Health of a
Population

Experience
of Care

Per Capita
Cost

IHI *Triple*Aim

# A Guide to Measuring the Triple Aim:

Population Health, Experience of Care,
and Per Capita Cost

**27**

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Institute for Healthcare Improvement, 20 University Road, 7th Floor, Cambridge, MA 02138
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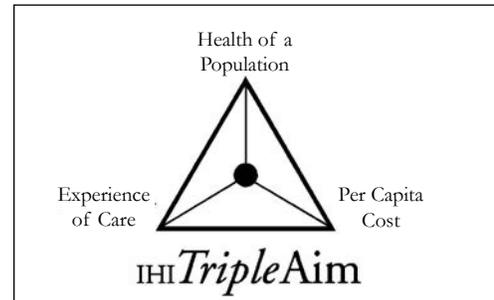
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Authors:

**Matthew Stiefel, MPH:** *Senior Director, Center for Population Health,*
*Kaiser Permanente Care Management Institute; Fellow, IHI*
**Kevin Nolan, MA:** *Senior Fellow, IHI*

## Executive Summary

In 2008 Don Berwick, Tom Nolan, and John Whittington first described the Triple Aim of simultaneously improving population health, improving the patient experience of care, and reducing per capita cost. The Institute for Healthcare Improvement (IHI) developed the Triple Aim as a statement of purpose for fundamentally new health systems that contribute to the overall health of populations while reducing costs. The idea struck a nerve. It has since become the organizing framework for the US National Quality Strategy, for strategies of public and private health organizations around the world, and for many of the over 100 sites from around the world that have been involved in IHI's Triple Aim prototyping initiative.

A useful system of measurement for the Triple Aim is essential to this work. Although no single organization or region has yet achieved an ideal, comprehensive measurement system for the Triple Aim, good examples and data sources are now available to illustrate how measurement can fuel a learning system to enable simultaneous improvement of population health, experience of care, and per capita cost of health care.

This white paper provides a menu of suggested measures for the three dimensions of the Triple Aim. The menu is based on a combination of the analytic frameworks presented in the paper and the practical experience of the organizations participating in the IHI Triple Aim prototyping initiative. The suggested measures are accompanied by data sources and examples. The paper also describes how the measures might be used along with increasingly specific, cascading process and outcome measures for particular projects to create a learning system to achieve the Triple Aim.

## Introduction

In 2008 Don Berwick, Tom Nolan, and John Whittington first described the Triple Aim of simultaneously improving population health, improving the patient experience of care, and reducing per capita cost.[1] The Institute for Healthcare Improvement (IHI) developed the Triple Aim as a statement of purpose for fundamentally new health systems that contribute to the overall health of populations while reducing costs. It has since become the organizing framework for the National Quality Strategy of the US Department of Health and Human Services (HHS) and for strategies of other public and private health organizations such as the Centers for Medicare & Medicaid Services (CMS), Premier, and The Commonwealth Fund.

Because no single sector alone has the capability to successfully pursue improving the health of a population, the Triple Aim explicitly requires health care organizations, public health departments, social service entities, schools systems, and employers to cooperate. Fostering this cooperation requires an integrator that accepts responsibility for achieving the Triple Aim for the population. Whether the integrator is a new or existing structure or organization, some entity is needed to pull together the resources to support the pursuit of the Triple Aim. Once the integrator creates an appropriate governance structure, the integrator then needs to lead the establishment of a clear purpose for the pursuit of the Triple Aim, identification of a portfolio of projects and investments to support that pursuit, and creation of a cogent set of high-level measures to monitor progress. The set of measures should operationally define each dimension of the Triple Aim. A good set of population outcome measures can fuel a learning system to enable simultaneous improvement of population health, experience of care, and per capita cost of health care.

Many organizations, including those in IHI's Triple Aim prototyping initiative, struggle with what to measure related to the execution of the Triple Aim and with accessing the needed data. Over the past five years, this initiative has included more than 100 sites from around the world, spanning a wide range of entities, from health plans to integrated health systems, social service entities, and regional coalitions. IHI has encouraged them to initiate the development of their measures by exploring the data to which they have access in their organizations or communities, how it can be obtained, and how often new data are available. Learning within the initiative contributed to the menu of measures recommended in this paper for each of the three dimensions of the Triple Aim, accompanied by data sources and examples.

## Measurement Principles

The principles that apply to good measurement, in general, apply to measurement of the Triple Aim. While a discussion of general measurement principles is beyond the scope of this paper, the principles used by the National Quality Forum for evaluation of quality measures are worth noting and apply equally well to Triple Aim measurement: importance, scientific acceptability, usability, and feasibility.[2] In addition, Billheimer[3] and Pestronk[4] provide other useful considerations for development of measures applicable to the Triple Aim (see Appendix A).

Key measurement principles that apply to the Triple Aim are described below.

- **The need for a defined population**
  The frame for the Triple Aim is a population, and the measures, especially for population health and per capita cost, require a population denominator. In a paper commissioned by the National Quality Forum Population Health Steering Committee, Jacobson and Teutsch make a useful distinction between *total population* and *sub-populations*.[5] The total population refers to all the residents of a geopolitical area, within which a variety of sub-populations can be defined. Sub-populations can be defined in a variety of ways, including by income, race/ethnicity, disease burden, or those served by a particular health system or in a particular workforce. By definition, the total population of a geopolitical area is the union of sub-populations within it. Populations served by a Triple Aim initiative might be either a total population or a sub-population defined in this way; in either case, it is essential to specify the population.

- **The need for data over time**
  In improvement science, tracking data over time helps to distinguish between common cause and special cause variation, to gain insight into the relationship between interventions and effects, and to better understand time lags between cause and effect.[6]

- **The need to distinguish between outcome and process measures, and between population and project measures**
  Measurement for the Triple Aim can be constructed hierarchically, with top-level population outcome measures for each dimension of the Triple Aim, and with related outcome and process measures for projects that support each dimension.

- **The value of benchmark or comparison data**
  While data tracked and plotted over time help to measure improvement, benchmark or comparison data enable comparisons with other systems. Benchmarking is easier if the measures selected are standardized and in the public domain.

Based on these measurement principles, the following menu of Triple Aim outcome measures evolved within the IHI Triple Aim prototyping initiative (see Table 1).

Table 1. Menu of Triple Aim Outcome Measures

| Dimension of the IHI Triple Aim | Outcome Measures |
|---|---|
| **Population Health** | **Health Outcomes:**<br>• Mortality: Years of potential life lost; life expectancy; standardized mortality ratio<br>• Health and Functional Status: Single-question assessment (e.g., from CDC HRQOL-4) or multi-domain assessment (e.g., VR-12, PROMIS Global-10)<br>• Healthy Life Expectancy (HLE): Combines life expectancy and health status into a single measure, reflecting remaining years of life in good health |
| | **Disease Burden:**<br>Incidence (yearly rate of onset, average age of onset) and/or prevalence of major chronic conditions |
| | **Behavioral and Physiological Factors**:<br>• Behavioral factors include smoking, alcohol consumption, physical activity, and diet<br>• Physiological factors include blood pressure, body mass index (BMI), cholesterol, and blood glucose<br>(Possible measure: A composite health risk assessment [HRA] score) |
| **Experience of Care** | Standard questions from patient **surveys**, for example:<br>• Global questions from Consumer Assessment of Healthcare Providers and Systems (CAHPS) or How's Your Health surveys<br>• Likelihood to recommend |
| | Set of measures based on **key dimensions** (e.g., Institute of Medicine's six aims for improvement: safe, effective, timely, efficient, equitable, and patient-centered) |
| **Per Capita Cost** | **Total cost** per member of the population per month |
| | **Hospital and emergency department (ED)** utilization rate and/or cost |

This menu of measures is based on a combination of the analytic frameworks presented in the next section and the practical experiences of organizations participating in the IHI Triple Aim prototyping initiative. The menu is intended to provide guidance to organizations seeking to measure the Triple Aim. Selection of measures will depend in part on data availability, resource constraints, and overall objectives.

- The health outcomes of mortality, health and functional status, and their combination — healthy life expectancy — are ultimate outcome measures for **population health**. Measures of disease burden and behavioral and physiological factors are included, as they are contributors to health outcomes. Sites might use these measures initially if data are more readily available.

