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Descriptive Finding

Cause-specific mortality as a sentinel indicator of current socioeconomic conditions in Italy

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Contents

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Abstract

BACKGROUND
In the last few years the need for disaggregated statistics at small territorial levels to monitor the social and economic conditions of the various areas of a country has increased considerably. The question of how to define these indicators has been the topic of a recent international debate.

OBJECTIVE
This study aims to assess whether simple, widely available demographic indexes, like mortality measures, may serve as sentinel indicators of economic development and social wellbeing in Italy.

METHODS
We analyse and compare the geographical patterns of the infant mortality rate and of the mortality rates for leading causes of death with the spatial pattern found for a more complex index, the vulnerability index, recently introduced by the Italian National Institute for Statistics at the provincial level in contemporary Italy.

RESULTS
Mortality from leading causes of death such as diseases of the circulatory system, and mortality from increasingly emergent causes of death such as diabetes, may offer a valid statistic to grasp economic development and social wellbeing in Italy today.

CONCLUSIONS
Our findings are important because policymakers need to rely on indicators with the following fundamental properties: easy availability, clear definition, temporal continuity, and spatial comparability.

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CONTRIBUTION
This study contributes to the literature by showing that mortality data is a straightforward and powerful tool to help policymakers plan appropriate interventions.

1. Introduction

The last few years have seen an increasing need for disaggregated statistics at small territorial levels that can monitor the social and economic conditions of the various areas of a country and highlight possible regional imbalances. The general climate of uncertainty that Italy and other countries – both in Europe and globally – have experienced in recent years has amplified the need and urgency for indicators that can drive policymakers in the planning and evaluation of structural and development policies. The question of how to define these indicators has been the topic of a recent international debate (Mazziotta and Pareto 2016).

For past populations and in developing countries the infant mortality rate is widely acknowledged as a good proxy for the level of a country's development because it represents a measure of both the population's socioeconomic conditions and its health system. Infant mortality is internationally defined, computed worldwide, and available in time series. Hence, it is easily exploitable and allows comparison over time and space, which makes this index even more appealing because it facilitates framing the socioeconomic situation of a population in a broader context and evaluating its development. However, given the long-term process of reduction in early mortality and the general levelling of territorial disparities, infant mortality may fail to represent the economic development and social wellbeing of current populations in developed countries.

In 2015 the Italian National Institute for Statistics (ISTAT) introduced a new indicator, the vulnerability index, which expresses the uncertainty in the social and economic status of a geographical area. The index is constructed by combining several elementary indicators calculated from census data (ottomilacensus.istat.it) and is available at a level of very fine spatial detail (municipal level). However, it is not internationally defined and is available only when there is a population census. As a result, it fails to meet two important requirements of an indicator: continuity over time and international comparability.

This study aims to assess whether nowadays simple, widely available demographic measures may still serve as sentinel indicators of economic development and social wellbeing in Italy. We assess whether infant mortality is still a good proxy for socioeconomic conditions and investigate whether cause-specific mortality offers a

valid alternative to infant mortality as a sentinel indicator. To this purpose, we analyse and compare the geographical patterns of the infant mortality rate and the mortality rates for leading causes of death with those found for the vulnerability index, in contemporary Italy and at the provincial level, as this is the finest territorial level for which ISTAT releases cause-specific mortality data.

2. Obsolescence of a socioeconomic indicator: The infant mortality rate vs. the vulnerability index

In historical demography and also in population studies of developing countries, infant mortality is often used as an indicator of the socioeconomic conditions of a population. Several studies show that the late decline in infant mortality in Italy, which caused a delayed demographic transition with respect to other European countries, was strongly connected to socioeconomic status (Manfredini and Pozzi 2004). After the unification of Italy, and indeed throughout the 1800s, the economic backwardness was clearly reflected in the high infant mortality rate recorded throughout the country. With the dawning of the new century the dualism that pitted economically and socially progressive north-central Italy against a strongly penalized southern Italy progressively increased. As a result, high levels of infant mortality increasingly became the prerogative of the south (Caselli 1987; Pozzi 2000). The geography of infant mortality in Italy reflected the persistence of a strong relationship between socioeconomic development and infant mortality until the 1960s, when due to a higher frequency of low-weight and preterm births the most industrialized regions lost some of the advantages that the economic conditions and the best health care facilities should have ensured (Pinnelli 1989). In more recent decades, Italy has quickly recovered: infant mortality has reached values that are among the lowest in Europe and continue to decline throughout the country, although in the last years there has been a slowing down of this trend. Furthermore, geographical discontinuities, although still persistent, have reduced (ISTAT 2014).

