Anti-Gay Prejudice and All-Cause Mortality Among Heterosexuals in the United States

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Objectives. We determined whether individuals who harbor antigay prejudice experience elevated mortality risk.

Methods. Data on heterosexual sexual orientation (n = 20 226, aged 18–89 years), antigay attitudes, and mortality risk factors came from the General Social Survey, which was linked to mortality data from the National Death Index (1988–2008). We used Cox proportional hazard models to examine whether antigay prejudice was associated with mortality risk among heterosexuals.

Results. Heterosexuals who reported higher levels of antigay prejudice had higher mortality risk than those who reported lower levels (hazard ratio [HR] = 1.25; 95% confidence interval [CI] = 1.09, 1.42), with control for multiple risk factors for mortality, including demographics, socioeconomic status, and fair or poor self-rated health. This result translates into a life expectancy difference of approximately 2.5 years (95% CI = 1.0, 4.0 years) between individuals with high versus low levels of antigay prejudice. Furthermore, in sensitivity analyses, antigay prejudice was specifically associated with increased risk of cardiovascular-related causes of death in fully adjusted models (HR = 1.29; 95% CI = 1.04, 1.60).

Conclusions. The findings contribute to a growing body of research suggesting that reducing prejudice may improve the health of both minority and majority populations. (*Am J Public Health.* 2014;104:332–337. doi:10.2105/AJPH.2013.301678)

Prejudice, whether it arises from individuals[1] or from social institutions and practices,[2,3] is a risk factor for poor health among members of socially disadvantaged groups. Intriguingly, a small but growing set of studies has suggested that those who harbor prejudice may also be at risk for negative health outcomes. For instance, data from a nationally representative survey of US adults indicated that Whites with high levels of prejudice against Blacks experienced higher risk of mortality than Whites with low levels of racial prejudice.[4]

Recent experimental studies have suggested biological pathways related to physiological responses to stress that could explain why harboring prejudice leads to poor health for majority group members. Specifically, individuals with high levels of racial prejudice experienced increases in the stress hormone cortisol during interactions with a cross-race partner, but not with a same-race partner.[5] By contrast, low-prejudice individuals do not appear to experience these same interactions as stressful. When evaluated by Black interviewers during a series of stressful tasks, Whites with low levels of racial prejudice experienced a greater increase in salutary neuroendocrine responses (i.e., dehydroepiandrosterone sulfate, or DHEA-S) than Whites with high levels. These experimental studies have provided evidence that harboring prejudice produces short-term physiological stress responses. Research on chronic stress exposure and health[6–8] suggests that, if these stress responses are continually activated, prejudiced individuals may ultimately be at elevated risk for long-term disease outcomes, as well as mortality.

We evaluated whether heterosexuals who harbor antigay prejudice are at elevated risk for mortality. Although existing health data sets have information on traditional correlates of disease and mortality, they typically lack data on social factors (e.g., prejudicial attitudes) that may contribute to morbidity and mortality. Consequently, the field has heretofore been unable to examine the health consequences of harboring antigay prejudice at a population level. However, an innovative new data set—the General Social Survey–National Death Index study—permits a rare opportunity to test this research question. Since 1972, the General Social Survey (GSS) has been the primary source of social indicator data for the social sciences. It contains questions surrounding a wide array of social attitudes—including antigay prejudice—as well as measures of sexual orientation. The GSS was linked to mortality data from the National Death Index (NDI) so that information on longevity is now available for participants across multiple waves of the GSS.[9] We were therefore able to test the hypothesis that heterosexuals who endorse higher levels of antigay prejudice are at elevated risk for mortality compared with heterosexuals who endorse lower levels of antigay prejudice.

