Comparative Analysis of the NHIS Public-Use and Restricted-Use Linked Mortality Files: 2010 Data Release

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Introduction

In 2009, NCHS completed a mortality update for the National Health Interview Survey (NHIS) participants for the years 1986 to 2004, with mortality ascertained through December 31, 2006. Due to requirements to protect the confidentiality of the NHIS participants, restricted-use versions of the NHIS Linked Mortality Files were made available only through the NCHS Research Data Center (RDC). To complement the restricted-use files and increase data access, NCHS has developed a plan to allow for a public-use release of linked mortality data.

In 2010, NCHS released public-use versions of the NHIS Linked Mortality Files. The public-use data release includes the addition of perturbed data and was developed with the intent of eliminating re-identification risk to survey participants, maximizing the amount of mortality data included in the public-use release, while at the same time limiting the amount of synthetic data introduced to the data file.

This report describes a comparative analysis of the public-use and restricted-use NHIS Linked Mortality Files. We used Cox proportional hazards models to compare the relative risk estimates for a standard set of socio-demographic covariates for all-cause as well as cause-specific mortality risk. NCHS is conducting this comparative analysis to demonstrate the comparability between the two versions of linked mortality files. NCHS recommends that researchers use these new linked mortality files as they supersede all prior data releases of the NHIS Linked Mortality Files.

Description of NHIS Linked Mortality Data Resources

Mortality status for eligible NHIS survey participants is ascertained primarily through probabilistic record matching with the National Death Index (NDI). For a complete description on the matching methodology please refer to http://www.cdc.gov/nchs/data/datalinkage/matching_methodology_nhis_final.pdf.

The restricted-use files include detailed mortality information for all eligible survey participants including children. The restricted-use files include the following variables: survey respondent eligibility status, mortality status, age at death, age last known alive, date of death (month, day and year), underlying and multiple causes of death, date of birth, NHIS interview date (month, day, and year) and adjusted sample weights.

Due to confidentiality protections, the public-use files include only eligible survey participants 18 years and older and a limited set of mortality variables. In addition, the public-use versions were subjected to data perturbation techniques to reduce the risk of participant re-identification. Synthetic data were substituted for the actual date of death and underlying cause-of-death data for selected decedent records. Information regarding vital status was not perturbed. Variables provided on the public-use NHIS Linked Mortality Files include: survey respondent eligibility status, mortality status, date of death (quarter and year), 113 grouped recodes of underlying causes of death and adjusted sample weights. In addition, three variables were created to indicate the presence of diabetes, hypertension, or hip fracture in the multiple cause-of-death codes, when these conditions are reported as contributing, rather than underlying, causes of death.

Methods

Sample selection

To effectively compare the restricted-use and public-use data sets, we merged the public-use NHIS person level file for each year 1986 to 2004 with the accompanying public-use and restricted-use mortality files, respectively, to create the analytic samples. We restricted all analyses to those eligible for mortality follow-up, who were at least 25 years

of age at the time of the NHIS interview, were non-Hispanic white, non-Hispanic black, or Hispanic, and with no missing values for education level, marital status, and cause of death. The public and restricted-use pooled 1986 to 2004 NHIS Linked Mortality Files each contain 1,956,925 records[1]. The final sample for the comparative analyses included 1,094,957 records.

Outcome measurement

We examined all-cause and cause-specific mortality in the public-use and restricted-use NHIS Linked Mortality Files using time from NHIS interview until death; respondents who were not identified as deceased by the end of the follow-up period were assumed to be alive. For the public-use files, duration of follow-up was constructed using NHIS interview year and year of death. Respondents who died in the same year as their NHIS interview were assumed to have ½-year of follow-up time as their duration. All other decedents were assumed to have ½–year of follow-up during the year of their interview, a full year of follow-up for each year after their year of interview until the year prior to their death, and then another ½-year of follow-up during the year of their death. For respondents assumed alive, their follow-up time was calculated by assuming ½-year of follow-up during their NHIS interview year and a full year of follow-up for each year thereafter until the end of 2006. For the restricted-use files, duration of follow-up was calculated using complete information on the month, day, and year of the NHIS interview and the month, day, and year of death or, for respondents assumed alive, until the end of the follow-up period, December 31, 2006.

In addition to all-cause mortality, we examined 15 causes of death that are among the leading causes of death in the United States and/or contribute to most years of potential life lost.[1] The NHIS Linked Mortality files encompass both the Ninth Revision of the *International Classification of Diseases* (ICD-9) and the Tenth Revision (ICD-10) cause-of-death coding for all U.S. deaths. In order to have the same cause-of-death codes across all years in the study period, we used the ICD-10 underlying cause-of-death 113 group

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[1] Since we are pooling across 1991 and 1992 NHIS years, we used the 1992 NHIS modified file that has the 1991 Hispanic oversample removed.

recode, which recodes all deaths occurring prior to 1999 into ICD-10 codes.[2] Although the code numbers are the same for all years of mortality data, the coding rules for determining underlying cause-of-death differ for deaths that occurred prior to 1999 under ICD-9 and those that occurred in later years under ICD-10. The analyses presented in this paper do not control for the transition in coding rules between ICD-9 and ICD-10 because that transition does not affect the comparisons of interest in this paper.

The cause-specific death categories include the following Underlying Cause-of-Death Recoded 113 Groups: heart disease (55-68), ischemic heart disease (59-61), cancer from all sites (20-44), lung cancer (27), colorectal cancer (23), breast cancer (estimated for women only) (29), prostate cancer (estimated for men only) (33), cerebrovascular diseases (70), diabetes (46), pneumonia and influenza (77-78), Alzheimer's disease (52) chronic liver diseases and Cirrhosis (94-95), unintentional injuries (114-123), suicide (125-126), and homicide (128-129).

