this study aims at investigating the role played by age in chronic conditions patterns. Additionally, this study considers the differences across diseases proposed by Hayward et al.: along with this study fatal diseases are considered among the major causes of death of adult population, while non-fatal diseases refer to burden of several disorders (Hayward *et al.*, 2000).

Second, analyzing the population-based prevalence and trends of multimorbidity across age, sex, and geographical location. Even if many studies analyzed the impact that socioeconomic status characteristics may have on an individual chronic disease (Eachus *et al.*, 1996; Marmot, 2005), only few analyzed the association between demographic conditions and multimorbidity (e.g. Mercer & Watt, 2007; Salisbury et al., 2011; Walker, 2007). Along with this study, with reference to demographic conditions, geographical area, sex and age will be investigated. In particular, previous studied identified differences in the risk of developing multimorbidity across different countries (Menotti *et al.*, 2001). Therefore, living in different geographical areas is expected to have an impact not only on the emergence of chronic condition, but also on multimorbidity. In addition, previous studies found that studies performed in specific geographic areas can help in both interpreting and disentangling the interactions between aging and the environment in which the patients live (Marengoni *et al.*, 2009; Landi *et al.*, 2010). Second, this study investigates whether the differences across gender associated with the chronic disease distribution are found also in the multimorbidity patterns. Finally, previous studies found that the proportion of people affected by multimorbidity increase with age, and that older people are those with the highest co-occurrence of chronic conditions (Barnett *et al.*, 2012). This study aims at analyzing this trend in Italy. Additionally, differences across fatal and non-fatal disease are considered also when analyzing the multimorbidity pattern.

Third, analyzing the co-occurrence of chronic conditions in Italy. Despite previous studies analyzed the different combination of co-occurring chronic conditions, many unique combinations have been found (Barnett *et al.*, 2012). This study aims at advancing some

knowledge on the co-occurrence of chronic disease in Italy and it will contribute to the current debate which underlines the most recurrent combinations of chronic conditions.

Fourth, examining and comparing the prevalence of multimorbidity by different health behaviors among Italian chronic patients. Previous studies found that health behaviors (like smoking and/or physical activity) may indirectly influence the prevalence of multimorbidity (Marengoni *et al.*, 2009; Barnett *et al.*, 2012). Therefore, a better understanding of the clear association between multimorbidity and health behaviors is needed. According to the Literature, incorrect health behaviors are among the most important causes for developing diseases (Steptoe and Wardle, 2001). The most common health problems is represented by chronic diseases in different geographic areas. In particular, considering the case of US, one fourth of US citizens suffer from more than one chronic disease (Ward, Schiller and Goodman, 2014) and the majority of illness, suffering and early death related to these conditions is caused by unhealthy behaviors (Kanny *et al.*, 2013; Esser *et al.*, 2014; U.S. Center for Disease Control and Prevention, 2014; Jamal *et al.*, 2015; Benjamin *et al.*, 2017). Different studies testified that this trend is similar across different countries. Since there is uncertainty about the magnitude of differences between chronic diseases, and, subsequently, of their co-occurrence, this study aims at analyzing their impact on the distribution of chronic diseases in the Italian context.

4 - Methodology

4.1 - *Sample Selection and Data Collection*

Along with this study, the survey "Indagine Multiscopo sulle Famiglie, Condizioni di salute e ricorso ai servizi sanitari", that is part of the Istat Multiscopo survey system carried out by the Italian National Statistical Office (ISTAT), will be used. The ISTAT replicate the survey on average every 5 years, and it is composed of 4 waves, carried out in the 1994, 1999-2000, 2004-2005, 2012-2013. This survey is based on direct interviews on a representative sample of Italian households living all over Italy. The sample's size increased after the first wave. For the purposes of this study, and in order to provide consistency of questions across years, only three waves are considered: the 1999-2000 wave (from now on "2000") contains answers from 40.119 households (140,011 individuals), in 2004-2005 (from now on "2005") the sample size is represented by 52,584 households (128.040 individuals), and in the wave of 2012-2013 (from now on "2013") the sample size is composed of 34,064 households (119.073 individuals). The data bank gathers detailed information on the state of health of the Italians, on chronic illness, on the use of the health service, on health-risk factors and demographic and relative socioeconomic characteristics of those people interviewed.

For the purposes of this study, only non-communicable diseases are considered. In particular, chronic conditions have been identified according to previous literature for their relevance and burden (Broemeling, Watson and Black, 2005; Information, 2011; Pefoyo *et al.*, 2015; World Health Organization, 2015), and, even if there is not the inclusion of an exhaustive list, the listed and included conditions represent most of the population-based epidemiological perspective (Pefoyo *et al.*, 2015). Additionally, consistently with previous studies, these conditions have been divided into fatal and non-fatal diseases in order to distinguish between their associated risk (Hayward *et al.*, 2000).
Table 1 represents all the analyzed variables.

4.2 - *Data Analysis*

Along with this study, the following analysis are conducted with STATA 13:

- Descriptive statistics for reporting the chronic diseases trends by demographic characteristics and type of disease;
- Descriptive statistics for reporting the multimorbidity trends by demographic characteristics and type of disease;
- Analysis of the likelihood of each condition to co-occur with more conditions;
- Analysis of the role of the health behaviors in multimorbidity trends.

DEMOGRAPHIC VARIABLES	
FEMALE	Dummy variable equal to 1 if the respondent is a female, 0 otherwise
AGE	Continuous variable representing the age of respondents
AGE_18_44	Dummy variable equal to 1 if the age of the respondent is between 18 and 44 included, 0 otherwise
AGE_45_64	Dummy variable equal to 1 if the age of the respondent is between 45 and 64 included, 0 otherwise
AGE_65_84	Dummy variable equal to 1 if the age of the respondent is between 65 and 84 included, 0 otherwise
AGE_85_MORE	Dummy variable equal to 1 if the age of the respondent is equal or greater than 85, 0 otherwise
NORTH	Dummy variable equal to 1 if the respondent is from Piemonte, Valle d'Aosta, Liguria, Lombardia, Trentino-Alto Adige, Veneto, Friuli-Venezia Giulia or Emilia-Romagna, 0 otherwise
CENTRE	Dummy variable equal to 1 if the respondent is from Toscana, Umbria, Marche or Lazio, 0 otherwise
SOUTH	Dummy variable equal to 1 if the respondent is from Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Sicilia or Sardegna, 0 otherwise
CHRONIC CONDITIONS VARIABLES	
CHRONIC	Dummy variable equal to one if the respondent is affected by Allergy, Diabetes, Angina, Hypertension, Other Hearth Diseases, Heart attack, Asthma, Thrombosis, Thyroid Disease, Chronic obstructive pulmonary disease, Arthritis, Cancer, Osteoporosis, Cirrhosis, Headache or Parkinson And Alzheimer, 0 otherwise
FATAL	Dummy variable equal to one if the respondent is affected by Diabetes, Hypertension, Heart attack, Thrombosis, Chronic obstructive pulmonary disease, or Cancer, 0 otherwise
NON-FATAL	Dummy variable equal to one if the respondent is affected by Allergy, Angina, Other Hearth Diseases, Asthma, Thyroid Disease, Arthritis, Osteoporosis, Cirrhosis, Headache or Parkinson And Alzheimer, 0 otherwise
MULTIMORBIDITY	Dummy variable equal to 1 if the respondent has more than 1 chronic disease, 0 otherwise
HEALTH BEHAVIORS VARIABLES	
OBESITY	Dummy variable equal to 1 if the BMI is equal and/or higher than 30, 0 otherwise
SPORT	Dummy variable equal to 1 if the respondent declared to practice sport by answering yes to the question "Routinely performs a physical and motor activity?", 0 otherwise
SMOKING	Dummy variable equal to 1 if the respondent declared to smoke by answering yes to the question "Do you currently smoke?", 0 otherwise

