



Process engineering for primary care: Quality improvement and population health

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Abstract

A fundamental paradox of the health care delivery systems in many industrialized nations is that desired population health metrics are often not achieved despite large expenditures in the health care delivery system. For example, the United States commits nearly 18% of its GDP to the health care delivery system, the largest amount of any nation, yet is 37th in achieving health or health care delivery metrics. This article addresses how general practice can be an important driver of population health in the Chinese health care delivery system through the application of quality improvement methods. The article shows examples of how the cause-and-effect diagram, the process map, and the plan, do, study, act (PDSA) cycle are important techniques to assist primary care practitioners for improving population health.

Keywords: Population health; general practice; primary care; quality improvement techniques

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Overview

In traditional general practice, patients are treated individually by a provider, one at a time, on the basis of the presenting condition. However, to maximize population health metrics as well as reduce costs, primary care practitioners also need to be proficient in managing populations of persons within a system of care. The two most common methods to conduct this approach are known as population health management and disease management. The goal of population health management is to keep a patient population as healthy as possible, minimizing the need for expensive interventions such as emergency department visits, hospitalizations, imaging tests, and procedures [1]. While population health management focuses on the high-risk patients who generate most of health costs, it also systematically

addresses the preventive and long-term care needs of every patient [2]. Similarly, disease management programs are designed to improve the health of persons with specific chronic conditions and to reduce health care service use and costs associated with avoidable complications, such as emergency department visits and hospitalizations [3].

The disease management model

A disease management program involves six steps – identification of the population, implementation of evidence-based guidelines, use of collaborative care models, measurement of process and outcome metrics, provision of self-management education, and reporting of metrics to patients, providers, and the community [4]:



1. *Patient identification.* The first step of population health management is to categorize patients according to health risk, health care use, and expenditures to identify individuals who will benefit from a disease management program. A disease management program then targets individuals with a specific disease, usually costly chronic conditions such as: asthma, diabetes, congestive heart failure, coronary heart disease, and end-stage renal disease.
2. *Evidence-based practice guidelines.* Disease management programs use evidence-based care guidelines to standardize care processes, reduce variation in care, and provide the best available care to ensure consistency in treatment across the targeted population.
3. *Collaborative practice models.* Disease management generally uses a multidisciplinary team of providers, including physicians, nurses, pharmacists, dietitians, respiratory therapists, and psychologists, to educate and help individuals manage their conditions.
4. *Patient self-management education.* Disease management programs are based on the concept that individuals who are better educated about how to manage and control their condition receive better care.
5. *Process and outcomes measurement.* Program impact is determined by measurement of both the process of care and the outcomes of care. These metrics are determined before the start of the program.
6. *Routine reporting and feedback between patients, providers, and health plans.* Providers, care teams, and patients need routine feedback to ensure that patients are effectively managing their conditions and receiving the care they need.

There are substantial gaps and wide variation in the management of patient populations. Closing these gaps requires systematic efforts to manage the performance of health departments in order to achieve healthy populations and healthy communities. Table 1 shows an example of quality gaps in the United States indicated by the low rates of preventive practices. While some improvements have been made over a ten-year timeframe, many of the preventive health changes have been modest.

Table 1. Ten-year trends for preventive practices, selected measures [5]

Effectiveness of care measure: percentages of patients receiving recommended intervention		
	1999	2009
Breast cancer screening	73.4%	71.3%
Cervical cancer screening	71.8%	77.3%
Childhood immunizations – MMR	87.0%	90.6%
Controlling of high blood pressure	39.0%	64.1%
Cholesterol screening	69.0%	85.70%
Comprehensive diabetes care – eye examinations	45.3%	56.5%
Comprehensive diabetes care – monitoring of nephropathy	36.0%	82.9%
Antidepressant management – continuation phase	42.1%	46.2%

The current metrics on preventive measures indicate that there are large gaps between the levels of desired performance and actual practice. Similar gaps between desired performance and actual practice are found in China. For example, although the recommended level of cesarean delivery is 15% [6], it is estimated that approximately 50% of deliveries in China are done by cesarean section [7]. Likewise, tobacco use among the male population older than 15 years is 47%, and cardiovascular diseases, diabetes, and cancer have replaced infectious diseases as the leading burden among diseases [8].