METHODS

The data used in this study came from the General Social Survey–National Death Index (GSS–NDI).[9] The GSS employs a multistage probability sample, which generates nationally representative estimates of the noninstitutionalized US adult population aged 18 years and older (beginning in 2006, Spanish speakers were included in the sample). Originally an annual survey, the GSS became biennial beginning in 1994. Response rates range from 70% to 82%. Additional details on sampling and weighting of the GSS can be found elsewhere.[10]

The GSS–NDI is a new retrospective cohort data set in which participants from 18 waves of the GSS are linked to mortality data by cause of death, which was obtained from the NDI. To link the 2 data sets, the GSS provided identifiable information on the respondents. We then linked this information to the NDI to determine whether the GSS participants were alive or dead as of 2008. The linkage methodology that we employed has been well validated in other national surveys, including the National Health Interview Survey and the National Health and Nutrition Examination

Survey (NHANES).[11] More details on the GSS–NDI study, including the linkage methodology, can be obtained elsewhere.[9]

The GSS–NDI covers GSS survey years 1978 through 2002 (given the relative recentness of the data, very few deaths were expected to have occurred after 2002). The current study used GSS data from 1988 to 2002 linked to NDI data through 2008. We selected the truncated years for this study because questions of sexual orientation were not available in the GSS survey until 1988, when questions related to the number and gender(s) of sexual partners were first included.

Measures

Sexual orientation. Since 1988, respondents were asked whether their sexual partners were exclusively male, exclusively female, or both male and female. Gender of sexual partners was assessed over the past 12 months and the past 5 years. Some years also included questions asking the number of sexual partners the respondent had of each gender since age 18 years. If respondents reported exclusively opposite-sex partners in the past 12 months, the past 5 years, or since age 18 years, we categorized them as heterosexuals (n = 20 226). We removed respondents who reported having sexual partners of the same sex (n = 914) from the analyses, given the study's focus on heterosexuals.

Predictor: antigay prejudice. We used 4 questions to measure antigay prejudice:

1. "If some people in your community suggested that a book in favor of homosexuality should be taken out of your public library, would you favor removing this book, or not?";
2. "Should a man who admits that he is a homosexual be allowed to teach in a college or university, or not?";
3. "Suppose a man who admits that he is a homosexual wanted to make a speech in your community. Should he be allowed to speak, or not?"; and
4. "Do you think that sexual relations between two adults of the same sex is always wrong, almost always wrong, wrong only sometimes, or not wrong at all?"

Questions 1 through 3 were dichotomous. We dichotomized question 4 as "not wrong at all" (coded as 0) versus all other responses. We averaged individuals' scores over these 4 questions, which we examined as a continuous measure of antigay prejudice.

Each of the 4 antigay prejudice items was asked in all waves that were analyzed. Among those respondents who were asked the antigay prejudice questions in each year, there were few items missing, with missing values ranging from a low of 2.9% on the item regarding public speeches to a high of 6.7% on the item regarding same-sex relations.

Individuals with less education and those who endorse a conservative ideology are more likely to report antigay prejudice and to support policies that target gays and lesbians for social exclusion, such as constitutional amendments banning same-sex marriage.[12–14] The antigay prejudice scale in the GSS was statistically significantly associated with lower educational attainment ($r = -0.35$; $P < .05$), indicating that antigay prejudice declines with higher levels of educational attainment. Furthermore, antigay prejudice was significantly associated with conservative ideology ($r = 0.13$; $P < .05$), providing additional support for the measure's convergent validity. In addition, the Cronbach α was 0.75, indicating that this is an internally reliable measure.

Outcome: all-cause mortality. We obtained information on all-cause mortality from the NDI, as described earlier in "Methods." We validated the GSS–NDI in part against the NHANES III–NDI, and the mortality distribution and age of death in the 2 data sets was nearly identical. In our models, respondents who had died by 2008 were coded 1 and those who survived the study period were coded 0.

The NDI also provided *International Classification of Diseases, Ninth Revision* (*ICD-9*)[15] and *ICD-10*[16] codes, which permitted the examination of whether specific causes of death differed between respondents who reported high versus low levels of antigay prejudice. Table 1 presents the top 5 causes of death for the heterosexual sample in the GSS–NDI from 1988 to 2008: cardiovascular and heart disease, cancer, stroke, chronic lower respiratory diseases, and infections. Data from the National Vital Statistics System (NVSS) for 2011 (the most recently available information) indicated that the 5 major causes of death in the United States were heart disease, cancer, chronic lower respiratory diseases, stroke, and accidents. Thus, with the exception of infections, the top 5 causes of death in the GSS–NDI are identical to those found in the NVSS.

