

Mortality Risks Among Persons Reporting Same-Sex Sexual Partners: Evidence From the 2008 General Social Survey—National Death Index Data Set

Susan D. Cochran, PhD, MS, and Vickie M. Mays, PhD, MSPH

Numerous studies have documented robust sexual orientation–related differences in suicide attempts,^{1–12} tobacco smoking,^{13–28} HIV infection risk among men,²⁹ and problems in health care access.^{30–35} However, whether these health differences actually translate into overall greater risk for early mortality among sexual minorities, including among men who have sex with men (MSM) and among women who have sex with women (WSW), is not clear. Persistent methodological barriers have posed a nearly insurmountable obstacle to investigating questions of sexual orientation–related differences in mortality risk.^{36,37} In the United States, for example, death certificates, a common data source utilized in mortality studies, do not record sexual orientation information. In addition, there are few population-based data sets in which both markers of sexual orientation and mortality-related information are available.

However, in recent years, evidence has begun to emerge that anticipated mortality differences might, in fact, exist though results to date are inconclusive. Two ecological studies,^{38,39} with their attendant methodological weaknesses,⁴⁰ linked higher rates of lung and colorectal cancer mortality among men to areas of relatively higher residential density of same-sex couples in the US Census. Three studies that we are aware of used newly available information from population registries in Denmark.^{41–43} One⁴¹ compared all-cause mortality rates of individuals in registered same-sex domestic partnerships (RDPs) to those of the Danish population as a whole, finding excess mortality risk for both men and women in RDP relationships. But these sexual orientation differences were most pronounced in individuals who were newly registered. With increasing duration of relationships, sexual orientation–related differences attenuated. Furthermore,

Objectives. We investigated the possibility that men who have sex with men (MSM) and women who have sex with women (WSW) may be at higher risk for early mortality associated with suicide and other sexual orientation–associated health risks.

Methods. We used data from the 1988–2002 General Social Surveys, with respondents followed up for mortality status as of December 31, 2008. The surveys included 17 886 persons aged 18 years or older, who reported at least 1 lifetime sexual partner. Of these, 853 reported any same-sex partners; 17 033 reported only different-sex partners. Using gender-stratified analyses, we compared these 2 groups for all-cause mortality and HIV-, suicide-, and breast cancer–related mortality.

Results. The WSW evidenced greater risk for suicide mortality than presumptively heterosexual women, but there was no evidence of similar sexual orientation–associated risk among men. All-cause mortality did not appear to differ by sexual orientation among either women or men. HIV-related deaths were not elevated among MSM or breast cancer deaths among WSW.

Conclusions. The elevated suicide mortality risk observed among WSW partially confirms public health concerns that sexual minorities experience greater burden from suicide-related mortality. (*Am J Public Health.* 2015;105:358–364. doi:10.2105/AJPH.2014.301974)

information on cause of death was not available. The second 2 studies^{42,43} investigated differences in suicide mortality between individuals in current or former RDP relationships and heterosexually married or formerly married persons, with the Mathy et al. study⁴³ observing higher rates of suicide mortality among RDP men but not among RDP women. Because suicide mortality is a relatively rare event,⁴⁴ the small numbers of RDP individuals may have led to insufficient statistical power to detect sexual orientation differences among women.

In a fourth study,⁴⁵ from the United States, we used information available in multiple years of the National Health Interview Survey, and reported that women in same-sex relationships had elevated risk for breast cancer mortality compared with heterosexually married women. This is consistent with persistent concerns that sexual minority women may have elevated risk

for breast cancer because of a unique combination of risk factors including lower rates of parity, higher tobacco and alcohol use, and problems in utilizing preventive health care.⁴⁵ However, an important limitation across all 4 studies that used relationship status to classify for sexual orientation was that comparisons were necessarily limited to partnered sexual minorities who represent but a minority of the sexual minority population.⁴⁶ Whether these differences or lack of differences are true for sexual minorities in general cannot be determined by these study designs.

More recently, 2006 mortality follow-up information obtained for men who were first interviewed in the 1988–1994 National Health and Nutrition Examination Survey III (NHANES III) provided clear evidence that MSM, including men not currently in same-sex relationships, experienced greatly elevated risk for mortality attributable to HIV infection

during the 1990s, which appeared to wane somewhat following widespread introduction of highly active antiretroviral therapies (HAART) in 1996.³⁷ In that study, men were asked the gender of their lifetime sexual partners, which was used to classify the sample into MSM versus men who did not report any same-sex partners. Contrary to the robust evidence for excess HIV-related mortality among MSM, the study revealed no evidence of increased risk for suicide-related mortality linked to sexual orientation. But, like the earlier studies, the small number of MSM in the NHANES III sample (n = 85) may have greatly limited power to detect such differences. A further limitation in NHANES III was that markers of sexual orientation were not assessed in female respondents.

