Providing better care at lower cost for multimorbid patients

Predictive modeling of payor data can identify the subset of high-cost patients who are most likely to respond to intensive, home-based interventions.

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[1] Uijen AA, van de Lisdonk EH. Multimorbidity in primary care: prevalence and trend over the past 20 years. *Eur J Gen Pract.* 2008;14(Suppl 1):28-32. Britt HC et al. Prevalence and patterns of multimorbidity in Australia. *Med J Austral.* 2008;189:72-77. Kadam UT et al. Clinical multimorbidity and physical function in older adults: a record and health status linkage study in general practice. *Fam Pract.* 2007;24: 412-419.
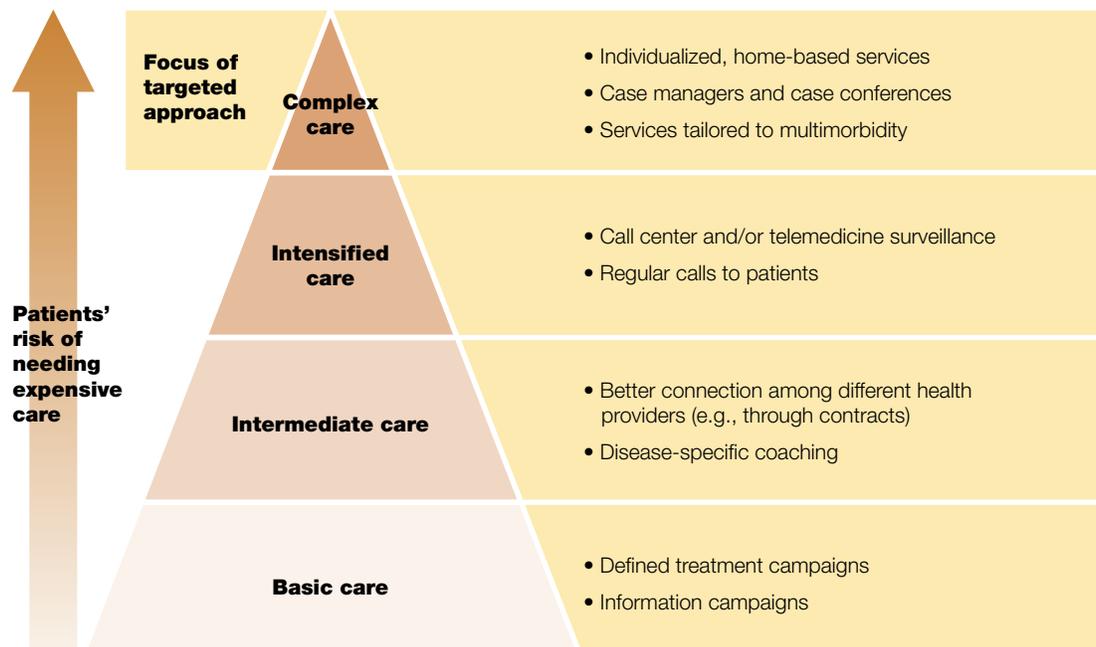
[2] Estimates of multimorbidity's prevalence vary for a number of reasons, most notably the fact that there is no standard definition of the term "chronic condition." Some studies, therefore, included only a relatively small number of conditions (e.g., arthritis, cancer, diabetes mellitus, hypertension, heart disease, obstructive lung disease, and psychiatric problems). Other studies used much broader definitions, including such conditions as cerebrovascular disease, gastroesophageal reflux, osteoporosis, chronic back pain, and obesity. Among the other factors that influence prevalence estimates are the age of the patients studied and the source of the data analyzed (hospital records, surveys of general practitioners, patient questionnaires, or administrative data). However, all recent studies support the general trends summarized here.

[3] Uijen AA, van de Lisdonk EH. Multimorbidity in primary care: prevalence and trend over the past 20 years. *Eur J Gen Pract.* 2008;14(Suppl 1): 28-32.

[4] Taylor AW et al. Multimorbidity – not just an older person's issue. Results from an Australian biomedical study. *BMC Public Health.* 2010;10:718.

