Ambulatory-Care Sensitive Conditions in the metropolitan area of Milan: inner inequalities and comparison with OECD megacities

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Extended abstract

Introduction

The largest cities in the developed world all face an unprecedented challenge: how to meet the needs of a population that lives longer, has declining birthrates, and is radically altering the demographic profile on which municipal services and social welfare programs have long been premised. These cities are centers of economic growth and finance, culture and media, sophisticated transportation systems and innovations of all kinds. They are renowned for their centers of excellence in medical care, top-ranking medical schools, institutes of bio-medical research, and public health infrastructure. Likewise, they attract some of the wealthiest, as well as the poorest populations of their nations, and are destinations for large immigrant communities from around the world, which exacerbate social and spatial inequalities and forces their health care systems to confront the challenge of glaring inequalities. At the same time, health status of residents in these world cities, on average, was found to be the same or better than corresponding health status at national level. For example, older persons in Paris and New York live longer than their counterparts in the rest of their countries (Rodwin and Gusmano, 2006).

Since world cities share many sociodemographic and economic characteristics, but have different health system characteristics (such as levels of medical resources, health insurance coverage, and organizational factors), comparative analyses can provide insights into the possible effects of these health systems on various health-related outcomes, and identify promising practices and lessons from failures.

Background

The World Cities Project (WCP) was launched in 2002 (Rodwin and Gusmano, 2002). Its aim is to study urban health, particularly the evolution and organization of public health infrastructure, as well as the health status and quality of life in world cities, and on this basis suggest lessons from comparative experience in wealthy nations as well as rapidly growing megacities worldwide. When the project started,

there was not good descriptions of urban public health infrastructure in world cities, and the WCP has addressed this gap. The project began focusing on the four largest cities in the organization for economic cooperation and development (OECD): New York City, having the most local control and responsibility over its public health infrastructure and health systems; London, Paris, and Tokyo that have more power to intervene in the life of their capital. These world cities were used as a laboratory to compare systematically their public health resources and health outcomes (Rodwin and Gusmano, 2002; Gusmano, Rodwin and Weisz, 2006; Gusmano et al., 2007; Gusmano, Weisz, and Rodwin, 2009; Gusmano et al., 2013; Gusmano, Rodwin and Weisz, 2014).

Beyond describing the public health infrastructure of each city, a major focus was to explore the impact of world cities—their health system and neighborhood characteristics—on two outcomes: the use of health services and health status. With regard to health status, the project has investigated infant mortality, premature mortality and life expectancy. With regard to the use of health care services, the project has examined mortality amenable to medical care, the use of revascularizations among patients with heart disease, and hospitalizations for ambulatory care sensitive conditions. The project explores the influence of individual, neighborhood and health system characteristics on health status and the use of health care services.

Metropolitan area of Milan

As said, the preliminary studies from the WCP have focused on the four largest cities in the OECD – London, New York, Paris and Tokyo. More recent studies have also included comparisons with cities in the so-called BRIC countries (Brazil, Russian, India and China) (Gusmano et al., 2015; Gusmano et al., 2016; Gusmano, Rodwin, and Weisz, 2017). Here, we propose to extend the WCP to the metropolitan area of Milan and compare access to ambulatory care in this city and three large OECD cities, namely Paris, New York and London.

Scholars in urban planning and urban political economy include Milan among cities categorized as "world cities," which are all hubs in the global economy (Taylor, Catalano, and Walker, 2002; Sassen, 2016). As such, Milan is a logical extension of the WCP. In addition to sharing a variety of economic and demographic characteristics with London, Paris, New York and Tokyo, Milan also offers an interesting comparison with the other cities in the WCP because Italy's national health system shares important similarities and differences with health systems in which the other cities are located. Like England, France and Japan – but unlike the U.S. – Italy offers universal access to health insurance. Similarly, like these other nations, Italy has focused in recent years on improving care coordination and reducing hospitalizations by encouraging more appropriate use of community-based services. Yet, Italy's per capita health care spending is significantly lower than these other countries[1]. We would like to explore the implications of these differences for access to ambulatory care and inequalities in access within the city.