Covariates
We included in all models a standard set of socio-demographic characteristics, which were reported at the time of the NHIS interview: age in continuous years, sex, race/ethnicity (non-Hispanic black, non-Hispanic white, Hispanic), educational attainment (less than high school, high school diploma or GED, some college, college degree or more), marital status (widowed, divorced/separated, never married, married), and region of the country (South, Midwest, Northeast, West).

Data Analysis
We used Cox proportional hazards models to compare the relative risk estimates for the covariates for all-cause as well as cause-specific mortality risk. All relative risk estimates were calculated with the survival procedure in Software for Survey Data Analysis (SUDAAN), version 10.0 to take into account the complex survey design of the NHIS.[3] The Efron method was used for handling tied failure times.[4]

Results

Descriptive Results

Table 1 shows the unweighted sample counts (n) and weighted percentage distributions for the covariates used in the analyses. Note that these descriptive statistics for covariates do not differ between the public-use and restricted-use files because the only differences between the two files are associated with the variables taken from the mortality file. Briefly, the distributions of covariates are as expected: the average age of this sample is 48.2 years and fewer than two percent of respondents are aged 85 or above. Females outnumber males, and non-Hispanic whites make up just over 80.0 percent of the sample while non-Hispanic blacks (11.0 percent) and Hispanics (8.9 percent) account for considerably smaller proportions. A vast majority of the sample is married at the time of NHIS interview (68.0 percent) and the modal educational category is a high school diploma or GED (34.8 percent).

The number and weighted percentage of persons, in our sample, who were identified as dying in each of the two files (n = 167,826; Percent = 13.8) is identical, since for the public-use file the vital status of individuals was not changed as a result of the perturbation process. The public-use file uses less detailed date information (year information only) and includes perturbed information for year of death for selected decedents, which affects the calculation of months of follow-up. Yet, for the pooled NHIS years 1986 to 2004, the mean years of follow-up (weighted) for both files are very similar (approximately 10.2 years). We examined the cause-specific percentage distributions for the 15 causes of death studied. Overall, the distributions are quite similar when comparing the two files. For example, heart disease (31%) and cancer (26%) account for the same percentage of deaths in both files. There is a slight difference between the two files in deaths attributed to lung cancer: 7.6% of deaths in the public-use file and 7.3% in the restricted-use file. Even for the less prevalent causes of death, the percentages of deaths attributed to a specific cause were quite similar (data not shown).

All-Cause Mortality Model Results

Table 2.1 displays results from two Cox proportional hazards models of all-cause mortality: one estimated from the public-use file and one estimated from the restricted-use file. Recall that while fact of death was not changed between the two files, there are differences in the duration of follow-up variables due to the perturbation of date of death for selected decedents in the public-use file and different level of detail for the date of death information used in the calculation. The results of both models are consistent. Age, race/ethnicity, education and marital status are all related to the risk of adult mortality in the expected directions. For example, non-Hispanic blacks, persons with less than a high school education, never married individuals, and those living in the South display the highest risks of mortality compared to their respective counterpart subgroups. Moreover, the relative risks and 95% confidence intervals are nearly identical for results from the public-use and restricted-use files.

The results of all-cause Cox proportional hazards models of adult mortality that are estimated separately by sex are shown in Table 2.2. For each sex, results from the public-use and restricted-use files are shown, respectively. The sex-specific models yield consistent results, when the public-use and restricted-use files are compared. Table 2.3 shows the results of separate proportional hazards models for non-Hispanic whites, non-Hispanic blacks, and Hispanics, respectively. Again, there are only non-substantive differences when comparing the results from the public-use and restricted-use files for each of the three racial/ethnic groups. For each group, covariates exhibit relationships with all-cause mortality that are consistent with what one would expect; for example, males exhibit higher mortality than females in each racial/ethnic group and persons with less than a high school education demonstrate higher mortality risks over the follow-up period in each racial/ethnic group compared to persons in the more highly educated groups.

Cause-Specific Mortality Model Results

Tables 3.1 through 3.15 display the results of the Cox proportional hazards models for 15 specific underlying causes of death. Each cause-specific table provides a comparison of the model results from the public-use version and the restricted-use version of the NHIS

Linked Mortality Files. Some of the specific causes (e.g., lung cancer, colorectal cancer, breast cancer, prostate cancer) are subsets of a larger underlying cause category (e.g., all-cancer mortality).

A comparison of the results for the public-use and restricted-use files for each of the 15 causes yields similar results. In general, the conclusions to be reached from the models are identical and there are only minor differences when comparing the actual coefficients and standards errors of the models. This is the case when both common underlying causes of death are specified as the outcome (e.g., heart disease mortality; all-cancer mortality) and less common underlying causes of death are specified (e.g., pneumonia/influenza mortality; homicide mortality) as the outcome.

To illustrate an example of the consistency between results from the public-use data and restricted-use data, Table 3.3 provides comparative models that specify all-cancer mortality as the outcome variable. Mortality risk increases just over seven percent for each additional year of age in both the public-use data model and the restricted-use data model. Males experience an approximately 59 percent higher cancer mortality risk than females over the course of the follow-up period in both files. Educational differences in overall cancer mortality risk favor those with a college degree or more in both the public-use and restricted-use data sets, with those who have less than a high school education exhibiting approximately 58 percent higher mortality risk over the follow-up period compared to those with a college degree or more. Finally, there exist regional differences in all-cancer mortality risk, with the magnitude of these regional cancer mortality risk differences nearly identical when comparing the results of the public-use and restricted-use models.

Mortality from unintentional injuries is an example of an underlying cause that is far less common than all-cancer mortality; unintentional injury accounts for only 2.9 percent of deaths in both the public-use and restricted-use NHIS Linked Mortality Files. Table 3.13 shows that when comparing public-use data and restricted-use data relative risks and 95% confidence intervals for standard socio-demographic covariates of unintentional injury

mortality are consistent. For example, results from both the public-use and restricted-use files show that males are twice as likely as females to die from an unintentional injury and those with less than a high school education experience twice the unintentional injury mortality risk compared to those with at least a college degree.

