Estimating Treatment Benefits for the Elderly: The Effect of Competing Risks

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To fully involve patients in treatment decisions, physicians need to communicate future health prospects that patients will have both with and without newly diagnosed disease. These prospects depend not only on the risks patients face from the new disease but also on the risks they face from other causes. Nowhere is an understanding of these competing risks more relevant than in the care of the elderly.

In this study, we use the declining exponential approximation for life expectancy (DEALE) to provide a framework to help clinicians gauge the effect of competing risks as a function of age. Because older patients have many competing risks for death, the absolute effect of a new diagnosis on life expectancy is often relatively small. Consequently, the potential gain in survival even from perfect therapy may also be small. Moreover, no therapy is perfect, and the risks of therapy often increase with age. In the elderly, the combination of a high burden of competing risks and high rates of treatment-related complications conspires to reduce the net benefit of numerous interventions. We conclude that, compared with younger patients, the elderly should request only the more clearly effective treatments and should be willing to tolerate fewer associated complications before they agree to initiate therapy.

The current practice of encouraging patients to participate in treatment decisions requires that clinicians be facile in communicating the risks and benefits of therapy. Sharing numeric data can foster the process. However, because the format in which data are presented influences their interpretation (1–3), clinicians need to consider which format best describes the outcomes their patients face.

Consider the tension between relative and absolute risk reduction. The interpretation of even a large relative risk reduction is highly dependent on the baseline risk for the specific disease. A 50% reduction in mortality with early intervention, for example, appears different when the risk for death from disease is changed from 2 per 1000 to 200 per 1000. When the mortality risk is low, the absolute survival benefit is small—0.1% (2/1000 to 1/1000);

when the risk is high, the absolute benefit is great— 10% (200/1000 to 100/1000). In the former scenario, patients might reasonably choose to forego a noxious intervention. In the latter, however, patients might be more likely to accept the morbidity of treatment. Because this distinction between relative and absolute risk reduction is concealed when benefit is expressed in only relative terms, many have argued that relative risk reductions should be anchored by baseline risk so that the absolute benefit of treatment is clear (2, 4, 5)

However, an absolute measure of disease risk (or risk reduction from therapy) is not the ultimate outcome of interest to patients. Overall risk is more important. The difference is the risks patients face from other conditions—that is, competing risks. When competing risks are great, they matter. The importance of even a 10% absolute survival benefit from treatment is markedly diminished for a patient who is at greater risk for death from other causes, regardless of the proposed therapy. Such great competing risks are most prevalent among the elderly. Although physicians intuitively understand the relevance of competing risks, they may be less sure about how to quantify the effect. We provide a framework to help physicians gauge the effect of competing risks in their elderly patients.

Methods

Overview

To quantify the effect of competing risks, we used age-specific mortality data from U.S. vital statistics and the declining exponential approximation for life expectancy (DEALE) to model age-specific expectations for persons faced with a particular disease-related mortality. We sought to determine, for example, how a new disease with a 5-year mortality rate of 25% would affect the life expectancy of an average 70-year-old man. We then considered two refinements: the first, to better adjust for the individual patient (using self-reported health status), and the second, to describe more thoroughly the outcome (by including disabling events).

Modeling the Effect of a New Disease on Life Expectancy

Life expectancy and mortality are fundamentally related to probability estimates. In the general population, life expectancy decreases with increasing age, and annual mortality increases. Gompertz was the first to describe this complex mathematic relation using an exponential function that now bears his name. As life expectancy decreases, mortality rates become almost constant over time. When this occurs, the relation between survival and mortality rates can be approximated with a much simpler mathematic relation: a declining exponential function (the DEALE). This approximation was first validated and popularized by Beck and colleagues (6, 7) and is particularly suited to calculating the effect that a new risk has in older patients. The fundamental assumption behind this technique is that life expectancy equals the inverse of the annual mortality rate:

$$LE = 1/m$$

Because mortality rates are essentially constant probability estimates when assessed over relatively short time horizons, patient-specific mortality rates can be expressed as the sum of the disease-independent mortality rate (also known as age-specific mortality rate) and a disease-related mortality rate (also known as case-fatality or excess mortality rate):

$$m_{patient-specific} = m_{age-specific} + m_{disease-related}$$

Note that when disease-related mortality is zero (that is, when the patient does not have the disease or when the disease has no effect on survival), the patient-specific mortality rate (and thus life expectancy) is determined solely by the patient's age.

