

# Individualizing Prevention for Older Adults

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Prevention can help older adults avoid illness by identifying and addressing conditions before they cause symptoms, but prevention can also harm older adults if conditions that are unlikely to cause symptoms in the individual's lifetime are identified and treated. To identify older adults who preventive interventions are most likely to benefit (and most likely to harm), we propose a framework that compares an individual's life expectancy (LE) with the time to benefit (TTB) for an intervention. If LE is less than the TTB, the individual is unlikely to benefit but is exposed to the risks of the intervention, and the intervention should generally NOT be recommended. If LE is longer than the TTB, the individual could benefit, and the intervention should generally be recommended. If LE is similar to the TTB, the individual's values and preferences should be the major determinant of the decision. To facilitate the use of this framework in routine clinical care, we explored ways to estimate LE, identified the TTB for common preventive interventions, and developed strategies for communicating with individuals. We have synthesized these strategies and demonstrate how they can be used to individualize prevention for a hypothetical beneficiary in the setting of a Medicare annual wellness visit. Finally, we place prevention in the context of curative and symptom-oriented care and outline how prevention should be focused on healthier older adults, whereas symptom-oriented care should predominate in sicker older adults. *J Am Geriatr Soc* 66:229–234, 2018.

**Key words:** prevention; life expectancy; time to benefit; cancer screening

**P**revention holds the promise of maintaining good health by identifying and treating conditions before they cause

symptoms. The idea of avoiding illness is tremendously popular<sup>1</sup> and led to development of the Medicare Annual Wellness Visit, which reimburses providers for a visit focusing on prevention in older adults,<sup>2</sup> but prevention has the potential to harm as well as help.<sup>3</sup> Prevention requires interventions (tests or treatments) for asymptomatic conditions that can cause immediate complications with the hope of better health in the future. Time to benefit (TTB) is the time between the preventive intervention (when complications and harms are most likely) to the time when health outcomes improve.<sup>4,5</sup> Just as different interventions have different magnitudes of benefit, different preventive interventions have different TTBs, with estimates ranging from 6 months (statin therapy for secondary prevention) to longer than 10 years (prostate cancer screening).<sup>6</sup>

For older adults, the TTB, or the answer to the question “When will it help?” is a critical factor in determining whether a preventive intervention is more likely to help or harm. For older adults whose life expectancy (LE) is substantially shorter than the TTB for a preventive intervention, performing that intervention exposes them to the immediate risks of the intervention with little likelihood of surviving long enough to benefit.<sup>4,7,8</sup> In addition, the factors associated with limited LE (e.g., older age, comorbidities, functional limitations) are strong risk factors for complications of interventions.<sup>9</sup> Thus, the complications of prevention are also most likely to harm older adults who are least likely to benefit because of limited LE. Many guidelines now explicitly endorse the central role of LE in targeting prevention, recommending preventive interventions such as cancer screening only for individuals with a long LE.<sup>10–13</sup>

To maximize the chances that prevention helps (rather than harms), we propose a framework to individualize prevention that focuses on comparing an older adult's LE with the intervention's TTB. Then, we will provide guidance on determining LE, determining TTB for different interventions, and communicating with individuals. We will highlight how this framework could be applied in the context of an annual wellness visit. Finally, we will conclude by placing prevention in the context of other health-care needs of older adults.

## FRAMEWORK FOR INDIVIDUALIZED PREVENTION

We propose juxtaposing estimated LE with estimated TTB in decision-making for all preventive interventions in older

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adults. Specifically, LE should be estimated for each individual, and the TTB for preventive interventions should be determined. When LE is substantially longer than TTB, the intervention should be recommended because it is more likely that the intervention will benefit than harm the individual. Conversely, when TTB is shorter than LE, the intervention should not be recommended because it is more likely to harm than benefit the individual. When LE is close to TTB, the benefits and harms of the preventive intervention are similar, and personal preferences (e.g., the degree of importance placed on the potential benefits and harms) should play the dominant role in whether the preventive intervention is recommended.

