

All-Cause and Cause-Specific Mortality of Immigrants and Native Born in the United States

ABSTRACT

Objectives. This study examined whether US-born people and immigrants 25 years or older differ in their risks of all-cause and cause-specific mortality and whether these differentials, if they exist, vary according to age, sex, and race/ethnicity.

Methods. Using data from the National Longitudinal Mortality Study (1979–1989), we derived mortality risks of immigrants relative to those of US-born people by using a Cox regression model after adjusting for age, race/ethnicity, marital status, urban/rural residence, education, occupation, and family income.

Results. Immigrant men and women had, respectively, an 18% and 13% lower risk of overall mortality than their US-born counterparts. Reduced mortality risks were especially pronounced for younger and for Black and Hispanic immigrants. Immigrants showed significantly lower risks of mortality from cardiovascular diseases, lung and prostate cancer, chronic obstructive pulmonary diseases, cirrhosis, pneumonia and influenza, unintentional injuries, and suicide but higher risks of mortality from stomach and brain cancer and infectious diseases.

Conclusions. Mortality patterns for immigrants and for US-born people vary considerably, with immigrants experiencing lower mortality from several major causes of death. Future research needs to examine the role of sociocultural and behavioral factors in explaining the mortality advantage of immigrants. (*Am J Public Health*. 2001;91:392–399)

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Since the adoption of the 1965 Immigration Act, both the nature and the volume of immigration to the United States have changed considerably. Before 1965, many US immigrants originated from such European countries as the United Kingdom, Germany, Italy, Greece, Portugal, Poland, and Ireland. In the past 3 decades, however, immigrants have come predominantly from such Asian, Latin American, and Caribbean countries as the Philippines, China, Taiwan, Korea, India, Vietnam, Mexico, Cuba, Colombia, El Salvador, the Dominican Republic, Haiti, Jamaica, and Trinidad and Tobago.^{1–3} The size of the US immigrant population has also risen considerably. Between 1980 and 1991, the annual number of immigrants grew more than 3-fold.² The US immigrant population totaled 19.8 million in the 1990 census, the largest it had ever been in US history, accounting for nearly 8% of the entire US population.^{1–3}

In spite of the impressive growth of the US immigrant population, few national studies have examined immigrant and US-born differentials in health status and health outcomes in general or adult mortality patterns in particular.^{4–7} Analysis of immigrant mortality patterns has focused mostly on perinatal and infant mortality, where immigrants from various ethnic backgrounds are generally shown to have more favorable birth outcomes than their US-born counterparts.^{8–11} In terms of morbidity and other nonmortality measures of health status, such as self-assessed health; number of restricted-activity days, bed disability days, work-loss days, and physician visits; and hospitalization rates, immigrants generally do better than the comparable US-born population.^{4,7}

In this report, using data from a large national sample, we examine the extent to which US-born and immigrant men and women differ in their risks of all-cause and cause-specific mortality after controlling for race/ethnicity and other socioeconomic and demographic characteristics. We also examine how immigrant and US-born differentials in adult mor-

tality vary with respect to age, sex, race, and ethnicity. For purposes of this study, “US or native born” refers to individuals born in the 50 states and the District of Columbia, whereas “immigrants or foreign born” refers to those born outside the 50 states and the District of Columbia.

Methods

To examine mortality differentials between immigrants and US-born individuals, we analyzed microdata from the National Longitudinal Mortality Study (NLMS), which is a longitudinal data set for examining socioeconomic, occupational, and demographic factors associated with all-cause and cause-specific mortality of the US civilian noninstitutionalized population. The NLMS was conducted by the National Heart, Lung, and Blood Institute in collaboration with the US Bureau of the Census and the National Center for Health Statistics.^{12,13} The public-use file consisted of 5 Current Population Survey (CPS) cohorts from 1979 to 1981 whose survival (mortality) experiences had been studied for 9 years.¹⁴ However, 2 of the CPS cohorts did not include nativity data.¹² As a result, 19.2% of the NLMS records were excluded. Data from death certificates on the fact of death and the cause of death were combined with the so-

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ocioeconomic and demographic characteristics of the CPS cohorts by means of the National Death Index. Detailed descriptions of the NLMS have been provided elsewhere.¹²⁻¹⁶ Supplementary behavioral and health status data, derived from the 1993 and 1994 National Health Interview Survey data files, are shown in Table 1 for US- and foreign-born men and women (last 4 rows).^{17,18}

In this study, the dependent variables were risks of all-cause and cause-specific mortality. In estimating the risk of all-cause mortality, individuals surviving beyond the 9-year follow-up were treated as right-censored observations. The cause-of-death analysis included major cardiovascular diseases such as heart disease, stroke, and atherosclerosis; overall cancer as well as di-

gestive (stomach, colorectal, pancreas, esophagus), lung, prostate, breast, ovarian, cervical, uterine, kidney, bladder, and brain cancer and non-Hodgkin lymphoma; diabetes; pneumonia and influenza; chronic obstructive pulmonary disease (COPD); chronic liver disease and cirrhosis; nephritis; infectious diseases; motor vehicle and other unintentional injuries; suicide; homicide; and firearm injuries. These causes of death were coded according to the *International Classification of Diseases, Ninth Revision (ICD-9)*.¹⁹ For the sake of brevity, results of several cause-specific models (colorectal, pancreas, esophagus, cervical, uterine, brain, bladder, and kidney cancer, non-Hodgkin lymphoma, and nephritis) are not shown but are discussed when significant nativity differentials are found.