Table 1 - Analyzed variables

5 - Results

Table 2 presents the descriptive statistics of the sample. The number of observations is around 100.000 for each year of observation, and, this number reflects the change in the population composition in Italy over the observed years. Women are about 52% of total population and the average value of age is increasing over the years. Even the relative share of the average age class shows that the youngest class age (AGE_18_44) is decreasing over time, while the average oldest class age is increasing over time. Considering health behaviors variables, the share of people with a BMI > 30 (OBESITY) is increasing over time, while the share of smokers and the share of people practicing regularly sport present a decreasing trend.

While Table 2 represents the descriptive statistics of the analyzed variables, a more detailed analysis of them is provided in the following paragraphs.

	YEAR 2000				YEAR 2005				YEAR 2013			
VARIABLE	**Mean**	**Std Dev**	**Min**	**Max**	**Mean**	**Std, Dev,**	**Min**	**Max**	**Mean**	**Std, Dev,**	**Min**	**Max**
FEMALE	0,519	0,500	0	1	0,523	0,499	0	1	0,524	0,499	0	1
NORD	0,402	0,490	0	1	0,419	0,493	0	1	0,423	0,494	0	1
CENTRO	0,178	0,383	0	1	0,181	0,385	0	1	0,179	0,384	0	1
SUD	0,420	0,494	0	1	0,400	0,490	0	1	0,397	0,489	0	1
AGE	47,963	18,381	18	105	49,189	18,420	18	106	51,508	18,545	18	90*
AGE_18_44	0,468	0,499	0	1	0,446	0,497	0	1	0,383	0,486	0	1
AGE_45_64	0,312	0,463	0	1	0,316	0,465	0	1	0,346	0,476	0	1
AGE_65_84	0,197	0,398	0	1	0,215	0,411	0	1	0,236	0,425	0	1
AGE_85_MORE	0,023	0,150	0	1	0,023	0,149	0	1	0,035	0,185	0	1
OBESITY	0,093	0,291	0	1	0,100	0,300	0	1	0,115	0,319	0	1
SPORT	0,364	0,481	0	1	0,245	0,430	0	1	0,254	0,435	0	1
SMOKE	0,247	0,431	0	1	0,220	0,414	0	1	0,211	0,408	0	1
N. OBS	115.019				105.844				99.479			
* In 2013 relevation report 90 as age for people with more than 90 year old												

Table 2 - Descriptive statistics of analyzed variables

- ***Chronic diseases trends in Italy by demographic characteristics***

One of the main objectives of the paper is to analyze the population-based prevalence and trends of chronic conditions across age, sex, and geographical location. In fact, according to previous studies, a positive trend in the incidence of chronic diseases is expected. In addition, since in Italy the socioeconomics conditions are significantly different across regions different distributions of chronic conditions across Italian regions are expected.

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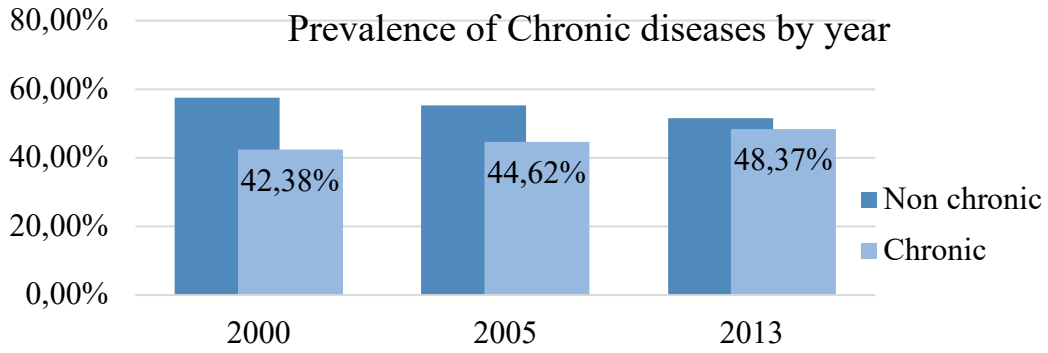

Figure 2 - Share of respondents with at least one chronic condition

Considering the results presented in Figure 2, chronic disease prevalence increases over the years, from 42,38% in 2000 to 48,37% in 2013. The increasing trend is even clearer when observing the prevalence of chronic disease in different age group (Figure 3), as a more relevant increase is observed for older age group (AGE_65_84 and AGE_85_MORE) and a positive trend in the prevalence of chronic disease is observable even in the younger group.

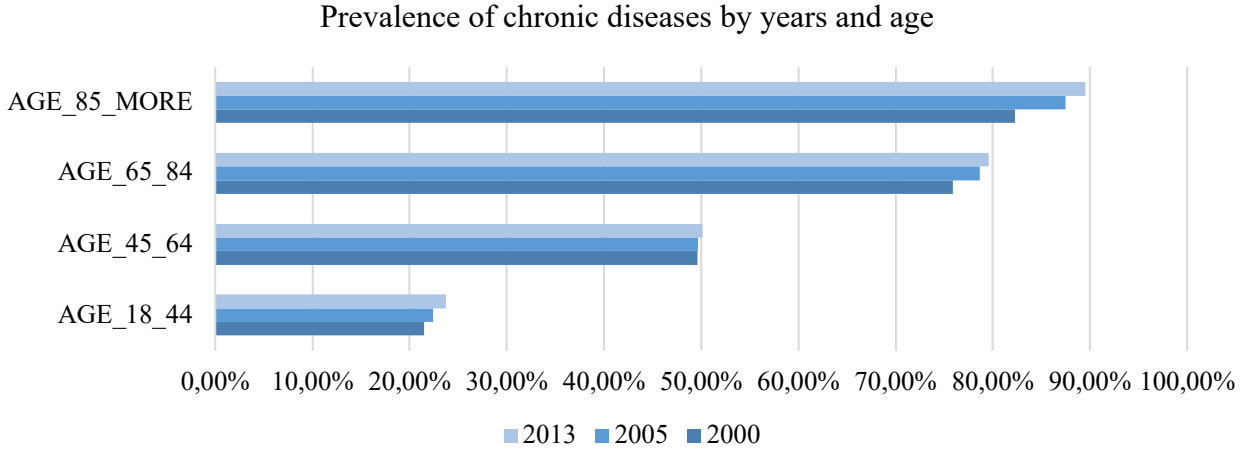

Figure 3 - Share of respondents with at least one chronic condition divided by age groups