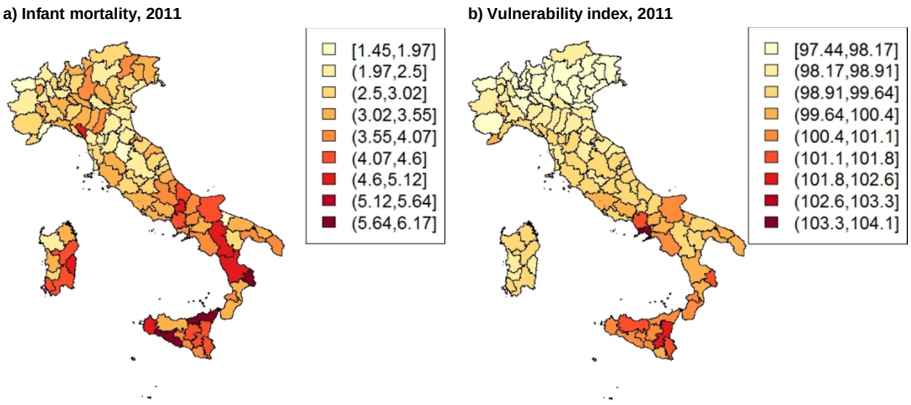
Recently, ISTAT introduced a new synthetic index to measure material and social vulnerability in Italy at the municipal level. This index exploits information from the population census and has been computed with reference to the 2011 census; it has also been reconstructed to 2011 borders for the two previous Italian censuses of 2001 and 1991. The index is constructed by combining seven elementary indicators that describe the main material and social vulnerability dimensions:

- The percentage of the population aged between 25 and 64 years with no educational qualifications;

- The percentage of households with six or more members;
- The percentage of young (parent age less than 35 years) or mature (parent age between 35 and 64 years) single-parent families;
- The percentage of households with potentially poor support: the proportion of households composed only of seniors (65 and over) with at least one octogenarian component;
- The percentage of the population in seriously crowded conditions: the percentage of people living in a house smaller than 40 sq. m. with more than four occupants, or 40–59 sq. m. with more than five occupants, or 60–79 sq. m. with more than six occupants;
- The percentage of young people (15–29 years) not in the labour market or education;
- The percentage of households with the potential to experience economic hardship: the proportion of young or mature families with children where no one is employed.

Figure 1 shows the geographical patterns of infant mortality and the vulnerability index in Italy at the provincial level in 2011. As expected, the two maps do not match. To evaluate the association between these two variables we computed Spearman's rank correlation coefficient ρ_s, which turns out be equal to 0.5. The highest levels of vulnerability are found in southern Italy, still economically and socially backward, whereas the industrialized north enjoys the lowest levels. For infant mortality the situation is different, with a south still penalized and a north that does not enjoy the best survival conditions at these early ages.