- For measuring the **experience of care**, two perspectives are considered: first, the perspective of the individual as he or she interacts with the health care system (i.e., patient experience surveys) and second, the perspective of the health care system focused on designing a high-quality experience for patients as defined by the Institute of Medicine's (IOM) six aims for improvement.[7]

- Total cost per member of the population per month is the desirable measure for **per capita cost**; sites can also use high-cost services (e.g., inpatient utilization/costs) that account for a substantial share of health care expenditures.

A more detailed description of the Triple Aim outcome measures in the menu, including data sources and examples, is included in Appendix B.

## Analytic Frameworks for Measuring the Triple Aim

In this section of the paper, we present the analytic frameworks underlying the specific measure recommendations for each dimension of the Triple Aim: population health, experience of care, and per capita cost of health care.

### A Framework for Measuring Population Health

Many frameworks and models have been developed to illustrate the relationships among the determinants and outcomes of population health. The model shown in Figure 1 is based on the model originally published by Evans and Stoddart.[8]

Figure 1. A Model of Population Health
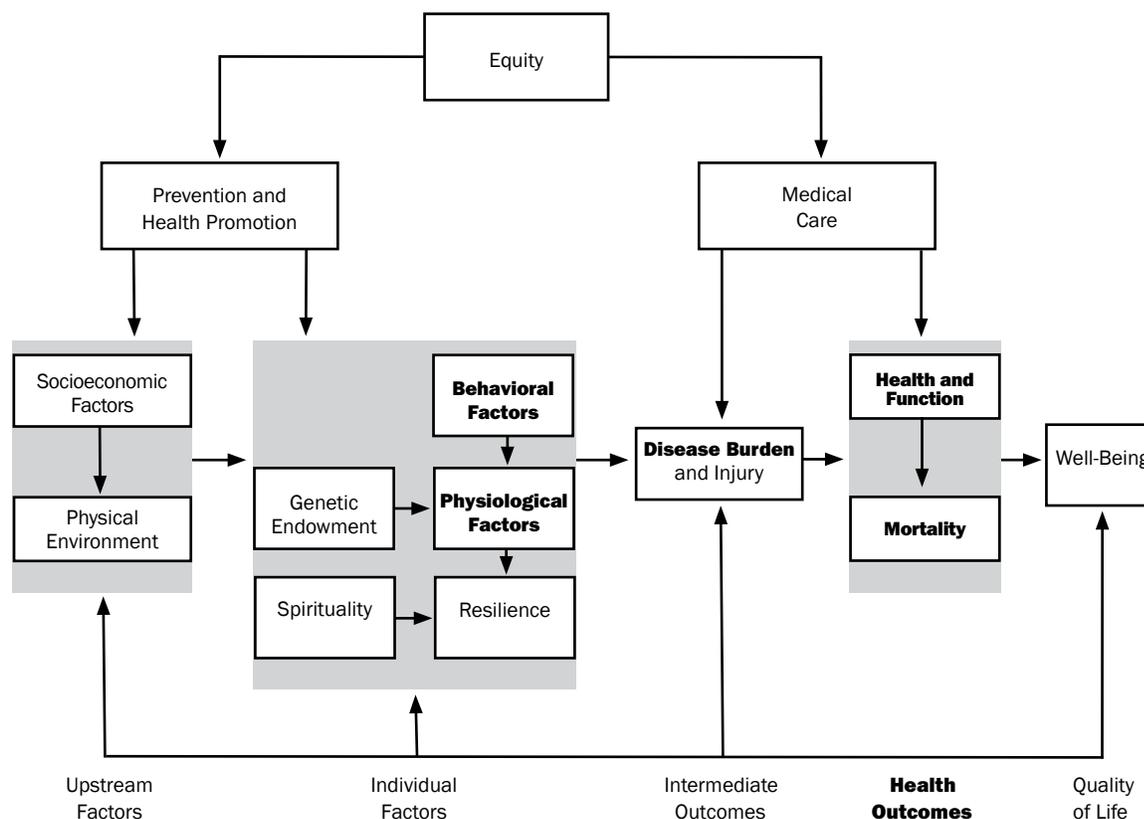


Note: Measures of population health in the Triple Aim measurement menu in Table 1 appear in **bold** text in Figure 1.

The model elaborates on the causal pathways and relationships described by Evans and Stoddart, and provides a framework for measurement by distinguishing between determinants (*upstream factors* and *individual factors*) and outcomes (both *intermediate outcomes* and *health outcomes*). The Triple Aim measurement menu (see Table 1) includes a pragmatic subset of population health measures based on this model; those measures are highlighted in bold in Figure 1. The full model provides context for this pragmatic subset, indicating where selected measures are located in the causal pathway from upstream determinants to downstream outcomes. A more complete description of the model components and relationships is provided in Appendix C.

Selection of measures will depend on the measurement capabilities of a particular Triple Aim site, although moving rightward in the model is the direction toward health outcomes that are more meaningful to people. The measures of **health outcomes** in the menu include mortality measures; health and functional status; and a combination of the two, healthy life expectancy (HLE). **Mortality** measures include years of potential life lost (YPLL), life expectancy, and standardized mortality ratio. There are many measures of **health and functional status** from which to choose; the menu lists three of the most common.

If Triple Aim sites don't yet have the ability to measure mortality or health and functional status, the second type of health measurement in the menu is the intermediate outcome of **disease burden** for major chronic conditions, expressed as incidence and/or prevalence rates. Some Triple Aim sites may choose to start further upstream with individual **behavioral and physiological factors** rather than health outcomes. Physiological markers, such as blood pressure, body mass index, blood glucose, and cholesterol, are the most common indicators of health risk measured in the health care system, in part because they are objective and there is strong evidence of their relationship with downstream health outcomes. Health-related behaviors, such as smoking, alcohol consumption, diet, and exercise, are increasingly measured in health systems because of their powerful impact on downstream outcomes. However, it is important to keep in mind that these measures are only surrogate measures for downstream health outcomes.

The County Health Rankings, part of the Mobilizing Action Toward Community Health collaboration between the Robert Wood Johnson Foundation and the University of Wisconsin Population Health Institute, provide a set of population health measures at the county level for all counties in the US.[9] The rankings include measures in most of the broad categories shown in Figure 1. However, since many of the sources are county-wide or based on relatively small random samples, it is difficult to apply the measures to sub-populations that are not at the county level.

The contributions of the health care delivery system shown in Figure 1 — prevention and health promotion, and medical care — while important determinants of health, are discussed further below as part of the frameworks for the experience of care and per capita cost dimensions of the Triple Aim, and illustrate the interrelationships among the three dimensions of the Triple Aim.

### A Framework for Measuring Experience of Care

The overall experience of care is best assessed by the patients who receive the care. The measurement menu in Table 1 includes some examples from patient surveys. The Consumer Assessment of Healthcare Providers and Systems (CAHPS) family of surveys, sponsored by the US Agency for Healthcare Research and Quality (AHRQ), includes a global question on the overall experience of health care: "Using any number from 0 to 10, where 0 is the worst health care possible and 10 is the best health care possible, what number would you use to rate all your health care in the last 12 months?"[10] How's Your Health, another widely utilized tool for consumers to assess their overall experience of care, asks consumers to answer the following question on a five-point Likert scale: "When you think about your health care, how much do you agree or disagree with this statement: 'I receive exactly what I want and need exactly when and how I want and need it'?"[11] Some health systems utilize an overall measure of "likelihood to recommend" as an indirect measure of quality of care.

The six aims for improvement articulated by the Institute of Medicine in *Crossing the Quality Chasm*[12] — safe, effective, timely, patient-centered, equitable, and efficient — provide a useful framework for measurement of the determinants of the care experience from the perspective of those delivering the care (see Figure 2). We recommend that organizations using the IOM aims as a population health outcome measure include most, if not all, of the six aims as the measure of care experience, as opposed to just one or two. Organizations can use these aims, together with an overall measure of patient experience, to construct a driver diagram for the experience of care, as shown in Figure 2. A thorough discussion of specific measures for each of these drivers is beyond the scope of this paper.

