

# Sexual Orientation and All-Cause Mortality Among US Adults Aged 18 to 59 Years, 2001–2011

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To determine whether sexual minorities have an earlier mortality than do heterosexuals, we investigated associations between sexual orientation assessed in the 2001 to 2010 National Health and Nutrition Examination Surveys (NHANES) and mortality in the 2011 NHANES-linked mortality file. Mortality follow-up time averaged 69.6 months after NHANES. By 2011, 338 individuals had died. Sexual minorities evidenced greater all-cause mortality than did heterosexuals after adjusting for demographic confounding. These effects generally disappeared with further adjustment for NHANES-detected health and behavioral differences. (*Am J Public Health*. 2016;106:918–920. doi:10.2105/AJPH.2016.303052)

 See also Stall et al., p. 787.

**B**ecause of the general lack of population-based cohorts in which both sexual orientation identity and mortality have been ascertained, it is unclear whether the health disadvantages seen among lesbian, gay, bisexual, and homosexually experienced individuals<sup>1–5</sup> result in early mortality.<sup>6–14</sup> We capitalized on the recent linkage of National Death Index mortality records through December 31, 2011, to the 2001 to 2010 National Health and Nutrition Examination Survey (NHANES) cohort to investigate this possibility.

## METHODS

We used publicly available data from the 2001 to 2010 NHANES and its linked National Death Index file, which tracks respondents' mortality status through December 31, 2011. Over the 10-year period, 15 564 adults were assessed for sexual orientation identity and mortality (data available as a supplement to the online version of this article at <http://www.ajph.org>). The NHANES measured sexual orientation identity and sex of lifetime sexual partners. From this, we classified respondents as (1) lesbian or gay (n = 228), (2) bisexual (n = 345), (3) having a history of same-sex sexual partners (homosexually experienced; n = 470), or (4) exclusively heterosexual (n = 14 521). The NHANES also measured sex, age, race/ethnicity, foreign birth, relationship status, educational attainment, and family income.

Also assessed were self-rated health, tobacco use, obesity, binge drinking, recent mental distress, hypertension, HIV infection, and health insurance coverage. The National Death Index file included all-cause mortality status and follow-up time. We used Cox proportional hazard models to estimate hazard ratios while adjusting for demographic and health status confounding sequentially. We also investigated an age-restricted subsample of men whom NHANES tested for HIV infection to evaluate a model that specifically adjusted for sexual orientation-related differences in HIV prevalence. For simplicity, we report results, including odds ratios (ORs), from adjusted models only.

## RESULTS

Sexual orientation-related demographic differences were present (Table A, available as a supplement to the online version of this article at <http://www.ajph.org>). Among women, this included age ( $P < .001$ ), foreign

birth ( $P < .01$ ), relationship status ( $P < .001$ ), family income ( $P < .01$ ), and survey year ( $P < .01$ ). Among men, this included age ( $P < .001$ ), race/ethnicity ( $P = .04$ ), foreign birth ( $P = .05$ ), relationship status ( $P < .001$ ), and educational attainment ( $P < .001$ ).

Sexual orientation was also associated, after adjusting for demographic confounding, with differences in health indicators (Table B, available as a supplement to the online version of this article at <http://www.ajph.org>). Among women, sexual minorities were more likely to report worse overall health ( $P < .01$ ), frequent mental distress ( $P < .001$ ), a positive lifetime history of tobacco use ( $P < .001$ ), monthly binge drinking ( $P < .001$ ), and a lower level of health insurance coverage ( $P = .02$ ) than were heterosexuals. These health disadvantages were greatest among bisexual women, who also had higher rates of obesity (adjusted OR [AOR] = 1.54; 95% confidence interval [CI] = 1.05–2.28) than did heterosexual women.

By contrast, lesbians differed from heterosexual women only in their histories of smoking (AOR = 1.98; 95% CI = 1.36, 2.88), recent binge drinking (AOR = 2.23; 95% CI = 1.24, 4.02), and having health care insurance (AOR = 0.53; 95% CI = 0.30, 0.95). For homosexually experienced women, only smoking histories (AOR = 4.65; 95% CI = 3.56, 6.06) and recent binge drinking (AOR = 2.21; 95% CI = 1.37, 3.57) exceeded those of heterosexual women. Prevalence of HIV infection among women, regardless of sexual orientation, was low.

