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Abstract

Objective: To evaluate the preferences of an ethnically diverse national sample of older Americans regarding length of life versus health quality. **Method:** A time trade-off task administered as part of the 2002 wave of the Health and Retirement Study. **Results:** Respondents equated 6.86 ($SD = 3.46$) years of perfect health with 10 years of life in imperfect health. Women and those who ranked their health less favorably were more likely to give up years of life for perfect health. Relative to Whites, Blacks were more willing to live longer in imperfect health. Those of lower levels of education were more likely to prefer 10 years of life in imperfect health. **Discussion:** There is wide variability in responses to the time trade-off task that is partially associated with self-rated health, gender, ethnicity, and education.

Keywords

time trade-off, utility assessment, older adults, value preference, epidemiology

Introduction

The past century has witnessed a dramatic demographic revolution, largely attributed to advances in medicine. Whereas the average life span in 1900

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was 47 years, current life span stands at 78 years and is expected to increase in future years. Older adults can expect not only to live for a longer period of time but also to enjoy better health relative to past generations (Healthy People, 2010). Given these advances in technology and medicine, health care priorities should be set concerning the allocation of resources, which tend to be limited. Thus, many times, a decision should be made both at the public level and at the individual level concerning the benefits and feasibility of further extension of life even in less than perfect health versus improvements in quality of life and health at the potential expense of years of life.

The time trade-off technique is the most widely used value preference (also called utility assessment) technique, aimed specifically at addressing the potential trade-off between quality of health versus length of life (Burstrom, Johannesson, & Diderichsen, 2006; Craig, Busschbach, & Salomon, 2009). The time trade-off technique can provide information at the individual level, by guiding specific patients' preferences regarding quality of health versus length of life, as well as at the public level by providing further guidance about public preferences and priorities.

The majority of research, to date, has evaluated the use of the time trade-off technique against other measures of value preference and quality of life (Craig et al., 2009; Martin, Glasziou, Simes, & Lumley, 2000). Most of these studies, but not all (Arnesen & Norheim, 2003; Arnesen & Trommald, 2005), have recommended the use of the time trade-off technique by arguing that the technique is well understood even by the oldest old and is highly reliable and valid (Tsevat et al., 1998).

In general, research has shown that most individuals are unwilling to trade much time for perfect health, although great variability exists (Meropol et al., 2008; O'Leary, Fairclough, Jankowski, & Weeks, 1995; van Nooten, Koolman, & Brouwer, 2009). Older adults, individuals of higher levels of education (Meropol et al., 2008), sicker individuals (Voogt et al., 2005), and those reporting lower quality of life tend to report a preference toward living in better health rather than for more years, whereas younger individuals and those with children tend to favor living for more years (Stiggebout, De Haes, Kiebert, Kievit, & Leer, 1996). Locus of control (Handler, Hynes, & Nease, 1997) as well as valuation of life (Lawton et al., 1999) were also found to correlate with individuals' preferences for length of life.

Whereas informative, most of these studies have focused on very specific populations, such as individuals who suffer from end-stage liver disease (Bryce, Angus, Switala, Roberts, & Tsevat, 2004), individuals with HIV (Bult, Hunink, Tsevat, & Weinstein, 1998; Fowler, Cleary, Massagli, Weissman, & Epstein, 1995), individuals with intermittent claudication

(de Vries, Kuipers, & Hunink, 1998), medically ill older adults (Tsevat et al., 1998), or individuals with cancer (Grimison, Simes, Hudson, & Stockler, 2009; Lloyd, van Hanswijck de Jonge, Doyle, & Cornes, 2008). Focusing on these specific populations has the advantage of being most clinically relevant. However, from a public policy point of view, obtaining the opinions of the very few who might be most directly affected by these issues neglects to take into consideration the opinions of the general public, which is most likely to contribute to the implementation or lack of implementation of various standards of health care.