The study sample consisted of 130 705 US-born men, 146 751 US-born women, 10618 immigrant men, and 13 109 immigrant women 25 years or older at baseline. The number of deaths among these 4 sex-nativity groups during the 9-year follow-up were 16 856, 14 242, 1470, and 1427, respectively (Table 1). About 84% of the study population was non-Hispanic White, 9% non-Hispanic Black, and 4% Hispanic; approximately 3% of the population was made up of Asians and Pacific Islanders and American Indians.

All analyses of all-cause and cause-specific mortality, conducted separately for men and women, included such covariates as age, race/ethnicity, marital status, nativity, rural or urban residence, education, occupa-

TABLE 1—Selected Socioeconomic, Demographic, and Behavioral Characteristics of Immigrants and US-Born Men and Women: National Longitudinal Mortality Study, 1979–1989

	Men (n=141 323)				Women (n=159 860)			
	US Born		Foreign Born		US Born		Foreign Born	
	No. of Deaths	% Population	No. of Deaths	% Population	No. of Deaths	% Population	No. of Deaths	% Population
All ages	16 856	100.00	1470	100.00	14 242	100.00	1427	100.00
Age, y								
25–44	1366	49.75	82	48.12	796	46.52	50	44.88
45–64	5953	34.28	251	28.49	3817	33.56	180	29.19
65–84	8719	15.20	933	20.79	8106	18.47	909	22.62
≥85	818	0.78	204	2.61	1523	1.46	288	3.32
Race/ethnicity								
Non-Hispanic White	14 666	87.61	1148	53.24	12 389	86.02	1200	56.60
Non-Hispanic Black	1761	8.32	21	3.48	1557	10.07	19	3.11
Hispanic	237	2.43	192	27.43	156	2.39	134	24.91
Other	192	1.63	109	15.86	140	1.53	74	15.38
Marital status								
Married	12 490	77.39	1066	78.02	5853	66.37	450	64.22
Single	1172	10.32	93	10.59	1081	7.82	61	7.28
Divorced/separated	1350	8.00	65	5.48	888	11.04	72	9.31
Widowed	1774	2.88	238	4.57	6386	14.44	840	18.78
Urban residence	10 819	62.28	1214	83.38	9897	65.66	1198	84.76
Education, y								
<9	6427	16.10	767	32.48	5182	14.74	851	35.20
9–11	2916	13.02	150	9.89	2614	14.73	129	10.33
12	4315	34.68	283	24.30	4065	41.55	304	30.34
13–15	1598	15.81	115	12.01	1388	15.28	77	11.46
≥16	1600	20.39	155	21.31	993	13.70	66	12.67
Occupation								
Professional	1753	26.37	116	22.90	529	13.96	35	10.23
Nonprofessional	5125	53.46	273	50.40	2030	39.45	118	35.26
Unemployed/outside labor force	9978	20.17	1081	26.69	11 683	46.58	1274	54.51
Family income, \$								
<5000	2889	6.84	259	9.54	4179	12.28	427	13.89
5000–9999	4485	13.22	480	18.88	3685	16.45	344	19.43
10 000–14 999	3049	16.40	228	17.66	2053	16.53	180	16.16
15 000–19 999	1654	14.45	127	13.24	1109	12.86	99	11.96
20 000–24 999	1373	15.10	105	11.70	800	12.90	113	11.21
25 000–49 999	1860	22.66	134	16.77	1098	19.13	119	16.74
≥50 000	375	4.32	33	4.22	247	3.62	27	3.64
Unknown	1171	7.00	104	7.99	1071	6.23	118	6.96
Current smoker, ^a %		30.94		26.55		27.26		12.61
Overweight, ^a %		29.65		21.31		26.16		21.88
Hypertensive (high blood pressure), ^a %		20.15		12.50		16.85		12.42
Activity limitation, ^a %		14.63		9.67		15.36		11.17

^aSmoking, overweight, hypertension, and activity limitation rates are estimated for the population aged 18 to 64 years and are derived from the 1993–1994 National Health Interview Survey data files.

tion/employment status, and family income. Native-born or immigrant status, the primary covariate of interest in this study, was determined on the basis of the place-of-birth data as reported by each household member in the CPS. Birthplace was recorded as the state of birth if the respondent was born within the United States or otherwise as Puerto Rico, Virgin Islands, Guam, Canada, Cuba, Mexico, or the remainder of the world.¹² For the

purpose of this study, we defined nativity status as a dichotomous variable by categorizing the birthplace variable into "US born" for those born in the 50 states and the District of Columbia and "foreign born" for those born elsewhere. All of the other covariates were measured as categorical variables, as shown in Table 2.

The mortality effects of nativity and other sociodemographic covariates were esti-

mated with Cox proportional hazards regression models.^{20,21} We estimated the parameters in the Cox model by the maximum likelihood method, using the PHREG procedure of SAS.²² The results are presented in terms of estimated hazard ratios or relative risks and their 95% confidence intervals. We checked the hazards proportionality assumption of the Cox model by including the log survival function against time in the models. Interactions

TABLE 2—Multivariate Hazards Regression Estimates of the Effects of Nativity/Immigrant Status and Other Sociodemographic Covariates on US All-Cause Mortality Among Men and Women 25 Years or Older: National Longitudinal Mortality Study, 1979–1989