Quality improvement methods and techniques have been used extensively in the acute care setting in the United States for more than 20 years [9] and have been shown to be exceptionally effective for improving health metrics. For example, use of quality improvement techniques in 103 intensive care units in Michigan resulted in the near elimination of catheter-associated bloodstream infections [10].

Quality improvement

Quality improvement techniques are specifically developed to help close gaps between current and desired performances for care populations. The application of quality improvement methods in general practice is resulting in measurable improvement in population health services, which translates to enhanced health status of populations. Quality improvement in population health is defined as the application of quality improvement methods and techniques to improve a specific process with a



defined beginning and end, using an identified quality improvement model [11]. Quality improvement involves deployment of process engineering techniques for the analysis, design, and ongoing implementation of health care processes to achieve measurable increases in population health outcomes.

Process design

All health care services are the result of a process. A process is a series of steps to produce an outcome. The delivery of a newborn, a flu vaccination program, and conducting tests to diagnose and treat illness are all examples work processes. Process design refers to the deliberate and intentional development of processes so that they result in the desired outcome. Quality improvement is based on process engineering, and all quality improvement initiatives analyze a process in order to improve performance. Three common tools used to analyze and improve processes are: (1) process maps, (2) cause-and-effect diagrams, and (3) plan, do, study, act (PDSA) cycles. As mentioned previously, a work process is defined as a series of steps designed to produce an outcome and has three components:

1. It has a beginning point and an end point.
2. It uses inputs (people, equipment, supplies, and facilities) to perform the process.
3. It produces an output created by the process, which is usually a service.

One example of a multiple-step process is a patient visit to a maternity clinic. The beginning point is when the woman calls for an appointment and the end point is when she leaves the clinic once the visit is completed. The inputs are dieticians, counselors, receptionists, rooms, equipment, and supplies, whereas the output is the patient who has been served. The series of steps in a work process are combined to add value to the inputs by changing them or using them to produce a service. In other words, a work process is a series of steps done in sequence to produce an outcome.

A typical hospital has hundreds, even thousands, of work processes to serve patients. A process improvement team may find it difficult to decide which process to study and how to draw the boundaries for the process. Creating a process map (also known as a flowchart) is a disciplined method to overcome these difficulties as well as to understand and analyze a process. Figure 1 illustrates an example of a process map.

Table 2 explains the function of each component of a process map. A process map can be created with three different

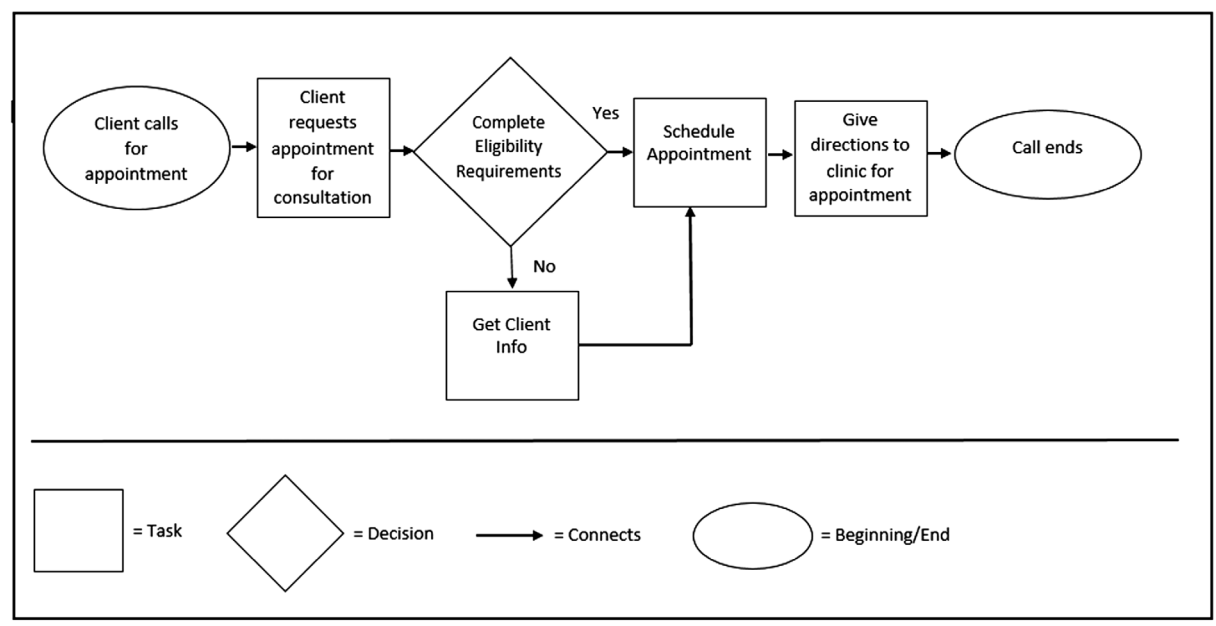


Fig. 1. Basic process map for making an appointment for a maternity visit.



