

Frameworks and inequalities in healthcare: some applications

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1. Introduction

There is increasing recognition of the importance of social determinants of health (SDOH), which encompass social, behavioural, and environmental influences on one's health. Indeed, SDOH have taken centre stage in many recent health policy discussions; particularly those relating to the Covid-19 pandemic, accountable care organizations, and other initiatives focusing on improving population health (Townsend et al., 1982). Furthermore, existing literature (Vian, 1982) and current research (Marmot et al., 2020) clearly suggest that a focus on SDOH can enable improvements in the health of populations. Therefore, giving greater attention to SDOH may help both improve Italians' health and reduce health care costs.

This paper:

1. Identifies and investigates the principal conceptual frameworks for action relating to SDOH;
2. Analyses possible relationships between SDOH and health outcomes (life expectancy, mortality rates, morbidity rates etc.) using the Quadrant Analysis technique; and
3. Contributes to the ongoing debate about practicable measures which could be used to alert regions to inequalities in health and healthcare.

2. Methodology, data, interpretation and use

Quadrant charts were used to plot SDOH against other indicators of interest on health outcomes (life expectancy, mortality rates, morbidity rates, quality of care, access and physical resources, etc.). These showed percentage differences from the Italian averages for each indicator; with the intersection of the axes representing the Italy average for both indicators. Therefore, deviations from the midpoint readily highlight which regions perform above or below the Italy average for both indicators. A simple correlation line was included.

There are many methods to measure health inequalities. Those chosen to quantify the degree of inequality in a specific health variable in this research were the **slope index of inequality** (SII) and **the concentration index** (CI), which the authors consider to be the most relevant and important. According to O'Donnell et al. (2008), the CI is able to measure the association between socio-economic and health inequalities; and it should be noted that the CI directly relates to Concentration Curves (Kakwani et al., 1997). Given there are various methods proposed to calculate the CI, the authors applied that deemed most relevant to their research, i.e., that for grouped data proposed by Brown (Fuller and Lury, 1977):

$$CI = (p_1L_2 - p_2L_1) + (p_2L_3 - p_3L_2) + \dots + (p_{T-1}L_T - p_TL_{T-1})$$

Italian data refers to the year 2016 and was sourced from:

- Health for All and I.Stat from Istituto Nazionale di Statistica (ISTAT);
- Osservasalute from Osservatorio Nazionale sulla Salute nelle Regioni Italiane dell'Istituto di Sanità Pubblica-Sezione di Igiene dell'Università Cattolica del Sacro Cuore;

- Rapporto sulla situazione sociale del Paese from Centro Studi Investimenti Sociali (CENSIS)
- Passi d'Argento from Istituto Superiore di Sanità.

Each region was colour-coded based on a simple (unweighted) risk factors index, which averaged smoking, alcohol and overweight variables. 'Blue' indicates that a region's performance is close to the Italian average; 'Green' indicates that it is significantly better (with 'low' risk factors); and 'Red' indicates that it is considerably worse (with 'high' risk factors).

3. Results

The first investigation examined the underlying conditions and root causes contributing to health inequities, and the interdependent nature of the factors that create them. After a holistic analysis of the various frameworks available in the literature (Canadian council on social determinants of health, 2015), it was considered that the conceptual model for community-based solutions to promote health equity (fig. 1) was the most appropriate and informative. Unlike a logic model, which is linear and progresses neatly from inputs to outputs and outcomes, the model in figure 1 is circular, thereby reflecting the topic's complexity. Inputs are shown in the outer circle and background, depicting the context of structural inequities, socio-economic and political drivers, and the determinants of health, in which health inequities and community-driven solutions exist.