Covariates. We included an array of covariates to eliminate alternative explanations for elevated mortality among heterosexuals harboring antigay prejudice. Specifically, we examined 3 types of individual-level covariates that have been strongly predictive of mortality risk in prior research: demographics, socioeconomic indicators, and current health.[17–20] We examined relationships between these covariates and mortality in bivariate models; all covariates were statistically significantly associated with mortality and were therefore retained in the multivariate models.

Demographic controls included respondent's racial/ethnic identification (White, Black, or other race), gender (male or female), age at interview, marital status (married, widowed, or divorced or separated), and nativity status (indicating whether the respondent was born outside the United States).

We included 2 socioeconomic measures—household income and individual educational attainment—because of the established inverse association between these variables and individual mortality risk.[21] Given the skewed distribution of the income variable, we used the natural log of income in our models. The measure of educational attainment corresponded to the respondent's number of years of formal education.

We included a measure of current health status, which was assessed by a single item: "Would you say your own health, in general, is excellent, good, fair or poor?" Previous research has demonstrated that self-rated health is a valid indicator of health distress as well as the presence of disease and differentiates heightened mortality risk.[22] We dichotomized self-rated health into fair or poor health (coded 1) and good or excellent health (coded 0).

In addition to these covariates, we controlled for 2 covariates in specificity analyses. First, we included a measure of racial prejudice to determine whether the results were specific to antigay prejudice or were attributable to prejudice more generally. This was necessary given that both measures of prejudice (racial and antigay) were strongly correlated in the GSS sample ($r = 0.31$; $P < .001$). We took the

TABLE 1—Top 5 Major Causes of Death Among Heterosexuals: General Social Survey–National Death Index Study, United States, 1988–2008

Cause of Death	No. (%)[a]	Mean Age at Death, Years
Cardiovascular and heart disease	1147 (27.30)	74.07
Cancers (all types)	1045 (24.88)	67.53
Stroke and vascular diseases	311 (7.40)	73.87
COPD and lung diseases (noncancerous)	226 (5.38)	71.48
Infections	160 (3.81)	72.48

Note. COPD = chronic obstructive pulmonary disease.
[a]The number of deaths out of all deaths (n = 4216) in the sample. The percentages are weighted.

measure of racial prejudice from the 5 items that were consistently available in the GSS. Four of these items asked respondents to indicate the reasons why Blacks have "worse jobs, income, and housing than White people." Possible answers ranged from "discrimination" to "Blacks have less in-born ability to learn." The fifth item asked respondents whether there should be laws against interracial marriage. Second, given that religious attitudes are associated with antigay prejudice,[23] we also controlled for religiosity, which was operationalized as frequency of prayer (those who prayed several times a week or more were considered to pray frequently).

Statistical Analyses

We analyzed data using Cox proportional hazard models to examine associations between antigay prejudice and mortality among heterosexuals. We selected this analytic strategy because we modeled time to death over the study period, which resulted in a censored amount of time at risk. Cox proportional hazard models can be used to analyze time to death, with the variable for death differentiating those deceased from those still living in 2008. For those who were deceased, we created our time variable by subtracting the year of interview from the year of death, yielding the number of years the respondent lived following the interview. For those who were still alive in 2008, we subtracted year of interview from 2008, which represents the number of years between the time a respondent was interviewed and the final year of the study.

Our primary analysis examined associations between antigay prejudice and mortality risk among heterosexuals, controlling for multiple potential confounders. Additionally, we converted hazard ratios into life expectancy values at age 18 years by multiplying the hazard ratio by the age-specific mortality rates starting at age 18 years (derived from an unabridged life table). The change in life expectancy before and after adjusting age-specific mortality rates is the difference in life expectancy.[24] We computed the 95% confidence interval using the upper and lower bound of the hazard ratio.

We also conducted 3 sensitivity analyses to provide further support for our inferences about the relationship between antigay prejudice and mortality among heterosexuals. The first 2 analyses included additional covariates (racial prejudice and religiosity). The third analysis examined specific causes of death to provide preliminary information on potential mechanisms linking antigay prejudice to mortality; for reasons of statistical power, we examined the 2 most frequent causes of death in the sample (cardiovascular disease and cancer, respectively). In this analysis, high-prejudice respondents were those in the highest quartile of antigay prejudice scores, and we compared them with all other respondents.