In countries around the world, the prevalence of multimorbidity (the simultaneous presence of two or more chronic conditions) has risen substantially in recent decades and will continue to rise in coming years. Among the factors contributing to the increasing prevalence are the obesity epidemic and, especially, population aging. Many studies suggest, for example, that three-quarters or more of people over age 75 have multiple chronic conditions.[1]

Multimorbidity impairs patients' quality of life, increases their risk of functional limitations, and makes effective treatment more difficult to deliver. It also raises health care utilization and costs substantially. Although many health systems use risk-adjustment schemes to compensate payors and providers for the increased utilization, the calculations employed often underestimate multimorbidity's true costs. Furthermore, a small subset of multimorbid patients can have such high rates of recurrent hospitalization and other expensive treatments that their medical expenses may account for the majority of a payor's spending; in some health systems, the cost of their care can even jeopardize a payor's financial sustainability.

Although most payors, providers, and health systems recognize the problems that multimorbidity presents, only a few of them have found effective ways to deal with those problems. Too often, care remains poorly integrated; as a result, quality of care suffers and costs remain uncontrolled.

A few payors and health systems, however, are now experimenting with a more focused approach. They are using predictive modeling or other methods to identify multimorbid patients with especially complex health care needs and very high health care costs. These patients are then offered an individualized, integrated, home-based case management program. The results to date are highly promising. Most patients experience better health status and markedly reduced hospitalization rates; the savings obtained from lower health care utilization generally far exceed the program's costs.

A growing problem

Although estimates of multimorbidity's prevalence vary from country to country, studies from around the world show similar trends.[2] Both the number of people affected and the average number of coexisting conditions are rising. A recent study, for example, found that between 1985 and 2005, multimorbidity's prevalence in the general Dutch population increased from 12.3 percent to 20.5 percent; the proportion of people with four or more chronic conditions nearly tripled from 2.6 percent to 7.5 percent.[3] In this study (as in other studies of multimorbidity), prevalence rose steadily with age; however, about 5 percent of teenagers had two or more chronic conditions.

Among people age 65 and older, multimorbidity is now the norm. In most studies, prevalence in this age group is at least 50 percent; among those age 75 and older, it is often 80 percent or higher.[1] In many countries, one-third or more of elderly patients have four or more chronic conditions.

Given population aging, multimorbidity is likely to become even more common in the next decades. However, population aging is not the only factor contributing to rising prevalence. A body mass index of 30 or higher triples the risk of multimorbidity in young adults and nearly doubles that risk in older people.[4] Other factors that have been linked to multimorbidity include unemployment, low socioeconomic status, tobacco use, and poor nutrition.

Exhibit 1   **Intensity of integrated care should vary based on patients' needs**

Focus of targeted approach

Complex care
- Individualized, home-based services
- Case managers and case conferences
- Services tailored to multimorbidity

Intensified care
- Call center and/or telemedicine surveillance
- Regular calls to patients

Intermediate care
- Better connection among different health providers (e.g., through contracts)
- Disease-specific coaching

Basic care
- Defined treatment campaigns
- Information campaigns

Patients' risk of needing expensive care

The consequences are severe. The more chronic conditions a patient has, the more likely he or she is to have functional limitations and an impaired quality of life.[5] The level of impairment often exceeds what would be expected based on the individual conditions present. And because most multimorbid patients take a high number of medications daily, they are at increased risk of adverse drug events — including death.

The number of chronic conditions also correlates with other forms of health care utilization. Multimorbid patients are much more likely than other patients to consult specialists often and to require hospitalization.[6] In addition, they are more apt to suffer complications while hospitalized, to have prolonged hospitalizations, and to require nursing home placement or recurrent hospitalizations.

The financial implications are considerable. In a recent Irish study, for example, health costs were almost five times higher in patients with four or more chronic conditions than in those without chronic disease.[7] In a similar US study, the cost differential was twice as large: health care spending was 10 times higher in patients with four or more coexisting conditions than in those without chronic illness.[8]

Coping with the consequences
Despite the dramatic financial impact that multimorbidity can produce, few health systems are well prepared to deal with it, for three primary reasons.

