

# WHY ARE DEATH RATES RISING IN THE WHITE POPULATION OF KANSAS?

## *The Role of Stress-Related Conditions*



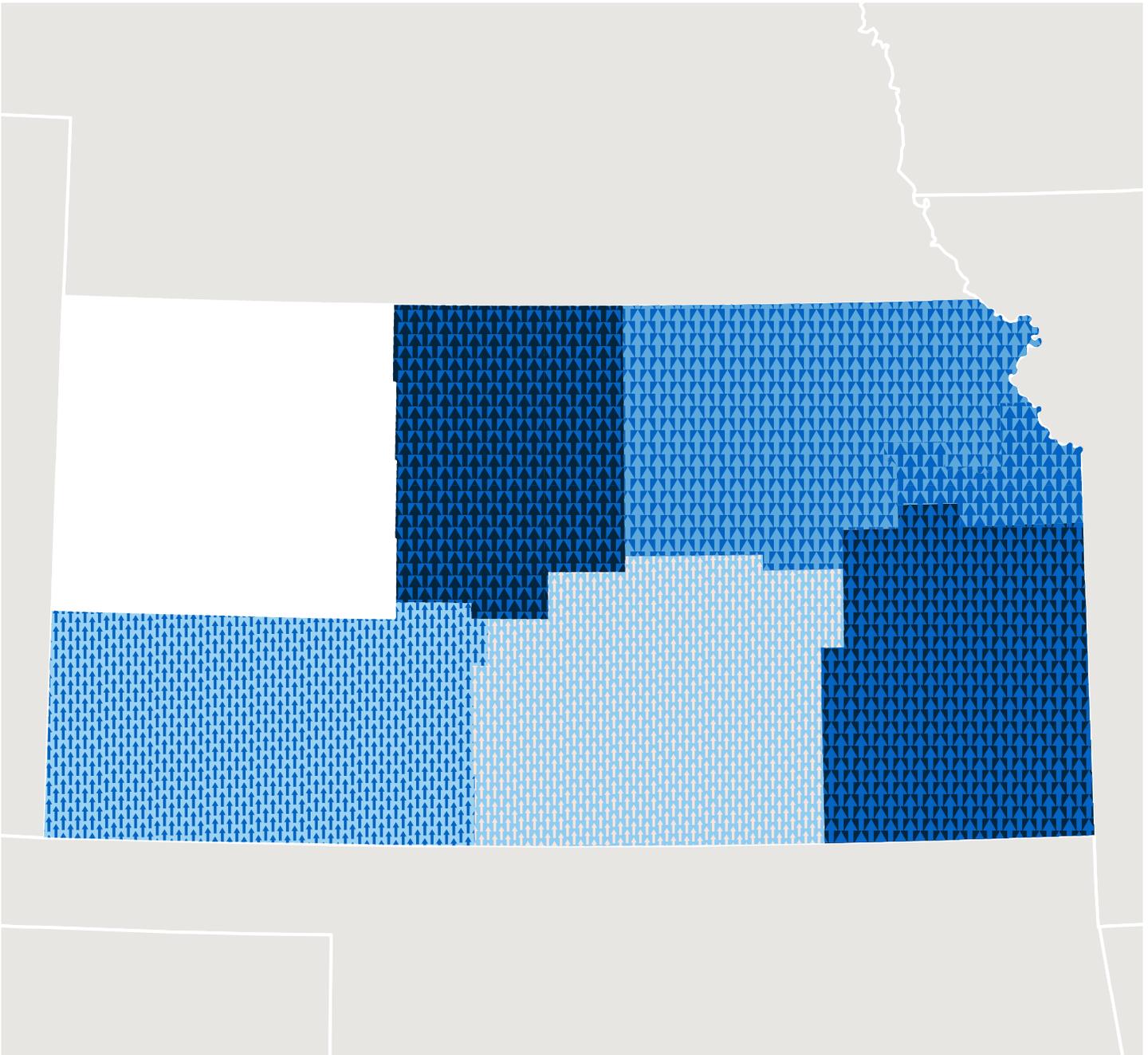
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## INTRODUCTION

We undertook a detailed examination of state vital statistics from 1995 to 2014 and compared results across the state's 105 counties. The study was conducted for the Sunflower Foundation: *Health Care for Kansans*, in coordination with the Kansas Health Institute, and through a partnership between the Center on Society and Health at Virginia Commonwealth University and the Graduate School of Public Health at the University of Pittsburgh. Our topline findings are presented in an accompanying issue brief.

This Technical Supplement provides documentation of the methods used in the study and greater detail about our results, along with data tables and figures, which could not be included in the issue brief.

## METHODS

Deaths in Kansas were examined in aggregate (all-cause mortality) and for specific causes from 1995 to 2014. Death data for Kansas were obtained from the National Center for Health Statistics (NCHS) after approval by the National Association for Public Health Statistics and Information Systems. Individual-level death data, including county of residence, were abstracted from the Mortality Multiple Cause Micro-data Files.<sup>1</sup> Rates or counts with fewer than 10 deaths were suppressed per NCHS regulations. Population counts for calculating mortality rates were obtained from the National Cancer Institute's Surveillance, Epidemiology, and End Results Program.<sup>2</sup> The study was exempted by the institutional review board of Virginia Commonwealth University.

Death counts were aggregated into 5-year periods (1995-1999, 2000-2004, 2005-2009, and 2010-2014) to increase stability and reduce suppression. Mortality rates were stratified by age, sex, race, and ethnicity. Sample size considerations required the population to be classified into five, broad racial-ethnic groups: Hispanics/Latinos and non-Hispanic (NH) whites, NH blacks, NH Asians and Pacific Islanders, and NH American Indians and Alaskan Natives. For simplicity, this report uses "whites" as a shorthand for NH whites.

Causes of death (based on underlying causes) were coded to the *International Classification of Diseases (ICD)* revision in effect at the time of death. Causes of death were grouped into 116 categories in 11 broad domains (Table 1).

**Table 1.**  
**HIERARCHICAL STRUCTURE FOR ANALYSIS OF CAUSES OF DEATH, BY DOMAIN AND PROJECT CODES**

CAUSE OF DEATH	PROJECT CODES (N = 111)	ICD-10 CODES
ALL CAUSES	001	A00-Z99
<b>Domain 1. Infectious and parasitic diseases</b>	<b>002</b>	<b>A00-B99</b>
Tuberculosis	003	A16-A19
Septicemia	004	A40-A41
Viral disease	005	A80-B34
Viral hepatitis	006	B15-B19
HIV disease	007	B20-B24
<b>Domain 2. Cancer</b>	<b>008</b>	<b>C00-C97, D00-D48</b>
Cancer of oral cavity and pharynx	009	C00-C14.8
Cancer of digestive organs	010	C15-C26, C48
Cancer of esophagus	011	C15
Cancer of stomach	012	C16
Cancer of other and ill-defined digestive	013	C17, C21, C23, C24, C26
Cancer of colon and rectum	014	C18-C20, C26.0
Cancer of liver and intrahepatic bile ducts	015	C22
Cancer of pancreas	016	C25
Cancer of the respiratory system	017	C30-C39
Cancer of larynx	018	C32
Cancer of lung and bronchus	019	C34
Cancer, melanoma of skin	020	C43
Cancer of breast	021	C50
Cancer of cervix uteri	022	C53
Cancer of corpus/uterus, NOS	023	C54-C55
Cancer of ovary	024	C56
Cancer of prostate	025	C61
Cancer of the testis	026	C62
Cancer of kidney and renal pelvis	027	C64-C65
Cancer of urinary bladder	028	C67
Cancer of brain/other nervous system	029	C70-C72
Cancer of thyroid	030	C73
Cancer, Hodgkin lymphoma	031	C81
Cancer, non-Hodgkin lymphoma	032	C82-C85
Cancer, myeloma	033	C88.7-C88.9, C90.0, C90.2
Cancer, leukemia	034	C90.1, C91-C95
In situ, benign and uncertain neoplasms	035	D00-D48
<b>Domain 3. Diseases of the endocrine system</b>	<b>038</b>	<b>E00-E88</b>
Diabetes mellitus	039	E10-E14
Nutritional deficiencies	040	E40-E64
Malnutrition	041	E40-E46
Obesity	042	E65-E68
Metabolic disorders	043	E70-E88
<b>Domain 4. Diseases of the nervous system</b>	<b>045</b>	<b>G00-G98</b>
Meningitis	046	G00, G03
Parkinson's disease	047	G20-G21
Alzheimer's disease	048	G30
Multiple sclerosis	049	G35
Epilepsy	050	G40-G41

**Table 1. (continued)**  
**HIERARCHICAL STRUCTURE FOR ANALYSIS OF CAUSES OF DEATH, BY DOMAIN AND PROJECT CODES**

CAUSE OF DEATH	PROJECT CODES (N = 111)	ICD-10 CODES
<b>Domain 5. Diseases of the circulatory system</b>	<b>114</b>	<b>I00-I99</b>
Heart disease	052	I00-I09, I11, I13, I20-I51
Rheumatic fever (acute) and chronic rheumatic heart diseases	053	I00-I09
Coronary heart disease	054	I11, I20-I25, I51.6
Hypertensive heart disease	055	I11
Ischemic heart diseases	056	I20-I25
Acute myocardial infarction	057	I21-I22
Atherosclerotic cardiovascular disease	058	I25.0
Hypertensive heart and renal disease	059	I13
Heart failure	060	I50
Hypertension (essential/primary) and hypertensive renal disease	061	I10, I12
Cerebrovascular diseases	062	I60-I69
Atherosclerosis	063	I70
Phlebitis, thrombophlebitis, venous embolism and thrombosis	064	I80-I82
<b>Domain 6. Diseases of the respiratory system</b>	<b>065</b>	<b>J00-J98</b>
Influenza and pneumonia	066	J10-J18
Influenza	067	J10-J11
Pneumonia	068	J12-J18
Chronic lower respiratory diseases	069	J40-J47
Bronchitis, chronic and unspecified	070	J40-J42
Emphysema	071	J43
Asthma	072	J45-J46
Pneumoconiosis	073	J60-J66
Pneumonitis due to solids and liquids	074	J69
<b>Domain 7. Diseases of the digestive system</b>	<b>075</b>	<b>K00-K92</b>
Peptic ulcer	076	K25-K28
Liver disease, chronic and cirrhosis	077	K70, K73-K74
Liver, alcoholic liver disease	078	K70
Cholelithiasis and other disorders of gallbladder	079	K80-K82
Pancreas and biliary tract disorders	080	K83-K86
<b>Domain 8. Genitourinary system</b>	<b>084</b>	<b>N00-N98</b>
Nephritis, nephrotic syndrome and nephrosis	085	N00-N07, N17-N19, N25-N27
Renal failure	086	N17-N19
<b>Domain 9. Congenital malformations, deformations, chromosomal abnormalities</b>	<b>089</b>	<b>Q00-Q99</b>
<b>Domain 10. External cause of death, injury and accidents</b>	<b>091</b>	<b>U01-U03, V01-Y89</b>
Homicide (assault)	095	U01-U02, X85-Y09, Y87.1
Homicide (assault), by discharge of firearm	096	U01.4, X93-X95
Suicide (intentional self-harm)	097	U03, X60-X84, Y87.0
Suicide (intentional self-harm), not firearm, other or unknown	098	U03, X60-X71, X75-X84, Y87.0
Suicide (intentional self-harm), by firearm	099	X72-X74
Accidents	100	V01-X59, Y85-Y86
Accidents, transport	101	V01-V99, Y85
Accidents, other transport, not motor vehicles	102	V01, V05-V06, V09.1, V09.3-V09.9, V10-V11, V15-V18, V19.3, V19.8-V19.9, V80.0-V80.2, V80.6-V80.9, V81.2-V81.9, V82.2-V82.9, V87.9, V88.9, V89.1, V89.3, V89.9, V90-V99, Y85

**Table 1. (continued)**  
**HIERARCHICAL STRUCTURE FOR ANALYSIS OF CAUSES OF DEATH, BY DOMAIN AND PROJECT CODES**

CAUSE OF DEATH	PROJECT CODES (N = 111)	ICD-10 CODES
Accidents, motor vehicle	103	V02-V04, V09.0, V09.2, V12-V14, V19.0-V19.2, V19.4-V19.6, V20-V79, V80.3-V80.5, V81.0-V81.1, V82.0-V82.1, V83-V86, V87.0-V87.8, V88.0-V88.8, V89.0, V89.2
Accidents, nontransport	104	W00-X59, Y86
Accidents, nontransport excluding poisoning	105	W00-X39, X50-X59, Y86
Falls	106	W00-W19
Accidental discharge of firearms	107	W32-W34
Drowning and submersion (accidental)	108	V90, V92, W65-W74
Fire, smoke, and flames (accidental)	109	X00-X09
Accidental poisoning and exposure to noxious substances	110	X40-X49
Accidental drug poisoning	111	X40-X44
Accidental alcohol poisoning	112	X45
Complications of medical and surgical care	113	Y40-Y84, Y88
<b>Domain 11. Other causes of death</b>		
Diseases of the blood and blood forming organs	036	D50-D89
Mental and behavioral disorders	044	F01-F99
Skin and subcutaneous tissue	081	L00-L98
Diseases of the musculoskeletal system & connective tissue	082	M00-M99
Rheumatoid arthritis and related inflammatory polyarthropathies	083	M05-M08
Pregnancy, childbirth, and the puerperium	087	O00-O99
Perinatal conditions	088	P00-P96
Symptoms, signs not otherwise classified	090	R00-R99
Diseases of the eye, adnexa, ear and mastoid	115	H00-H57, H60-H93

Deaths from 1995-1998 and 1999-2014 were coded to ICD-9 and ICD-10, respectively (Table 2). Because the transition from ICD-9 to ICD-10 in 1999 could potentially introduce artifactual changes in cause-specific rates and because some mortality patterns changed distinctly after 2000-2004, the percentage increase in mortality rates was measured from two baseline time periods: 1995-1999 and 2000-2004. Mortality data are not shown for 1995-1999 if the specific cause of death did not have corresponding codes in the 9<sup>th</sup> and 10<sup>th</sup> revisions; mortality rates for these causes of death are shown only from 2000-2004 to 2010-2014.