Thus, at present, although several studies have found hints that sexual orientation might be differentially linked to early mortality, reported findings have not been conclusive and mortality risks among sexual minority women, in particular, have been greatly unexamined. In the current study, we capitalized on information available in the 2008 General Social Survey (GSS)–National Death Index (NDI) data set⁴⁷ to investigate possible sexual orientation differences in mortality risk among both men and women who vary in their reports of the gender of their lifetime sexual partners. This novel data set combines information obtained from 14 years of data collection for the GSS surveys in which markers of sexual orientation (e.g., gender of lifetime and recent sexual partners) were assessed in a large sample of adults. Mortality data recently linked to these GSS participants provides up to 20 years of mortality follow-up and offers a unique opportunity to investigate possible sexual orientation differences in risk for both all-cause mortality and mortality attributable to the 3 factors that have long raised concerns in these communities: suicide,⁴⁸ HIV infection among men,^{37,49} and breast cancer among women.⁴⁵

METHODS

The 2008 GSS–NDI data set, created by the National Opinion Research Center (NORC),⁴⁷ combines interviews originally obtained from respondents in the 1978–2002 GSS biennial surveys with information obtained from the

NDI to provide mortality follow-up through December 31, 2008. To create the GSS's representative survey samples, NORC used a multistage probability design to recruit individuals aged 18 years and older, from the English-speaking, noninstitutionalized US population. Respondents were administered a face-to-face household interview assessing primarily social variables followed by either self-administered questionnaires (years 1978–2000) or a computer-assisted self-interview (2000–2002). Mortality matching was facilitated by identifying information held securely by NORC, although social security numbers were not commonly available.⁴⁷ Records from two thirds of GSS respondents resulted in a probabilistic match with NDI death records. Using a modified NDI matching method, NORC successfully linked 70% of deaths to an exactly matched respondent. The remaining 30% of deaths were allocated on the basis of best agreement with GSS identifiers.

Beginning in 1988, the GSS added a second self-administered questionnaire module, converted in 2000–2002 to a computer-assisted personal interview, to assess sexual behavior and drug use histories. We use 2 sets of questions from the module (lifetime numbers of male and female sexual partners and gender of sexual partners in the year before the interview) to classify for putative sexual orientation. Of the 21 045 individuals interviewed in the 1988–2002 period and included in the GSS–NDI data set, 1693 discontinued GSS participation considerably before the assessment of sexual behavior. Of the remaining 19 352, 17 886 (93%) provided information on their sexual partners and comprise the final sample of interest. During this time, GSS response rates to the survey in general varied from 70% to 82% (mean = 75.0%).

Measures

Sexual partner patterns. The GSS sexual behavior module asked participants the number of male and female sexual partners they had had in their lifetime. An additional question asked if their sexual partners in the previous year were men only, women only, or both men and women. From this information, we classified individuals into 1 of 2 groups: those reporting evidence of any same-sex sexual partners either lifetime or in the past

year (n = 853) or only evidence of different-sex sexual partners (n = 17 033).

Person characteristics. In every survey cycle, the GSS also collected information about individual demographics (gender, age in years, race, years of education, and family income with inflation adjusted across cycles to the year 2000), residential location (collapsed to US Census regions in the public data set), and 2 markers of health status (self-reported general health, general happiness) both of which are known risk factors for mortality.⁵⁰ Given the relatively small number of respondents reporting same-sex sexual partners, we simplified these variables by coding race into 2 categories (White vs other), educational attainment into 2 categories (≤ 12 years vs ≥ 13 years), and family income into 3 categories ($< \$20\ 000$, $\$20\ 000$ to $< \$45\ 000$, and $\geq \$45\ 000$). We collapsed US Census regions into the 4 standard US Census divisions (Northeast, Midwest, South, and West). We measured general health status by a single question asking respondents to rate their health as “excellent,” “very good,” “good,” “fair,” or “poor.” We recoded this into 2 categories (excellent, very good, or good vs fair or poor). The general happiness item asked respondents: “Taken all together, how would you say things are these days? Would you say that you are very happy, pretty happy, or not too happy?” Answers were coded into 2 categories (very or pretty happy vs not too happy).

Mortality. The GSS–NDI public data file includes both *International Classification of Diseases, Ninth Revision*⁵¹ (ICD-9; for deaths before 1999) and *International Classification of Diseases, Tenth Revision*⁵² (ICD-10; for deaths from 1999 on) classification, as well as Clinical Classification Software (CCS) codes⁵³ of the underlying, or primary, cause of death. We combined this information to create 5 variables capturing primary cause of death: all-cause mortality and mortality allocated to intentional self-harm or suicide (CCS code: 662; ICD-9 codes: E950–E959; ICD-10 codes: *U03, X60–X84, Y72–Y74, Y87.0), HIV-related illness (CCS code: 5; ICD-9 codes: 042–044; ICD-10 codes: B20–B24), breast cancer (CCS code: 24; ICD-9 codes: 174–175; ICD-10 code: C50), or all other medical conditions. Because only 2 men died from breast cancer during the follow-up period (none who reported any

same-sex partners) and no woman who reported any same-sex partners died of HIV-related causes, we coded breast cancer deaths among men and HIV-related deaths among women into the “all other medical conditions” category for analytic reasons. Total individual follow-up time was available in years between the year of interview until either death or, if still alive, December 31, 2008.

