

POPULATION HEALTH. AN ANALYSIS OF THE DEFINITION AND A MEASUREMENT OF THE CONCEPT

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Abstract: *The aim of this paper is to discuss the definition and the measurement of the population health concept, as well as the extent to which this measurement follows the rules of scientific measurement. This paper, based on scientific literature, constitutes an attempt to establish an operational definition for this concept. It will also offer a brief description of the most common measures of this concept, in order to gain a proper understanding of what these actually measure.*

Key words: *health status of a population, life expectancy, healthy life expectancy.*

1. Introduction

The *population health* concept does not yet have an agreed-upon definition. It is debated whether it refers to a concept of health or to the field of study of health determinants [4].

In this paper, *population health* is seen as a concept and an entity in itself. Even when *population health* is seen as a health concept, many terms related to it are used imprecisely, across different disciplines like public health, health promotion, social epidemiology or sociology of health.

One thing is clear. When using such a phrase we stand at a macro-level analysis. In other words, the unit of analysis is a group of individuals and not the individual itself.

In academic health literature there are two major trends related to defining and measuring the concept of *population health*. Most papers give no concise definition of the term, although they make use of it.

For instance, in theoretical papers such as [1] or in empirical studies such as [6], [9] the measurement of *population health* is used, but no definition is given and no attempt is made to operationalize the concept. Some papers give a holistic definition of this concept or at least they offer a syntactic definition, without operationalizing the concept in detail [2], [3], [4]. The reasons behind this situation are understandable, given the difficulty of defining such a concept which in turn is made up of two underlying concepts, that of *health* and that of *population*.

The lack of clarity of the definitions at macro level makes this concept synonymous with macro indicators that measure actual components of the health of a population (e.g., mortality rates, life expectancy, etc.). Due to the widespread use of this approach, very few studies still ask „What is the operational definition of this term?”

This article constitutes an attempt to

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establish an operational definition for this concept. It will also give a brief description of the most common indicators used to measure this concept, in order to gain a proper understanding of what is actually measured by these indicators.

These conceptual clarifications are useful to population health researchers, as well as to people responsible for establishing health policies, who frequently use this concept in different studies and analyses.

Sometimes, people use a range of indicators without truly understanding their meanings, thus causing significant miscommunication. A good knowledge of how to define and measure this concept and its associated indicators will lead to reliable conclusions and will guard against the danger of using concepts, thinking they measure something, when in fact they only measure one component of that concept or something else entirely.

The information in this paper may be used as a starting point for further studies aiming to improve the measurement scheme suggested here.

2. What is population health? Definition and concept

The term *population health* combines two concepts: that of *population* and that of *health*.

Population refers to a group of individuals organized in different units of analysis. From a public health perspective, “populations are defined by the geography of a community (e.g., city, county, regional, state, or national levels” [2, p. 1164]

Population health refers to the health of a group as a whole, not to the health of a sum of individuals. “Health is determined by the collective characteristics and social norms of the group”. [4, p.142]

The question is an epistemological one. How do we measure the health of a population as a whole, taking into account

its characteristics and properties?

One suggested definition for this concept [3,366] offers a solution to defining *population health* through macro indicators: “the health outcomes of a group of individuals, including the distribution of such outcomes within the group. These populations are often defined by geographic regions, such as nations or communities, but they can also be defined by other groups, such as employees, ethnic groups, disabled persons, or prisoners.”

Even if, ontologically speaking, society is not reduced to the sum of individuals who make it up, in terms of methodology, we cannot know a society only through its individuals. Therefore, the health of a population cannot be known only by summing up the health of individuals, expressed in macro-level indicators. This data expresses synthetic information at individual level and it is an average of values at individual level. This kind of approach is met with a number of criticisms, the most frequent one being that averages can give a misleading picture of what is happening in the population, especially if the population has a high degree of heterogeneity. But in this case, it is the only viable solution for measuring what is happening with the *population health*.

There is another aspect to be highlighted in relation to defining the health issue contained in the definition at the individual level. Health is a process that takes place as a continuum, from good health to death. For this reason, academic literature on public health prefers to use the term of *health outcomes* rather than *health status*; because this term reflects dynamic health and not just health at a given time.