Figure 2. Drivers of Excellent Experience of Care Based on IOM Six Aims for Improvement
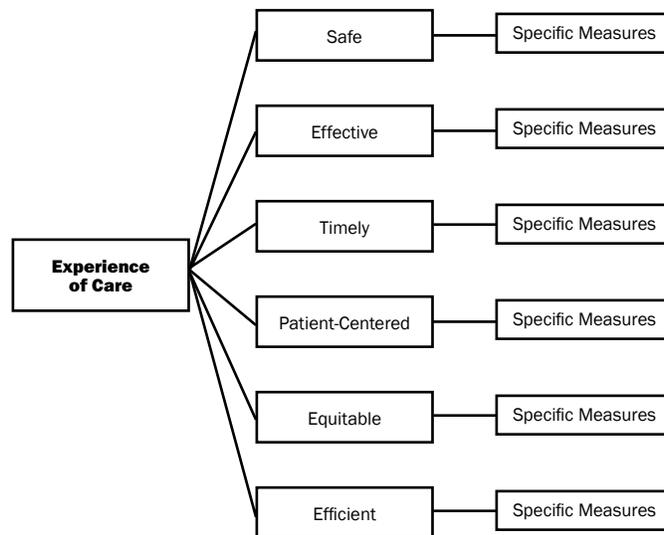


### A Framework for Measuring Per Capita Cost of Health Care

Conceptually, per capita cost measurement is more straightforward than measurement of population health and experience of care because cost measurement involves common monetary units that can be easily aggregated or disaggregated. In practice, however, cost measurement is complicated by a number of factors. Per capita cost, like population health, requires a population denominator for measurement, but separation of health care delivery and financing in most of the US often makes it difficult to identify the population served by the delivery system. In addition, it is not clear which costs to include, and from whose perspective.

Figure 3 provides a framework for measuring per capita cost. The framework includes three lenses on cost: the **supply** lens of providers (Figure 3, right); the **demand** lens of consumers, purchasers, and the general public (Figure 3, left); and the **intermediary** lens of health plans and insurers, which provides an opportunity for them to act as an integrator of information about costs (Figure 3, center). The different lenses assist in understanding the costs being measured.

Figure 3. A Framework for Measuring Per Capita Cost
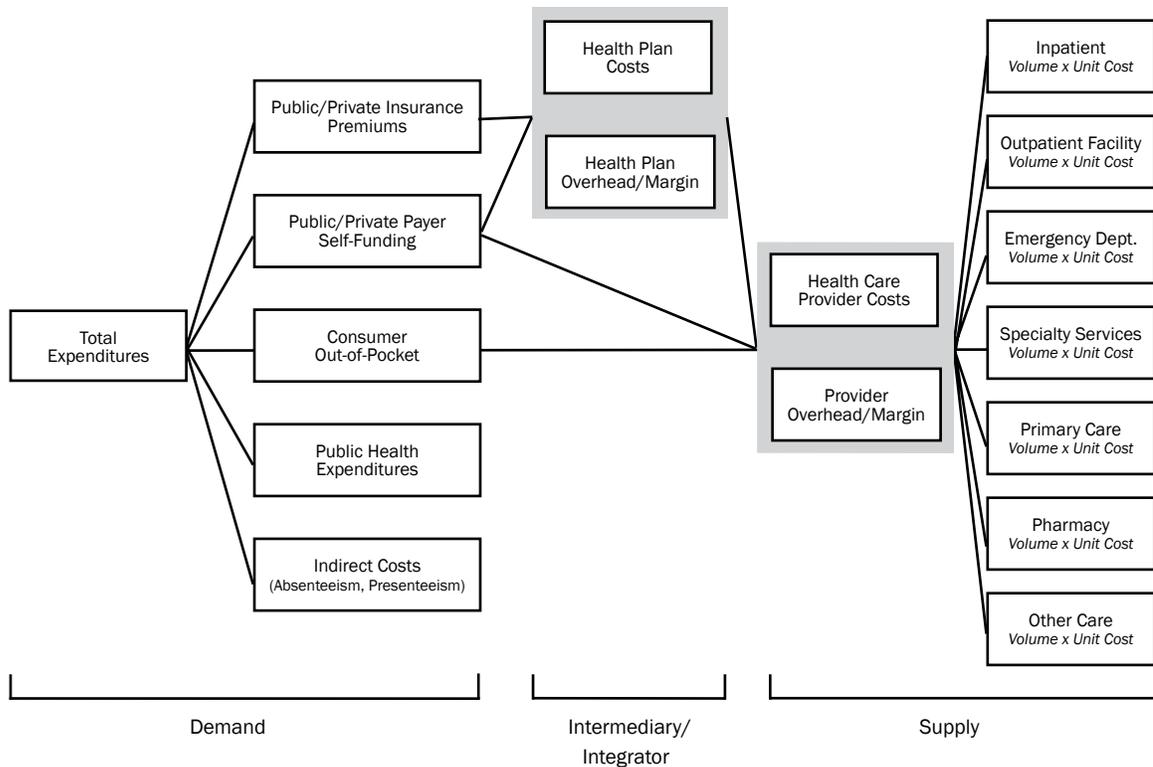


For providers, costs can be disaggregated into various types of health care, as shown in Figure 3. It is also useful to further disaggregate provider costs into volume and unit cost (e.g., hospital days and cost per day), to better understand sources of variation and change. As shown in the measurement menu in Table 1, Triple Aim sites that do not have access to the full range of cost data (i.e., total cost per member of the population per month) may choose to start with hospital and emergency department (ED) costs, which account for a substantial percentage of costs in most health systems. Data for hospital and ED costs, though, as well as other provider costs, are often obtained from claims data plus consumer out-of-pocket payments; they are not the actual cost of "production" of care.

The sum of these provider costs, plus their overhead and margin, are the total costs of care. These costs are paid by a combination of payments from health plans and insurers, public and private payer self-funding, and consumer out-of-pocket payments. In turn, the payments from health plans and insurers, plus their overhead and margin, are the premium costs paid by public and private payers, including government programs such as Medicare and Medicaid, employers and union trusts, and individual consumers. For example, Medicare Advantage payments to health plans flow through this pathway. These public and private payers also purchase care directly from providers through self-funding (although in practice these payments are often administered by insurers through "third-party administrator" services).

From the broader public perspective, total costs also include public health expenditures in addition to direct health care costs. This is especially important for regional Triple Aim collaborations looking at the appropriate allocation of broad, health-related expenditures in a community. Finally, employers are increasingly recognizing that the indirect costs of poor health, including absenteeism and productivity, may exceed direct health care expenditures and need to be taken into account when assessing the value of their health promotion and health care programs. Since Triple Aim sites typically focus on costs realized when individuals interact with the health care system, data for the measure "total cost per member of the population per month" in the menu in Table 1 are often obtained from claims data plus consumer out-of-pocket payments. Regional Triple Aim collaborations are beginning to use the broader frameworks for cost that include public health and indirect costs as well.

**The Three Dimensions of the Triple Aim Together: A Framework for Measuring Value**

The three dimensions of the Triple Aim, taken together, provide a useful framework for measuring *value* in health care. Value can be conceptualized as the optimization of the Triple Aim, recognizing that different stakeholders may give different weights to the three dimensions. Cost measurement in isolation doesn't have much utility; it needs to be combined with measures of the other two dimensions of the Triple Aim. The combination of per capita cost and experience of care enables measurement of *efficiency*. According to the AQA Alliance, "Efficiency of care is a measure of the relationship of the cost of care associated with a specific level of performance measured with respect to the other five IOM aims of quality."[13] Similarly, the combination of population health with the experience of care enables measurement of *effectiveness* of care, or *comparative effectiveness* when comparing alternative treatments. Combining all three dimensions of the Triple Aim — population health, experience of care, and per capita cost — enables measurement of *cost effectiveness*, or overall value.