Covariate	Both Sexes (n=301 183)		Men (n=141 323)		Women (n=159 860)	
	RR	95% CI	RR	95% CI	RR	95% CI
Age group, y						
25–34	1.00	(Reference)	1.00	(Reference)	1.00	(Reference)
35–44	2.47***	2.27, 2.69	2.37***	2.13, 2.64	2.66***	2.31, 3.06
45–54	6.18***	5.73, 6.67	5.99***	5.45, 6.58	6.54***	5.77, 7.42
55–64	12.82***	11.94, 13.77	12.63***	11.55, 13.81	13.16***	11.67, 14.84
65–74	21.73***	20.21, 23.37	20.24***	18.45, 22.19	23.71***	21.01, 26.76
75–84	40.92***	37.96, 44.12	35.79***	32.50, 39.42	47.44***	41.93, 53.67
≥85	75.46***	69.47, 81.96	57.07***	50.96, 63.91	96.32***	84.54, 109.74
Nativity/immigrant status						
US born	1.00	(Reference)	1.00	(Reference)	1.00	(Reference)
Foreign born	0.84***	0.81, 0.88	0.82***	0.78, 0.87	0.87***	0.82, 0.92
Sex						
Men	2.08***	2.03, 2.13				
Women	1.00	(Reference)				
Race/ethnicity						
Non-Hispanic White	1.00	(Reference)	1.00	(Reference)	1.00	(Reference)
Non-Hispanic Black	1.05***	1.01, 1.09	1.01	0.96, 1.07	1.11***	1.05, 1.17
Hispanic	0.68***	0.63, 0.73	0.68***	0.62, 0.76	0.67***	0.60, 0.76
Other ^a	0.79***	0.73, 0.87	0.76***	0.68, 0.85	0.84**	0.73, 0.96
Marital status						
Married	1.00	(Reference)	1.00	(Reference)	1.00	(Reference)
Single	1.29***	1.23, 1.35	1.22***	1.15, 1.30	1.34***	1.25, 1.43
Divorced/separated	1.37***	1.31, 1.43	1.33***	1.26, 1.41	1.42***	1.33, 1.51
Widowed	1.24***	1.20, 1.28	1.14***	1.09, 1.20	1.28***	1.23, 1.33
Place of residence						
Rural	1.00	(Reference)	1.00	(Reference)	1.00	(Reference)
Urban	1.11***	1.09, 1.14	1.13***	1.10, 1.17	1.09***	1.05, 1.13
Education, y						
0–8	1.32***	1.26, 1.38	1.33***	1.25, 1.41	1.28***	1.19, 1.37
9–11	1.30***	1.23, 1.36	1.34***	1.26, 1.43	1.22***	1.13, 1.31
12	1.17***	1.12, 1.22	1.22***	1.15, 1.29	1.11***	1.03, 1.19
13–15	1.13***	1.07, 1.19	1.19***	1.11, 1.27	1.04	0.96, 1.13
≥16	1.00	(Reference)	1.00	(Reference)	1.00	(Reference)
Occupation						
Professional	1.00	(Reference)	1.00	(Reference)	1.00	(Reference)
Nonprofessional	1.08***	1.03, 1.14	1.11***	1.04, 1.17	1.00	0.91, 1.10
Unemployed/outside labor force	1.78***	1.70, 1.87	1.85***	1.74, 1.97	1.67***	1.53, 1.83
Family income, \$						
<5000	1.43***	1.32, 1.55	1.62***	1.45, 1.81	1.24***	1.09, 1.41
5000–9999	1.39***	1.28, 1.51	1.50***	1.35, 1.67	1.25***	1.10, 1.42
10 000–14 999	1.29***	1.19, 1.40	1.36***	1.22, 1.51	1.19***	1.05, 1.35
15 000–19 999	1.19***	1.10, 1.30	1.21***	1.08, 1.35	1.14*	1.00, 1.30
20 000–24 999	1.08*	0.99, 1.18	1.10*	0.99, 1.23	1.03	0.90, 1.18
25 000–49 999	1.06	0.97, 1.15	1.07	0.96, 1.19	1.03	0.90, 1.17
≥50 000	1.00	(Reference)	1.00	(Reference)	1.00	(Reference)
Unknown	1.18***	1.08, 1.29	1.21***	1.07, 1.35	1.10	0.97, 1.26
Model χ^2	60 743.81***		31 472.13***		28 671.68***	
df	28		27		27	

Note. RR=estimated relative risk (hazard ratio); CI=confidence interval.

^aThis category includes Asians and Pacific Islanders and American Indians.

* $P < .10$; ** $P < .05$; *** $P < .01$.

TABLE 3—Age- and Covariate-Adjusted Mortality Risks for Immigrants Relative to US-Born Men and Women, by Age, Sex, and Race: National Longitudinal Mortality Study, 1979–1989