## HOW TO ESTIMATE LIFE EXPECTANCY

We will highlight 2 ways to estimate LE for older adults. First, U.S. life table data can be used to estimate LE for the average person at any age. To account for individuals who may be more or less healthy than average, life tables can provide the LE of the healthiest and least healthy quartiles<sup>7</sup> (Figure 1). To use these tables, a clinician must first estimate whether an individual is in the healthiest quartile, least healthy quartile, or one of the middle quartiles. Then, the clinician can find the appropriate age and sex data, which provide an estimate of LE for the individual.

The second way to estimate LE uses previously developed mortality indexes. A systematic review identified 16 unique mortality indexes for older adults in a variety of settings (e.g., hospitalized individuals, nursing home residents, individuals being seen in clinic).<sup>6</sup> To facilitate use by clinicians, these mortality indexes have been compiled and translated into online calculators at ePrognosis.com. To use these indexes, a clinician needs to enter the data elements required for the specific index (age, sex, comorbidities, functional limitations), and the website will provide the predicted mortality risk or LE.

## HOW TO ESTIMATE TTB

Although the measures and methodologies to quantify the magnitude of benefit (relative risk reduction, number needed to treat) have been standardized and are now widely accepted, the methodology to estimate TTB is relatively new. We developed and published a survival meta-analysis methodology to quantify the TTB between breast and colorectal cancer screening and observed mortality reduction.<sup>4,14</sup> Combining data from high-quality trials of screening mammography, we found that it would take 10.7 years (95% confidence interval (CI) = 4.4–21.6) to prevent 1 breast cancer death for 1,000 women screened.<sup>4</sup> Similarly, it would take 9.4 years (95% CI = 7.6–11.3) to prevent 1 colorectal cancer death for 1,000 persons screened with flexible sigmoidoscopy. Because major complications from screening occur in approximately 1 in 1,000 persons, we believe that targeting cancer screening to adults with a LE of longer than 10 years will maximize the benefits and minimize the harms of breast and colorectal cancer screening.

A second methodology for determining TTB relies on statistical process control methods. Re-analyzing data from the Fracture Intervention Trial (FIT), this methodology

found that for women younger than 70, the TTB is 19 months, whereas for women aged 70 and older, the TTB is 8 months.<sup>15</sup> Both methods calculate a TTB (1.5 years to achieve an absolute risk reduction of 5%) by reexamining data from trials that report magnitude of benefit for a fixed time interval (e.g. HR 0.80 for median follow-up of 3.5 years). Going forward, the ideal solution would be for all trials of interventions for older adults to report a TTB, which would obviate the need for subsequent analyses to estimate TTB.<sup>3</sup>

