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Black and white differences in subjective survival expectations: An evaluation of competing mechanisms

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ABSTRACT

While black-white inequality in longevity is well documented in the United States, little is known about how individuals from different race/ethnic groups form their own personal survival expectations. Prior research has found that despite having higher mortality, blacks on average report higher survival expectations relative to whites. Using data from the Health and Retirement Study, we examined racial differences in subjective survival expectations across birth cohorts and provide explanatory mechanisms.

We find that blacks—men in particular—were overly optimistic about their survival, but this effect had waned with successive birth cohorts. Furthermore, whereas subjective survival expectations and actual survival were correlated among white men, among black men the most optimistic fared worst. Blacks and whites differed not only in their response patterns, but also in how they weighed the different factors (socioeconomic, psychosocial, health, parental longevity) associated with expected survival. Importantly, those who estimated their survival probability with certainty had positive psychosocial characteristics, irrespective of race, but only whites had better health.

These findings underscore the importance of group differences in subjective survival expectations as another potential form of inequality. Racial differences in how long individual expect to live may account for differences in social and economic behavior and outcomes, irrespective of actual longevity differentials.

1. Introduction

How people perceive their surrounding mortality regime is a fundamental question in demography (Montgomery, 2000). Survival expectations of individuals and their kin are integral in explaining the demographic transition, as well as its social and economic consequences. As demographer Tim Dyson reflected, "mortality decline generates higher levels of confidence in society as regards the worldly future [because] individuals think more about their long-term prospects and make practical plans accordingly" (Dyson, 2013, p. 159). Throughout much of the demographic transition, however, survival expectations could only be inferred indirectly and in retrospect. Only in the past three decades have population surveys asked respondents explicitly to provide probabilistic assessments of how long they expect to live. Numerous studies have found that subjective survival expectations are associated with health lifestyles and behaviors, consumption and saving patterns, retirement choices, and social security claims (Edwards, 2013; Hurd et al., 1998; Kalemli-Ozcan & Weil, 2010; Post & Hanewald, 2013); toward end-of-life, they are also a critical component of one's psychological wellbeing (Shrira et al., 2014). In other words, how long people expect to live is associated with their social, economic, and health behavior.

Much of this literature originated in economics, psychology, and gerontology, whereas demographers have paid attention to subjective survival expectations primarily in attempts to improve mortality forecasts (e.g., Elder, 2013; Perozek, 2008). The underlying logic was that individuals hold private information concerning their health status, risk factors, and family background—information that is directly relevant to mortality risk, and therefore can be used to improve actuarial forecasts. Indeed, much like measures of self-rated health, subjective survival expectations are predictive of actual mortality among middle-aged and older adults (Hurd & McGarry, 2002). For the same reason, subjective survival expectations in the aggregate tend to parallel official life tables (Hurd, 2009). Yet demographers have largely overlooked the ways in which these expectations vary across subpopulations, as well as their potential role in explaining group differences in social and economic

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behavior and outcomes.

Despite the spectacular rise in longevity over the past two centuries, subnational populations are often subjected to markedly different mortality regimes. In the United States, mortality inequalities between racial and ethnic groups persist. Black Americans in particular have lower life expectancy and greater lifespan variability compared with white Americans (Firebaugh et al., 2014b; Harper et al., 2014). Differential exposure to mortality in one's kin and social networks, to the extent that they are stratified by race, may in turn shape divergent survival expectations for blacks and whites. A recent study found that exposure to deaths in the family throughout the life course—more commonly experienced among blacks than whites—is negatively associated with subjective survival expectations in old age (Donnelly et al., 2020). Thus, one might expect black Americans to have lower survival expectations, on average, than whites. Yet in practice blacks appear to report *higher* subjective odds of survival relative to whites of similar age, a phenomenon that has been termed an 'anomaly' (Mirowsky, 1999). Several hypotheses have been proposed to explain the so-called racial anomaly in subjective survival, ranging from sample selection among black respondents to greater optimism about future mortality reductions, though neither appears to be completely satisfactory.

To complicate matters further, at older ages blacks may actually hold a mortality advantage relative to whites. This phenomenon, known as a mortality 'crossover,' is well documented (Sautter et al., 2012), though its causes remain widely debated (Dupre et al., 2006; Masters, 2012). Furthermore, the age in which black mortality dips below white mortality has shifted to older ages over time (Lynch et al., 2003). Irrespective of the underlying causes, older blacks can expect to live longer than whites conditional on surviving to old age—the effects of which on subjective survival has yet to be examined.

This study offers a detailed examination of the "racial anomaly" in subjective longevity. We also aim to explain why middle-aged black Americans express higher survival expectations than whites despite having higher mortality at those ages. In so doing, we broaden our understanding of subjective survival expectations as a demographic phenomenon. First, using data from the Health and Retirement Survey (HRS), we apply Gompertz and Weibull models to construct subjective survival curves for individuals, pool by race, gender, and birth cohort, and compare them with actual in-sample survival. In order to do so, we capitalize on 26 years of prospective mortality follow-up, reflecting actual mortality among survey respondents, rather than actuarial estimates. Second, we examine whether racial differences in subjective survival expectations stem from race-specific reporting patterns—particularly as they relate to focal-point answers (i.e., 0, 50, and 100% chance of surviving to a given age). Third, using logistic regression we evaluate socioeconomic, family background, health, and psychosocial correlates of providing subjective survival expectations with absolute certainty across black and white respondents. Lastly, based on our empirical analysis we offer a systematic assessment of the hypotheses put forth to explain black-white differences in subjective survival expectations. Understanding racial differences in subjective survival, as well as their drivers, may play an important role in explaining social and economic disparities toward old age.