Also, in order to examine different samples, including a sample with fewer years of follow-up, we repeated these analyses on subsets of the 1986 to 2004 NHIS data file. We examined the NHIS years 1987 to 1994 with follow-up through 2006 and the NHIS years 1997 to 2004 with follow-up through 2006. Overall, comparisons of the public-use and restricted-use linked mortality files again produced consistent results (data not shown). For the 1997-2004 period, we found slight variations in results for two causes of death. In the public-use file, the relative risk of mortality from lung cancer for non-Hispanic blacks compared to non-Hispanic whites did not reach statistical significance at the 0.05 level (RR=0.997, 95% confidence interval 0.932, 1.066) and in the restricted-use file the comparable results did meet statistical significance at the 0.05 level (RR=0.919, 95% confidence interval 0.856, 0.987). This also was the case for mortality from ischemic heart disease. The results from the public-use file for non-Hispanic blacks were (RR=0.943, 95% confidence interval 0.880, 1.011) whereas in the restricted-use file the results were (RR=0.922, 95% confidence interval 0.860, 0.989).

Discussion

This report describes analyses comparing results obtained from the public-use version and restricted-use version of the NHIS Linked Mortality Files, with mortality follow-up through 2006. In the public-use version of the data file, a limited amount of information for decedents was perturbed. Further, there is less detailed date of death information in the public-use version, compared to the restricted-use file, where no information has been perturbed and there is complete information on date of death.

The comparative analysis finds that the two data files yield very similar descriptive and model results. This is particularly true when examining all-cause mortality. Because the perturbation process in the public-use files did not affect the vital status of any

individuals in the file, differences in results between the two files when examining overall (all-cause) mortality arise because the public-use files include perturbed information for date of death as well as less specific information regarding date of death for individuals compared to the restricted-use files. Differences in results for all-cause mortality between the public-use files and restricted-use files were very minor.

The comparative analysis of cause-specific mortality across the public-use and restricted-use versions of the NHIS Linked Mortality Files also yielded consistent model results, even for causes of death like diabetes, chronic liver disease and cirrhosis, homicide, unintentional injuries, and suicide that each represent fewer than three percent of all U.S. adult deaths. The perturbation process in the public-use files will impact the frequency distributions for causes of death and should be kept in mind when conducting cause-specific analyses of the public-use files. Yet, overall, the percentage of death attributed to the leading causes of death for both files remained similar.

Our findings should provide analysts with the confidence to use these most recent public-use data files providing mortality follow-up for eligible adult NHIS respondents. However, there are some analytic considerations that should be noted by all potential users. We used the statistical software package SUDAAN 10.0 because it fits Cox proportional hazard models to sample surveys and uses Efron's likelihood for tied failure times as the default.[4] Using only interview year and year of death to calculate follow-up time in the public-use files, results in more tied failure times than if the additional information on quarter of interview and quarter of death had been included[2]. Moreover, caution in using the public-use files is urged when examining the mortality patterns of small subgroups of the population, such as numerically small racial/ethnic minority groups, very old individuals, or young adults. This is particularly the case when cause-specific analyses of such numerically small demographic subgroups are performed.

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[2] On the previous release of the public-use NHIS Linked Mortality Files, we had conducted additional analyses using the available information on quarter of interview and quarter of death to calculate length of follow-time and found no substantive or significant differences in results compared to those presented in this report.

In sum, the 2010 release of a public-use version of the NHIS Linked Mortality Files provide the public health, social science, demographic, and medical communities with a data set that is easily available, large, nationally representative, and rich in detail for both mortality covariates and specificity in outcomes. The public-use files are an important resource for researchers and policymakers in further understanding adult mortality trends and patterns.

References

1. National Center for Health Statistics. *Health, United States, 2009*. Hyattsville, MD: 2010.

2. Anderson RN, Minino AM, Hoyert DL, Rosenberg HM. Comparability of cause of death between ICD-9 and ICD-10: Preliminary estimates. National Center for Health Statistics. *National Vital Statistics Reports 49*. 2001;No.2.

3. SUDAAN: Software for the Statistical Analysis of Correlated Data,10.0. RTI International.

4. Hertz-Picciotto I; Rockhill B. Validity and efficiency of approximation methods for tied survival times in Cox regression. *Biometrics.* 1997;53:1151-1156.

Table 1. Baseline sample characteristics, 1986-2004 NHIS: n = 1,094,957

	Unweighted n	Weighted percentage or mean
Age in years, mean		48.2
Age in years (grouped)		
25-44	530,764	48.5%
45-64	354,259	32.5
65-84	192,082	17.3
85+	17,852	1.7
Sex		
Male	506,720	47.5%
Female	588,237	52.5
Race/Ethnicity		
non-Hispanic white	819,689	80.1%
non-Hispanic black	142,415	11.0
Hispanic	132,853	8.9
Marital status		
Married	742,148	68.1%
Widowed	91,033	8.0
Divorced/separated	132,882	12.0
Never married	128,894	11.8
Education level		
Less than high school	240,801	19.5%
High school/GED	384,429	34.8
Some college	237,542	22.8
College degree or more	232,185	22.9
Region		
Northeast	220,802	20.5%
Midwest	263,542	24.7
South	387,182	35.8
West	223,431	19.0