## Examples, Data Sources, and Methods for Measuring the Triple Aim

Although no single organization or region has yet achieved an ideal, comprehensive measurement system for the Triple Aim, good examples and data sources are now available. In the tables that follow, we include examples of measures for population health, experience of care, and per capita cost used by sites in IHI's Triple Aim prototyping initiative — keyed to the menu of Triple Aim outcome measures presented in Table 1. The examples focus on population-level measures, although some (for example, population health measures of risk status) could also serve as measures for a specific project. For each measure, the tables list the Triple Aim prototyping initiative site using the measure, their population of focus, and the data source. Each set of measures — for population health, care experience, and per capita cost — is followed by tips about data sources and methods. Appendix B contains more detail on the specifications and sources of the measures in the tables, and a general glossary and website links for some of the more commonly used measures.

**Measuring Population Health**

Table 2. Examples of Measures of Population Health

| Measure | Site | Population | Data Source |
|---|---|---|---|
| **Health Outcomes:** Infant mortality rate | Cincinnati Children's Hospital Medical Center and the Office of Maternal Infant Health & Infant Mortality Reduction and its community affiliates (Ohio) | Hamilton County, Ohio | Ohio Department of Health Vital Statistics |
| **Health Outcomes:** Single-question self-reported health status | Partnership with Genesee Health Plan (GHP) (Michigan) | Low-income, uninsured members of GHP | Member enrollment and annual re-enrollment survey |
| **Health Outcomes:** Health/functional status, and risk status | Kaiser Permanente (California) | Kaiser Permanente members | "Total Health Assessments": Self-assessments completed by members |
| **Disease Burden:** Percent with diabetes (prevalence) | CareOregon (Oregon) | Health plan members | Electronic health record (EHR) |
| **Disease Burden:** Percent of new cases of diabetes (incidence) | Chinle Service Unit, Indian Health Service (Arizona) | Beneficiaries of the Indian Health Service | Data automatically input into health information system from the EHR |
| **Physiological Factor:** Percent elevated blood pressure (BP) | Martin's Point Health Care (Maine) | Active paneled patients at Martin's Point Health Care centers | EHR data collected during a patient's last office visit BP or last validated home BP, average reported through Martin's Point data warehouse |
| **Behavioral and Physiological Factors:** Average heath risk assessment (HRA) score | Bellin Health (Wisconsin) | Employees of Bellin Health | Annual HRA for employees administered by health system staff at multiple locations over a defined period of time |
| **Behavioral Factors:** Optimal Lifestyle Measure (OLM) (includes activity, diet, smoking, alcohol consumption) | HealthPartners (Minnesota) | Health plan members | Annual health assessment and annual health plan satisfaction survey includes questions to ascertain compliance with all components of optimal lifestyle |

**Tips for Measuring Population Health**

*Data Sources*

- Sources of data on deaths used by sites in the IHI Triple Aim prototyping initiative include hospitals within an integrated system, affiliated health plans, Social Security Administration,[14] state-specific vital statistics, and local health departments.
- To measure self-reported health status, some sites in the Triple Aim prototyping initiative included the single question (or short set of questions) in a health risk assessment, existing care experience survey, or after-visit survey; some used the single question as a vital sign at the point of care, at enrollment and at annual re-enrollment, or in a birthday greeting (phone call, mailed card, or email).
- Sources of data on the incidence and prevalence of chronic illness used by sites in the Triple Aim prototyping initiative include disease management registries, claims data, data from an electronic health record, health records, and population surveys.

*Methods of Measurement*

**Health Outcomes Measurement**

1. Mortality
   - **Years of potential life lost** (YPLL) is a population mortality measure that expresses the sum of life-years lost in a population due to premature mortality.[15] (For example, if the life expectancy target for a population is 75 years and someone lives to age 65, there are ten years of potential life lost. YPLL is the sum of these measures for individuals for a population during a specified time period.)
   - **Standardized mortality ratios** are raw mortality rates adjusted by the particular age composition of a population. The calculation multiplies the actual age-specific rates of the population by the age distribution of a standard population to enable comparisons.[16]
   - **Mortality amenable to health care** measures deaths from certain causes before age 75 that are potentially preventable with timely and effective health care.[17]
   - **Life expectancy** measurement uses the same underlying age-specific mortality rates in the population, but uses a life table to calculate expected years of remaining life at any age, using the current age-specific mortality rates applied to a hypothetical prospective cohort.[18] Life expectancy is typically reported by gender, at birth and at age 65; it is considered a more intuitive and meaningful measure of mortality compared to the other measures.
   - Consideration should be given to the size of the population to calculate useful mortality statistics. Multiple years and/or ages can be aggregated. Ezzati and colleagues calculated life expectancy for US counties with populations of at least 10,000 men and 10,000 women, pooled over five years, to create stable life expectancy estimates.[19]

2. Health and Functional Status
   - **Single-question assessment** of self-perceived health status: "In general, would you say your health is [excellent, very good, good, fair, poor]?" This is the most commonly used health status question in surveys throughout the world, and its reliability and validity, including predictive validity for mortality and utilization, have been extensively documented.[20,21]
   - **Multi-domain assessment:** One of the most frequently used multi-domain assessments is the VR-12, a 12-item assessment adapted by the US Veterans Administration from the original SF-family of health assessments.[22] It covers eight domains of health (general health perceptions; physical functioning; role limitations due to physical and emotional problems; bodily pain; energy/fatigue; social functioning; and mental health) and is summarized into a physical component score and mental component score. The VR-12 is included in the Medicare Health Outcomes Survey and the Medicare "Stars" quality bonus framework.[23] Another example is the PROMIS Global-10, a 10-item assessment instrument that is part of the NIH-funded PROMIS item bank of patient-reported measures.[24]

3. Healthy Life Expectancy
   A broader health measure in the Triple Aim measurement menu is healthy life expectancy (HLE), a combined single measure that adjusts life expectancy by the expected level of health or function during the remaining years of life. Many nations around the world have adopted this summary measure of population health at the national level, though the measure can be adapted for use in smaller geographic areas or health systems.[25]

**Disease Burden Measurement**

The prevalence of a chronic illness can be calculated by using the percentage of the population with the illness by age bracket (e.g., people ages 20 to 29, ages 30 to 39, etc.). The prevalence can then be compared over time by standardizing (i.e., age-adjusting), using the population size in each age bracket from the initial year. Summary measures of disease burden used for risk assessment and predictive modeling are also available. Examples include the Charlson Comorbidity Index (CCI) and commercial products like DxCG risk scores and Episode Risk Groups (ERGs).[26,27,28]

**Behavioral and Physiological Factors Measurement**

- Kottke and Isham recommend that both health plans and clinical service providers measure and report the rates of five behaviors: smoking, physical activity, excessive drinking, nutrition, and condom use by sexually active youth.[29]
- Behavioral factors are regularly measured in national and state health surveys, such as the Behavioral Risk Factor Surveillance System, with data at the county level.[30]
- Many health systems utilize health risk assessment instruments, available from a variety of commercial vendors, that combine information on health-related behaviors, physiological factors, and other risk factors, including some of the upstream factors depicted in Figure 1, to produce overall risk summaries for their populations. Some of these instruments also include measures of self-perceived health and functional status, moving toward a more comprehensive assessment of total health.[31]

**Measuring Experience of Care**

Table 3. Examples of Measures of Experience of Care

| Measure | Site | Population | Data Source |
|---|---|---|---|
| How's Your Health global question (added as a supplemental question to the CAHPS Clinician & Group Survey) | Martin's Point Health Care (Maine) | Active paneled patients at Martin's Point Health Care centers | Survey administered by National Research Corp. (NRC) Picker summarized quarterly from a random sample of patients *(Rules: Had a visit within the survey period, one survey per household per quarter, one survey per calendar year)* |
| Percent of patients who would recommend HealthPartners clinics | HealthPartners (Minnesota) | Patients seen at HealthPartners clinics | Survey administered by NRC Picker summarized monthly from a random sample of patients |
| Dashboard based on IOM aims (clinical effectiveness, hospital mortality, safety, service, resource stewardship, equity) | Kaiser Permanente (California) | Kaiser Permanente members | Internal performance data with external benchmarks: HEDIS, TJC, HSMR, CAHPS, HCAHPS, Milliman |

**Tips for Measuring Experience of Care**

*Data Sources*

- Sites in the Triple Aim prototyping initiative use the global question from Consumer Assessment of Healthcare Providers and Systems (CAHPS) from the US Department of Health and Human Services to measure experience from the patient's perspective.
- An index of Healthcare Effectiveness Data and Information Set (HEDIS) measures or The Joint Commission (TJC) measures can be used to measure the effectiveness of care.