Calculation of the life expectancy estimates used in Figures 1 and 2 is relatively simple. Because Figure 1 is the central portion of our paper, we now describe it in detail. Normal life expectancy (the top curves) was determined from the most recent data (1991) from the National Center for Health Statistics, U.S. Department of Health and Human Services (8). On the basis of remaining life expectancy and the DEALE (6, 7), we calculated the age-specific mortality rate for each age cohort from 65 to 85 years of age. Combining the age-specific mortality with the hypothetical disease-related mortality allowed us to calculate the other four curves. The disease-related annual mortality rate can be calculated from 5-year disease-specific survival using the following equation:

$$m_{disease-related} = -\frac{1}{5}\ln\ (fraction\ alive\ after\ 5\ years)$$

Thus, if the disease-related 5-year mortality rate is 25% (and the 5-year survival rate is 75%), then the disease-related annual mortality rate is 0.06.

$$= -\frac{1}{5}\ln 0.75$$

A 70-year-old man, for example, has a life expectancy of 12.2 years or an annual age-specific mortality rate of 0.08.

$$= \frac{1}{12.2}$$

Given the foregoing disease, the man's all-cause annual mortality rate is 0.14 (= 0.06 + 0.08), and his life expectancy is 7.2 years.

$$= \frac{1}{0.14}$$

Thus, the sum of the age-specific and disease-related mortality rates gives the patient-specific mortality rate, the inverse of which is life expectancy.

Normal life expectancy serves as our proxy for disease-independent data. The mortality reflected in this measure is, of course, itself the result of several diseases in the elderly—primarily cardiovascular disease and cancer. The method we describe produces a valid approximation whenever the disease in question is not a major contributor to the age-specific mortality rate. For example, if the disease in question was all cardiovascular disease or all cancer, then much of the age-specific mortality rate would already account for the mortality from the disease. Completely successful therapy for such a broad category of disease would move a patient well above his or her normal life expectancy by removing the common causes of death. Thus, the method we describe should be applied only when the physician is considering more discrete diagnoses (for example, aortic aneurysm or breast cancer), which make a relatively small contribution to overall mortality.

To provide some quantitative data on how great a contributor to all-cause mortality a given disease can be without affecting our method, we did a sensitivity analysis that removed the contribution of a particular disease from "normal" life expectancy and accordingly revised the estimate of perfect treatment on life expectancy. For example, for a disease that accounts for 40% of all-cause mortality (such as all cardiovascular diagnoses), revised treatment benefit (in years) was three times the benefit estimated by our method. For a disease that accounts for 30% of all-cause mortality (for example, all cancers considered together), the revised benefit was twice as high as the benefit estimated by our

method. However, for a disease that constitutes less than 10% of all-cause mortality (this is the case for any individual cancer), the revised benefit is small (for example, < 20% higher than that estimated by our method).

Adjustments for Health Status

The adjustments for health status shown in Table 1 are based on data from the East Boston Senior Health Project. All participants were asked the following question: "Compared with others your age, would you rate your overall health as excellent, good, fair, or poor?" Analyzing the 1437 men and 2332 women separately, we used 5-year follow-up data to calculate, for each health status self-rating, the proportion of patients who died. The ratio of this health status–specific survival to overall survival served as our health status weight. A more precise analysis for men and women, using five age cohorts (ages 65 to 69 years, 70 to 74 years, 75 to 79 years, 80 to 84 years, and 85 years and older) produced essentially the same weights.

Overall, men who described themselves as in excellent health had a lower mortality rate than average (health status weight, 0.52). Men who reported themselves as in good, fair, and poor health had health status weights of 0.89, 1.26, and 1.88, respectively. The analysis for women showed health status weights of 0.64, 0.88, 1.08, and 1.82 for self-reported health status of excellent, good, fair, and poor, respectively.