We know that the term *population health* refers to the health outcomes of a group of individuals. But how do we define the concept of health and health outcomes and how can this concept actually be measured at population level. In other words, which

are the dimensions and the indicators?

Suggestions regarding the dimensions of these indicators (health outcomes) are identified in papers as follows [10, p.1]: „An ideal population health outcome metric should reflect a population’s dynamic state of physical, mental, and social well-being.” These dimensions are those used by the World Health Organization to define health at the individual level. According to this suggested definition, the dimensions of the concept are: physiological, psychological and social.

How to measure *health outcomes*? Measures of *population health* are made by aggregating individual-level health measures related to these dimensions. These *health outcomes* can be objective or subjective measures, depending on the possibilities of measurement and of data collection.

Objective indicators involve measuring a social phenomenon from an outer subject perspective. Other forums decide whether something is in some way or another. Subjective indicators are based on the subjective evaluation of attitudes and on opinion about a social phenomenon [5]. Data collected on the basis of surveys, measuring the subjects’ perceptions about their own health, are considered subjective indicators.

Starting from the idea that health is on a continuum between negative or positive spectrum, health outcomes also will exist on a continuum from negative outcomes to positive outcomes. Positive outcomes are related to being alive, to functioning well mentally, physically, and socially and to having a sense of well-being. Negative outcomes include death, loss of function, and lack of well-being [10].

Regarding the above, a clarification is necessary. While the biomedical traditional vision about health focuses on negative aspects, such as the absence of diseases,

the modern understanding of health underlines its positive aspects (like wellness or well-being [4], [11].

Also, over the past 40 years summary measures of *population health* have been developed, which combine information about mortality or nonfatal health outcomes as a single numerical index [10], [7]. The use of these indexes is preferred, because they are much easier to use for comparisons across countries, they do not depend on the age structure of the population and they offer an overview of what happens in the populations.

In conclusion, *population health*:

- can be seen as a concept and an entity in itself;
- is a multidimensional concept;
- includes objective and subjective elements;
- should include rather positive health outcomes than negative outcomes;
- can be expressed as a numerical index.

3. A proposed operational definition

In social sciences, when measuring one variable, we start from its definition in a theory. If we do not identify any theory or the existing theories are not useful for measuring that variable, the only solution is to define the concept through an operational definition [8].

There are few theories in the Sociology of Health and those that exist do not approach the measurement of the *population health* concept, but only that of the factors that determine health or lead to the adoption of healthy behaviours. Therefore, the only way to measure *population health* is through an operational definition. Some standard steps are taken to establish such a definition [8]: (1) the operational definition of the principle is established; (2) the operational work definition is established; (3) the aggregation scheme of the indicators and

dimensions in to the index variable is established.

Next, I will provide my own attempt to establish an operational definition of this concept, by highlighting its particularities.

3.1. The operational definition of the principle

Based on scientific literature, I conceptualized *population health* through the main encountered dimensions: the physiological, the psychological and the social one. For each dimension I have established two sub-dimensions: objective and subjective outcomes, each of these subdivided in turn into another three sub-dimensions: negatives outcomes, intermediate outcomes and positive outcomes (Table 1).

Although scientific literature speaks only about negative outcomes and positive outcomes, I have included the third category, the intermediate outcomes, and I have changed the manner of defining these categories. Therefore, through negative outcomes we understand fatal outcomes (e.g., mortality), through intermediate outcomes we understand non-fatal outcomes (e.g., morbidity or limitation in activities) and through positive outcomes we understand positive aspects of health (e.g., wellness, but also the absence of morbidity)

Usually, an operational definition should also include, in addition to the dimensions of the concept, the direct measurable indicators. In this case (Table 1), because there are macro indicators, these can be used only if this data was collected by specialized institutions. Therefore, I thought it more pragmatic at this stage to use only some general descriptions of the dimensions, exemplifying them subsequently with indicators in the operational work definition (Table 2), according to data availability.

3.2. The operational work definition

No variable can be measured through the operational definition of the principle, for various reasons: either the number of indicators is too high or there is no available data, etc.

The question is what criteria can we use to select the indicators that will remain in the operational work definition?