The metropolitan area of Milan includes 134 municipalities ("comuni"), that present significant differences in terms of their economy, environment, social structure, quality of life. According to census data collected over the past decade, the quality of life in Milan has increased, but suburban areas have not kept up with its pace.[2] Territorial differences can also cause inequalities in terms of population access to health services and health status, and this study intends to assess whether this is occurring.

[1] https://data.oecd.org/healthres/health-spending.htm.

[2] http://www.eupolis.regione.lombardia.it/shared/ccurl/805/901/35_2016_Monitor_Osservatorio%20qualità%20della%20vita_29novembre2016.pdf

Aim and Research Questions

The aim of the present work is to assess access to health care in the metropolitan area of Milan and quantify avoidable hospital care to answer the following research questions:

- How does Milan and its surrounding metropolitan region compare to its country as a whole in access to health care?
- How has hospitalization for AHC changed over the past decade?
- What is the extent of disparities within the metropolitan area of Milan?
- How does Milan compare to New York, Paris and London?

Methods

In this section, we provide details on data sources and methodological strategy for the analysis in the metropolitan area of Milan, that will be compared to New York, Paris and London, for which consistent data have been already created and similar approaches been adopted.

Data

This research combines two sources of data: (i) individual level-data that come from the hospital discharge database of the Italian Health Ministry; (ii) aggregate data at municipality level collected from multiple sources including Ministry of economy and finance, Ministry of health, national office for statistics (ISTAT) and regional data.

For the use of hospital discharge database, the current regulations of ethics committees in Italy require only standard written informed consent at the time of hospital admission and anonymous publication of scientific data. Our retrospective observational study fulfilled these requirements and was based on anonymized and de-identified hospital records. A standard discharge record ("Scheda di Dimissione Ospedaliera" (SDO)) must be completed for each patient. Hospitals do not have any incentive to under-report cases given the reimbursement of hospitalization is conditional to completion of SDO, hence reassuring on completeness and quality of data.

Discharge records contain information on the diagnosis, the treatment, the demographics, the length of stay and the diagnosis-related group (DRG) class. Diagnosis and treatment are classified according to the International Classification of Diseases- ninth revision- Clinical Modification (ICD-9-CM) codes.

The discharge records also have information on patient's residence as well as hospital's address. Each patient and hospital this way can be geographically located within a municipality. This enables us to match the individual level dimension with the corresponding aggregate municipality-level demographics.

We used data from all available periods spanning from 2005 to 2016.

Measures

Within WCP, a database has been developed to compare the world cities and to describe their public health infrastructure and examine indicators of the health, quality of life, and health and social services for older persons and children in each city. The variables included in the dataset for the case of the metropolitan city of Milan were based on this database; a synthesis of available measures and corresponding source is presented in Table 1 and described below.

Avoidable Hospital Care

Policy researchers often rely on hospital administrative data to measure residence-based Ambulatory Care Sensitive Conditions (ACSC) hospitalization rates as an indicator of access to primary care. The rationale for

focusing on ACSC is that if patients have access to timely and effective primary care, it should be possible to reduce hospitalizations for these conditions by preventing the occurrence of the disease (e.g. bacterial pneumonia) or managing the chronic condition in an outpatient setting (e.g. asthma, arterial hypertension, diabetes, congestive heart failure). Such policies are based on evidence that high rates of ACSC hospitalizations reflect poor access to effective primary care (Billings, 2004; Casanova and Starfield, 1995; Weissma, Gatsonis and Epstein, 1992).

Weissman and colleagues (1992) conducted a literature review on ACSC and selected 12 hospital discharge diagnoses, using a panel of internists, for which variations in hospitalization rates can be attributed to poor access to ambulatory care. Billings and colleagues (1993) and Billings and Weinick (2003) identified a more extensive group of hospital stays, by principal discharge diagnoses, which they defined as "avoidable" if patients receive timely and effective primary care. One could infer from these studies that disadvantaged populations, or those with poorer coverage, are at greater risk of being hospitalized for ACSC because of their higher rates of morbidity. Along with differences in the prevalence of chronic diseases, however, studies in the U.S. indicate that patients without health insurance, and therefore poorer access to primary care, have higher rates of ACSC than those with insurance (Ansari et al., 2012). Moreover, there is evidence of an independent effect of better access to primary care with lower rates of ACSC.