To approximate a "physiologic" age to reflect health status, we applied the health status weights to four chronologic ages: 65, 70, 75, and 80 years. Using the age-specific annual mortality from U.S. Vital Statistics data (8) and the health status weight, we calculated a health status–adjusted mortality rate as the following:

health status adjusted mortality = ln (1 −

[*age-specific mortality* × *health status weight*])

We then returned to the Vital Statistics data to determine the age at which an average person would have this annual mortality rate. These data do not provide annual mortality rates for persons older than 85 years, forcing us to report "85 years and older" for the highest mortality rates. The process was done separately for men and women.

Future Disabling Events

The expectation of future disabling events (Figure 3) is based on cross-sectional data from the National Long-Term Care Survey (9). The definition of disability encompasses conditions ranging from institutionalization in the case of frail elderly persons to cognitive impairment or inability to perform two or more instrumental activities of daily living (such as preparing meals, shopping, walking distances, doing housework, and managing finances). These data report the proportion of disabled persons among those who are alive at specified ages, according to sex.

To create a comprehensive view of the future for a person who is not disabled, we estimated the 5-year expectation for one of three states: dead, disabled, and well. We first used Vital Statistics data (8) to calculate the proportion of each age and sex cohort that would be expected to die within 5 years. To calculate the proportion of those who were still living at 5 years that would become disabled, we used the cross-sectional data to model the incidence of disability. This required some assumption about the proportion of the observed disability in the cross-sectional data that represented preexisting disability—in other words, an assumption about the survival among those identified as disabled during the previous period. We assumed their mortality rate to be twice that of the age and sex average, a conservative estimate of the effect of disability on mortality (10, 11). Those who survived for 5 years represented the preexisting disability in the cross-sectional data, and the remainder represented new disability. Thus, we calculated the frequency of newly disabled individual persons over a 5-year period for each age and sex cohort. The persons who were not disabled at the outset and were neither dead nor disabled at 5 years were considered well.

Effect of New Disease

For simplicity, we begin our discussion of the effect of a new disease using the most unambiguous outcome measure: survival. Consider a woman newly diagnosed with an indolent disease who asks her physician what she can expect in the future. The physician knows information specific to the new disease: namely, that approximately 10% of patients with this diagnosis die of the disease within 10 years. Depending on the patient's age, however, other causes of death may loom much larger (Figure 2). To answer the patient's question, the physician must gauge a comprehensive expectation for the future, one that combines the effects of the disease with which she is immediately concerned and the other conditions that she might develop or might already have.

A summary measure of future survival is derived from all-cause mortality. When all-cause mortality is reported for a cohort of patients with a particular disease, it reflects both the effect of disease-related mortality and the competing risks for death from other causes. If mortality is based on a cohort of
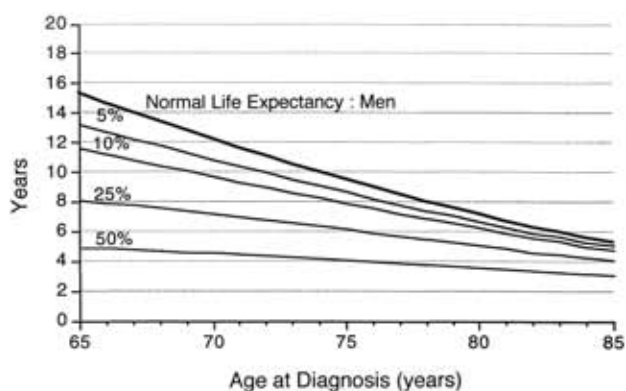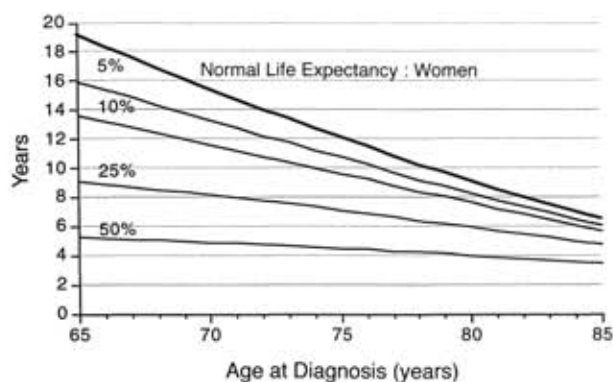
Figure 1. The effect of selected disease-related mortality rates on the remaining life expectancy of women (*left*) and men (*right*) at the time of diagnosis. Normal life expectancy is indicated by the top curve; the four curves beneath the top curve represent life expectancies resulting from 5-year disease-related mortality rates of 5%, 10%, 25%, and 50%.
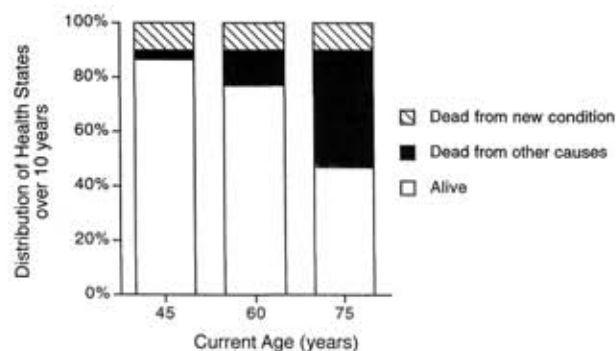