Table 2.1. Relative Risks for all-cause mortality: NHIS 1986-2004 linked mortality files, mortality follow-up through 2006 (n = 1,094,957)

| | Public-use | | | Restricted-use | | |
	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI
Age in years	1.092	1.091	1.092	1.092	1.091	1.092
Sex (Female)						
Male	1.666	1.647	1.686	1.668	1.648	1.687
Race/ethnicity (NHW)						
Hispanic	0.764	0.744	0.783	0.764	0.745	0.784
NHB	1.120	1.096	1.440	1.120	1.096	1.144
Education (College degree or more)						
Less than high school	1.747	1.712	1.783	1.747	1.712	1.783
High school	1.457	1.428	1.486	1.457	1.429	1.486
Some college	1.319	1.290	1.348	1.319	1.290	1.349
Marital status (Married)						
Widowed	1.229	1.212	1.248	1.230	1.212	1.248
Divorced/Separated	1.453	1.426	1.479	1.454	1.428	1.481
Never married	1.503	1.465	1.541	1.504	1.466	1.542
Region (West)						
Northeast	0.944	0.924	0.965	0.945	0.926	0.965
Midwest	0.980	0.957	1.003	0.980	0.958	1.003
South	1.063	1.042	1.085	1.063	1.043	1.084

Notes:
Relative Risks are estimated from a Cox proportional hazards model.
All models adjust for sample weights and the NHIS complex survey design using the SUDAAN software program (10.0).
NHW refers to non-Hispanic white; NHB refers to non-Hispanic black.
Values in parenthesis are reference categories.

Table 2.2. Relative Risks for all-cause mortality by sex: NHIS 1986-2004 linked mortality files, mortality follow-up through 2006 (n = 1,094,957)

	Men						Women					
	Public-use			Restricted-use			Public-use			Restricted-use		
	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI
Age in years	1.092	1.091	1.093	1.092	1.091	1.093	1.092	1.091	1.092	1.092	1.091	1.092
Race/ethnicity (NHW)												
Hispanic	0.770	0.744	0.796	0.770	0.745	0.797	0.760	0.732	0.790	0.761	0.733	0.790
NHB	1.150	1.118	1.183	1.150	1.118	1.183	1.093	1.064	1.123	1.093	1.064	1.122
Education (College degree or more)												
Less than high school	1.790	1.746	1.836	1.791	1.746	1.836	1.655	1.608	1.704	1.654	1.607	1.702
High school	1.509	1.472	1.546	1.510	1.473	1.547	1.368	1.331	1.406	1.367	1.330	1.405
Some college	1.375	1.337	1.413	1.375	1.338	1.414	1.229	1.191	1.269	1.230	1.191	1.270
Marital status (Married)												
Widowed	1.182	1.150	1.214	1.182	1.151	1.215	1.246	1.223	1.269	1.246	1.223	1.269
Divorced/Separated	1.507	1.467	1.548	1.508	1.468	1.549	1.399	1.364	1.435	1.400	1.365	1.436
Never married	1.579	1.531	1.629	1.580	1.531	1.630	1.414	1.360	1.469	1.414	1.360	1.470
Region (West)												
Northeast	0.974	0.946	1.003	0.975	0.947	1.005	0.916	0.893	0.940	0.917	0.894	0.941
Midwest	0.991	0.963	1.020	0.991	0.963	1.020	0.969	0.942	0.996	0.969	0.943	0.996
South	1.105	1.077	1.133	1.105	1.077	1.133	1.022	0.997	1.047	1.021	0.997	1.046

Notes:

Relative Risks are estimated from a Cox proportional hazards model.

All models adjust for sample weights and the NHIS complex survey design using the SUDAAN software program (10.0).

NHW refers to non-Hispanic white; NHB refers to non-Hispanic black.

Values in parenthesis are reference categories.

Table 2.3. Relative Risks for all-cause mortality by race/ethnicity: NHIS 1986-2004 linked mortality files, mortality follow-up through 2006 (n = 1,094,957)

	non-Hispanic whites						non-Hispanic blacks					
	Public-use			Restricted-use			Public-use			Restricted-use		
	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI
Age in years	1.095	1.094	1.096	1.095	1.094	1.096	1.076	1.075	1.077	1.076	1.075	1.077
Sex (Female)												
Male	1.670	1.649	1.692	1.671	1.650	1.693	1.671	1.619	1.725	1.672	1.619	1.726
Education (College degree or more)												
Less than high school	1.753	1.715	1.791	1.753	1.715	1.791	1.758	1.646	1.878	1.754	1.643	1.873
High school	1.446	1.415	1.477	1.447	1.416	1.478	1.448	1.351	1.551	1.446	1.350	1.549
Some college	1.304	1.274	1.335	1.305	1.275	1.336	1.319	1.225	1.421	1.319	1.225	1.421
Marital status (Married)												
Widowed	1.224	1.204	1.245	1.225	1.205	1.246	1.221	1.169	1.275	1.220	1.168	1.274
Divorced/Separated	1.507	1.475	1.540	1.509	1.476	1.542	1.281	1.227	1.337	1.282	1.228	1.338
Never married	1.466	1.424	1.509	1.467	1.425	1.510	1.478	1.407	1.552	1.477	1.407	1.551
Region (West)												
Northeast	0.941	0.919	0.964	0.942	0.920	0.964	0.960	0.894	1.031	0.965	0.899	1.035
Midwest	0.976	0.952	1.001	0.976	0.952	1.000	1.019	0.948	1.095	1.023	0.952	1.098
South	1.062	1.038	1.086	1.062	1.039	1.085	1.081	1.017	1.148	1.083	1.020	1.149

	Hispanics					
	Public-use			Restricted-use		
	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI
Age in years	1.086	1.084	1.089	1.087	1.084	1.089
Sex (Female)						
Male	1.628	1.546	1.715	1.628	1.545	1.715
Education (College grad+)						
Less than high school	1.538	1.400	1.690	1.536	1.399	1.688
High school	1.359	1.230	1.502	1.360	1.230	1.503
Some college	1.307	1.168	1.463	1.305	1.166	1.460
Marital status (Married)						
Widowed	1.241	1.160	1.328	1.239	1.159	1.326
Divorced/Separated	1.285	1.196	1.380	1.283	1.194	1.378
Never married	1.338	1.202	1.489	1.337	1.201	1.488
Region (West)						
Northeast	0.964	0.902	1.030	0.965	0.904	1.030
Midwest	1.008	0.921	1.103	1.011	0.925	1.106
South	1.100	1.043	1.160	1.101	1.045	1.160

Notes:
Relative Risks are estimated from a Cox proportional hazards model.
All models adjust for sample weights and the NHIS complex survey design using the SUDAAN software program (10.0).
NHW refers to non-Hispanic white; NHB refers to non-Hispanic black.
Values in parenthesis are reference categories.