*Methods of Measurement*

- How's Your Health[32] contains the option for a care team or employer to give persons an access code to this web-based resource that allows for aggregating results for populations.
- Sites should consider multiple dimensions (e.g., the six IOM aims) when developing a measure of experience of care from the delivery system perspective, rather than focusing on a single dimension such as effectiveness.
- Some measures based on IOM aims used by sites in the IHI Triple Aim prototyping initiative to measure experience of care from the delivery system perspective are: safe (adverse events); effective (hospital standardized mortality ratio, an index of HEDIS measures, index of The Joint Commission measures); patient-centered (patient engagement or confidence); timely (access); and efficient (readmissions). Stratification of these measures by race and gender provides measures of equitable care.
- Kottke and Isham recommend the following set of county-level indicators of health care system performance: insurance coverage; rates of unmet medical, dental, and prescription drug needs; preventive services delivery rates; childhood vaccination rates; rates of preventable hospitalizations; and disparities in access to health care associated with race and income (the original set included two metrics associated with cost, discussed below).[33]

**Measuring Per Capita Cost**

Table 4. Examples of Measures of Per Capita Cost

| Measure | Site | Population | Data Source |
|---|---|---|---|
| Risk-adjusted health plan allowed costs per member per month | HealthPartners (Minnesota) | Health plan members | Administrative data: Eligibility, medical and pharmacy claims |
| Risk-adjusted health plan costs per member per month | Kaiser Permanente (California) | Health plan members | Internal health plan and delivery system cost data, DxCG risk scores, Milliman cost benchmarks |
| Health plan costs per member per month | Martin's Point Health Care (Maine) | Health plan members | Claims data reported through Martin's Point data warehouse |
| Cost per employee per year | Bellin Health (Wisconsin) | Employees of Bellin Health | Claims data from third-party administrator |
| ED utilization per 1,000 members | Partnership with Genesee Health Plan (GHP) (Michigan) | Low-income, uninsured members of GHP | Claims data |

**Tips for Measuring Per Capita Cost**

*Data Sources*

- Sites participating in the IHI Triple Aim prototyping initiative found claims from health plans and Medicare to be a key source of data.
- For integrated systems without a health plan, Triple Aim sites used data available within the system (hospital, ED, and primary care) and/or from collaboration with affiliated health plans, Regional Health Information Organizations (RHIOs), or accountable care organizations.
- Cost data for Medicare patients is available from *The Dartmouth Atlas of Health Care*,[34] which aggregates Medicare data by attributing claims to hospital service areas or hospital referral regions and not individual health care systems.
- HEDIS contains Relative Resource Use measures focusing on five high-cost conditions for health plans.[35] The measures use standard unit costs to control for differences in prices to facilitate comparisons and exclude certain costs, such as laboratory and radiology, for which standard pricing tables are not readily available.

*Methods of Measurement*

- The National Quality Forum has endorsed the HealthPartners measures of Total Cost of Care and Resource Use.[36] The approach uses "allowable" costs from claims payment systems and consumer cost sharing for all types of health care services. The method enables separate calculation of a total cost index and total relative resource use in aggregate and by condition.
- Some Triple Aim sites use hospital and ED utilization for ambulatory care sensitive conditions (ACSC). ACSC are "conditions for which good outpatient care can potentially prevent the need for hospitalization or for which early intervention can prevent complications or more severe disease." Ambulatory care sensitive hospitalization also has an impact on an individual's experience of care. Technical specifications are available from the Agency for Healthcare Research and Quality.[37]
- A measure being considered by some communities is the ratio of the average family health insurance premium cost to the average household income. For comparison, actuarial value should be used to standardize premium costs. Actuarial value is a measure of the percentage of medical expense paid by a health plan.

## Integrating Triple Aim Measurement into a Learning System

As the examples above illustrate, a variety of options are available for measuring the three dimensions of the Triple Aim. Some organizations participating in IHI's Triple Aim prototyping initiative — such as Martin's Point Health Care, HealthPartners, Kaiser Permanente, and CareOregon — have developed a good set of Triple Aim measures for their defined populations. Challenges ahead include increasing the ability of communities to use publicly available data sources (national and local) supplemented by data generated within the health care systems from EHRs and registries to develop measures for their region, and to have organizations and communities produce data over time on their measures to monitor performance levels. Organizations and communities pursuing the Triple Aim also need to integrate their measures into a learning system to fuel simultaneous improvement of population health, experience of care, and per capita cost.

A learning system is an interdependent group of elements with the aim of building and using knowledge. For improvement initiatives such as the Triple Aim, the new knowledge is used to develop and adapt changes to improve performance. The foundation of the learning system is the population outcome measures described previously. Goals should establish "how much improvement, by when" for these measures. For example, an organization or community might set a goal to maintain growth in per capita cost for a population below the growth in the Consumer Price Index for the next two years, or to decrease the years of potential life lost in a community by 15 percent by 2015. To achieve these goals, the organization or community needs to make changes.

We have observed that no single change or improvement project implemented in health care organizations and in communities will achieve the goals set for the three dimensions of the Triple Aim. Multiple changes contained within a portfolio of projects are needed. As organizations and communities test changes and scale them up for the population, measures established for each project will guide the learning. For example, a project to reduce hospitalizations for a population of individuals over 65 years of age could have as a key project measure the rate of ambulatory care sensitive hospitalizations; or a project to reduce smoking prevalence could monitor the number of people completing a smoking cessation class as a process measure and the percent that stopped smoking as an outcome measure. Both of these projects would be expected to have an impact on the population outcome measures for cost and health. The structure of a learning system then is the connection among projects, project measures, and population outcome measures. This connection is illustrated with an example from CareOregon, a nonprofit health plan serving Medicaid and Medicare recipients in Oregon (see Table 5). CareOregon has two primary Triple Aim initiatives: case management for socially complex patients, and the transformation of primary care.[38] CareOregon established multiple projects for each of these initiatives. The example is not meant to define an ideal set of measures or projects, but to highlight the connections among them.

For illustration in this example, projects are associated with population health, experience of care, or per capita cost. In reality, each successful project will often have an effect on the population outcome measure for two dimensions of the Triple Aim, although perhaps not all three. For example, improvement in the rate of ambulatory care sensitive hospitalizations or in the overuse of low-value services[39] could impact both per capita cost and experience of care.

Table 5. Integrating Population Outcome Measures, Projects, and Project Measures:
        CareOregon Example of a Triple Aim Learning System

| Dimension of the IHI Triple Aim | Outcome Measures | Projects | Project Measures |
|---|---|---|---|
| **Population Health** | Total health risk assessment scores | Recuperative care program (RCP) for homeless | Number of patients enrolled in RCP |
| | | Proactive outreach to high-risk patients and enrollment in complex case management programs | • Number of high-risk patients assisted in complex case management programs<br>• Percent of high-risk patients with EQ-5D functional limitations |
| | | Chronic pain programs | Number of members enrolled in chronic pain programs |
| **Experience of Care** | Global rating of health care | • Primary care empanelment<br>• Advanced access scheduling | • Primary care empanelment and continuity rates<br>• Time to third next available appointment |
| | HEDIS effectiveness of care index | • Transparent panel-level clinical metrics<br>• Chronic condition clinical standards and reliability strategies<br>• Disease management programs and training for staff | • HEDIS metrics dashboards by team<br>• Chronic disease care management caseload per care manager<br>• Percent of patients enrolled in chronic disease management programs being contacted at least once every 45 days |
| **Per Capita Cost** | Health plan costs per member per month | Community-based outreach teams for high-cost members | • Average number of members outreached per month per team<br>• Average number of members contacted per month |
| | Hospital costs and utilization rates | Transitional care follow-up | • Readmission rates<br>• Ambulatory care sensitive hospitalization rates<br>• Number of days from discharge to follow-up appointment with primary care physician |
| | Emergency department (ED) cost and utilization rates | ED outreach by primary care | • Time to third next available appointmment or percent same-day access<br>• Clinic-specific ED rates |

A learning system should include some structured approach to oversight. Those involved with oversight should regularly monitor the progress of the improvement work, and determine whether improvement seen in project measures has an effect on the population outcome measures. If population outcome measures don't improve as project measures improve, organizations should consider re-balancing the portfolio of projects.

