

Table 26. Total number of injury deaths by mechanism and intent of death and total mentions of nature of injury as classified in ICD-10 mortality diagnosis matrix: United States, 2002

Mechanism and intent of death (Based on the <i>International Classification of Diseases, Tenth Revision, 1992</i>)	Total injury deaths	Total mentions of injury	Fracture	Dislocation	Internal organ injury	Open wound	Amputation	Blood vessel	Superficial and contusion	Crushing	Burn	Foreign body ¹	Other effects of external causes	Poisoning	Toxic effects	Multiple injuries	Other specified ² injury	Unspecified injury
All injury (*U01-U03,Y01-Y36, Y85-Y87,Y89) ³	161,269	247,195	20,665	528	26,254	42,295	177	2,475	688	925	3,212	4,730	18,076	41,323	8,709	2,216	4,872	70,050
Unintentional (V01-X59, Y85-Y86)	106,742	163,997	19,564	507	19,868	1,899	141	1,466	591	898	2,801	4,625	9,381	28,780	6,043	1,915	3,622	61,896
Suicide (*U03,X60-X84, Y87.0) ³	31,655	45,181	555	8	2,664	21,214	24	206	22	13	188	47	7,014	7,419	2,131	73	440	3,163
Homicide (*U01-U02, X85-Y09, Y87.1) ³	17,638	29,877	418	9	3,266	18,482	8	771	58	9	154	42	1,202	117	152	208	728	4,253
Undetermined (Y10-Y34, Y87.2, Y89.9)	4,830	7,523	128	4	379	305	4	14	17	5	68	15	468	4,962	383	17	64	690
Legal intervention/ war (Y35-Y36, Y89[.0,.1])	404	617	-	-	77	395	-	18	-	-	1	1	11	45	-	3	18	48
Cut/pierce (W25-W29, W45, X78, X99, Y28, Y35.4)	2,762	6,492	24	1	353	4,657	5	297	6	-	17	10	53	22	6	18	227	796
Unintentional (W25-W29, W45)	109	183	9	1	17	47	1	26	1	-	4	1	18	1	1	3	4	49
Suicide (X78)	566	1,234	1	-	29	851	1	77	-	-	2	3	5	20	2	1	45	197
Homicide (X99)	2,074	5,053	14	-	307	3,742	3	193	5	-	11	6	30	1	3	14	178	546
Undetermined (Y28)	13	22	-	-	-	17	-	1	-	-	-	-	-	-	-	-	-	4
Legal intervention/war (Y35.4)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Drowning (W65-W74, X71, X92, Y21)	4,146	4,642	17	-	41	21	-	-	8	-	3	17	4,201	159	30	2	10	133
Unintentional (W65-W74)	3,447	3,749	12	-	28	8	-	-	4	-	3	12	3,489	83	20	-	7	83
Suicide (X71)	368	484	4	-	8	10	-	-	1	-	-	1	376	51	6	1	2	24
Homicide (X92)	72	110	-	-	5	2	-	-	3	-	-	1	77	2	-	-	1	19
Undetermined (Y21)	259	299	1	-	-	1	-	-	-	-	-	3	259	23	4	1	-	7
Fall (W00-W19, X80, Y01, Y30)	17,116	25,005	7,355	61	7,448	158	4	88	146	14	18	79	292	55	9	82	583	8,613
Unintentional (W00-W19)	16,257	23,453	7,202	57	7,252	135	4	73	144	11	17	79	249	46	8	70	480	7,626
Suicide (X80)	740	1,356	125	4	161	22	-	15	2	1	1	-	39	4	-	11	94	877
Homicide (Y01)	16	32	9	-	5	-	-	-	-	1	-	-	1	-	-	-	1	15
Undetermined (Y30)	103	164	19	-	30	1	-	-	-	1	-	-	3	5	1	1	8	95
Fire/hot object or substance (*U01.3, X00-X19, X76-X77, X97-X98, Y26-Y27, Y36.3) ⁴	3,645	5,349	12	-	26	12	-	-	-	-	2,089	5	36	36	3,009	1	24	99
Unintentional (X00-X19)	3,261	4,773	10	-	24	6	-	-	-	-	1,820	5	32	29	2,746	1	20	80
Suicide (X76-X77)	150	219	-	-	-	-	-	-	-	-	145	-	2	2	65	-	1	4
Homicide (*U01.3, X97-X98)	134	211	2	-	2	5	-	-	-	-	74	-	2	1	113	-	2	10
Undetermined (Y26-Y27)	100	146	-	-	-	1	-	-	-	-	50	-	-	4	85	-	1	5
Legal intervention/war (Y36.3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fire/flame (X00-X09, X76, X97, Y26)	3,539	5,187	12	-	22	12	-	-	-	-	1,948	5	32	33	3,005	1	20	97
Unintentional (X00-X09)	3,159	4,616	10	-	20	6	-	-	-	-	1,682	5	29	26	2,742	1	16	79
Suicide (X76)	150	219	-	-	-	-	-	-	-	-	145	-	2	2	65	-	1	4
Homicide (X97)	131	206	2	-	2	5	-	-	-	-	71	-	1	1	113	-	2	9
Undetermined (Y26)	99	146	-	-	-	1	-	-	-	-	50	-	-	4	85	-	1	5

See footnotes at end of table.

Table 26. Total number of injury deaths by mechanism and intent of death and total mentions of nature of injury as classified in ICD-10 mortality diagnosis matrix: United States, 2002—Con.

Mechanism and intent of death (Based on the <i>International Classification of Diseases, Tenth Revision, 1992</i>)	Total injury deaths	Total mentions of injury	Fracture	Dislocation	Internal organ injury	Open wound	Amputation	Blood vessel	Superficial and contusion	Crushing	Bum	Foreign body ¹	Other effects of external causes	Poisoning	Toxic effects	Multiple injuries	Other specified ² injury	Unspecified injury
Hot object/substance(X10-X19,X77,X98,Y27)	106	162	-	-	4	-	-	-	-	-	141	-	4	3	4	-	4	2
Unintentional(X10-X19)	102	157	-	-	4	-	-	-	-	-	138	-	3	3	4	-	4	1
Suicide(X77)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Homicide(X98)	3	5	-	-	-	-	-	-	-	-	3	-	1	-	-	-	-	1
Undetermined(Y27)	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Firearm(*U01.4,W32-W34,X72-X74,X93-X95,Y22-Y24,Y35.0)	30,242	45,012	432	1	4,658	36,050	4	691	27	1	33	23	40	47	20	63	631	2,291
Unintentional(W32-W34)	762	1,110	10	-	132	811	-	29	-	1	-	4	3	1	-	-	31	88
Suicide(X72-X74)	17,108	24,526	303	-	2,334	20,197	1	92	13	-	5	7	20	28	13	29	219	1,265
Homicide(*U01.4,X93-X95)	11,829	18,485	116	1	2,081	14,378	3	543	10	-	28	10	14	14	7	33	365	882
Undetermined(Y22-Y24)	243	375	3	-	44	270	-	9	4	-	-	1	1	3	-	-	5	35
Legal intervention/war(Y35.0)	300	516	-	-	67	394	-	18	-	-	-	1	2	1	-	1	11	21
Machinery(W24,W30-W31) ⁵	652	1,143	99	2	99	15	8	11	1	97	12	2	102	-	2	96	50	547
All transport(*U01.1,V01-V99,X82,Y03,Y32,Y36.1) ⁵	47,939	77,177	7,487	412	9,518	509	124	1,194	268	622	678	76	1,674	120	361	1,574	2,386	50,174
Unintentional(V01-V99)	47,739	76,852	7,452	410	9,481	508	121	1,190	267	617	673	76	1,661	117	354	1,571	2,379	49,975
Suicide(X82)	112	191	18	2	15	-	3	4	-	3	4	-	8	2	4	1	4	123
Homicide(*U01.1,Y03) ⁵	61	99	16	-	17	1	-	-	1	2	1	-	4	-	2	2	3	50
Undetermined(Y32)	27	35	1	-	5	-	-	-	-	-	-	-	1	1	-	-	-	26
Legal intervention/war(Y36.1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Motor vehicle traffic(V02-V04[.1,.9],V09.2,V12-V14[.3-.9],V19[.4-.6],V20-V28[.3-.9],V29-V79[.4-.9],V80[.3-.5],V81.1,V82.1,V83-V86[.0-.3],V87[.0-.8],V89.2) ⁵	44,065	71,062	6,972	385	8,811	446	96	1,112	251	501	580	74	1,035	108	306	1,460	2,228	46,697
Occupant(V30-V79[.4-.9],V83-V86[.0-.3]) ⁵	21,344	34,390	3,377	172	4,213	204	36	530	115	286	382	42	617	60	201	726	904	22,525
Motorcyclist(V20-V28[.3-.9],V29[.4-.9]) ⁵	3,153	5,190	519	19	732	50	16	77	22	21	7	3	13	9	-	97	172	3,433
Pedal cyclist(V12-V14[.3-.9],V19[.4-.6]) ⁵	550	899	92	9	144	6	-	7	3	9	-	2	1	-	-	8	25	593
Pedestrian(V02-V04[.1,.9],V09.2) ⁵	5,041	8,201	830	48	1,019	43	12	93	23	73	3	5	31	12	2	133	267	5,607
Other(V80[.3-.5],V81.1,V82.1) ⁵	16	28	3	-	4	-	-	-	4	1	-	-	-	-	-	-	2	14
Unspecified(V87[.0-.8],V89.2) ⁵	13,961	22,354	2,151	137	2,699	143	32	405	84	111	188	22	373	27	103	496	858	14,525
Pedal cyclist, other(V10-V11,V12-V14[.0-.2],V15-V18,V19[.0-.3,.8,.9]) ⁵	217	362	47	1	87	1	-	5	2	1	-	-	2	-	-	-	6	210
Pedestrian, other(V01,V02-V04[.0],V05,V06,V09[.0,.1,.3,.9]) ⁵	1,050	1,732	143	5	204	22	19	13	3	72	1	1	29	7	1	55	40	1,117

See footnotes at end of table.