Sex, Age Group (Years), and Race	Age Adjusted ^a		Covariate Adjusted ^b	
	RR	95% CI	RR	95% CI
Both sexes				
Total (≥25 y)	0.83***	0.80, 0.86	0.84***	0.81, 0.88
25–44 y	0.71***	0.60, 0.85	0.67***	0.55, 0.81
45–64 y	0.62***	0.57, 0.69	0.69***	0.62, 0.76
65–84 y	0.87***	0.83, 0.91	0.87***	0.83, 0.92
≥85 y	0.87***	0.79, 0.96	0.84***	0.76, 0.94
Men				
Total (≥25 y)	0.79***	0.75, 0.83	0.82***	0.78, 0.87
25–44 y	0.75***	0.60, 0.93	0.69***	0.54, 0.89
45–64 y	0.63***	0.56, 0.72	0.70***	0.61, 0.80
65–84 y	0.81***	0.76, 0.87	0.83***	0.78, 0.90
≥85 y	0.83**	0.71, 0.97	0.83**	0.70, 0.97
Non-Hispanic White (≥25 y)	0.86***	0.81, 0.91	0.83***	0.78, 0.89
Non-Hispanic Black (≥25 y)	0.47***	0.30, 0.72	0.53***	0.34, 0.82
Hispanic (≥25 y)	0.81**	0.67, 0.98	0.78**	0.64, 0.95
Women				
Total (≥25 y)	0.86***	0.81, 0.90	0.87***	0.82, 0.92
25–44 y	0.69***	0.52, 0.91	0.63***	0.45, 0.87
45–64 y	0.63***	0.55, 0.74	0.67***	0.57, 0.79
65–84 y	0.91***	0.85, 0.97	0.92**	0.85, 0.98
≥85 y	0.87**	0.77, 0.99	0.84**	0.74, 0.96
Non-Hispanic White (≥25 y)	0.93***	0.88, 0.99	0.89***	0.84, 0.95
Non-Hispanic Black (≥25 y)	0.52***	0.33, 0.81	0.55***	0.34, 0.86
Hispanic (≥25 y)	0.70***	0.51, 0.97	0.63***	0.45, 0.88

Note. RR = estimated relative risk (hazard ratio); CI = confidence interval.

^aAdjusted for age only.

^bAdjusted for age, race, sex, marital status, place of residence, education, occupation, and family income.

** $P < .05$; *** $P < .01$.

of nativity with age, race, and socioeconomic factors were examined, which led to the estimation of age- and race-specific all-cause mortality models in Table 3. No significant interactions between nativity and socioeconomic factors were found.

Results

Differentials in All-Cause Mortality

Because immigrant and US-born populations differed significantly with respect to age, ethnic composition, marital status, urban residence, educational attainment, occupation, and family income, discussion is focused on the multivariate models in Table 2, although the gross (age-adjusted) effects of nativity status on overall mortality are also shown in Table 3. Immigrant men 25 years and older had an 18% lower risk of overall mortality than their US-born counterparts. Immigrant women had a 13% lower risk of overall mortality than US-born women. For both sexes, immigrants had a 16% lower risk of overall mortality than the US-born population. Education and family income were

both inversely and independently related to all-cause male and female mortality. Moreover, there was a consistent gradient in mortality for both education and family income. Men with less than 9 years of education had a 33% higher mortality risk than their counterparts with a college degree. Men with annual family incomes of less than \$5000 had 62% higher mortality than those with incomes of \$50000 or more. The education and income gradients in mortality were somewhat steeper for men than for women. Unemployed men and women and those outside the labor force had almost twice the mortality risk of those employed in professional and managerial occupations.

Other notable results reported in Table 2 include significantly increased mortality risks associated with marital disruption, being unmarried, urban residence, and being a Black woman and significantly reduced risks for Hispanic men and women. The effect of marital status on mortality tended to be stronger for women than for men, and the racial disparity (Black/White ratio) in survival was greater among women than among men.

The native-immigrant differentials in all-cause mortality varied substantially by age even

after other sociodemographic covariates were controlled for (Table 3). The differential among men became significantly and consistently narrower with the older age cohorts. For example, immigrant men aged 25 to 44 years had a 31% lower mortality risk than their US-born counterparts, whereas immigrant men 85 years and older had only a 17% lower risk of mortality than their US-born counterparts. Among women, the largest nativity differential was for the age group 25 to 44 years (37% lower for immigrants), whereas the smallest differential was for those aged 65 to 84 years. Regarding ethnicity-nativity differentials, the largest differential was for Black immigrant men and women, whose mortality risks were respectively 47% and 45% lower than those of their US-born Black counterparts. Hispanic immigrant men and women, respectively, had 22% and 37% lower mortality risks than their US-born Hispanic counterparts. White immigrant men and women, respectively, had 17% and 11% lower mortality risks than their US-born counterparts.

Differentials in Mortality From Chronic and Infectious Diseases, Suicide, Homicide, and Unintentional Injuries

Immigrants generally showed lower cause-specific mortality than did US-born men and women (Table 4). Even after socioeconomic characteristics were controlled for, immigrants had a significantly lower risk of death from cardiovascular diseases in general and from heart disease (15% lower for immigrant men and 8% lower for immigrant women) and atherosclerosis (53% lower among immigrant women) in particular. The overall adjusted cancer mortality was 15% lower among immigrant men and 10% lower among immigrant women than among their US-born counterparts. Although there were no significant nativity differentials in colorectal, pancreas, and esophagus cancer mortality, the risk of stomach cancer mortality was 81% and 110% greater for immigrant men and women, respectively. Immigrant men and women, respectively, had 29% and 34% lower risks of mortality from lung cancer than their US-born counterparts. Immigrant men were 33% less likely to die from prostate cancer than were US-born men. However, immigrants, regardless of sex, had an 82% higher risk of brain cancer mortality than US-born individuals (hazard ratio=1.82; 95% confidence interval=1.11, 3.00).