Data Analysis

We analyzed data with Stata version 12 (StataCorp LP, College Station, TX) by using both primary sampling unit information and weights included in the GSS–NDI data set. In initial analyses, we used gender-stratified logistic regression to evaluate possible

demographic and health-related differences associated with sexual orientation. We evaluated effects by adjusted Wald F Tests. Then, we used gender-stratified logistic regression to investigate associations between sexual orientation and mortality-related outcomes while adjusting for possible confounding. This was done in 3 ways: (1) adjusting for ascribed statuses (age, race) only, (2) adjusting for demographic statuses (age, race, educational attainment, family income) only, and (3) adjusting for both demographic and health (general physical and emotional health) statuses simultaneously.

Finally, we used Cox proportional hazard survival analysis to investigate sexual orientation–related differences in all-cause and

specific-cause mortality while we adjusted for follow-up time. We estimated all confidence intervals with 95% certainty. All significance tests utilized the criterion of $P < .05$. As all 3 analytic approaches produced results with identical conclusions, for simplicity we report findings that adjust for possible confounding from both demographic and health-related differences.

RESULTS

At the time of interview, 4.8% (95% confidence interval [CI] = 4.4%, 5.1%) of individuals reported any same-sex sexual partners during their lifetime with women less likely to do so than men (adjusted odds ratio [AOR] = 0.83; 95% CI = 0.71, 0.97).

TABLE 1—Person Characteristics and Mortality Status as of December, 31, 2008, Among Sexually Experienced Adults by Self-Reported Gender of Lifetime Sexual Partners and Respondent Gender: General Social Survey, 1988–2002

Characteristics	Men			Women		
	Any Male Partners (n = 424), % (SE) or Mean ±SE	Female Partners Only (n = 7456), % (SE) or Mean ±SE	P	Any Female Partners (n = 429), % (SE) or Mean ±SE	Male Partners Only (n = 9577), % (SE) or Mean ±SE	P
Person characteristics						
Age at interview, y	43.2 ±0.7	43.7 ±0.2	.72	38.8 ±0.6	45.3 ±0.2	< .001
≤ high school equivalent	41.9 (2.4)	46.0 (0.6)	.15	38.6 (2.4)	50.5 (0.5)	< .001
White race	80.2 (1.9)	84.8 (0.4)	.06	78.3 (2.0)	80.9 (0.4)	.99
Annual family income, \$			< .01			< .01
< 20 000	24.5 (2.21)	19.4 (0.5)		32.6 (2.3)	30.3 (0.5)	
20 000–44 999	39.1 (2.4)	34.5 (0.6)		37.0 (2.4)	32.4 (0.5)	
≥ 45 000	36.4 (2.4)	46.1 (0.6)		30.4 (2.3)	37.3 (0.5)	
US Census region			.85			.02
Northeast	20.3 (2.0)	18.8 (0.4)		20.7 (2.0)	19.6 (0.4)	
Midwest	24.3 (2.1)	26.2 (0.5)		17.9 (1.8)	25.5 (0.4)	
South	31.8 (2.3)	34.8 (0.6)		33.3 (2.3)	34.9 (0.5)	
West	23.6 (2.1)	20.3 (0.5)		28.0 (2.2)	20.0 (0.4)	
Rates health as “fair/poor”	19.3 (2.2)	19.8 (0.5)	.41	17.6 (2.1)	22.4 (0.5)	.5
Rates self as “not very happy”	13.2 (1.7)	10.0 (0.4)	.22	13.3 (1.7)	11.8 (0.4)	.48
Mortality status: years of follow-up	11.0 ±0.2	11.4 ±0.1	.15	11.0 ±0.2	11.7 ±0.05	< .001
Primary cause of death by end of follow-up (December 31, 2008)^a						
Intentional self-harm	0.2 (0.2)	0.6 (0.1)	.36	0.9 (0.5)	0.1 (0.03)	.02
HIV-related causes	1.2 (0.5)	0.6 (0.1)	.68			
Breast cancer				0.9 (0.5)	0.8 (0.1)	.4
All other conditions	18.9 (1.9)	18.6 (0.4)	.56	8.4 (1.3)	16.7 (0.4)	.31
All-cause mortality	20.3 (2.0)	19.9 (0.5)	.73	10.2 (1.5)	17.6 (0.4)	.69

Note. Weighted prevalences shown. Sexual orientation differences in person characteristics evaluated by gender-stratified logistic regressions in which sexual orientation was regressed on all person characteristics simultaneously. For mortality status, sexual orientation–related differences evaluated by gender-stratified multiple regression (follow-up years) or logistic regression (all-cause, suicide-, HIV-, or breast cancer–related, or all other conditions mortality status) with adjustment for person characteristics.

^aHIV-related causes coded under “all other conditions” for women; breast cancer coded under “all other conditions” for men.

Demographic Differences

Among men, there was little difference in personal characteristics between MSM and presumptively heterosexual men (Table 1). However, MSM did report lower family income than did heterosexual men (contrasting middle income to lowest income: AOR = 0.86; 95% CI = 0.64, 1.15; contrasting highest income to lowest income: AOR = 0.59; 95% CI = 0.43, 0.81). Conversely, among women, WSW, compared with presumptively heterosexual women, were younger (AOR = 0.98; 95% CI = 0.97, 0.98), reported higher educational levels (AOR = 1.58; 95% CI = 1.25, 1.99) and lower family income (contrasting middle income to lowest income: AOR = 0.92; 95% CI = 0.71, 1.19; contrasting highest income to lowest income: AOR = 0.56; 95% CI = 0.49, 0.80). They also resided in somewhat different geographic locations (contrasting Midwest to West: AOR = 0.55; 95% CI = 0.38, 0.82; contrasting South to West: AOR = 0.80; 95% CI = 0.56, 1.13; contrasting Northeast to West: AOR = 0.88; 95% CI = 0.58, 1.34).