Figure 2. The effect of age on the distribution of health states in the future. This example considers the distribution of health states over 10 years for a woman newly diagnosed with a disease for which the 10-year disease-related mortality is 10%.
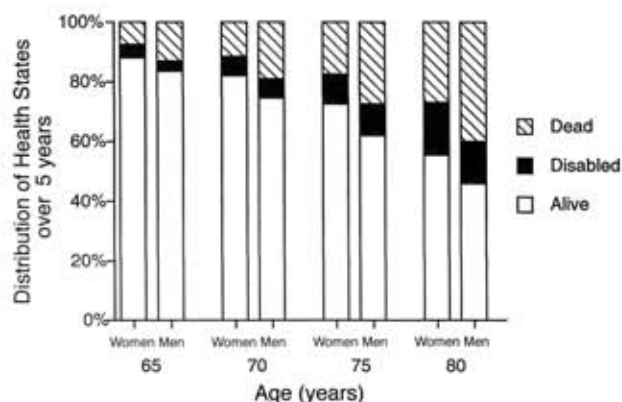

Figure 3. The estimated effect of age on the expectation of disability for nondisabled men and women 5 years in the future (9). The definition of disability encompasses conditions ranging from the institutionalized frail elderly to persons who are cognitively impaired or cannot perform two or more instrumental activities of daily living.

patients whose average age is similar to that of the patient being advised, it is a sound measure to communicate what to expect in the future. Sometimes, however, all-cause mortality is not reported. And unfortunately, even when it is, it is often based on cohorts in which the elderly are poorly represented. Such studies produce data not generalizable to the elderly.

Other information, however, can help quantify the effect of new disease on the elderly. All-cause mortality is simply the sum of disease-related and disease-independent mortality (the mortality from other conditions). Age-specific life expectancy, which is calculated from annual mortality rates in the general population, is the most familiar metric for expressing disease-independent mortality. Clearly, an individual patient's expectation for future survival is modified by his or her age. That a 20-year-old woman can expect to live 60 years, whereas her 80-year-old grandmother can expect to live only 9 years, for example, reflects a substantial difference in their annual risks for fatal disease (8). In effect, the normal life expectancies for elderly women and

men shown in Figure 1 aggregate the various competing risks for death and thus serve as a proxy for future survival without the new disease.

However, disease-related mortality estimates (also known as case-fatality estimates) exclude information about the future without the new disease and thus say nothing about competing risks. By combining disease-related and disease-independent mortality estimates, clinicians can surmise the average survival of patients after they have received a diagnosis of a new medical condition (Figure 1). Using the DEALE (6, 7), we constructed additional life expectancy curves for four disease-related (excess) 5-year mortality percentages: 5%, 10%, 25%, and 50% (that is, 5-year survival rates of 95%, 90%, 75%, and 50%). The overall effect of a new disease on life expectancy at different ages can be seen as the distance between the appropriate excess mortality curve and the normal life expectancy curve.