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Mechanism and intent of death (Based on the <i>International Classification of Diseases, Tenth Revision, 1992</i>)	Total injury deaths	Total mentions of injury	Fracture	Dislocation	Internal organ injury	Open wound	Amputation	Blood vessel	Superficial and contusion	Crushing	Burn	Foreign body ¹	Other effects of external causes	Poisoning	Toxic effects	Multiple injuries	Other specified ² injury	Unspecified injury
Other land transport . . . (V20-V28 [0-2], V29-V79[0-3], V80[0-2, 6-9], V81-V82[0, 2-9], V83-V86 [4-9], V87, V88[0-9], V89 [0, 1, 3, 9], X82, Y03, Y32)	1,333	2,155	228	14	300	14	5	32	6	42	33	1	116	3	17	45	70	1,229
Unintentional (V20-V28 [0-2], V29-V79[0-3], V80 [0-2, 6-9], V81-V82[0, 2-9], V83-V86[4-9], V87, V88[0-9], V89[0, 1, 3, 9])	1,134	1,832	193	12	264	13	2	28	5	37	28	1	103	-	10	42	63	1,031
Suicide (X82)	112	191	18	2	15	-	3	4	-	3	4	-	8	2	4	1	4	123
Homicide (Y03)	60	97	16	-	16	1	-	-	1	2	1	-	4	-	2	2	3	49
Undetermined (Y32)	27	35	1	-	5	-	-	-	-	-	-	-	1	1	1	-	-	26
Other transport (*U01.1, V90-V99, Y36.1) ³	1,274	1,866	97	7	116	26	4	32	6	6	64	-	492	2	37	14	42	921
Unintentional (V90-V99)	1,273	1,864	97	7	115	26	4	32	6	6	64	-	492	2	37	14	42	920
Homicide (*U01.1) ³	1	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
Legal intervention/war . . . (Y38.1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Natural/environmental . . . (W42-W43, W53-W64, W92-W99, X20-X39, X51-X57) ⁵	1,554	2,076	27	-	57	24	-	6	12	4	15	4	1,594	30	84	10	26	183
Overexertion (X50) ⁵	10	12	-	-	1	-	-	-	-	-	-	-	6	-	-	-	2	3
Poisoning . . . (*U01[6-7], X40-X49, X60-X69, X85-X90, Y10-Y19, Y35.2)	26,435	46,554	37	-	155	44	5	4	9	1	108	194	244	40,482	5,104	3	31	133
Unintentional (X40-X49)	17,550	31,775	30	-	129	10	3	4	8	1	76	161	131	28,330	2,780	2	20	90
Suicide (X60-X69)	5,486	9,391	3	-	10	27	2	-	-	-	25	25	70	7,185	2,015	1	6	22
Homicide (*U01[6-7], X85-X90)	63	93	-	-	-	2	-	-	-	-	1	-	2	65	21	-	1	1
Undetermined (Y10-Y19)	3,336	5,295	4	-	16	5	-	-	1	-	6	8	41	4,902	288	-	4	20
Legal intervention/war . . . (Y35.2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Struck by or against . . . (W20-W22, W50-W52, X79, Y00, Y04, Y29, Y35.3)	1,182	2,095	206	4	323	52	1	24	6	113	3	1	146	6	-	98	71	1,041
Unintentional (W20-W22, W50-W52)	890	1,587	183	3	229	16	1	20	4	113	2	-	130	2	-	86	58	740
Suicide (X79)	3	6	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	4
Homicide (Y00, Y04)	287	497	23	1	92	34	-	4	2	-	1	1	16	4	-	11	13	295
Undetermined (Y29)	2	5	-	-	2	-	-	-	-	-	-	-	-	-	-	1	-	2
Legal intervention/war . . . (Y35.3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Suffocation (W75-W84, X70, X91, Y20)	12,791	13,780	81	1	106	74	3	12	12	3	14	4,170	8,698	181	23	15	66	321
Unintentional (W75-W84)	5,517	5,943	39	-	91	9	-	7	3	1	1	4,153	1,441	61	8	6	27	96
Suicide (X70)	6,462	6,747	30	1	6	20	2	5	5	2	-	11	6,450	105	13	1	18	78
Homicide (X91)	679	947	10	-	9	45	1	-	4	-	13	5	680	11	2	8	19	140
Undetermined (Y20)	133	143	2	-	-	-	-	-	-	-	-	1	127	4	-	-	2	7

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Mechanism and intent of death (Based on the <i>International Classification of Diseases, Tenth Revision, 1992</i>)	Total injury deaths	Total mentions of injury	Fracture	Dislocation	Internal organ injury	Open wound	Amputation	Blood vessel	Superficial and contusion	Crushing	Bum	Foreign body ¹	Other effects of external causes	Poisoning	Toxic effects	Multiple injuries	Other specified ² injury	Unspecified injury
Other specified, classifiable . . (*U01 [0,2,5],*U03.0,W23,W35-W41, W44,W49,W85-W91,X75,X81,X96, Y02,Y05-Y07,Y25,Y31,Y35[1,5], Y36[0,2,4-8],Y85) ³	2,073	3,008	166	1	491	60	16	18	10	43	154	35	667	51	17	47	112	1,120
Unintentional (W23,W35-W41,W44,W49,W85-W91,Y85)	1,398	1,872	89	1	348	45	-	14	2	37	150	34	465	9	16	24	82	556
Suicide . . . (*U03.0,X75,X81) ³	315	516	46	-	55	7	12	3	-	3	2	-	1	-	1	19	18	349
Homicide . . (*U01[0,2,5],X96, Y02,Y05-Y07)	267	522	24	-	81	8	-	1	7	-	2	1	199	1	-	3	11	184
Undetermined (Y25,Y31)	26	52	7	-	7	-	4	-	1	3	-	-	-	-	-	1	1	28
Legal intervention/war . . . (Y35 [1,5],Y36[0,2,4-8])	67	46	-	-	-	-	-	-	-	-	-	-	2	41	-	-	-	3
Other specified, not elsewhere classified . . (*U01.8,*U02,X58,X83, Y08,Y33,Y35.6,Y86-Y87,Y89[0-1])	2,066	3,076	375	6	696	167	1	14	21	3	39	41	133	68	33	101	165	1,213
Unintentional (X58,Y86)	1,046	1,373	297	-	398	19	-	1	11	-	17	34	10	39	17	10	80	440
Suicide (X83,Y87.0)	200	298	14	1	30	33	1	3	1	-	3	-	32	9	12	9	22	128
Homicide (*U01.8, *U02,Y08,Y87.1)	623	1,105	47	5	206	110	-	8	7	2	12	6	54	7	1	75	49	516
Undetermined (Y33,Y87.2)	163	248	17	-	53	4	-	2	2	1	6	1	30	10	3	5	7	107
Legal intervention/war . . (Y35.6, Y89[0,1])	34	52	-	-	9	1	-	-	-	-	1	-	7	3	-	2	7	22
Unspecified . . . (*U01.9,*U03.9,X59, X84,Y09,Y34,Y35.7,Y36.9,Y89.9)	8,656	11,774	4,347	39	2,282	452	6	116	162	24	29	73	190	66	11	106	488	3,383
Unintentional (X59)	6,550	8,096	4,105	33	1,582	246	3	85	134	16	11	60	50	32	7	36	356	1,340
Suicide (*U03.9,X84)	145	213	11	-	16	45	2	7	-	4	1	-	11	13	-	-	11	92
Homicide (*U01.9,Y09)	1,533	2,723	157	2	461	155	1	22	19	4	11	12	123	11	3	62	85	1,595
Undetermined (Y34,Y89.9)	425	739	74	4	222	6	-	2	9	-	6	1	6	10	1	8	36	354
Legal intervention/war . . (Y35.7, Y36.9)	3	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	2

- Quantity zero.

¹Effect of foreign bodies entering orifice.

²"Other specified" includes injuries to nerves, sprains, and strains, and muscle and tendon injuries that were too few to enumerate separately in addition to other specified injuries (see Table II for all included codes).