Immigrant men and women, respectively, had 24% and 52% lower COPD mortality risks than their US-born counterparts. The nativity effect was especially strong for cirrhosis mortality, where immigrant men had a 49% lower risk than US-born men. As for infectious disease mortality, immigrant women had a 50%

TABLE 4—Age- and Covariate-Adjusted Mortality Risks (Derived From Cox Hazards Regression Models) for Immigrants Relative to US-Born Men and Women Aged 25 Years or Older, by Major Causes of Death: National Longitudinal Mortality Study, 1979–1989

Cause of Death (ICD-9 Codes)	Men (n=141 323)				Women (n=159 860)			
	Age Adjusted ^a		Covariate Adjusted ^b		Age Adjusted ^a		Covariate adjusted ^b	
	RR	95%	RR	95% CI	RR	95% CI	RR	95% CI
Major cardiovascular diseases (390–448)	0.80***	0.74, 0.86	0.84***	0.78, 0.91	0.81***	0.82, 0.95	0.89***	0.82, 0.96
Heart disease (390–398, 402, 404–429)	0.80***	0.74, 0.87	0.85***	0.78, 0.93	0.92**	0.84, 0.99	0.92*	0.84, 1.00
Stroke (430–438)	0.86	0.70, 1.06	0.92	0.74, 1.14	0.87	0.73, 1.03	0.88	0.74, 1.06
Atherosclerosis (440)	0.84	0.52, 1.36	0.93	0.56, 1.52	0.50***	0.30, 0.83	0.47***	0.28, 0.81
Cancer (140–208)	0.79***	0.71, 0.89	0.85***	0.75, 0.95	0.83***	0.74, 0.94	0.90*	0.79, 1.02
Digestive system (150–159)	0.97	0.79, 1.20	1.01	0.81, 1.25	1.06	0.86, 1.30	1.10	0.89, 1.37
Stomach (151)	1.78***	1.18, 2.70	1.81**	1.15, 2.85	2.29***	1.38, 3.79	2.10**	1.19, 3.69
Lung (162)	0.65***	0.52, 0.80	0.71***	0.57, 0.89	0.56***	0.40, 0.79	0.66**	0.47, 0.93
Prostate (185)	0.67**	0.48, 0.94	0.67**	0.47, 0.95	...	...	...	...
Breast (174)	...	...	...	...	0.70**	0.52, 0.95	0.82	0.60, 1.12
Ovarian (183.0)	...	...	...	...	0.63	0.36, 1.10	0.63	0.35, 1.12
Diabetes (250)	0.82	0.53, 1.28	0.73	0.45, 1.16	0.96	0.68, 1.38	0.79	0.54, 1.16
Pneumonia and influenza (480–487)	0.81	0.61, 1.08	0.76*	0.56, 1.03	1.01	0.76, 1.34	0.92	0.68, 1.25
COPD (490–496)	0.73**	0.56, 0.95	0.76**	0.58, 1.00	0.48***	0.31, 0.74	0.48***	0.31, 0.76
Chronic liver disease and cirrhosis (571)	0.70	0.42, 1.16	0.51**	0.30, 0.89	0.74	0.39, 1.40	0.66	0.33, 1.34
Infectious diseases (001–139)	0.90	0.57, 1.41	0.82	0.50, 1.33	1.31	0.87, 1.97	1.50*	0.97, 2.30
Unintentional injuries (E800–E949)	0.71**	0.52, 0.97	0.72*	0.51, 1.02	0.82	0.56, 1.21	0.89	0.59, 1.35
Motor vehicle crashes (E810–E825)	0.86	0.52, 1.44	0.93	0.53, 1.63	1.26	0.69, 2.30	1.22	0.62, 2.38
All other injuries (E800–E807, E826–E949)	0.63**	0.42, 0.94	0.64**	0.42, 0.98	0.65*	0.39, 1.08	0.75	0.44, 1.27
Suicide (E950–E959)	0.50**	0.30, 0.86	0.48**	0.27, 0.86	1.17	0.59, 2.34	1.39	0.66, 2.91
Homicide (E960–E978)	1.66*	0.99, 2.79	0.88	0.47, 1.64	1.06	0.42, 2.64	0.93	0.33, 2.61
Firearm injuries (E922, E955.0–E955.4, E965.0–E965.4, E970, E985.0–E985.4)	0.58**	0.35, 0.96	0.50**	0.29, 0.86	1.12	0.49, 2.59	1.07	0.42, 2.77

Note. RR = estimated relative risk (hazard ratio); CI = confidence interval; COPD = chronic obstructive pulmonary disease; ICD-9 = International Classification of Diseases, Ninth Revision.

^aAdjusted for age only.

^bAdjusted for age, race, marital status, place of residence, education, occupation, and family income.

P* < .10; ** *P* < .05; * *P* < .01.

higher risk than US-born women, although the relative risk was only marginally significant. For mortality associated with non-motor vehicle unintentional injuries, suicide, and firearms, respectively, immigrant men had 36%, 52%, and 50% lower risks than US-born men. Although immigrant men had a 66% higher risk of death by homicide than US-born men, the excess risk was entirely accounted for by nativity differences in socioeconomic characteristics, including urban/rural residence.