First, the sheer complexity of care these patients require leaves them at increased risk of receiving suboptimal treatment. A patient with congestive

[5] Vogeli C et al. Multiple chronic conditions: prevalence, health consequences, and implications for quality, care management, and costs. *J Gen Intern Med.* 2007;22(Suppl 3):391-395.
[6] Starfield B et al. Comorbidity and the use of primary care and specialist care in the elderly. *Ann Fam Med.* 2005;3:215-222.
[7] Glynn LG et al. The prevalence of multimorbidity in primary care and its effect on health care utilization and cost. *Fam Pract.* 2011;28:516-523.
[8] Robert Wood Johnson Foundation. *Chronic Care: Making the Case for Ongoing Care.* 2010.

heart failure, diabetes, and chronic pulmonary problems, for example, needs interdisciplinary care that coordinates and harmonizes the various treatments prescribed. Yet care coordination rarely occurs. Instead, patients are often given conflicting instructions from multiple health care providers and may be left to themselves to sort out the conflicts. In most health systems, no one is available to explain the details of their treatments to them, their families, and their other care givers. No one takes the time to coach them on how to cope with their complex and often confusing treatment regimens. No one is available to ensure adequate follow-up; to monitor for drug-drug, drug-disease, or disease-disease interactions; or even to determine whether all the drugs prescribed are actually necessary. Under these circumstances, it is hardly surprising that health care utilization and costs are so high.

Second, the education most health professionals undergo remains comparatively siloed; not many of them (not even many general practitioners) receive sufficient training to provide care beyond their area of specialization. Siloed thinking is often inadvertently reinforced by treatment guidelines, which typically focus on a single disease. Clinical research also reinforces siloed thinking — many clinical trials exclude multimorbid patients, and few studies attempt to address the treatment of multiple conditions simultaneously.

Third, most health systems fail to give health professionals appropriate incentives to integrate care effectively. Too often, doctors are paid to treat specific problems, not to collaborate with colleagues in other specialties. Similarly, too few systems give any health professionals incentives (financial or otherwise) to use care coordination to improve patients' health or reduce the number of treatments needed.

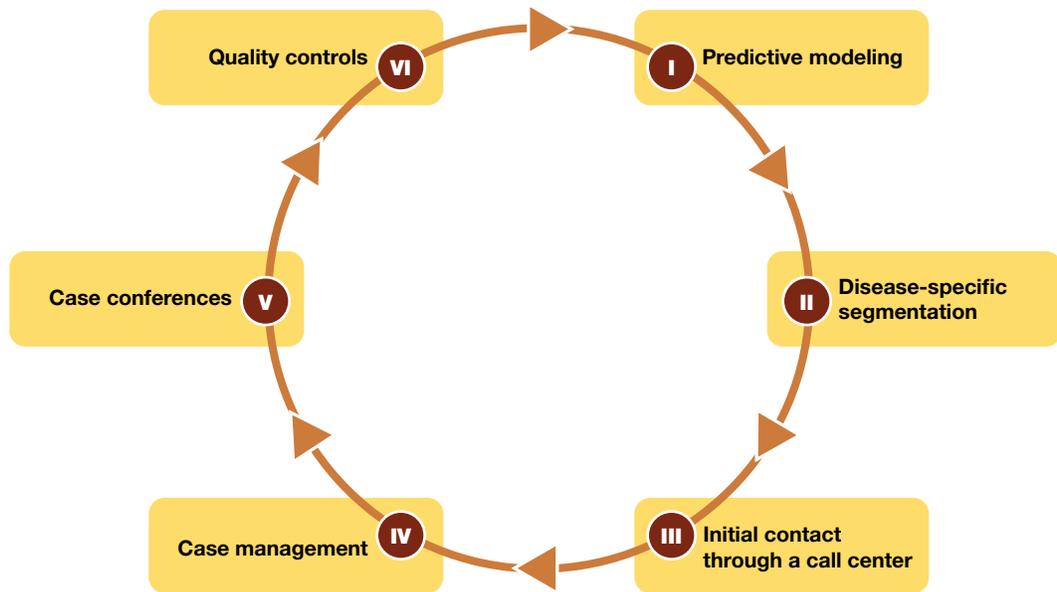## Using data to improve care while reducing costs

Siloed thinking and poorly integrated care hinder a health system's ability to provide high-quality services for all patients, but the consequences are especially severe for patients with complex care needs. Greater care integration can improve quality of life for many of them. It can also lower health care costs if the level of integration is matched to the severity of patient risk (Exhibit 1). How can this matching be done?

A few payors and health systems have found ways to identify patients with a similar set of characteristics: poor compliance with complex treatment regimens, insufficient coordination of care, recurrent hospitalizations, and very high health care costs. These patients can then be offered individualized, integrated case management within their own homes, using interventions that have been shown to improve outcomes (Exhibit 2). In our experience, most of these patients have multimorbidity.