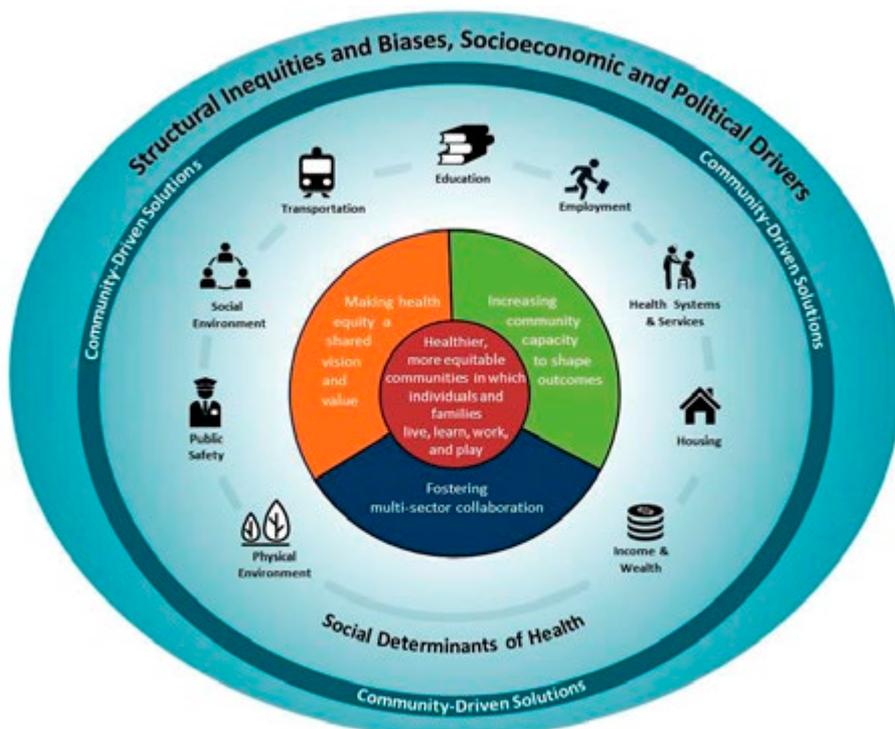


Figure 1 - A conceptual model for community-based solutions to promote health equity.

SOURCES: National Academies of Sciences, Engineering, and Medicine (2017), Communities in Action: Pathways to Health Equity

The quadrant charts were used to measure the extent by which SDOH influence better access, quality and health outcomes (OECD, 2019). These analyses illustrated the relationship between a variable linked to the health and social care system and another variable of interest; the latter included health risks factors, income (or other economic variables) and environmental quality.

The main results are presented in the figure 2 and 3.

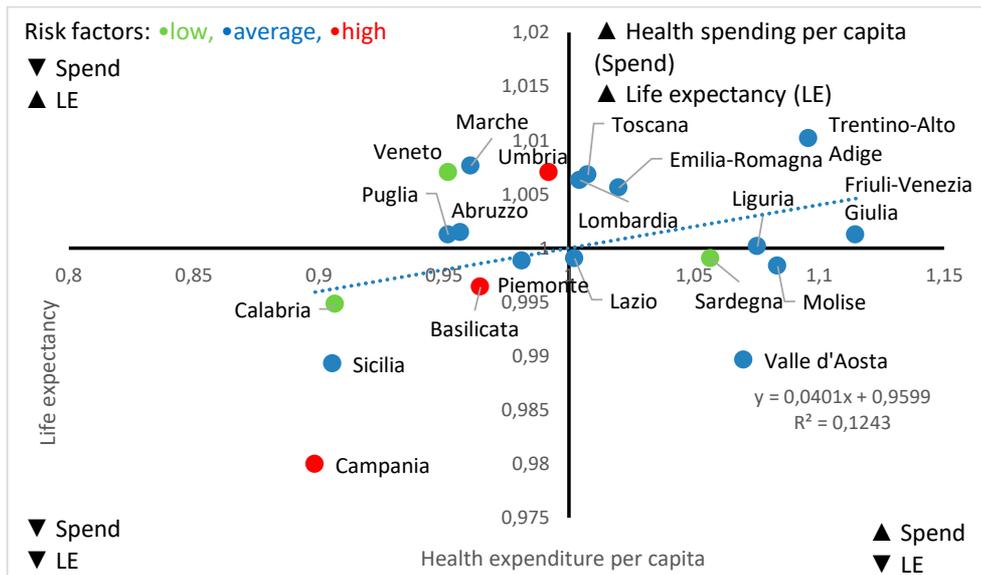


Figure 2 - Life expectancy and health expenditure

Figure 2 illustrates the extent to which regions that spend more on health have better health outcomes (noting such associations do not guarantee a causal relationship). There is a clear positive association between health spending per capita and life expectancy. Amongst the twenty regions, six spend more and also have higher life expectancy than the Italy average (top right quadrant). A further five regions spend less and have lower life expectancy at birth (bottom left quadrant). Of particular interest are regions that deviate from this basic relationship. Five regions spend less than average but achieve higher life expectancy overall (top left quadrant); these are Marche, Umbria, Veneto, Puglia, and Abruzzo. The four regions in the bottom right quadrant present higher spending, but lower life expectancy than the Italy average; these are: Lazio, Sardegna, Molise, and Valle d'Aosta.