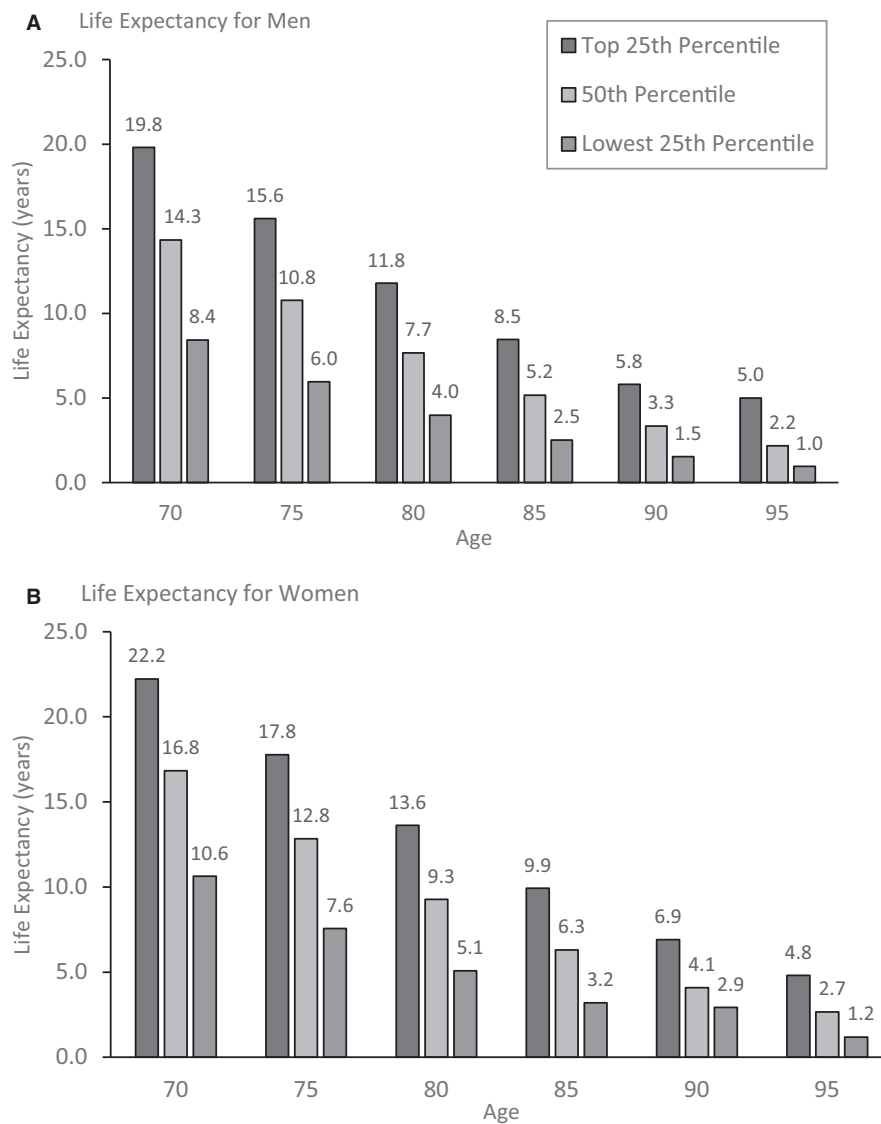
## TTBS FOR SPECIFIC INTERVENTIONS

Table 1 provides a summary of TTBS for preventive interventions, ranging from bisphosphonates for osteoporosis (8–19 months) to prostate cancer screening (10–15 years). A recent review suggested that the TTB is 1 to 2 years for primary prevention of cardiovascular events for hypertension.<sup>16</sup> Studies that included secondary prevention and studies that focused stroke outcomes generally showed shorter TTBS.<sup>16</sup> The recent Systolic Blood Pressure Intervention Trial (which included some secondary prevention patients with baseline cardiovascular disease) suggested that, for individuals aged 75 and older, those who are fit, with have a lower baseline risk of events, have a longer TTB (~2 years), whereas frail individuals with a higher baseline risk of events have a shorter TTB (~1 year).<sup>17</sup>

For primary prevention of cardiovascular events for hyperlipidemia using statins, a narrative review found that the time to decrease myocardial infarction ranged from 2 to 5 years.<sup>18</sup> Although only few studies report TTB data, those that have focused on younger individuals reported shorter TTB (Asymptomatic Carotid Artery Plaque Study, mean age 61, TTB 1.5 years<sup>19</sup>) than those that have focused on older adults (Justification for the Use of Statins in Prevention: An Intervention Trial Evaluating Rosuvastatin, mean age 66, TTB 2.5–3 years).<sup>18,20</sup> A recent meta-analysis focusing on trials reporting results for adults aged 65 and older found that statins decreased risk of myocardial infarction and stroke but not cardiovascular or all-cause mortality over 3.5 years.<sup>16,21</sup>