**Table 2.**  
**TRANSLATION BETWEEN CORRESPONDING ICD-9 AND ICD-10 CODES**

PROJECT CODE	CAUSE OF DEATH	ICD-10 CODE	ICD-9 CODE
1	All causes of death	A00-Z99	000-799, E800-E999
2	Infectious and parasitic diseases	A00-B99	000-139
3	Tuberculosis	A16-A19	010-018
4	Septicemia	A40-A41	038
5	Viral disease	A80-B34	042-079
6	Viral hepatitis	B15-B19	070
7	Human immunodeficiency virus (HIV) disease	B20-B24	042-044
8	Cancer	C00-C97	140-208
9	Cancer of oral cavity and pharynx	C00-C14.8	140-149
10	Cancer of digestive organs	C15-C26, C48	150-159
11	Cancer of esophagus	C15	150
12	Cancer of stomach	C16	151
13	Cancer of other and ill-defined digestive	C17, C21, C23, C24, C26	152, 154.2, 154.3, 154.8, 156, 159.1, 159.8, 159.9
14	Cancer of colon and rectum	C18-C20, C26.0	153.0-154.1, 159.0
15	Cancer of liver and intrahepatic bile ducts	C22	155
16	Cancer of pancreas	C25	157
17	Cancer of the respiratory system	C30-C39	160-165
18	Cancer of larynx	C32	161
19	Cancer of lung and bronchus	C34	162.2-162.9
20	Cancer, melanoma of skin	C43	172
21	Cancer of breast	C50	174-175
22	Cancer of cervix uteri	C53	180
23	Cancer of corpus/uterus, NOS	C54-C55	179, 182.0-182.8
24	Cancer of ovary	C56	183.0
25	Cancer of prostate	C61	185
26	Cancer of the testis	C62	186
27	Cancer of kidney and renal pelvis	C64-C65	189.0, 189.1
28	Cancer of urinary bladder	C67	188
29	Cancer of brain/other nervous system	C70-C72	191-192
30	Cancer of thyroid	C73	193
31	Cancer, Hodgkin lymphoma	C81	201
32	Cancer, non-Hodgkin lymphoma	C82-C85	200.0-200.8, 202.0-202.2, 202.8-202.9
33	Cancer, myeloma	C88.7-C88.9, C90.0, C90.2	203.0, 203.2-203.8
34	Cancer, leukemia	C90.1, C91-C95	202.4, 203.1, 204-208
35	In situ, benign and uncertain neoplasms	D00-D48	210-239
36	Diseases of the blood and blood forming organs	D50-D89	280-289
37	Drug-induced deaths	D52.1, D59.0, D59.2, D61.1, D64.2, E06.4, E16.0, E23.1, E24.2, E27.3, E66.1, F11.0-F11.5, F11.7-F12.5, F12.7-F13.5, F13.7-F14.5, F14.7-F15.5, F15.7-F16.5, F16.7-F17.0, F17.3-F17.5, F17.7-F18.5, F18.7-F19.5, F19.7-F19.9, G21.1, G24.0, G25.1, G25.4, G25.6, G44.4, G62.0, G72.0, I95.2, J70.2-J70.4, L10.5, L27.0-L27.1, M10.2, M32.0, M80.4, M81.4, M83.5, M87.1, R78.1-R78.5, U01.6, X40-X44, X60-X64, X85, Y10-Y14	292, 304, 305.2-305.9, E850-E858, E950.0-E950.5, E962.0, E980.0-E980.5
38	Diseases of the endocrine system	E00-E88	240-279
39	Diabetes mellitus	E10-E14	250

**Table 2. (continued)**  
**TRANSLATION BETWEEN CORRESPONDING ICD-9 AND ICD-10 CODES**

PROJECT CODE	CAUSE OF DEATH	ICD-10 CODE	ICD-9 CODE
40	Nutritional deficiencies	E40-E64	260-269
41	Malnutrition	E40-E46	260-263
42	Obesity	E65-E68	278
43	Metabolic disorders	E70-E88	270-277
44	Mental and behavioral disorders	F01-F99	290-319
45	Diseases of the nervous system	G00-G98	320-359
46	Meningitis	G00, G03	320-322
47	Parkinson's disease	G20-G21	332
48	Alzheimer's disease	G30	331.0
49	Multiple sclerosis	G35	340
50	Epilepsy	G40-G41	345
51	Cardiovascular diseases (major)	I00-I78	390-448
52	Heart disease	I00-I09, I11, I13, I20-I51	390-398, 402, 404-429
53	Rheumatic fever (acute) and chronic rheumatic heart diseases	I00-I09	390-398
54	Coronary heart disease	I11, I20-I25, I51.6	402, 410-414, 429.2
55	Hypertensive heart disease	I11	402
56	Ischemic heart diseases	I20-I25	410-414
57	Acute myocardial infarction	I21-I22	410
58	Atherosclerotic cardiovascular disease	I25.0	429.2
59	Hypertensive heart and renal disease	I13	404
60	Heart failure	I50	428
61	Hypertension (essential/primary) and hypertensive renal disease	I10, I12	401, 403
62	Cerebrovascular diseases	I60-I69	430-438
63	Atherosclerosis	I70	440
64	Phlebitis, thrombophlebitis, venous embolism and thrombosis	I80-I82	451-453
65	Diseases of the respiratory system	J00-J98	460-519
66	Influenza and pneumonia	J10-J18	480-487
67	Influenza	J10-J11	487
68	Pneumonia	J12-J18	480-486
69	Chronic lower respiratory diseases	J40-J47	490-496
70	Bronchitis, chronic and unspecified	J40-J42	490-491
71	Emphysema	J43	492
72	Asthma	J45-J46	493
73	Pneumoconiosis	J60-J66	500-505
74	Pneumonitis due to solids and liquids	J69	507
75	Diseases of the digestive system	K00-K92	520-579
76	Peptic ulcer	K25-K28	531-534
77	Liver disease, chronic and cirrhosis	K70, K73-K74	571
78	Liver, alcoholic liver disease	K70	571.0-571.3
79	Cholelithiasis and other disorders of gallbladder	K80-K82	574-575
80	Pancreas and biliary tract disorders	K83-K86	576-577
81	Skin and subcutaneous tissue	L00-L98	680-709
82	Diseases of the musculoskeletal system & connective tissue	M00-M99	710-739
83	Rheumatoid arthritis and related inflammatory polyarthropathies	M05-M08	714
84	Genitourinary system	N00-N98	580-629
85	Nephritis, nephrotic syndrome and nephrosis	N00-N07, N17-N19, N25-N27	580-589
86	Renal failure	N17-N19	584-586
87	Pregnancy, childbirth, and the puerperium	O00-O99	630-676

**Table 2. (continued)**  
**TRANSLATION BETWEEN CORRESPONDING ICD-9 AND ICD-10 CODES**

PROJECT CODE	CAUSE OF DEATH	ICD-10 CODE	ICD-9 CODE
88	Perinatal conditions	P00-P96	760-779
89	Congenital malformations, deformations, chromosomal abnormalities	Q00-Q99	740-759
90	Symptoms, signs not otherwise classified	R00-R99	780-799
91	External cause of death, injury and accidents	U01-U03, V01-Y89	E800-E999
92	Firearm related injuries (accidental, suicide, homicide, undetermined, legal interv.)	U01.4, W32-W34, X72-X74, X93-X95, Y22-Y24, Y35.0	E922, E955.0-E955.4, E965.0-E965.4, E970, E985.0-E985.4
93	Poisoning (accidental, suicide, homicide, undetermined, legal interv.)	U01.6, U01.7, X40-X49, X60-X69, X85-X90, Y10-Y19, Y35.2	E850-E869, E950-E952, E962, E972, E980-E982
94	Suffocation and strangulation (accidental, suicide, homicide, undetermined)	W75-W84, X70, X91, Y20	E911-E913, E953, E963, E983
95	Homicide (assault)	U01-U02, X85-Y09, Y87.1	E960-E969
96	Homicide (assault), by discharge of firearm	U01.4, X93-X95	E965.0-E965.4
97	Suicide (intentional self-harm)	U03, X60-X84, Y87.0	E950-E959
98	Suicide (intentional self-harm), not firearm, other or unknown	U03, X60-X71, X75-X84, Y87.0	E950-E954, E955.5-E959.9
99	Suicide (intentional self-harm), by firearm	X72-X74	E955.0-E955.4
100	Accidents	V01-X59, Y85-Y86	E800-E869, E880-E929
101	Accidents, transport	V01-V99, Y85	E800-E848, E929.0, E929.1
102	Accidents, other transport, not motor vehicles	V01, V05-V06, V09.1, V09.3-V09.9, V10-V11, V15-V18, V19.3, V19.8-V19.9, V80.0-V80.2, V80.6-V80.9, V81.2-V81.9, V82.2-V82.9, V87.9, V88.9, V89.1, V89.3, V89.9, V90-V99, Y85	E800-E807, E820-E848, E929.0, E929.1
103	Accidents, motor vehicle	V02-V04, V09.0, V09.2, V12-V14, V19.0-V19.2, V19.4-V19.6, V20-V79, V80.3-V80.5, V81.0-V81.1, V82.0-V82.1, V83-V86, V87.0-V87.8, V88.0-V88.8, V89.0, V89.2	E810-E819
104	Accidents, nontransport	W00-X59, Y86	E850-E869, E880-E928, E929.2-E929.9
105	Accidents, nontransport excluding poisoning	W00-X39, X50-X59, Y86	E880-E924.0, E924.8-E928, E929.2-E929.9
106	Falls	W00-W19	E880-E886, E888
107	Accidental discharge of firearms	W32-W34	E922
108	Drowning and submersion (accidental)	V90, V92, W65-W74	E830, E832, E910
109	Fire, smoke, and flames (accidental)	X00-X09	E890-E899
110	Accidental poisoning and exposure to noxious substances	X40-X49	E850-E869, E924.1
111	Accidental drug poisoning	X40-X44	E850-E858
112	Accidental alcohol poisoning	X45	E860
113	Complications of medical and surgical care	Y40-Y84, Y88	E870-E879, E930-E949
114	Diseases of the circulatory system	I00-I99	390-459
115	H codes	H00-H57, H60-H93	360-389
116	R and Y codes	R00-R99, Y10-Y39, Y89	780-799, E970-E999

Age adjustment was performed to account for changes in age distributions within the age groups. Weights calculated from the 2000 US standard million population were applied to age-specific rates and summed across age-groups to produce the final age-adjusted rates. Trends in death rates reported in the issue brief generally refer to age-adjusted rates; crude rates are reported in selected tables to provide the reader with complete information on actual death rates. The statistical significance of differences in mortality rates was determined using the standard error of the difference<sup>3</sup> (for crude rates) and by checking for overlap between 95% confidence intervals, which were computed using Fay and Feuer's method using the gamma distribution<sup>4</sup> (for age-adjusted rates). Calculations were performed in SAS (version 9.4, Cary, NC).