³Figures include September 11, 2001-related deaths for which death certificates were filed as of October 24, 2002; see "Technical Notes."

⁴Codes *U01.3 and Y36.3 cannot be divided separately into the subcategories shown below; therefore, subcategories may not add to the total.

⁵Intent of death is unintentional.

Table 27. Number of deaths with any mention and total mentions of specified poisoning or toxic effects by intent of death: United States, 2002

Poisoning and toxic effect substances	Intent of death							
	Any mention				Total mentions			
	All intents ¹	Unintentional	Suicide	Undetermined intent	All intents ¹	Unintentional	Suicide	Undetermined intent
All poisonings and toxic effects (T36-T65, T96-T97)	30,050	20,613	5,739	3,454	50,032	34,823	9,550	5,345
Poisoning by drugs, medicaments, and biological substances (T36-T50, T96)	24,283	16,789	4,116	3,260	41,323	28,780	7,419	4,962
Antibiotics, anti-infectives, and antiparasitics (T36-37)	36	28	5	3	36	28	5	3
Hormones and their synthetic substitutes and antagonists, not elsewhere classified (T38)	98	24	62	8	98	24	62	8
Non-opioid analgesics, antipyretics, and antirheumatics (T39)	998	438	460	97	1,041	450	487	101
Salicylates (aspirin) (T39.0)	159	37	112	9	159	37	112	9
4-Aminophenol derivatives (acetaminophen/paracetamol) (T39.1)	640	273	306	60	640	273	306	60
Other non-opioid analgesics, antipyretics, and antirheumatics (T39.2-T39.9)	240	138	69	32	242	140	69	32
Narcotics and psychodysleptics (T40)	14,468	10,958	1,232	2,226	18,240	14,081	1,411	2,692
Heroin (T40.1)	2,101	1,950	34	115	2,101	1,950	34	115
Other specified opioids (T40.0,T40.2)	4,484	3,303	651	515	4,484	3,303	651	515
Methadone (T40.3)	2,376	1,924	151	295	2,376	1,924	151	295
Cocaine (T40.5)	4,737	3,988	142	584	4,737	3,988	142	584
Other and unspecified narcotics and psychodysleptics (T40.4,T40.6-T40.9)	4,496	2,882	429	1,175	4,542	2,916	433	1,183
Anesthetics and therapeutic gases (T41)	201	143	18	28	202	143	19	28
Antiepileptic, sedative-hypnotic, and antiparkinsonism drugs (T42)	2,845	1,772	764	307	3,129	1,934	857	336
Barbiturates (T42.3)	289	126	132	30	289	126	132	30
Benzodiazepines (T42.4)	2,079	1,416	437	225	2,079	1,416	437	225
Other antiepileptic, sedative-hypnotic, and antiparkinsonism drugs (T42.0-T42.2,T42.5-T42.8)	733	377	277	79	761	392	288	81
Psychotropic drugs, not elsewhere classified (T43)	3,826	2,235	1,136	439	4,371	2,535	1,315	505
Antidepressants (T43.0-T43.2)	2,422	1,171	939	308	2,629	1,274	1,011	340
Other psychotropic drugs, not elsewhere classified (T43.3-T43.9)	1,707	1,239	293	163	1,742	1,261	304	165
Other specified and unspecified drugs, medicaments, and biological substances (T44-T50)	13,467	9,217	2,961	1,235	14,145	9,535	3,258	1,284
Sequelae of poisoning by drugs, medicaments, and biological substances (T96)	61	50	5	5	61	50	5	5
Toxic effects of substances chiefly nonmedicinal as to source (T51-T65, T97)	7,801	5,337	1,993	343	8,709	6,043	2,131	383
Alcohol (T51)	2,219	1,767	301	151	2,382	1,899	322	161
Ethanol (T51.0)	1,448	1,175	193	80	1,448	1,175	193	80
Other and unspecified alcohol (T51.1-T51.9)	932	722	129	81	934	724	129	81
Organic solvents (T52)	146	56	72	17	151	60	73	17
Soaps and detergents (T55)	1	1	-	-	1	1	-	-
Metals (T56)	42	27	10	5	42	27	10	5
Lead (T56.0)	1	1	-	-	1	1	-	-
Mercury (T56.1)	-	-	-	-	-	-	-	-
Other and unspecified metals (T56.2-T56.9)	41	26	10	5	41	26	10	5
Carbon monoxide (T58)	2,660	1,141	1,393	83	2,660	1,141	1,393	83
Other gases, fumes, and vapors (T59)	2,921	2,576	169	78	3,006	2,653	171	80
Pesticides (T60)	30	8	18	3	32	8	20	3
Insecticides (T60.0-T60.2)	7	1	4	2	7	1	4	2
Herbicides and fungicides (T60.3)	6	2	4	-	6	2	4	-
Other and unspecified pesticides (T60.4-T60.9)	19	5	12	1	19	5	12	1
Noxious substances eaten as seafood and other foods (T61-T62)	8	6	2	-	8	6	2	-
Contact with venomous animals (T63)	79	78	1	-	79	78	1	-
Other specified and unspecified substances (T53-T54,T57,T64-T65)	307	148	124	30	323	150	135	33
Sequelae of toxic effects (T97)	25	20	4	1	25	20	4	1

- Quantity zero. ¹Includes intent categories homicide and legal intervention.

Table 28. Deaths due to natural underlying causes with any mention of external cause of injury, 2002

[Figure (s) in brackets [] applies to the code or range of codes preceding it. For explanation of asterisks preceding cause-of-death codes, see "Technical Notes"]

Natural causes of death (Based on the International Classification of Diseases, Tenth Revision, 1992)	Total deaths	Unintentional										Other unintentional injuries		Suicide (*U03, X60-X84, Y87.0)	Homicide (*U01-U02, X85-Y09, Y87.1)	Undetermined intent (Y10-Y34, Y87.2, Y89.9)
		All injury (*U01-U03, Y85-Y87, Y89)	Total (V01-X59, Y85-Y86)	Drowning (W65-W74)	Fall (W00-W19)	Fire/hot object or substance (X00-X09)	Firearms (W32-W34)	Motor vehicle traffic ¹	Poisoning (X40-X49)	Suffocation (W75-W84)	Exposure to unspecified factor (X59)	Other and unspecified injuries				
All natural causes	2,279,275	36,884	36,223	104	4,525	144	38	717	2,434	16,274	10,789	1,558	153	143	332	
Salmonella infections (A01-A02)	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Shigellosis and amebiasis (A03,A06)	8	1	1	-	-	-	-	-	-	1	-	-	-	-	-	
Certain other intestinal infections (A04,A07-A09)	2,465	96	95	-	12	1	-	3	2	24	50	4	-	-	1	
Tuberculosis (A16-A19)	784	12	12	-	1	-	-	1	3	5	1	1	-	-	-	
Respiratory tuberculosis (A16)	626	9	9	-	-	-	-	1	3	4	1	-	-	-	-	
Other tuberculosis (A17-A19)	158	3	3	-	1	-	-	-	-	1	-	1	-	-	-	
Whooping cough (A37)	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Scarlet fever and erysipelas (A38,A46)	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Meningococcal infection (A39)	161	3	3	-	-	-	-	1	1	-	1	-	-	-	-	
Septicemia (A40-A41)	33,865	411	403	-	38	-	1	17	18	133	174	22	4	1	2	
Syphilis (A50-A53)	41	1	1	-	-	-	-	-	-	1	-	-	-	-	-	
Acute poliomyelitis (A80)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Arthropod-borne viral encephalitis (A83-A84,A85.2)	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Measles (B05)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Viral hepatitis (B15-B19)	5,793	52	47	-	7	-	-	-	10	11	15	4	-	1	2	
Human immunodeficiency virus (HIV) disease (B20-B24)	14,095	61	60	-	4	-	1	1	11	24	9	10	-	-	1	
Malaria (B50-B54)	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Other and unspecified infectious and parasitic diseases and their sequelae (A00,A05,A20-A36, A42-A44,A48-A49,A54-A79,A81-A82, A85.0-A85.1,A85.8,A86-B04,B06-B09, B25-B49,B55-B99)	6,707	133	130	1	14	1	1	3	9	49	38	16	-	-	3	
Malignant neoplasms (C00-C97)	557,271	2,511	2,476	1	218	13	7	20	79	937	1,106	100	15	11	2	
Malignant neoplasms of lip, oral cavity, and pharynx (C00- C14)	7,737	115	115	-	3	-	1	-	2	94	15	2	-	-	-	
Malignant neoplasm of esophagus (C15)	12,701	94	93	-	-	-	-	1	-	76	12	5	-	-	1	
Malignant neoplasm of stomach (C16)	12,198	47	47	-	3	-	-	1	2	29	12	-	-	-	-	
Malignant neoplasms of colon, rectum, and anus (C18- C21)	56,741	232	228	-	28	-	-	1	5	100	89	5	-	4	-	
Malignant neoplasms of liver and intrahepatic bile ducts (C22)	14,047	42	42	-	7	-	-	1	3	8	21	2	-	-	-	
Malignant neoplasm of pancreas (C25)	30,264	83	81	1	5	2	-	2	-	30	38	3	2	-	-	
Malignant neoplasm of larynx (C32)	3,723	57	56	-	2	1	-	-	1	41	9	2	-	-	-	

See footnotes at end of table.