For prostate cancer screening, an American Urological Association review noted that there was strong evidence of lack of treatment benefit in men with a LE of less than 10 to 15 years.<sup>11</sup> Specifically, the Scandinavian Prostate Cancer Group Study Number 4 found that, for men aged 65 and older, prostate cancer treatment (radical prostatectomy) did not result in lower all-cause or prostate cancer mortality than watchful waiting at 15 years, suggesting that, although prostate cancer screening TTB may be 10 years for those younger than 65, it is longer than 15 years for those aged 65 and older.<sup>22</sup>

In addition to preventive interventions, TTB can also inform decisions about procedures when one procedure has better longer-term outcomes but a second procedure has better shorter-term outcomes. For example, for abdominal aortic aneurysm repair, endovascular procedures result in better short-term outcomes (less pain, lower short-term mortality) but worse long-term outcomes (greater risk of late graft failure and need for re-intervention) than open surgical repair. Current data suggest that it takes 6 to 8 years for the long-term benefits of open



**Figure 1.** Upper, middle, and lower quartiles of life expectancy for women and men at selected ages. From U.S. life table data (<https://www.ssa.gov/oact/STATS/table4c6.html>). Adapted from: Walter LC, Covinsky KE. Cancer screening in elderly patients: A framework for individualized decision making. *JAMA* 2001;285:2750–2756.

surgical repair to outweigh the short-term risks, suggesting that open surgical repair may be better for individuals with a LE of longer than 6 to 8 years.<sup>23</sup>

## HOW TO COMMUNICATE THE BALANCE BETWEEN THE BENEFITS AND HARMS OF PREVENTION

One barrier to implementing this framework is the challenge of communicating the rationale for starting, stopping, or continuing preventive interventions.<sup>24</sup> Although some individuals want to discuss LE, many do not,<sup>25</sup> citing the inherent uncertainty with any prediction and the discomfort that the topic brings on.<sup>26</sup> Thus, although the framework of LE and TTB may be useful from a population health perspective, when communicating with people, it may be better to focus on the most likely end results of screening. Specifically, one study found that individuals respond negatively to statements such as, “You may not

live long enough to benefit from this test.”<sup>26</sup> In contrast, individuals responded much more positively to statements such as, “This test isn’t going to help you live longer,”<sup>27</sup> or “This test is more likely to hurt you than help you.”<sup>26</sup> One resource that models best practices in prognosis communication is videos available at <http://ePrognosis.ucsf.edu/communication>.

## UNCERTAINTY

LE and TTB are probabilistic population estimates with inherent uncertainty at the individual level. Despite the uncertainty, population estimates can provide important insights into individual risks and lead to better clinical decisions. The American College of Cardiology/American Heart Association cardiovascular risk calculator and the CHADS2 atrial fibrillation stroke risk score (Congestive heart failure, Hypertension, Aged  $\geq 75$ , Diabetes mellitus, Stroke/transient ischemic attack) are examples of

**Table 1. Time to Benefit for Preventive Interventions for Older Adults**

Time to Benefit, Years	Preventive Intervention	Guideline	References
8–19 months	Bisphosphonates for osteoporosis	None	15
1–2	Primary prevention, hypertension	None	16,17,31
2–5	Primary prevention with statins	None	16,18–20,32
5	Surgical (vs transcatheter) aortic valve replacement for high risk aortic stenosis	None	33
6–8	Open (vs endovascular) repair for abdominal aortic aneurysm	None	23
10	Aspirin for cardiovascular disease and colorectal cancer prevention	USPSTF	34
10	Intensive glycemic control in diabetes mellitus	American Geriatrics Society	35
10	Colorectal cancer screening	USPSTF, American College of Physicians, Society of General Internal Medicine	1,36–38
10	Breast cancer screening	Society of General Internal Medicine, American College of Physicians	1,37,38
10–15	Prostate cancer screening	American Urological Association, American College of Physicians	11,22,37

USPSTF = U.S. Preventive Services Task Force.

population risk estimates that are commonly used to guide individual decisions. Much evidence-based medicine relies on applying uncertain population estimates to individuals to target treatments that are most likely to be beneficial. Thus, despite the uncertainty, using LE and TTB can lead to better outcomes more often than if we ignore LE and TTB.