To date, there have been only very few national studies employing the time trade-off technique (Dolan, Gudex, Kind, & Williams, 1996; van Nooten et al., 2009), and to our knowledge, none conducted in the United States. Although much of current efforts to date are geared toward improving one's quality of life as well as extending one's length of life, many times, one of these aspects has to receive priority over the other. Examining public preferences at the national level can assist in identifying specific groups in the population that differ in their values concerning quality of health versus years of life. Given the fact that past research has shown a wide diversity in preferences, it is important to evaluate these preferences at the national context. For instance, research has consistently shown that ethnic minorities in the United States have very different attitudes and practices concerning death and dying than the majority culture, with most research demonstrating that ethnic minorities prefer more aggressive end of life care (Barnato, Anthony, Skinner, Gallagher, & Fisher, 2009). Thus, it is important to evaluate whether ethnicity plays a role in preferences concerning the time trade-off technique. Another unique feature of the present study is that it allows for a potential distinction between more objective correlates of the time trade-off task, such as medical and cognitive status versus one's subjective health and mental health status. Based on past research, we expected ethnic minorities and less educated individuals to report a greater preference toward length of life versus quality of health. We further expected that relative to objective indicators of functioning, subjective indicators would have a stronger correlation with the time trade-off preferences.

Method

The Health and Retirement Study (HRS) is a nationally representative sample of individuals 50 years and older. Blacks, Latinos, and residents of Florida are overrepresented. The HRS is sponsored by the National Institute of Aging and is conducted by the University of Michigan. The study is reviewed and

approved by the University of Michigan's Health Sciences institutional review board. Participants take part in a biennial interview that covers a range of topics, including income, wealth, work, retirement, health, health care utilization, and so on.

Baseline data for the present study were collected in the year 2002. Overall, 18,167 individuals responded to the 2002 HRS questionnaire. In addition to the core interview, each wave of the HRS includes additional modules on selected topics that are administered to randomly selected participants. A total of 1,471 individuals were randomized to the time trade-off module. However, due to missing data on self-rated health status and the eight questions required to assess the time trade-off, the analytic sample comprised 952 (65.2%) respondents.

Measures

Outcome variable: The time trade-off module. Respondents were asked to think of two imaginary friends, one who has the same self-rated health as the respondent (Adams) and the other who enjoys perfect health (Brown). The former is expected to live for 10 years in similar health as respondent, whereas the length of time to be lived by the friend who enjoys perfect health varies across eight hypothetical states and ranges from 10 years to 1 year. Respondents were asked to decide whether they would rather live for 10 years in their current self-rated health or for a shorter number of years in perfect health or whether they view the two options as equal. Relative to other time trade-off techniques, the present technique employs a relatively long period of maximum time to death (10 years). This strategy is justified given the fact that this study enrolled community-dwelling older adults and not older adults suffering from particular life threatening illnesses. Table 1 and Figure 1 outline the exact scenarios presented to respondents.

Predictors

Sociodemographic data. Age, gender, education (<12, high school, >high school), and ethnicity (White, Latino, Black, Other) were gathered based on self-report.

Self-rated health. Respondents were randomized to receive one of three versions of a subjective health rating task: (a) They were asked how they would rate their "current health on a scale from 0 to 100, in which 0 represents *death* and 100 represents *perfect health*"; (b) the phrase "for someone