Table 2. Components of a process map

Component	Function
Oval	Designates the start and finish of the process
Rectangle/box	Represents a task or activity. It has one arrow pointing away
Arrow	Connects various process steps
Diamond	Designates a decision. It has two arrows pointing away. Decisions must have a closed loop. No arrow can end with an activity that does not connect again to the process

levels of detail: (1) the macro level, which shows key action steps but no decision points; (2) the intermediate level, which shows both action and decision points; and (3) the micro level, which shows extensive detail.

Uncovering problem areas with a process map

After a process map has been constructed, it can be analyzed for specific problem areas. Often a process map will uncover a problem in the process that cuts across departments. The process map can also identify where a breakdown may occur or where steps can be eliminated. Table 3 lists and defines five types of problems that one can identify by studying a process map.

Cause-and-effect diagram

A second important quality improvement technique for process analysis is a cause-and-effect diagram. A cause-and-effect diagram is a tool used to identify the possible causes

of a problem in a process. For example, the cause-and-effect diagram in Fig. 2 was created because the infectious disease officer was concerned by the low rates of HIV testing at the public health department. A quality improvement team developed a cause-and-effect diagram to study why clients do not receive HIV testing. The team identified four main causes and organized them as headers in the diagram: clients, staff, the test location, and client counseling. There were also subcauses associated with each main cause.

A cause-and-effect diagram organizes group knowledge about causes of a problem and displays the information graphically. In a cause-and-effect diagram, the problem is written on the far right, while the causes of the problem are represented by diagonal lines which are connected to a horizontal line leading to the problem. This diagram is also known as the fishbone diagram due to its resemblance of a fish (the problem is the “head” of the fish and the causes represent the “bones”).

Table 3. Five problem areas identified by process maps

Problem area	Definition
Disconnect	A disconnect occurs when a handover from one group to another is poorly managed. For example, the appointment scheduler makes a client appointment on a day the WIC specialist is not in the clinic
Bottleneck	A bottleneck is a point in a process where volume overwhelms capacity. For example, the same appointment time is scheduled for two clients
Redundancy	A redundancy is an activity repeated at two points in a process. For example, a client is asked for demographic information at several different times (when the appointment is scheduled, when the client arrives for the visit, and so forth)
Rework	Rework is when work is fixed or corrected. For example, if the client demographic information is entered incorrectly or incompletely, extra work is required to retrieve the information at a later time
Inspection	Inspection is a point in the process where appraisal occurs. This is usually an extra step that can be costly, and also creates potential delay. For example, a cleaned hospital room cannot be occupied until it has been inspected by a supervisor

WIC, Women, infants, and children.

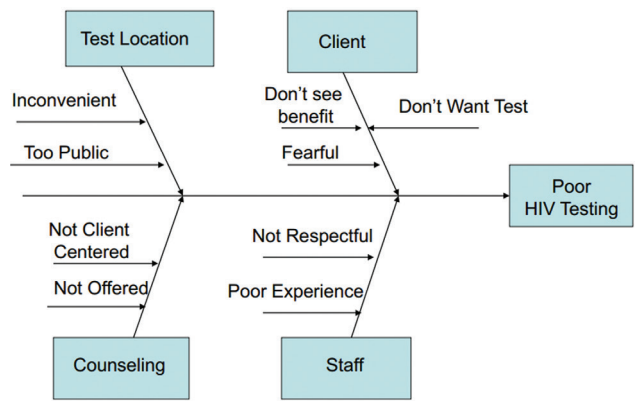


Fig. 2. Cause-and-effect diagram, an analysis of the low rate of HIV testing at the public health department [12].