Table 28. Deaths due to natural underlying causes with any mention of external cause of injury, 2002—Con.

[Figure (s) in brackets [] applies to the code or range of codes preceding it. For explanation of asterisks preceding cause-of-death codes, see "Technical Notes"]

Natural causes of death (Based on the International Classification of Diseases, Tenth Revision, 1992)	Total deaths	Unintentional										Other unintentional injuries		Undetermined intent (Y10–Y34, Y87.2, Y89.9)	
		All injury (*U01–*U03, V01–Y36, Y85–Y87, Y89)	Total (V01–X59, Y85–Y86)	Drowning (W65–W74)	Fall (W00–W19)	Fire/hot object or substance (X00–X09)	Firearms (W32–W34)	Motor vehicle traffic ¹	Poisoning (X40–X49)	Suffocation (W75–W84)	Exposure to unspecified factor (X59)	Other and unspecified unintentional injuries	Suicide (*U03, X60–X84, Y87.0)		Homicide (*U01–*U02, X85–Y09, Y87.1)
Malignant neoplasms of trachea, bronchus, and lung (C33–C34)	157,713	555	544	–	49	5	2	1	30	170	267	20	7	1	–
Malignant melanoma of skin (C43)	7,514	26	25	–	–	1	–	–	1	3	16	4	–	–	–
Malignant neoplasm of breast (C50)	41,883	177	174	–	19	–	–	1	2	37	106	9	2	–	1
Malignant neoplasm of cervix uteri (C53)	3,952	10	10	–	1	–	–	–	1	2	5	1	–	–	–
Malignant neoplasms of corpus uteri and uterus, part unspecified (C54–C55)	6,853	21	21	–	–	–	–	–	–	6	15	–	–	–	–
Malignant neoplasm of ovary (C56)	14,682	50	49	–	5	–	1	–	1	17	24	1	1	–	–
Malignant neoplasm of prostate (C61)	30,446	169	167	–	15	–	–	2	3	49	91	7	–	1	–
Malignant neoplasms of kidney and renal pelvis (C64–C65)	12,165	41	41	–	7	1	–	–	2	7	20	4	–	–	–
Malignant neoplasm of bladder (C67)	12,628	67	66	–	5	–	–	1	1	19	35	6	–	–	–
Malignant neoplasms of meninges, brain, and other parts of central nervous system (C70–C72)	12,830	49	47	–	5	–	–	2	2	28	10	–	2	–	–
Malignant neoplasms of lymphoid, hematopoietic, and related tissue (C81–C96)	56,225	316	315	–	39	2	3	3	11	71	177	10	–	1	–
Hodgkin's disease (C81)	1,352	13	13	–	1	–	–	1	7	3	1	–	–	–	–
Non-Hodgkin's lymphoma (C82–C85)	21,910	109	108	–	10	–	–	1	2	34	57	5	–	1	–
Leukemia (C91–C95)	21,498	95	95	–	18	1	1	–	2	18	52	3	–	–	–
Multiple myeloma and immunoproliferative neoplasms (C88,C90)	11,392	98	98	–	10	1	2	1	–	16	66	2	–	–	–
Other and unspecified malignant neoplasms of lymphoid, hematopoietic, and related tissue (C96)	73	1	1	–	–	–	–	–	–	–	1	–	–	–	–
All other and unspecified malignant neoplasms (C17,C23–C24, C26–C31,C37–C41,C44–C49,C51–C52,C57–C60,C62–C63,C66, C68–C69,C73–C80,C97)	62,969	360	355	–	25	1	–	4	12	150	144	19	1	4	–
In situ neoplasms, benign neoplasms, and neoplasms of uncertain or unknown behavior (D00–D48)	13,299	153	150	–	20	–	–	6	5	61	51	8	2	–	–
Anemias (D50–D64)	4,614	64	64	–	10	–	–	1	4	15	26	8	–	–	–
Diabetes mellitus (E10–E14)	73,249	768	755	–	93	8	1	10	43	246	316	45	3	4	6
Nutritional deficiencies (E40–E64)	3,779	123	120	–	14	–	3	3	–	50	48	6	–	1	1

See footnotes at end of table.

Table 28. Deaths due to natural underlying causes with any mention of external cause of injury, 2002—Con.

[Figure (s) in brackets [] applies to the code or range of codes preceding it. For explanation of asterisks preceding cause-of-death codes, see "Technical Notes"]

Natural causes of death (Based on the <i>International Classification of Diseases, Tenth Revision, 1992</i>)	Total deaths	Unintentional										Suicide (*U03, X60–X84, Y87.0)	Homicide (*U01–*U02, X85–Y09, Y87.1)	Undetermined intent (Y10–Y34, Y87.2, Y89.9)	
		All injury (*U01–*U03, V01–Y36, Y85–Y87, Y89)	Total (V01–X59, Y85–Y86)	Drowning (W65–W74)	Fall (W00–W19)	Fire/hot object or substance (X00–X09)	Firearms (W32–W34)	Motor vehicle traffic ¹	Poisoning (X40–X49)	Suffocation (W75–W84)	Exposure to unspecified factor (X59)				Other and unspecified unintentional injuries
Malnutrition (E40–E46)	3,510	113	110	–	12	–	3	3	–	44	46	6	–	1	1
Other nutritional deficiencies (E50–E64)	269	10	10	–	2	–	–	–	–	6	2	–	–	–	–
Meningitis (G00, G03)	700	11	11	–	–	–	–	1	2	4	1	4	–	–	–
Parkinson's disease (G20–G21)	16,959	840	839	–	36	–	–	–	2	679	122	11	1	–	–
Alzheimer's disease (G30)	58,866	2,055	2,051	–	159	1	1	2	6	1,219	618	61	–	2	1
Major cardiovascular diseases (I00–I78)	918,628	15,689	15,425	49	2,881	66	15	444	1,207	4,946	5,162	764	55	63	135
Diseases of heart (I00–I09, I11, I13, I20–I51)	696,947	10,192	9,983	45	2,540	57	12	386	1,017	1,352	4,012	617	30	54	117
Acute rheumatic fever and chronic rheumatic heart diseases (I00–I09)	3,579	52	51	–	6	–	–	3	1	13	25	3	–	–	–
Hypertensive heart disease . . . (I11)	26,551	648	631	6	183	7	3	21	167	47	152	49	3	5	8
Hypertensive heart and renal disease (I13)	2,895	57	56	–	14	3	–	1	9	4	23	2	–	1	–
Ischemic heart diseases . . . (I20–I25)	494,382	7,042	6,901	34	1,948	35	8	285	570	823	2,792	443	20	38	79
Acute myocardial infarction (I21–I22)	179,514	1,726	1,705	5	307	8	4	113	111	226	851	89	3	7	10
Other acute ischemic heart diseases (I24)	3,407	50	50	–	4	1	1	1	4	9	26	4	–	–	–
Other forms of chronic ischemic heart disease (I20, I25)	311,461	5,266	5,146	29	1,637	26	3	171	455	588	1,915	350	17	31	69
Atherosclerotic cardiovascular disease, so described . . (I25.0)	68,129	1,890	1,835	14	824	12	2	88	213	125	372	196	3	15	36
All other forms of chronic ischemic heart disease (I20, I25.1–I25.9)	243,332	3,376	3,311	15	813	14	1	83	242	463	1,543	154	14	16	33
Other heart diseases (I26–I51)	169,540	2,393	2,344	5	389	12	1	76	270	465	1,020	120	7	10	30
Acute and subacute endocarditis (I33)	1,154	9	9	–	1	–	–	2	2	2	2	1	–	–	–
Diseases of pericardium and acute myocarditis . . (I30–I31, I40)	848	9	9	–	1	–	–	–	4	1	2	1	–	–	–
Heart failure (I50)	56,494	657	653	–	122	1	–	10	21	142	335	26	2	1	1
All other forms of heart disease (I26–I28, I34–I38, I42–I49, I51)	111,044	1,718	1,673	5	265	11	1	64	243	320	681	92	5	9	29
Essential (primary) hypertension and hypertensive renal disease (I10, I12)	20,261	293	289	1	40	2	–	3	12	45	161	25	1	–	2
Cerebrovascular diseases . . . (I60–I69)	162,672	4,803	4,759	2	261	7	1	40	128	3,447	821	104	21	8	13
Atherosclerosis (I70)	13,821	182	180	1	20	–	–	4	7	37	103	6	1	–	1
Other diseases of circulatory system (I71–I78)	24,927	219	214	–	20	–	–	11	43	65	65	12	2	1	2

See footnotes at end of table.

Table 28. Deaths due to natural underlying causes with any mention of external cause of injury, 2002—Con.