Addressing and communicating uncertainty is a core competency in palliative medicine. Best practices include normalizing the uncertainty, resetting expectations, and acknowledging emotions about uncertainty.<sup>28</sup> Finally, the inherent uncertainty in current estimates of LE and TTB suggests that personal preferences should be given substantial deference when making prevention decisions in older adults.

### APPLYING THE FRAMEWORK DURING AN ANNUAL MEDICARE WELLNESS VISIT

Mr. A is a 75-year-old man who has hypertension (blood pressure 135/75 mmHg on fosinopril and chlorthalidone), hyperlipidemia (on simvastatin) and diabetes (last glycosylated hemoglobin 7.2 on glipizide and metformin), chronic obstructive lung disease, and painful osteoarthritis. He no longer smokes but has difficulty walking several blocks and bathing independently. He rates his overall health as good, and he has not been hospitalized in the past year. He is wondering whether he should be screened for colorectal cancer and whether he can stop one of his medications.

#### Step 1: Determine the Individual's LE

Using published general mortality indexes for older adults from a systematic review, we identify the Schonberg and Lee indexes as appropriate for this individual. Using the web calculators for these indexes at [www.ePrognosis.com](http://www.ePrognosis.com), we find that the Schonberg index estimates that the individual has a 5-year mortality risk of 59%, whereas the Lee

index estimates that he has a 4-year mortality risk of 45%. Because the median LE is the time to 50% mortality risk, these indexes suggest that this individual's LE is approximately 5 years.

#### Step 2a: Determine the TTB for Colorectal Cancer Screening

Our recent studies suggest that, for colorectal cancer screening, the TTB for an absolute risk reduction of 1 death prevented for 1,000 persons screened is approximately 10 years. Because the TTB exceeds the individual's LE, it is unlikely that he would benefit from colorectal cancer screening. Thus, he should be advised that colorectal cancer screening is more likely to harm than help and that he would likely be best served by focusing on other health concerns such as his osteoarthritis or hypertension.

#### Step 2b: Determine the TTB for Blood Pressure Control

The Action in Diabetes and Vascular disease: PreterAx and Diamicon MR Controlled Evaluation Study suggests that the benefits of intensive blood pressure control in older adults with diabetes first appear at 12 months, with full benefit at approximately 33 months.<sup>29</sup> Given Mr A's LE of 5 years, continuing intensive blood pressure control is likely to decrease his mortality risk and would be recommended.

#### Step 2c: Determine the TTB for Lipid Control

The TTB for primary prevention of cardiovascular events in individuals with hyperlipidemia vary from 1.5 to 5 years, depending on the population studied (Table 1). Given Mr A's LE of 5 years, he has a reasonable chance of benefiting from hyperlipidemia treatment. The decision to continue or stop his simvastatin depends primarily on how much he wants to decrease his medication burden.

### Step 2d: Determine the TTB for Glycemic Control

The American Geriatrics Society Guidelines for the Care of Older Adults with Diabetes suggests limited benefit of lowering glycosylated hemoglobin to less than 8% for individuals with a LE of less than 10 years.<sup>12</sup> Given Mr A's LE of 5 years, it is unlikely that he would benefit from tight glycemic control. Given his desire to eliminate one of his medications, decreasing or discontinuing glipizide may be a reasonable recommendation.