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Exhibit 2   **Targeted case management includes six elements**

Quality controls **VI**

Predictive modeling **I**

Case conferences **V**

Disease-specific segmentation **II**

Case management **IV**

Initial contact through a call center **III**

Patient identification

The process required to identify appropriate candidates for case management is not simple, but the results achieved make the effort worthwhile. In many cases, sophisticated predictive modeling is used; one German payor, for example, analyzes more than 200 variables in its model. We will describe the approach this payor has developed to illustrate how health systems and other payors can translate insights derived from administrative data into better care delivery, improved patient health, and lower costs. A few other organizations are using similar approaches to achieve comparable results.

The payor begins by calculating each patient's health care costs from the previous year to identify those with spending levels above a specific threshold. It then determines both the number and type of chronic conditions each patient has; special weight is placed on diseases that carry a high risk for recurrent inpatient stays, such as chronic heart failure and chronic obstructive pulmonary disease. Other important variables include the medications and adjuvant therapies (e.g., nebulizers and home oxygen) prescribed for each patient.

In addition, the payor looks for information suggesting that the treatments may have been mishandled or neglected — for example, the number and type of complications (e.g., decubital ulcers and malnutrition) each patient has suffered recently. It also checks for certain hospitalization patterns, such as three or more stays for the same diagnosis. However, the payor also monitors for evidence suggesting

that patients are so ill that targeted case management would provide neither clinical nor economic benefits.

Predictive modeling is not a one-time-only event. Instead, the payor repeats the analysis regularly so that new patients can be added and information about existing patients can be updated. This method ensures that high-risk patients are identified as early as possible, before their health status deteriorates further and their health care costs skyrocket.

Disease-specific segmentation

Once the predictive modeling is completed, the payor has a medical expert review the records of all identified high-risk patients and categorize them according to their primary disease, likelihood of recurrent hospitalizations, and previous hospital stay pattern. Given the complexity of the patients' conditions, a decision about the primary issue to be addressed by case management can be difficult, which is why expert medical review is required. The decision is generally based on the most striking diagnosis or disease focus (usually, a discharge diagnosis or the chronic condition that led to the recurrent need for expensive treatments).

Initial contact and case management

Once each high-risk patient's case has been reviewed, he or she is contacted by one of the payor's call agents, who provides guidelines and manuals geared specifically to the patient's conditions. In addition, the call agent arranges to have a case manager visit the patient at home.

The case managers are typically nurses with long professional track records; many of them have significant management experience or have worked in intensive care units and thus are used to coping with complex health care needs. The

case managers work with the patients to develop personalized care plans tailored to their conditions to ensure that they are receiving optimal treatment. In addition, the case managers evaluate the medications the patients use; determine whether they are being taken appropriately; arrange for prescription changes to be made, when necessary; and find ways to help the patients increase their compliance with treatment.

The case managers also evaluate the patients' social situation to determine who the primary care givers are and how much help is available. In addition, they also educate the patients (and their care givers) about how to cope with their conditions and the treatments required, help them make behavioral changes to slow disease progression, and provide a range of other services (Exhibit 3).

The case managers receive a carefully developed suite of materials to help them work with the patients. The materials include a condensed medical manual that discusses all of the most common chronic conditions, as well as consent forms and educational flyers for patients. In addition, the case managers are given checklists and electronic forms to fill out after each patient visit so that they can document their actions, recommendations, and suggested next steps.

On average, each case manager works actively with 30 patients at a time. Not all patients require close support year round, though. As a result, a typical case manager can handle 60 or more patients a year, varying the intensity of care delivered to each one as needed.

