

Population health management: Principles, models and areas of application in public health

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Abstract. There is no single model for Population Health Management (PHM) and different definitions have been proposed. All PHM models and definitions share the overall aim of improving population health and reduce healthcare costs. To achieve these objectives, PHM makes use of conceptual tools such as the Chronic Care Model and predictive medicine, and technical tools such as information systems and computational and record-linkage techniques to collect and analyse data. Using these tools, it makes it feasible to articulate PHM approaches in the following steps: identification of a population, stratification of individuals according to risk levels, mapping of health needs and development of targeted interventions and models of care. PHM has been applied in a variety of national and regional settings, proving to have great potential. However, the success of PHM models depends on a number of factors. In particular, few key points have emerged that must be taken into consideration when planning and implementing PHM programs. They include PHM funding schemes, strategies to ensure people adherence, the equity dimension in its multiple aspects, and the privacy of personal data. In addition to these challenges, there is the need to act in a legislative context appropriate to the implementation of PHM. (www.actabiomedica.it)

Key words: population health management, public health

Introduction, definition and objectives of population health management

Public Health can be defined as the organisation that deploys scientific, technical, professional and economic resources to address the health problems of populations, seeking to ensure their best state of health (1). The Public Health professional shifts the focus of his or her care from the patient to the community. Among the epidemiological tools guiding his or her care actions are the so-called health profiles, understood as a precise description of health - and related determinants - regarding a population or segments of it to identify areas for intervention (2). Gathering information and systematising it into population health profiles enables a systematic and proactive approach to community health protection and

promotion through a tool known as Population Health Management (PHM).

PHM consists of a procedure for stratifying a population by a priori risk status assessment to individuals, in order to target specific interventions, improve health status and contain healthcare costs (3). Since the early 2000s, numerous definitions of PHM have been developed with different variations; in them, an attempt has been made to describe the new strategies implemented by various countries to improve the health of the population and the economic sustainability of their systems (4); in the absence of a single definition of PHM, in order to understand its meaning, it is necessary to focus on the objectives of this approach. Indeed, the first definitions implied the application of PHM as a system governance tool, aimed at the development of three objectives. These objectives have been

subsequently included in the triple aim concept (5), which consists of: (I) to improve the patient care experience, (II) to improve population health, and (III) to reduce the per capita costs of healthcare. To achieve these goals, it is necessary to stratify the population by risk groups. These risk groups enable caregivers and health and social service providers to target and tailor care interventions to the individual patient, to implement organisational models and care strategies according to risk assessment, taking into account sustainability, equity, appropriateness and effectiveness of interventions (3).

PHM aims to improve the health outcomes of a well-defined population, simultaneously allocating resources and scheduling services to appropriately meet the needs of the population with cost benefits, creating a 'win-win' scenario. At the same time, the population must also play an active role in these strategies, as already codified by the Chronic Care Model (6). In accordance with this model, the patient - also with the support of the caregiver - is at the centre of the care processes, informed and motivated to achieve health objectives in a perspective of patient empowerment and self-management. Thus, the individual, with greater awareness, is determined to undertake and adhere to the proposed prevention and care pathways.

Population health management tools

For the development of PHM programs or models, it emerges that the local level information systems play a strategic role. They must be capable of collecting and integrating health and administrative data, also by means of record-linkage techniques. These data allow the stratification based on risk assessment and group the population into segments. The retrospective analysis of these sources - by means of computational systems - concretely makes it possible to switch to a prospective, predictive medicine approach, capable of assessing in advance the risk of unfavourable progression of individuals' health trajectories. The health system then activates the articulations of its services, inviting patients identified by its analysis to take preventive action, without passively waiting for patients to present themselves at a late stage of the disease.

Thus, proactive medicine is implemented. Subjects are grouped by homogeneous classes of needs and, consequently, resources are allocated in relation to the appropriateness of interventions. This approach brings considerable benefits to patients because it adopts a preventive method, aimed at delaying the evolution of chronic diseases and avoiding exacerbations and hospitalisations; these benefits bring advantages in terms of avoided costs, generating economic savings (3). Hence, the health system makes more extensive use of the cost-effectiveness of preventive interventions, aimed at keeping the patient healthy and avoiding the need for acute care. The benefits of PHM are clear and distinct, both in terms of health outcomes and economic sustainability.

