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How Health Systems Could Avert 'Triple Fail' Events That Are Harmful, Are Costly, And Result In Poor Patient Satisfaction

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ABSTRACT Health care systems in many countries are using the "Triple Aim"—to improve patients' experience of care, to advance population health, and to lower per capita costs—as a focus for improving quality. Population strategies for addressing the Triple Aim are becoming increasingly prevalent in developed countries, but ultimately success will also require targeting specific subgroups and individuals. Certain events, which we call "Triple Fail" events, constitute a simultaneous failure to meet all three Triple Aim goals. The risk of experiencing different Triple Fail events varies widely across people. We argue that by stratifying populations according to each person's risk and anticipated response to an intervention, health systems could more effectively target different preventive interventions at particular risk strata. In this article we describe how such an approach could be planned and operationalized. Policy makers should consider using this stratified approach to reduce the incidence of Triple Fail events, thereby improving outcomes, enhancing patient experience, and lowering costs.

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The "Triple Aim" of health care is to improve individual patients' experiences of care, advance population health, and reduce per capita health care costs.[1] A central tenet of the Triple Aim is to restructure care in ways that lead to improvements across all three of these goals.

The Institute for Healthcare Improvement has worked with organizations in many countries to implement populationwide interventions to foster the Triple Aim.[2] Examples are programs that encourage self-management of chronic conditions,[3] promote e-mail communication between patients and physicians,[4] and encourage greater use of primary care.[5]

Other organizations have adopted a more targeted approach to achieving the Triple Aim. For example, a Commonwealth Fund case study found examples of organizations that were focusing on improving access and care for individual patients who had low incomes, were uninsured, or had complex chronic conditions.[3] Indeed, several authors have argued that success will require both population health and individually focused strategies, such as those employed by Genesys Health System in Flint, Michigan.[1,3,6,7] For example, Genesys increased its primary care capacity (that is, a population approach) and offered health navigators to its high-risk patients (that is, a targeted approach).

The objectives of this article are to propose a third, stratified approach to tackling the Triple Aim and to explore some of the ethical challenges that this new approach presents. The stratified approach to the Triple Aim involves identifying and prioritizing subpopulations according to their risk of experiencing health encounter failures—what we call "Triple Fail" events—and according to their likelihood of benefiting from preventive care.[6,8]

We define a *Triple Fail event* as a health outcome

that is recorded in administrative data and arises from the health care process. Such events simultaneously have three failures: They are costly, represent a suboptimal health outcome, and are a poor patient experience. To generate the list of Triple Fail events in Exhibit 1, we applied our definition to the published literature to confirm each example's failure on all three Triple Aim goals.

Triple Fail Events

Triple Fail events include untimely nursing home admissions,[9] unplanned hospital readmissions,[10–12] inappropriate initiations of hemodialysis,[13–15] and surgeries for low back pain in patients not offered decision support.[16] For example, nursing home admission was cited as a common fear among older people,[9] was often preceded by poor physical and emotional health,[17] and was estimated to cost $203–$243 billion annually in the United States in 2009.[18]

Other Triple Fail events are more controversial, such as overmedicalized death, which may be defined as receiving "life-sustaining treatments, such as mechanical ventilation, that most beneficiaries indicate they prefer to avoid when faced with less than a year to live."[19]