Table 3 highlights that female are more affected by chronic diseases, independently from the age class considered. When considering the prevalence by geographical area (Figure 4), even if the highest level is observed in central Italy, and the lower in the southern part of Italy, all the considered regions present increasing values of chronic conditions emergence. It is also interesting to note that the biggest increase in the prevalence of chronic disease is observed in southern Italy from 2005 to 2013, where the population affected by at least on chronic disease moved from 41,38% to 46,94%.

PREVELENCE OF CHRONIC DISEASES BY SEX AND AGE

YEAR	Prevalence		AGE_18_44		AGE_45_64		AGE_65_84		AGE_85_MORE	
	M	F	M	F	M	F	M	F	M	F
2000	36,47%	47,86%	18,09%	24,84%	43,04%	56,02%	70,69%	79,91%	78,16%	84,37%
2005	39,14%	49,62%	19,19%	25,57%	44,34%	54,81%	74,04%	82,25%	85,37%	88,53%
2013	42,39%	53,79%	19,97%	27,44%	44,41%	55,50%	75,06%	83,25%	84,29%	92,09%

Table 3 - Share of respondents with at least one chronic condition divided by age groups and gender

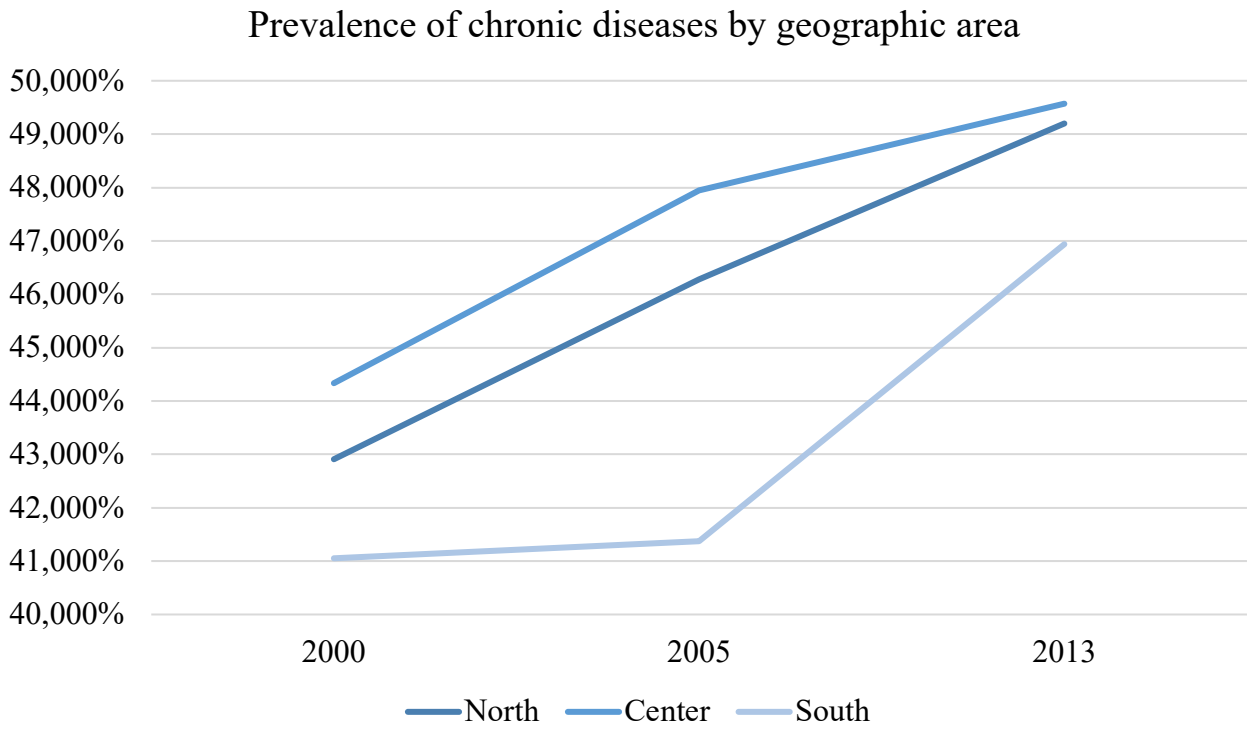

Figure 4 - Share of respondents with at least one chronic condition divided by geographical area

- ***Chronic diseases trends in Italy by type of disease (fatal vs non-fatal diseases)***

Some interesting results arise also when investigating chronic diseases considering the differences between fatal disease and non-fatal disease, as defined above. According to the data presented in Figure 5 and Table 4, both fatal and non-fatal diseases prevalence increase over the considered time interval.