Case conferences

The case managers do not work in isolation. Every two weeks, they meet with a multidisciplinary panel of experts, including doctors

Exhibit 3   **Case manager activities during home visits**

General medical problems	• Identify what medical problems the patients were encountering as a result of their conditions • Take steps, as necessary, to help patients address those problems and get their conditions under better control
Education	• Teach patients (and their care givers) about their conditions and how to avoid deterioration • Help them better understand what should be done when problems develop – especially when emergencies arise
Drug and adjuvant therapy	• Identify what medications and adjuvant treatments (e.g., home oxygen) the patients have been prescribed • Determine whether any of the drugs are contraindicated because of coexisting conditions • Evaluate whether the patients are taking their medications and using the adjuvant therapies appropriately • Consult with the patients' doctors to arrange for prescription changes, when necessary
Behavioral change	• Find ways to help the patients increase their compliance with treatment • Instruct them about other behavioral changes they can make to minimize the risk that hospitalization will be needed (e.g., teaching patients with chronic heart failure to avoid excessive fluid intake)
Social situation	• Evaluate the patients' social situation to determine who the primary care givers are and how much help is available • Determine whether there are any problems with the patients' social situation that would make it difficult to provide care at home • Teach care givers to recognize symptoms suggesting that a patient's health status is deteriorating • Enable care givers to prepare for emergencies (e.g., by helping them develop detailed emergency plans and lists of people to contact)
Patient-doctor relationship	• Assess the patients' relationships with their doctors • When necessary, take steps to improve that relationship (e.g., by encouraging the patients to consult their doctors more often or by getting the doctors to make home visits)
Assistance from ancillary health professionals	• Investigate whether the patients are receiving in-home care from nurses or other ancillary health professionals • If so, evaluate what results are being achieved and whether an increase in the amount of home care is appropriate • If not, determine whether this type of home care could help avoid hospitalization

from a range of specialties, nurses, pharmacists, and physical and respiratory therapists, to review treatment plans and progress. Patients are put on the list for review if they are newly enrolled in the program or if a senior case manager, who reviews the reports from case managers in the field, determines that re-evaluation or a problem-solving discussion is needed.

To facilitate discussion, all participants follow a pre-specified set of guiding principles and use the same presentation formats. The information reviewed for each patient includes hospitalization pattern, medication regimens, family and social surroundings, the latest actions taken during home visits, the impact of those actions, and any other issues that need to be addressed.

The panel carefully considers each patient's condition, keeping alert for evidence of deterioration. The multidisciplinary approach enables the participants to weigh the likely impact of a given event on the patient's overall health status, not simply on one condition. For example, will a change in a patient's drug regimen improve his asthma but worsen his heart disease? Multidisciplinary advice also helps the case managers check whether their focus of care is optimal for preventing the patient's health from worsening.

At the end of each case discussion, the participants agree on a plan for the patient, including any new actions that should be taken or other changes to be made. The case manager then carries out the revised plan. The expert panel and case manager also agree on the types of performance checks needed (e.g., a second home visit within two weeks to determine whether the patient is adhering to the new medication and exercise regimen). The goal is to improve how the patients are coping with their chronic conditions and thereby reduce the likelihood that they will require recurrent hospitalizations and other expensive treatments due to exacerbations of otherwise manageable diseases.
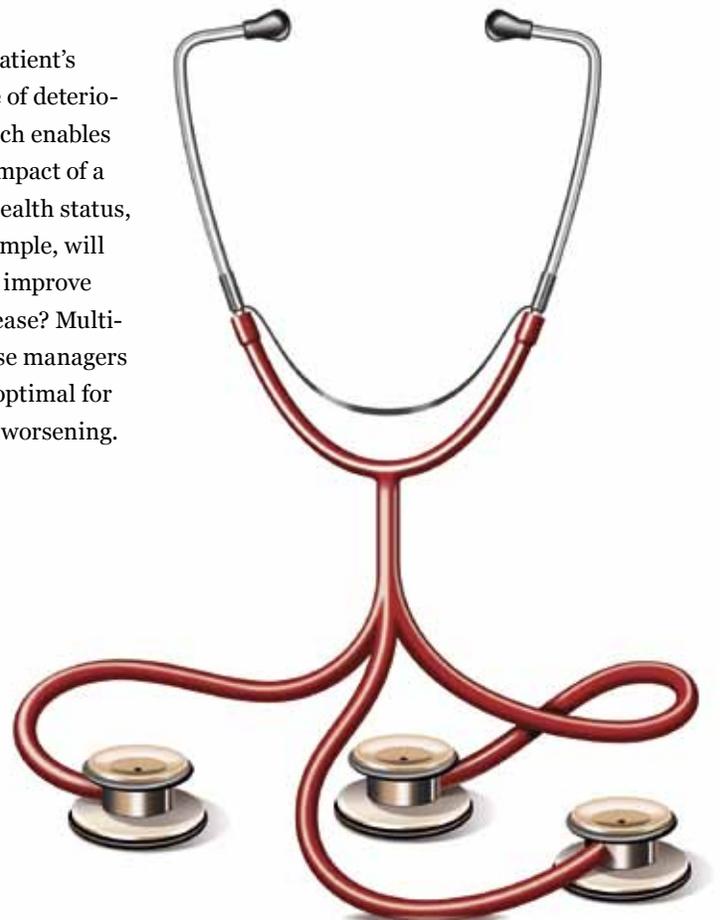
The experts on the multidisciplinary panels also help improve patient outcomes in other ways. When necessary, they can offer additional training to the case managers, as well as counseling on how to care for difficult patients. In addition, they can provide advice to the patients' primary doctors when questions about optimal treatment arise.