Among men, sexual minorities were more likely to report frequent mental distress

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**TABLE 1—Association Between Sexual Orientation and All-Cause Mortality Among Respondents by Gender and Sexual Orientation: United States, 2001–2010 NHANES and 2011 Linked Mortality File**

Sexual Orientation Comparisons	No.	Deaths, No.	Death Rate <sup>a</sup>	Model 1, <sup>b</sup> AHR (95% CI)	Model 2, <sup>c</sup> AHR (95% CI)	Model 3, <sup>d</sup> AHR (95% CI)
<b>Total sample: women</b>						
Overall	8018	133	284.51			
Heterosexual	7370	121	224.12	1 (Ref)	1 (Ref)	
Combined groups comparison: sexual minority	648	12	201.69	1.84 (0.89, 3.84)	1.54 (0.70, 3.36)	
Separate groups comparisons						
Gay/lesbian	93	5	807.14	3.25 (1.13, 9.34)	2.35 (0.85, 6.52)	
Bisexual	236	0	...	...	...	
Homosexually experienced	307	7	483.12	2.44 (1.03, 5.75)	2.49 (1.03, 6.05)	
<b>Total sample: men</b>						
Overall	7546	205	417.47			
Heterosexual	7151	183	389.24	1 (Ref)	1 (Ref)	
Combined groups comparison sexual minority	395	22	938.57	2.22 (2.35, 3.97)	2.45 (1.42, 4.26)	
Separate groups comparisons						
Gay	130	6	785.27	2.36 (0.84, 6.61)	3.09 (1.09, 8.77)	
Bisexual	109	11	1593.43	2.91 (1.40, 6.03)	2.98 (1.59, 5.57)	
Homosexually experienced	151	5	661.27	1.53 (0.51, 4.64)	1.62 (0.54, 4.88)	
<b>HIV-tested sample: men only<sup>e</sup></b>						
Overall	6286	120	305.84			
Heterosexual	5958	105	282.96	1 (Ref)	1 (Ref)	1 (Ref)
Combined groups comparison						
Sexual minority	328	15	729.40	2.32 (1.25, 4.30)	2.50 (1.39, 4.50)	1.60 (0.69, 3.70)
Separate groups comparisons						
Gay	116	4	566.30	2.24 (0.66, 7.59)	2.83 (0.82, 9.78)	1.00 (0.18, 5.49)
Bisexual	88	8	1360.78	3.47 (1.45, 8.34)	3.49 (1.70, 7.14)	2.49 (0.98, 6.34)
Homosexually experienced	124	3	469.99	1.41 (0.40, 5.02)	1.45 (0.40, 5.18)	1.44 (0.40, 5.14)

Note. AHR = adjusted hazard ratio; CI = confidence interval; NHANES = National Health Nutrition and Examination Survey. Respondents were aged 18–59 years. We used Cox proportional hazard models to estimate the association between sexual orientation and all-cause mortality twice, once grouping sexual minorities (lesbian, gay, bisexual, and homosexually experienced) into a single group and again investigating comparisons between sexual orientation subgroups and heterosexuals. Age restrictions on sexual orientation measurement in the total sample varied across survey cycle: in 2001–2008, respondents aged 20–59 years are included, and in 2009–2010 respondents aged 18–59 years are included.

<sup>a</sup>Per 100 000 person-years.

<sup>b</sup>Model 1 adjusted for demographics (gender, age, race/ethnicity, nativity, marital or cohabitation status, educational attainment, and family income) and survey cycle.

<sup>c</sup>Model 2 adjusted for demographics, survey cycle, and initial health status except HIV infection (self-rated health, mental distress, tobacco use, binge drinking, obesity, hypertension, and insurance status).

<sup>d</sup>Model 3 adjusted for demographics, survey cycle, initial health status, and HIV infection status.

<sup>e</sup>Restricted sample included male respondents eligible for HIV testing who were aged 20–49 years in 2001–2008 survey cycles and aged 18–59 years in the 2009–2010 survey cycle.

( $P < .001$ ) and to have prevalent HIV infection ( $P < .001$ ) than were heterosexual men. This, however, masked differences among subgroups of sexual minority men. Gay men were more likely to be HIV infected (13.5%; 95% CI = 6.4%, 20.6%) than were heterosexual men (0.2%; AOR = 229.98; 95% CI = 85.42, 619.20) but did not differ otherwise except for lower hypertension prevalence (AOR = 0.50; 95% CI = 0.29, 0.86) and higher insurance coverage (AOR = 2.28; 95% CI = 1.22, 4.28).