## Conclusion

Much of the data needed to measure population health, experience of care, and per capita cost are available, but much can still be done to make access to data easier. Quality Improvement Organizations (QIOs) play an important role in making Medicare data available to regions in a timely and usable fashion (as do states for Medicaid data), and should consider including this responsibility in QIO contracts. Public entities and health care delivery systems can form regional collaboratives (e.g., Regional Health Information Organizations) to share available data. The US Department of Health and Human Services facilitates such exchanges through its support of the Beacon Community Program and the State Health Information Exchange Program.

Guided by the menu of measures in Table 1, organizations can begin selecting outcome measures for the Triple Aim by exploring available sources of data for the identified population. They can refine the measures they select initially and improve them over time. For example, an organization initially measuring the percentage of their population with elevated blood pressure could decide to measure a health outcome such as self-rated health status — by including single-question, self-reported health in an existing survey.

Organizing constructs also enable organizations to make sense of the measures needed to comply with numerous reporting requirements. Two key constructs can help: the three dimensions of the Triple Aim, and the hierarchy of measures illustrated by the connection between population outcome measures and project measures. This connection among population outcome measures, projects, and project measures forms the structure of a learning system needed to successfully pursue the Triple Aim (see Table 5). Organizations and communities can use this measurement framework to take accountability for the health, experience of care, and per capita cost for the populations that rely on them.

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## Appendix A:
## Measurement Principles

Billheimer has articulated several questions about the structure and function of metrics that apply to Triple Aim measurement.

- Are the measures actionable?
- Are the measures sensitive to interventions?
- Are the measures affected by population migration?
- Are the measures easily understood by collaborating organizations, policy makers, and the public?
- Is the meaning of an increase or decrease in a measure unambiguous?
- Do the measures stand alone or are they aggregated into an index or summary measure?
- Are the measures uniform across communities?
- To what extent do measures address disparities as well as overall burden?
- Can unintended consequences be tracked?

Source: Bilheimer LT. Evaluating metrics to improve population health. *Preventing Chronic Disease*. 2010;7(4):A69. Available at: http://www.cdc.gov/pcd/issues/2010/jul/10_0016.htm.

Pestronk provides a related set of characteristics of ideal measures applicable to the Triple Aim.

- Simple, sensitive, robust, credible, impartial, actionable, and reflective of community values
- Valid and reliable, easily understood, and accepted by those using them and being measured by them
- Useful over time and for specific geographic, membership, or demographically defined populations
- Verifiable independently from the entity being measured
- Politically acceptable
- Sensitive to change in response to factors that may influence population health during the time that inducement is offered
- Sensitive to the level and distribution of health in a population
- Responsive to demands for evidence of population health improvement by measuring large sample sizes

Source: Pestronk RM. Using metrics to improve population health. *Preventing Chronic Disease*. 2010;7(4):A70. Available at: http://www.cdc.gov/pcd/issues/2010/jul/10_0018.htm.

## Appendix B:
## Detail on the Menu of Triple Aim Outcome Measures and Glossary of Data Sources

A more detailed description of the Triple Aim outcome measures in the menu in Table 1, including data sources and examples, is included in this Appendix.

*Note: The measures detailed below can be used by most entities (e.g., health plans, hospital-based systems, social service entities, communities) as long as they are applied to a defined population.*

**Measuring Population Health**

| Measure and Definition | Sources of Data | Notes and References |
|---|---|---|
| **1. Health Outcomes**<br>A. Mortality<br>A1. Life expectancy (LE): Average years of life remaining at a given age if current age-specific mortality rates continue to apply. Calculations require the number of deaths and the number in the population for each age or age group. This information is presented in a life table.<br><br>A2. Years of potential life lost (YPLL): A measure of premature mortality calculated by aggregating over a population for a given year the difference between age at death and a standard life expectancy target (typically 75 years). YPLL is often standardized per 1,000 or per 100,000 members of a population less than 75 years of age and age adjusted.<br><br>A3. Standardized mortality ratio (SMR): Ratio of observed to expected deaths. Calculation of expected deaths based on a standard population and typically adjusted for age and gender. | LE is available by counties in US Department of Health and Human Services Community Health Status Indicators (CHSI) using 2006 data.<br><br>Mobilizing Action Toward Community Health (http://www.countyhealthrankings.org) includes YPLL for counties using pooled data for 3 years. The 2011 rankings use data from National Center for Health Statistics (NCHS) for 2005-2007.<br><br>Potential sources of data on deaths:<br>• Hospitals within integrated system<br>• Affiliated health plans<br>• Social Security Administration (http://www.ntis.gov/products/ssa-dmf.aspx)<br>• State vital statistics<br>• Local health departments | Consideration must be given to the size of the population to calculate useful mortality statistics. Multiple years and/or ages can be aggregated.<br><br>Life expectancy is the most intuitive and meaningful mortality measure, and age-adjustment is built in, but requires a relative stable population. YPLL is easy to calculate and understand, though it doesn't count years lived above the target. Raw mortality is not typically recommended since differences or changes in underlying risk factors, such as age, are not taken into account. Other measures of mortality are infant mortality and "mortality amenable to health care," which measures deaths from certain causes that are potentially preventable with timely and effective health care.<br><br>*Handbook of Health Research Methods* (2005): "In a meta-analysis, a statistically significant relationship between single question self-rated health and risk of death was found. This relationship persisted in studies with a long duration of follow-up, for men and women, and irrespective of country origin. The association may occur because self-rated health serves as an important proxy for the array of covariates known to predict health and resource needs."(Source: Bowling A, Ebrahim S (eds.). *Handbook of Health Research Methods*. Open University Press; 2005.) |

**Measuring Population Health (continued)**

| Measure and Definition | Sources of Data | Notes and References |
|---|---|---|
| **1. Health Outcomes** (continued)<br><br>B. Health/Functional Status (self-reported)<br>B1. Single-question health status: Response to the question "Would you say that in general your health is: Excellent, Very Good, Good, Fair, Poor?"<br><br>B2. Multi-domain health/functional status: SF-12 or 36; FHS-6; CDC HRQOL-14<br><br>B3. Utility-based health/functional status: Health Utilities Index; EuroQol EQ-5D, SF-6D (convert scores into 0-1 utility scores based on societal preferences, commonly used to measure quality-adjusted life years (QALYs) used in economic analyses and research)<br><br>Note: Healthy life expectancy (HLE) combines life expectancy and health status into a single measure, reflecting remaining years of life in good health (http://reves.site.ined.fr/en/DFLE/definition/). | Single question is included in many survey instruments, including CDC HRQOL-4. HRQOL-4 (http://www.cdc.gov/hrqol/hrqol14_measure.htm) is included in the CDC state-based Behavioral Risk Factor Surveillance System (BRFSS) (http://www.cdc.gov/brfss) in the National Health and Nutrition Examination Survey (NHANES); in the Medicare Health Outcome Survey (HOS); the CAHPS and HCAHPS care experience surveys; the UK General Household survey; as well as many proprietary surveys, such as the SF-12.<br><br>EU Statistics on Income and Living Conditions Survey also includes a question on limitations due to a health problem.<br><br>Mobilizing Action Toward Community Health (http://www.countyhealthrankings.org) uses a weighted average of mortality (YPLL) and 4 measures of morbidity: self-rated health, poor physical and mental health days in the past month from BRFSS, and low birth weight from National Center for Health Statistics (NCHS). | Options for collecting data on self-reported health:<br>• Include in health risk assessment (HRA)<br>• Include in care experience survey<br>• Vital sign at point of care or after-visit survey<br>• At enrollment and follow-up annually at re-enrollment or in birthday greeting (phone call, mailed card, email)<br><br>HLE: An Excel spreadsheet is available for calculations (Sullivan Method) for Life Expectancy (LE) and Disability Free Life Expectancy (DFLE) (http://reves.site.ined.fr/en/resources/computation_online/sullivan/).<br><br>Reference: Kindig D, Asada Y, Booske B. A population health framework for setting national and state health goals. *JAMA*. 2008 May 7;299(17):2081-2083. |