Estimates of Mortality

The GSS respondents were followed up for mortality status an average of 11.6 years (95% CI = 11.5, 11.7). This did not differ between MSM and heterosexual men after we adjusted for confounding (b = -0.36; 95% CI = -0.86, 0.13), but did among WSW and heterosexual women (b = -1.13; 95% CI = -1.64, 0.62).

Over the course of follow-up, there were 3304 deaths, including 62 deaths from intentional self-harm or suicide, 49 from HIV-related causes among men, and 78 from breast cancer among women. Of the 853 individuals who reported any same-sex sexual partners during interview, 130 died during the follow-up period.

In gender-stratified comparisons, all-cause mortality among men was associated with older age ($P < .001$), being non-White ($P < .01$), possessing lower educational attainment ($P < .01$), having lower family income ($P < .01$), and having worse self-reported health ($P = .01$), but not same-sex sexual partner status ($P = .72$). Likewise, there were no apparent same-sex sexual partner history differences in mortality when the primary cause was suicide ($P = .36$) or HIV-related ($P = .68$), after we adjusted for confounding. Approximately

5.8% (95% CI = 0.8, 10.8) of deaths among MSM arose out of HIV-related causes versus 3.0% (95% CI = 2.1%, 3.8%) of deaths among men reporting only female sexual partners. All but 1 of these HIV-related deaths among MSM occurred after the 1996 introduction of HAART. But there was no evidence of difference between MSM and heterosexual men in the timing of HIV-related deaths among men who died from HIV infection whether the death occurred before 1997 or later (OR = 3.67; 95% CI = 0.35, 38.51). Multivariate survival analysis taking into account years of follow-up also failed to detect significant differences between MSM and men reporting only female sexual partners in risk of death from suicide ($P = .48$), HIV-related causes ($P = .62$), all other conditions ($P = .81$), or all-cause mortality ($P = .74$), after we adjusted for the minor differences in personal characteristics between the 2 groups (Table 2).

Among women, all-cause mortality was similarly associated with older age ($P < .001$), being non-White ($P < .001$), lower educational attainment ($P < .001$), lower family income ($P < .001$), and worse self-reported health ($P < .001$). Positive same-sex sexual histories was not a significant correlate of all-cause mortality ($P = .68$) or breast cancer specifically ($P = .40$). Approximately 9.1% (95% CI = 4.9%, 17.7%) of the WSW who died, died from breast cancer versus 4.4% (95% CI = 3.4%, 5.4%) of

the heterosexual women who died. However, WSW did evidence a higher risk of death attributed to suicide ($P = .02$) after we adjusted for confounding. Indeed, fully 9% (95% CI = 0.5%, 17.7%) of WSW-associated deaths were allocated to suicide or intentional self-harm. This contrasts with 0.5% (95% CI = 0.2%, 0.9%) among women who reported only male sexual partners. As with men, a history of same-sex sexual partners was not a significant predictor of all-cause mortality in multivariate survival analyses ($P = .72$) after we adjusted for confounding. Nor was it a significant predictor of death attributable to breast cancer ($P = .27$). However, a positive history of same-sex sexual partners was linked to risk of death from suicide ($P = .01$) after we adjusted for confounding.

DISCUSSION

Studies of mortality risk among sexual minorities are rare^{37-39,41-43,45} despite the increasingly well-documented sexual orientation differences in health risks, some of which have direct implications for early mortality.^{37,45,48,49} In that regard, in the current study, we took advantage of the recently created GSS-NDI data set to add to the nascent understanding of the ways in which sexual orientation might shape differential mortality risks at the population level. Our findings add

TABLE 2—Adjusted Mortality Hazards Among US Adults Aged 18 Years and Older, by Self-Reported Gender of Lifetime Sexual Partners and Respondent Gender: General Social Survey—National Death Index Data Set (1988–2008)

Primary Cause of Death ^a	Men With Any Male Sexual Partners, ^b Adjusted HR (95% CI)	Women With Any Female Sexual Partners, ^c Adjusted HR (95% CI)
Intentional self-harm	0.40 (0.05, 3.05)	6.28 (1.45, 27.22)
HIV-related causes	1.29 (0.47, 3.51)	...
Breast cancer	...	1.82 (0.63, 5.32)
All other conditions	1.06 (0.83, 1.36)	0.96 (0.69, 1.33)
All-cause mortality	1.04 (0.82, 1.31)	1.06 (0.78, 1.43)

Note. CI = confidence interval; HR = hazard ratio. Hazard ratios estimated by gender-stratified Cox-proportional hazards survival analyses with adjustment for age, education, race, family income, census division, and self-rated health and happiness at interview.
^aHIV-related causes coded under “all other conditions” for women; breast cancer coded under “all other conditions” for men.
^bReference category: female sexual partners only.
^cReference category: male sexual partners only.