Besides nativity differences, socioeconomic and ethnic variations are also worth mentioning (Table 5), because they highlight, using individual-level data, the adjusted ethnic and socioeconomic inequalities in US male and female mortality—which, although often shown for all-cause and cardiovascular mortality, remain largely undocumented for mortality from cancer, other chronic diseases, and injuries. Consistent with past research, education, occupational status, and family income were all inversely related to mortality from heart disease and stroke. The mortality effects of these socioeconomic measures, however, were much stronger for COPD, lung cancer, pneumonia and influenza, cirrhosis, injuries, and homicide. Although socioeconomic char-

acteristics accounted for Black–White differentials in mortality from such causes as heart disease, stroke, cancer, and pneumonia and influenza, Hispanics, compared with non-Hispanic Whites, maintained a substantially lower risk of mortality from several causes of death, including heart disease; stroke; lung, digestive (colorectal), and breast cancer; and COPD. However, after socioeconomic differences were controlled for, Hispanic men had a 133% higher risk of cirrhosis mortality and a 229% higher risk of death by homicide than their non-Hispanic White counterparts. Furthermore, compared with non-Hispanic White men of equivalent socioeconomic background, Black men had a 57% lower risk of COPD mortality and a 63% lower risk of suicide but a 488% higher risk of death by homicide, a 147% higher risk of esophagus cancer mortality, a 116% higher risk of prostate cancer mortality, a 119% higher risk of nephritis mortality, and a 51% higher risk of infectious disease mortality. Black women, compared with their non-Hispanic White counterparts, had a 79% lower risk of suicide and a 46% lower risk of COPD mortality but higher risks of mortality from esophagus cancer (178%), stomach cancer (162%), cervical cancer (82%),

nephritis (92%), cirrhosis (99%), stroke (26%), diabetes (65%), homicide (304%), and firearm injuries (112%).

Discussion

This study clearly shows that levels and patterns of mortality for immigrants and for those born in the United States vary considerably. Immigrants show a significantly lower risk of mortality not only from all causes combined but also from several major causes of death, such as cardiovascular diseases, lung cancer, prostate cancer, COPD, liver cirrhosis, pneumonia and influenza, unintentional injuries, and suicide (the last 3 for immigrant men only). Because of the small number of deaths among the immigrants, the observed and covariate-adjusted mortality differentials between those born in the United States and the foreign born, although quite substantial, were not statistically significant for several major causes of death. This pattern can be noted for breast and ovarian cancer (18% and 37% lower mortality risks for immigrant women), diabetes (about 20%–30% lower risk among immigrants), cirrhosis (34% lower risk among

TABLE 5—Adjusted Racial/Ethnic, Educational, and Income Differentials (Estimated Hazard Ratios or Relative Risks) in Cause-Specific Mortality^a (Derived From Multivariate Cox Hazards Regression Models) Among US Men and Women Aged 25 Years or Older: National Longitudinal Mortality Study, 1979–1989