EXHIBIT 1

Examples Of Triple Fail Events

Event	Quality of care	Patient experience	Cost
Unplanned hospital readmission within 30 days	A readmission may indicate complications, a premature discharge, a failure to coordinate and reconcile medications, inadequate communication, or poor discharge planning[a]	Higher 30-day risk-standardized hospital readmission rates are associated with lower patient satisfaction[b]	A 2009 study found that 30-day rehospitalizations cost Medicare $17.4 billion annually[c]
Nursing home admission	Predictors of nursing home admission include low self-rated health status and functional and cognitive impairment[d]	Loss of independence and nursing home admission are two of the major fears of older people[e]	The cost of long-term care in the United States in 2009 was estimated to be $203–$243 billion[f]
Inappropriate initiation of hemodialysis	Peritoneal dialysis patients experienced a lower adjusted relative risk of death compared with those beginning hemodialysis;[g] late and early dialysis initiation appear to be associated with equal outcomes[h]	Peritoneal dialysis patients reported better quality of life and better satisfaction with dialysis care[i]	Median annual health care costs in 2004 were $43,510 higher for hemodialysis patients than peritoneal dialysis patients[j]
Wrong-site surgery	Wrong-site surgery is one of the National Quality Forum's "never events"[k]	Wrong-site surgery can be a devastating experience for the patient[l]	A 2010 study found that the average compensation paid to victims of wrong-site surgery was $47,216[m]
Intentional injury or maltreatment of a child	Child maltreatment involving physical abuse is the leading cause of infant death from injury[n]	Child abuse has been associated with a wide range of psychological symptoms in the victim[o]	A 2012 study found the annual acute medical costs and annual societal costs of childhood abuse in the United States were $2.9 billion and $80 billion, respectively[p]
Overly invasive treatment for a preference-sensitive condition	Patients offered a decision aid for a preference-sensitive condition reported significantly improved outcomes[q]	Patients offered a decision aid reported significantly greater satisfaction with their selected treatment[q]	Patients offered a decision aid were 21–44% less likely to choose costly, aggressive surgery[q]

SOURCE Authors' analysis. Sources are listed by individual entries in this exhibit. **NOTE** A preference-sensitive condition has multiple treatment options with roughly equivalent risks and benefits, which means that the patient's preference should determine which option is selected. An example is low back pain, which can be treated by surgery, physical therapy, or analgesics. [a]See Note 10 in text. [b]See Note 11 in text. [c]See Note 12 in text. [d]See Note 17 in text. [e]See Note 9 in text. [f]See Note 18 in text. [g]Mehrotra R, Chiu YW, Kalantar-Zadeh K, Bargman J, Vonesh E. Similar outcomes with hemodialysis and peritoneal dialysis in patients with end-stage renal disease. Arch Intern Med. 2011;171(2):110–8. [h]See Note 13 in text. [i]See Note 14 in text. [j]See Note 15 in text. [k]Michaels RK, Makary MA, Dahab Y, Frassica FJ, Heitmiller E, Rowen LC, et al. Achieving the National Quality Forum's "Never Events": prevention of wrong site, wrong procedure, and wrong patient operations. Ann Surg. 2007;245(4):526–32. [l]Mulloy DF, Hughes RG. Wrong-site surgery: a preventable medical error. Chapter 36 in: Hughes RG, editor. Patient safety and quality: an evidence-based handbook for nurses. Rockville (MD): Agency for Healthcare Research and Quality; 2008 Mar. p. 381–94. [m]Stahel PF, Sabel AL, Victoroff MS, Varnell J, Lembitz A, Boyle DJ, et al. Wrong-site and wrong-patient procedures in the universal protocol era: analysis of a prospective database of physician self-reported occurrences. Arch Surg. 2010;145(10):978–84. [n]Overpeck MD, Brenner RA, Trumble AC, Trifiletti LB, Berendes HW. Risk factors for infant homicide in the United States. N Engl J Med. 1998;339(17):1211–6. [o]Gross AB, Keller HR. Long-term consequences of childhood physical and psychological maltreatment. Aggress Behav. 2006;18(3):171–85. [p]Gelles RJ, Perlman S. Estimated annual cost of child abuse and neglect [Internet]. Chicago (IL): Prevent Child Abuse America; 2012 Apr [cited 2013 Feb 27]. Available from: http://www.preventchildabuse.org/downloads/PCAA_Cost_Report_2012_Gelles_Perlman_final.pdf. [q]See Note 16 in text.

Approaches To Preventive Care

POPULATION AND TARGETED APPROACHES The two leading approaches to preventive care—the population strategy and the targeted (high-risk) strategy—were described in a seminal article by the British epidemiologist Geoffrey Rose.[20] The population strategy seeks to shift the distribution of risk within an entire population toward a lower range—for example, by decreasing the amount of salt in the typical diet to reduce the population's average blood pressure. The targeted strategy aims to truncate the risk distribution by identifying high-risk individuals and offering them interventions to reduce their individual susceptibility—for example, by screening blood pressure among the population and offering medication to people with hypertension.

An important advantage of the population strategy is its potential to make widespread improvements in public health.[20] However, the benefit to each individual is relatively small using this approach. Most people experience no particular improvement in their health—a result known as the "prevention paradox."[20,21] In contrast, the targeted strategy provides customized care that maximizes outcomes for individual patients. But such customized care will rarely be cost-effective for all patients, and hence it should not be offered universally.