The study focused on identifying causes of death responsible for shifting death rates in the population. This was accomplished by first examining and reporting all-cause mortality trends by race and ethnicity and then conducting a more detailed analysis of age-specific mortality trends (across 5-year age bands) among NH whites. As reported below, we identified NH whites ages 25-64 years, ages 30-59 years in particular, as the age groups that experienced the largest relative increase in mortality rates.<sup>a</sup>

The study then focused on identifying the specific causes of death responsible for these trends. This involved a systematic examination of cause-specific mortality trends at each level of the hierarchical classification of deaths (Table 1), from mortality trends in the 10 broadest categories of causes of death, to those in the 116 causes of death, and those at specific 3-digit and 4-digit ICD code levels. We also calculated mortality rates for four "stress-related conditions (SRC)": (1) accidental drug overdoses, (2) alcohol poisoning, (3) alcoholic liver disease, and (4) suicides (project codes 111, 112, 078, and 097, respectively, in Table 1).

We focused on causes of death that produced a statistically significant increase in age-adjusted mortality rates.

Excess and averted deaths were calculated using the following procedure: the expected number of deaths for each time period (assuming no mortality increase) was computed by applying the prior time period's crude mortality rate to the subsequent time period's population. Specifically, crude mortality rates for 1995-1999 were applied to the population of 2000-2004, 2000-2004 mortality rates to the 2005-2009 population, and 2005-2009 rates to the 2010-2014 population. Actual deaths were subtracted from the expected deaths to determine the number of averted deaths (decrease in cause-specific mortality) or excess (increase in cause-specific mortality) for each time period. The number of averted/excess deaths was summed over the three time periods to arrive at a total number of averted/excess deaths by cause.

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<sup>a</sup>This age group was identified in both an initial examination of crude all-cause mortality rates and a subsequent analysis of age-adjusted SRC mortality rates.

We encountered challenges in examining cause-specific mortality trends at the sub-state level due to the small population sizes of many Kansas counties. SRC data were suppressed for many of these counties because fewer than ten SRC deaths were reported per time period (see above). In 58 counties<sup>b</sup>—usually those with small populations—we could not calculate the relative increase in SRC death rates between time periods because data were lacking for one or more time periods. Moreover, many of the 47 counties with adequate data to calculate changes in mortality rates did not have changes that achieved statistical significance.

We therefore aggregated deaths across counties by examining mortality trends for seven regions established by the Kansas Department of Commerce (Table 3).<sup>5</sup>

We mapped mortality trends by region and by counties (for those counties that had mortality data available).

**Table 3.**  
**KANSAS COUNTIES AND CITIES, BY REGION**

SOUTHEAST	SOUTH CENTRAL	SOUTHWEST
Allen County	Barber County	Clark County
Anderson County	Butler County	Comanche County
Bourbon County	Chase County	Edwards County
Chautauqua County	Cowley County	Finney County
Cherokee County	Harper County	Ford County
Coffey County	Harvey County	Grant County
Crawford County	Kingman County	Gray County
Elk County	Marion County	Hamilton County
Franklin County	McPherson County	Haskell County
Greenwood County	Pratt County	Hodgeman County
Labette County	Reno County	Kearny County
Linn County	Rice County	Kiowa County
Lyon County	Sedgwick County	Meade County
Miami County	Stafford County	Morton County
Montgomery County	Sumner County	Pawnee County
Neosho County		Seward County
Osage County		Stanton County
Wilson County		Stevens County
Woodson County		

<sup>b</sup> Data were unavailable to calculate changes in SRC mortality rates (statistically significant or otherwise) in the following 58 counties: Chase County, Chautauqua County, Cheyenne County, Clark County, Clay County, Cloud County, Comanche County, Decatur County, Doniphan County, Edwards County, Elk County, Ellsworth County, Gove County, Graham County, Grant County, Gray County, Greeley County, Hamilton County, Harper County, Haskell County, Hodgeman County, Jackson County, Jewell County, Kearny County, Kiowa County, Lane County, Lincoln County, Logan County, Marshall County, Meade County, Mitchell County, Morris County, Morton County, Ness County, Norton County, Osborne County, Ottawa County, Pawnee County, Phillips County, Rawlins County, Republic County, Rooks County, Rush County, Russell County, Scott County, Sheridan County, Sherman County, Smith County, Stafford County, Stanton County, Stevens County, Thomas County, Trego County, Wabaunsee County, Wallace County, Washington County, Wichita County, and Woodson County.

**Table 3. (continued)**  
**KANSAS COUNTIES AND CITIES, BY REGION**

<b>EAST CENTRAL</b>	<b>NORTH CENTRAL</b>	<b>NORTHWEST</b>
Douglas County	Barton County	Cheyenne County
Johnson County	Ellis County	Decatur County
Leavenworth County	Ellsworth County	Gove County
Shawnee County	Jewell County	Graham County
Wyandotte County	Lincoln County	Greeley County
<b>NORTHEAST</b>	Mitchell County	Lane County
Atchison County	Osborne County	Logan County
Brown County	Phillips County	Ness County
Clay County	Rooks County	Norton County
Cloud County	Rush County	Rawlins County
Dickinson County	Russell County	Scott County
Doniphan County	Smith County	Sheridan County
Geary County		Sherman County
Jackson County		Thomas County
Jefferson County		Trego County
Marshall County		Wallace County
Morris County		Wichita County
Nemaha County		
Ottawa County		
Pottawatomie County		
Republic County		
Riley County		
Saline County		
Wabaunsee County		
Washington County		

*Regional scheme adapted from Kansas Department of Commerce. Business and Community Development Assistance. Accessed 3-14-18 at <https://www.kansascommerce.gov/850/Business-Community-Development>*

We used data from the U.S. Census Bureau to compare counties and regions in terms of population size and 29 other place-based characteristics covering seven domains: demographic characteristics, educational attainment, income and employment, housing, transportation, environment, and access to health care (Table 4). We calculated Pearson correlation coefficients to determine how closely each of these place-based values correlated with (a) absolute SRC mortality as of 2010-2014 and (b) the relative (%) increase in SRC mortality from 1995-1999 to 2010-2014. Specifically, the place-based values used for these calculations were aggregate values (e.g., proportions, rates, ratios) for (a) the population of each of the seven regions and (b) the aggregated population of those counties in each region *that experienced a statistically significant increase in SRC mortality*. Increases in counties that did not experience a statistically significant increase were not considered reliable for the calculation.

**Table 4.**  
**PLACE-BASED INDICATORS EXAMINED IN KANSAS REGIONS AND COUNTIES**

PLACE-BASED INDICATOR	DEFINITION	DATA SOURCE
<b>Geographic Characteristics</b>		
Rurality (%)	Percentage of the locality population living in rural areas	U.S. Census, 2010 Census Urban and Rural Classification
Urbanicity (%)	Percentage of the locality population living in urban areas	U.S. Census, 2010 Census Urban and Rural Classification
<b>Demographic Characteristics</b>		
Diversity Index	Probability that two individuals chosen at random would be of different races or ethnicities	PolicyMap, 2010-2014
Foreign born population (%)	Percentage of the population who is foreign-born	U.S. Census, ACS 2014 5-year estimates, Table B05012
Single parent households (%)	Percentage of children who live in single-parent households	2016 County Health Rankings
<b>Educational Attainment</b>		
High school degree or more education (%)	Percentage of persons 25 years of older with a high school degree or higher	2016 County Health Rankings
Some college or more education (%)	Percentage of persons 25 years or older with some post-secondary education	U.S. Census, ACS 2014 5-year estimates, Table S1505
Bachelor's degree or more education (%)	Percentage of persons 25 years or older with a Bachelor's degree or higher	U.S. Census, ACS 2014 5-year estimates, Table S1505
<b>Household Economic Conditions</b>		
Median household income (\$)	Median annual household income	2016 County Health Rankings
Poverty (%)	Percentage of population living below poverty level	U.S. Census, ACS 2015 5-year estimates, Table S1701
Child poverty (%)	Percentage of children (under age 18 years) living in poverty	2016 County Health Rankings
Poverty (adult only, %)	Percentage of population ages 18-64 years living below poverty level	U.S. Census, ACS 2015 5-year estimates, Table S1701
Gini Index	Statistical dispersion measure (zero to 1.0) representing the distribution of income	U.S. Census, ACS 2014 5-year estimates, Table B19083
Unemployment (%)	Percentage of civilian labor force (ages 16 and older) that is unemployed but seeking work	2016 County Health Rankings
<b>Physical Environment</b>		
Ozone days (per year)	Number of ozone days per year above regulatory standard	CDC Environmental Public Health Tracking Network, 2012
Low food access (%)	Percentage of population living more than 1 mile from a grocery store in an urban area or more than 10 miles in a rural area	2015 USDA ERS Food Environment Atlas
Violent crime rate (per 100,000)	Number of reported violent crime offenses per 100,000 population	2016 County Health Rankings

**Table 4. (continued)**  
**PLACE-BASED INDICATORS EXAMINED IN KANSAS REGIONS AND COUNTIES**

PLACE-BASED INDICATOR	DEFINITION	DATA SOURCE
<b>Housing</b>		
Severe housing disrepair (%)	Percentage of households with at least 1 of 4 housing problems: overcrowding, high housing costs, or lack of kitchen or plumbing facilities	2016 County Health Rankings
Overcrowding (%)	Percentage of households with more than one occupant per room	U.S. Census, ACS 2014 5-year estimates, Table DP04
Housing built before 1950 (%)	Proportion of housing units built 1950 or earlier	U.S. Census, ACS 2014 5-year estimates, Table B25034
Cost burden (renters, %)	Percentage of renter-occupied households paying more than 30% of income on housing	U.S. Census, ACS 2014 5-year estimates, Table B25070
Cost burden (homeowners, %)	Percentage of owner-occupied households paying more than 30% of income on housing	U.S. Census, ACS 2014 5-year estimates, Table B25093
<b>Transportation</b>		
No vehicle access (%)	Percentage of workers age 16 years and over in households without a vehicle available	U.S. Census, ACS 2014 5-year estimates, Table B08141
Commuting to work by motor vehicle (%)	Percentage who commute by car, truck, van, taxi, motorcycle, or other means	U.S. Census, ACS 2014 5-year estimates, Table S0801
Commuting to work by public transit (%)	Percentage of workers age 16 years and over who commute to work by bus, train, or subway	U.S. Census, ACS 2014 5-year estimates, Table S0801
Commuting to work by walking/cycling (%)	Percentage of workers age 16 years and over who commute to work by walking or cycling	U.S. Census, ACS 2014 5-year estimates, Table S0801
<b>Access to Health Care</b>		
Uninsured (%)	Percentage of population without any health insurance	U.S. Census, ACS 2014 5-year estimates, Table S2701
Public insurance (%)	Percentage with public health insurance (e.g., Medicare, Medicaid)	U.S. Census, ACS 2014 5-year estimates, Table S2701
Private insurance (%)	Percent with private insurance	U.S. Census, ACS 2014 5-year estimates, Table S2701
ACS= American Community Survey, CDC= Centers for Disease Control and Prevention		

Finally, we examined temporal socioeconomic data to see how regions fared over time in terms of median household income, poverty, and unemployment. We obtained poverty and income data from the U.S. Census Bureau, using its Small Area Income and Poverty Estimates (SAIPE) Program for recent decades (1999 forward)<sup>6</sup> and its Historical Income Tables<sup>7</sup> to examine whether the patterns observed predate the observation period of this study. We obtained employment data from the U.S. Bureau of Labor Statistics Local Area Unemployment Statistics (LAUS) program.<sup>8</sup>

## RESULTS

We found that age-adjusted all-cause mortality decreased in Kansas between 1995-1999 and 2010-2014, but the decrease was more pronounced among NH blacks and Hispanics (Table 5). Between 1995-1999 and 2010-2014, the mortality rate among NH whites decreased by 8.0%, compared to decreases of 18.6% and 16.5% among non-Hispanic blacks and Hispanics, respectively (decreases among Asians and Pacific Islanders did not achieve statistical significance). Notably, among American Indian and Alaskan Natives in Kansas, all-cause mortality increased by 28.2% between 1995-1999 and 2010-2014, and by 43.9% after 2000-2004.