Table 1. The Time Trade-Off Module

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- Question 1: Now I'm going to ask you to consider some made-up situations. I'll describe two imaginary friends who are both your age but are in different states of health. Imagine that one friend your age, (Mr/Mrs) Adams, has some health problems. On a scale from 0 to 100, (his/her) health rates as yours. Adams lives for 10 more years in this health and then dies in his/her sleep.
- Now imagine that another friend your age, (Mr/Mrs) Brown, is in perfect health. On a scale from 0 to 100, (his/her) health rates about a hundred. Mr/Mrs Brown lives for 10 more years in perfect health and then dies in (his/her) sleep. Which friend do you think was better off?
- Question 2: Imagine again that (Mr/Mrs) Adams lives for 10 more years. His/her health rates as yours. Now imagine that (Mr/Mrs) Brown, who is in perfect health, lives 7 more years. Which friend do you think was better off?
- Question 3: Imagine once more that (Mr/Mrs) Adams lives for 10 more years. His/her health rates as yours. Now imagine that (Mr/Mrs) Brown, who is in perfect health, lives for 9 more years. Which friend do you think was better off?
- Question 4: If (Mr/Mrs) Adams lives for 10 more years with his/her health rating that is similar to yours and if we imagine that (Mr/Mrs) Brown, who is in perfect health, lives for 9 years and 10 months, which friend do you think was better off?
- Question 5: If (Mr/Mrs) Adams lives for 10 more years with his/her health rating similar to yours and if we imagine that (Mr/Mrs) Brown, who is in perfect health, lives for 8 more years, which friend do you think was better off?
- Question 6: Imagine once more that (Mr/Mrs) Adams lives for 10 more years with (his/her) health rating that is similar to yours. Now imagine that (Mr/Mrs) Brown, who is in perfect health, lives for 3 more years. Which friend do you think was better off?
- Question 7: Imagine once more that (Mr/Mrs) Adams lives for 10 more years. His/her health rates as yours. But now imagine that (Mr/Mrs) Brown, who is in perfect health, lives for 5 more years. Which friend do you think was better off?
- Question 8: If (Mr/Mrs) Adams lives for 10 more years with (his/her) health rating similar to yours, and if we imagine that (Mr/Mrs) Brown, who is in perfect health, lives for 1 more year, which friend do you think was better off?
-

your age” was added to the end of the question; and (c) the phrase “for a 20-year-old” was added (Ubel, Jankovic, Smith, Langa, & Fagerlin, 2005).

Depressive symptoms. The Center for Epidemiologic Studies Depression Scale (CES-D) is a common measure of depressive symptomatology that has been used in a variety of population-based studies (Radloff, 1977). The HRS uses eight items from the CES-D (e.g., felt alone, enjoyed life). Response options on these items are yes and no. Response options were reverse coded as needed and summed up to represent an overall depressive score, ranging from 0 to 8, with a higher score indicating greater depressive symptoms.

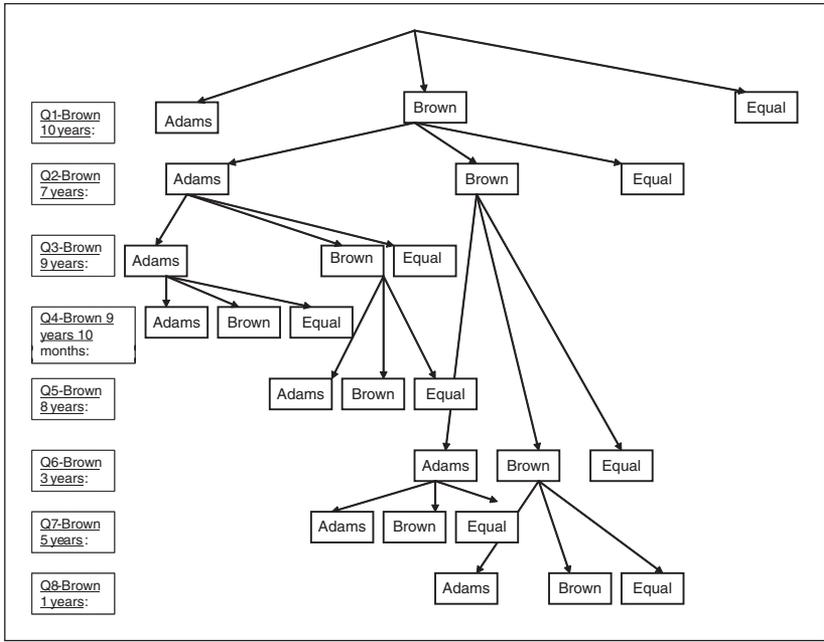


Figure 1. Order of administration of the time trade-off module

Because this is not a normally distributed variable, we used a cutoff of four and higher to represent high depressive symptoms as has been recommended in HRS guidelines (Steffick, 2000).

Cognitive functioning. Four tests (e.g., immediate and delayed word recall, subtraction, and backward count) were used to represent overall cognitive functioning. The tests were modeled after the Mini-Mental Status Exam, a standard geriatric dementia screen (Brandt, Spencer, & Folstein, 1988; Folstein, Folstein, & McHugh, 1975). Perfect performance is scored one and a failure is scored zero. Because scores are highly correlated with each other, we used a composite score ranging from 0 to 26.