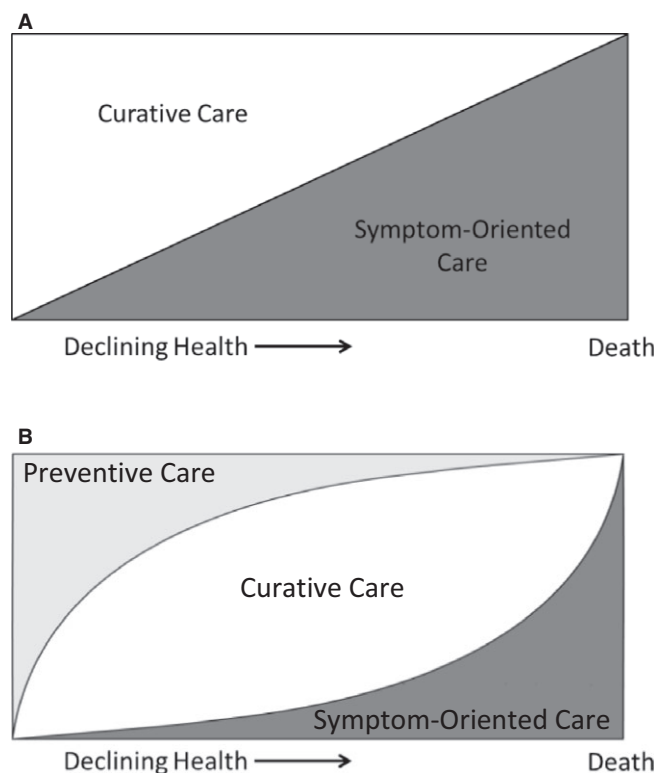
### PREVENTION, TREATMENT, AND SYMPTOM-ORIENTED CARE

Treatments for many chronic asymptomatic conditions in older adults also have immediate risks and delayed benefits and should be viewed similarly to prevention. For example, treatment for hypertension can quickly lead to orthostatic hypotension and falls, but decreased cardiovascular outcomes occur many months or years later. Glycemic treatment for diabetes can cause immediate hypoglycemia, with fewer vascular complications seen many years in the future. Whenever an intervention has immediate risks and delayed benefits, it is preventive and should be targeted to older adults who have a LE that exceeds the TTB. Thus, the framework for individualizing prevention applies to the treatment of many diseases in older adults.

In contrast to the treatment of asymptomatic diseases, TTB is not a consideration in symptom-oriented care because the harms and benefits occur immediately. If an individual has a bothersome symptom, any treatment for that symptom could produce immediate benefits, meaning that the TTB is 0. For example, analgesics for low back pain may cause renal insufficiency, but the benefits of analgesia occur immediately. Thus, TTB and the framework of juxtaposing LE and TTB are irrelevant for symptom-oriented care.

### PREVENTION AND PALLIATIVE CARE

Figure 2A shows one of the current dominant paradigms in palliative care.<sup>30</sup> It shows that, as individuals slowly progress through declining health toward death, the proportion of curative care should decrease and the proportion of symptom-oriented care should increase. Figure 2B shows how we can build on this paradigm to place preventive care in relationship with curative and symptom-oriented care for individuals progressing through declining health. When individuals are healthy (on the left side of the figure), most of their care should focus on prevention of future adverse outcomes. As an individual becomes sicker (in the middle of the graph), the proportion of care that is focused on prevention should decrease because he or she has more pressing needs. Care at this stage should focus on diseases that are fixable, such as infections or treatable cancers. As individuals approach death (on the right side of the graph), most of their care should focus on symptoms, and a palliative approach to care is often most appropriate. Thus, prevention and symptom-oriented



**Figure 2.** (A) Current paradigm in palliative care. (B) Incorporating preventive care into the palliative care paradigm.

palliative care represent the opposite ends of the spectrum of care that older adults need as their health declines.

### CONCLUSION

Preventing illness through early detection and treatment is a central component of medical care for older adults, but most prevention exposes individuals to immediate risks in the hope of better health outcomes in the future. Thus, it is critical to the answer to the question, "When will it help?" when individualizing preventive decisions in older adults. Although research will continue to improve the accuracy of LE prediction and TTB, many guidelines have moved beyond age and explicitly encourage clinicians to juxtapose LE and TTB to maximize benefits and minimize harms of prevention.

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