Figure 1: Infant mortality rate (per 1000) and vulnerability index, Italy, 2011



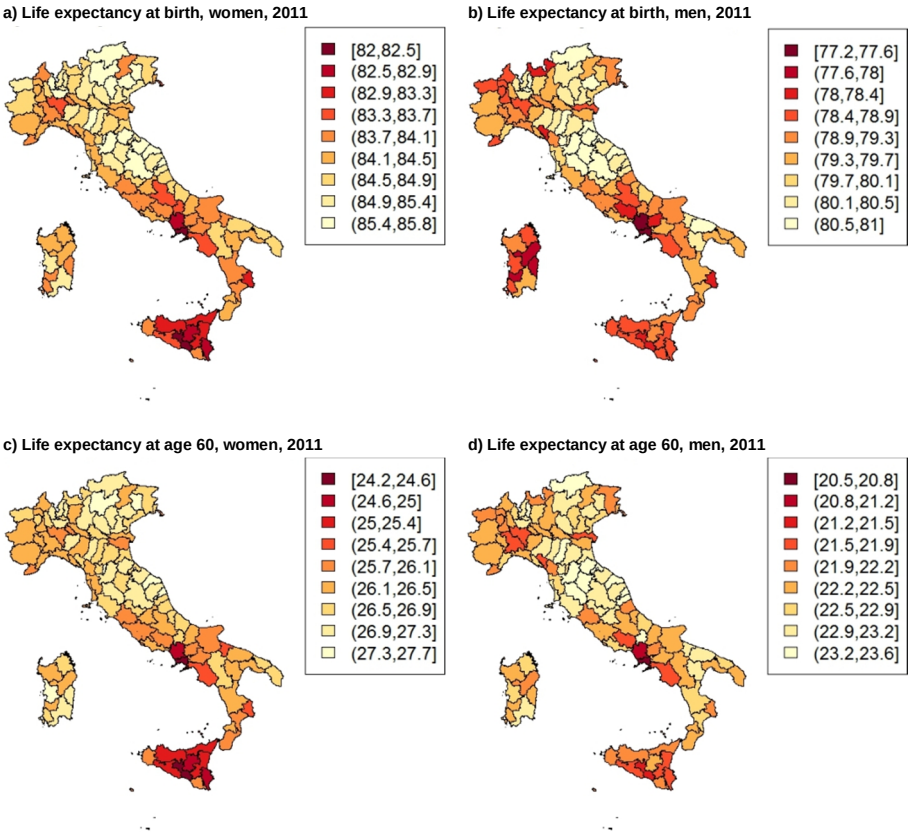
3. Mortality data is still an option

As we have seen in Section 2, in Italy infant mortality is no longer the ideal proxy for socioeconomic conditions. Nevertheless, mortality is a powerful measure which allows geographical and temporal comparisons: statistical institutes collect mortality data in a comprehensive way, with territorial details and in long time series, and encode them following internationally accepted rules. Mortality is also very informative, is the ultimate measure of health, and is easy to measure – unlike other health indicators such as disability or disease prevalence.

We therefore focused on another important mortality indicator, life expectancy at birth, separately for women and men, and given the increasing importance of elderly mortality in determining the current level of human survival we also considered life expectancy at age 60. Figure 2 depicts a mixed picture, especially for men. While for women it is possible to see a distinction between the north and the south of Italy – which is clearly disadvantaged even though the highest values of life expectancy both at birth and at age 60 are not a prerogative of all the northern provinces – for men the picture is much less obvious. The lowest values of life expectancy at birth and at age 60 are more scattered across the country: they are recorded in both many southern provinces and many economically developed northern provinces. A common feature for both women and men is that a cluster of provinces in central Italy enjoys the best survival conditions. Hence, like the infant mortality rate, in Italy today these indicators do not prove very useful in uniquely identifying areas of economic and social disadvantage. Spearman's rank correlation coefficient between the vulnerability index (Figure 1, right) and life expectancy at birth is $\rho_s = -0.54$ for women and $\rho_s = -0.36$ for men, whereas the correlation coefficients between the vulnerability index and life expectancy at age 60 are $\rho_s = -0.54$ and $\rho_s = -0.25$ for women and men respectively.

Clearly, this overall picture may hide different patterns that emerge when looking at mortality for selected causes of death, which may better reflect the specific features of a geographical area (Caselli et al. 2003). Therefore, we turned to analysing mortality from the two leading causes of death in Italy, which together comprise around two-thirds of total deaths: cancers and cardiovascular diseases. The cause-specific mortality data refers to the X International Classification of Diseases (ICD). The group of cancers refers to ICD10: C000–D489 and the group of cardiovascular diseases to ICD10: I000–I990. Mortality due to cancer is highly associated with specific risks not necessarily dependent on age. It predominates at adult and young-old ages, although over time its importance has shifted to increasingly older ages (Barbi, Caselli, and Yashin 2004; Barbi and Caselli 2009). Conversely, mortality from cardiovascular diseases is strongly related with the senescence process and is predominant at older ages.