1.1. Racial differences in subjective survival

Individuals' beliefs about their longevity have important ramifications for their psychological well-being, attitudes, and economic decision-making and outcomes (e.g., retirement, spending and saving) (Gan et al., 2015; Salm, 2010). Lower levels of uncertainty about future survival have been linked to preventive and less risky behaviors, retirement decisions, and demand for long-term care insurance (Dormont et al., 2018). Furthermore, these attitudes and behaviors have immediate consequences for 'social security systems, insurance providers, employers and policy makers' (Nivakoski, 2020). In addition to economic ramifications, longer expected longevity has been linked to greater psychological well-being (Bergman & Segel-Karpas, 2020a) and greater 'sense of control' in old age, which in turn reduce biological stress reactions (Mirowsky, 1997). Expected longevity is also associated with health behaviors and outcomes, ranging from adherence to preventive medical tests to one's mental state in old age (Picone et al., 2004). Thus, expected longevity is potentially an important determinant of social behavior, and group differences in expected longevity may account for social and economic disparities toward old age.

Prior research has found that perceived longevity varies across countries and cultures (Rappange et al., 2016). Differences in expected longevity reflect information directly relevant to one's mortality risk—including health status, lifestyle, and parental longevity—but also social factors such as socioeconomic status and exposure to social adversity throughout the life course (Mittal & Griskevicius, 2017). Black Americans and other disadvantaged social groups are therefore hypothesized to differ in their longevity expectations relative to more advantaged groups. First, black Americans have lower life expectancy at birth than white Americans (Firebaugh et al., 2014a). Second, they are also more likely to experience the death of family members and friends—particularly at young age—which is negatively correlated with subjective survival expectations (Donnelly et al., 2020; Umberson et al., 2017). Yet in spite of these factors, blacks tend to report *higher* survival expectations compared to whites of the same age (Mirowsky, 1999).

Several explanations for the 'anomaly', that is the racial discrepancy between objective and subjective survival, have been suggested: (1) anticipation of future mortality reductions—black Americans may expect larger declines in mortality than white Americans; (2) mortality selection—blacks who have survived to old age have been subjected to higher mortality and are thus healthier, more resilient, and/or more optimistic about the future (Bulanda & Zhang, 2009); (3) cultural differences—blacks exhibit different attitudes than whites toward risk and uncertainty (Lee & Smith, 2016). For example, whereas black Americans report high expected survival in spite of lower actual longevity, Mexican Americans report lower expected survival—net of age, gender, and nativity—even though their life expectancy is in fact *higher* than that of whites (Bulanda & Zhang, 2009). Importantly, the mortality crossover between blacks and whites may be underlying both explanations (1) and (2). In the first case, older blacks may anticipate lower mortality because they look to their peers and predecessors when forming their own survival assessments. In the second case, they themselves may be select (healthier, more resilient) relative to their white peers, having survived to old age in spite of exposure to higher mortality throughout the life course.

In order to understand why expected survival varies across social groups, including black and white Americans, we must first understand how these expectations are construed.[1]

1.2. How subjective survival expectations are construed by individuals

According to Griffen and colleagues (2013), "individuals construct an understanding of their personal life expectancy based on similar factors that predict actual life expectancy, but not all mortality risk factors appear to be weighted realistically." Based on this premise, they developed a biopsychosocial model of subjective life expectancy with factors falling into five categories: (1) biomedical and genetic factors; (2) socioeconomic status; (3) health behaviors; (4) psychological factors; and (5) social connectedness—all of which, aside from socioeconomic status, were statistically significant in predicting survival expectations (Griffin et al., 2013a). However, there may be group differences in the weights assigned to various biopsychosocial factors due to differences in underlying cultural and psychosocial attitudes. We note that literature on subjective survival expectations is not unanimous on the causal

[1] We excluded Hispanics from our analysis due to the small sample size among the relevant age group.

direction between subjective survival and various correlates. Neither do we intend to establish whether economic, biodemographic, psychosocial, or health and health behaviors impact or are impacted by subjective survival expectations—a complex causal nexus that is likely to vary over time and across populations.

In addition to differences in how subjective longevity may be construed, there are substantial differences in reporting survival probabilities across socioeconomic and race/ethnic groups. Less educated individuals more often provide focal-point responses (i.e., 0, 50, or 100 percent) to questions about subjective survival (Hurd et al., 1998). Responses of 50 percent are thought to arise from strong rounding (Gan, Hurd, and McFadden 2005), from extreme uncertainty surrounding mortality risk (Hill, Perry, and Willis 2004), or from 'epistemic uncertainty', which refers to an inability to assess survival probabilities because it is presumed to be outside of the individual's control (Bruine de Bruin et al., 2002). Responses of 0 or 100 percent may also reflect extreme pessimism/optimism, in addition to difficulties providing precise risk assessments. Irrespective of socioeconomic status, there are also different patterns of focal-point responses by race/ethnicity—among whites, the most common focal-point response is 50%; among blacks 100%; among Spanish-interviewed Hispanics it is 0% (Lee & Smith, 2016).

The demographic research literature has mainly focused on the predictive accuracy of subjective survival expectations, which remains debated. Some have argued that, at least in the aggregate, these expectations are indicative of mortality trends because individuals hold personal information about their health status and social circumstance (Hurd & McGarry, 2002; Perozek, 2008). Others have criticized this finding and argued that subjective expectations contain considerable measurement error, can yield incoherent mortality projections with respect to the aging process, and have poor in-sample predictive accuracy (Elder, 2013). Our concern in this study, however, is not with the predictive accuracy of individual or aggregate survival expectations—but rather with how they may be formed and their potential impact on social and economic outcomes for different social groups. In other words, we deem these expectations important because of their potential ability to shape economic behavior, health lifestyles, and late life preparations (Lang & Rupprecht, 2019; van Solinge & Henkens, 2018), irrespective of whether they constitute accurate assessments of one's mortality risk.

Thus, our aim is to improve our understanding of black-white differences in subjective survival expectations—first, by estimating the extent of those differences and how they have changed across birth cohorts; second, by evaluating different mechanisms hypothesized to explain those differences.

1.3. Research objectives

Our objective is to answer the following questions:

A) What are the black and white differences in expected survival?
B) What are possible mechanisms underlying those differences?
C) Which factors explain focal-point response patterns among blacks?