It is noticed that two of the three regions with high overall risk factors (red dots) have lower life expectancy than the Italy average; and are also typically below the trend line, which shows the average spending to life expectancy ratio across Italy regions. Further interesting results were obtained using the same quadrant analysis technique applied to different SDOH and health outcomes. The great strength of this diagram is that it enables the simultaneous consideration of the three variables being studied, viz. life expectancy, per capita health expenditure and risk factors. Added value is created by deliberately using colour to reflect whether a region's figures were above or below the range of $M \pm \sigma$. Furthermore, the diagram serves to highlight that outcomes (such as life expectancy, mortality, morbidity, infant mortality etc.) can be influenced by variables that are outside the National Health System, i.e., it is not certain that increasing health expenditure per capita will necessarily enable improvements in health outcomes. This conclusion is consistent not only with the oldest literature (Bruno et al., 1978; Vian, 1982; Fabbris, 1990; Biggeri and Grisotto, 2005) but also with the most recent literature (Marmot et al., 2020). The results presented in this quadrant analysis invite the reader and the regional health authorities to broaden their approach to improving health and look beyond the National Health System itself by investing in the social determinants of health. Particular attention should be given to the key risk factors, viz. smoking, alcohol consumption and overweight. The need for a wider approach is reinforced by the statement that non-medical factors play a substantially larger role than do medical factors in the maintenance of health, with medical factors only weighted from 10%-20% (Remington et al., 2015; National

Academies of Sciences, Engineering, and Medicine, 2017).

The SII and CI methods were applied to an outpatient department in the Marches region. The aim was to analyse inequalities among women, classified according to their level of education, with regards to their degree of access to qualified gynaecological staff. The results are presented in Tables 1 & 2 and Figures 3 & 4 below:

Level of education	f women	f _r women	Cum. f _r	f of visits	f _r
Primary school	594	0,12	0,12	253	12,75
Secondary school	861	0,17	0,29	271	13,65
High school	1704	0,34	0,63	526	26,50
Bachelor's degree	1212	0,24	0,87	459	23,12
Master's degree	646	0,13	1,00	476	23,98
Total	5017	1		1985	100

Table1–SII. Classification of the women population by level of education and by number of obstetric visits received by a gynaecologist in an outpatient department in the Marches region

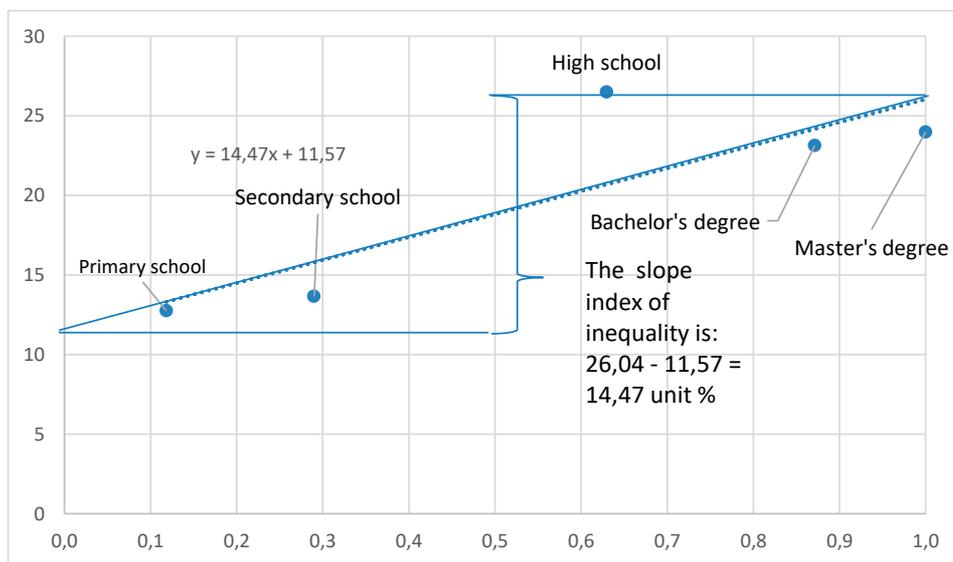


Figure 3–SII representing inequalities in obstetric needs compared to the level of education