Cause of Death (ICD-9 Codes)	Race/Ethnicity				Family Income (1980 Dollars)									
	Non-Hispanic Black	Hispanic	Non-Hispanic White		<5000	5000–9999		10000–14999		15000–19999	20000–25000–49999		≥50000	
			Hispanic	White		9–11	12	13–15	≥16					
	Men (n = 141 323)													
Major cardiovascular diseases (390–448)	0.91**	0.55***	1.00	1.36***	1.32***	1.24***	1.23***	1.00	1.63***	1.49***	1.35***	1.18**	1.12	1.00
Heart disease (390–398, 402, 404–429)	0.87***	0.55***	1.00	1.38***	1.32***	1.28***	1.23***	1.00	1.68***	1.51***	1.35***	1.17*	1.13	1.00
Stroke (430–438)	1.17	0.47***	1.00	1.31***	1.40**	1.18	1.34**	1.00	1.46	1.45	1.38	1.18	0.94	0.77
Cancer (140–208)	1.08	0.57***	1.00	1.38***	1.32***	1.15**	1.08	1.00	1.56***	1.43***	1.36***	1.32***	1.13	1.00
Digestive system (150–159)	1.12	0.51***	1.00	1.29**	1.19	1.22*	1.00	1.00	1.65**	1.42*	1.39	1.21	1.04	1.00
Stomach (151)	1.49	0.59	1.00	1.93*	1.51	1.41	2.03*	1.00	3.58**	2.53	2.38	2.39	1.13	1.00
Lung (162)	0.90	0.43***	1.00	1.84***	1.74***	1.37***	1.21	1.00	1.82***	1.70***	1.62***	1.52**	1.13	1.00
Prostate (185)	2.16***	1.44	1.00	0.79	0.76	0.80	0.90	1.00	0.93	0.99	0.93	1.09	1.11	0.76
Diabetes (250)	1.18	1.25	1.00	0.82	0.99	0.89	1.02	1.00	1.78	2.24*	1.79	1.48	1.61	1.00
Pneumonia and influenza (480–487)	0.92	1.12	1.00	1.40*	1.67**	1.23	1.24	1.00	2.69**	2.20*	1.88	1.60	1.44	1.00
COPD (490–496)	0.43***	0.36***	1.00	1.63***	1.67***	1.24	1.21	1.00	1.92**	1.97**	1.38	1.78	1.36	1.00
Chronic liver disease and cirrhosis (571)	1.21	2.33***	1.00	1.25	1.66**	1.52*	1.68**	1.00	1.59	1.53	1.72	0.78	0.88	1.00
Infectious diseases (001–139)	1.51**	1.05	1.00	0.97	1.25	0.94	1.16	1.00	1.19	1.33	1.33	1.12	0.81	1.00
Unintentional injuries (E800–E949)	1.15	0.91	1.00	1.41**	1.42**	1.29*	0.95	1.00	1.41	1.31	1.20	1.08	0.73	1.00
Motor vehicle crashes (E810–E825)	0.82	0.98	1.00	1.85**	2.11***	1.83***	1.12	1.00	1.02	1.32	0.97	1.25	0.63	1.00
All other injuries (E800–E807, E826–949)	1.31*	0.84	1.00	1.18	1.11	1.01	0.95	1.00	1.60	1.35	1.36	0.94	0.80	1.00
Suicide (E950–E959)	0.37***	0.79	1.00	1.62**	1.26	1.36	1.46	1.00	1.56	1.53	1.06	0.68	1.18	1.00
Homicide (E960–E978)	5.88***	3.29***	1.00	1.46	1.38	1.19	0.73	1.00	3.84*	2.38	1.74	1.27	1.04	1.00
Firearm injuries (E922, E955.0–E955.4, E965.0–E965.4, E970, E985.0–E985.4)	1.26	1.35	1.00	2.33***	1.96***	1.63**	1.66**	1.00	2.29**	2.40**	1.77	1.17	1.81	1.00
	Women (n = 159 860)													
Major cardiovascular diseases (390–448)	1.08*	0.68***	1.00	1.39***	1.33***	1.16***	1.09	1.00	1.35***	1.37***	1.25**	1.23*	1.14	1.00
Heart disease (390–398, 402, 404–429)	1.04	0.68***	1.00	1.47***	1.43***	1.22***	1.18**	1.00	1.81***	1.65***	1.45***	1.40**	1.26*	1.00
Stroke (430–438)	1.26**	0.53**	1.00	1.26**	1.16	1.07	1.00	1.00	0.71*	0.78	0.77	0.83	0.75	0.87
Cancer (140–208)	1.05	0.51***	1.00	1.07	1.11	1.04	0.96	1.00	1.06	1.11	1.17	1.05	1.02	1.00
Digestive system (150–159)	1.16	0.69*	1.00	1.06	1.13	0.99	0.88	1.00	1.24	1.41	1.22	1.35	1.10	1.00
Stomach (151)	2.62***	0.82	1.00	1.02	1.08	0.50	0.40	1.00	0.55	1.30	1.09	1.45	0.64	1.00
Lung (162)	0.92	0.22***	1.00	1.49**	1.74***	1.70***	1.35	1.00	0.80	0.90	0.97	0.78	0.89	1.00
Breast (174)	0.86	0.53**	1.00	0.69**	0.90	0.84	0.85	1.00	0.95	0.97	1.31	1.10	1.22	1.00
Ovarian (183.0)	0.81	0.55	1.00	1.17	0.88	0.76	0.88	1.00	1.77	2.24	2.05	1.97	1.33	1.00
Diabetes (250)	1.65***	1.28	1.00	4.33***	2.86***	1.99**	2.63**	1.00	1.07	1.04	1.10	0.87	0.64	1.00
Pneumonia and influenza (480–487)	1.09	1.40	1.00	1.16	0.88	1.00	0.97	1.00	0.81	0.85	0.63	0.80	0.60	1.00
COPD (490–496)	0.54***	0.53	1.00	0.86	0.96	0.87	0.69	1.00	1.87	1.85	1.82	1.36	1.20	1.00
Chronic liver disease and cirrhosis (571)	1.99***	1.21	1.00	0.92	0.79	0.95	0.86	1.00	2.95	3.02	1.75	2.50	2.64	1.00
Infectious diseases (001–139)	2.19***	0.39	1.00	1.92*	1.65	1.90*	1.13	1.00	2.03	1.97	1.89	2.35	1.56	1.00
Unintentional injuries (E800–E949)	0.80	0.44*	1.00	1.44	1.56*	1.14	1.89**	1.00	2.77**	2.22	2.51*	2.02	2.14	1.00
Motor vehicle crashes (E810–E825)	0.94	1.01	1.00	1.09	0.74	0.86	1.35	1.00	1.70	2.30	2.62	1.37	1.82	1.00
All other injuries (E800–E807, E826–949)	0.74	...	1.00	1.98*	2.52**	1.53	2.66***	1.00	3.15	2.23	2.45	2.63	2.46	1.00
Suicide (E950–E959)	0.21***	0.75	1.00	1.16	1.42	1.20	1.57	1.00	0.30**	0.43*	0.49	0.69	0.61	1.00
Homicide (E960–E978)	4.04***	1.72	1.00	0.73	0.89	1.17	1.01	1.00	1.77	0.89	0.40	0.45	0.16**	1.00
Firearm injuries (E922, E955.0–E955.4, E965.0–E965.4, E970, E985.0–E985.4)	2.12**	0.86	1.00	1.02	1.31	1.30	0.84	1.00	1.14	0.72	0.33*	0.67	0.49	1.00

Note. ICD-9 = International Classification of Diseases, Ninth Revision; COPD = chronic obstructive pulmonary disease.

^aAdjusted for age, race, nativity/immigrant status, marital status, place of residence, education, occupation, and family income.

* $P < .10$; ** $P < .05$; *** $P < .01$.

immigrant women), and suicide (39% higher risk for immigrant women).

The findings of this study are remarkably consistent with those reported by the 1986 Kestenbaum study, which was based on vital statistics data (without any statistical controls for socioeconomic differences) and which showed markedly lower all-cause and cause-specific mortality rates among immigrants.⁵ The immigrant population in the 1986 study had 18% lower overall mortality than the US-born population, compared with 17% in this study. Nativity differences in relative risks of death from cancer, heart disease, and other cardiovascular diseases were also similar in the 2 studies. The 1960 Matched Records Study also provided somewhat similar results in that White immigrant men and women aged 35 to 64 years experienced 13% and 2% lower mortality than their respective US-born counterparts.⁶ In a recent study covering 1988 through 1992, Caribbean-born Blacks in New York City were found to have substantially lower all-cause and cardiovascular mortality rates than Blacks born in the southern and northeastern United States²³—a finding consistent with the results of this study.