[Figure (s) in brackets [] applies to the code or range of codes preceding it. For explanation of asterisks preceding cause-of-death codes, see "Technical Notes"]

Natural causes of death (Based on the <i>International Classification of Diseases, Tenth Revision, 1992</i>)	Total deaths	Unintentional											Suicide (*U03, X60–X84, Y87.0)	Homicide (*U01–U02, X85–Y09, Y87.1)	Undetermined intent (Y10–Y34, Y87.2, Y89.9)
		All injury (*U01–*U03, V01–Y36, Y85–Y87, Y89)	Total (V01–X59, Y85–Y86)	Drowning (W65–W74)	Fall (W00–W19)	Fire/hot object or substance (X00–X09)	Firearms (W32–W34)	Motor vehicle traffic ¹	Poisoning (X40–X49)	Suffocation (W75–W84)	Exposure to unspecified factor (X59)	Other and unspecified unintentional injuries			
Aortic aneurysm and dissection (I71)	14,818	101	97	–	8	–	–	10	33	23	22	2	1	1	2
Other diseases of arteries, arterioles, and capillaries (I72–I78)	10,109	118	117	–	12	–	–	1	10	42	43	10	1	–	–
Other disorders of circulatory system (I80–I99)	4,711	95	87	–	18	1	–	7	3	20	29	9	–	1	6
Influenza and pneumonia (J10–J18)	65,681	309	303	1	31	2	–	7	23	172	54	14	3	1	2
Influenza (J10–J11)	727	12	12	–	1	–	–	–	–	8	2	1	–	–	–
Pneumonia (J12–J18)	64,954	297	291	1	30	2	–	7	23	164	52	13	3	1	2
Other acute lower respiratory infections (J20–J22)	386	18	18	–	1	–	–	–	3	11	3	–	–	–	–
Acute bronchitis and bronchiolitis (J20–J21)	279	13	13	–	1	–	–	–	3	7	2	–	–	–	–
Unspecified acute lower respiratory infection (J22)	107	5	5	–	–	–	–	–	–	4	1	–	–	–	–
Chronic lower respiratory diseases (J40–J47)	124,816	2,132	2,091	1	294	22	3	43	136	624	874	108	6	7	23
Bronchitis, chronic and unspecified (J40–J42)	955	43	41	–	3	–	–	4	3	18	9	5	–	–	2
Emphysema (J43)	15,489	183	179	–	22	3	1	6	17	38	88	6	–	1	3
Asthma (J45–J46)	4,261	144	133	–	5	2	–	4	55	40	23	5	–	1	10
Other chronic lower respiratory diseases (J44, J47)	104,111	1,762	1,738	1	264	17	2	29	61	528	754	92	6	5	8
Pneumoconioses and chemical effects (J60–J66, J68)	1,114	26	26	–	1	2	1	–	2	10	8	2	–	1	–
Pneumonitis due to solids and liquids (J69)	17,593	2,708	2,706	–	62	1	1	5	13	2,435	263	24	–	1	–
Other diseases of respiratory system (J00–J06, J30–J39, J67, J70–J98)	25,039	399	391	1	43	5	–	23	31	170	102	19	2	2	4
Peptic ulcer (K25–K28)	4,079	98	96	–	3	–	–	5	4	51	32	2	–	–	1
Diseases of appendix (K35–K38)	480	9	9	–	1	–	–	–	1	5	2	–	–	–	–
Hernia (K40–K46)	1,595	100	99	–	5	–	–	3	1	76	14	1	–	1	–
Chronic liver disease and cirrhosis (K70, K73–K74)	27,257	299	290	2	42	2	–	9	35	79	99	23	–	1	8
Alcoholic liver disease (K70)	12,121	141	136	2	18	1	–	4	17	44	37	13	–	–	5
Other chronic liver disease and cirrhosis (K73–K74)	15,136	158	154	–	24	1	–	5	18	35	62	10	–	1	3
Cholelithiasis and other disorders of gallbladder (K80–K82)	2,979	49	49	–	2	–	–	3	3	29	10	2	–	–	–
Nephritis, nephrotic syndrome, and nephrosis (N00–N07, N17–N19, N25–N27)	40,974	427	423	1	46	3	–	9	28	117	202	18	3	–	–

See footnotes at end of table.

Table 28. Deaths due to natural underlying causes with any mention of external cause of injury, 2002—Con.

[Figure (s) in brackets [] applies to the code or range of codes preceding it. For explanation of asterisks preceding cause-of-death codes, see "Technical Notes"]

Natural causes of death (Based on the <i>International Classification of Diseases, Tenth Revision, 1992</i>)	Total deaths	Unintentional										Suicide (*U03, X60–X84, Y87.0)	Homicide (*U01–*U02, X85–Y09, Y87.1)	Undetermined intent (Y10–Y34, Y87.2, Y89.9)
		All injury (*U01–*U03, V01–Y36, Y85–Y87, Y89)	Total (V01–X59, Y85–Y86)	Drowning (W65–W74)	Fall (W00–W19)	Fire/hot object or substance (X00–X09)	Firearms (W32–W34)	Motor vehicle traffic ¹	Poisoning (X40–X49)	Suffocation (W75–W84)	Exposure to unspecified factor (X59)				Other and unspecified unintentional injuries
Acute and rapidly progressive nephritic and nephrotic syndrome (N00–N01,N04)	166	2	2	-	-	-	-	-	-	-	2	-	-	-
Chronic glomerulonephritis, nephritis, and nephropathy not specified as acute or chronic, and renal sclerosis unspecified (N02–N03, N05–N07,N26)	553	4	4	-	1	-	-	-	-	-	2	1	-	-
Renal failure (N17–N19)	40,222	420	416	1	45	3	-	9	28	117	198	16	3	-
Other disorders of kidney (N25,N27)	33	1	1	-	-	-	-	-	-	-	-	1	-	-
Infections of kidney (N10–N12, N13.6,N15.1)	788	15	14	-	3	-	-	-	-	6	4	1	-	1
Hyperplasia of prostate (N40)	437	5	5	-	1	-	-	-	-	-	3	1	-	-
Inflammatory diseases of female pelvic organs (N70–N76)	114	2	2	-	1	-	-	-	-	-	1	-	-	-
Pregnancy, childbirth, and the puerperium (O00–O99)	379	5	3	-	-	-	-	-	3	-	-	-	-	1
Pregnancy with abortive outcome (O00–O07)	22	1	1	-	-	-	-	-	1	-	-	-	-	-
Other complications of pregnancy, childbirth, and the puerperium (O10–O99)	357	4	2	-	-	-	-	-	2	-	-	-	-	1
Certain conditions originating in the perinatal period (P00–P96)	14,254	51	39	1	2	-	-	6	3	19	7	1	-	9
Congenital malformations, deformations, and chromosomal abnormalities (Q00–Q99)	10,687	165	161	1	4	-	-	4	8	116	24	5	2	1
Symptoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified (R00–R99)	29,975	27	12	-	1	-	-	-	-	6	3	2	-	-
All other diseases (Residual)	194,591	6,961	6,756	45	457	16	3	80	735	3,923	1,317	262	57	33

- Quantity zero.

¹ICD-10 codes for "Motor vehicle traffic" accidents are V02–V04[.1-.9], V09.2, V12–V14[.3-.9], V19[.4-.6], V20–V28[.3-.9], V29–V79[.4-.9], V80[.3-.5], V81.1, V82.1, V83–V86[.0-.3], V87[.0-.8], V89.2.

Technical Notes

Nature and sources of data

Data in this report are based on information from all death certificates filed in the 50 States and the District of Columbia. The U.S. Standard Certificate of Death—which is used as a model by the States—was last revised in 1989; for additional details see the 1989 revision of the U.S. standard certificates and reports (43) and *Technical Appendix of Vital Statistics of the United States, 1989, Volume II, Mortality, part A (44)*.

Mortality statistics are based on information coded by the States and provided to the National Center for Health Statistics (NCHS) through the Vital Statistics Cooperative Program (VSCP) and from copies of the original certificates received by NCHS from the State registration offices. In 2002 all the States and the District of Columbia participated in this program and submitted part or all of the mortality data for 2002 in electronic data files to NCHS.

Data for the entire United States refer to events occurring within the United States. Data shown for geographic areas are by place of residence. Beginning with 1970, mortality statistics for the United States exclude deaths of nonresidents of the United States. All data exclude fetal deaths.

Cause-of-death classification

The mortality statistics presented in this report were compiled in accordance with World Health Organization (WHO) regulations, which specify that member nations classify and code causes of death in accordance with the current revision of the *International Classification of Diseases (ICD)*. The ICD provides the basic guidance used in virtually all countries to classify and code causes of death. Effective with deaths occurring in 1999, the United States began using the Tenth Revision of this classification (ICD-10) (11). For earlier years, causes of death were classified according to the revisions then in use—1979-98, Ninth Revision; 1968-78, Eighth Revision, adapted for use in the United States; 1958-67, Seventh Revision; and 1949-57, Sixth Revision.