Given the structure of the GSS, not all questions were asked among all respondents each year. Consequently, each of the antigay prejudice items had greater than 5% missing data because of this planned missing design, which motivated the use of an imputation strategy.[25–27] Multiple imputation is a strategy used to address the effects of item missingness on analyses that creates several complete data sets that are imputed on the basis of the most likely outcomes given an array of predictor variables. Failure to correct for item missingness could lead to nonresponse bias if there is a particular pattern to the nonresponse and it relates to the outcome of interest (i.e., all-cause mortality).[27]

We used the ICE command in Stata version 11.2 (StataCorp LP, College Station, TX) to impute missing values for the antigay prejudice variables with the other covariates used in the imputation models. After we imputed the data, we analyzed the data sets together using "Rubin's Rules" for combining imputed data sets for analysis.[28] We created 10 data sets using all covariates in the chained imputation models. We adjusted the imputation command to ensure proper estimation of missing values on the covariates (i.e., continuous, dichotomous, or ordinal measurement). When we analyzed the imputed data sets separately, there were no statistical differences between the estimates of the means and standard errors of the covariates, which enabled us to predict the missing values for the antigay prejudice questions for respondents in years in which the questions were asked but they were not given the opportunity to respond. This was an appropriate solution to handling missing data because the split ballot design of the GSS ensures that participants were distributed randomly across the groups. Furthermore, we used the entire sample and all of our covariates, including year of interview, in the imputation models to ensure that the predicted values of antigay prejudice were the best possible estimates for each respondent. It was important to include year of interview in the imputation models in case there was any significance to year of interview in calculating the most likely responses for respondents in a given year. Although we used multiple imputation as part of our data preparation, we did not impute on our dependent variable.[26]

We conducted all analyses in Stata version 11.2 to adjust for the complex sampling design and set statistical significance at $P < .05$.

RESULTS

Table 2 provides the demographic characteristics of the heterosexual participants in the GSS–NDI study who participated in an interview from 1988 to 2008. Of the 20 226 heterosexuals in our sample, 4216 (19% of the weighted sample) were dead in 2008.

TABLE 2—Descriptive Statistics of Heterosexual Participants: General Social Survey–National Death Index Study, United States, 1988–2008

Variables	Weighted Mean or Proportion (95% CI)	TSA Standard Error	Range of Values
Respondent dead by 2008, %	19 (17, 20)	0.01	0-100
Mean prejudice score[a]	0.38 (0.36, 0.39)	0.01	0-1
Age at interview, y	44.47 (43.90, 45.03)	0.29	18-89
Race/ethnicity, %			
White	81 (79, 84)	0.01	0-100
Black	13 (11, 15)	0.01	0-100
Other	6 (4, 7)	0.01	0-100
Gender, %			
Male	45 (44, 46)	0.00	0-100
Female	55 (54, 56)	0.00	0-100
Marital status, %			
Married	59 (57, 60)	0.01	0-100
Widowed	7 (6, 7)	0.00	0-100
Divorced or separated	13 (13, 14)	0.00	0-100
Never married	21 (20, 22)	0.01	0-100
Immigrant, %	9 (6, 11)	0.01	0-100
Income, ln	10.46 (10.42, 10.50)	0.02	6.05-13.90
Education, y	13.12 (12.98, 13.26)	0.07	0-20
Fair or poor self-rated health[b]	33 (30, 35)	0.01	0-100

Note. TSA = Taylor Series Approximation; ln = natural log.
[a]There were 4 items measuring antigay prejudice that were consistently asked in the General Social Survey beginning in 1988. We dichotomized each of the 4 items (coded 1 for prejudice) and then summed them (range = 0–4); we then took the average of these scores for each respondent, which was examined as a continuous measure of antigay prejudice.
[b]A proportion of a dichotomized measure (fair or poor self-rated health vs good or excellent self-rated health).