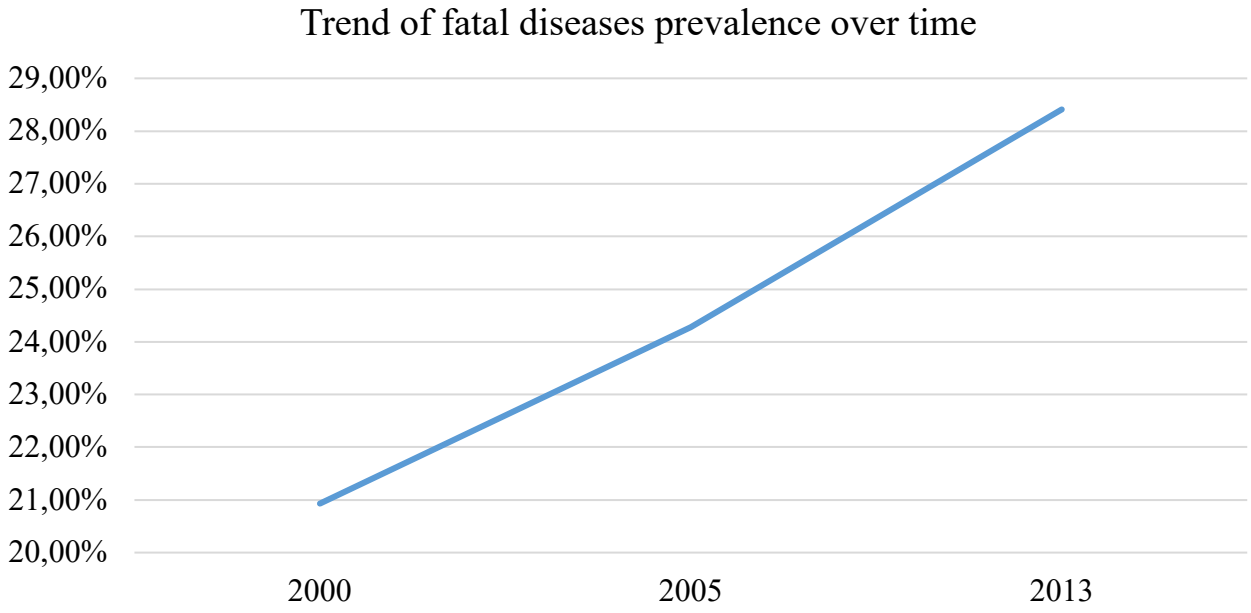

Figure 5 - fatal diseases prevalence over time

The share of respondents with fatal conditions increase from 20,93% in 2000 to 28,41% in 2013, while the share of respondent with non-fatal diseases is bigger of the one with fatal diseases but this share in more stable over time (from 35,42% in 2000 to 37,86% in 2013).

Prevalence by age class

Variable	Year	Prevalence	AGE_18_44	AGE_45_64	AGE_65_84	AGE_85_MORE
Fatal	2000	20,93%	3,74%	25,12%	51,10%	55,00%
	2005	24,28%	4,38%	27,28%	57,07%	62,45%
	2013	28,41%	4,58%	28,39%	60,96%	69,09%
Non-fatal	2000	35,42%	19,47%	39,39%	62,73%	71,86%
	2005	36,81%	19,91%	38,43%	64,89%	80,02%
	2013	37,86%	21,07%	36,23%	61,27%	79,31%

Table 4 - Prevalence of fatal and non-fatal disease divided by age class

Table 4 reports the prevalence of fatal and non-fatal diseases divided by age class. As expected, older age class presents a higher prevalence of both types of chronic condition (fatal vs non-fatal) with a sharp increase for fatal condition in the last years. More in the details, a reduction in the prevalence of non-fatal condition in respondents classified in AGE_85_MORE can be observed from 2005 to 2013.

Additionally, Figure 6 reports the trends of fatal and non-fatal diseases occurrence, divided by geographical area. The higher prevalence of non-fatal conditions is observed in Central Italy, while the lower prevalence is observed in the Southern Italy. In particular, a nonlinear trend is faced. In fact, in the central part of Italy, non-fatal diseases prevalence increased from 2000 to 2005 to subsequently decrease in 2013. However, the prevalence of southern Italian people affected by non-fatal diseases in 2013 is higher than the starting one in 2000.

The southern part of Italy presents a lower prevalence with respect to the center and the northern parts of the country. More specifically, a decreasing trend in the share of respondent affected by non-fatal disease from 2000 to 2005 can be observed, and this leads to an increase in the gap between different geographical areas. However, from 2005 to 2013 the gap between different geographical areas decreases: a sharp increase in prevalence of non-fatal diseases in South Italy and a decrease in Central Italy are observed.

Figure 6 also show the trend for fatal diseases prevalence. This last trend is much more linear with respect to the previous one. All geographical areas present an increasing trend. In particular, South Italy, the area with the lower prevalence of fatal diseases in 2000, became the area with the higher prevalence in 2013.

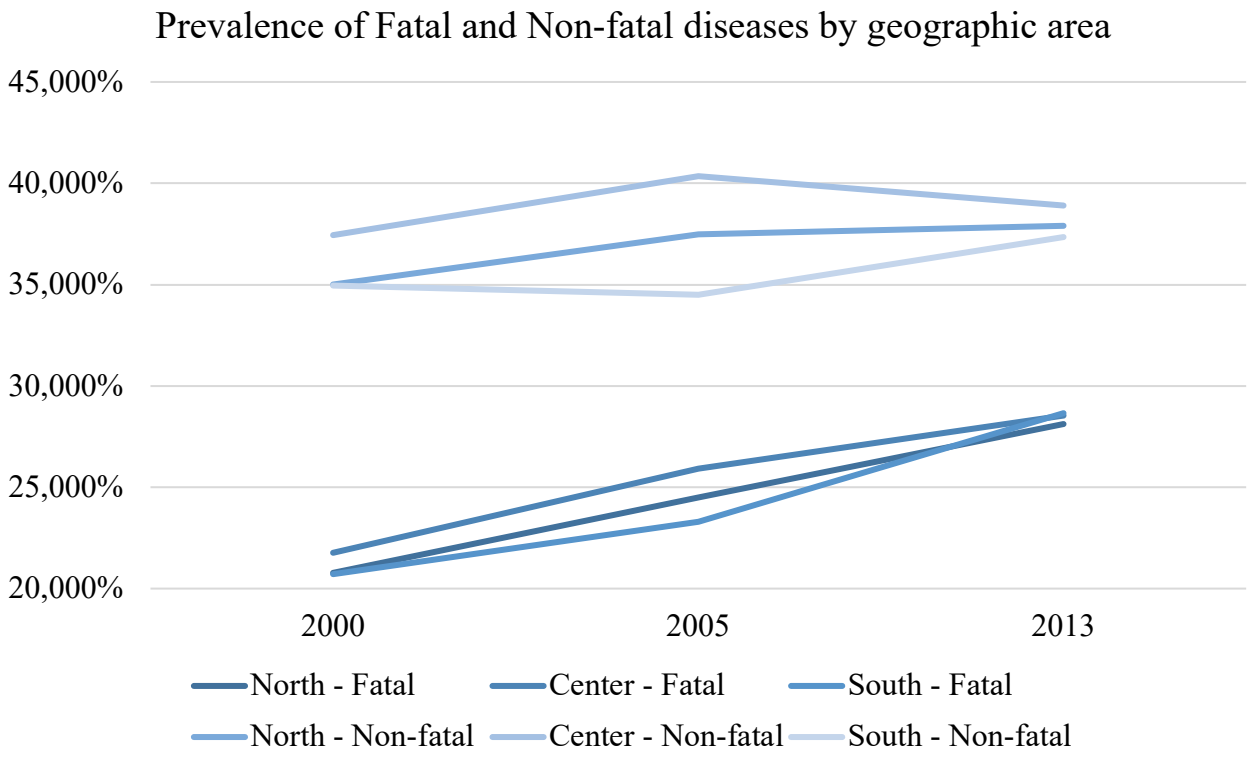

Figure 6 - Prevalence of Fatal and Non-fatal diseases by geographic area

Additionally, Table 5 presents the prevalence of single disease divided by age class. All non-fatal diseases present an increase in prevalence, apart from angina, arthritis and headache. All fatal diseases present an increase in prevalence, apart from chronic obstructive pulmonary diseases. The most prevalent non-fatal diseases are arthritis (about 20% of the population is affected by this disease) and allergy (about 9%), while the most prevalent fatal diseases are hypertension (about 20%) and diabetes (about 7%). As expected, the more common diseases are the one for which previous studies found an association with age. Some fatal diseases increased consistently from 2000 to 2013: diabetes moved from 4,46% in 2000 to 7,12% in 2013, hypertension from 14,01% to 21,46% and cancer, almost doubled the share of prevalence, from 1,06% to 1,94%.