Medical conditions. Number of chronic medical conditions out of six common conditions (e.g., high blood pressure, diabetes, cancer, lung diseases, heart problems, and stroke) was gathered based on self-report. We dichotomized respondents into those with 0 to 1 medical conditions versus >1 conditions.

Statistical Analysis

First, we conducted a descriptive analysis of all background variables to obtain frequencies (for categorical variables) and means (for continuous variables). Following this, we created a time trade-off variable by looking at the eight hypothetical items that ask respondents to decide whether they would rather live for 10 years in their current self-rated health (Adams), or for a certain number of years in perfect health (Brown), or whether they thought both options were equal (see Table 1 and Figure 1). When the respondent chose equal, this determined their tipping point for time versus health quality (i.e., the time trade-off variable)—thus indicating the amount of time the particular respondent is willing to give up for perfect health. For respondents, who never picked equal but reached an end point because they felt that, for example, they would rather live for 3 years in perfect health (See Table 1 and Figure 1, Question 6, choosing Brown) but then chose Adams, (i.e., living in own health for 10 years rather than for 1 year in perfect health, Question 8; Table 1 and Figure 1), we estimated the tipping point to be 2 years (e.g., respondents are willing to give up 8 years of life for perfect health). Respondents who chose to live 10 years (the longest time assessed) with their own health were excluded from the main analysis due to a ceiling effect. Respondents who chose perfect health until 1 year (the shortest time assessed) were coded as both 0 and 0.5 years, and a sensitivity analysis (a technique for systematically changing parameters in the model to determine the effects of such changes) was conducted to determine whether coding as 0 or 0.5 years makes a difference. With the final time trade-off score, we conducted a multivariate linear regression analysis. We entered into the model all potential covariates and examined potential interactions between covariates.

As an exploratory post hoc analysis, we compared the respondents who chose their own health at 10 years to live and those who chose perfect health at 1 year. The unrelated paired *t* test and chi-square test were used to investigate differences on background and health variables for these two groups.

Results

In the initial randomization into the module, 75.7% of the sample was White, 8.2% was Latino, 14.5% was Black, and 1.6% self-identified as other. However, Blacks, Latinos, and those who self-identified as Other had a disproportionately high refusal rates for this module (42.1% Black, 50% Latino, 41.6% Other, 31.5% White). Thus, the final sample comprised of 952

Table 2. Demographic Variables ($N = 952$)^a

Variables	Statistic
Health status	70.93 (20.11)
Age	68.30 (8.92)
Gender (female)	522 (54.83%)
Race	
White	807 (84.77%)
Black	121 (12.71%)
Other	24 (2.52%)
Education	
<12	222 (23.32%)
High school	330 (34.60%)
>High school	400 (42.02%)
Cognitive functioning (0-26)	14.51 (4.41)
Depressive symptoms	123 (12.92%)
Medical conditions	379 (39.81%)
Time trade-off	6.86 (3.46)

a. Frequencies (%) are presented for categorical variables and M (SD) for continuous variables.

respondents, with the majority of the sample being White (84.7%). Due to the small number of Latinos and those self-identified as Other in the final sample, we could not split the two groups apart. The mean age of the sample was 68.17 (± 9.19), and more than half of the sample was women (55.08%). On average, respondents equated living for 6.86 ($SD = 3.46$) in perfect health with living for 10 years with their own self-rated health. However, 275 (28.9%) were unwilling to give up any length of time for perfect health, and 121 (12.7%) were willing to give up 9 or more years for perfect health. Background and health variables can be seen in Table 2.