Quality controls

To further ensure that the high-risk patients are given the best possible care, the performance of all case managers is closely tracked through activity and achievement summaries. Some of the metrics used are data that the payor collects routinely, such as each patient's diagnoses, hospitalizations, and costs. Also included is information the case managers record after each home visit in the forms they fill out: How willing is the patient to accept home visits and cooperate with the case manager? What is the patient's general status? What actions did the case manager perform during each visit? What changes in the patient's health resulted from the last set of actions taken? Together, the two sets of data permit the payor to evaluate whether the program is controlling costs. Even more important, it enables the payor to determine whether the program is improving patients' health status and quality of life.

The quality control analysis, like the predictive modeling, is repeated regularly. In this way, the payor is able to identify good practices and create a positive feedback loop to refine the program.

Size of the impact

The German payor has already used its targeted case management approach in a pilot program with 300 high-risk multimorbid patients; it is now rolling out the approach more broadly.

The results it has achieved to date illustrate both the type of services that can be delivered to multimorbid patients and the impact those services can have.

Patient acceptance of the program has been strong. More than 80 percent of the patients contacted by call agents agreed to participate, and more than 70 percent of the patients enrolled were cooperative during the first home visit.

Most of the patients needed help with medical issues, such as getting their conditions under better control. However, many of them also required education about their conditions, advice and encouragement to improve treatment compliance, or instructions about what to do to reduce the risk of recurrent hospitalization. Some patients also needed more intense in-home care from nurses or other ancillary health professionals, which the case managers were able to arrange.

As a result of the program, the patients' health status has improved and hospitalization rates have decreased significantly. According to surveys of patients and their care givers, two factors explain the improved outcomes: the patients better understand how to manage their conditions and react to changes in their health status, and their care givers are better able to recognize the early signs of deterioration.

The reduced hospitalization rates translated to significant cost savings. In the program's first year, health care costs were 8 to 15 percent lower among the enrolled patients than among a comparable group of control patients. The total savings were three to four times the program's cost. Furthermore, the payor believes that its savings will be higher in the future, because

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some of its first-year spending was allocated to start-up, training, and process optimization. Once rolled out more broadly (to approximately 1,000 participants), the payor anticipates saving approximately €5 million per year.

Other health care organizations have used a similar approach to improve care delivery and reduce costs. For example, one California payor analyzed its records to carefully identify multimorbid patients with especially complex care needs and then utilized home visits, patient education, multidisciplinary team support, and other tools to reduce the need for repeat hospitalizations.[9] During the program's first 16 months, the payor was able to reduce the hospitalization rate among enrolled patients by more than 30 percent and the cost of care for those patients by 26 percent.

Similarly, an academic medical center in New England decided to mine its administrative records after it realized that a small fraction of its elderly patients had extraordinarily high health care costs. After identifying the patients with the highest spending levels, it assigned nurses to provide them with targeted support

and to more closely coordinate their care. Within a few years, the patients' health care utilization had decreased by more than 15 percent, and the cost of their care had fallen significantly.[10]

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Given current trends, the prevalence of multimorbidity is likely to continue to rise, putting further pressure on health system economics. Predictive modeling combined with individualized case management provides an effective way to lower the cost of care for multimorbid patients and, more important, to improve their health status and quality of life. ○

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[9] Sweeney L et al. Patient-centered management of complex patients can reduce costs without shortening life. *Am J Manag Care.* 2007;13:84-92.
[10] Gawande A. The hot spotters. *New Yorker.* January 24, 2011.