There are some suggestions regarding this in social sciences research, one of the most important ones being that the indicators used must be directly measurable [8]. To this criterium we added a few specific public health criteria suggested by various groups working in the field [10], like: (1) to be measurable with available data sources, (2) to include the need for the indicators, (3) to be valid and reliable, (4) to be easily understood by people who use them, (5) to be measurable over time.

In building the working operational definition, direct measurability and the availability of data for these indicators in public databases were the decisive criteria.

The analysed databases were those offered by the European Commission (ECHI - European Core Health Indicators and Eurostat) [14], [15] and by the World Health Organization (Global Health Observatory Data Repository) [16]. The last database contains indicators that considerably overlap over those offered by the European Commission. Therefore, I used only Eurostat and ECHI for this kind of definition (Table 2).

In the Eurostat database there are few indicators that are not found in the ECHI database, but that I consider useful for the operational definition proposed here. These indicators are showed in the third (3rd) Table, in italics. Although some of these indicators are found in these databases, they have not been updated in the last seven years.

The operational definition of the principle regarding population health Table 1

Dimensions	Sub-dimensions	Description of the dimensions (types of indicators)		
		Negative outcomes	Intermediate outcomes	Positive outcomes
Physiologic	Objective (register-based prevalence)	Indicators related to fatal outcomes: deaths	Indicators related to non-fatal outcomes: the presence of chronic diseases, of episodic diseases, of a certain disorder (episodic or long-term) or disabilities / physical limitations	Indicators related to positive aspects: the absence of chronic diseases, of episodic diseases, of a certain disorder (episodic or for long-term) or disabilities / physical limitations and wellness
	Subjective (self-reported prevalence)	-	Indicators related to self-perception, to the non-fatal outcomes	Indicators related to self-perception, to the positive aspects.
Psychologic	Objective	-	Indicators related to non-fatal outcomes: the presence of mental diseases, the presence of a certain disorder (depression, anxiety, memory impairment, etc.) (episodic or long-term)	Indicators related to positive aspects: the absence of mental diseases, of a certain disorder (depression, anxiety, memory impairment, etc.) (episodic or long-term) and the presence of well-being.
	Subjective	-	Indicators related to self-perception, to non-fatal outcomes.	Indicators related to self-perception, to positive aspects.
Social	Objective	-	Indicators related to non-fatal outcomes: not fulfilling the roles in society (professional, family, within the social networks)	Indicators related to positive aspects: fulfilling roles in society (professional, family, within the social networks)
	Subjective	-	Indicators related to self-perception, to non-fatal outcomes.	Indicators related to self-perception, to positive aspects.

The data from Table 2 shows that most indicators for that data were collected and reflects the physiological component. These are rather negative outcomes on the physiological component. Both the subjective and the objective indicators are almost equal. Subjective indicators are

used when objective data is not available. There are few positive outcomes. Therefore, when it comes to *population health*, reference is made especially to the negative aspects (negative outcomes and intermediate outcomes) rather than to positive aspects (positive outcomes).

The operational work definition regarding health population

Table 2

Dimensions	Sub-dimensions	Measures of health (Indicators)		
		Negative outcomes	Intermediate outcomes	Positive outcomes
Physiological	Objective	General mortality, Infant mortality, Perinatal mortality, Diseases-specific mortality, Drug-related deaths, Smoking-related deaths*, Alcohol-related deaths*, Excess mortality by heat waves*,	Incidence of communicable diseases, Incidence of HIV/AIDS, Cancer incidence*, Diabetes*, Asthma*, Chronic obstructive pulmonary disease*, Low birth weight, Acute myocardial infarction*, Stroke*, Suicide attempt*, Long-term activity limitations*, General musculoskeletal pain*, <i>Physical and sensory functional limitations*</i> , <i>Limitations in personal care activities</i> , <i>Limitations in household activities</i>	-
	Subjective	-	<i>Self-perceived health (bad)</i> <i>People declaring physical pain or physical discomfort, People having a long-standing disease or health problem, People reporting a chronic disease, People reporting having had an accident, which resulted in injury for which medical treatment was sought, Asthma, Chronic obstructive pulmonary disease, Self-reported chronic morbidity, Diabetes: self-reported prevalence, Self-perceived long-standing limitations in usual activities due to health problem**</i>	<i>Self-perceived health (well)</i>
Psychological	Objective	-	Dementia*, Depression*	
	Subjective	-	Depression, <i>Psychological distress **</i>	<i>Psychological well-being **</i>
Social	Objective		<i>In-patient average length of stay</i>	-