Table 3.1. Relative Risks for heart disease mortality: NHIS 1986-2004 linked mortality files, mortality follow-up through 2006 (n = 1,094,957)

	Public-use			Restricted-use		
	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI
Age in years	1.107	1.106	1.108	1.107	1.106	1.108
Sex (Female)						
Male	1.880	1.845	1.917	1.899	1.862	1.936
Race/ethnicity (NHW)						
Hispanic	0.747	0.708	0.788	0.709	0.670	0.750
NHB	1.130	1.092	1.169	1.118	1.080	1.158
Education (College degree or more)						
Less than high school	1.785	1.723	1.850	1.834	1.768	1.902
High school	1.415	1.366	1.466	1.453	1.402	1.507
Some college	1.261	1.211	1.314	1.288	1.235	1.343
Marital status (Married)						
Widowed	1.331	1.299	1.364	1.339	1.306	1.372
Divorced/Separated	1.438	1.391	1.487	1.445	1.398	1.495
Never married	1.556	1.487	1.629	1.538	1.472	1.607
Region (West)						
Northeast	1.009	0.965	1.056	1.010	0.966	1.056
Midwest	1.001	0.959	1.044	1.001	0.959	1.043
South	1.070	1.030	1.111	1.078	1.038	1.120

Notes:
Relative Risks are estimated from a Cox proportional hazards model.
All models use sample weights and take into account the NHIS complex survey design using the SUDAAN software program (10.0).
NHW is non-Hispanic white; NHB is non-Hispanic black.
The values in parentheses are reference categories.

Table 3.2. Relative Risks for ischemic heart disease mortality: NHIS 1986-2004 linked mortality files, mortality follow-up through 2006 (n = 1,094,957)

	Public-use			Restricted-use		
	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI
Age in years	1.096	1.094	1.098	1.098	1.097	1.100
Sex (Female)						
Male	2.076	2.004	2.151	2.102	2.028	2.179
Race/ethnicity (NHW)						
Hispanic	0.688	0.614	0.770	0.669	0.592	0.755
NHB	0.932	0.880	0.988	0.919	0.866	0.975
Education (College degree or more)						
Less than high school	1.985	1.851	2.129	2.039	1.899	2.189
High school	1.511	1.416	1.613	1.548	1.448	1.654
Some college	1.255	1.170	1.347	1.284	1.195	1.380
Marital status (Married)						
Widowed	1.235	1.181	1.291	1.239	1.185	1.296
Divorced/Separated	1.397	1.317	1.483	1.395	1.314	1.481
Never married	1.298	1.196	1.409	1.305	1.200	1.419
Region (West)						
Northeast	1.088	1.001	1.184	1.081	0.995	1.175
Midwest	1.185	1.093	1.284	1.174	1.083	1.273
South	1.323	1.229	1.423	1.330	1.237	1.430

Notes:

Relative Risks are estimated from a Cox proportional hazards model.

All models use sample weights and take into account the NHIS complex survey design using the SUDAAN software program (10.0).

NHW is non-Hispanic white; NHB is non-Hispanic black.

The values in parentheses are reference categories.

Table 3.3. Relative Risks for all cancer mortality: NHIS 1986-2004 linked mortality files, mortality follow-up through 2006 (n = 1,094,957)

	Public-use			Restricted-use		
	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI
Age in years	1.076	1.075	1.076	1.077	1.077	1.078
Sex (Female)						
Male	1.585	1.549	1.621	1.594	1.558	1.630
Race/ethnicity (NHW)						
Hispanic	0.692	0.657	0.729	0.708	0.673	0.746
NHB	1.132	1.095	1.169	1.133	1.097	1.170
Education (College degree or more)						
Less than high school	1.582	1.528	1.637	1.586	1.532	1.642
High school	1.428	1.382	1.475	1.426	1.380	1.474
Some college	1.280	1.236	1.334	1.286	1.238	1.336
Marital status (Married)						
Widowed	0.882	0.853	0.912	0.893	0.864	0.923
Divorced/Separated	1.329	1.285	1.374	1.331	1.288	1.376
Never married	0.955	0.911	1.001	0.978	0.934	1.024
Region (West)						
Northeast	1.044	1.008	1.081	1.048	1.012	1.085
Midwest	1.026	0.992	1.062	1.033	0.999	1.068
South	1.091	1.057	1.127	1.096	1.062	1.132

Notes:
Relative Risks are estimated from a Cox proportional hazards model.
All models use sample weights and take into account the NHIS complex survey design using the SUDAAN software program (10.0).
NHW is non-Hispanic white; NHB is non-Hispanic black.
The values in parentheses are reference categories.