NON-FATAL DISEASES

	Year	All	AGE_18_44	AGE_45_64	AGE_65_84	AGE_85_MORE
ALLERGY	2000	8,52%	10,14%	7,50%	6,73%	4,68%
	2005	8,36%	10,29%	7,26%	6,33%	4,84%
	2013	9,75%	11,65%	9,53%	7,63%	5,45%
ANGINA	2000	1,07%	0,06%	0,98%	3,20%	4,53%
	2005	0,83%	0,05%	0,69%	2,35%	3,76%
	2013	0,85%	0,06%	0,61%	2,09%	3,49%
OTHER HEARTH DISEASES	2000	3,99%	0,66%	3,17%	11,33%	20,14%
	2005	3,84%	0,63%	2,81%	10,58%	17,37%
	2013	4,83%	0,81%	3,18%	11,41%	20,52%
ASTHMA	2000	3,26%	1,66%	2,71%	7,12%	10,07%
	2005	3,71%	2,61%	2,88%	6,67%	8,81%
	2013	4,29%	3,43%	3,66%	5,96%	8,74%
THYROID DISEASE	2000	3,43%	1,89%	4,74%	5,01%	3,32%
	2005	4,12%	2,36%	5,86%	5,28%	3,31%
	2013	6,24%	3,17%	7,87%	8,80%	6,41%
ARTHRITIS	2000	21,44%	4,58%	26,53%	49,38%	55,94%
	2005	22,29%	3,06%	24,46%	53,75%	71,42%
	2013	19,41%	2,03%	17,03%	44,61%	62,62%
OSTEOPOROSIS	2000	5,42%	0,24%	5,80%	15,47%	19,77%
	2005	6,46%	0,19%	6,17%	18,05%	23,66%
	2013	8,92%	0,33%	5,97%	22,49%	40,16%
CIRRHOSIS	2000	0,23%	0,03%	0,28%	0,62%	0,34%
	2005	0,31%	0,07%	0,39%	0,69%	0,21%
	2013	0,32%	0,07%	0,33%	0,71%	0,40%
HEADACHE	2000	6,57%	4,95%	8,04%	8,02%	7,24%
	2005	7,04%	5,73%	8,34%	7,78%	7,90%
	2013	6,80%	5,32%	7,90%	7,43%	7,81%
PARKINSON AND ALZHEIMER	2000	1,14%	0,27%	0,56%	2,74%	12,71%
	2005	0,87%	0,01%	0,19%	2,45%	12,49%
	2013	1,56%	0,04%	0,25%	3,58%	17,20%

FATAL DISEASES

	Year	All	AGE_18_44	AGE_45_64	AGE_65_84	AGE_85_MORE
DIABETES	2000	4,464%	0,480%	5,003%	12,146%	12,410%
	2005	5,556%	0,665%	5,670%	14,566%	14,640%
	2013	7,153%	0,914%	6,005%	17,210%	18,762%
HYPERTENSION	2000	14,012%	2,026%	17,390%	34,640%	35,232%
	2005	16,832%	2,280%	19,535%	40,457%	41,108%
	2013	21,458%	2,424%	21,646%	47,530%	51,547%
HEART ATTACK	2000	1,366%	0,082%	1,484%	3,828%	4,791%
	2005	2,111%	0,100%	1,850%	6,027%	8,106%
	2013	2,408%	0,131%	1,837%	6,069%	8,175%
THROMBOSIS	2000	1,042%	0,117%	0,805%	3,051%	5,847%
	2005	1,381%	0,112%	0,804%	4,019%	9,305%
	2013	1,774%	0,137%	0,878%	4,459%	10,332%

CHRONIC OBSTRUCTIVE PULMONARY	2000	5,304%	1,065%	4,856%	14,203%	21,388%
	2005	5,511%	1,309%	4,528%	13,947%	21,712%
	2013	4,503%	0,993%	3,189%	10,375%	16,151%
CANCER	2000	1,059%	0,197%	1,348%	2,512%	2,226%
	2005	1,140%	0,231%	1,357%	2,574%	2,399%
	2013	1,943%	0,415%	1,802%	4,272%	4,315%

Table 5 - Prevalence of single diseases by class age

- ***Multimorbidity trends in Italy by demographic characteristics***

Considering the co-occurrence of chronic conditions in Italy, results of this study present an increasing trend in the prevalence of multimorbidity. In fact, the total share of respondents with at least two chronic conditions moved from 21,18% in 2000 to 26,11% in 2013. This result is well represented in Figure 7, where the share of respondents is represented for the different number of diseases from which the respondents are affected. It clearly shows that, while in 2000 the share of respondents with 0 diseases was higher than the same share in 2013, the share of respondents with one or more chronic diseases is always higher in 2013 than in 2000. Considering the prevalence in multimorbidity in different age classes (Figure 8), results present an increase in multimorbidity prevalence for all of them, a part AGE_45_64. The biggest increase is represented by the age class AGE_85_MORE: from 59,29% in 2000 to 73,15% in 2013.