**Measuring Population Health (continued)**

| Measure and Definition | Sources of Data | Notes and References |
|---|---|---|
| **2. Disease Burden**<br>A. Incidence and/or prevalence of chronic illness:<br>• Incidence: Annual rate or average age at onset for identified conditions<br>• Prevalence: Percent of a population with identified conditions<br><br>B. Predictive model scores: Mathematical modeling is used with inputs such as diagnosis and claims data to segment a population on such outcomes as likelihood of hospitalization, mortality, resource utilization, and cost. (Note: Relationship to per capita cost dimension of the Triple Aim.) | Potential sources of data on the incidence and/or prevalence of chronic illness: disease management registries, claims data, electronic health record data, health records, population surveys. | Age-adjusted prevalence of a prominent chronic illness (e.g., diabetes) can be calculated and compared over time by using the percent of the population with the disease by age brackets (e.g., 20-29 years, 30-39 years, etc.) standardized to the population size in the age brackets for the initial year.<br><br>Gallup-Healthways has represented disease burden by monitoring the prevalence of disease conditions (0, 1 to 3 conditions, 4 or more conditions) in a population. They provide a list of conditions that include high blood pressure, diabetes, depression, pain, and cancer.<br><br>Examples of predictive models are DxCG, ACG, ERG. Comparisons of predictive model scores can be made over time by standardizing using the initial population size in different risk categories (e.g., healthy, at risk, uncomplicated chronic, and complex). |
| **3. Behavioral and Physiological Factors**<br>Behavioral factors include smoking, alcohol, physical activity, and diet. Physiological factors include blood pressure, body mass index, cholesterol, and blood glucose. | A health risk assessment (HRA) is a questionnaire that allows for categorization of people by risk status based on a variety of behavioral risk factors or biometrics. There are commercially-available HRAs. Examples:<br>Healics (http://www.healics.com/)<br>HealthMedia (http://www.healthmedia.com/index.htm)<br><br>An HRA available in the public domain from Trustees of Dartmouth College: HowsYourHealth (http://www.howsyourhealth.org).<br><br>BRFSS includes information on health determinants: obesity, alcohol, smoking, and also comparisons to peer groups. However, it represents only a small random sample of a state or county. | Although an HRA focuses primarily on behavioral factor rather than outcomes of health, these determinants are leading indicators of health outcomes. Scores can be aggregated across questions to form an index or the percent of the population in different categories based on risks can be calculated and compared over time. In addition, an HRA often contains health or functional status questions that can be used separately as measures of health.<br><br>The Dartmouth Institute and the University of Washington are developing an HRA that will be available in the public domain. An HRA is also in development for Medicare enrollees as part of a new Annual Wellness Visit (section 4103 of Affordable Care Act). |

**Measuring Experience of Care**

| Measure and Definition | Sources of Data | Notes and References |
|---|---|---|
| **1. Global experience questions from patient, member, or population surveys**<br>A. US CAHPS survey (HHS/AHRQ) HP-CAHPS health plan survey includes four global questions of experience including: "Using any number from 0 to 10, where 0 is the worst health care possible and 10 is the best health care possible, what number would you use to rate all your health care in the last 12 months?" Global questions also include experience with personal physician, specialist, and health plan.<br><br>B. How's Your Health<br>Global question: "When you think about your health care, how much do you agree or disagree with this statement: 'I receive exactly what I want and need exactly when and how I want and need it'?"<br><br>C. NHS World Class Commissioning (WCC) or CareQuality Commission experience questions<br><br>D. Key global questions from a current patient survey (e.g., likelihood to recommend) | HP-CAHPS (health plan survey) results available to individual participants (http://www.cahps.ahrq.gov/default.asp).<br><br>H-CAHPS (hospital survey) results available publicly (http://www.hospitalcompare.hhs.gov).<br><br>How's Your Health (http://www.howsyourhealth.org) contains the option for a care team or employer to give persons an access code to this web-based resource.<br><br>Patient experience survey used in your organization or region. | How's Your Health was also included as a publicly available HRA.<br><br>WCC Assurance Handbook (page 72), Planned Care, contains experience questions (http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_085141.pdf).<br><br>CareQuality Commission (http://www.cqc.org.uk/public/reports-surveys-and-reviews/surveys).<br><br>A combination of measures for loyalty are retention (e.g., in a health plan or primary care practice) and questions on overall satisfaction and likelihood to recommend. (Source: Wilburn W. *Managing the Customer Experience*. ASQ Quality Press; 2007.) |

**Measuring Experience of Care (continued)**

| Measure and Definition | Sources of Data | Notes and References |
|---|---|---|
| **2. Set of care experience measures based on key dimensions**<br>For example, a dashboard created from the US Institute of Medicine (IOM) aims for improvement that impact the health care experience of an individual: Safe, Effective, Timely, Efficient, Equitable, Patient-Centered. | Much data should be available within the health care system (e.g., clinical practice management).<br><br>Hospital standardized mortality ratio (HSMR) from Dr. Foster (http://www.drfosterhealth.co.uk/features/what-are-hospital-standard-mortality-ratios.aspx).<br><br>Data summaries available in databases such as:<br>• HHS Hospital Compare – Medicare data (http://www.hospitalcompare.hhs.gov/)<br>• The Joint Commission Quality Check (http://www.qualitycheck.org/Consumer/SearchQCR.aspx)<br>• Health Effectiveness Data and Information Set (HEDIS) (http://www.ncqa.org/tabid/59/Default.aspx) | Some examples of measures based on IOM aims are Safe (adverse events), Effective (HSMR, an index of HEDIS measures, index of The Joint Commission measures), Patient-Centered (patient engagement or confidence), Timely (access), and Efficient (readmissions). Stratification of the above measures by race and gender provide measures of Equitable care. |

**Measuring Per Capita Cost**

| Measure and Definition | Sources of Data | Notes and References |
|---|---|---|
| **1. Total cost per member (or citizen) of the population per month**<br>Total costs, and costs by type of service (inpatient, outpatient, pharmacy, ancillary, etc.) each month for a population, divided by the number of people in the population | Claims or electronic health record data from health plans and Medicare are a key source of data. Potential sources for integrated systems without a health plan: data available within system (hospital, ED, and primary care) and/or collaboration with affiliated health plans, Regional Health Information Organization (RHIOs), or accountable care organizations. | Systems that serve a defined population and include a health plan or insurance entity should be able to calculate cost per member per month (PMPM). |
| **2. Hospital and emergency department (ED) utilization rate**<br>Total number of hospital admissions and ED visits each month for a population divided by the total number of people in the population, typically expressed as a rate per 1,000 | Sources of data similar to the above.<br><br>US Health Effectiveness Data and Information Set (HEDIS) contains Relative Resource Use measures focusing on six high-cost conditions for health plans. Areas of resource use include inpatient, evaluation and management (E&M), surgery and procedures, and pharmacy. | Cost for hospital admissions and ED visits can be determined by multiplying the number of each by standard unit costs.<br><br>A good measure for improvement is hospital and ED utilization for ambulatory care sensitive conditions (ACSC). ACSC are "conditions for which good outpatient care can potentially prevent the need for hospitalization or for which early intervention can prevent complications or more severe disease" (Source: AHRQ, 2004 – see below). |

References for ambulatory care sensitive conditions (ACSC):
- *AHRQ Quality Indicators—Guide to Prevention Quality Indicators: Hospital Admission for Ambulatory Care Sensitive Conditions.* Rockville, MD: Agency for Healthcare Research and Quality. Revision 3. (January 9, 2004). AHRQ Pub. No. 02-R0203.
- *AHRQ Prevention Quality Indicators (PQI): Technical Specifications.* (V3.1 March 2007). Rockville, MD: Agency for Healthcare Research and Quality.

Method for calculating ACSC rate per 100,000 member months from CareOregon: Run the AHRQ algorithm (Technical Specs) on inpatient claims data for a certain time period. ICD-9 codes and DRGs are used to determine if the visit meets the criteria for a PQI visit. The Overall PQI measure does not include two measures: appendicitis and low birth weight babies (these have their own denominators: number with appendicitis and number of births). If a hospital admission has multiple PQI measures, it is counted once. The number of member months on the plan is based on enrollment data for the same time period.