to a growing sense that overall mortality risks among sexual minorities and heterosexual individuals may be highly similar, contrary to beliefs that minority sexual orientation shortens lives.^{41,54}

During the 20-year follow-up period, both MSM and WSW experienced all-cause mortality risks that showed unremarkable variation from those of persons who reported sexual behavior patterns consistent with heterosexuality. This observed pattern is also highly similar to findings from NHANES III,³⁷ in which mortality attributable to causes other than HIV-related illness did not differ between MSM and men who reported only female sexual partners. It is also consistent with conclusions drawn from the Danish study by Frisch et al.⁴¹ In addition, we failed to detect evidence of greater breast cancer mortality risk among WSW when compared with women reporting only male sexual partners. Although this is at odds with findings from the National Health Interview Survey⁴⁵ where women in same-sex relationships experienced greater odds of breast cancer mortality compared with married women, the 2 studies differ importantly in their source populations. Parity, strongly correlated with marriage, is a strong protective factor against breast cancer mortality among women diagnosed with the disease⁵⁵; but women in same-sex relationships likely have lower parity rates than heterosexually married women.⁴⁶ Only future studies with larger samples and longer follow-up periods can provide definitive findings.

Nevertheless, relatively rare causes of death might yet have a disproportionate impact on sexual minorities without exerting substantial effects on all-cause mortality. For example, suicide, the 10th-leading cause of death in the United States, still accounts for only 1.5% of deaths annually.⁴⁴ An elevated risk among sexual minorities might have only a small effect on all-cause mortality. Consistent with that perspective, we observed a much elevated hazard for suicide-related mortality among WSW compared with women reporting only male sexual partners despite the lack of differences in all-cause mortality. Furthermore, the robustness of the elevated rate is consistent with previously reported^{1-5,7-12} odds of suicide attempts among sexual-minority adolescent and adult females compared with heterosexual

females. These findings suggest that the greater vulnerability to suicide-related morbidity among sexual-minority women is matched by parallel vulnerability among WSW for suicide-related mortality. Nevertheless, similar findings were not observed among men in the current study or in a previous study that used the NHANES III cohort.³⁷ Whether this gender difference among WSW and MSM reflects a true gender difference within this population is unknowable at this point.

HIV-related deaths are also relatively uncommon at the population level, accounting for approximately 0.3% of deaths annually in the United States.⁴⁴ Yet, HIV is potentially an important cause of death among MSM.³⁷ However, unlike the greatly elevated number of HIV-related deaths observed in NHANES III among MSM, in the GSS cohort, HIV-related mortality was not significantly higher among MSM compared with men reporting only female partners. This may reflect the differences in initial data collection periods between the 2 cohorts (1988–1994 vs 1988–2002) with the NHANES III cohort recruited before HAART implementation. Indeed, in NHANES III, the majority of HIV-related deaths came relatively early before the widespread introduction of HAART. But in both the NHANES III and the GSS cohorts, we also note that deaths from HIV-related causes, though greatly reduced, continued to occur among MSM even after HAART introduction. This underscores the importance of continuing vigilance in efforts to prevent HIV infections, to facilitate early illness detection, and to extend HIV-related treatment services to MSM. General awareness of HIV risk among MSM may account for the similar rates of HIV-related mortality between MSM and other men despite what are likely wide differences in prevalence of HIV infection.⁵⁶

Limitations

Five study limitations merit consideration in framing our findings. One is that the GSS–NDI included very limited assessment of sexual orientation both in terms of how it was accomplished and what questions were asked. Method of assessment has been shown to affect prevalence of self-reports of minority sexual orientation markers, especially in households with children or in regions of the country that have less-tolerant attitudes toward

homosexuality.⁵⁷ Although sexual behavior is an important indicator of HIV infection risk,⁵⁶ and sexual orientation classification using gender of sexual partners has been strongly linked to differences in histories of suicide attempts,⁴⁸ other aspects of sexual orientation, such as identifying as lesbian, gay, or bisexual, may create differential patterns of mortality risk.³⁶ Thus, generalizing findings to lesbian-, gay-, and bisexual-identified individuals should be done with caution. Furthermore, many individuals who have positive histories of same-sex sexual partners self-identify as heterosexual,^{36,58} and to the extent that homosexually experienced heterosexuals evidence mortality risks more similar to other heterosexually identifying individuals, our findings may be somewhat biased toward the null.

Second, stigma surrounding disclosure of same-sex sexual experiences may lead to underreporting, though this effect appears to be waning over time as evidenced by increasing rates of reports of same-sex sexual experiences in the GSS over the years.⁵⁹ The effect of this possible bias is indeterminable. Forty percent of GSS respondents who declined to provide information about their sexual histories were aged 66 years or older suggesting that a general discomfort with questions about sexuality may have also played an important role in generating nondisclosure. Nevertheless, if disclosure is differentially associated with mortality patterns, then the direction of the bias in our findings is unknowable.