To answer (A) we calculate black-white subjective survival probabilities (SSP) using data from the U.S. Health and Retirement Study (HRS) and Gompertz and Weibull survival models. For (B) we hypothesize that one driver for the black-white racial anomaly is that blacks tend to have more certainty in survival prospects perhaps due to relatively higher incidence of optimism (positive outlook) regarding the future. Finally, for (C) we hypothesize that black and white individuals who estimated 100% chance of survival weighed differently their personal health or psychosocial characteristics.

2. Methods

We begin analysis by creating separate subjective survival curves for individuals in each group based on data from the HRS, which has been used quite frequently in research on subjective life expectancy. Most importantly, we use this survey because in the 1992 HRS survey questionnaire individuals are asked to predict their survival chances to two distinct ages. This permits us to estimate subjective survival curves until death for each individual, based on parametric survivor functions. Our methods are heavily based on methods used by Perozek (2008) whose paper presented perhaps the strongest argument that subjective survival is useful and can be predictive (Perozek, 2008). Using her novel methods, we add the black-white racial component to examine racial inequality in subjective survival rates. We also utilize the updated mortality of the respondents using the latest HRS release to compare the subjective survival with the actual survival of the respondents of each racial group till the year 2018 (Bugliari et al., 2021). Then, after observing the greater tendency of blacks to answer 100% than whites, we compare select psychosocial, health, and SES characteristics of the 100%ers (those who estimate survival certainty, that is 100% survival probability to age 75) to the rest of the population by race. Finally, we apply logistic regression to see which factors are associated with answering 100% (i.e., complete certainty) of survival to the target age.

2.1. Data

We use data from the Health and Retirement Survey, focusing our analysis on the first wave of interviews of the HRS cohort in 1992. In this wave respondents were asked the following questions:

> "Using any number from zero to ten, where zero equals *absolutely no chance* and 10 equals *absolutely certain*, what do you think are the chances that you will live to be 75 or more?"
>
> "… that you will live to be 85 or more?"

Respondents' answers to these two questions will be interpreted as a probability distribution. We consider only individuals between the ages of 51 and 60 at the time of interview, which yields n = 10,053 individuals. HRS is a representative survey of the U.S. population, oversampling blacks, Hispanics, and residents of Florida; we incorporated sampling weights in our analysis to ensure that the findings are representative of the U.S. population.

2.2. Estimating subjective survival curves

Subjective expectations of survival to age 75 and 85 in the HRS ranged from 0 to 10. In accordance with prior research (Hurd & McGarry, 1995; Perozek, 2008), we converted these responses to probabilities between 0 and 1 by dividing by 10. We followed the method developed by Perozek (2008), fitting a cumulative survival distribution function (Gompertz, Weibull) for each individual. A minimum of three data points per survey respondent is needed, so we introduced a third data point by assuming that subjective survival to age 110 is very close to zero.

For convenience we reiterate Perozek's method here. We denote the probability of surviving to age 75 and 85 as P_{75,age_i} and P_{85,age_i} respectively, where age_i denotes the age of respondent i at the survey interview. These probabilities of survival are conditional on survival to age_i in which the survey interview was conducted, ranging from age 51 to 60 (inclusive). We further adjusted the survival probabilities (see Appendix A1) to ensure that they are consistent with the biological aging process and with one another (i.e., that the probability of survival to age 85 is equal to or smaller than survival to age 75). We applied both the Gompertz and Weibull survival functions, $S_{i,t}(\alpha_i,\beta_i)$:

$$\text{Weibull}: \; S_{i,t}(\alpha_i,\beta_i) = e^{-\frac{t-age_i\beta_i}{\alpha_i}}$$

$$\text{Gompertz}: \; S_{i,t}(\alpha_i, \beta_i) = \exp\left[\frac{\alpha_i}{\beta_i}\right]\left(1 - e^{\beta_i(t-age_i)}\right)$$

Where each individual, *i*, at their respective age at the time of the survey, age_i, have parameters $\alpha_i$and β_i from a select cumulative survival function fit to their subjective survival probabilities.

Nonlinear least squares regression was used to estimate $\alpha_i$and β_i so that $P_{75,85,110} = S_{i,t}(\alpha_i, \beta_i)$ for $age_i \varepsilon [51, 60]$. Based on the modeled survival functions, we could estimate each individual's subjective survival from age_i to 110. Below we introduce minor changes to this methodology in order to compare black and white subpopulations.

2.3. Birth cohorts

To increase the power of our results, respondents with ages 51–55 and 56–60 (inclusive) at interview are pooled together. The grouping allows us to analyze the black and white racial subpopulations, with 675 black and 3,385 white respondents in the first age group, and 660 black and 3,069 white respondents in the second age group. Although life tables are generally sensitive to each age, the subjective life tables to be formulated here are based on predictions of survival ten to fifteen years into the future. We assume a 51-year old's prediction of survival at age 75 will not change much in four years' time. Comparisons of the calculated subjective survival curves between each age confirm this assumption.

To group the ages, the cumulative survival at each age will be normalized to age 55 for the first group (which spans birth cohorts of 1937–1941), and 60 for the second group (which spans birth cohorts of 1932–1936). For each individual, *i*, the normalized survival, $S_{i,t,group_j}$ is equal to:

$$S_{i,t,group_1} = S_{i,t}/S_{i,55} \text{ for } 1937 - 1941 \text{ birth cohort}$$

And

$$S_{i,t,group_2} = S_{i,t}/S_{i,60} \text{ for } 1932 - 1936 \text{ birth cohort}$$

These cumulative survival probabilities are multiplied by the HRS-supplied person-level (sample) weights ($S_{i,t,group_j} * W_i$) which establishes a cohort for each individual, with a declining population from 1992 till age 110. These individual cohorts are summed, $\sum_{i=1}^{N} S_{i,t,group_j} * W_i$, for each age group and variable of interest (race, gender) to generate theoretical subjective cohorts. That is, a cohort of individuals whose subjective survival curves suggest they expected themselves to be alive.