**Table 5.**  
**ALL-CAUSE MORTALITY RATES (ALL AGES), BY RACE-ETHNICITY, KANSAS, 1995-2014**

RACE-ETHNICITY	1995–1999		2000–2004		2005–2009		2010–2014		RELATIVE INCREASE IN AGE-ADJUSTED MORTALITY RATE (%)	
	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE	FROM 1995–99 TO 2010–2014	FROM 2000–04 TO 2010–2014						
Non-Hispanic whites	109,493	821.5	111,470	811.8	111,275	777.8	113,685	755.6	-8.0*	-6.9*
Non-Hispanic blacks	5,976	1159.5	6,315	1156.8	6,259	1059.6	6,331	943.9	-18.6*	-18.4*
Non-Hispanic American Indians and Alaskan Natives	591	1072.3	672	955.0	1,061	1364.6	1,235	1374.3	28.2*	43.9*
Non-Hispanic Asians and Pacific Islanders	379	523.4	434	377.3	663	439.9	892	437.2	-16.5	15.9
Hispanics	1,757	674.9	2,278	600.0	2,870	551.1	3,527	552.0	-18.2*	-8.0

\* p < 0.05

Although all-cause mortality rates in the white population of Kansas decreased between 1995-1999 and 2010-2014, there was no statewide decrease among NH whites ages 25-64 years. In the Southeast region, all-cause mortality increased significantly in this age group, rising by 11.5% between 1995-1999 and 2010-2014 and by 8.6% between 2000-2004 and 2010-2014 ( $p < 0.05$ ). Increases in all-cause mortality rates among NH whites ages 25-64 years achieved statistical significance in six counties (Table 6). Only three of these counties (Allen County, Cherokee County, and Coffey County) were in the Southeast region.

**Table 6.**  
**ALL-CAUSE MORTALITY RATES, NON-HISPANIC WHITES AGES 25-64 YEARS, SELECTED COUNTIES,**  
**KANSAS, 1995-2014**

COUNTY	1995–1999		2000–2004		2005–2009		2010–2014		RELATIVE INCREASE IN AGE-ADJUSTED MORTALITY RATE (%)	
	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE	FROM 1995–99 TO 2010–2014	FROM 2000–04 TO 2010–2014
Allen County	130	363.2	139	373.9	180	490.2	194	532.1	46.5%*	42.3%*
Cherokee County	245	420.7	238	405.9	339	543.5	346	562.0	33.6%*	38.5%*
Coffey County	52	231.6	76	313.7	69	250.0	110	420.4	81.5%*	34.0%
Morton County	10	130.9	22	283.6	22	299.6	35	484.8	270.3%*	71.0%
Reno County	482	313.6	506	308.1	638	371.4	674	378.5	20.7%*	22.8%*
Saline County	393	316.9	406	308.8	493	343.2	553	376.5	18.8%	21.9%*

\*  $p < 0.05$ .

Between 1995-1999 and 2000-2014, all-cause mortality also increased significantly ( $p < 0.05$ ) among NH whites ages 30-59 years in Allen County (61.0%), Barber County (136.3%), Barton County (42.4%), Cherokee County (59.9%), Montgomery County (34.5%), Reno County (25.6%), and Saline County (33.9%).

In addition, we found a significant statewide increase in SRC mortality—our composite measure of deaths from drug overdoses, alcohol poisoning, alcoholic liver disease, and suicides—among NH whites ages 25-64 years. SRC mortality increased statewide in this age group by 111.5% between 1995-1999 and 2010-2014 and by 54.9% between 2000-2004 and 2010-2014.

Tables 7-8 list the specific causes of death responsible for increasing mortality rates among NH whites ages 25-64 years in Kansas. The increase in mortality from the 18 conditions<sup>c</sup> claimed an estimated 2,863 lives<sup>d</sup> between 1995-1999 and 2010-2014, 47.5% (1,361 deaths) due to drug overdoses, alcoholic liver disease, and suicides. Notably, the mortality rate from accidental drug overdoses increased by 584.7% between 1995-1999 and 2010-2014, and the death rate from alcohol poisoning increased by 440% after 2000-2004.<sup>e</sup> Medical complications of substance abuse also increased—e.g., deaths from alcoholic liver disease increased by 53.8% between 1995-1999 and 2010-2014—and the suicide rate increased by 51.8%. The rate of fatal fall injuries among NH whites ages 25-64 years increased by 45.0% between 1995-1999 and 2010-2014, and the rate of fatal drownings increased by 81.5% after 2000-2004.

<sup>c</sup> The 18 conditions included (1) drug overdoses, (2) alcoholic liver disease, (3) suicides, (4) pedestrian transport accidents, (5) motorcycle transport accidents, (6) falls, (7) drownings, (8) chronic lower respiratory disease, (9) pneumonitis, (10) viral hepatitis, (11) liver cancer, (12) obesity, (13) essential hypertension, (14) cardiomegaly, (15) renal failure, (16) sepsis, (17) anoxic brain damage, and (18) uterine cancer.

<sup>d</sup> The total estimate of 2,863 excess deaths includes 1,361 excess deaths from SRC (Table 7), 1,415 excess deaths from organ diseases (Table 8), and 75 and 12 excess deaths, respectively, from increasing rates of fatal falls and drownings (see text).

<sup>e</sup> Some of the increase in deaths from alcohol poisoning may reflect a change in coding that occurred in 2007-2008.

**Table 7.**  
**MORTALITY FROM STRESS-RELATED CONDITIONS AMONG NON-HISPANIC WHITES AGES 25-64 YEARS,**  
**KANSAS, 1995-2014**

CAUSE OF DEATH (ICD-10 CODE*)	1995–1999		2000–2004		2005–2009		2010–2014		RELATIVE INCREASE IN AGE-ADJUSTED MORTALITY RATE (%) §		EXCESS DEATHS FROM 2000–2004 TO 2010–2014
	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	FROM 1995–1999 TO 2010–2014	FROM 2000–2004 TO 2010–2014	
<b>STRESS-RELATED CONDITIONS †</b>	<b>1,255</b>	<b>21.8</b> (21.8)	<b>1,732</b>	<b>29.8</b> (30.1)	<b>2,269</b>	<b>38.6</b> (38.8)	<b>2,746</b>	<b>46.2</b> (46.5)	<b>111.5</b> (112.9)	<b>54.9</b> (54.5)	<b>1,361</b>
<b>Conditions related to drug use</b>											
Accidental drug poisoning (X40-X44)	128	2.2 (2.2)	397	6.9 (6.9)	696	12.3 (11.9)	838	15.1 (14.2)	584.7 (537.0)	116.8 (105.7)	697
Sedative-hypnotic, psychotropic, anti-epileptic, and antiparkinsonian drugs (X41)	NC	NC	42	0.7 (0.7)	49	0.9 (0.8)	83	1.5 (1.4)	NC (NC)	104.0 (92.6)	NC
Narcotics and hallucinogens (X42)	NC	NC	166	2.9 (2.9)	270	4.9 (4.6)	332	6 (5.6)	NC (NC)	103.8 (94.9)	NC
Other drugs, medicaments and biological substances (X44) ¶	NC	NC	179	3.1 (3.1)	372	6.5 (6.4)	415	7.5 (7.0)	NC (NC)	140.4 (126.0)	NC
<b>Conditions related to alcohol use</b>											
Alcoholic liver disease (K70)	235	4.1 (4.1)	285	4.6 (5.0)	360	5.3 (6.2)	446	6.4 (7.6)	53.8 (84.7)	37.6 (52.5)	203
Alcoholic cirrhosis of liver (K70.3)	139	2.4 (2.4)	173	2.8 (3.0)	212	3.1 (3.6)	260	3.6 (4.4)	47.9 (82.0)	29.7 (NS) (46.5)	116
Accidental alcohol poisoning (X45.0) †	NA	NA	16	0.3 (0.3)	43	0.7 (0.7)	89	1.5 (1.5)	NA (NA)	440.3 (442.3)	NC
<b>Suicide (see notes)</b>	<b>883</b>	<b>15.4</b> (15.4)	<b>1,034</b>	<b>18</b> (18.0)	<b>1,170</b>	<b>20.3</b> (20)	<b>1,373</b>	<b>23.3</b> (23.3)	<b>51.8</b> (51.3)	<b>29.5</b> (29.4)	<b>461</b>
Suicide not involving firearm (see notes)	386	6.7 (6.7)	501	8.8 (8.7)	584	10.4 (10)	635	11 (10.8)	64.2 (60.1)	24.8 (23.5)	235
Hanging, strangulation, or suffocation (X70)	144	2.5 (2.5)	192	3.5 (3.3)	240	4.4 (4.1)	328	5.9 (5.6)	135.0 (121.6)	69.9 (66.5)	178
Narcotics and hallucinogens (X62)	NC	NC	24	0.4 (0.4)	26	0.5 (0.4)	24	0.4 (0.4)	NC (NC)	-7.7 (NS) (-2.5) (NS)	NC

**Table 7. (continued)**

**MORTALITY FROM STRESS-RELATED CONDITIONS AMONG NON-HISPANIC WHITES AGES 25-64 YEARS, KANSAS, 1995-2014**

CAUSE OF DEATH (ICD-10 CODE*)	1995–1999		2000–2004		2005–2009		2010–2014		RELATIVE INCREASE IN AGE-ADJUSTED MORTALITY RATE (%) ‡		EXCESS DEATHS FROM 2000–2004 TO 2010–2014
	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	FROM 1995–1999 TO 2010–2014	FROM 2000–2004 TO 2010–2014	
Other drugs, medicaments and biological substances (X64)	NC	NC	102	1.8 (1.8)	135	2.4 (2.3)	138	2.3 (2.3)	NC (NC)	28.5 (NS) (31.9) (NS)	NC
Suicide by firearm (X72-74)	497	8.7 (8.7)	533	9.2 (9.3)	586	9.9 (10)	738	12.3 (12.5)	42.2 (44.5)	34.0 (35.0)	226

\* ICD-10 codes refer to deaths from 1999 forward. Deaths in 1995-1998 were classified under ICD-9 codes using the conversion dictionary provided in Table 2.

‡ Stress-related conditions include total deaths from accidental drug poisoning (X40-X44), alcoholic liver disease (K70), accidental alcohol poisoning (X45.0), and suicides (see Notes).

§ All mortality rate increases were statistically significant ( $p < 0.05$ ) unless otherwise noted as non-significant (NS).

¶ Includes agents primarily acting on smooth and skeletal muscles and the respiratory system anesthetics (general)(local) drugs affecting the: cardiovascular system, gastrointestinal system, hormones and synthetic substitutes, systemic and hematological agents, systemic antibiotics and other anti-infectives therapeutic gases, topical preparations, vaccines, water-balance agents, and drugs affecting mineral and uric acid metabolism.

NA=Not available.

NC=No conversion: deaths not reported because deaths during this period (1995-1999) were classified under ICD-9 codes that were not comparable to those in ICD-10. Increases in death rates from 1995-1999 (and calculations of excess deaths since that time period) therefore cannot be calculated and are also designated as "NC."

NS=Not statistically significant.

**Notes:** The table focuses on specific causes of death and not overarching categories; a statistically significant increase in age-adjusted mortality rates between 1995-1999 and 2010-2014 was observed for deaths from "external causes," which includes accidents and injuries. The table omits data on causes of death that did not produce a statistically significant increase in age-adjusted rates. An exception was made for suicides involving narcotics and other drugs given the public health significance of the current opioid crisis. Population counts for calculating crude rates were 5,743,812 (1995-1999), 5,753,614 (2000-2004), 5,850,848 (2005-2009), and 5,903,050 (2010-2014). ICD-10 codes for suicide included U03, X60-84, and Y87.0; those for suicides not involving firearms included U03, X60-X71, X75-X84, and Y87.0.

Other organ diseases contributed significantly to increasing mortality rates in Kansas among NH whites (Table 8). Behaviors that could be traced to stress may have contributed to these fatal organ diseases, including smoking (chronic lower respiratory disease), drug use (e.g., hepatitis C, liver cancer), and overeating (obesity). Increasing death rates from essential hypertension and cardiomegaly could be linked to alcohol abuse, but other explanations are possible. Further research is needed to determine whether increasing death rates from these diseases are causally linked to accidents, trauma, or heavy sedation associated with overdoses or suicide attempts (e.g., renal failure, sepsis, pneumonitis from aspiration pneumonia, anoxic brain injury) or have independent explanations.