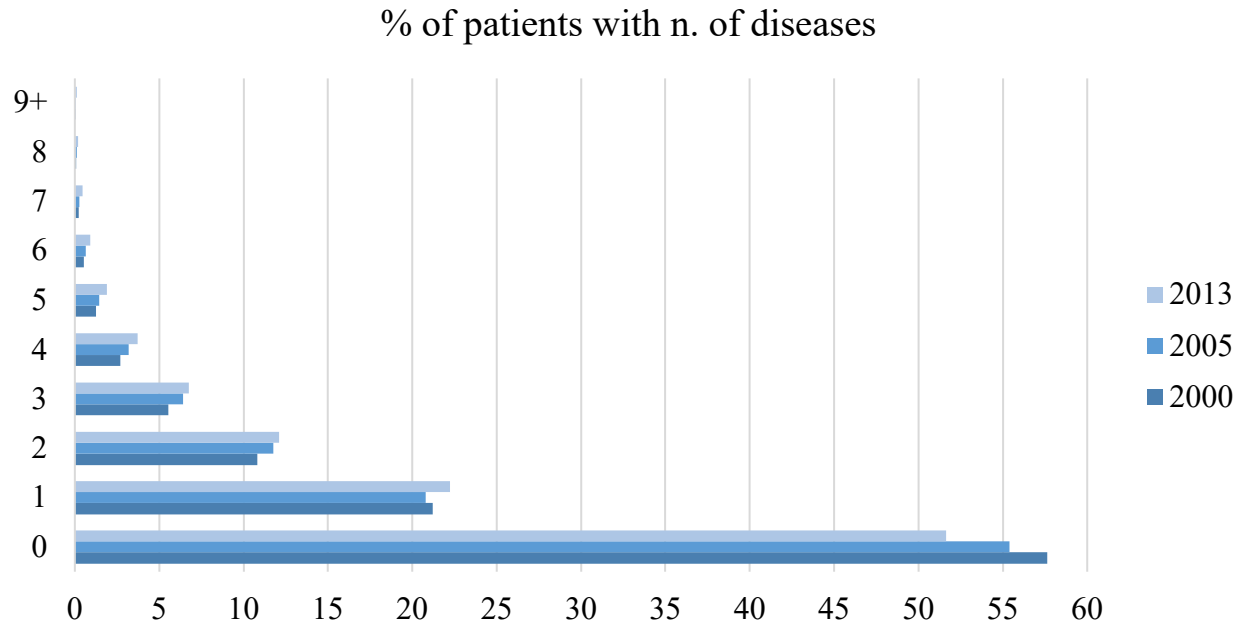

Figure 7 - Share of respondents with number of diseases by years

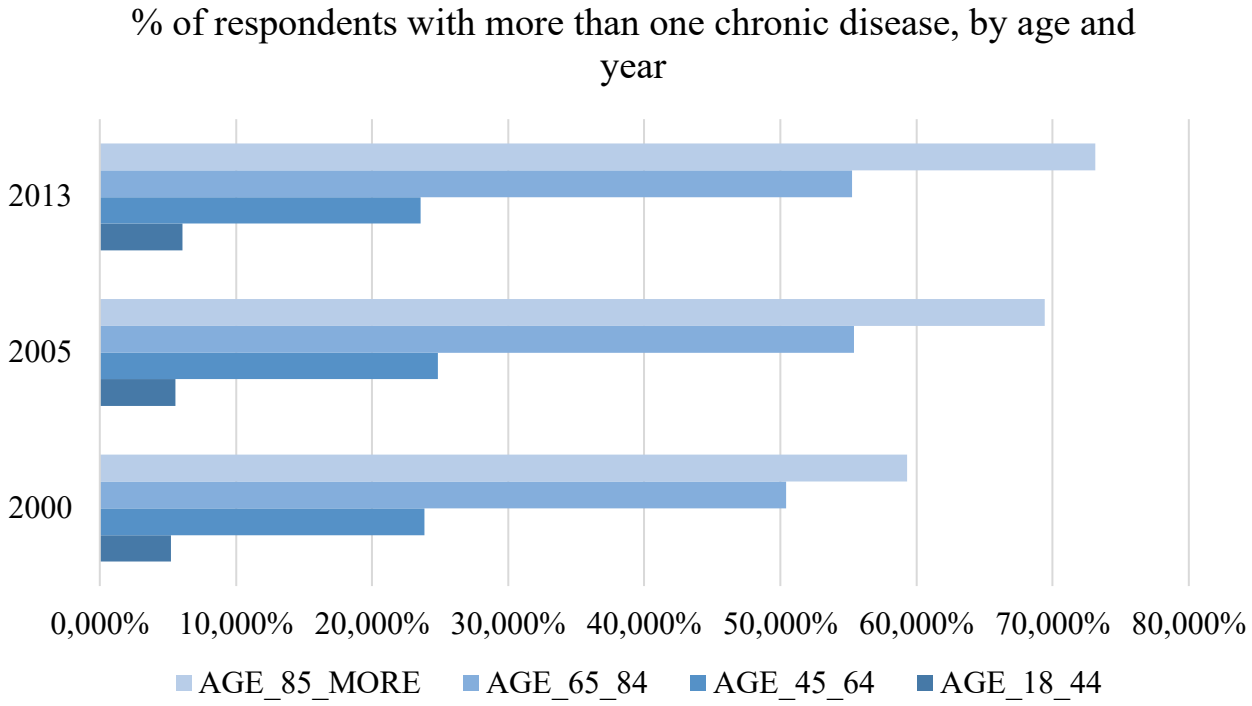

Figure 8 - Share of respondents with more than one chronic disease, by age and year

For what it concerns the association between geographical area and comorbidity (Figure 9), a trend similar to the one observed for fatal diseases prevalence per geographical area is detected. In this case, in South Italy the increase in comorbidity prevalence from 2005 to 2013 is so relevant that from being the area with the lower level of comorbidity in 2005 (South 22,97%, Center 26,63% and North 23,44%), it became the area with the higher level of comorbidity in 2013 (South 26,72%, Center 26,30% and North 25,46%).

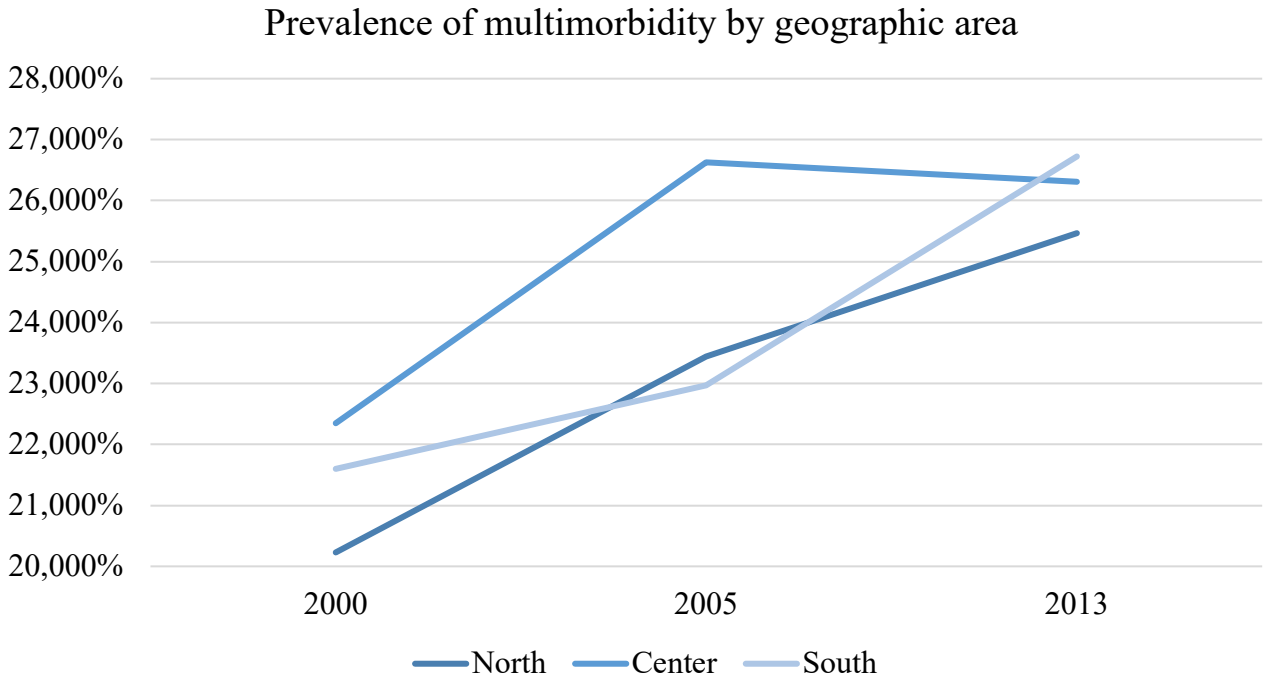

Figure 9 - Prevalence of multimorbidity by geographic area

- ***Multimorbidity trends in Italy by type of disease (fatal vs non-fatal disease)***