2.4. Actual survival in HRS cohorts

In the beginning of 2021, HRS updated their mortality database till the year 2018, thus the youngest in the 1932–1936 birth cohort group (ages 56–60 in 1992) reached age 82 (spans 82–86), and the youngest in the 1937–1941 cohort (ages 51–55 in 1992) reached age 77 (spans ages 77–81). Thus, both groups surpassed age 75, their first target of expected survival. To calculate actual survival of the same individuals for which we calculated subjective survival we simply use nonparametric survival analysis, Kaplan-Meier analysis, to generate survival curves. To make the results comparable, we separate into the same age cohort groups as above and normalize at age 55 and 60 for each respective group. This shifts the objective survival curve to a normalized age for each group so that those who were aged 51–55 in 1992 are now all normalized and pooled together at age 55, and likewise those aged 56–60 in 1992 are normalized to age 60, just as we grouped ages for the subjective survival curves.

2.5. Correlates of certainty in subjective survival

To understand the possible factors considered for each race when estimating a 100% chance of survival, we calculate the incidence and significance (with a two-tailed *t*-test) of various factors within the 100% ers and the rest of the population. We chose factors that individuals might evaluate before making longevity predictions (Griffin et al., 2013a). Our factors are broken into 5 categories: 1) Psychology variables – in the 1992 wave HRS does not have an 'optimism' variable (or CES-D measure) so we use related psychology questions that reflect optimism: enjoyment of life, happiness, depression, and self-rated emotional health. 2) Social connectedness – we examined household size, number of siblings, number of children, presence or absence of good friends, satisfaction with friendships and satisfaction with marriage. 3) Health status and health behaviors (e.g., BMI, alcohol consumption, whether are current or former smokers). 4) Personal health and family history – we examined self-rated current health, total health conditions as verified by a doctor, number of living parents, if mother or father are living and till what age each of them lived. 5) Socioeconomic status –we also examine: income and education.

We then perform logistic regression to analyze which of these correlates predict answering 100% in response to subjective survival expectations, while accounting for the remaining factors. We fit a series of sequential regression models, adding at each step a category of correlates (demographic, socioeconomic, health status and behaviors, psychosocial factors, social ties). Overall, there were 11% missing cases across all correlates (psychosocial variables have been previously imputed by RAND). We imputed those missing cases using chained multiple imputation (either linear or logistic regression, depending on the outcome) based on demographic predictors (age, gender, birth cohort).

In order to maintain statistical power, we present our results based on the complete analytic sample, controlling for cohort and cohort-race interaction.

3. Results

3.1. Subjective survival by race

For each race, gender, and birth cohort group (sample size in Table A1) we generated SSP curves for fitted Gompertz (Fig. 1) and Weibull (Figure A3) subjective survival curves (which essentially represents an approximate range of survival expectations). The survival expectations appear robust to the choice of survival function. It should be noted that the basis for the subjective survival calculations is the individual given responses to the expected survival questions (which can be seen in A1 and A2[2]).

For the 1932–1936 birth cohort white men have the lowest estimated SSP (Fig. 1) throughout the life course, followed by white women. Black women share similar perceived survival probabilities with white women until just before age 75 and then surpass the survival expectations of white women (a subjective survival crossover). At old ages black men and women share approximately the same and the greatest survival expectations.

Aside from beginning at a younger age (55), the patterns among the 1937–1941 birth cohort are quite different. Instead of black men having higher expectations of survival throughout their life course, they have the lowest expectations until the crossover at age 78. After the crossover,

[2] Note the focal point (0, 0.5, and 1) clustering and that blacks have greater response of 1 ("100% chance or certain of survival") across gender and birth cohort relative to their white counterparts; this is especially noticeable for black males from the 1932–1936 birth cohort, and even in the 1937–1941 cohort 18% of white males chose 100% survival compared to 28% of black males, we will address this phenomenon further in section 3.3.

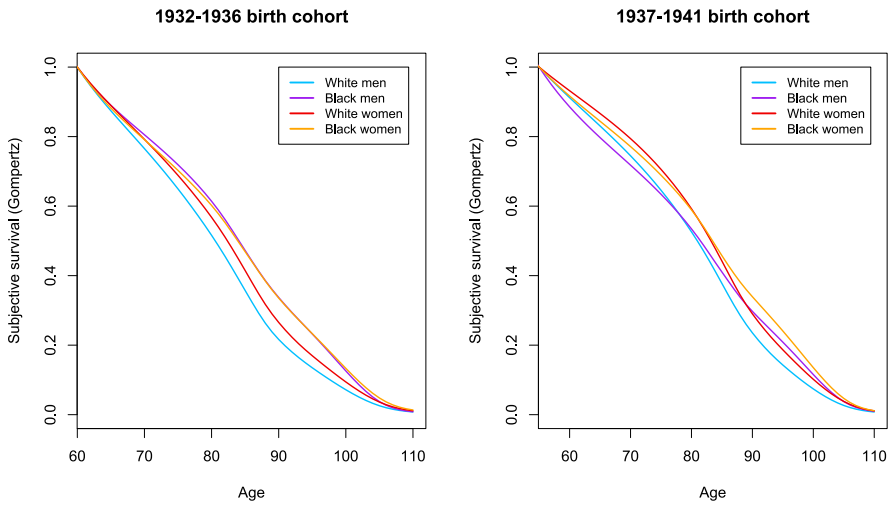

Fig. 1. Subjective survival curves by race and gender for the 1932–1936 and 1937–1941 birth cohorts. Subjective survival curves are calculated using the Gompertz model (Methods 2.2).

white men have the lowest survival expectations. Thus, the 'racial anomaly' only occurs at older ages. There is a similar crossover among women. White women have slightly higher SSP than black women, with some overlap from age 55 to age 80. Thus, for women the crossover occurs at about age 80, at which point black women have a higher SSP than white women.

In summary in the earlier 1932–1936 birth cohort, there is consistent advantage in perceived survival for black men over white men, with a peak difference of 0.12 at age 88. In the later 1937–1941 black men have a peak in perceived survival advantage at age 92 with a discrepancy of about 0.08 over white men. Black and white women share similar inequalities in SSPs as their male counterparts, it is in the same direction by birth cohort but with less magnitude. Our comparison of subjective survival suggests that black individuals' overestimation (or optimism) is decreasing with birth cohort for both the Gompertz and Weibull models. The racial anomaly (and thus the subjective crossover) is shifting closer to age 80 in the younger cohort.