Table 3.4. Relative Risks for lung cancer mortality: NHIS 1986-2004 linked mortality files, mortality follow-up through 2006 (n = 1,094,957)

| | Public-use | | | Restricted-use | | |
	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI
Age in years	1.070	1.069	1.072	1.073	1.071	1.074
Sex (Female)						
Male	2.071	1.983	2.162	2.111	2.018	2.208
Race/ethnicity (NHW)						
Hispanic	0.405	0.363	0.451	0.379	0.336	0.427
NHB	1.006	0.949	1.068	0.940	0.882	1.001
Education (College degree or more)						
Less than high school	2.512	2.339	2.698	2.684	2.485	2.899
High school	1.949	1.821	2.086	2.099	1.952	2.258
Some college	1.635	1.512	1.769	1.723	1.585	1.873
Marital status (Married)						
Widowed	0.867	0.812	0.925	0.891	0.833	0.953
Divorced/Separated	1.594	1.502	1.692	1.583	1.488	1.684
Never married	0.885	0.807	0.971	0.830	0.753	0.915
Region (West)						
Northeast	1.016	0.951	1.086	1.031	0.961	1.107
Midwest	1.026	0.966	1.088	1.039	0.975	1.107
South	1.193	1.129	1.261	1.228	1.157	1.304

Notes:
Relative Risks are estimated from a Cox proportional hazards model.
All models use sample weights and take into account the NHIS complex survey design using the SUDAAN software program (10.0).
NHW is non-Hispanic white; NHB is non-Hispanic black.
The values in parentheses are reference categories.

Table 3.5. Relative Risks for colorectal cancer mortality: NHIS 1986-2004 linked mortality files, mortality follow-up through 2006 (n = 1,094,957)

	Public-use			Restricted-use		
	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI
Age in years	1.084	1.081	1.087	1.086	1.083	1.088
Sex (Female)						
Male	1.531	1.429	1.640	1.546	1.443	1.657
Race/ethnicity (NHW)						
Hispanic	0.846	0.733	0.976	0.879	0.761	1.016
NHB	1.273	1.156	1.402	1.303	1.183	1.434
Education (College degree or more)						
Less than high school	1.586	1.421	1.771	1.575	1.414	1.755
High school	1.518	1.364	1.689	1.487	1.337	1.654
Some college	1.296	1.148	1.464	1.282	1.138	1.444
Marital status (Married)						
Widowed	0.981	0.894	1.076	0.996	0.910	1.091
Divorced/Separated	1.312	1.173	1.467	1.316	1.177	1.470
Never married	1.227	1.071	1.406	1.277	1.120	1.456
Region (West)						
Northeast	1.249	1.129	1.382	1.237	1.123	1.363
Midwest	1.179	1.059	1.313	1.166	1.050	1.295
South	1.066	0.964	1.178	1.054	0.955	1.162

Notes:
Relative Risks are estimated from a Cox proportional hazards model.
All models use sample weights and take into account the NHIS complex survey design using the SUDAAN software program (10.0).
NHW is non-Hispanic white; NHB is non-Hispanic black.
The values in parentheses are reference categories.

Table 3.6. Relative Risks for breast cancer mortality: NHIS 1986-2004 linked mortality files, mortality follow-up through 2006 (n = 588,237)

	Public-use			Restricted-use		
	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI
Age in years	1.047	1.045	1.050	1.050	1.047	1.053
Race/ethnicity (NHW)						
Hispanic	0.759	0.645	0.893	0.768	0.655	0.899
NHB	1.328	1.196	1.475	1.334	1.198	1.484
Education (College degree or more)						
Less than high school	1.118	0.979	1.276	1.132	0.987	1.299
High school	1.162	1.035	1.304	1.183	1.050	1.331
Some college	1.110	0.964	1.277	1.121	0.974	1.290
Marital status (Married)						
Widowed	0.979	0.882	1.087	0.984	0.887	1.092
Divorced/Separated	1.140	1.024	1.269	1.157	1.039	1.290
Never married	1.206	1.037	1.402	1.164	0.993	1.365
Region (West)						
Northeast	1.050	0.930	1.186	1.055	0.936	1.190
Midwest	0.958	0.853	1.076	0.961	0.857	1.078
South	0.932	0.837	1.038	0.952	0.855	1.060

Notes:
Relative Risks are estimated from a Cox proportional hazards model.
All models use sample weights and take into account the NHIS complex survey design using the SUDAAN software program (10.0).
NHW is non-Hispanic white; NHB is non-Hispanic black.
The values in parentheses are reference categories.

Table 3.7. Relative Risks for prostate cancer mortality: NHIS 1986-2004 linked mortality files, mortality follow-up through 2006 (n = 506,720)

	Public-use			Restricted-use		
	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI
Age in years	1.140	1.136	1.145	1.143	1.139	1.147
Race/ethnicity (NHW)						
Hispanic	0.755	0.605	0.943	0.785	0.627	0.982
NHB	2.430	2.157	2.738	2.452	2.182	2.755
Education (College degree or more)						
Less than high school	1.181	1.029	1.357	1.189	1.037	1.362
High school	1.186	1.030	1.366	1.170	1.018	1.344
Some college	1.168	0.989	1.381	1.148	0.972	1.355
Marital status (Married)						
Widowed	0.845	0.730	0.979	0.855	0.737	0.992
Divorced/Separated	1.119	0.938	1.336	1.139	0.956	1.357
Never married	0.866	0.678	1.107	0.916	0.721	1.165
Region (West)						
Northeast	0.989	0.865	1.131	0.992	0.867	1.134
Midwest	1.048	0.922	1.191	1.051	0.926	1.193
South	1.030	0.908	1.167	1.033	0.912	1.170

Notes:
Relative Risks are estimated from a Cox proportional hazards model.
All models use sample weights and take into account the NHIS complex survey design using the SUDAAN software program (10.0).
NHW is non-Hispanic white; NHB is non-Hispanic black.
The values in parentheses are reference categories.