Table 6 shows the most common disease among the respondents with more than one chronic condition. Among the non-fatal diseases, the most common condition in multichroic subject is arthritis, followed by osteoporosis. This result is in line with the previous argumentation, according to which multichronic conditions are most commonly found in older people (Anagnostis *et al.*, 2009). Therefore, it is reasonable to observe that the most prevalent conditions in patients affected by multimorbidity are those that emerge with age. Considering fatal diseases, the most common condition in multichronic subjects is hypertension, followed by diabetes.

Non fatal diseases			Fatal diseases		
Allergy	2000	20,28%	**Diabetes**	2000	16,56%
	2005	18,12%		2005	19,00%
	2013	20,90%		2013	22,48%
Angina	2000	4,70%	**Hypertension**	2000	48,61%
	2005	3,35%		2005	52,75%
	2013	3,16%		2013	59,92%
Other hearth diseases	2000	16,24%	**Heart attack**	2000	5,63%
	2005	14,27%		2005	7,83%
	2013	16,30%		2013	8,17%
Asthma	2000	13,36%	**Thrombosis**	2000	4,26%
	2005	12,77%		2005	5,27%
	2013	13,41%		2013	6,14%
Thyroid disease	2000	11,49%	**Chronic obstructive pulmonary**	2000	21,89%
	2005	12,04%		2005	20,08%
	2013	17,53%		2013	15,05%
Arthritis	2000	70,91%	**Cancer**	2000	3,86%
	2005	73,39%		2005	3,91%
	2013	61,46%		2013	5,92%
Osteoporosis	2000	23,52%			
	2005	24,52%			
	2013	31,19%			
Cirrhosis	2000	0,94%			
	2005	1,05%			
	2013	1,02%			
Headache	2000	22,05%			
	2005	20,42%			
	2013	18,30%			
Parkinson and Alzheimer	2000	4,23%			
	2005	3,20%			
	2013	5,20%			

Table 6 - Share of patient with single disease among multichroic patients

Additionally, Table 7 shows that for any given condition, the most common comorbidity is arthritis, apart from diabetes, heart attack and thrombosis, for which the most common comorbidity is represented by hypertension.

	ALLERGY	ANGINA	OTHER HEARTH DISEASES	ASTHMA	THYROID DISEASE	ARTHRITIS	OSTEOPOROSIS	CIRRHOSIS	HEADACHE	PARKINSON AND ALZHEIMER	DIABETES	HYPERTENSION	HEART ATTACK	THROMBOSIS	CHRONIC OBSTRUCTIVE PULMONARY	CANCER
ALLERGY		1,26%	5,29%	14,42%	7,55%	26,52%	9,25%	0,37%	13,23%	0,93%	5,04%	18,39%	1,82%	1,39%	8,23%	1,68%
ANGINA	12,06%		27,58%	13,89%	10,71%	63,13%	25,92%	1,12%	15,58%	5,71%	24,06%	62,72%	33,96%	7,98%	25,95%	4,16%
OTHER HEARTH DISEASES	5,10%	6,06%		11,27%	11,70%	58,89%	24,20%	0,85%	13,86%	4,98%	18,46%	53,51%	9,79%	6,77%	21,31%	4,08%
ASTHMA	34,21%	3,44%	12,71%		8,84%	44,17%	15,60%	0,81%	14,63%	2,73%	11,77%	32,30%	5,28%	3,30%	36,18%	2,80%
THYROID DISEASE	14,76%	2,19%	10,87%	7,28%		43,23%	20,80%	0,63%	16,49%	1,72%	10,31%	34,39%	3,14%	2,38%	10,17%	3,73%
ARTHRITIS	11,12%	2,76%	11,74%	7,81%	9,28%		24,82%	0,67%	15,22%	3,32%	13,53%	41,17%	4,96%	3,67%	14,96%	3,14%
OSTEOPOROSIS	11,95%	3,49%	14,84%	8,49%	13,75%	76,40%		0,90%	16,95%	5,36%	14,69%	46,82%	6,11%	4,78%	16,21%	4,23%
CIRRHOSIS	11,61%	3,61%	12,60%	10,62%	9,97%	49,62%	21,58%		13,36%	5,37%	23,66%	36,25%	6,68%	6,90%	22,89%	8,00%
HEADACHE	17,34%	2,12%	8,57%	8,03%	10,99%	47,23%	17,09%	0,56%		2,53%	7,75%	29,18%	2,87%	2,84%	12,17%	2,57%
PARKINSON AND ALZHEIMER	6,98%	4,47%	17,75%	8,62%	6,59%	59,29%	31,11%	1,30%	14,55%		18,73%	41,93%	7,72%	14,31%	19,55%	4,50%
DIABETES	7,87%	3,93%	13,71%	7,75%	8,25%	50,41%	17,79%	1,19%	9,30%	3,90%		50,56%	8,40%	5,66%	14,32%	3,31%
HYPERTENSION	9,43%	3,36%	13,03%	6,98%	9,02%	50,32%	18,59%	0,60%	11,49%	2,87%	16,59%		6,11%	4,52%	12,48%	3,06%
HEART ATTACK	8,34%	16,21%	21,26%	10,18%	7,34%	54,08%	21,63%	0,98%	10,08%	4,71%	24,56%	54,44%		9,55%	20,89%	3,95%
THROMBOSIS	8,90%	5,33%	20,61%	8,90%	7,80%	55,98%	23,73%	1,42%	13,97%	12,23%	23,19%	56,45%	13,38%		19,98%	4,79%
CHRONIC OBSTRUCTIVE PULMONARY	15,24%	4,68%	17,49%	26,33%	8,99%	61,58%	21,68%	1,27%	16,14%	4,50%	15,82%	42,04%	7,89%	5,39%		4,03%
CANCER	10,95%	2,82%	12,60%	7,66%	12,41%	48,72%	21,32%	1,68%	12,85%	3,90%	13,79%	38,78%	5,62%	4,86%	15,19%	

Table 7: Respondents with a given disease that also present another chronic disease

- ***Role of health behaviors in multimorbidity trends in Italy***

In terms of health behaviors, this study aims at examining and comparing the prevalence of multimorbidity by different health behaviors among Italian chronic patients.