These results show that women who have a higher level of education have a 14.47% better chance of receiving obstetric care from qualified personnel than those who have a lower level of education.

Level of education	f women	f _r women	Cum. f _r	f of visits	f _r of visits	Cum. f _r	CI
Primary school	594	0,12	0,12	253	0,13	0,13	-0,006
Secondary school	861	0,17	0,29	271	0,14	0,27	-0,013
High school	1704	0,34	0,63	526	0,26	0,53	0,018
Bachelor's degree	1212	0,24	0,87	459	0,23	0,76	0,111
Master's degree	646	0,13	1,00	476	0,24	1,00	0,000
Total	5017	1		1985	1		0,110

Table2 – CI using Brown formula. Classification of the women population by level of education and by number of obstetric visits received by a gynaecologist in an outpatient department in the Marches region

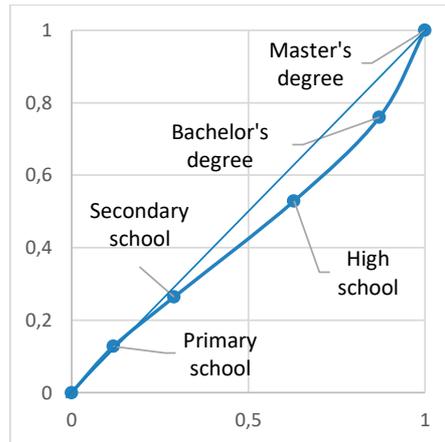


Figure 4 - Concentration curve representing inequalities in obstetric needs compared to the level of education

The obtained value of the CI is 0.11. Its positive value indicates the existence of a weak inequality that is favourable to the more educated female population. This is inferred from the fact that the 63% of the female population with lower levels of education (i.e., up to high school) accounted for only 53% of the obstetric visits. In summary, females with a higher level of education have a greater chance of obtaining obstetric visits from a qualified gynaecological staff.

This conclusion is consistent with the idea that higher levels of scholarship enable people to better understand health literacy, and innovations in medical and food hygiene fields. Also, more educated people are arguably more able to deal with disadvantageous situations. In synthesis, better education can facilitate better health (Feinstein et al., 2006; Zajacova et al., 2018).

4. Conclusion

Pandemics are arguably more of a social problem than a healthcare problem. A population that lives in poverty and in neighbourhoods that are overcrowded, with poor maintenance and sanitation, is being disproportionately affected by COVID-19. This serves to highlight the importance and weight assumed by SDOH in the health of populations.

To this end, following a brief review of the available main frameworks, our research identified three types of variables that are identified in any health system, namely: the final variables (outcomes), the instrumental variables (linked to the healthcare sector) and the current variables (linked to the characteristics of socio-economic systems).

The Quadrant Analysis showed some relationships between a final variable (life expectancy) and an instrumental variable (per capita health expenditure). The existing low correlation between these two variables was already known in the literature, but the simultaneous visualization of risk factors in the quadrants suggests a need to look more widely than the health system alone and develop/invest in socio-health policies that address the SDOH.

The work identified some important measures of inequality in healthcare through the use of SII and CI (the last calculated according to Brown's formula). The applications involved social and health facilities in an *area vasta* of the Marche Region, and highlighted how the use of an obstetric outpatient department by the female population varied according to women's level of education (which is a key SDOH).

A further application of the CI (using Erreygers formula) examined the evolution of inequalities in the Marche region, and suggested their weakening over the years investigated. The application of the methodology on the *area vasta* of the Marche region has limits linked to the specificity of the demographic and social context; yet its transferability to other contexts is straightforward. Therefore, it is considered that this research has made a methodological contribution to the visualization of SDOH and to the measurement of inequalities.

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