**Glossary of Data Sources for Measuring the Triple Aim**

An alphabetical listing and brief description of data sources for some of the more commonly used measures discussed in this white paper for measuring the Triple Aim: population health, experience of care, and per capita cost.

**BRFSS:** Behavioral Risk Factor Surveillance Survey from the Centers for Disease Control and Prevention, contains county-level data on health indicators
http://www.cdc.gov/brfss

**CAHPS:** Consumer Assessment of Healthcare Providers and Systems from the US Department of Health and Human Services, includes surveys for different populations: Health Plans (HP), Hospitals (H), and Clinician and Group (CG)
https://www.cahps.ahrq.gov

**Community Commons:** An interactive mapping, networking, and learning utility for the healthy communities movement; provides over 7,000 GIS (graphic information system) data layers at state, county, zip code, block group, tract, and point-levels, as well as mapping, visualization, analytic, impact, and communication tools and applications
http://www.communitycommons.org

**County Health Rankings:** From the University of Wisconsin's Population Health Institute, provides data by county on key determinants of health
http://www.countyhealthrankings.org/

**Dartmouth Atlas:** Contains mainly cost data for Medicare patients by state and hospital referral region (HRR)
http://www.dartmouthatlas.org/

**HEDIS:** Healthcare Effectiveness Data and Information Set is a tool for health plans from the National Committee for Quality Assurance (NCQA)
http://www.ncqa.org/tabid/59/Default.aspx

**Hospital Compare:** From the US Department of Health and Human Services, includes the comparison of hospitals on key quality indicators by condition
http://www.hospitalcompare.hhs.gov/

**HSMR:** Hospital standardized mortality ratio from Dr. Foster
http://www.drfosterhealth.co.uk/features/what-are-hospital-standard-mortality-ratios.aspx

**Milliman**: A private organization that provides actuarial consulting services to the health care industry
http://www.milliman.com

**Scorecard on Local Health System Performance:** The Commonwealth Fund tracks 43 indicators spanning four dimensions of health system performance: access, prevention and treatment, costs and potentially avoidable hospital use, and health outcomes (the Scorecard compares all 306 local health care areas, known as hospital referral regions, in the US)
http://www.commonwealthfund.org/Publications/Fund-Reports/2012/Mar/Local-Scorecard.aspx

**TJC Quality Check:** From The Joint Commission, includes rates for hospitals on key quality indicators by condition
http://www.qualitycheck.org/Consumer/SearchQCR.aspx

**Appendix C:**
**An Explanation of the Model of Population Health Components and Relationships**

Figure 1. A Model of Population Health
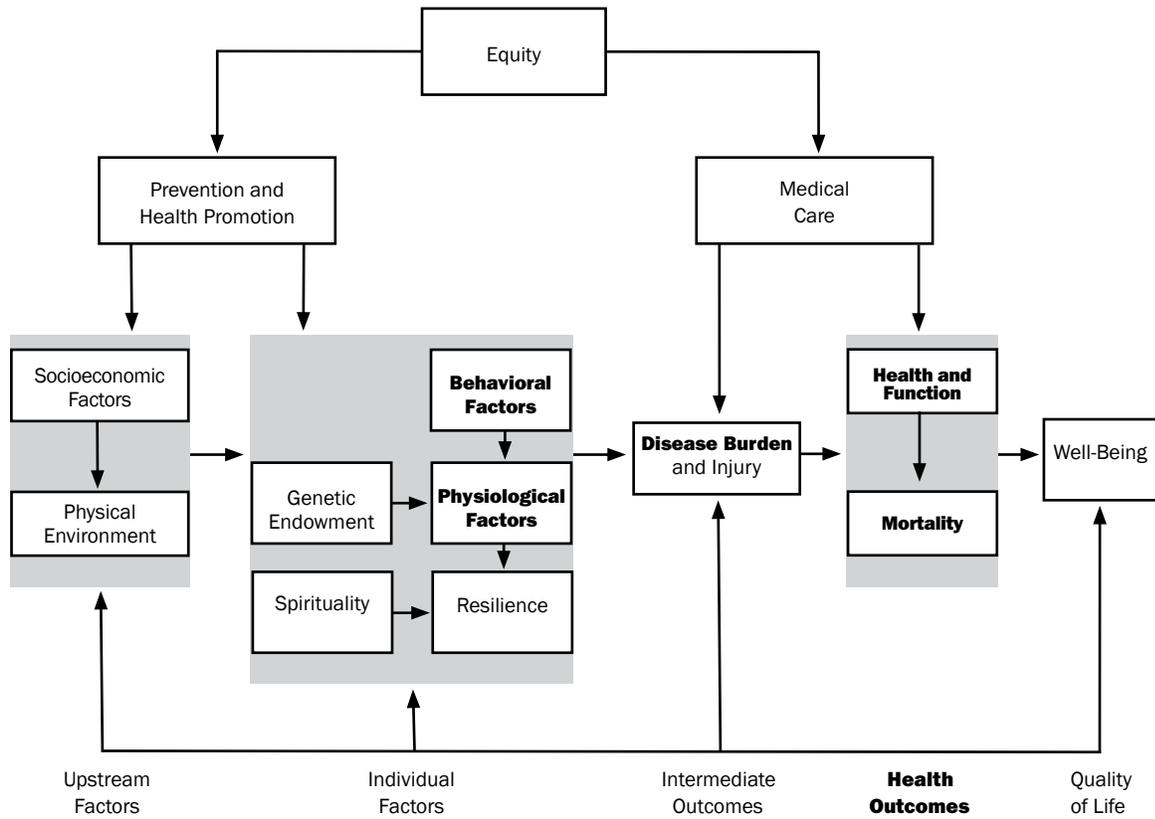


Note: Measures of population health in the Triple Aim measurement menu in Table 1 appear in **bold** text in Figure 1.

The model elaborates on the causal pathways and relationships described by Evans and Stoddart,[i] and provides a framework for measurement by distinguishing between determinants (upstream and individual factors) and outcomes, and within outcomes, between intermediate outcomes and health outcomes (states of health).

**Upstream Factors:** Socioeconomic Factors, Physical Environment

- Socioeconomic Factors: Income and wealth, education, employment and occupation, family and social support
- Physical Environment: The built environment, the food environment, community safety and culture, the media/information environment, and environmental pollution

**Individual Factors:** Genetic Endowment, Behavioral Factors, Physiological Factors, Spirituality, Resilience

- These factors are influenced by the upstream factors, as well as relationships among the individual factors.
- Four individual behaviors — smoking, diet, exercise, and alcohol consumption — are estimated to account for 40 percent of premature mortality.[ii]
- Spirituality and resilience are increasingly recognized as important determinants of health, in turn influenced by both the upstream factors as well as behaviors and physiology.[iii]

**Prevention and Health Promotion**

- The first potential contributions of health care, prevention and health promotion, are directed primarily at the upstream and individual factors.

**Intermediate Outcomes:** Disease Burden and Injury

- The individual factors and upstream factors influence the intermediate outcomes of disease and injury. However, two people with identical physiological markers and healthy behaviors may have very different manifestations of disease.

**Health Outcomes:** Health and Function, Mortality

- The intermediate outcomes influence, but aren't the same as, health outcomes or states of health, shown as health and functional status, and mortality. Similarly, two people with the same disease state may have very different levels of self-perceived health and functional status, and may have very different life expectancies.

**Medical Care**

- The second potential contribution of health care, direct medical care, influences disease burden and injury and states of health, and the relationship between them.

**Quality of Life:** Well-Being

- Well-being is intended to capture quality of life, of which health is only one contributor. Such factors as meaningful relationships and work, influenced powerfully and directly by the upstream factors, also contribute to well-being.
- Well-being can also influence the individual factors of physiology and resilience, and even the upstream factors. For example, people with greater well-being are more likely to succeed in school and work.[iv,v]

**Equity**

- Kindig and Stoddart added the important dimension of the *distribution* of health to the population health model to differentiate it from individual health.[vi] This dimension is captured in the model as equity, and is shown to influence the upstream factors of socioeconomics and physical environment, as well as the contributions of health care, prevention, health promotion, and medical care.

Sources:

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