A sensitivity analysis suggested no significant differences in the models whether the shortest time period was coded 0 or 0.5. Therefore, we report the results using 0.5 as this is in-line with our other midpoint estimations (e.g., when no equilibrium was reached by respondents, we calculated an average score to represent a point where both options are considered equal). In both bivariate and multivariate analyses, ethnicity, self-rated health, and gender were significant correlates of time trade-off preferences. Relative to Whites, Blacks were more likely to report a longer time trade-off ($B = 0.942$, 95% CI [-0.195, 1.689], $p = .014$). In addition, respondents who reported better self-rated health also reported a longer time trade-off than those with poorer self-rated health ($B = 0.028$, 95% CI [0.016, 0.041], $p < .001$). Female participants

Table 3. Bivariate and Multivariate Linear Regressions Predicting the Time Trade-Off Variable ($n = 789$)

	Bivariate coefficients	p value	Multivariate coefficients	95% CI	p value
Health status	0.030	<.001	0.029	0.017, 0.043	<.001
Gender (female)	-0.830	.001	-0.832	-1.313, -0.352	.001
Age	-0.027	.055	-0.009	-0.038, 0.020	.562
Race					
White	Ref				
Black	0.828	.026	0.942	-0.195, 1.689	.014
Other	0.951	.237	1.057	-0.496, 2.610	.182
Education					
<12	Ref				
High school	-0.576	.107	-0.609	-1.288, 0.069	.078
>High school	-0.052	.871	-0.400	-1.091, 0.290	.256
Medical conditions	-0.229	.365	0.153	-0.365, 0.671	.562
Cognitive functioning	0.046	.101	0.045	-0.019, 0.110	.165
Depressive symptoms (+4)	-0.622	.102	-0.074	-0.845, 0.698	.851

significantly chose shorter time trade-off than male participants ($B = -0.807$, 95% CI $[-1.279, -0.335]$, $p = .001$). Interaction effects between self-rated health and gender, self-rated health and ethnicity, and self-rated health and source of reference (perfect health vs. a 20-year-old vs. one's own age) were investigated; however, these interactions were excluded from the final results as they were not significant (see Table 3).

Finally, we investigated the differences between those with a ceiling and floor effects in the time trade-off (Table 4). The only variable that differentiated between respondents was education. Relative to those with less than 12 years of education, respondents with more than high school education were more likely to choose perfect health even at the expense of 9 years of life, therefore choosing quality of health over years of life.

Discussion

This study evaluated the willingness of older Americans above the age of 50 to trade years of life for perfect health. Evaluating public opinions on this matter is particularly important as they can assist prioritizing health care plans as well as guide health care providers. Currently, there are tremendous efforts

Table 4. Comparison Between Endpoints of the Time Trade-Off Module (*n* = 258)^a

	Self at 10 years (<i>n</i> = 140)	Hypothetical till end (<i>n</i> = 118)	Test statistic
Health status	67.39 (20.79)	67.21 (23.86)	<i>T</i> = 0.06, <i>p</i> = .457
Gender (female)	88 (62.86%)	79 (66.95%)	$\chi^2 = 0.470, p = .493$
Age	69.22 (9.37)	68.86 (9.18)	<i>T</i> = 0.31, <i>p</i> = .376
Medical conditions	65 (46.43%)	46 (38.98%)	$\chi^2 = 1.449, p = .229$
Education			
<12	46 (32.86%)	23 (19.19%)	$\chi^2 = 6.102, p = .047$
High school	50 (35.71%)	47 (39.83%)	
>High school	44 (31.43%)	48 (40.68%)	
Race			
White	116 (82.86%)	102 (86.44%)	$\chi^2 = 4.312, p = .128^b$
Black	19 (13.57%)	16 (13.56%)	
Other	5 (3.57%)	0	
Depressive symptoms			
Low	110 (79.71%)	96 (81.36%)	$\chi^2 = 0.110, p = .741$
High (≥ 4)	28 (20.29%)	22 (18.64%)	
Cognitive functioning	12.77 (4.32)	14.03 (3.89)	<i>T</i> = -2.39, <i>p</i> = .991

a. *t* tests are calculated for continuous variables, *M* (*SD*); chi-square analyses are calculated for categorical variables (frequency, %).

b. Fisher's Exact *p* value.

geared toward the extension of life as well as the improvement of one's quality of health. Needless to say, however, these efforts do not always go together and given limited resources, priorities should be set. The present study shows that as many as 28.9% of the sample prefers to live with some health problems consistent with their current physical health for 10 additional years rather than live in perfect health for a shorter period of time. This finding is particularly important as healthy individuals may underestimate one's desire to live even in imperfect health (Tsevat et al., 1998). Nonetheless, the majority of the sample preferred to live in perfect health for a shorter period of time, some for as short a period as 1 year or less. Thus, similar to past research (Tsevat et al., 1998), we found a great variability in older adults' preferences.