After adjustments for different measures of health status, most studies support the conclusion that although hospital discharges for ACSC may reflect morbidity and health-seeking behaviors (Blustein, Hanson and Shea, 1998), it remains a good indicator of access to primary care. The Institute of Medicine supports the idea that hospital discharges for ACSC reflect access to primary health care and the Agency for Healthcare Research and Quality tracks access to primary care with reference to ACSC. Likewise, the Commonwealth Fund monitors ACSC as a measure of access across all states in the U.S. Beyond U.S. studies, there is international evidence in support of ACSC as a measure of access to timely and effective primary care in Australia, Brazil, Canada, England and Spain, Italy, Hong Kong, New Zealand; and many more countries.
Avoidable hospital conditions consisted of 27 ICD-CM9 conditions, previously selected and used throughout the development of the project. See appendix for the full list.

Individual level variables
A number of individual level characteristics are available from hospital discharge database and considered as possible risk factors for hospitalization for AHC. These variables are socio-demographic characteristics of patient including sex, age, education (elementary school or less, middle school, high school, higher education, degree or higher), residence, place of birth and citizenship; and clinical information such as type and date of admission, presence of any injury, source of admission (sent by doctor, planned admission, etc.).

Municipality level variables
Municipality variables include demographic indicators such as population density, proportion of residents older than 65 years and younger than 15, women men ratio; socioeconomic indicators such as income quartile, percentage of unemployment, proportion of individuals with a degree, proportion of immigrants, households composed by 4 members or more; and health system indicators such as number of physicians per thousand habitants and hospitals density.

TABLE 1. List of variables and corresponding source, by individual and aggregate level

Variables	Individual level	Area Metropolitana di Milano
Avoidable hospital care	SDO	
Age	SDO	ISTAT
Sex	SDO	ISTAT
Ethnicity/nationality	SDO	ISTAT

Place of birth	SDO	
Residence	SDO	
Clinical information	SDO	
Payer source	SDO	
Education	SDO	ISTAT
Income quartile		IRPEF
Occupation		ISTAT
Household size		ISTAT
% residents older than 65		ISTAT
% residents younger than 15		ISTAT
women men ratio		ISTAT
Population density		ISTAT
Physician density		Regione Lombardia
Hospital density		Ministry of health

SDO= Scheda Dimission Ospedaliera (Discharge record)

ISTAT= Istituto nazionale di statistica (National Institute of Statistics)

Research Methods

We calculate hospital discharge rates of AHC for sex and age-adjusted cohorts, applying direct standardization methods using the 2005 and 2015 Italian populations (data from ISTAT). To assess whether the change in AHC rates across time periods is significant, we conduct a Wilcoxon signed-rank test.

When we study risk factors for hospitalization for AHC, we want to identify both individual (age, sex, education, citizenship, place of birth) and area-level (income quantile, unemployment, population density, and other factors) variations in population (i.e. individual) health. To do so, we use multilevel logistic regression model, which accounts for the correlation in the outcome among individuals who live in the same area, and quantifies unexplained between-area variability in the risk of the outcome. The individual outcomes y_{ij} (individual *j*, area *i*) are modelled in terms of a set of individual-level predictors x_{ij} and a set of area-level predictors z_i by a logistic regression with risk $p_{ij}(x_{ij}, z_i)$, where

$$p_{ij}(x_{ij}, z_i) = \frac{\exp(\mu_i + \beta x_{ij} \gamma z_i)}{1 + \exp(\mu_i + \beta x_{ij} \gamma z_i)}$$

where μ_i is an area-level random effect, assumed to be normally distributed across areas with mean μ and variance σ^2.

As a further step, we plan to advance the analysis and rely on statistical models for combining individual and aggregate data developed by Jackson, Best and Richardson (2006; 2008), to separate the effects of place of residence and personal circumstances. This consists in a multilevel modelling method termed hierarchical related regression (HRR). While standard multilevel models, as illustrated above, explain only variations in individual-level outcomes, the novel extension proposed by Jackson and colleagues also models area-level outcomes. Aggregate outcomes are modelled by averaging the individual-level exposure–outcome relationship over the area, which can alleviate the ecological bias associated with interpreting the relationship between aggregate quantities as an individual-level relationship (Jackson et al.,2008).