*data for these indicators are not available at the time of publication of this material (2015), but are listed in the databases mentioned

** there is no recent data for these indicators (the latest dates back to 2008)

The psychological component is under-represented and the social component is missing. For the social component I included one indicator for which I found data in a section on health services. I believe that in the absence of other more suitable indicators for this dimension (retired persons due to disease, a number of persons with extended medical leave,

etc.), this indicator (In-patient average length of stay) may reflect the degree of fulfilment of roles in society.

This rather medical approach, where the focus is on the physiological component and on the negative aspects, is probably due to the difficulty of collecting and processing data and of gaining access to such data.

4. The aggregation of indicators

In order to estimate the *overall population health*, it is necessary to establish a scheme of aggregation of indicators into index variables for each dimension. Next comes the aggregation of the dimensions into the final index variable (meaning the measurable concept).

Currently, there are such standard schemes, based on information summarised into a single indicator. This kind of indicator allows comparisons among various populations, while ensuring the replicability condition.

Although in the consulted literature from the field of public health [4], [7] by „summary measure of population health” we merely understand a measure which combines information on fatal outcomes and non-fatal outcomes, in this paper I have chosen to go beyond this definition and I have taken into account the definition used in sociological practice. According to this latter definition, by index we understand a measure which combines information from several indicators. [8]

Although general mortality cannot be thought of as an index, according to the above mentioned definition, it is still placed in table no. 3, because it offers a general perspective on what is happening at the „negative outcomes” category level. This indicator can be considered an indicator by itself (negative outcomes), because is directly measurable (the data also is recorded as death per general). No aggregation scheme is necessary in order to obtain this indicator. Based on this indicator *life expectancy* is calculated.

Health outcomes as *life expectancy* and *healthy life expectancy* (and different variations of this indicator) are made on the basis on such standardized schemes [12]. *Life expectancy* is calculated only on the basis of objective indicators from physiological component (negative

outcomes). This index may be considered as intermediate summary measures (Table 3), because this index expresses the number of years that a person has to live in terms of mortality from that population. This index does not tell us anything about the quality of life that a person lives, and nothing about the wellness or well-being of the people.

Healthy Life expectancy (Healthy Life Years at birth/or at age 65), Healthy life expectancy based on self-perceived health is calculated on the basis of objective and subjective indicators, from the physiological component. This index combines information from life expectancy (intermediate outcomes) and the absence of nonfatal health outcomes (diseases and limitations in activity). It is one of the few indexes that can be considered positive health outcomes, even if does not express a positive aspect of health, such as wellness (Table 3).

A wide array of summary measures has been proposed throughout time (e.g., active life expectancy, disability-free life expectancy, dementia-free life expectancy, etc.) [7]. All these indexes can be considered positive health outcomes, but there is no data available in public databases mentioned. Also, they do not express positive aspects of health like wellness or well-being.

Self-perceived health and *Psychological well-being* are placed in Table 3, although these are not summary measures (in this case, with data from public databases mentioned). These indicators are directly measurable, through a single question in the questionnaire, but can also be measured indirectly by several parameters that require an aggregation scheme..

Therefore, at this time, aggregation schemes are only available for the physiological dimensions of the *population health* concept (objective or a combination of objective and subjective indicators). For

a better understanding of *population health* we need to develop aggregation schemes that would include the psychological and the social dimension, or at least the psychological one.

5. Measure validity and precision

The operational definition of the principle is not judged in terms of validity, but in terms of exhaustiveness. The list of dimensions and associated indicators must be complete, even if this can generate an almost endless list of indicators. Because of the impossibility of measuring a very large list of indicators through specific methods of social research, the list of indicators is limited (in what is called a working operational definition). This is done according to some well-established criteria in order to achieve such measurements [8]. In this case, when operating with indicators at macro level, the only obstacle are the costs for the collection of such data in each country and sometimes the impossibility of their collection.