Blacks were more favorable toward lengthening life even in imperfect health. This is consistent with past research that has shown that Blacks are more likely to favor aggressive treatments in an attempt to keep one alive even

in poor health. Nonetheless, it is important to note that a disproportionately large number of ethnic minorities refused to participate in this module. Whereas the exact reasons for nonparticipation of ethnic minorities in this task are unknown, this could be either due to lack of understanding of the assignment or because ethnic minorities are more reluctant to even consider a trade-off between length of life and quality of health. Further research is necessary to better understand the reluctance of ethnic minorities to participate in this task and to better take the preferences of ethnic minorities into account.

As expected, those who reported better self-rated health were less willing to give up years of life for perfect health. Interestingly, neither medical condition nor cognitive or depressive symptoms were associated with preferences concerning the time trade-off task. Hence, results suggest that, in this sample of community dwelling older adults, it is the subjective perception of one's health that is associated with one's preferences, rather than one's objective medical or cognitive states. Our results also demonstrate a distinction between one's depressive symptoms and one's subjective health perception.

Consistent with past research (Dolan et al., 1996), women were more willing to give up years of life for perfect health. This finding should be viewed in light of the fact that women actually enjoy longer life expectancy than men. Hence, their preferences are actually discordant with current reality. Finally, consistent with past research (Meropol et al., 2008), level of education distinguished between the two end points of the time trade-off task, so that those of lower level of education were more likely to prefer 10 years of life in imperfect health, whereas those of more than high school level of education were likely to give up 9 years or more for perfect health.

The present study has several limitations that should be noted. First, hypothetical case scenarios may not reflect one's preferences in real life. Furthermore, past research has shown that health status plays a role in peoples' choices. Yet, in this study, self-rated health, but not number of medical conditions, correlated with one's preferences, possibly because the sample focused on community-dwelling older adults and not on older adults with significant medical limitations as was the case in the majority of past research. Thus, it is important to remember that the present findings reflect public preferences rather than the preferences of more severely ill older adults to whom the time trade-off technique might be more relevant. Another limitation of the present study is the fact that we were unable to incorporate psychological mechanisms, such as sense of control or personality type, that could potentially account for some variability on the time trade-off technique. However, we were able to distinguish between objective and subjective indicators of functioning as potential correlates of the time trade-off variable.

Nevertheless, this study provides a unique contribution to the present state of knowledge because to the best of our knowledge this is the first study to evaluate public preferences regarding length of life versus quality of health in a nationally representative sample of older Americans. The inclusion of an ethnically diverse sample and the focus on potential ethnic variability is important given past research that has shown that ethnic minorities hold different preferences concerning end-of-life care. Examining medical, emotional, and cognitive functioning as potential correlates of the time trade-off variable is yet another advantage of this study. The present findings are important for decision makers, health care providers, caregivers and, of course, patients themselves. The present study demonstrates that the majority of older adults are able and willing to respond to the time trade-off task. Yet ethnic minorities are disproportionately more likely to refuse participation in such a task, suggesting that further research is required to better reflect the preferences of ethnic minorities. It is possible that a similar phenomenon exists in real life, and as a result health care providers might have to go through extra efforts to elicit the preferences of ethnic minorities. The present study also shows great variability, with 28.9% of older adults being unwilling to trade-off any years of life and as many as 12.7% trading off 9 years of life and more for perfect health, indicating that a refined assessment of public preferences concerning quality of health versus years of life is required and that there is lack of consensus concerning public preferences. Therefore, priorities concerning quality of health versus length of life should be individualized.

Authors' Note

Study concept and design, analysis and interpretation of data, and preparation of manuscript were done by LA, and analysis and interpretation of data were taken care of by BKK. Both the authors were involved in the critical revisions of the manuscript.

Declaration of Conflicting Interests

The author(s) declared no conflicts of interest with respect to the authorship and/or publication of this article.

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