Associations Between Antigay Prejudice and Mortality

We ran 4 models to evaluate associations between antigay prejudice and mortality among heterosexuals (Table 3). In the first model, we examined bivariate associations between antigay prejudice and mortality and observed that harboring antigay prejudice strongly increased mortality risk for heterosexuals (hazard ratio [HR] = 2.87; 95% confidence interval [CI] = 2.51, 3.27). The second model depicts the effect of antigay prejudice on mortality after controlling for gender, age at interview, race/ethnicity, marital status, and nativity status. After adjustment for these demographic factors, the association between antigay prejudice and mortality was attenuated; however, harboring antigay prejudice was still significantly associated with mortality risk among heterosexuals (HR = 1.49; 95% CI = 1.31, 1.69). The third model included additional controls for household income and years of education, and antigay prejudice remained significantly associated with elevated mortality among heterosexuals (HR = 1.26; 95% CI = 1.10, 1.43). In the fourth model, we added self-rated health. Controlling for this risk factor did not attenuate the relationship between antigay prejudice and mortality among heterosexuals (HR = 1.25; 95% CI = 1.09, 1.42). This result translates into a life expectancy difference of approximately 2.5 years (95% CI = 1, 4 years).

Sensitivity Analyses

We reran model 4 by including racial prejudice and religiosity as additional covariates (models not shown but available upon request). When we controlled for all other risk factors in model 4, antigay prejudice remained a statistically significant predictor of elevated mortality risk among heterosexuals after adjustment for racial prejudice (HR = 1.22; 95% CI = 1.02, 1.47) and religiosity (HR = 1.23; 95% CI = 1.08, 1.40).

Sensitivity analyses that examined specific causes of death revealed that antigay prejudice was specifically associated with cardiovascular-related causes of death among heterosexuals (HR = 1.29; 95% CI = 1.04, 1.60) in the fully adjusted model; by contrast, antigay prejudice was not associated with mortality from cancer (HR = 1.01; 95% CI = 0.79, 1.30).

DISCUSSION

Using recently released data from a nationally representative study linking the GSS to the NDI, we found evidence that antigay prejudice is associated with elevated mortality risk among heterosexuals, over and above multiple established risk factors for mortality. In particular, there was a 2.5-year life expectancy difference between individuals with high versus low levels of antigay prejudice. To our knowledge, only 1 other study has examined relationships between prejudice and mortality among majority populations. This previous study documented that White individuals with high levels of racial prejudice died sooner than Whites with low levels of racial prejudice.[4] It was unclear, however, whether those findings on the health consequences of racial prejudice were generalizable to other forms of prejudice. Thus, our ability to document a relationship between a different form of prejudice (i.e., antigay attitudes) and mortality risk suggests that the effects of prejudice on population health may have a broader reach than originally thought. Indeed, taken together, these results suggest that the deleterious health consequences of prejudice are not merely confined to minority group members, but may also result in increased mortality risk for majority group members.

The current study's findings raise several important questions that warrant future empirical attention. In particular, research is needed to identify mechanisms linking antigay prejudice to population health. Prior studies have shown that Whites interacting with Blacks in a laboratory setting exhibit maladaptive cardiovascular responses, including blunted vagal withdrawal, vasoconstriction, and inefficient hemodynamic profiles.[29] If chronically

TABLE 3—Cox Proportional Hazard Models Predicting All-Cause Mortality Risk for Heterosexuals: General Social Survey–National Death Index Study, United States, 1988–2008

Variables	Model 1, HR (95% CI)	Model 2, HR (95% CI)	Model 3, HR (95% CI)	Model 4, HR (95% CI)
Individual mean prejudice score	2.87*** (2.51, 3.27)	1.49*** (1.31, 1.69)	1.26*** (1.10, 1.43)	1.25*** (1.09, 1.42)
Age at interview	. . .	1.05*** (1.05, 1.05)	1.05*** (1.05, 1.05)	1.05*** (1.04, 1.05)
Race/ethnicity				
African American	. . .	1.36*** (1.19, 1.56)	1.26 ** (1.09, 1.45)	1.23** (1.06, 1.41)
Other	. . .	1.06 (0.87, 1.30)	1.01 (0.83, 1.23)	0.99 (0.81, 1.20)
Not US-born	. . .	0.82 (0.67, 1.01)	0.83* (0.67, 0.77)	0.81* (0.65, 0.99)
Female	. . .	0.73*** (0.68, 0.78)	0.72*** (0.67, 0.77)	0.72*** (0.67, 0.77)
Marital status				
Widowed	. . .	1.24*** (1.12, 1.37)	1.13* (1.02, 1.25)	1.14* (1.02, 1.26)
Divorced or separated	. . .	1.08 (0.98, 1.19)	0.98 (0.88, 1.09)	0.98 (0.88, 1.09)
Never married	. . .	1.12 (0.99, 1.25)	0.99 (0.88, 1.12)	0.99 (0.98, 1.11)
Household income, ln	. . .	. . .	0.88*** (0.84, 0.93)	0.98*** (0.97, 0.99)
Years of education	. . .	. . .	0.97*** (0.96, 0.98)	0.98*** (0.97, 0.99)
Fair or poor self-rated health	. . .	. . .	. . .	1.45*** (1.30, 1.62)