The evidence presented in this study suggests that the socioeconomic measures—education, occupation, income, marital status, and place of residence—contribute little to the observed nativity differentials in overall mortality and in mortality from several major causes of death. The reduced mortality risk for immigrants may partly reflect positive immigrant selectivity (i.e., those migrating to the United States are a much healthier group than those who remain in their countries of origin), but it may also be due to nativity differences in a host of behavioral, lifestyle, cultural, and psychosocial characteristics (e.g., smoking, alcohol and drug use, physical activity, dietary habits, nutrition, reproductive behavior, social and familial support, and social integration) known to influence health status, morbidity, and mortality.^{8,24–33} Several studies, including the National Health Interview Survey, data from which are presented in Table 1, have reported substantial nativity differences in smoking, alcohol use, obesity, dietary patterns, and social and familial support.^{8,11,26,28–31} Compared with the US-born population, immigrants tend to have more of the favorable behavioral and social support characteristics that are generally regarded as more conducive to positive health outcomes.

Several previous studies in North America have shown that immigrants have an increased risk of violent death in general and of homicide victimization in particular.^{25,34,35} Such findings depend to some degree on sex, ethnicity, and the comparative levels of violence in the countries of origin and destination.^{25,35} In

a national study of immigrant homicides covering the period 1950 to 1964, no significant differences were found between US- and foreign-born Whites.³⁴ However, the nativity differential varied substantially by geographic region, so that immigrants living in the western and south-central parts of the United States had twice the homicide rates of those born in those regions, but in New England and the Southeast, immigrants had substantially lower rates than their native-born counterparts. In a recent study of those aged 15 to 34 years in California, White, Hispanic, and Asian immigrants had significantly higher homicide rates from 1970 to 1992 than their US-born counterparts.³⁵ However, both of those studies failed to take into account nativity differences in socioeconomic and demographic characteristics. In the present analysis, after adjustment for ethnic and socioeconomic factors, no increased risk of violent death among immigrants was found. On the contrary, immigrant men had a substantially lower risk of mortality from suicide, firearms, and unintentional injuries.

Finally, this study has certain limitations. As shown here and in several other studies, the size of the nativity effect on mortality and other health outcomes can vary appreciably for the members of different racial/ethnic groups^{4,5,8,10}; in the present study, the nativity difference was especially pronounced for Blacks and Hispanics. However, because of the small numbers of deaths, cause-specific mortality differentials could not be shown for US- and foreign-born Blacks, Hispanics, and Asians. Other disadvantages of the study include the time-fixed nature of the covariates over the 9-year follow-up period, the omission of the institutionalized population (which perhaps underestimates the reported immigrant–US-born mortality differentials), and the lack of data on behavioral, psychosocial, health status, and health care factors known to influence mortality. Native-born or immigrant status was derived from the birthplace data collected in 3 different CPS cohorts. However, on the basis of these 3 CPS cohorts, immigrants made up 6.3% of the NLMS population, which is similar to the 1980 census figure of 6.2%.^{1,36} The exclusion of 2 CPS cohorts (see “Methods” section) probably did not produce any systematic bias, as the 3 CPS cohorts on which the present analysis was based were nationally representative samples. The distribution of people with known birthplaces in the 2 excluded CPS cohorts (also representative samples of the US population) was assumed to be similar to the distribution in the 3 CPS cohorts for which data were available. However, if there was a tendency on the part of some immigrants to randomly report themselves in the CPS as US born, the mortality differentials presented here may be understated. The differentials

would be overestimated if “sicker” immigrants more often misrepresented their nativity status because of real or perceived risks in being identified as immigrants with poor mental or physical health.

Although the terms *immigrant* and *foreign born* are used interchangeably in this study, data on the immigrant population, as recorded in the CPS, the census, and vital statistics, do not distinguish between naturalized immigrants, permanent residents, nonimmigrants (e.g., temporary workers, students, and visitors), and illegal immigrants.^{1,9} Since socioeconomic attainment patterns and health service access and use can vary greatly by naturalization status, legal status, or both,^{7,36} health status and mortality are also expected to differ significantly within the immigrant population by these characteristics. Furthermore, because of lack of data, length of residence in the host country (i.e., duration of residence since the time of immigration), an important variable in migrant health studies, was not considered in this study. Health and mortality patterns vary substantially not only with respect to generational status (first vs second generation) but also by length of residence among the first-generation immigrants in the destination country. Studies show that as the length of residence in the destination country increases, health status, mortality patterns, and health behaviors of immigrants tend to converge toward those of the native born.^{7,28–30,37} This occurs largely as a result of the acculturation and social assimilation process by which immigrants adopt the values, attitudes, beliefs, practices, and lifestyle characteristics of the native born or the dominant group in the host society, although the degree of assimilation could vary according to country of birth or ethnic origin.^{11,28–30,36–38}

This study underscores the need to consider such factors as health-related behaviors, social support, acculturation, naturalization and legal status, length of residence, ethnic origin, and country of birth to understand more fully the health and mortality differentials between immigrant and US-born populations. Although the aforementioned factors are multifactorial in nature, a sociocultural perspective that examines, in addition to socioeconomic factors, the fundamental role of social support, social integration and cohesion, ethnocultural identity, and assimilation may serve as the most useful strategy for analyzing nativity differentials in health-related behaviors, health status, and mortality.^{8,33,36,39} □

Contributors

G. K. Singh planned and designed the study, analyzed the data, and wrote the paper. M. Siahpush contributed to the analysis and to the writing of the paper.

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