**Table 8.**  
**INCREASED MORTALITY FROM ORGAN DISEASES AMONG NON-HISPANIC WHITES AGES 25-64 YEARS, KANSAS, 1995-2014**

CAUSE OF DEATH (ICD-10 CODE*)	1995–1999		2000–2004		2005–2009		2010–2014		RELATIVE INCREASE IN AGE-ADJUSTED MORTALITY RATE (%) §		EXCESS DEATHS FROM 2000–2004 TO 2010–2014
	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	FROM 1995–1999 TO 2010–2014	FROM 2000–2004 TO 2010–2014	
<b>PULMONARY DISEASES</b>											
Chronic lower respiratory disease (J40-47)	706	12.3 (12.3)	744	11.7 (12.9)	857	11.6 (14.6)	1116	13.5 (18.9)	10.0 (NS) (53.8)	15.1 (46.2)	389
Pneumonitis due to solids and liquids (J69)	27	0.3 (0.3)	64	1.0 (1.1)	65	0.9 (1.1)	78	1.1 (1.3)	126.4 (181.1)	5.6 (NS) (18.8) 9NS)	49
<b>GASTROINTESTINAL DISEASES</b>											
Viral hepatitis (B15-19)	61	1.1 (1.1)	117	1.9 (2.0)	192	2.8 (3.3)	209	2.7 (3.5)	153.6 (233.4)	41.9 (74.1)	144
Hepatitis C (B18.2)	NC	NC (NC)	58	0.9 (1.0)	177	2.6 (3.0)	190	2.4 (3.2)	NC (NC)	160.9 (219.3)	NC
Malignant neoplasm of liver and intrahepatic bile ducts (C22)	108	1.9 (1.9)	130	2.1 (2.3)	200	2.7 (3.4)	302	3.7 (5.1)	98.0 (172.1)	81.3 (126.4)	190
<b>ENDOCRINE DISEASES AND OBESITY</b>											
Obesity (E66)	54	0.9 (1.0)	116	1.9 (2.0)	158	2.4 (2.7)	187	2.8 (3.2)	190.6 (237.0)	46.0 (57.1)	130
<b>CIRCULATORY DISEASES</b>											
Essential hypertension (I10)	27	0.5 (0.5)	47	0.7 (0.8)	52	0.7 (0.9)	71	1.0 (1.2)	104.5 (155.9)	28.9 (NS) (47.2) (NS)	43
Cardiomegaly (I42)	NA	NA	35	0.6 (0.6)	73	1.2 (1.2)	134	2.2 (2.3)	NA (NA)	281.3 (273.2)	NC

Table 8. (continued)

**INCREASED MORTALITY FROM ORGAN DISEASES AMONG NON-HISPANIC WHITES AGES 25-64 YEARS, KANSAS, 1995-2014**

CAUSE OF DEATH (ICD-10 CODE*)	1995–1999		2000–2004		2005–2009		2010–2014		RELATIVE INCREASE IN AGE-ADJUSTED MORTALITY RATE (%) §		EXCESS DEATHS FROM 2000–2004 TO 2010–2014
	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	FROM 1995–1999 TO 2010–2014	FROM 2000–2004 TO 2010–2014	
<b>RENAL CONDITIONS</b>											
Renal failure (N17-19)	115	2.0 (2.0)	187	3.0 (3.3)	261	3.7 (4.5)	291	3.8 (4.9)	88.2 (146.2)	25.6 (NS) (51.7)	170
Chronic renal failure (N18)	39	0.7 (0.7)	76	1.2 (1.3)	102	1.4 (1.7)	120	1.6 (2.0)	136.8 (199.4)	28.9 (NS) (53.9)	79
Acute renal failure (N17)	22	0.4 (0.4)	24	0.4 (0.4)	52	0.7 (0.9)	55	0.7 (0.9)	85.5 (NS) (143.3)	89.0 (NS) (123.4)	32
<b>INFECTIOUS DISEASES</b>											
Septicemia (A40-41)	125	2.2 (2.2)	213	3.4 (3.7)	275	3.9 (4.7)	322	4.4 (5.5)	100.3 (150.7)	28.0 (NS) (47.3)	191
<b>NEUROLOGIC DISEASES</b>											
Anoxic brain damage, not elsewhere classified (G93.1)	39	0.7 (0.7)	74	1.2 (1.3)	83	1.2 (1.4)	91	1.3 (1.5)	86.6 (127.1)	7.7 (NS) (19.9) (NS)	50
<b>GYNECOLOGIC DISEASES</b>											
Uterine cancer (C55)	47	0.8 (0.8)	79	1.3 (1.4)	60	0.8 (1.0)	108	1.4 (1.8)	73.8 (123.6)	12.9 (NS) (33.2) (NS)	59
										<b>TOTAL</b>	<b>1,415</b>

\* ICD-10 codes refer to deaths from 1999 forward. Deaths in 1995-1998 were classified under ICD-9 codes using the conversion dictionary provided in Table 2.

§ All mortality rate increases were statistically significant ( $p < 0.05$ ) unless otherwise noted as non-significant (NS).

NA=Not available.

NC=No conversion: deaths not reported because deaths during this period (1995-1999) were classified under ICD-9 codes that were not comparable to those in ICD-10. Increases in death rates from 1995-1999 (and calculations of excess deaths since that time period) therefore cannot be calculated and are also designated as "NC."

NS=Not statistically significant.

Table 9 provides the relative changes in mortality rates by region and, when available, by county. The table emphasizes SRC data (including drug overdoses, alcoholic liver disease, and suicide). Data for alcohol poisoning were suppressed due to small death counts by locality. See footnotes for information about increases in mortality from organ diseases (e.g., liver cancer, renal failure) and unintentional injuries that achieved statistical significance.

<b>Table 9.</b>											
<b>RELATIVE (%) INCREASES IN MORTALITY FROM STRESS-RELATED CONDITIONS AMONG NON-HISPANIC WHITES AGES 25-64 YEARS, KANSAS, BY REGION AND COUNTY</b>											
	POPULATION (WHITES AGES 25-54 YRS, 2010-2014)	SRC		DRUG OVERDOSE		ALCOHOLIC LIVER DISEASE		SUICIDE		OTHER STATISTICALLY SIGNIFICANT INCREASES	
		FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004
<b>EAST CENTRAL</b>	<b>2,246,072</b>	<b>114.6%*</b>	<b>50.5%*</b>	<b>338.9%*</b>	<b>98.8%*</b>	<b>69.4%*</b>	<b>62.5%*</b>	<b>74.9%*</b>	<b>29.6%*</b>	<b>Non-firearm suicide (89.8%*), including hanging† (186.6%*); suicide by firearm (60.9%*); alcoholic cirrhosis of liver (93.7%*)</b>	<b>Drug overdoses involving narcotics (65.1%*); suicide by firearm (52.0%*), including hanging† (56.0%*); alcoholic cirrhosis of liver (69.9%*)</b>
<b>Counties</b>											
Douglas County	224,476	158.0%* <sup>1</sup>	88.8%* <sup>2</sup>	NA	NA	NA	NA	92.7%	21.2%		
Johnson County	1,284,198	115.4%*	58.8%	424.6%*	106.7%*	47.2%	59.8%	83.9%*	43.8%*	Non-firearm suicide (93.2%), including hanging† (276.8%*); suicide by firearm (75.2%*); mental and behavioral disorders (120.5%*)	Hanging† (108.7%*); suicide by firearm (90.0%*)
Leavenworth County	173,145	177.7%*	104.1%*	NA	108.9%	NA	NA	122.8%*	107.5%		
Shawnee County	365,894	129.2%* <sup>3</sup>	32.0%	NA	105.5%*	137.5%*	47.0%	61.4%*	4.5%		
Wyandotte County	198,359	83.2%* <sup>4</sup>	32.9%	128.6%*	51.3%	78.9%	74.5%	63.0%	18.5%		

Table 9. (continued)

**RELATIVE (%) INCREASES IN MORTALITY FROM STRESS-RELATED CONDITIONS AMONG NON-HISPANIC WHITES AGES 25-64 YEARS, KANSAS, BY REGION AND COUNTY**

	POPULATION (WHITES AGES 25-54 YRS, 2010-2014)	SRC		DRUG OVERDOSE		ALCOHOLIC LIVER DISEASE		SUICIDE		OTHER STATISTICALLY SIGNIFICANT INCREASES	
		FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004
<b>SOUTH CENTRAL</b>	<b>1,657,266</b>	<b>96.2%*</b>	<b>53.7%*</b>	<b>689.3%*</b>	<b>90.6%*</b>	<b>20.4%</b>	<b>11.4%</b>	<b>26.6%*</b>	<b>36.4%*</b>	<b>Mental and behavioral disorders (81.8%*); hanging† (67.9%*);</b>	<b>Drug overdoses involving narcotics (93.9%*); non-firearm suicide (44.8%*); including hanging† (115.4%*)</b>
<b>Counties</b>											
Barber County	11,602	NA	NA	NA	NA	NA	NA	NA	NA		
Butler County	155,668	85.2%* <sup>5</sup>	79.7%*	NA	219.4%*	NA	NA	-16.3%	37.6%		
Chase County	6,315	NA	NA	NA	NA	NA	NA	NA	NA		
Cowley County	75,033	51.0%	28.6%	NA	NA	NA	NA	1.9%	-8.7%		
Harper County	13,173	NA	NA	NA	NA	NA	NA	NA	NA		
Harvey County	72,729	157.2%	101.6%	NA	NA	NA	NA	NA	NA		
Kingman County	18,475	NA	NA	NA	NA	NA	NA	NA	NA		
Marion County	27,850	NA	NA	NA	NA	NA	NA	NA	NA		
McPherson County	68,203	107.2%	49.1%	NA	NA	NA	NA	NA	NA		
Pratt County	21,401	NA	NA	NA	NA	NA	NA	NA	NA		
Reno County	141,121	79.8%	82.0%*	NA	NA	101.6%	NA	8.7%	10.2%		
Rice County	20,682	NA	NA	NA	NA	NA	NA	NA	NA		
Sedgwick County	959,947	94.8%*	44.5%*	597.2%*	50.2%*	-7.4%	-6.6%	34.0%*	47.4%* <sup>6</sup>	Hanging† (96.9%*)	Hanging† (131.8%*); suicide by firearm (62.5%*); falls (130.7%*)
Stafford County	9,290	NA	NA	NA	NA	NA	NA	NA	NA		
Sumner County	55,777	148.0% <sup>8</sup>	115.8% <sup>9</sup>	NA	NA	NA	NA	14.1%	31.7%		

Table 9. (continued)

**RELATIVE (%) INCREASES IN MORTALITY FROM STRESS-RELATED CONDITIONS AMONG NON-HISPANIC WHITES AGES 25-64 YEARS, KANSAS, BY REGION AND COUNTY**

	POPULATION (WHITES AGES 25-54 YRS, 2010-2014)	SRC		DRUG OVERDOSE		ALCOHOLIC LIVER DISEASE		SUICIDE		OTHER STATISTICALLY SIGNIFICANT INCREASES	
		FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004
<b>SOUTHEAST</b>	<b>716,284</b>	<b>147.0%*</b>	<b>65.1%*</b>	<b>1063.5%*</b>	<b>220.4%*</b>	<b>104.9%*</b>	<b>57.1%</b>	<b>37.3%</b>	<b>7.4%</b>	<b>Hanging† (147.5%*)</b>	<b>Drug overdoses involving narcotics (280.5%*)</b>
<b>Counties</b>											
Allen County	30,307	133.3%	NA	NA	NA	NA	NA	23.5%	NA		
Anderson County	18,144	20.0%	NA	NA	NA	NA	NA	NA	NA		
Bourbon County	33,075	NA	38.5%	NA	NA	NA	NA	NA	NA		
Chautauqua County	7,718	NA	NA	NA	NA	NA	NA	NA	NA		
Cherokee County	49,945	308.6%*	101.5%	NA	NA	NA	NA	NA	-1.3%		
Coffey County	20,981	NA	NA	NA	NA	NA	NA	NA	NA		
Crawford County	81,772	172.5%*	52.4%	NA	NA	NA	NA	23.5%	-36.3%		
Elk County	6,184	NA	NA	NA	NA	NA	NA	NA	NA		
Franklin County	61,971	146.2%	101.0%	NA	NA	NA	NA	NA	NA		
Greenwood County	15,258	NA	NA	NA	NA	NA	NA	NA	NA		
Labette County	47,161	46.6%	13.7%	NA	NA	NA	NA	NA	NA		
Linn County	23,113	NA	NA	NA	NA	NA	NA	NA	NA		
Lyon County	59,613	201.5%*	91.3%	NA	NA	NA	NA	66.7%	27.2%		
Miami County	82,098	216.9%*	38.9%	NA	NA	NA	NA	NA	19.6%		
Montgomery County	72,322	70.9%	15.3%	NA	35.7%	NA	NA	4.3%	-15.0%		
Neosho County	37,399	NA	31.2%	NA	NA	NA	NA	NA	NA		
Osage County	39,624	NA	44.7%	NA	NA	NA	NA	NA	NA		
Wilson County	21,635	NA	NA	NA	NA	NA	NA	NA	NA		
Woodson County	7,964	NA	NA	NA	NA	NA	NA	NA	NA		