Third, the GSS–NDI cohort, though large and offering many years of mortality follow-up, still includes a relatively small number of individuals who reported any same-sex sexual partners. This may have reduced statistical power to detect sexual orientation effects that might be observable within a larger cohort. It is important to note that we were unable to investigate possible intersections of mortality disadvantage that might especially affect individuals who are both sexual and racial/ethnic minorities and female.^{60,61} Nor were we able to investigate secular trends. Given the rapid changes during the time period under study in social attitudes toward homosexuality and the social lives of sexual minorities,⁶² it is reasonable to anticipate that such trends might be present. In addition, we had limited ability to adjust for confounding and some of the

adjustment we could make (e.g., family income) may be differentially effective across the 2 sexual-orientation groups resulting in residual confounding.

Fourth, some sexual orientation–related health differences, such as differential patterns of health care access^{30–35} and tobacco exposure,^{17,19,20,28,63} may exert their cumulative effects on mortality in older ages, which are currently underrepresented in the GSS–NDI data set in which individuals were on average middle-aged at the time of interview.

Finally, follow-up time was somewhat shorter for WSW than for heterosexual women and, in addition, the former group was significantly younger. This may have underestimated mortality differences in the 2 groups of women. Longer-term follow-ups of the GSS–NDI cohort may eventually demonstrate substantive differences in sexual orientation–related risk patterns than what we report here.

Conclusions

Despite these concerns, our findings provide important confirmation, at least among women, that the excessively high prevalence of suicide attempts in the sexual-minority population is matched by a similar elevation in risk for suicide mortality. These results strongly support the importance of suicide prevention efforts targeting sexual-minority women.⁴⁸ ■

About the Authors

Susan D. Cochran is with the departments of Epidemiology and Statistics, University of California, Los Angeles (UCLA) Fielding School of Public Health, Los Angeles. Vickie M. Mays is with the departments of Psychology and Health Policy and Management, UCLA. Both authors are also with the UCLA Center for Bridging Research Innovation, Training and Education for Minority Health Disparities Solutions, Los Angeles.

Correspondence should be sent to Susan D. Cochran, Department of Epidemiology, UCLA Fielding School of Public Health, Box 951772, Los Angeles, CA 90095-1772 (e-mail:cochran@ucla.edu). Reprints can be ordered at <http://www.ajph.org> by clicking the "Reprints" link.

This article was accepted March 3, 2014.

Contributors

S. Cochran originated the study, conducted analyses, and wrote an initial draft of the article. Both authors conceptualized the ideas for the current article, interpreted the findings, and edited drafts of the article.

Acknowledgments

This research was supported by grants from the National Institute on Drug Abuse (DA 20826) and the National

Center for Minority Health and Health Disparities (MD006923).

Human Participant Protection

Because of our use of publicly available, anonymous data only, this study was exempt from human participant review by the University of California Los Angeles institutional review board. All participants gave informed consent in the original General Social Survey.

References

1. Silenzio VM, Pena JB, Duberstein PR, Cerel J, Knox KL. Sexual orientation and risk factors for suicidal ideation and suicide attempts among adolescents and young adults. *Am J Public Health*. 2007;97(11):2017–2019.
2. Russell ST, Joyner K. Adolescent sexual orientation and suicide risk: evidence from a national study. *Am J Public Health*. 2001;91(8):1276–1281.
3. Remafedi G, French S, Story M, Resnick MD, Blum R. The relationship between suicide risk and sexual orientation: results of a population-based study. *Am J Public Health*. 1998;88(1):57–60.
4. Lhomond B, Saurel-Cubizolles MJ. Violence against women and suicide risk: the neglected impact of same-sex sexual behaviour. *Soc Sci Med*. 2006;62(8):2002–2013.
5. King M, Semlyen J, Tai SS, et al. A systematic review of mental disorder, suicide, and deliberate self harm in lesbian, gay and bisexual people. *BMC Psychiatry*. 2008;8:70.
6. Herrell R, Goldberg J, True WR, et al. Sexual orientation and suicidality: a co-twin control study in adult men. *Arch Gen Psychiatry*. 1999;56(10):867–874.
7. Gilman SE, Cochran SD, Mays VM, Hughes M, Ostrow D, Kessler RC. Risk of psychiatric disorders among individuals reporting same-sex sexual partners in the National Comorbidity Survey. *Am J Public Health*. 2001;91(6):933–939.
8. Garofalo R, Wolf RC, Wissow LS, Woods ER, Goodman E. Sexual orientation and risk of suicide attempts among a representative sample of youth. *Arch Pediatr Adolesc Med*. 1999;153(5):487–493.
9. Faulkner AH, Cranston K. Correlates of same-sex sexual behavior in a random sample of Massachusetts high school students. *Am J Public Health*. 1998;88(2):262–266.
10. de Graaf R, Sandfort TG, ten Have M. Suicidality and sexual orientation: differences between men and women in a general population-based sample from the Netherlands. *Arch Sex Behav*. 2006;35(3):253–262.
11. Cochran SD, Mays VM. Lifetime prevalence of suicide symptoms and affective disorders among men reporting same-sex sexual partners: results from NHANES III. *Am J Public Health*. 2000;90(4):573–578.
12. Cochran SD, Mays VM, Alegria M, Ortega A, Takeuchi DT. Mental health and substance use disorders among Latino and Asian American lesbian, gay, and bisexual adults. *J Consult Clin Psychol*. 2007;75(5):785–794.
13. Brewster KL, Tillman KH. Sexual orientation and substance use among adolescents and young adults. *Am J Public Health*. 2012;102(6):1168–1176.
14. Hatzenbuehler ML, Wiering NF, Keyes KM. Community-level determinants of tobacco use disparities in lesbian, gay, and bisexual youth: results from

a population-based study. *Arch Pediatr Adolesc Med*. 2011;165(6):527–532.