The choice of preventive strategies should depend on the cost and effectiveness of the proposed intervention. Both of Rose's strategies may be cost-effective when the intervention cost is low. But populationwide approaches tend to be more appropriate when the intervention's effect is large, while targeted approaches are more suitable when accurate predictive models are available and an optimal risk threshold for intervention is used. For example, treatment may be determined by a risk score cut-off point, which is based on a simulation of the costs and benefits and is designed to maximize the cost-effectiveness of the intervention.[22]

Rose's hypothesis was formulated prior to the development of accurate multivariable risk-prediction tools.[23] More recent analysis of population data suggests that targeted, high-risk approaches may be particularly advantageous under certain circumstances, such as when the intervention has a degree of disutility—for example, if the intervention is considered a poor patient experience, which might include cost, lost time, or an adverse lifestyle change.[23]

THE STRATIFIED APPROACH Our novel, stratified approach to the Triple Aim could generate additional value by combining some of the advantages of the other two approaches.[8] This third approach is best adopted by organizations with responsibility for a population's health, such as accountable care organizations. It involves analyzing medical claims, pharmacy claims, electronic health record information, and other administrative data to predict individuals' risks of different Triple Fail events. The organization would next estimate each person's likely response to a range of preventive programs and then assign people to different interventions according to their likely benefit.

Compared with the population at large, the subpopulation of each risk stratum would be relatively homogeneous, allowing the intervention to be customized to meet the needs of the patients in that stratum. For example, a program aimed at preventing hospital readmission might offer case management, telephonic care, and remote monitoring, with more intensive interventions offered to patients in higher risk strata. We recommend that an ethics committee approve any algorithms used for targeting interventions prior to implementation and that excluded patients be considered as part of a feedback loop for program evaluation and improvement.

Within a high risk stratum, the average person's risk of experiencing the Triple Fail event will be higher than the average population risk. As a result, a higher proportion of individuals in these groups could benefit from preventive care. In other words, this stratum would have a higher positive predictive value, which in turn would increase the cost-effectiveness of the preventive intervention, all other things being equal. However, the stratified approach is beset by a number of challenges, principally those relating to the ethical aspects of risk stratification, which are described below.[23]

The stratified approach to the Triple Aim described in this article includes three phases. A planning phase would involve conducting an opportunity analysis, developing predictive models and impactibility (also known as intervenability) models. The latter are models that seek to identify subgroups of high-risk people who are most likely to engage with and respond to various preventive interventions, such as case management. The planning phase would also include an ethical review to ensure its compliance with our adaptation of James Wilson and Gunner Jungner's prerequisites, described below.

An operational phase would use the predictive models and impactibility models to identify high-opportunity patients—those who are both at risk and amenable to an intervention—and offer them preventive interventions. An ongoing feedback phase would refine the predictive models and impactibility models—for example, by prioritizing patients with characteristics similar to those of patients who responded well to the intervention.

Implementing The Stratified Approach

OPPORTUNITY ANALYSIS The starting point for a health system interested in pursuing the stratified approach to the Triple Aim is to undertake a detailed analysis of where the greatest opportunities exist for improving care. Known in the strategic management literature as opportunity analysis, this process would, in the case of the Triple Aim, involve analyzing historical population data to identify Triple Fail events and gauging how responsive each such event might have been to a cost-effective preventive intervention identified from the literature.[24]

Once a high-opportunity subpopulation of patients has been identified in historical data, people in the population with these characteristics need to be identified prospectively to determine who should be offered an intervention. Therefore, a key requirement for the stratified approach is the ability to identify patients who are at risk of future Triple Fail events.[6]

PREDICTIVE MODELING Predictive risk models are statistical algorithms based on relationships in historical population data. They may be applied in an automated fashion to routinely collected data to estimate the probability that a person will experience a Triple Fail event in a specified future time period.[25,26] For example, the combined predictive model is used by National Health Service organizations in England to calculate a person's risk of unplanned hospitalization in the next twelve months, according to factors recorded in the previous two years' worth of primary care electronic health record data and hospital claims data.[27]