Consider, for example, a man in average health who has moderate-grade, clinically localized prostate cancer. He faces a 5% cancer-related mortality rate at 5 years. The right-hand panel of Figure 1

shows that if he is 65 years of age, his life expectancy will be diminished from slightly more than 15 years to slightly more than 13 years. In contrast, if he is 85 years of age, his life expectancy will be diminished from slightly more than 5 years to roughly 5 years. Similarly, a 65-year-old man with head and neck cancer (a disease that carries roughly a 50% mortality over 5 years) will have his life expectancy reduced by about 10 years; his 85-year-old counterpart will have a reduction of about 2 years.

One observation stands out with regard to Figure 1: The life expectancy curves move closer together as age increases. This reflects an important principle. Because competing risks increase with age, a given disease-related mortality has less of an absolute effect on life expectancy as patients grow older.

An important consequence of this principle is that rough approximations of disease-related mortality may be sufficient in the very old. For these patients, life expectancy is not particularly sensitive to imprecision in disease-related mortality. This is fortunate, because disease-related mortality rates are either imprecise or are not available for most cancers and chronic diseases. Nevertheless, clinicians readily distinguish relatively high-risk conditions such as lung and stomach cancers associated with a 5-year mortality rate greater than 50% from much less life-threatening diagnoses, such as mild angina without heart failure, low-grade prostate and endometrial cancers, and small (< 2 cm) breast masses that are not associated with regional adenopathy. Therefore, this level of precision, although not ideal, still provides useful information. Although a young woman should care a great deal if a 5-year prognosis changes by a few percentage points, an 85-year-old woman should be less concerned about such differences because they have little influence on her life expectancy.

Treatment Benefits

Life expectancy is also a useful metric for estimating the upper limit of treatment benefit as a function of age. Completely effective treatments should return patients to their normal life expectancies. In terms of Figure 1, this means a return to the highest curve. Thus, the best case for the patient with localized prostate cancer would be a 2-year increase in life expectancy for a 65-year-old person and an increase of a few months for an 85-year-old person. Similarly, the best case for a patient with head and neck cancer would be a 10-year increase in life expectancy for the 65-year-old and a 2-year increase for the 85-year-old.

We must make an important caution about this

Table 1. Estimated Physiologic Age of Elderly Patients Adjusted for Their Self-Reported Health Status*

Chronologic Age, y	Physiologic Age†			
	Self-Reported Health Status			
	Excellent	Good	Fair	Poor
Men				
65	58	64	68	73
70	62	69	73	78
75	67	74	78	83
80	72	79	83	85+
Women				
65	60	64	66	72
70	65	69	71	77
75	70	74	76	82
80	75	79	81	85+

* A "best guess" about the effect of health status on expected mortality has been calculated using data from East Boston Senior Health Project (see Methods).
† Physiologic age is determined by the self-reported health status.

method: The estimate of treatment benefit is not valid when the new disease in question is a major contributor to all-cause mortality (that is, > 10%; see the Methods section). Thus, it is not appropriate to use this method when gauging the benefit of eliminating all cardiovascular diagnoses or all cancer (either of which would considerably elevate "normal" life expectancy). The method is appropriate, however, for most diagnoses that are more discrete. It is applicable, for example, to the decision of whether to treat an aortic aneurysm or any individual cancer (for example, lung or breast cancer).

Two additional observations from Figure 1 should now be noted. First, because younger patients face smaller competing risks, they always have a greater potential survival gain from disease-specific therapy. Second, regardless of age, patients with more aggressive disease (in terms of disease-related mortality) have a greater potential survival gain from therapy than do those with less aggressive disease.

Of course, the assumption of completely effective treatment is untenable. Nevertheless, the upper bound benefit estimate obtained from Figure 1 is valuable in communicating the best-case scenario for treatment. Efforts to refine the estimate of true net benefit from treatment are often hampered by a familiar obstacle: lack of data. Despite this obstacle, however, two qualitative refinements are possible.

First, treatments are likely to work better in patients with mild disease. Low-grade, clinically localized prostate cancer, for example, generally does not extend beyond the prostate and thus is easily extirpated by surgery. However, because disease-related mortality is also low, even "near-perfect" therapy offers relatively small benefit (12). High-grade prostate cancer, on the other hand, is much more aggressive and is associated with a much higher disease-related mortality. Treatment often fails because microscopic spread has usually occurred. Thus, although "near-perfect" therapy would pro-

vide greater benefit in this case, the low efficacy of treatment dampens the net treatment benefit. This situation is common to most cancers: Although treatment usually cures most early-stage (or, in some cases, low-grade) cancers, its effectiveness is markedly attenuated in patients with more advanced disease. Consequently, physicians face a dilemma: Treatment success is often most difficult to achieve in the patients who would gain most from it.