15. Blossnich J, Lee JG, Horn K. A systematic review of the aetiology of tobacco disparities for sexual minorities. *Tob Control*. 2013;22(2):66–73.
16. Bauer GR, Jaram JA, Baidooonso SM. Sexual health, risk behaviors, and substance use in heterosexual-identified women with female sex partners: 2002 US National Survey of Family Growth. *Sex Transm Dis*. 2010;37(9):531–537.
17. Trocki KF, Drabble LA, Midanik LT. Tobacco, marijuana, and sensation seeking: comparisons across gay, lesbian, bisexual, and heterosexual groups. *Psychol Addict Behav*. 2009;23(4):620–631.
18. Hughes TL, Johnson TP, Matthews AK. Sexual orientation and smoking: results from a multisite women's health study. *Subst Use Misuse*. 2008;43(8-9):1218–1239.
19. Easton A, Jackson K, Mowery P, Comeau D, Sell R. Adolescent same-sex and both-sex romantic attractions and relationships: implications for smoking. *Am J Public Health*. 2008;98(3):462–467.
20. Gruskin EP, Greenwood GL, Matevia M, Pollack LM, Bye LL. Disparities in smoking between the lesbian, gay, and bisexual population and the general population in California. *Am J Public Health*. 2007;97(8):1496–1502.
21. Tang H, Greenwood GL, Cowling DW, Lloyd JC, Roeseler AG, Bal DG. Cigarette smoking among lesbians, gays, and bisexuals: how serious a problem? *Cancer Causes Control*. 2004;15(8):797–803.
22. Stall RD, Greenwood GL, Acree M, Paul J, Coates TJ. Cigarette smoking among gay and bisexual men. *Am J Public Health*. 1999;89(12):1875–1878.
23. King BA, Dube SR, Tynan MA. Current tobacco use among adults in the United States: findings from the National Adult Tobacco Survey. *Am J Public Health*. 2012;102(11):e93–e100.
24. Ryan H, Wortley PM, Easton A, Pederson L, Greenwood G. Smoking among lesbians, gays, and bisexuals: a review of the literature. *Am J Prev Med*. 2001;21(2):142–149.
25. Smoking out a deadly threat: tobacco use in the LGBT community. Washington, DC: American Lung Association; 2010.
26. Lee JG, Griffin GK, Melvin CL. Tobacco use among sexual minorities in the USA, 1987 to May 2007: a systematic review. *Tob Control*. 2009;18(4):275–282.
27. Lindley LL, Walsemann KM, Carter JW Jr. The association of sexual orientation measures with young adults' health-related outcomes. *Am J Public Health*. 2012;102(6):1177–1185.
28. Cochran SD, Bandiera F, Mays VM. Sexual orientation-related differences in secondhand smoke exposure among adults, age 20–59 years in the United States: results from the 2003–2010 NHANES. *Am J Public Health*. 2013;103(10):1837–1844.
29. Kilmarx PH. Global epidemiology of HIV. *Curr Opin HIV AIDS*. 2009;4(4):240–246.
30. Fredriksen-Goldsen KI, Kim HJ, Barkan SE, Muraco A, Hoy-Ellis CP. Health disparities among lesbian, gay, and bisexual older adults: results from a population-based study. *Am J Public Health*. 2013;103(10):1802–1809.