Population health management activities and applications

The implementation of PHM can be broken down into a few main phases (4). The process begins with population identification, triple aim assessment and stratification. It continues with the mapping of the need for healthcare services and the activation of service providers and the implementation of care models. It ends with the evaluation of the impact of interventions and the continuous monitoring of the quality of services provided. The PHM approach proves to be a valuable - and already implemented - tool for ensuring the sustainability of healthcare systems (7). The first applications were implemented by the Kaiser Permanente, a non-profit organisation serving approximately 9.5 million members and their families in the United States, with the goal of protecting and maintaining their health. This organisation stratifies its patients based on health profiles and utilisation of health services, assigning the most appropriate care plan to each individual. Through individual and community-based interventions, Kaiser Permanente has positively influenced many of its members' health determinants, particularly by encouraging healthy lifestyles (8). Another US experience, based on data from the electronic primary care records of 100.000 patients, showed the effective relationship between early interventions - also aimed at self-management - on chronic patients

and the reduction of access to acute services and consequently of healthcare costs (9). In Italy, numerous experiences based on similar models have been introduced in various regions, such as Emilia-Romagna, Lombardy, Tuscany and Veneto (10). In Lombardy, for example, there have been applications with multiple models: first the CREG (*Chronic Related Group*), and later the PIC (*Preso In Carico*). The PIC adopted a stratification system on 10.000.000 citizens, borrowed from Kaiser Permanente, segmenting the population into 5 levels of increasing risk: from those who did not use services (level 5) to those who needed a case management approach due to high clinical and functional frailty (level 1). The system then planned interventions and allocated resources based on the collected data (11).

Perspectives on population health management

The success of these PHM programs depends on multiple variables and until today there are obstacles to overcome that have emerged during these applications. First of all, it is important to mention the ways in which PHM programs are financed, which vary between countries and may determine the interests of stakeholders in pursuing or collaborating in PHM policies (7). It is important to build a model that stimulates all the organisational articulations of the healthcare system to achieve the same goals, taking into account the economic sustainability of its funding mechanisms (12).

Another critical point to consider is patient adherence to these programs. Chronic patients usually live for years with one or more diseases and their therapeutic adherence in the primary care setting is low, thus requiring a personalised multidimensional approach (13). Costly investments in PHM policies, to which low percentages of the population adhere, lead to an increase in overall costs, without benefit to the system. Moreover, PHM policies must be guided by the epidemiological analysis of the geographical area of interest. The epidemiology should be based on advanced and integrated information systems, which allow the estimation of the health needs of a population and of the supply of services of the system. The equity dimension, which involves numerous aspects,

must be included in these evaluations. For example, it is necessary to collect inclusive data on nationality and ethnicity in public health monitoring and surveillance systems and in epidemiological reports in order to undertake interventions that guarantee equity of approach to health protection (14). At the same time, how to reach, to involve and to inform the population about their health status, may also vary, e.g. according to age groups (15).

Finally, with specific regard to Italy, the use of personal data, their storage, and the appropriate communication of data management to the persons involved are of great importance (16). The integration of health data must adhere to Italian and European privacy regulations. According to the Italian regulation, indeed, there are three fundamental principles to be taken into account (17): 1) the principle that the individual has the right to know about the existence of automated decision-making processes concerning him or her and to receive meaningful information about the logic used by these processes; 2) the principle that the person who is the recipient of the legal effects of an automated decision has the right that the decision is not based exclusively on an automated process; 3) the principle that the data controller must use mathematical or statistical procedures appropriate to profiling, implementing appropriate measures to ensure that the risk of errors is minimized, and guarantee the security of personal data, preventing discriminatory effects. These principles highlight a concrete privacy issue when personal data, without the consent of the individuals involved, are used to stratify populations and profile individuals by means of algorithms, with a view to proactively inserting them into care pathways.

In conclusion, the methodological and technological tools to improve population health and the sustainability of healthcare systems are already available to policymakers. However, the obstacles to be overcome between the methods already implemented (18) or implementable and the legislative context in which to introduce them (12), must be assessed in advance (17). The legislative context should evolve coherently with innovations in the health field, finding interest and priority on the political agenda. This approach would enhance technical efforts for the benefit of protecting the health of the population.

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