Second, treatment-related risks increase with age. Many physicians have found that their older patients are more prone to have adverse effects from therapy. Increasing age has now been empirically shown to be an important risk factor for complications after surgery and toxicity after chemotherapy and therapy with other medications (13–16).

The combination of a higher burden of competing risks and higher rates of treatment-related risks conspires to reduce the net benefit of numerous interventions in the elderly. Compare the estimated net benefit of early surgery for a small (< 5 cm) abdominal aortic aneurysm for two women, aged 65 years and 85 years, with otherwise normal life expectancies. The disease-related mortality (from rupture) has been estimated to be approximately 10% over 5 years (17). Given the competing risks for death, the greatest possible benefit for the 65-year-old is about 5.5 years of survival; for the 85-year-old, it is less than 9 months of survival. Furthermore, these estimates assume that treatment is 100% effective and do not account for the surgery-related mortality of aneurysm repair. The risk for surgery-related mortality is also a function of age: 3.4% for the 65-year-old and 7.7% for the 85-year-old (18). The 85-year-old must weigh the possible benefit (9 months) against the risk for surgery-related mortality (1 in 13) when deciding about treatment.

It is reasonable to prescribe therapies that are well tolerated (such as treatment with diuretics, angiotensin-converting enzyme inhibitors, and β-blockers), regardless of the patient's age. These agents offer some hope for reducing the morbidity and mortality from heart failure and angina pectoris, and they pose relatively small treatment risks. But more invasive procedures, such as revascularization of coronary arteries for angina, endarterectomy for symptomatic carotid disease, and elective aortic aneurysm repair, should be scrutinized more carefully. For the elderly, net treatment benefit strikingly diminishes as treatment risks increase.

Refinements

Adjustments for Patient Health Status

Clinicians recognize that "normal life expectancy" does not apply to all of their patients. We are all familiar with patients who "appear younger than their stated age" or those who are prime examples of "vigorous octogenarians." Indeed, patients who report themselves to be in excellent health do live longer on average (19). Table 1 uses 5-year survival data from the East Boston Senior Health Project to help quantify the association between self-reported health status and life expectancy. A 70-year-old man who claims to be in excellent health, for example, has the estimated life expectancy of a 62-year-old man and thus is likely to live longer than an "average" 70-year-old. A self-report of "excellent health" has somewhat less effect on life expectancy for women; a 70-year-old woman in excellent health is similar to an average 65-year-old woman. Equally relevant is the predictive value of a self-report of "poor health." In the case of a 70-year-old, poor health equates to the life expectancy of a 78-year-old (for men) or of a 77-year-old (for women). A clinician may use the estimates in Table 1 to transform a chronologic age to a physiologic age before using Figure 1.

Quality of Life

Many treatments are prescribed for the elderly primarily to enhance quality of life rather than to increase survival. For this reason, life expectancy is not the only metric for estimating net treatment benefit. Nevertheless, clinicians should be clear about the purpose of therapy when communicating with patients.

Even when the goal of treatment is to improve quality of life, life expectancy is relevant. Many treatments involve any of several up-front risks: death, excess illness, or simply life disruption. In the presence of such risks, patients should consider interventions for improving quality of life in the context of expected benefit. This is a function of both the quality of each year and the number of years of a patient's expected survival. Consider an 80-year-old woman who is an ex-smoker and has long-standing non–insulin-dependent diabetes and intermittent claudication. She reports her health status as "good." During the past 6 months, she has noticed that her leg pain starts sooner and lasts longer. She asks about vascular surgery. How might she be counseled?