Table 9. (continued)

**RELATIVE (%) INCREASES IN MORTALITY FROM STRESS-RELATED CONDITIONS AMONG NON-HISPANIC WHITES AGES 25-64 YEARS, KANSAS, BY REGION AND COUNTY**

	POPULATION (WHITES AGES 25-54 YRS, 2010-2014)	SRC		DRUG OVERDOSE		ALCOHOLIC LIVER DISEASE		SUICIDE		OTHER STATISTICALLY SIGNIFICANT INCREASES	
		FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004
<b>SOUTHWEST</b>	<b>217,838</b>	<b>104.5%*</b>	<b>73.3%</b>	<b>NA</b>	<b>NA</b>	<b>5.3%</b>	<b>24.6%</b>	<b>90.9%*</b>	<b>45.8%</b>		
<b>Counties</b>											
Clark County	4,536	NA	NA	NA	NA	NA	NA	NA	NA		
Comanche County	4,232	NA	NA	NA	NA	NA	NA	NA	NA		
Edwards County	6,309	NA	NA	NA	NA	NA	NA	NA	NA		
Finney County	45,702	59.5%	115.2%	NA	NA	NA	NA	-3.9%	NA		
Ford County	39,604	157.4%	111.9%	NA	NA	NA	NA	NA	NA		
Grant County	11,142	NA	NA	NA	NA	NA	NA	NA	NA		
Gray County	12,738	NA	NA	NA	NA	NA	NA	NA	NA		
Hamilton County	4,644	NA	NA	NA	NA	NA	NA	NA	NA		
Haskell County	7,541	NA	NA	NA	NA	NA	NA	NA	NA		
Hodgeman County	4,331	NA	NA	NA	NA	NA	NA	NA	NA		
Kearny County	6,715	NA	NA	NA	NA	NA	NA	NA	NA		
Kiowa County	5,615	NA	NA	NA	NA	NA	NA	NA	NA		
Meade County	8,728	NA	NA	NA	NA	NA	NA	NA	NA		
Morton County	5,906	NA	NA	NA	NA	NA	NA	NA	NA		
Pawnee County	16,098	NA	NA	NA	NA	NA	NA	NA	NA		
Seward County	21,337	NA	NA	NA	NA	NA	NA	NA	NA		
Stanton County	3,329	NA	NA	NA	NA	NA	NA	NA	NA		
Stevens County	9,331	NA	NA	NA	NA	NA	NA	NA	NA		

Table 9. (continued)

**RELATIVE (%) INCREASES IN MORTALITY FROM STRESS-RELATED CONDITIONS AMONG NON-HISPANIC WHITES AGES 25-64 YEARS, KANSAS, BY REGION AND COUNTY**

	POPULATION (WHITES AGES 25-54 YRS, 2010-2014)	SRC		DRUG OVERDOSE		ALCOHOLIC LIVER DISEASE		SUICIDE		OTHER STATISTICALLY SIGNIFICANT INCREASES	
		FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004
<b>NORTH CENTRAL</b>	<b>234,025</b>	<b>157.8%*</b>	<b>70.1%*</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>102.8%</b>	<b>113.8%*</b>	<b>42.9%</b>	<b>Suicide by firearm (132.7%*)</b>	
<b>Counties</b>											
Barton County	58,948	298.3%*	148.5%	NA	NA	NA	NA	NA	140.2%		
Ellis County	63,182	154.2%	45.1%	NA	NA	NA	NA	NA	39.3%		
Ellsworth County	15,237	NA	NA	NA	NA	NA	NA	NA	NA		
Jewell County	7,128	NA	NA	NA	NA	NA	NA	NA	NA		
Lincoln County	7,721	NA	NA	NA	NA	NA	NA	NA	NA		
Mitchell County	14,634	NA	NA	NA	NA	NA	NA	NA	NA		
Osborne County	8,835	NA	NA	NA	NA	NA	NA	NA	NA		
Phillips County	13,142	NA	NA	NA	NA	NA	NA	NA	NA		
Rooks County	12,407	NA	NA	NA	NA	NA	NA	NA	NA		
Rush County	7,716	NA	NA	NA	NA	NA	NA	NA	NA		
Russell County	16,234	NA	NA	NA	NA	NA	NA	NA	NA		
Smith County	8,841	NA	NA	NA	NA	NA	NA	NA	NA		
<b>NORTHEAST</b>	<b>705,509</b>	<b>111.5%*</b>	<b>54.8%*</b>	<b>NA</b>	<b>130.9%*</b>	<b>78.4%</b>	<b>21.1%</b>	<b>51.8%*</b>	<b>38.0%</b>	<b>Non-firearm suicide (123.6%*)</b>	
<b>Counties</b>											
Atchison County	35,361	NA	64.5%	NA	NA	NA	NA	NA	NA		
Brown County	21,162	NA	NA	NA	NA	NA	NA	NA	NA		
Clay County	19,939	NA	NA	NA	NA	NA	NA	NA	NA		
Cloud County	20,964	NA	NA	NA	NA	NA	NA	NA	NA		
Dickinson County	46,242	NA	64.7%	NA	NA	NA	NA	NA	NA		
Doniphan County	18,205	NA	NA	NA	NA	NA	NA	NA	NA		
Geary County	52,914	65.4%	64.3%	NA	NA	NA	NA	19.5%	21.5%		
Jackson County	29,789	NA	NA	NA	NA	NA	NA	NA	NA		
Jefferson County	48,046	93.4%	120.6%	NA	NA	NA	NA	NA	NA		
Marshall County	24,123	NA	NA	NA	NA	NA	NA	NA	NA		
Morris County	13,631	NA	NA	NA	NA	NA	NA	NA	NA		

Table 9. (continued)

**RELATIVE (%) INCREASES IN MORTALITY FROM STRESS-RELATED CONDITIONS AMONG NON-HISPANIC WHITES AGES 25-64 YEARS, KANSAS, BY REGION AND COUNTY**

	POPULATION (WHITES AGES 25-54 YRS, 2010-2014)	SRC		DRUG OVERDOSE		ALCOHOLIC LIVER DISEASE		SUICIDE		OTHER STATISTICALLY SIGNIFICANT INCREASES	
		FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004
<b>NORTHEAST</b>	<b>705,509</b>	<b>111.5%*</b>	<b>54.8%*</b>	<b>NA</b>	<b>130.9%*</b>	<b>78.4%</b>	<b>21.1%</b>	<b>51.8%*</b>	<b>38.0%</b>	<b>Non-firearm suicide (123.6%*)</b>	
<b>Counties</b>											
Nemaha County	23,186	NA	NA	NA	NA	NA	NA	NA	NA		
Ottawa County	15,039	NA	NA	NA	NA	NA	NA	NA	NA		
Pottawatomie County	51,838	NA	7.8%	NA	NA	NA	NA	NA	NA		
Republic County	11,352	NA	NA	NA	NA	NA	NA	NA	NA		
Riley County	122,202	53.8%	-14.9%	NA	NA	NA	NA	22.9%	7.2%		
Saline County	120,875	135.8%*	57.8%	NA	NA	NA	-5.0%	75.1%	80.0%		
Wabaunsee County	17,562	NA	NA	NA	NA	NA	NA	NA	NA		
Washington County	13,079	NA	NA	NA	NA	NA	NA	NA	NA		
<b>NORTHWEST</b>	<b>126,056</b>	<b>86.9%</b>	<b>46.2%</b>	<b>NA</b>	<b>NA</b>	<b>5.0%</b>	<b>NA</b>	<b>48.6%</b>	<b>14.7%</b>	<b>Non-firearm suicide (123.6%*)</b>	
<b>Counties</b>											
Cheyenne County	5,901	NA	NA	NA	NA	NA	NA	NA	NA		
Decatur County	6,849	NA	NA	NA	NA	NA	NA	NA	NA		
Gove County	6,149	NA	NA	NA	NA	NA	NA	NA	NA		
Graham County	5,899	NA	NA	NA	NA	NA	NA	NA	NA		
Greeley County	2,704	NA	NA	NA	NA	NA	NA	NA	NA		
Lane County	3,983	NA	NA	NA	NA	NA	NA	NA	NA		
Logan County	6,565	NA	NA	NA	NA	NA	NA	NA	NA		
Ness County	6,839	NA	NA	NA	NA	NA	NA	NA	NA		
Norton County	13,419	NA	NA	NA	NA	NA	NA	NA	NA		
Rawlins County	5,942	NA	NA	NA	NA	NA	NA	NA	NA		
Scott County	10,348	NA	NA	NA	NA	NA	NA	NA	NA		
Sheridan County	5,838	NA	NA	NA	NA	NA	NA	NA	NA		
Sherman County	13,001	NA	NA	NA	NA	NA	NA	NA	NA		
Thomas County	17,889	NA	NA	NA	NA	NA	NA	NA	NA		
Trego County	7,338	NA	NA	NA	NA	NA	NA	NA	NA		

**Table 9. (continued)**

**RELATIVE (%) INCREASES IN MORTALITY FROM STRESS-RELATED CONDITIONS AMONG NON-HISPANIC WHITES AGES 25-64 YEARS, KANSAS, BY REGION AND COUNTY**

	POPULATION (WHITES AGES 25-54 YRS, 2010-2014)	SRC		DRUG OVERDOSE		ALCOHOLIC LIVER DISEASE		SUICIDE		OTHER STATISTICALLY SIGNIFICANT INCREASES	
		FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004	FROM 1995-1999	FROM 2000-2004
Wallace County	3,303	NA	NA	NA	NA	NA	NA	NA	NA		
Wichita County	4,089	NA	NA	NA	NA	NA	NA	NA	NA		

\* Statistically significant (p<0.05).

NA = *Inadequate data for calculations.*

SRC = *Stress-related conditions.*

Not reported here are significant increases between 1995-1999 and 2010-2014 in mortality (among NH whites ages 25-64 years) from uterine cancer (164.6%) and renal failure (88.5%) in the East Central region; from non-transport accidents excluding poisoning (48.3%) (including falls [109.0%]), obesity (133.6%), sepsis (175.3%), viral hepatitis (148.0%), liver cancer (161.6%), respiratory diseases (24.6%), digestive diseases (46.7%), anoxic brain damage (188.7%), and genitourinary diseases (63.8%) (including renal failure [130.2%]) in the South Central region; from all-causes (11.5%), sepsis (107.6%), liver cancer (145.0%), respiratory diseases (44.5%) (including chronic lower respiratory disease [40.2%]), and digestive diseases (80.2%) in the Southeast region; from endocrine diseases (138.1%) in the Southwest region; and from endocrine diseases (57.7%\*) in the Northeast region. Also not reported here are significant increases in mortality between 1995-1999 and 2010-2014 in Sedgwick County from liver cancer (394.5%), sepsis (214.0%), and renal failure (136.5%).

<sup>1</sup> Increase of 177.1% among NH whites ages 30-59 years (p < 0.05).

<sup>2</sup> Increase of 92.8% among NH whites ages 30-59 years (p < 0.05).

<sup>3</sup> Increase of 150.9% among NH whites ages 30-59 years (p < 0.05).

<sup>4</sup> Increase of 108.1% among NH whites ages 30-59 years (p < 0.05).

<sup>5</sup> Increase of 94.1% among NH whites ages 30-59 years (p < 0.05).

<sup>6</sup> Increase of 55.7% among NH whites ages 30-59 years (p < 0.05).

<sup>7</sup> Increase of 145.5% among NH whites ages 30-59 years (p < 0.05).

<sup>8</sup> Increase of 214.6% among NH whites ages 30-59 years (p < 0.05).

<sup>9</sup> Increase of 164.7% among NH whites ages 30-59 years (p < 0.05).

We examined place-based data for each region and county (Table 10). For each location we examined population size and 29 other place-based characteristics covering seven domains: demographic characteristics, educational attainment, income and employment, housing, transportation, environment, and access to health care.

Table 10.