3.2. Comparing expected survival and actual survival

We compare the objective survival, that is the actual survival probabilities of the same black and white individuals from which we calculated the SSP curves, directly to the subjective survival rates until age 77 for the 1937–1941 birth cohort and until age 83 for the 1932–1937 birth cohort (Fig. 2, with confidence intervals in appendix fig. A4); we examine the inaccuracies in survival predictions and then later investigate potential causes.

One of the advantages of calculating the subjective survival for each age is the more dynamic approach when comparing the subjective and objective survival rates for each race. For example, focusing on age 75, white men had an objective survival of 0.70 (Fig. 2), and a subjective survival of 0.67 for the 1932–1936 birth cohort, 0.74 and 0.67 respectively for the 1937–1941 cohort (the subjective survival was the same for each birth cohort). That is a 0.03 underestimation that increased to a 0.07 underestimation of survival in the next birth cohort. Black men on the other hand overestimated their survival by 0.14 and 0.11 in the 1932–1937 and 1937–1941 birth cohorts, respectively. The curve at all ages provides more information than the one age point, mainly, that the agreement between the objective and subjective survival for black men is increasing with birth cohort, but especially at younger ages (for the 1937–1941 birth cohort) where the agreement surpasses that of white men. This suggests age-specific patterning in the predictive power of subjective survival rates, that mid-aged black men's survival predictions are becoming more accurate.

Black women have incredible agreement between the subjective and objective survival rates (Fig. 2). At age 75 the objective survival is 0.71 and 0.70, and the subjective survival is 0.71 and 0.72, respective to the 1932–1936 and 1937–1941 birth cohorts. Based on age 75 alone we might surmise that the predictive power of black women decreased slightly with birth cohort, however the curves show strong agreement between the subjective and objective survival continues for the first 18 years for both cohorts; from 55 for the 1937–1941 cohort and 60 for the 1932–1937 birth cohort.[3]

Like white men, white women also tend to underestimate their survival but to an even greater degree. White women at age 75 had an objective survival and SSP discrepancy of 0.10 and 0.05 for the 1932–1936 and 1937–1941 birth cohorts, which suggests a decrease in the underestimation. We note that we are limited in the age of mortality follow-up for these results and do not yet see the age of objective survival crossover for either cohort or gender. In summary: white men are increasing in their underestimation (pessimism) with birth cohort, white women are becoming more accurate (decreasing their pessimism), black men are becoming more accurate (decreasing optimism), and black women are remaining accurate.

3.3. Focal point drivers of subjective survival by race

The previous findings revealed that black men are more optimistic than white regarding their survival expectations, despite having worse objective survival outcomes. We ask whether this manifest optimism reflects true expectations or merely an inability to assess risk—i.e., some respondents answering with absolute certainty. Figures A1 and A2 compare the frequency in which blacks and whites responded with 100% chance of survival to age 75 and 85, respectively, by gender and birth cohort. To statistically analyze this phenomenon for our two birth cohorts we perform logistic regression for the likelihood of choosing either 0 (no chance), 50% chance of survival, or 100% (survival certainty).

For the 1937–1941 cohort, an increase in age, being female and

[3] Significant tests comparing the objective survival and subjective survival just at age 75 shows that there is no significant difference for black women, but there is significance difference for white men, women, and black men.

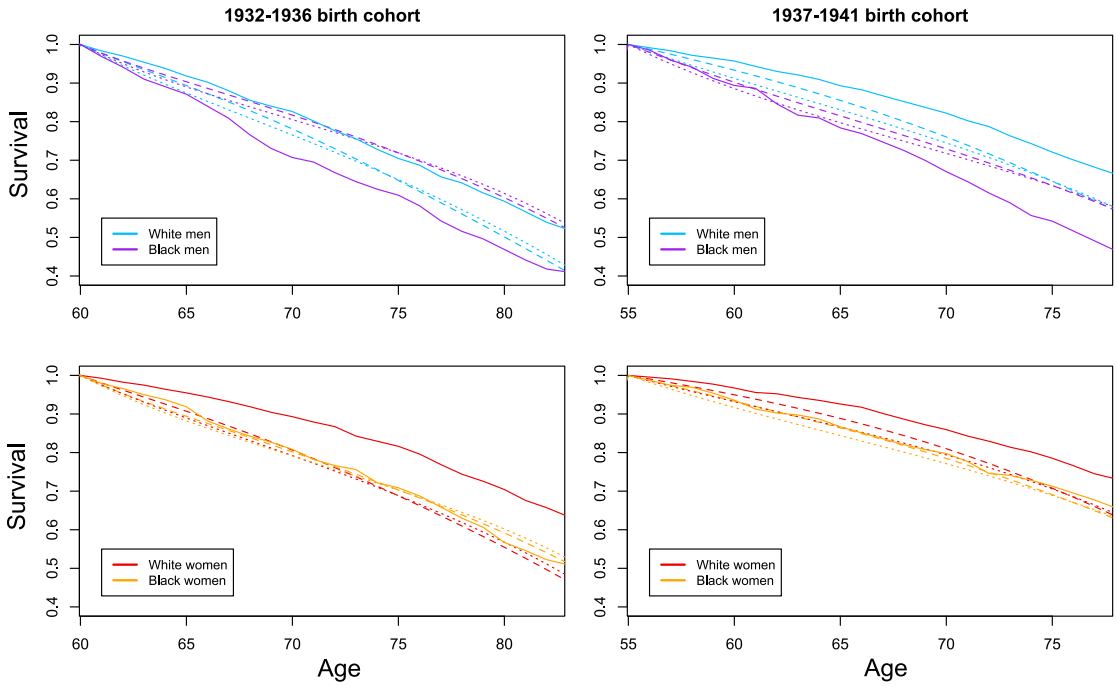

Fig. 2. Subjective vs objective survival, with gender separated panels. Dashed lines are subjective survival curves based on the Weibull survivor function, dotted on the Gompertz function. The solid line represents actual survival of respondents updated till 2018 where the youngest in the 1937–1941 cohort reaches age 77, and the youngest in the 1932–1936 cohort reached age 82.

being black increases the likelihood of selecting 100% for P75 (Table 1). For the 1932–1936 cohort, being black increased the odds of selecting 100% with an odds ratio of 1.7 and 2.8 for P75 and P85, respectively (Table A2). Black individuals from both cohorts were more likely to select 100%, but even more so from the earlier 1932–1936 birth cohort. We also checked how education level affected the likelihood of selecting 100% and found that it is not a significant predictor for either cohort nor for P75 or P85.