A predictive model for identifying vulnerable people could potentially be built for any type of Triple Fail event whose occurrence is recorded in routine data. For example, researchers in New Zealand have developed a model that predicts the risk within five years of intentional injury or maltreatment to an individual child.[28] A model developed in the United Kingdom predicts the risk of admission to a nursing home within twelve months.[29] And Canada uses a model to predict hospital readmissions within thirty days.[30]

IMPACTIBILITY MODELING A recognized limitation of using predictive risk models to organize care is that some of the patients identified as being at high risk may not be amenable to the proposed preventive intervention.[25] In response, many organizations have developed impactibility models that seek to identify the subgroups of high-risk people who are most likely to engage with and respond to various preventive interventions.[31,32] This additional filter is intended to improve the cost-effectiveness of preventive programs.

Several approaches to impactibility modeling have been described elsewhere.[33] First, health care organizations may prioritize people with conditions known to be responsive to preventive care, such as patients with an ambulatory care–sensitive condition, who may be particularly likely to respond to hospital avoidance interventions.[33]

Second, organizations may prioritize patients whose care appears suboptimal, such as patients with multiple "gaps in care." An example of such a gap would be not giving beta-blocker therapy to a patient with heart failure.[34]

Third, some organizations report that they place lower priority on patients who are expected to respond poorly to preventive care, such as people with cognitive or other mental health disabilities and those who have language barriers. Or an organization may exclude all of the very highest-risk patients, because such patients are sometimes regarded as being less amenable than others to preventive care.[34]

The first two approaches to impactibility modeling may help reduce health care disparities, because both suboptimal care[35] and ambulatory care–sensitive conditions[36] tend to be more common in people with low incomes. In contrast, the third approach—placing lower priority on those less likely to benefit from preventive care—raises serious ethical concerns. This approach would probably exacerbate health care disparities, and it may be illegal in some countries.[37] Finally, because patients in very high risk strata have such a high propensity for Triple Fail events, expending resources to identify the few who can be affected is usually worth the effort.

Ethics Of Screening Using Predictive Risk Models

As Rose noted, the individual approach to health improvement is hampered by the "difficulties and costs of screening."[20(p36)] A screening test seeks to identify people who are at sufficiently high risk of an adverse outcome to warrant offering them a diagnostic test or recommending a prophylactic treatment. The stratified approach to the Triple Aim likewise requires screening a population to identify subpopulations that are at sufficiently high risk of a Triple Fail event and sufficiently amenable to a preventive intervention to justify further action.

Any screening test has the potential to cause more harm than good, such as by exposing patients to false positive and false negative results. Therefore, strict ethical guidelines are required to safeguard against the inappropriate use of screening.[38] The World Health Organization

published ten prerequisites, proposed by Wilson and Jungner, that should be met by any ethical screening program.[38,39] Among these prerequisites are that the condition being screened for should be an important health problem; that there should be a detectable early stage when treatment would be of more benefit than it would be later; and that the risks, both physical and psychological, should be less than the benefits.

Because the stratified approach to the Triple Aim involves population screening using routine data, we suggest that equivalent caveats should apply as part of the planning phase. Adapting Wilson and Jungner's prerequisites,[39] we propose the following ethical criteria for stratifying populations according to risk for Triple Fail events.

PREREQUISITES FOR STRATIFICATION The event being predicted should be an important health problem. There should be an intervention that can mitigate the risk of the event; resources and systems for timely risk stratification and preventive interventions; sufficient time for intervention between stratification and the occurrence of the event; a sufficiently accurate predictive risk model for the event, which—together with the impactibility model—is acceptable to the population at large; and an accepted policy about who should be offered the preventive intervention.

In addition, the natural history—that is, the practices and processes that typically lead to this type of Triple Fail event—should be adequately understood by the organization offering the preventive intervention. The cost of stratification should be "economically balanced," meaning that it should not be excessive relative to the cost of the program as a whole. And stratification should be a continuous process, not just a "once and for all" occurrence.

ACCESS FOR CERTAIN HIGH-RISK POPULATIONS Another important ethical concern relates to the use of impactibility modeling. Although certain subpopulations are at high risk, they may be denied preventive care because they are not expected to respond to it. For instance, people with personality disorders or alcohol dependency might not be amenable to programs aimed at preventing hospital readmission. The question is whether such people should be denied preventive care on this basis, which corresponds to Wilson and Jungner's requirement that there be an accepted policy about who should be offered the intervention.