Changes in classification of causes of death due to these revisions may result in discontinuities in cause-of-death trends. Consequently, cause-of-death comparisons across revisions require consideration of comparability ratios and, where available, estimates of their standard errors. Comparability ratios describing the differences between the Sixth and Seventh Revisions, the Seventh and Eighth Revisions, the Eighth and Ninth Revisions, and the Ninth and Tenth Revisions may be found in other NCHS reports and the NCHS Web site (45-49). The Ninth and Tenth Revision comparability ratios based on the external cause of death matrix are provided in "Technical Notes" in table I. Readers of the previous edition of this report should note that table I has been slightly modified from the previous year's report (19).

The ICD not only details disease classification but also provides definitions, tabulation lists, the format of the death certificate, and the rules for coding cause of death. Cause-of-death data presented in this publication were coded by procedures outlined in annual issues of the *NCHS Instruction Manual (50,51)*. It includes rules for selecting the underlying cause of death for tabulation purposes, definitions, tabulation lists, and regulations on the use of the ICD.

In this report most of the tabulations showing cause-of-death statistics are based on the underlying cause of death. The underlying cause is defined by the ICD as "the disease or injury which initiated the train of events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury" (11). It is selected from the conditions entered by the physician in the cause-of-death section of the death certificate. Generally, more medical information is reported on death certificates than is directly reflected in the underlying cause of death. The set of causes or conditions listed on the death certificate are referred to as multiple causes of death. Coding of the underlying cause of death requires first coding multiple causes of death. The underlying cause is then selected from among the multiple causes according to the sequence of the multiple-cause coded conditions as listed on the certificate, provisions of the ICD, and associated selection and modification rules.

Prior to the 1968 data year, mortality medical data were based on manual coding of an underlying cause of death for each certificate in accordance with the ICD rules. Effective with data year 1968, NCHS converted to computerized coding of the underlying cause and manual coding of all causes (multiple causes) on the death certificate. In this system, called "Automated Classification of Medical Entities" or ACME (52), multiple cause codes serve as inputs to the computer software that employs the ICD rules to select the underlying cause. The ACME system is used to select the underlying cause of death for all death certificates in the United States.

Beginning with 1990 data, the Mortality Medical Indexing, Classification, and Retrieval system (MICAR) (53,54) was introduced to automate coding multiple causes of death which are used as inputs to ACME. In addition, MICAR provides more detailed information on the conditions reported on death certificates than is available through the ICD code structure. Beginning with data year 1993, SuperMICAR, an enhancement of the MICAR system, was introduced. SuperMICAR allows for literal entry of the multiple-cause-of-death text as reported by the certifier. This information is then automatically processed by the MICAR and ACME computer systems. Records that cannot be automatically processed by MICAR or SuperMICAR are manually multiple-cause coded and then further processed through ACME.

For 2002 approximately 77 percent of the Nation's death records were multiple-cause coded using SuperMICAR and 23 percent, using MICAR only. This represents data from 41 States, New York City, and the District of Columbia that were coded by SuperMICAR and data from 9 States that were coded by MICAR.

Recognizing the value of and need for data that draws upon the complete medical certification, NCHS developed a system for classifying multiple causes of death on a condition-by-condition basis (55,56). The codes produced by MICAR (used as inputs to ACME) are referred to as entity-axis codes and are coded within the framework of the intent of the certifier. That is, they contain information on both the cause or condition as reported by the certifier and the position or line on which the certifier reported the cause or condition. While entity-axis codes form the foundation for a multiple-cause-of-death data set, they are limited in their utility. Entity-axis codes are useful in etiological studies and in evaluating the reporting of cause of death, but they typically lack consistency with underlying cause data, standardization, and compatibility of codes within the certification required for statistical tabulations and analysis. To provide this consistency, NCHS developed an automated system called TRANSAX designed to translate the entity-axis

Table I. ICD-10 and ICD-9 comparability ratios for underlying cause of death according to mechanism of injury and intent of death

[Figures in brackets [] apply to the code or range of codes preceding them. For explanation of asterisks preceding cause-of-death codes, see "Technical Notes"]

Mechanism and intent of death	ICD-10 codes	ICD-9 codes ¹	Comparability ratio
All injury	*U01-U03,V01-Y36,Y85-Y87,Y89	E800-E869,E880-E929,E950-E999	1.0159
Unintentional	V01-X59,Y85-Y86	E800-E869,E880-E929	1.0251
Suicide	*U03,X60-X84,Y87.0	E950-E959	1.0022
Homicide	*U01-U02,X85-Y09,Y87.1	E960-E969	1.0020
Undetermined	Y10-Y34,Y87.2,Y89.9	E980-E989	0.9867
Legal intervention/war	Y35-Y36,Y89[0..1]	E970-E978,E990-E999	0.9235
Cut/pierce	W25-W29,W45,X78,X99,Y28,Y35.4	E920,E956,E966,E974,E986	0.9428
Unintentional	W25-W29,W45	E920	0.8049
Suicide	X78	E956	0.8708
Homicide	X99	E966	0.9587
Undetermined	Y28	E986	*
Legal intervention/war	Y35.4	E974	*
Drowning	W65-W74,X71,X92,Y21	E910,E954,E964,E964	1.0269
Unintentional	W65-W74	E910	1.0297
Suicide	X71	E954	1.0149
Homicide	X92	E964	1.0159
Undetermined	Y21	E984	1.0047
Fall	W00-W19,X80,Y01,Y30	E880-E886,E888,E957,E968.1,E987	1.0015
Unintentional	W00-W19	E880-E886,E888	0.9991
Suicide	X80	E957	1.0409
Homicide	Y01	E968.1	1.0833
Undetermined	Y30	E987	0.9857
Fire/hot object or substance	*U01.3,X00-X19,X76-X77,X97-X98,Y26-Y27,Y36.3	E890-E899,E924,E958[1..2..7],E961,E968[0..3],E988[1..2..7],E990	0.9969
Unintentional	X00-X19	E890-E899,E924	0.9987
Suicide	X76-X77	E958[1..2..7]	0.9675
Homicide	*U01.3,X97-X98	E961,E968[0..3]	1.0048
Undetermined	Y26-Y27	E988[1..2..7]	0.9420
Legal intervention/war	Y36.3	E990	*
Fire/flame	X00-X09,X76,X97,Y26	E890-E899,E958.1,E968.0,E988.1	0.9975
Unintentional	X00-X09	E890-E899	0.9995
Suicide	X76	E958.1	0.9675
Homicide	X97	E968.0	0.9951
Undetermined	Y26	E988.1	0.9682
Hot object/substance	X10-X19,X77,X98,Y27	E924,E958[2..7],E961,E968.3,E988[2..7]	0.9720
Unintentional	X10-X19	E924	0.9694
Suicide	X77	E958[2..7]	*
Homicide	X98	E961,E968.3	*
Undetermined	Y27	E988[2..7]	*
Firearm	*U01.4,W32-W34,X72-X74,X93-X95,Y22-Y24,Y35.0	E922,E955[0-4],E965[0-4],E985[0-4],E970	1.0012
Unintentional	W32-W34	E922	1.0165
Suicide	X72-X74	E955[0-4]	1.0012
Homicide	*U01.4,X93-X95	E965[0-4]	1.0019
Undetermined	Y22-Y24	E985[0-4]	1.0000
Legal intervention/war	Y35.0	E970	0.9196
Machinery ²	W24,W30-W31	E919	0.8813
All transport	*U01.1,V01-V99,X82,Y03,Y32,Y36.1	E800-E848,E958.5,E988.5,E994	0.9930
Unintentional	V01-V99	E800-E848	0.9929
Suicide	X82	E958.5	0.9437
Homicide	*U01.1,Y03	...	*
Undetermined	Y32	E988.5	*
Legal intervention/war	Y36.1	E994	*
Motor vehicle traffic ²	V02-V04[1..9],V09.2,V12-V14[3-9],V19[4-6],V20-V28[3-9],V29-V79[4-9],V80[3-5],V81.1,V82.1,V83-V86[0-3],V87[0-8],V89.2	E810-E819	0.9545
Occupant ²	V30-V79[4-9],V83-V86[0-3]	E810-E819[0..1]	0.6191
Motorcyclist ²	V20-V28[3-9],V29[4-9]	E810-E819[2..3]	1.1520
Pedal cyclist ²	V12-V14[3-9],V19[4-6]	E810-E819[6]	0.8038
Pedestrian ²	V02-V04[1..9],V09.2	E810-E819[7]	0.9535
Other, specified ²	V80[3-5],V81.1,V82.1	E810-E819[4..5..8]	*
Unspecified ²	V87[0-8],V89.2	E810-E819[9]	1.8753
Pedal cyclist, other ²	V10-V11,V12-V14[0-2],V15-V18,V19[0-3,8..9]	E800-E807[3],E820-E825[6],E826[1..9]	1.7477
Pedestrian, other ²	V01,V02-V04[0],V05,V06,V09[0..1,3..9]	E800-E807[2],E820-E825[7],E826-E829[0]	1.2057

See footnotes at end of table.