Figure 2: Life expectancy at birth and at age 60 for women and men in 2011



The current geographical patterns of these leading causes of death are similar to those observed in the past (Caselli and Egidi 1981; Caselli, Cerbara, and Leti 1993). Figure 3 shows the standardized mortality rates due to cancer for women and men in 2011.[4] It seems to confirm the thesis of a reverse relationship between development and mortality: The highest levels of cancer mortality are recorded for both women and men in the north of Italy, whereas the south experiences more favourable levels. This thesis is also confirmed by the negative values of the rank correlation coefficient between

[4] The standardized rates presented in this paper are calculated with reference to the deaths and the resident population in Italy. The standard population is the total Italian population in 2011. We used five-year age groups with the exception of the two initial groups (0, 1–4 years) and the final open group (90 years and over). All data is from ISTAT.

mortality from cancers and the vulnerability index, which is –0.58 for women and –0.50 for men. A negative correlation with the vulnerability index is also found when looking at the two leading specific causes for the two sexes, namely breast cancer for women (ICD10: C500–C509) and cancers of the larynx, trachea, bronchus, and lungs for men (ICD10: C320–C349), at $\rho_s = -0.29$ and $\rho_s = -0.22$ respectively. Mortality from cardiovascular diseases presents a totally different picture (Figure 4): The dualism between the disadvantaged provinces of the south and the northern provinces with lower mortality levels is visible for both women and men, and is particularly marked for women. The geographical patterns of these two leading causes of death are similar for the two sexes, but the intensity of each cause is very different for women and men: for men, mortality from cancer can be double the level observed for women, while male and female levels of mortality from cardiovascular diseases are similar (Lagona and Barbi 2018). Thus, for men in the north, the disadvantage is mainly due to mortality from cancers whose risk factors are linked to the occupations and life styles (high alcohol consumption, early spread of smoking, etc.) typical of more developed and industrialized provinces. For women in the south the disadvantage is due to mortality from cardiovascular disease, which is prevalent among women in the southern provinces where healthcare is generally less adequate and women are generally less educated and economically less independent. Thus, it is not surprising that the geographical pattern of mortality from cardiovascular diseases for women (Figure 4, left) matches well with that of the vulnerability index (Figure 1, right). Spearman's coefficient between these two indexes $\rho_s = 0.69$ corroborates this correspondence (for men $\rho_s = 0.57$).

Figure 3: Standardized rates of mortality due to cancers for women and men in 2011

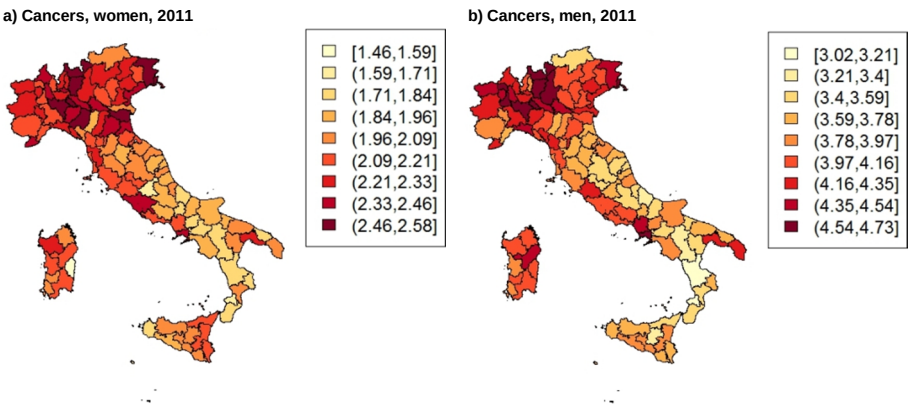
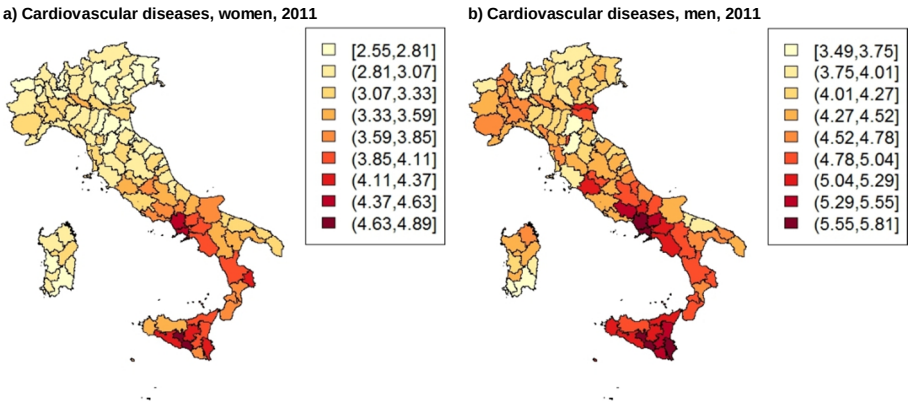
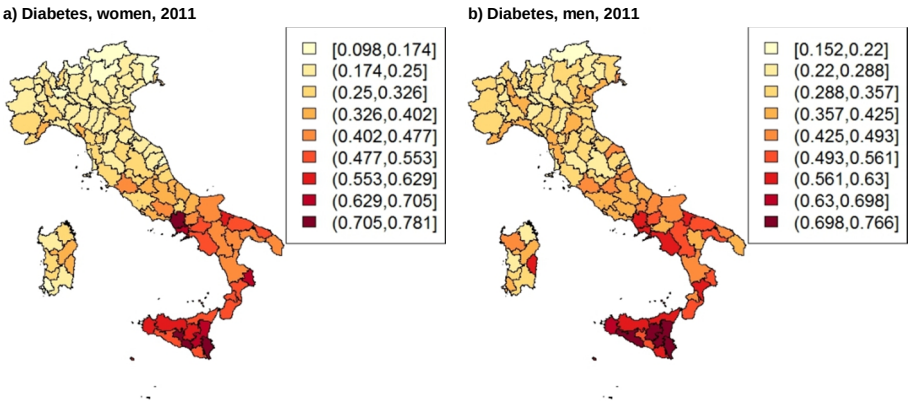