## PLACE-BASED CHARACTERISTICS OF REGIONS AND COUNTIES IN KANSAS

LOCATIONS	SRC MORTALITY			GEOGRAPHY		DEMOGRAPHICS			EDUCATIONAL ATTAINMENT		
	SRC MORTALITY (PER 100,000) (2010-2014)	INCREASE (%) IN SRC MORTALITY		SIZE OF POP.	RURILITY	DIVERSITY INDEX	FOREIGN BORN	SINGLE PARENTS	HIGH SCHOOL OR MORE	SOME COLLEGE+	BACH+
		FROM 1995-1999 TO 2010-2014	FROM 2000-2004 TO 2010-2014								
<b>REGIONS</b>											
East Central	42.5	114.6%*	50.5%*	2,246,072	8.7	42.5	8.1	29.0	74.4	70.0	41.2
North Central	45.5	157.8%*	70.1%*	234,025	49.0	12.2	3.0	29.0	67.0	57.9	22.8
Northeast	40.3	111.5%*	54.8%*	705,509	43.7	18.8	3.7	27.9	68.9	59.0	25.5
Northwest	40.4	86.9%	46.2%	126,056	70.5	18.5	3.8	21.7	64.6	56.7	21.3
South Central	50.9	96.2%*	53.7%*	1,657,266	21.8	21.4	6.2	30.3	66.8	61.2	26.8
Southeast	55.4	147.0%*	65.1%*	716,284	51.7	17.9	2.5	30.3	62.8	55.5	20.5
Southwest	43.9	104.5%*	73.3%*	217,838	39.4	38.4	20.0	28.7	46.5	48.2	18.0
<b>COUNTIES</b>											
Barton County	59.7	298.3%*	148.5%	58,948	31.8	29.5	5.9	31.4	55.7	53.6	11.3
Butler County	50.0	85.2%*	79.7%*	155,668	40.5	18.2	2.1	24.3	74.8	66.2	1.1
Cherokee County	70.2	308.6%*	101.5%	49,945	49.1	20.5	1.1	25.0	61.9	52.5	2.6
Crawford County	45.1	172.5%*	52.4%	81,772	34.9	21.8	3.3	29.7	69.5	61.5	2.2
Douglas County	45.9	158.0%*	88.8%*	224,476	11.0	34.3	6.6	28.9	81.7	75.0	0.7
Johnson County	33.8	115.4%*	58.8%*	1,284,198	3.8	33.0	8.2	21.5	84.0	80.3	0.1
Leavenworth County	52.8	177.7%*	104.1%*	173,145	29.1	35.3	3.5	25.5	66.2	60.3	0.9
Lyon County	63.3	201.5%*	91.3%	59,613	26.3	43.1	9.8	33.6	56.8	52.8	26.9
Miami County	45.4	216.9%*	38.9%	82,098	51.0	12.9	0.7	24.9	71.6	62.0	4.4
Saline County	47.8	135.8%*	57.8%	120,875	14.6	32.8	5.5	39.4	60.6	55.9	1.9
Sedgwick County	52.7	94.8%*	44.5%*	959,947	7.7	48.9	8.5	32.6	67.1	62.0	0.5
Shawnee County	57.2	129.2%*	32.0%	365,894	15.8	41.6	4.5	35.8	65.0	59.3	0.3
Wyandotte County	61.5	83.2%*	32.9%	198,359	6.1	68.3	15.0	48.2	48.3	45.8	0.0

**Table 10. (continued)**

**PLACE-BASED CHARACTERISTICS OF REGIONS AND COUNTIES IN KANSAS**

LOCATIONS	HOUSEHOLD ECONOMIC CONDITIONS						HOUSING				
	MEDIAN HOUSEHOLD INCOME (\$)	POVERTY RATES			INEQUALITY	UN-EMPLOYMENT	HOUSING DISREPAIR	OVER-CROWDING	PRE-1950 HOUSING	HOUSING COST BURDEN	
		ALL AGES	CHILDREN	AGES 18-64	GINI INDEX					RENTING	OWNER-SHIP
<b>REGIONS</b>											
East Central	56,156	12.2	15.4	11.7	0.4	4.4	14.6	1.7	14.0	50.2	21.2
North Central	45,331	14.8	17.5	15.1	0.4	3.3	10.0	1.2	38.1	50.7	17.3
Northeast	49,332	15.0	17.1	15.4	0.4	4.4	13.4	2.8	30.0	52.1	19.2
Northwest	48,767	10.4	15.9	10.3	0.4	2.8	9.4	1.3	35.9	46.9	14.7
South Central	51,249	14.1	18.7	12.9	0.4	4.9	13.0	1.6	24.3	49.6	19.6
Southeast	43,580	16.6	22.3	16.6	0.4	5.4	13.1	1.7	35.9	54.2	19.6
Southwest	52,262	15.3	20.5	13.4	0.4	3.4	13.0	3.9	25.0	42.4	17.5
<b>COUNTIES</b>											
Barton County	46,942	16.0	22.0	15.4	0.5	3.5	9.3	1.9	32.8	47.3	13.0
Butler County	60,123	9.3	14.0	8.5	0.4	4.9	10.3	1.2	19.3	45.5	21.0
Cherokee County	40,686	17.9	27.4	16.3	0.4	5.0	11.4	1.2	37.5	50.3	17.9
Crawford County	38,491	21.7	25.0	24.8	0.5	5.3	16.2	3.1	32.2	62.9	18.4
Douglas County	49,246	18.5	15.3	21.8	0.5	4.1	21.7	1.5	12.7	56.4	23.0
Johnson County	76,104	6.5	8.0	6.2	0.4	3.8	11.7	1.2	6.4	45.2	20.2
Leavenworth County	65,549	10.8	14.0	9.3	0.4	5.0	13.1	1.2	22.2	41.7	20.7
Lyon County	43,038	22.1	21.1	22.7	0.4	5.2	16.7	2.0	33.2	50.9	17.6
Miami County	63,924	9.3	12.1	8.2	0.4	4.7	12.8	0.9	21.2	64.2	24.6
Saline County	48,460	17.6	18.6	15.1	0.4	4.2	13.7	1.8	24.3	52.1	21.8
Sedgwick County	51,175	15.1	19.4	13.7	0.4	5.4	14.2	1.9	17.4	50.9	20.2
Shawnee County	52,795	16.3	20.8	15.8	0.4	4.8	14.7	1.9	20.9	53.3	17.9
Wyandotte County	37,087	24.3	34.5	20.5	0.4	6.9	20.8	3.4	29.7	58.6	29.5

**Table 10. (continued)**

**PLACE-BASED CHARACTERISTICS OF REGIONS AND COUNTIES IN KANSAS**

LOCATIONS	TRANSPORTATION				ENVIRONMENT			HEALTH CARE		
	NO VEHICLE	COMMUTING			OZONE DAYS	VIOLENT CRIME	LOW FOOD ACCESS	HEALTH INSURANCE COVERAGE		
		MOTOR VEHICLE	WALK/BIKE	PUBLIC TRANSIT				UN-INSURED	PRIVATE (ONLY)	PUBLIC (ONLY)
<b>REGIONS</b>										
East Central	1.7	93.1	2.0	0.7	23	0.3	23.1	11.6	62.8	11.0
North Central	1.8	91.5	3.9	0.4	6	0.3	26.4	10.7	54.9	13.9
Northeast	2.0	88.9	4.9	0.3	12	0.3	30.0	10.3	60.4	11.4
Northwest	1.7	88.3	4.7	0.0	3	0.2	49.0	10.7	55.2	12.7
South Central	2.0	94.0	2.1	0.4	17	0.5	27.4	12.6	56.6	14.5
Southeast	1.9	92.7	3.5	0.2	20	0.3	23.1	13.3	51.8	16.0
Southwest	1.6	92.5	3.4	0.3	4	0.3	34.5	16.5	54.9	15.2
<b>COUNTIES</b>										
Barton County	1.6	93.4	3.0	0.4	10	0.4	23.0	15.1	49.0	18.1
Butler County	1.5	95.4	1.2	0.0	23	0.2	24.6	9.8	61.2	12.5
Cherokee County	2.2	93.8	2.7	0.0	24	0.3	16.2	14.5	47.4	19.0
Crawford County	1.4	93.6	3.4	0.2	23	0.3	30.3	14.8	54.9	15.5
Douglas County	2.5	87.7	6.4	2.0	26	0.4	13.3	12.5	66.2	8.1
Johnson County	1.1	93.3	1.0	0.4	21	0.2	22.0	8.2	71.5	7.4
Leavenworth County	1.5	94.5	2.6	0.1	27	0.5	19.5	9.1	60.2	9.8
Lyon County	2.7	91.2	5.0	0.1	19	0.3	9.9	16.3	53.8	14.8
Miami County	1.7	94.0	1.7	0.0	22	0.2	10.6	9.6	60.7	9.7
Saline County	2.2	93.9	2.4	0.4	9	0.4	20.5	14.0	54.9	14.1
Sedgwick County	2.1	95.0	1.4	0.5	27	0.6	29.1	13.7	56.7	15.0
Shawnee County	2.7	94.2	2.1	0.7	21	0.5	26.9	12.0	54.1	14.2
Wyandotte County	2.6	95.1	1.8	1.2	22	0.6	31.0	24.0	40.4	22.2

\* p < 0.05.

NC = not calculable

RUCC = Rural-Urban Continuum Codes

SRC mortality = age-adjusted deaths per 100,000 from stress-related conditions (combined deaths from drug overdoses, alcohol poisoning, alcoholic liver disease, and suicides)

See text for definitions of variables and units of analysis. Most place-based values are percentages, with the exception of population counts, indices, income levels, and ratios.

Characteristics of interest included not only the rurality of the counties and the demographic characteristics of their populations but also the socioeconomic status and physical and social environment. Of special interest was identifying the features that differentiated counties with the largest relative increases in SRC mortality from those with more modest increases. We then examined how strongly these factors correlated with absolute SRC mortality rates and the relative change in SRC mortality rates between 1995-1999 and 2010-2014.

As shown by the Pearson correlation coefficients in Table 11, we found that absolute SRC mortality rates (in 2010-2014) among whites ages 25-64 years correlated most strongly (correlation coefficients greater than  $\pm 0.50$ ) at the region level with poverty, unemployment, and violent crime; reliance on public insurance (e.g., Medicaid) for health care and the use of motor vehicles to commute to work; and the proportion of households with children headed by single parents. At the county level, SRC mortality rates correlated inversely with population size, educational attainment, and median household income and correlated positively with poverty and the lack of a vehicle or health insurance.

The largest relative increases in SRC mortality between 1995 and 2014 occurred in regions with lower household incomes, greater poverty and income inequality, and a larger proportion of single-parent households. Counties with the largest relative increases were more rural and had older (pre-1950) housing stock.<sup>f</sup>

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<sup>f</sup> Although many of these correlations are intuitive and consistent with evidence about the social determinants of health (e.g., greater mortality in populations with less education and income), some counterintuitive findings should be interpreted with caution due to potential biases when U.S. Census Bureau indicators are applied to rural areas like those dominating much of Kansas. For example, rurality is defined as the percentage of the population not living in an urbanized area (50,000 or more population) or an “urban cluster” (population of 2,500-50,000 people). A county with a high proportion of residents living in one large city or multiple smaller clusters would be classified by the U.S. Census Bureau as mostly urban, even if most of the land area is sparsely populated. Low food access in a rural area is defined by the percentage of the population living more than 10 miles from a grocery store. Whereas distance from a grocery store can be a useful measure of low food access (e.g., food deserts) in urban areas, in rural Kansas it may not accurately distinguish between populations with more or less access to healthy foods.