In order to *validate* measurements through operational work definitions, we have more solutions [8] but two might apply in the case of the definition proposed here, such as *The Jury Expert* and the Delphi investigation.

Public health experts have debated and established a list of indicators and criteria for their selection [10], but the approach is limited to the physiological dimension. Some authors have proposed summary measures that include the psychological component (e.g., dementia-free life expectancy, Ritchie et al. 1993), but for these indexes no data is available in public databases, at least none in those mentioned in this article. Although the definition of the term „health” referred to by most researchers is that given by the World Health Organization, which also mentions

the social dimension, it seems that this dimension is ignored when it comes to its effective measuring through health outcomes. The measurement scheme proposed in this paper could become the subject of debate for experts in the field of health in order to reach its validation.

Data replicability. There are now global institutions (e.g., World Health Organization) or European institutions (e.g., European Commission) which establish a standard methodology for calculating *population health* indicators. Measuring *population health* in a standardized way allows the use of data in any country, as well as making comparisons among people, countries and cultures. This means that there is a structure for creating and using summary measures on the psychological and social component, it just needs to be brought to the attention of researchers.

Data precision. Objective indicators for population health, at least the registration of deaths is virtually complete in most countries. Condition-specific mortality data and incidence of diseases may be less precise due to errors in determining and coding the cause of death or some kind of diseases. For subjective indicators, the size of the samples used by each country is sufficient to provide national estimates for the total population with relative standard errors of 1% to 3%, although relative standard errors of estimates for small subgroups may be as high as 10% to 30%.[10].

Data accuracy. Data accuracy refers to the degree of managing sources of error which may occur in data collection. Most indicators used are objective and refer to deaths or incidence of diseases diagnosed by doctors. Because these diagnoses meet certain scientific standards, it can be said that there is a high degree of accuracy in the data collection. We should not forget that there are cultural differences on the

meaning of the diseases from country to country or even from specialists to specialists. This may affect even the diagnosis made by doctors. Thus, error sources can occur even when recording such objective indicators.

Regarding subjective indicators, data collection errors can be reduced only through rigorous data collection methodology, which must be strictly followed. But this data is affected by the

cultural perceptions of diseases at the level of different categories of people within the same country, as well as at the level of some populations from different countries. Moreover, admitting to this kind of relativity seems to be a paradigmatic characteristic of contemporary knowledge [13]. In the absence of other possibilities for measuring some indicators, it is the only viable solution.

Summary measures regarding health population

Table 3

Dimensions	Sub-dimensions	Summary measures of health population (Indexes)		
		Negative outcomes	Intermediate outcomes	Positive outcomes
Physiologic	Objective	General mortality*	Life expectancy	Healthy life expectancy
	Subjective	–	Self-perceived health (bad)*	Self-perceived health (well)*
Psychologic	Objective	–	-	–
	Subjective	–	Psychological distress*	Psychological well-being*
Social	Objective	–		–

**these indicators are not a indexes, they do not combine information from several indicators*

6. Conclusions

Although many works have approached health topics, few papers have given a definition of the *population health* concept. Even when the concept is defined, and although the three measures of the concept are specified, we mostly use the indicators of the physiological component (usually those referring to general or to infantile mortality) or synthetic measures of health, such as life expectancy or healthy life expectancy.

In other words, in this case, the scientific measurement rules are not strictly followed.

The operational definition of the principle proposed in this paper can be a model for us, population health researchers. We can use this scheme as a

starting point in order to propose standardized measurement schemes for summary measures of population health, for both the psychological and the social dimension. It needs to develop indexes, as *life expectancy* or *healthy life expectancy* for physiological dimension, but for the psychological and social components as well. Also, it is necessary to develop indexes that combine information from all three dimensions, and this is the ideal situation when measuring the *population health* concept.

Although in theory, the tendency is to focus on the positive aspects of health and not only on the absence of diseases or disorders, the present summary measures of health do not express this. Maybe this should be reflected in future suggested

measurement schemes and developed in future indexes.

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