Bisexual (AOR = 2.61; 95% CI = 1.59, 4.28) and homosexually experienced (AOR = 2.16; 95% CI = 1.33, 3.51) men were more likely than were heterosexual men to evidence frequent mental distress. Homosexually experienced men were more likely than were heterosexual men to have smoked (AOR = 1.56; 95% CI = 1.01, 2.42). HIV infection among bisexual men (6.8%; 95% CI = 2.5%, 11.2%), but not homosexually experienced men (0.8%; 95% CI = 0.0%, 2.2%),

was significantly elevated compared with heterosexual men (AOR = 44.70; 95% CI = 17.60, 113.55 and AOR = 3.57; 95% CI = 0.44, 29.22, respectively).

Mortality follow-up time averaged 69.6 months (95% CI = 67.40, 71.85) after NHANES. By December 31, 2011, 338 individuals (2.0%; 95% CI = 1.8%, 2.3%) had died. Sexual minorities evidenced greater all-cause mortality after adjusting for demographic confounding (adjusted hazard

ratio = 2.02; 95% CI = 1.31, 3.11) than did heterosexuals (Table 1 shows the sex-stratified results). For women, but not men, these mortality differences disappeared after adjusting for NHANES-measured health and behavioral differences. In a subanalysis of men with known HIV status, approximately 22.6% (95% CI = 8.0%, 37.2%) of deaths occurred among those who were HIV infected. Mortality risk was higher among sexual minority men, primarily bisexual men, than it was among heterosexual men. However, after adjusting for HIV infection, mortality risk among sexual minorities was similar to that among heterosexual men.

## DISCUSSION

Research has documented that minority sexual orientation is a risk indicator for health disadvantages, including higher rates of tobacco use,<sup>1</sup> suicide attempts,<sup>4</sup> and HIV infection among men.<sup>5</sup> All of these are positively associated with elevated risk for early mortality,<sup>7–13</sup> but, remarkably, no general population-based survey, to the best of our knowledge, has examined whether self-identified lesbians, bisexuals, or gay men are more likely than are heterosexuals to experience early mortality.

Our results indicate that lesbians, homosexually experienced women, and bisexual men, as compared with their same-sex heterosexual counterparts, do experience elevated mortality risk. However, consistent with the view that it is not sexual orientation, per se, but rather sexual orientation-related health disadvantages that create this vulnerability, we also observed that statistical adjustment for health differences identified at onset of follow-up eliminated the sexual orientation effect, except for homosexually experienced women. Further evidence from subanalyses also demonstrated that HIV infection among sexual minority men, despite the availability of highly active antiretroviral therapy protocols,<sup>15</sup> remains an important mortality risk factor, especially for bisexual men.

Four study limitations shaped our results. First, sexual minorities in the NHANES cohort are relatively few and mortality follow-up time is short. We had limited statistical power to investigate more than all-cause mortality although certain specific causes of death may be more common among sexual

minorities.<sup>7,9–11,13–14</sup> Furthermore, although HIV infections are more prevalent among African American sexual minority men,<sup>16</sup> our sample size precluded investigating racial/ethnic differences. Second, sexual orientation and health markers were measured only at the start of follow-up; any subsequent changes may have affected study outcomes. Third, respondents, on average, were middle aged, and some sexual orientation-related health differences are likely to show cumulative effects on mortality in older individuals.<sup>13</sup> With longer follow-up, it may be that the risk patterns we observed will change.

Finally, the NHANES does not measure psychological factors (e.g., perceptions of discrimination or stress) thought to contribute to the health disadvantages evident among sexual minorities.<sup>3</sup> Although we did find health disadvantages consistent with minority stress models at the onset of follow-up, we are unable to establish why these exist. Furthermore, the NHANES has only limited information about social support and socioeconomic status. Poverty, in particular, is an important cofactor in predicting both health disadvantages and mortality.<sup>17</sup> Although we adjusted our analyses for family income, we were unable to take into account differential levels of social support that might also contribute to mortality risk.

Despite our small sample size and restricted statistical power, our findings underscore the public health imperative to remedy health disadvantages experienced by sexual minorities. The heterogeneity of elevated mortality risks also has implications for developing targeted health interventions, particularly for lesbians, bisexual men, and homosexually experienced women, who are not commonly the focus of health intervention studies. **AJPH**

## CONTRIBUTORS

S. D. Cochran wrote the initial draft of the article. S. D. Cochran and C. Björkenstam conducted the analyses. All authors conceptualized the article, interpreted the findings, and edited the article.

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## HUMAN PARTICIPANT PROTECTION

No protocol approval was necessary because this study used publicly available, existing data sources. All participants gave

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