For the likelihood of selecting 50% chance of survival, there is little to no significance in race or gender as predictors (not shown). Education does seem to behave as a significant predictor and will be a focus in future research.

Being male increases the likelihood of selecting 'no chance' or 0% survival for every cohort and target age. For the 1937–1941 cohort, being black also increases the likelihood of selecting 0% (Table A4). For the 1932–1936 cohort, the likelihood of men selecting 0% for P75 has very slight significance (not shown), and for P85, men are 22% more likely to select 0% than women (Table A4). We found also that level of education is a significant predictor of selecting 0% but does not mitigate the significance of gender. We later investigate if the 100%ers have any unique qualities that might suggest their selection was purposeful and not a reflection of misunderstanding.

Table 1
Logistic regression on answering 100% of survival to age 75 and 85, 1937–1941 birth cohort.

P75 Predictors	β	*SE* β	e^{β} (odds ratio)	t value	Pr(>|t|)
Intercept	−5.965	1.561	0.002	−3.819	0.000 ***
Age	0.073	0.029	1.076	2.519	0.011 *
Female	0.267	0.083	1.306	3.193	0.001 **
Black	0.310	0.102	1.364	3.046	0.002 **
P85	β	*SE* β	e^{β} (odds ratio)	t value	Pr(>|t|)
Predictors					
Intercept	−5.050	2.250	0.002	−2.244	0.024 *
Age	0.021	0.042	1.076	0.520	0.603
Female	0.316	0.123	1.306	2.569	0.010 *
Black	0.879	0.129	1.364	6.802	1.18e-11 ***

3.4. Validity of the '100%ers' predictions

Descriptive statistics indicate that white men who responded with 100% have greater survival rates than those who denoted 50% or 0% for both birth cohorts. However, black men who answered 100% chances of survival had worse survival rates than those who answered 50% for both cohorts (Fig. 3).

We confirmed that black men who answered 100% less accurately predicted their longevity than white men with logistic regression of the probability of being alive at age 75 (not shown). White and black women's and white men's subjective survival expectations at age 75 are significant predictors of whether they will be alive at age 75 for the 1932–1937 birth cohort, but black men's subjective survival at age 75 does not significantly predict their objective survival. However, for black men in the 1937–1941 birth cohort subjective survival at age 75 was significant at the <0.1 level. This further suggests that with successive birth cohorts the accuracy of predictions improved for black men.

3.5. Descriptive statistics of the 100%ers

So far, we found that black and white respondents clustered around focal points differently, and the biggest racial difference occurred at the 100% survival prediction. We further showed that black men in general, and black 100%ers did not have survival estimates with predictive value. We believe that the focal point clustering is not merely artifact or error but a reflection of tendencies towards different cultural attitudes within the population.

When all those who answered 100% are excluded from analysis, black men no longer overestimate their mortality, they underestimate, although still to a lesser extent than white men (Figure A5); suggesting more optimism in the black population (or alternatively more pessimism

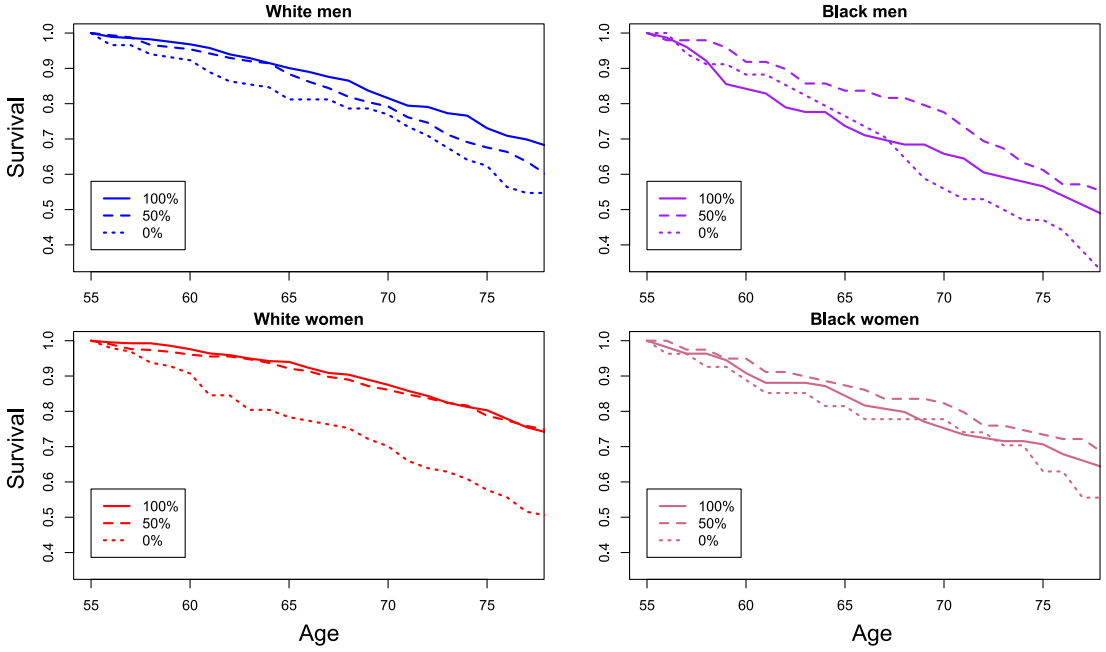

Fig. 3. Actual survival of black and white men and women in the 1937–1941 cohort, stratified by focal point response (100%, 50%, 0%) to the subjective survival survey question ("What are the chances you will be alive at age 75?").