Table 3.8. Relative Risks for cerebrovascular disease mortality: NHIS 1986-2004 linked mortality files, mortality follow-up through 2006 (n = 1,094,957)

| | Public-use | | | Restricted-use | | |
	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI
Age in years	1.121	1.119	1.123	1.123	1.121	1.125
Sex (Female)						
Male	1.182	1.131	1.235	1.205	1.153	1.259
Race/ethnicity (NHW)						
Hispanic	0.822	0.754	0.896	0.837	0.769	0.911
NHB	1.207	1.133	1.285	1.217	1.143	1.297
Education (College degree or more)						
Less than high school	1.535	1.427	1.652	1.535	1.428	1.650
High school	1.359	1.264	1.462	1.353	1.259	1.454
Some college	1.212	1.113	1.320	1.212	1.114	1.319
Marital status (Married)						
Widowed	1.103	1.047	1.161	1.112	1.057	1.171
Divorced/Separated	1.286	1.181	1.401	1.290	1.185	1.404
Never married	1.209	1.100	1.328	1.223	1.115	1.342
Region (West)						
Northeast	0.722	0.671	0.776	0.722	0.672	0.777
Midwest	0.917	0.854	0.984	0.918	0.856	0.986
South	0.962	0.901	1.026	0.960	0.899	1.024

Notes:
Relative Risks are estimated from a Cox proportional hazards model.
All models use sample weights and take into account the NHIS complex survey design using the SUDAAN software program (10.0).
NHW is non-Hispanic white; NHB is non-Hispanic black.
The values in parentheses are reference categories.

Table 3.9. Relative Risks for diabetes mortality: NHIS 1986-2004 linked mortality files, mortality follow-up through 2006 (n = 1,094,957)

	Public-use			Restricted-use		
	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI
Age in years	1.080	1.077	1.082	1.081	1.079	1.084
Sex (Female)						
Male	1.377	1.287	1.474	1.405	1.312	1.504
Race/ethnicity (NHW)						
Hispanic	1.707	1.522	1.914	1.652	1.470	1.858
NHB	1.873	1.718	2.042	1.874	1.721	2.042
Education (College degree or more)						
Less than high school	2.278	2.001	2.592	2.285	2.013	2.593
High school	1.820	1.595	2.077	1.808	1.587	2.060
Some college	1.446	1.259	1.660	1.445	1.259	1.659
Marital status (Married)						
Widowed	1.291	1.187	1.404	1.305	1.200	1.419
Divorced/Separated	1.502	1.362	1.656	1.507	1.366	1.662
Never married	1.517	1.345	1.712	1.555	1.378	1.753
Region (West)						
Northeast	0.964	0.857	1.085	0.957	0.851	1.075
Midwest	1.135	1.018	1.265	1.128	1.013	1.256
South	1.112	1.002	1.234	1.109	1.001	1.227

Notes:
Relative Risks are estimated from a Cox proportional hazards model.
All models use sample weights and take into account the NHIS complex survey design using the SUDAAN software program (10.0).
NHW is non-Hispanic white; NHB is non-Hispanic black.
The values in parentheses are reference categories.

Table 3.10. Relative Risks for pneumonia/influenza mortality: NHIS 1986-2004 linked mortality files, mortality follow-up through 2006 (n = 1,094,957)

	Public-use			Restricted-use		
	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI
Age in years	1.137	1.133	1.141	1.139	1.135	1.144
Sex (Female)						
Male	1.777	1.658	1.904	1.824	1.700	1.957
Race/ethnicity (NHW)						
Hispanic	0.695	0.573	0.842	0.718	0.596	0.865
NHB	0.996	0.888	1.116	1.015	0.907	1.137
Education (College degree or more)						
Less than high school	1.841	1.638	2.069	1.838	1.638	2.063
High school	1.484	1.319	1.669	1.473	1.310	1.656
Some college	1.421	1.244	1.625	1.405	1.231	1.603
Marital status (Married)						
Widowed	1.255	1.153	1.365	1.274	1.171	1.386
Divorced/Separated	1.469	1.303	1.656	1.494	1.327	1.683
Never married	1.816	1.555	2.120	1.870	1.602	2.182
Region (West)						
Northeast	0.754	0.667	0.852	0.750	0.664	0.848
Midwest	0.752	0.665	0.851	0.754	0.666	0.853
South	0.854	0.765	0.952	0.852	0.763	0.951

Notes:
Relative Risks are estimated from a Cox proportional hazards model.
All models use sample weights and take into account the NHIS complex survey design using the SUDAAN software program (10.0).
NHW is non-Hispanic white; NHB is non-Hispanic black.
The values in parentheses are reference categories.

Table 3.11. Relative Risks for Alzheimer's disease mortality: NHIS 1986-2004 linked mortality files, mortality follow-up through 2006 (n = 1,094,957)

	Public-use			Restricted-use		
	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI
Age in years	1.181	1.177	1.186	1.184	1.180	1.189
Sex (Female)						
Male	0.918	0.836	1.007	0.934	0.850	1.025
Race/ethnicity (NHW)						
Hispanic	0.755	0.617	0.926	0.764	0.627	0.932
NHB	0.717	0.624	0.823	0.728	0.634	0.836
Education (College degree or more)						
Less than high school	1.026	0.893	1.180	1.030	0.897	1.183
High school	1.078	0.944	1.232	1.073	0.940	1.226
Some college	1.026	0.881	1.195	1.019	0.875	1.185
Marital status (Married)						
Widowed	0.826	0.744	0.916	0.830	0.747	0.921
Divorced/Separated	0.943	0.790	1.125	0.952	0.798	1.137
Never married	0.853	0.700	1.039	0.862	0.708	1.049
Region (West)						
Northeast	0.669	0.585	0.766	0.670	0.586	0.766
Midwest	0.860	0.757	0.976	0.858	0.755	0.976
South	1.029	0.918	1.154	1.024	0.912	1.150

Notes:
Relative Risks are estimated from a Cox proportional hazards model.
All models use sample weights and take into account the NHIS complex survey design using the SUDAAN software program (10.0).
NHW is non-Hispanic white; NHB is non-Hispanic black.
The values in parentheses are reference categories.