Given her history of diabetes and claudication, she is facing a 5-year excess mortality of 5% to 10%. The surgery may improve her quality of life, in terms of better ambulation during the time she remains healthy and nondisabled from other diseases. However, this treatment will not lengthen her life, and the duration of improved function is limited by her remaining life expectancy—which, by using Table 1 in combination with the left-hand panel of Figure 1, her clinician estimates to be

about 8 years. Peripheral vascular surgery carries a measurable risk for perioperative mortality (according to 1992 Medicare data, this risk is about 3% to 4% for patients with diabetes in this age group) and postoperative morbidity. She would probably be hospitalized for a little longer than 1 week. Numerous trips to physician offices and additional out-of-pocket expenses are also likely to be involved. That it will take time to regain function is certain. When discussing treatment to improve quality of life with a patient, the clinician should present information about 1) the likelihood of these additional concerns and 2) the duration of benefit. Only then will the patient be able to weigh the potential gains of therapy against the potential harms.

Future Disabling Events

Patients should also consider the effect of other disabling events on future quality of life. Figure 3 shows that the frequency of disability increases with age and is more common in women (9, 10, 20). In general, for example, an 80-year-old woman has about a one-in-four chance of being disabled (at a minimum, unable to perform two instrumental activities of daily living) if she survives for 5 years. Because this woman is already partially disabled, her risk for future disability is even higher. Thus, the potential 8 years of benefit, discussed above, may include a substantial period of disability. Just as competing mortality risks reduce longevity benefits of treatment, future disabling events reduce the overall quality-of-life benefits. These estimates of rates for future disabling events provide additional information to elderly patients—information with which they can better judge the potential benefits of treatment for a specific disease.

Shared Decision Making or Ageism?

Some may view the communication of limited life expectancy and increased risk of therapy to the elderly as a thinly veiled form of age discrimination. Indeed, the information presented here may, and probably should, dissuade some elderly patients from choosing some therapies. However, the accurate communication of risk and benefit only promotes the interests of elderly patients, allowing them to make informed choices.

In contrast, to deny elderly persons access to information relevant to treatment decisions would be a thinly veiled form of paternalism. The reality of competing risks means that the elimination of a disease-related outcome has a smaller long-term effect in the elderly. Barring such knowledge, the elderly may fail to carefully scrutinize the risks and life disruptions associated with therapy. Having access to this knowledge, on the other hand, only encourages patients to consider their own values and preferences—the essence of shared decision making.

Conclusion

The reality of aging favors a cautious approach to detecting disease and managing medical problems. Physicians have long recognized that advancing age brings attenuated prospects for health. By illustrating the effect of competing risks, we have shown that the potential benefit for even completely effective therapy decreases with age. Treatment risk often increases with age, further attenuating the net gain. Thus, compared with younger patients, the elderly should request only the more clearly effective treatments and should be willing to tolerate fewer associated complications before agreeing to initiate therapy.

Clinicians should be aware that our analysis has some limitations. First, it is a deliberately simplified decision aid meant to be generalizable to a diverse set of diseases. For a specific disease, expert analysts might well debate the particulars of the exact method used (for example, additive compared with proportional hazard functions) (21) or explore methodologic refinements (such as time-varying all-cause mortality rates) (22). Our approach must be viewed, therefore, as only a proxy for a more thorough decision model. Second, the framework provided by our approach is limited to diseases that are not major contributors to all-cause mortality. Thus, it does not apply to decisions about strategies that are directed toward eliminating all cardiovascular diagnoses or all cancers.

Finally, readers should recognize that age is not a perfect predictor of the competing risks faced by an individual person. Clearly, many other variables are also relevant. As we have shown, one variable is self-assessed health status. Other studies have shown the relevance of physiologic and functional measures (11). Future research in this area should focus on finding easily accessible metrics that improve the ability to predict competing risks for an individual patient.

However, clinical decisions involving the elderly cannot wait for these perfect data, because such decisions are being made daily. Also, the communication of risks and benefits should be based on some knowledge about competing risks. Physicians who counsel elderly patients already deal with a lack of perfect data about the natural history of disease and the efficacy of treatment. Although informing patients about their competing risks is fraught with similar uncertainty, an obvious place to start is with the patient's age. We hope that our method gives clinicians a practical tool for improv-

ing communication of risk with their elderly patients—a tool that is meant to help clinicians share the principles and patterns of competing risks and not to enable them to promise patients a particular outcome.

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