Descriptives and Expected Findings

The definition of urban core adopted in the WCP is guided by five criteria: (1) historic centers of urban development, (2) large populations, (3) high population density, (4) mix of high- and low-income populations, and (5) functions as central hubs for employment and medical resources. In the publication introducing the project (Rodwin & Gusmano, 2002), these criteria are illustrated for the cases of New York, London, Paris and Tokyo. Here we show these five features for Milan. The population (1,4 million inhabitants) and surface dimension (182 Km^2) of Milan and the comparison with its surrounding area (3.2 million people and 1575 Km^2) are very much in line with characteristics of the other world cities, (for example, Paris's area is 105 Km^2 and its inhabitants at the time of project onset were 2.1 million)

FIGURE 1. Milan: urban core and metropolitan area populations (millions)

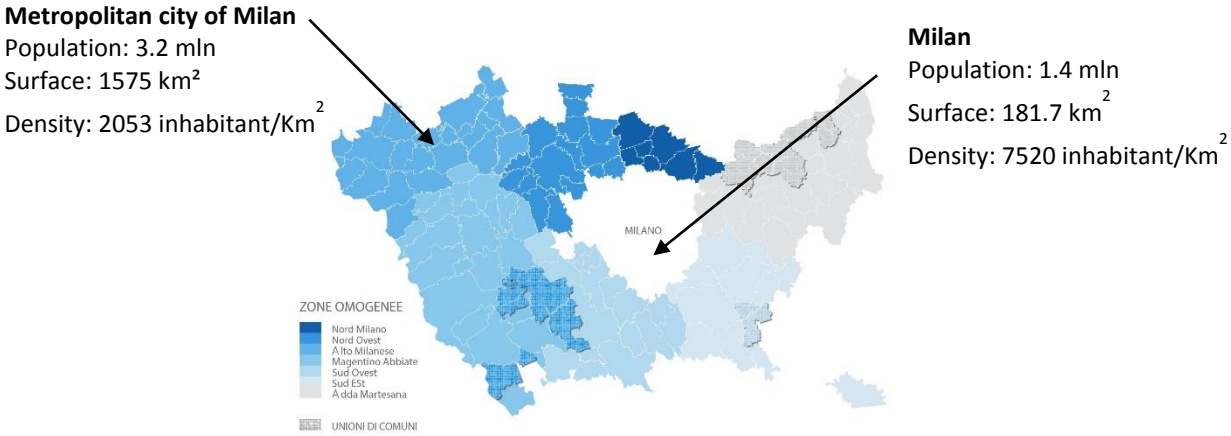

Table 2 illustrates some key health system characteristics of Milan and its metropolitan area and the world cities considered in our comparative analysis. Overall features are in line with those of Paris, London and NYC. Similarly to London, Milan and its surroundings stand out as having the lowest number of teaching hospitals and acute hospital beds, while the number of physicians is close to Manhattan and Paris.

Regarding healthcare system, Parisians are covered by national health insurance (NHI), New Yorkers are covered by a patchwork insurance system of public and private indemnity insurers and managed-care organizations, and Londoners and Milanese are covered by the National Health Service (NHS). The similarities and dissimilarities across these four world cities offer an interesting case to investigate how Milan, who has a health system similar to London, demographic indicators and dimension close to Paris, compare to these two European capital and with New York that with regard to these indicators is the most distant scenario.

TABLE 2. Medical resources: Milan and Metropolitan area of Milan compared to Manhattan, Inner London, Paris, and Tokyo at project onset.

	Milan	Metropolitan area of Milano	Manhattan [c]	Inner London [c]	Paris [c]
Teaching hospitals	11 [a]	13 [a]	19	13	25
Acute hospital beds per 1,000 population	5.7 [a]	3.7 [a]	8.9	4.1	9.6
Physicians per 10,000 population	66 [b]	68 [b]	71.2	36.9	74.5

Source: [a] Ministry of Health; [b] ATS Milano città Metropolitana
[c] Features from Rodwin and Gusmano (2002)

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