Figure 4: Standardized rates of mortality due to cardiovascular diseases for women and men in 2011



Even more impressive is the overlap between the vulnerability index and mortality due to diabetes (ICD10: E100–E149; Figure 5), an important disease that often has a negative impact on mortality from cardiovascular disease. Early diagnosis, good-quality healthcare facilities, and primary prevention education programmes are of fundamental importance in reducing mortality due to an avoidable cause of death like diabetes, and therefore mortality from cardiovascular disease. It is no coincidence that mortality from these causes of death is lowest in the most prosperous provinces of the country. As a result, mortality due to diabetes considerably correlates with the social and material vulnerability of a population for both women and men ($\rho_s = 0.77$ for women, $\rho_s = 0.71$ for men). Therefore, a targeted analysis of mortality by sex and cause of death may prove useful information for monitoring the country, detecting geographical differentials in socioeconomic conditions, and eventually planning appropriate interventions.

Figure 5: Standardized rates of mortality due to diabetes for women and men in 2011



4. Conclusion

The choice of efficient economic and social indicators is essential for planning appropriate population policies. However, reducing the observed complexity of reality into a synthetic indicator that is able to discriminate gender and age factors is a challenge. In this regard we have shown that mortality measures can still be used to locate disadvantaged areas in terms of socioeconomic conditions, at least for countries with reliable vital registration. Given the historical transition from reduction in early-life mortality to reduction in later-life mortality, and the shift from acute infectious diseases to chronic and degenerative diseases, infant mortality is no longer an appropriate measure for evaluating the development level of a population. Mortality from leading causes of death such as diseases of the circulatory system, and mortality from increasingly emergent causes of death such as diabetes may offer a valid statistic to grasp economic development and social wellbeing in Italy today. This finding is important because policymakers need to rely on indicators with the following fundamental properties: easy availability, clear definition, temporal continuity, and spatial comparability. In this paper we have given an example of how by analysing data at the provincial level – the most finely detailed cause-specific mortality data released by ISTAT – straightforward demographic measures can be used as proxies for more complex composite indexes. Finer spatial detail would be desirable to guide policymakers in planning appropriate interventions, even at the cost of pooling data over a few years to avoid random variation.

Furthermore, as a by-product of this research, we show how women in Italy pay a higher price in terms of mortality from certain causes of death, due to the economic, social, and cultural backwardness that persists in some areas. Policies designed to improving the efficiency of health services and interventions aimed at prevention, education, and equity both help to close the observed spatial and gender disparity.

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