31. Ponce NA, Cochran SD, Pizer JC, Mays VM. The effects of unequal access to health insurance for same-sex couples in California. *Health Aff (Millwood)*. 2010;29:1539–1548.
32. Austin EL. Sexual orientation disclosure to health care providers among urban and non-urban southern lesbians. *Women Health*. 2013;53(1):41–55.
33. Williams KA, Chapman MV. Unmet health and mental health need among adolescents: the roles of sexual minority status and child–parent connectedness. *Am J Orthopsychiatry*. 2012;82(4):473–481.
34. Clift JB, Kirby J. Health care access and perceptions of provider care among individuals in same-sex couples: findings from the Medical Expenditure Panel Survey (MEPS). *J Homosex*. 2012;59(6):839–850.
35. Wallace SP, Cochran SD, Durazo EM, Ford CL. The health of aging lesbian, gay and bisexual adults in California. *Policy Brief UCLA Cent Health Policy Res*. 2011;(PB2011–2):1–8.
36. Cochran SD. Emerging issues in research on lesbians' and gay men's mental health: does sexual orientation really matter? *Am Psychol*. 2001;56(11):931–947.
37. Cochran SD, Mays VM. Sexual orientation and mortality among US men aged 17 to 59 years: results from the National Health and Nutrition Examination Survey III. *Am J Public Health*. 2011;101(6):1133–1138.
38. Boehmer U, Ozonoff A, Miao X. An ecological approach to examine lung cancer disparities due to sexual orientation. *Public Health*. 2012;126(7):605–612.
39. Boehmer U, Ozonoff A, Miao X. An ecological analysis of colorectal cancer incidence and mortality: differences by sexual orientation. *BMC Cancer*. 2011;11:400.
40. Rothman K, Greenland S. *Modern Epidemiology*. 2nd ed. Philadelphia, PA: Lippincott-Raven Publishers; 1998.
41. Frisch M, Bronnum-Hansen H. Mortality among men and women in same-sex marriage: a national cohort study of 8333 Danes. *Am J Public Health*. 2009;99(1):133–137.
42. Qin P, Agerbo E, Mortensen PB. Suicide risk in relation to socioeconomic, demographic, psychiatric, and familial factors: a national register-based study of all suicides in Denmark, 1981–1997. *Am J Psychiatry*. 2003;160(4):765–772.
43. Mathy RM, Cochran SD, Olsen J, Mays VM. The association between relationship markers of sexual orientation and suicide: Denmark, 1990–2001. *Soc Psychiatry Psychiatr Epidemiol*. 2011;46(2):111–117.
44. Hoyert D, Xu J. *Deaths: Preliminary Data for 2011*. Hyattsville, MD: National Center for Health Statistics; 2012.
45. Cochran SD, Mays VM. Risk of breast cancer mortality among women cohabiting with same sex partners: findings from the National Health Interview Survey, 1997–2003. *J Womens Health (Larchmt)*. 2012;21:528–533.
46. Carpenter C, Gates GJ. Gay and lesbian partnership: evidence from California. *Demography*. 2008;45:573–590.
47. Muenning P, Johnson G, Kim J, Smith TW, Rosen Z. The General Social Survey–National Death Index: an innovative new dataset for the social sciences. *BMC Res Notes*. 2011;4:385.
48. Haas AP, Eliason M, Mays VM, et al. Suicide and suicide risk in lesbian, gay, bisexual, and transgender populations: review and recommendations. *J Homosex*. 2011;58(1):10–51.
49. Hogg RS, Strathdee SA, Craib KJ, O'Shaughnessy MV, Montaner JS, Schechter MT. Modelling the impact of HIV disease on mortality in gay and bisexual men. *Int J Epidemiol*. 1997;26(3):657–661.
50. Muenning P, Kuebler M, Kim J, Todorovic D, Rosen Z. Gender differences in material, psychological, and social domains of the income gradient in mortality: implications for policy. *PLoS ONE*. 2013;8:e59191.
51. Centers for Disease Control and Prevention, National Center for Health Statistics. *International Classification of Diseases, Ninth Revision*. Available at: <http://www.cdc.gov/nchs/icd/icd9.htm> Accessed May 24, 2014.
52. Centers for Disease Control and Prevention, National Center for Health Statistics. *International Classification of Diseases, Tenth Revision*. Available at: <http://www.cdc.gov/nchs/icd/icd10.htm>. Accessed May 24, 2014.
53. Agency for Healthcare Research and Quality Healthcare Cost and Utilization Project. Clinical Classifications Software for ICD-10. 2009. Available at: http://www.hcup-us.ahrq.gov/toolssoftware/icd_10/ccs_icd_10.jsp. Accessed May 24, 2014.
54. Hogg RS, Strathdee SA, Craib KJ, O'Shaughnessy MV, Montaner J, Schechter MT. Gay life expectancy revisited. *Int J Epidemiol*. 2001;30(6):1499.
55. Falagas ME, Zarkadoulia EA, Ioannidou EN, Peppas G, Christodoulou C, Rafailidis PI. The effect of psychosocial factors on breast cancer outcome: a systematic review. *Breast Cancer Res*. 2007;9(4):R44.
56. Xu F, Sternberg MR, Markowitz LE. Men who have sex with men in the United States: demographic and behavioral characteristics and prevalence of HIV and HSV-2 infection: results from National Health and Nutrition Examination Survey 2001–2006. *Sex Transm Dis*. 2010;37(6):399–405.
57. Villarreal MA, Turner CF, Eggleston E, et al. Same-gender sex in the United States: impact of T-ACASI on prevalence estimates. *Public Opin Q*. 2006;70(2):166–196.
58. Laumann EO, Gagnon JH, Michael RT, Michaels S. *The Social Organization of Sexuality: Sexual Practices in the United States*. Chicago, IL: University of Chicago Press; 1994.
59. Wienke C, Whaley RB. Same-gender sexual partnering: a re-analysis of trend data. *J Sex Res*. 2013;Epub ahead of print.
60. Mays VM, Yancey AK, Cochran SD, Weber M, Fielding JE. Heterogeneity of health disparities among African American, Hispanic, and Asian American women: unrecognized influences of sexual orientation. *Am J Public Health*. 2002;92(4):632–639.
61. Kim HJ, Fredriksen-Goldsen KI. Hispanic lesbians and bisexual women at heightened risk for health disparities. *Am J Public Health*. 2012;102(1):e9–e15.
62. Terry J. *An American Obsession: Science, Medicine, and Homosexuality in Modern Society*. Chicago, IL: University of Chicago Press; 1999.
63. Pizacani BA, Rohde K, Bushore C, et al. Smoking-related knowledge, attitudes and behaviors in the lesbian, gay and bisexual community: a population-based study from the U.S. Pacific Northwest. *Prev Med*. 2009;48(6):555–561.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.