At this purpose, Table 8 reports the results for respondents affected by obesity (BMI >30) versus respondents with a BMI lower than 30 (BMI<30); respondents declaring to carry out regular physical activity (Sport) versus respondents who declare to do not carry out regular physical activity (No sport); and smokers (Smoke) versus non-smokers (No Smoke). Table 8 shows that respondents affected by obesity have a higher prevalence in comorbidity for all age classes. Similar results are obtained for regular physical activity, where respondents who carry out regular physical activity present a lover prevalence of multimorbidity for all age classes. For what it concerns smokers, unexpected results were found, since smokers present a lower level of multimorbidity with respect to non-smokers.

YEAR	PREVALENCE		AGE_18_44		AGE_45_64		AGE_65_84		AGE_85_MORE	
	BMI>30	**BMI<30**	**BMI>30**	**BMI<30**	**BMI>30**	**BMI<30**	**BMI>30**	**BMI<30**	**BMI>30**	**BMI<30**
2000	36,82%	19,57%	9,45%	5,00%	35,32%	22,04%	60,33%	48,90%	68,02%	58,50%
2005	40,97%	21,93%	12,66%	5,14%	37,06%	22,92%	65,87%	53,64%	76,70%	68,72%
2013	42,17%	24,03%	11,16%	5,73%	36,77%	21,49%	65,43%	53,26%	78,63%	72,51%
	Sport	**No Sport**	**Sport**	**No Sport**	**Sport**	**No Sport**	**Sport**	**No Sport**	**Sport***	**No Sport**
2000	13,13%	25,79%	4,61%	5,75%	20,12%	25,62%	41,95%	52,58%	47,50%	60,06%
2005	11,40%	27,87%	4,73%	6,01%	19,95%	26,07%	43,21%	56,48%	40,00%	69,64%
2013	13,70%	30,35%	5,26%	6,61%	19,30%	24,87%	42,77%	56,81%	55,41%	73,53%
	*for age class 84+ the sample of people that declare to be active (sport) is very small and not representative									
	Smoke	**No Smoke**	**Smoke**	**No Smoke**	**Smoke**	**No Smoke**	**Smoke**	**No Smoke**	**Smoke***	**No Smoke**
2000	13,18%	23,81%	5,51%	5,07%	19,59%	25,30%	40,02%	51,71%	48,84%	59,65%
2005	15,09%	26,29%	5,66%	5,49%	20,92%	26,12%	48,77%	56,08%	64,18%	69,54%
2013	17,45%	28,44%	6,17%	6,06%	22,29%	23,98%	47,22%	56,19%	67,09%	73,29%
	*for age class 84+ the sample of people that declare to be smokers (smoke) is very small and not representative									

Table 8 - Prevalence of comorbidity for different health behaviors obesity (BMI > 30) physical activity (sport) and smoking

6 - Discussion

This study analyzed the trends of chronic conditions and multimorbidity in Italy over the years 2000, 2005 and 2013. According to the results of this study, the prevalence of both chronic conditions and multimorbidity increased over the considered periods of observation.

Additionally, the differentiation between fatal and non-fatal diseases, as proposed by Hayward et al., has been adopted (Hayward *et al.*, 2000). Results show that a bigger increase in the prevalence of fatal diseases, with respect to non-fatal diseases, has been registered during the years of observation.

Results of this study are in line with previous studies, according to which the emergence of chronic conditions is associated with age (e.g. Hoffman, Rice, & Sung, 1996; Wolff et al., 2002). Combining this with the ageing population trend observed in many European countries, and,

especially, in Italy (ISTAT, 2018) give an idea of the challenges that health systems will face in the coming future.

Another expected result is that female is more subject to chronic diseases. In fact, for what it concerns the sex, results of this study are in line with previous studies, according to which women develop chronic conditions more frequently with respect to men (Matud, 2017; OECD, 2019). However, further research is needed in order to analyze more in details which are the conditions that are emerging more frequently, according to different sex.

According to previous studies, the provision of services varies a lot across Italian regions, and, consistently, different conditions emerged in different regions (Lattanzio *et al.*, 2010). This study found that the sharpest increase in the chronic conditions has been registered in the southern part of Italy after 2005. This sharp increase could be explained by a different reasons. In particular, different trends in the aging process have been found in the South with respect to North and Central Italy. In addition, other local factors, such as the regional management of the heathcare system (that is highly decentralized in Italy), or difference in lifestyle could motivate the detected differences in the italian regions. Further investigation could be conducted to assess the precise drivers in the sharp increase in the chronic disease prevalence in South Italy also a further research could focus on whether this is associated with the effect of the economic crisis, which has been followed by a reduction in the public expenditure.
Multimorbidity trends in Italy have been analyzed, as well.

Previous studies found an association between the emergence of multimorbidity and age, Barnett *et al.*, 2012 found a similar results in Scotland. This study is in line with this stream of the Literature, since the share of older people with multiple chronic conditions increased a lot over years. In particular, the chronic multimorbidity increased drastically in the southern part of Italy after 2005.

Considering the emergence of different chronic conditions, patients with more than one chronic conditions are more likely to develop arthritis among non-fatal diseases and hypertension among fatal diseases, as underlined by previous studies using Canadian data (e.g. Pefoyo et al., 2015).

According to the results of previous studies, health behaviors (like smoking and/or physical activity) may have an indirect effect on the prevalence of multimorbidity (Barnett *et al.*, 2012). In fact, Steptoe and Wardle, in their study, found that one of the most important cause of diseases development is represented by the incorrect health behavior (Steptoe and Wardle, 2001). In particular, Patel et al. found in their study that pathologies like diabetes is strongly associated with the extent of being past- smokers (Patel *et al.*, 2009). At this purpose, further research could analyze differences in the chronic multimorbidity trends between smokers and past smokers. Results of this study are in line with previous literature according to which multimorbidity is more prevalent among people with bad heath behaviors, especially among people affected by obesity.

This analysis contribute to the literature by providing the analysis of trend of chronic conditions and multimorbidity prevalence using Italian data, by focusing on different type of chronic conditions (fatal and non-fatal as defined in Hayward and colleagues). Results of this study found that the prevalence in fatal conditions increase more sharply than non-fatal condition and differences across geographic areas have been detected.

Policy implications can be derived from this study, as well. In particular, this study suggests that preventions policy could be implemented with a specific focus on fatal diseases

like hypertension and diabetes. Also, South Italy would require a more detailed analysis to understand the sharp increase in prevalence of chronic disease.

In line with previous research, this study is not without limitations. In particular, it is based on a limited set of chronic diseases, and, therefore, further research could provide a more detailed investigation of a variety of chronic conditions. In addition, further research could focus on the causal effect of the analyzed variables, such as sex age and geographical distribution on the prevalence in chronic diseases.

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