Table 2
Odds ratios of answering 100% survival with five potential models. Significance levels >0.1 '.', 0.05 '*', 0.01 '**', 0.001 '***'. For Self-Rated Health and Total Health conditions the higher number indicates worse health. Enjoy life and Happy are on a scale ranging from 1-all the time to 4-None of the time. Depression has the same scale, i.e., the higher numbers indicate less or no depression. Self-rated emotional health is 1- excellent ranging to 5- poor. Satisfaction with friendships ranges from 1-very satisfied to 5- very dissatisfied.

MODEL	DEMOGRAPHIC		+ SES		+ HEALTH and HEALTH BEHAVIORS		+ PSYCHO-LOGICAL FACTORS		+ SOCIAL FACTORS	
Intercept	0.04	**	0.03	**	0.05	*	0.12		0.12	
Age	1.02		1.03		1.05	*	1.05	*	1.05	*
Women	1.22	**	1.21	**	1.21	**	1.24	**	1.22	**
Cohort (1937)	1.18		1.18		1.20		1.21		1.21	
Black	1.72	***	1.72	***	2.12	***	2.05	***	2.00	***
Cohort x Black	0.76	.	0.76	.	0.79	.	0.76	.	0.75	.
Married	0.96		0.96		0.90		0.83	*	0.80	**
Household Income			1.00		1.00	*	1.00	*	1.00	*
Highest Year Education			1.00		0.95	***	0.95	***	0.96	**
Self-Rated Health					0.65	***	0.71	***	0.71	***
Total Health Conditions					0.91	*	0.92	*	0.92	*
BMI					1.00		1.00		1.00	
Alcoholic Drinks per Day					0.99		0.99		0.99	
Currently Smoke					0.92		0.92		0.92	
Mom Alive					1.07		1.08		1.08	
Dad Alive					1.13		1.13		1.12	
Depression							1.13	.	1.13	.
Enjoy Life							0.73	***	0.74	***
Happy							0.92		0.92	
Emotional Health							0.89	**	0.89	**
Number of Siblings									1.01	
Number of Children									1.04	**
Satisfied with Friends									0.91	.
N	8,042		8,042		8,042		8,042		8,042	

in the white population).

For men in the 1937–1941 cohort (those aged 51–55) we found that both black and white 100%ers had significantly better psychosocial scores than the rest of the population (Table A5). That is, the 100%ers enjoyed life more, were happier, had less depression and better self-rate emotional health than the rest of the black and white population. Black and white 100%ers also enjoyed significantly greater satisfaction with friendships.

However only white 100%ers had significantly better self-rated health and objective health than the rest of the white respondents. Black 100%ers do not share the same advantageous health benefits.

3.6. Possible explanatory model of the 100%ers

To further analyze the associated factors above while accounting for changes in each variable, a logit regression was performed in steps with five potential models. First with just demographic factors, then SES factors were added, followed by health and health behaviors, psychological factors, and then social factors (Table 2).

Our primary focus is how adding each category of predictors impacts

racial differences in selecting 100% survival certainty. We found that the odds ratio between blacks and whites of selecting 100% is about 1.72 and does not change much when socioeconomic factors are added. However, when health and health behaviors are accounted for, racial differences in selecting 100% increases to a ratio of 2.12. Racial differentials in selecting 100% are slightly reduced by accounting for psychological factors and reduced even further when social factors are added (Table 2). When analyzed both cohorts separately, we found that in the earlier cohort (1932–1936) racial differentials in the likelihood of selecting 100% are mitigated even more drastically when psychological and social factors are added to the model. However, Table 2 shows that the cohort differences are not significant, although there is slight significance for the cohort race interaction.

Finally, when stratifying the black and white populations and running the same explanatory models we found that unlike the white populations, demographic factors, education, and total (objective) health conditions are not significant predictors of selecting 100% for the black population (Table A6 and Table A7). Self-rated health is a significant predictor for both races, but whites have less likelihood of selecting 100% with worse self-rated health. Racial differences in estimating 100% survival can be partially attributed to racial differences in weighing health factors. Psychological and social factors account for some of the racial differences at the same health level (Table 2), but not all as net of psychosocial factors blacks are still twice as likely to select 100% probability of survival.

4. Discussion

Individuals base their decisions on their survival expectations, whether those expectations are accurate or not (Hurd, 2009). Thus, group differences in subjective survival are potentially important arenas of social inequality, in addition to inequalities in actual survival.

Our results suggest that middle-aged American black men tend to be overly optimistic about their survival prospects, although this optimism has waned with successive birth cohorts. At the same time, the accuracy of their survival expectations (in the aggregate) has increased. By contrast, black women's survival expectations are quite accurate in relation to actual cohort survival. White men and women consistently underestimate their survival, but in later cohorts, white women's survival expectations were slightly more accurate (and less pessimistic). White men's expectations, on the other hand, were bleaker in later cohorts despite improvements in their actual survival. Overall, the picture painted by subjective survival expectations—and how they are patterned across race, gender, and birth cohorts—differs in important ways from documented inequalities in actual survival.

A novel finding is that the racial anomaly in subjective survival appears to be shifting to older ages. It resembles the black-white mortality crossover[4] that has been documented after age 80 (Yao & Robert, 2011) and appears to be shifting to older ages as well (Lynch et al., 2003). Regrettably, we cannot compare the subjective and objective crossovers directly as the latter has not yet occurred within the study population's follow-up period. In general, mortality crossovers can result from selection mechanisms among disadvantaged groups—i.e., due to lifelong exposure to higher mortality, only the most resilient individuals survive to old age, therefore having a survival advantage in old age (Wrigley-Field, 2014). It is less clear why a similar crossover should be observed in subjective survival.