Note. HR = hazard ratio; CI = confidence interval; ln = natural log. The full sample was n = 20 226.
*$P < .05$; **$P < .01$; ***$P < .001$.

activated, this autonomic nervous system reactivity may increase risk of subsequent cardiovascular disease.[30–32] Furthermore, anger is a core affective component of antigay prejudice, particularly among heterosexual men.[12,33,34] In turn, physiological changes associated with anger, such as increased cardiac responses, have been linked to the development of hypertension and to coronary heart disease.[35–37] Consistent with these findings, we showed that antigay prejudice was specifically associated with cardiovascular-related causes of death in our sample. These preliminary results suggest potential mechanisms linking antigay prejudice to mortality among heterosexuals, but they require replication with stronger measures of mediating pathways.

Antigay prejudice does not exist in isolation, but is present alongside other forms of prejudice. Because the data were limited, we were unable to determine whether it is antigay prejudice in particular, or prejudice more broadly, that is associated with mortality among majority group members. However, our sensitivity analyses indicated that antigay prejudice increased mortality risk more strongly than racial prejudice. Future studies with a wider range of prejudice measures are needed to evaluate whether the health effects of antigay prejudice remain robust to adjustment for other forms of prejudice.

The results should be considered in the context of the study's limitations. Although we controlled for multiple potential confounders, unmeasured confounding remains a possibility. For example, we were unable to control for certain health behaviors (diet, tobacco use, and heavy alcohol use) that are established risk factors for mortality because the GSS measured these behaviors very infrequently. However, existing evidence suggests that for highly prejudiced individuals, intergroup interactions are stressful.[5,38] Stress in turn is associated with less healthy behavior, such as overeating,[39] smoking,[40] and heavy drinking.[41] These health behaviors are therefore likely mechanisms linking antigay prejudice to mortality, and controlling for them in analyses would be inappropriate.

There are also limitations regarding the antigay prejudice items. Although we provided evidence for the internal reliability and convergent validity of the antigay prejudice scale, the 4 items composing the scale represent a limited range of potential indices of antigay prejudice, thereby reducing the content validity of the measure. We were constrained by the number of items on antigay prejudice that were consistently available in the GSS; future studies would benefit from a more comprehensive measure of this construct, including forms of antigay prejudice that exist at the social or structural level. Despite these limitations, one of the primary strengths of this measure is that the same items have been asked of respondents over multiple years, thereby offering us a unique opportunity for addressing our research question. Furthermore, random measurement error related to the 4 items composing the antigay prejudice scale would likely bias our results toward the null. It is therefore possible that our results are conservative estimates of the relationship between antigay prejudice and mortality.

The current study provides some of the strongest evidence to date that antigay prejudice may be an important indicator of heightened mortality risk among majority group members. Prior research has indicated that antigay prejudice harms the mental[2,42,43] and physical[44,45] health of sexual minorities. This study extends these findings to show that antigay prejudice also negatively influences the health of heterosexuals. In so doing, the study demonstrates the public health impact of antigay prejudice and suggests that efforts to improve antigay attitudes may improve health outcomes at a population level. ■

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Contributors

M. L. Hatzenbuehler initiated the study idea, led the research and writing, and supervised the data analysis. A. Bellatorre conducted the statistical analyses. P. Muennig created the General Social Survey–National Death Index data set. All authors contributed original ideas and edited drafts of the article.

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Human Participant Protection

The General Social Survey–National Death Index has been approved by the Columbia University Medical Center institutional review board.

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