Table 3.12. Relative Risks for chronic liver disease mortality: NHIS 1986-2004 linked mortality files, mortality follow-up through 2006 (n = 1,094,957)

	Public-use			Restricted-use		
	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI
Age in years	1.037	1.033	1.040	1.038	1.035	1.042
Sex (Female)						
Male	2.233	2.000	2.492	2.225	1.996	2.479
Race/ethnicity (NHW)						
Hispanic	1.311	1.118	1.537	1.323	1.130	1.548
NHB	0.764	0.638	0.915	0.804	0.674	0.958
Education (College degree or more)						
Less than high school	2.420	2.027	2.889	2.322	1.948	2.768
High school	1.829	1.536	2.179	1.744	1.469	2.072
Some college	1.893	1.582	2.266	1.801	1.512	2.145
Marital status (Married)						
Widowed	1.414	1.158	1.726	1.448	1.188	1.764
Divorced/Separated	2.721	2.383	3.107	2.781	2.441	3.170
Never married	1.710	1.425	2.050	1.753	1.466	2.096
Region (West)						
Northeast	0.800	0.680	0.941	0.807	0.687	0.946
Midwest	0.780	0.663	0.917	0.767	0.655	0.898
South	0.949	0.823	1.094	0.939	0.816	1.080

Notes:
Relative Risks are estimated from a Cox proportional hazards model.
All models use sample weights and take into account the NHIS complex survey design using the SUDAAN software program (10.0).
NHW is non-Hispanic white; NHB is non-Hispanic black.
The values in parentheses are reference categories.

Table 3.13. Relative Risks for unintentional injury mortality: NHIS 1986-2004 linked mortality files, mortality follow-up through 2006 (n = 1,094,957)

	Public-use			Restricted-use		
	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI
Age in years	1.037	1.034	1.039	1.039	1.036	1.041
Sex (Female)						
Male	2.124	1.989	2.268	2.133	2.001	2.274
Race/ethnicity (NHW)						
Hispanic	0.789	0.703	0.884	0.796	0.708	0.895
NHB	0.826	0.746	0.915	0.850	0.768	0.941
Education (College degree or more)						
Less than high school	2.127	1.910	2.368	2.094	1.880	2.332
High school	1.698	1.532	1.881	1.651	1.492	1.828
Some college	1.476	1.314	1.659	1.450	1.292	1.628
Marital status (Married)						
Widowed	1.737	1.578	1.912	1.737	1.581	1.910
Divorced/Separated	1.580	1.439	1.734	1.581	1.443	1.733
Never married	1.870	1.680	2.081	1.873	1.688	2.079
Region (West)						
Northeast	0.764	0.691	0.845	0.763	0.692	0.841
Midwest	0.942	0.850	1.043	0.944	0.855	1.044
South	1.104	1.009	1.207	1.095	1.003	1.194

Notes:
Relative Risks are estimated from a Cox proportional hazards model.
All models use sample weights and take into account the NHIS complex survey design using the SUDAAN software program (10.0).
NHW is non-Hispanic white; NHB is non-Hispanic black.
The values in parentheses are reference categories.

Table 3.14. Relative Risks for suicide mortality: NHIS 1986-2004 linked mortality files, mortality follow-up through 2006 (n = 1,094,957)

	Public-use			Restricted-use		
	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI
Age in years	1.011	1.007	1.016	1.012	1.008	1.016
Sex (Female)						
Male	4.752	4.117	5.484	4.621	4.007	5.329
Race/ethnicity (NHW)						
Hispanic	0.430	0.344	0.538	0.456	0.362	0.573
NHB	0.347	0.268	0.448	0.361	0.280	0.464
Education (College degree or more)						
Less than high school	1.483	1.217	1.806	1.464	1.212	1.769
High school	1.418	1.209	1.663	1.393	1.192	1.629
Some college	1.323	1.117	1.568	1.297	1.099	1.532
Marital status (Married)						
Widowed	1.489	1.149	1.930	1.540	1.203	1.971
Divorced/Separated	1.956	1.679	2.279	1.948	1.679	2.261
Never married	1.847	1.549	2.203	1.829	1.538	2.175
Region (West)						
Northeast	0.600	0.505	0.713	0.599	0.504	0.711
Midwest	0.725	0.614	0.856	0.726	0.615	0.858
South	0.936	0.813	1.079	0.942	0.816	1.087

Notes:
Relative Risks are estimated from a Cox proportional hazards model.
All models use sample weights and take into account the NHIS complex survey design using the SUDAAN software program (10.0).
NHW is non-Hispanic white; NHB is non-Hispanic black.
The values in parentheses are reference categories.

Table 3.15. Relative Risks for homicide mortality: NHIS 1986-2004 linked mortality files, mortality follow-up through 2006 (n = 1,094,957)

	Public-use			Restricted-use		
	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI	Relative Risk	Lower Bound 95% CI	Upper Bound 95% CI
Age in years	0.987	0.978	0.996	0.989	0.980	0.998
Sex (Female)						
Male	2.480	2.027	3.033	2.455	2.010	3.000
Race/ethnicity (NHW)						
Hispanic	1.854	1.375	2.500	1.873	1.400	2.505
NHB	3.669	2.896	4.648	3.536	2.797	4.471
Education (College degree or more)						
Less than high school	3.119	2.108	4.617	2.817	1.947	4.075
High school	2.028	1.368	3.006	1.797	1.242	2.601
Some college	1.639	1.082	2.483	1.484	1.000	2.203
Marital status (Married)						
Widowed	1.205	0.701	2.071	1.325	0.798	2.198
Divorced/Separated	1.660	1.276	2.160	1.644	1.264	2.140
Never married	1.819	1.388	2.384	1.776	1.359	2.321
Region (West)						
Northeast	0.493	0.343	0.707	0.493	0.346	0.701
Midwest	0.776	0.564	1.067	0.760	0.554	1.042
South	1.119	0.844	1.482	1.110	0.838	1.469

Notes:
Relative Risks are estimated from a Cox proportional hazards model.
All models use sample weights and take into account the NHIS complex survey design using the SUDAAN software program (10.0).
NHW is non-Hispanic white; NHB is non-Hispanic black.
The values in parentheses are reference categories.