**Table 11.**

**CORRELATIONS BETWEEN PLACE-BASED CHARACTERISTICS AND ABSOLUTE AND RELATIVE (%) INCREASES IN MORTALITY FROM STRESS-RELATED CONDITIONS (SRC) BETWEEN 1995-1999 AND 2010-2014**

	CORRELATION COEFFICIENTS			
	REGIONS		COUNTIES*	
	Correlation With SRC Mortality Rate	Correlation With Increase in SRC Mortality Rate Between 1995-99 and 2010-14	Correlation With SRC Mortality Rate	Correlation With Increase in SRC Mortality Rate Between 1995-99 and 2010-14
Relative increase in SRC mortality between 1995-1999 and 2010-2014	0.44	1.00	0.45	1.00
Relative increase in SRC mortality between 2000-2004 and 2010-2014	0.34	0.61	0.33	0.68
SRC mortality (deaths per 100,000), 2010-2014	1.00	0.44	1.00	0.45
Size of population	0.16	-0.15	-0.51	-0.48
Rurality	-0.09	0.08	0.27	0.64
Diversity index	-0.25	-0.36	0.28	-0.47
Foreign-born population	-0.19	-0.34	0.11	-0.44
Single-parent households	0.63	0.52	0.38	-0.31
High school degree or more education	-0.10	0.13	-0.78	-0.24
Some college or more education	-0.12	-0.02	-0.82	-0.31
Bachelor's degree or more education (%)	-0.21	-0.09	-0.75	-0.39
Median household income	-0.48	-0.62	-0.65	-0.23
Poverty				
<i>All ages</i>	0.60	0.61	0.55	0.09
<i>Children</i>	0.78	0.36	0.72	0.15
<i>Ages 18-64</i>	0.53	0.76	0.39	0.13
Income inequality (Gini index)	0.08	0.52	-0.30	-0.13
Unemployment	0.71	0.23	0.42	-0.35
Housing disrepair	0.20	-0.05	0.02	-0.36
Overcrowding	-0.23	-0.27	0.22	-0.24
Pre-1950 housing	0.18	0.41	0.78	0.60
Housing cost burden				
<i>Renting</i>	0.43	0.56	-0.09	0.00
<i>Ownership</i>	0.36	0.23	-0.20	-0.56

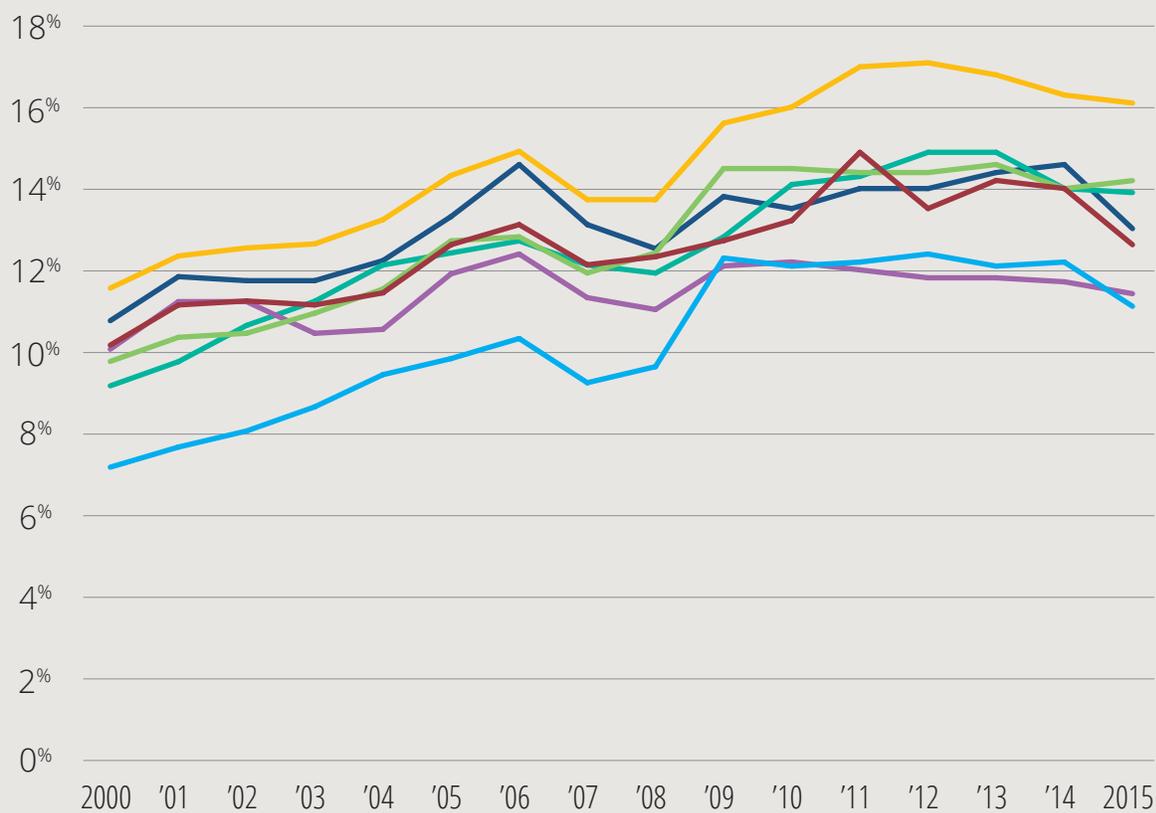
**Table 11. (continued)**

**CORRELATIONS BETWEEN PLACE-BASED CHARACTERISTICS AND ABSOLUTE AND RELATIVE (%) INCREASES IN MORTALITY FROM STRESS-RELATED CONDITIONS (SRC) BETWEEN 1995-1999 AND 2010-2014**

	CORRELATION COEFFICIENTS			
	REGIONS		COUNTIES*	
	Correlation With SRC Mortality Rate	Correlation With Increase in SRC Mortality Rate Between 1995-99 and 2010-14	Correlation With SRC Mortality Rate	Correlation With Increase in SRC Mortality Rate Between 1995-99 and 2010-14
No vehicle	0.36	0.09	0.60	-0.06
Commuting				
<i>By motor vehicle</i>	0.66	0.23	0.13	-0.22
<i>By walking/cycling</i>	-0.41	0.04	0.17	0.33
<i>By public transit</i>	-0.02	0.16	-0.13	-0.33
Ozone days	0.46	0.18	-0.06	-0.26
Violent crime	0.55	-0.06	0.34	-0.29
Low food access	-0.54	-0.64	-0.05	-0.50
Health insurance				
<i>Uninsured</i>	0.34	-0.10	0.58	-0.01
<i>Private (only)</i>	-0.60	-0.31	-0.82	-0.27
<i>Public (only)</i>	0.78	0.31	0.76	0.20
*Data are only from counties that experienced a statistically significant increase in SRC mortality rates between 1995-1999 and 2010-2014. See caveats in footnote f on page 30 about interpretation of these place-based indicators in rural Kansas communities.				

We examined changes in socioeconomic conditions over time. Regions of Kansas with the largest relative increases in SRC mortality among NH whites ages 25-64 years experienced periods of increasing poverty (Figure 1), but income alone did not explain the increasing mortality rates. As shown in the issue brief, although two regions with the highest relative increase in SRC mortality (North Central and Southeast) consistently had the lowest median household income levels, dating back to 1969, the East Central region—which had the third highest increase in SRC mortality—had the highest income levels in the state.

**Figure 1. Regional Poverty Rates in Kansas, 2000-2015**



REGIONS	(% Increase in SRC Mortality, from 1995-1999 to 2010-2014)
Southeast	147.0% increase
Southwest	104.5% increase
Northeast	111.5% increase
South Central	96.2% increase
North Central	157.8% increase
East Central	114.6% increase
Northwest	86.9% increase

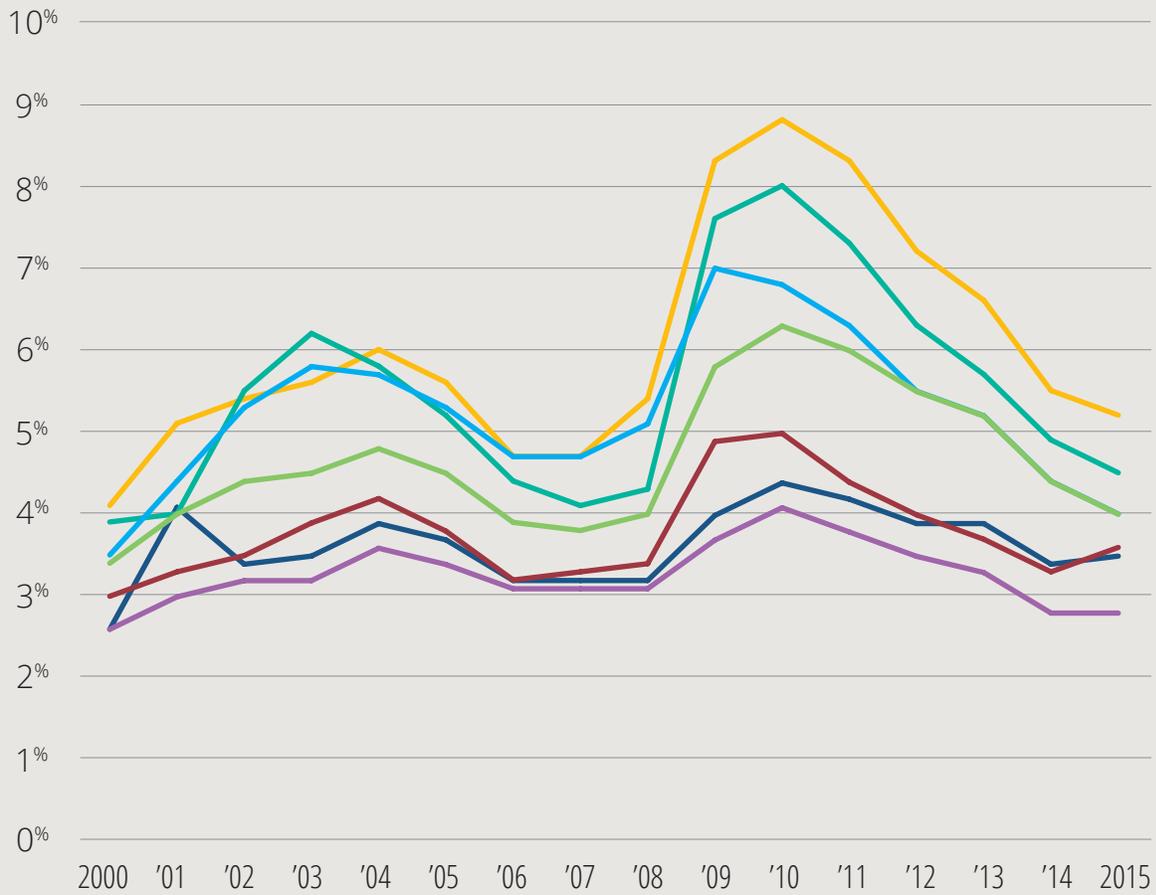
SRC=Stress-related conditions.

\*Percentages shown in parentheses in the legend refer to the relative increase in mortality from stress-related conditions in the region among NH whites ages 25-64 years between 1995-1999 and 2010-2014.

Source: Data obtained from U.S. Census Bureau, Small Area Income and Poverty Estimates (SAIPE) Program, 1999-2015 (<https://www.census.gov/did/www/saipe/data/statecounty/data/index.html>); U.S Census Bureau, Historical Income Tables, Counties, Table C4 (<https://www.census.gov/data/tables/time-series/dec/historical-income-counties.html>)

Similarly, although regions with high relative increases in SRC mortality (e.g., North Central) experienced weaker recoveries in employment rates after the 2007 recession, other impacted regions (e.g., Southeast) experienced stronger rebounds (Figure 2).

**Figure 2. Regional Unemployment Rates in Kansas, 2000-2015**



REGIONS (% Increase in SRC Mortality, from 1995-1999 to 2010-2014)	
■ Southeast	(147.0% increase)
■ Southwest	(104.5% increase)
■ Northeast	(111.5% increase)
■ South Central	(96.2% increase)
■ North Central	(157.8% increase)
■ East Central	(114.6% increase)
■ Northwest	(86.9% increase)

SRC=Stress-related conditions.

\*Percentages shown in parentheses in the legend refer to the relative increase in mortality from stress-related conditions in the region among NH whites ages 25-64 years between 1995-1999 and 2010-2014.

Source: Data obtained from U.S. Bureau of Labor Statistics. Local Area Unemployment Statistics (LAUS), Labor force data by county, 2000-2015 annual averages.

## CONCLUSIONS

The evidence reported here should be interpreted with caution and with an awareness of potential limitations. The data rely on reported causes of death, which are subject to well-documented errors and biases. Coding practices changed over time, including the way overdose deaths were classified. The stigma associated with substance abuse and suicide may also have influenced SRC mortality trends. Small death counts limit the interpretability of relative increases in death rates, especially at the local level. This report focuses on the white population and examines data through 2014. Mortality trends in populations of color, including data from more recent years, require equally careful study. Notably, we observed that the all-cause mortality rate among American Indian and Alaskan Natives (of all ages) in Kansas increased by 28.2% between 1995-1999 and 2010-2014.

As discussed in the issue brief, the subject of this study—the rise in death rates from certain causes in the NH white population of Kansas—should not distract attention from addressing the causes of historic and deeper inequities that have undermined the health of other racial groups. The factors responsible for mortality trends in the white populations signal disturbing health trends that should be monitored in other racial groups. This report helps underscore the importance of addressing the root causes of poor health—including social, economic, and environmental conditions—and of adopting policy solutions that can ensure opportunities for good health among Kansans of all backgrounds.

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