Table I. ICD-10 and ICD-9 comparability ratios for underlying cause of death according to mechanism of injury and intent of death—Con.

[Figures in brackets [] apply to the code or range of codes preceding them. For explanation of asterisks preceding cause-of-death codes, see "Technical Notes"]

Mechanism and intent of death	ICD-10 codes	ICD-9 codes ¹	Comparability ratio
Other land transport	V20-V28[.0-2], V29-V79[.0-3], V80[.0-2,.6-9], V81-V82[.0,2-9], V83-V86[.4-9], V87.9, V88[.0-9], V89[.0,1,3,9], X82, Y03, Y32	E800-E807[.0,1,8,9], E820-E825[.0-5,8,9], E826[.2-8], E827-E829[.2-9], E846, E958.5, E988.5	2.6292
Unintentional	V20-V28[.0-2], V29-V79[.0-3], V80.0-2,.6-9, V81-V82[.0,2-9], V83-V86[.4-9], V87.9, V88 [0-9], V89[.0,1,3,9]	E800-E807[.0,1,8,9], E820-E825[.0-5,8,9], E826[.2-8], E827-E829[.2-9], E846	2.7630
Suicide	X82	E958.5	0.9437
Homicide	Y03	...	*
Undetermined	Y32	E988.5	*
Other transport	*U01.1, V90-V99, Y36.1	E830-E845, E847-E848, E994	0.9098
Unintentional	V90-V99	E830-E845, E847-E848	0.9098
Homicide	*U01.1	...	*
Legal intervention/war	Y36.1	E994	*
Natural/environmental ²	W42-W43, W53-W64, W92-W99, X20-X39, X51-X57	E900-E909, E928[.0-2]	1.0390
Overexertion ²	X50	E927	*
Poisoning	*U01[.6-7], X40-X49, X60-X69, X85-X90, Y10-Y19, Y35.2	E850-E869, E950-E952, E962, E972, E980-E982	1.0192
Unintentional	X40-X49	E850-E869	1.0365
Suicide	X60-X69	E950-E952	1.0013
Homicide	*U01[.6-7], X85-X90	E962	1.0417
Undetermined	Y10-Y19	E980-E982	0.9870
Legal intervention/war	Y35.2	E972	*
Struck by or against	W20-W22, W50-W52, X79, Y00, Y04, Y29, Y35.3	E916-E917, E960.0, E968.2, E973, E975	1.0852
Unintentional	W20-W22, W50-W52	E916-E917	1.0549
Suicide	X79	...	*
Homicide	Y00, Y04	E960.0, E968.2	1.1765
Undetermined	Y29	...	*
Legal intervention/war	Y35.3	E973, E975	*
Suffocation	W75-W84, X70, X91, Y20	E911-E913, E953, E963, E983	1.0974
Unintentional	W75-W84	E911-E913	1.2320
Suicide	X70	E953	1.0025
Homicide	X91	E963	1.0840
Undetermined	Y20	E983	0.9016
Other specified, classifiable	*U01[.0,2,.5], *U03.0, W23, W35-W41, W44, W49, W85-W91, X75, X81, X96, Y02, Y05-Y07, Y25, Y31, Y35[.1,5], Y36[.0,2,4-8], Y85	E914-E915, E918, E921, E923, E925-E926, E929[.0-5], E955[.5,9], E958[.0,3,4], E960.1, E965[.5-9], E967, E968.4, E971, E978, E985.5, E988[.0,3,4], E991-E993, E996, E997[.0-2]	0.8956
Unintentional	W23, W35-W41, W44, W49, W85-W91, Y85	E914-E915, E918, E921, E923, E925-E926, E929[.0-5]	0.8769
Suicide	*U03.0, X75, X81	E955[.5,9], E958[.0,3,4]	0.9010
Homicide	*U01[.0,2,.5], X96, Y02, Y05-Y07	E960.1, E965[.5-9], E967, E968.4	0.9730
Undetermined	Y25, Y31	E985.5, E988[.0,3,4]	*
Legal intervention/war	Y35[.1,5], Y36[.0,2,4-8]	E971, E978, E991-E993, E996, E997[.0-2]	1.2000
Other specified, not elsewhere classified	*U01.8, *U02, X58, X83, Y08, Y33, Y35.6, Y86-Y87, Y89[.0-1]	E928.8, E929.8, E958[.6,8], E959, E968.8, E969, E977, E988[.6,8], E989, E995, E997.8, E998, E999	1.5667
Unintentional	X58, Y86	E928.8, E929.8	9.0920
Suicide	X83, Y87.0	E958[.6,8], E959	1.1878
Homicide	*U01.8, *U02, Y08, Y87.1	E968.8, E969	0.9605
Undetermined	Y33, Y87.2	E988[.6,8], E989	1.0800
Legal intervention/war	Y35.6, Y89[.0,1]	E977, E995, E997.8, E998, E999	*
Unspecified	*U01.9, *U03.9, X59, X84, Y09, Y34, Y35.7, Y36.9, Y89.9	E887, E928.9, E929.9, E958.9, E968.9, E976, E988.9, E997.9	1.1124
Unintentional	X59	E887, E928.9, E929.9	1.1293
Suicide	*U03.9, X84	E958.9	1.7368
Homicide	*U01.9, Y09	E968.9	1.0177
Undetermined	Y34, Y89.9	E988.9	0.9960
Legal intervention/war	Y35.7, Y36.9	E976, E997.9	*

... Category not applicable.

* Figure does not meet standard of reliability or precision.

¹ ICD-9 categories in this table are not all consistent with the ICD-9 external cause of injury death matrix. The following ICD-9 codes have been allocated to different categories of the injury matrix so that the ICD-9 definition conforms more closely to that dictated by the ICD-10 version of this instrument.

ICD-9 codes

E990
E800-E807[.0,1,8,9], E820-E825[.0-5,8,9], E826[.2-8], E827-E829[.2-9], E846
E958.5
E988.5
E830, E832, E847-E848
E994
E958[.3]
E958[.6]
E988[.3]
E988[.6]

² Intent of death is unintentional.

were placed under:

Fire/hot object or substance, legal intervention
Other land transport, unintentional
Other land transport, suicide
Other land transport, undetermined
Other transport, unintentional
Other transport, legal intervention
Other specified classifiable, suicide
Other specified, not elsewhere classified, suicide
Other specified classifiable, undetermined
Other specified, not elsewhere classified, undetermined

Table II. ICD-10 codes used to define cells of the injury mortality diagnosis matrix for use with multiple cause-of-death data

[Figures in brackets [] apply to the code or range of codes preceding them]

Body region of injury	Nature of injury															
	Fracture	Dis-location	Internal organ injury	Open wound	Amputation	Blood vessel	Superficial and contusion	Crushing	Bum	Effect of Foreign Bodies entering orifice	Other effects of external causes	Poisoning	Toxic effects	Multiple injuries	Other specified injury	Un-specified injury
All head and neck																
Traumatic brain injury (TBI)	S02[.0-.1, .3, .7-.9], T90.2	...	S06, T90.5	S01, T90.1	...	...	...	S07	...	...	...	...	...	S09.7	S04.0, S09.8, T90[.4, .8]	S09.9, T90.9
Other head	S02[.2, .4-.6]	S03[.0-.3]	...	S05[.2-.7], S08.0, S09.2	S08 [.1-.9]	S09.0	S00, S05 [.0-.1], T90.0	...	T26	T15-T16, T17[.0-.1], T18.0	T33.0, T34.0	...	...	...	S03[.4-.5], S04[.1-.9], S05.8, S09.1, T90.3	S05.9
Neck	S12 [.8-.9]	S13 [.2-.3]	...	S11	S18	S15 [.0, .2-.9]	S10	S17	T27.0, T27.4	T17 [.2-.4]	T33.1, T34.1	...	...	S19.7	S13[.5-.6], S14[.3-.6], S16, S19.8	S19.9
Head and neck, other . . . . .	...	...	...	...	...	...	...	...	T20, T28.0, T28.5, T95.0	...	T35.2	...	...	...	...	...
Spine and upper back																
Spinal cord . . . . .	...	...	S14[.0-.1], S24[.0-.1], S34[.0-.1, .3], T09.3, T91.3	...	...	...	...	...	...	...	...	...	...	...	...	...
Vertebral column	S12[.0-.7], S22[.0-.1], S32[.0-.2], T08, T91.1	S13[.0-.1], S23[.0-.1], S33[.0-.2]	S14.2	...	...	S15.1	...	...	...	...	...	...	...	...	S13.4, S23.3, S24.2, S33[.5-.7] S34[.2, .4], T09.4	...
Torso																
Thorax	S22[.2-.9]	S23.2	S26.0, S27 [.0-.6, .8-.9], T91.4	S21	S28.1	S25	S20	S28.0	T28[.1, .6]	T17.5	T33.2, T34.2	...	...	S27.7, S29.7	S23[.4-.5], S24[.3-.6], S26.8, S29[.0, .8]	S26.9, S29.9
Abdomen . . . . .	...	...	S36	S31[.1, .8]	...	S35[.0-.4]	S30.1	...	...	T18[.2-.4]	...	...	...	...	...	...
Pelvis and lower back	S32[.3-.8]	S33[.3-.4]	S37	S31[.0, .2-.5]	S38.2	S35.5	S30 [.0, .2]	S38.0	T28[.3, .8]	T18.5, T19	...	...	...	...	S34.5	...