PDSA cycle

The PDSA cycle describes how to test a change – by trying it, observing the consequences, and then learning from those consequences. Once a team has set an aim, established measures to indicate whether a change leads to an improvement, and found a promising idea for change, the next step is to test that change in the work setting by conducting a PDSA cycle [13].

Conduct PDSA cycle

A PDSA cycle describes how to test a change in a process to improve its performance. It has four separate components:

1. Plan: plan the change
2. Do: try the change
3. Study: observe the consequences
4. Act: learn from those consequences

These four components of the PDSA cycle are shown in Fig. 3. Each of the four components of the PDSA cycle has specific questions that need to be addressed during that phase.

Ideally, health quality results from comprehensive process design and continuous quality improvement. In reality this is far from the case. Serious quality and efficiency problems in the health system persist despite the best efforts of health professionals. While health personnel are individually committed to quality excellence, organizational processes are often not adequate to ensure efficiency and effectiveness in a complex system. Quality must be recognized as a system

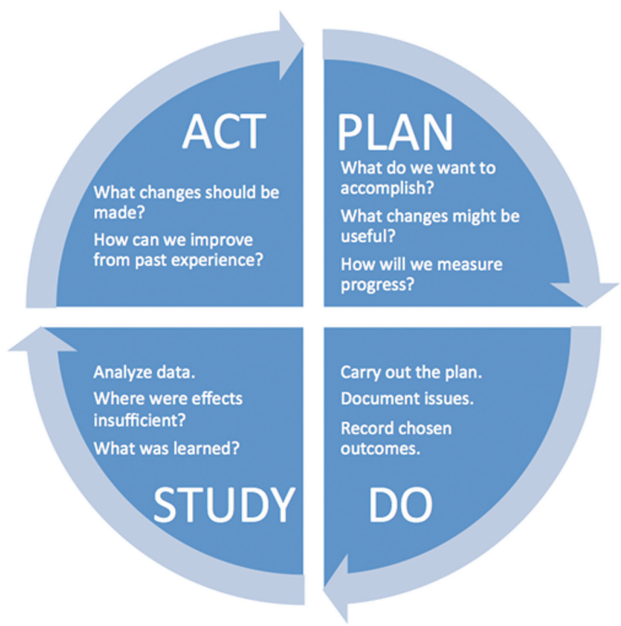


Fig. 3. Components of the PDSA cycle [14].

property, which means that health care processes are deliberately designed to achieve desired outcomes, and process control is in place to detect when system outcomes do not meet expectations. The concept of making quality a system property means ensuring that the system itself is sound, rather than relying solely on individuals to achieve quality. Better quality and population health management will not be achieved by imploring health care providers to work harder or better. To improve quality, population health management systems need to be designed to achieve the desired outcomes.

In summary, quality improvement in health care involves the analysis of a specific process with an identified beginning and end, using a defined quality improvement model with the intent to achieve measureable improvement and efficient outputs and outcomes. Quality improvement methods and techniques are essential to design processes for primary care practitioners to successfully engage in population health management. Undertaking a quality improvement project is not difficult. Completing a successful project requires a clinical content expert and a quality improvement consultant to work with a team of providers to identify a process to improve, study the process, and implement interventions. This article



has illustrated some of the techniques that can be used in a quality improvement project, and these can be implemented with a knowledgeable consultant, or person trained in quality improvement methods and techniques.

It is unknown whether these methods and techniques can be successfully applied to the Chinese health care delivery system. However, a recent study which compared differences in management practices across hospitals within China and in countries around the world reported that the quality of management practices in Chinese public hospitals is slightly below average, caused in part by an absence of formal processes for continuous improvement [15]. This suggests that quality improvement methods and techniques may be helpful in bolstering hospital outcomes and health metrics in China.

Summary Learning Points

General practice has an essential role to improve population health metrics as well as reduce the overall cost of care. In order to perform these important functions, primary care practitioners not only need proficiency in treating individual patients, but also to manage populations of persons within a system of care. The goal of population health management is to keep a patient population as healthy as possible, which reduces the need for expensive interventions. Quality improvement techniques are specifically developed to help develop processes to care for populations. Among the more important techniques to improve population health are: process maps, cause and effect diagrams, and the PDCA Cycle.

The application of quality improvement methods in general practice can result in measurable improvement in population health services, which translates to enhanced health status of populations.

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Conflict of interest

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