Nancy Kass argued that for reasons of distributive justice, programs should not exclude individuals on the basis of nonclinical characteristics such as race and sex.[40] However, Andrew Smart, Paul Martin, and Michael Parker argued that such discrimination may be justified on the principle that it is permissible to treat people differently if there is some ethical justification. For example, programs that target low-income or uninsured people because of social justice considerations rightly treat different people differently.[41]

Discussion

ESTABLISHING A FEEDBACK LOOP A feedback loop is necessary for assessing the impact of the preventive program on outcomes.[42] This step may be valuable both for evaluating the program and for refining the impactibility model.

For example, a regression analysis might show that patients with certain characteristics were more likely than others to respond to an intervention. This knowledge could then be used to adjust the impactibility model to ensure that patients with these characteristics were prioritized in the future, unless that adjustment violated ethical considerations.

CURRENT POLICY CONTEXT The Triple Aim is becoming increasingly important to policy makers in developed countries as their populations age, chronic diseases increase in prevalence, and funding constraints become pressing.[43] Predictive modeling is now widely accepted in the United States,[44] but the use of impactibility models is less extensive.

New financial and quality rules are giving hospitals and accountable care organizations incentives to prevent Triple Fail events such as avoidable readmissions. However, many such organizations are relying on population strategies to achieve these goals, including better care coordination and improvements in information technology.[45] Ultimately, success will probably require targeting specific subpopulations as well.[45]

RECOMMENDATIONS The following recommendations could promote the appropriate use of the stratified approach to the Triple Aim.

▶**USE PILOTS:** First, Triple Aim pilots should be established in which demonstration sites are required to compare population, individual, and stratified approaches; conduct opportunity analyses; and apply predictive risk and impactibility models.

▶**REDUCE DATA LAGS:** Second, the use of predictive modeling should be promoted by reducing lags in the availability of information from the Medicare limited data set as well as files available for specific uses, such as those for accountable care organizations. The Medicare limited data set lags by more than a year, and the specific-use files lag by several months. Since some factors recorded in routine data are

strongly predictive of an imminent Triple Fail event, reducing the time lag between the occurrence of such factors and their availability in the data improves the accuracy of the predictive model.

▶**CONDUCT AN ETHICAL REVIEW:** Third, there should be appropriate ethical reviews of both the design and implementation of predictive and impactibility models.

▶**RECORD MORE EVENTS:** Finally, the use of database indicators should be expanded to cover more potentially adverse events. For example, the Hospital Episode Statistics database in England records whether each admission was elective or not, thereby indicating whether the event was a likely Triple Fail event.

FOCUS OF FUTURE WORK There is a growing body of evidence for the ability of predictive models to identify and classify adverse outcomes.[46] However, relatively few studies have assessed the amenability of people to respond to different interventions.[32] Mathematical simulation models may help clinicians and administrators choose between different approaches for addressing the Triple Aim.[22] Given the current focus on comparative effectiveness research, it might be helpful if future trials of interventions designed to prevent Triple Fail events examined the effect of impactibility models on population outcomes and on disparities.

CONCLUSION The Triple Aim is being used in many countries to improve the quality, experience, and cost-effectiveness of health care. A stratified approach to the Triple Aim offers a number of potential advantages but requires careful planning, monitoring, and adaptation. By increasing the use of predictive modeling to identify Triple Fail events before they occur, this approach can contribute to improved individual and population health in a cost-conscious health care environment. ■

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NOTES

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In this month's *Health Affairs*, Geraint Lewis and coauthors propose a new rubric for improving health care: predicting and preventing so-called Triple Fail events, which simultaneously reflect poor patient experience and high costs while constituting inferior patient care—the opposite of the Triple Aim. They note that the risk of experiencing different Triple Fail events varies widely across individuals, and they argue that by stratifying populations according to each person's risk and anticipated response to a health intervention, health systems could more effectively target different preventive services, such as case management. The authors also discuss how the approach of stratifying the population and tailoring interventions could be planned and operationalized.

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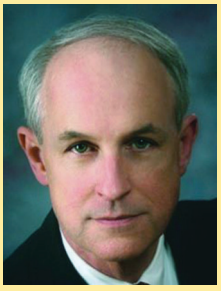

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