Importantly, the racial anomaly does not occur at all ages. Blacks have *lower* survival expectations than their white peers at college age (Mittal et al., 2020) and under age 50 (Umberson et al., 2017), but *higher* survival expectations beyond that age (Bulanda & Zhang, 2009). Thus, subjective survival expectations of black Americans may not be anomalous at all but rooted instead in their mortality experience throughout the life course. The crossover in subjective survival expectations may be related to the mortality crossover in two ways. First, older blacks may be basing their expectations by inferring from the mortality experience of their peers and predecessors, who are in fact living longer once they have reach old age. Second, they themselves may be more select with respect to health and resilience relative to their white peers, thus expecting to live longer. We find no support for the second argument because blacks who were particularly optimistic about their survival chances (responded 100% chance to survive to the target age) had in fact poorer health and higher mortality. Thus, the explanation may lie in the first hypothesis, though we could not test it directly. Our analysis was further limited by the HRS sampling design to ages between 50 and over, and only two birth cohorts at baseline, so we remain cautious about over-interpreting age and cohort effects on subjective survival among blacks and whites.

Our findings further suggest that overestimating survival was largely driven by focal point answers of 100 percent chance of survival to the target age. Although prior research attributed focal point answers to knowledge deficit among less educated individuals, we did not find that the 100% certain response was mitigated by educational attainment (Bago D'uva et al., 2015). Furthermore, even if we were to remove those who answered 100%, black men on average would still be more optimistic in their survival chances compared to white men (who underestimate their actual survival to a greater extent). Focal point rounding has been noted in prior research (Hunyh and Jung, 2011; Kleinjans and Soest, 2014; Hurd, 2009), and so did the greater tendency among blacks to cluster at 100 percent (Lee & Smith, 2016). However, no study to date has systematically attempted to explain those differences.

If those predicting survival till age 75 with certainty (the 100%ers) indeed believe that they have some advantage that will enable them to survive past their demographic's average survival, what is the advantage? We found that both black and white 100%ers had better psychosocial attributes than the rest of the sample. However only white 100%ers also had better health. Accounting for health status and health behaviors only *increased* the black-white differentials in selecting 100 percent. This might explain why black 100%ers and black men in general did not accurately predict their actual survival; they did not give sufficient weight to their health when calculating their survival expectations.

These findings support the notion that middle- and old-aged black Americans are more optimistic than their white peers. Compared to their white counterparts, older black men more frequently engage in adaptive coping strategies and have a stronger resolve that their future would be better (Heckman et al., 2000). Having greater optimism in survival in late life may have developed as a protective psychological mechanism, following repeated exposure to adversity over the life course. As survival to old age became less exceptional with successive birth cohorts, optimism has played a smaller part in the expected survival of black men.

Psychological research has found that optimism has many protective benefits and can offer hope and better quality of life (Gallagher et al., 2020). Furthermore, older respondents generally tend to be more optimistic than younger ones (Ludwig & Zimper, 2013; Wu et al., 2015), suggesting that a positive outlook on longevity might develop as a response to events experienced throughout the life course. Further investigation at younger ages could elucidate how this observation effects black and white populations. Interestingly, subjective survival is a measure that can have behavior effects even at young ages. One study of college-age students revealed that students' self-care is highly correlated

[4] We distinguish between mortality crossovers and survival crossovers – survivorship is a cumulative measure and thus the crossover is sensitive to starting age (which in this study depends on the birth cohort). Therefore, we do not expect exact agreement between literature on mortality crossovers and our subjective survival crossovers, nonetheless finding a similar trend is encouraging.

to their perceived longevity, and that their life expectancy perceptions are highly modifiable (Rodemann & Arigo, 2018).[5]

Our research highlights the importance of considering psychosocial and cultural attitudes of subpopulations when using subjective survival rates, as groups differ in how they weigh their personal information in their survival predictions. An additional example was found in the UK where an Irish subpopulation was found to overestimate survival while comparable populations from Scotland and England underestimated survival (Bell et al., 2020). The driving mechanism for the difference has yet to be found, but was not a result of differing survey procedures, perhaps suggesting some underlying cultural differences could be propagating the surprising differentials.

This study is not without limitations. First, the survey respondents were asked to assess their probability of survival to age 75 and 85 at a single point in time. Based on responses to those two questions, we derived subjective life expectancies using parametric models. Our findings are robust to choice of parametric model (Gompertz or Weibull), though there is no guarantee that individuals' subjective assessments are actuarially coherent—e.g., that they reflect the increase in risk of mortality with age—as the parametric models impose. Indeed, a minority of respondents reported a greater or equal probability of surviving to age 85 and to age 75, which we excluded from the analysis or perturbed. Second, our sample was limited to community-dwelling Americans aged 51 to 60 at baseline. As a result, we cannot infer about subjective life expectancy at younger ages and how it may have changed over the life course among blacks and whites. Our mortality follow-up is similarly right-censored, so we can only observe actual survival to age 83 and 77, on average, in the earlier and later birth cohorts respectively. Third, although our analysis was broken down by birth cohort, the differences we report in subjective life expectancy may be attributed to age, rather than cohort effects. Future research may overcome some of those limitations as HRS respondents age and more data become available.

Nevertheless, our study extends the research on racial differences in subjective survival by examining in greater detail group patterns in focal point clustering, in order to elucidate divergent characteristics of our black and white subpopulations. Subjective survival expectations ultimately reflect how long individuals believe that they will live, given their unique life history, and it is associated with their social and economic behavior, as well as their psychosocial wellbeing. A central question for sociologists and demographers alike is how racial disparities in subjective survival differ from objective mortality inequalities, and how they may shape inequalities in other social outcomes in old age.

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[5] It has been suggested that informing individuals about population life expectancies for people of their age and gender can help them to more accurately predict their remaining lifetime. One study found that young individuals who did not know their population life expectancy had 21% higher subjective mortality than individuals who knew their population life expectancy exactly (Koc & Kalwij, 2020). Misinformation can lead respondents to overestimate their remaining lifespan by 18% on average (Chen et al., 2020) and over predicting survival can impede advanced care planning and setting up a living will (Lou & Carr, 2020). We do not address the question here if the benefits of a higher perceived longevity outweigh the costs of an inaccurate longevity prediction.

CRediT authorship contribution statement

Shayna Fae Bernstein: Conceptualization, Formal analysis, Visualization, Writing. **Isaac Sasson:** Conceptualization, Methodology, Supervision, Writing.

Declaration of competing interest

None.

Data availability

HRS and RAND data products are freely available after registration. https://hrsdata.isr.umich.edu/data-products/rand.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssmph.2023.101339.

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