See footnotes at end of table.

Table II. ICD-10 codes used to define cells of the injury mortality diagnosis matrix for use with multiple cause-of-death data—Con.

[Figures in brackets [] apply to the code or range of codes preceding them]

Body region of injury	Nature of injury															
	Fracture	Dis- location	Internal organ injury	Open wound	Amputation	Blood vessel	Superficial and contusion	Crushing	Burn	Effect of Foreign Bodies entering orifice	Other effects of external causes	Poisoning	Toxic effects	Multiple injuries	Other specified injury	Un- specified injury
Torso—Con																
Abdomen, lower back & pelvis	T02.1	...	S39[.6-.7], T06.5, T91.5	S31.7	S38.3	S35[.7-.9]	S30[.7-.9]	S38.1	...	...	T33.3, T34.3, T35.3	...	...	T03.1	S34[.6, .8], S39[.0, .8]	S39.9
Other trunk	T91.2	...	...	T09.1	T09.6	...	T09.0	T04.1	T21, T27 [.2-.3, .6-.7], T28[.2, .7], T95.1	T17[.8-.9], T18 [.1, .8-.9]	...	...	...	T09.2	T09[.5, .8]	T09.9
Extremities																
Upper extremity	S42, S52, S62, T02 [.2, .4], T10, T92 [.1-.2]	S43[.0-.3], S53[.0-.1], S63[.0-.2]	...	S41, S51, S61, T01.2, T11.1, T92.0	S48, S58, S68 T05 [.0, .2], T11.6	S45, S55, S65, T11.4	S40, S50, S60, T00.2, T11.0	S47, S57, S67, T04.2	T22-T23, T95.2	...	T33[.4-.5] T34[.4-.5] T35.4	...	...	S49.7, S59.7, S69.7, T03.2, T11.2, T92[.3, .6]	S43[.4-.7], S44, S46, S49.8, S53[.2-.4], S54, S56, S59.8, S63[.3-.7], S64, S66, S69.8, T11[.3, .5, .8], T92[.4-.5, .8]	S49.9, S59.9, S69.9, T11.9, T92.9
Hip	S72[.0-.2]	S73.0	...	S71.0	S78.0	...	S70.0	S77.0	...	...	...	...	...	...	S73.1, S76.0	...
Other lower extremity	S72[.3-.9], S82, S92, T02[.3, .5], T12, T93 [.1-.2]	S83[.0-.1], S93 [.0-.1, .3]	...	S71[.1-.8], S81, S91, T01.3, T13.1, T93.0	S78[.1-.9], S88, S98, T05[.3, .5], T13.6	S75, S85, S95, T13.4	S70 [.1-.9], S80, S90, T00.3, T13.0	S77 [.1-.2], S87, S97, T04.3	T24-T25, T95.3	...	T33[.6-.8] T34[.6-.8], T35.5	...	...	S79.7, S89.7, S99.7, T03.3, T13.2, T93[.3, .6]	S74, S76[.1-.7], S79.8, S83[.2-.6], S84, S86, S89.8, S93[.2, .4-.6], S94, S96, S99.8, T13[.3, .5, .8], T93[.4-.5, .8]	S79.9, S83.7, S89.9, S99.9, T13.9, T93.9
Unclassifiable by body region																
Multiple body regions	T02[.8-.9]	...	...	T01.9	T05[.8-.9]	T06.3	T00[.8-.9]	T04 [.8-.9]	T27.1, T27.5, T28.9	...	T35 [.0-.1, .6]	...	...	T03[.8-.9], T91.0	T06[.2, .4], T91.8	T07, T91.9, T94.0

See footnotes at end of table.

Table II. ICD-10 codes used to define cells of the injury mortality diagnosis matrix for use with multiple cause-of-death data—Con.

[Figures in brackets [] apply to the code or range of codes preceding them]

Body region of injury	Nature of injury															
	Fracture	Dis- location	Internal organ injury	Open wound	Amputation	Blood vessel	Superficial and contusion	Crushing	Burn	Effect of Foreign Bodies entering orifice	Other effects of external causes	Poisoning	Toxic effects	Multiple injuries	Other specified injury	Un- specified injury
Unclassifiable by body region—Con.																
System wide . . . . .	...	...	...	...	...	...	...	...	...	...	T66-T75	T36-T50, T96	T51- T85, T97	...	T79[.0-.9], T98.2	...
Unspecified	T14.2	...	...	T14.1	...	T14.5	T14.0	...	T28.4, T30-T32, T95 [.4, .8-9]	T98.0	...	T33.9, T34.9, T35.7	...	T14.3, T14.7	T14[.4, .6]	T14 [.8-.9], T94.1, T98.1

... Category not applicable.

NOTES: The matrix excludes the following codes that are not valid in the U.S.: T00[.0-.1, .6], T01[.0-.1, .6, .8], T02[.0, .6-.7], T03[.0, .4], T04[.0, .4, .7], T05[.1, .4, .6], T06[.0, .1, .8], T29. Also excluded are codes T78, T80-T88, T98.3 for adverse effects, not elsewhere classified and complications of surgical and medical not elsewhere classified.

codes, employing linkage and other provisions in the ICD, into a form amenable to the tabulation and analysis of multiple-cause-of-death statistics (55). The translated entity-axis codes are referred to as record-axis codes. Multiple-cause-of-death statistics presented in this report are based on record-axis data. Multiple cause data allow up to 20 different ICD codes (including the underlying cause) on both the entity and record axes. Most death certificates for which injury is the underlying cause of death have no more than two injury diagnoses (23).

Changing injury mortality classifications from ICD-9 to ICD-10

Fundamental changes in the classification of injury occurred with the introduction of ICD-10, implemented beginning with 1999 mortality data. In ICD-9, codes were numeric with external causes of injury classified to a supplementary chapter in which codes were given the prefix "E," hence the use of the term "E-codes" to denote those used for external causes (57). Nature of injury codes were often referred to as "N-codes." In ICD-10, the terms "E-code" and "N-code" are no longer appropriate to describe injury mortality because all ICD-10 codes are alphanumeric, each beginning with a letter of the alphabet followed by numbers ("E-codes" in ICD-10 would include endocrine, nutritional and metabolic diseases found in Chapter IV of the ICD; "N-codes" would refer to diseases of the genitourinary system found in Chapter XIV). External cause-of-death codes in ICD-10 begin with letters "V," "W," "X" or "Y." Nature-of-injury and poisoning codes begin with letters "S" or "T" (11).

Another important difference in the classification of injury mortality introduced with ICD-10 involves changes in the way the codes are organized. In ICD-10, transport accidents are grouped by the characteristics of the injured person, e.g., pedestrian (V01-V09), pedal cyclist (V10-V19), car occupant (V40-V49). In ICD-9, transport accidents were grouped by the type of vehicle involved in the accident, e.g., railway accidents (E800-E807), motor vehicle traffic (E810-E819), and water transport accidents (E830-E838). Nature-of-injury codes are also organized differently in ICD-10 and are grouped according to the site of the injury, e.g., head (S00-S09), neck (S10-S19), and ankle and foot (S90-S99). In ICD-9, nature-of-injury codes were grouped according to the type of injury, e.g., fractures (800-829), intracranial injury (850-854), and open wound (870-897).

Although ICD-10 is generally more detailed, some external cause categories have less specificity in ICD-10. ICD-10 codes for unintentional poisonings (X40-X49) are substantially less detailed than in ICD-9 (E850-E869). For example, ICD-10 code X41 (accidental poisoning by and exposure to antiepileptic, sedative-hypnotic, anti-Parkinsonism and psychotropic drugs) would be roughly comparable to ICD-9 codes E851 (barbiturates), E852.0-E852.9 (various other sedatives and hypnotics), E853.0-E853.9 (various tranquilizers), E854.0 (antidepressants), E854.2 (psychostimulants), E854.3 (central nervous system stimulants), and E855.0 (anticonvulsant and anti-Parkinsonism drugs). In ICD-10, carbon monoxide cannot be uniquely identified using the assigned external cause code X47 (accidental poisoning by and exposure to other gases and vapors). In ICD-9, codes E868.0-E868.9 involve categories of carbon monoxide poisoning. Fortunately, much of the poisoning detail lost in the external cause codes in ICD-10 can be regained by using multiple-cause poisoning codes

(in "Injury and Poisoning" chapter) in combination with the external cause codes. For example, an underlying cause coded to X47 with T58 in the multiple cause data would indicate poisoning by carbon monoxide. Unintentional firearm categories (W32-W34) are also somewhat less detailed in ICD-10 than in ICD-9 (E922.0-E922.9).

In some cases, comparable ICD-10 codes do not exist for categories in ICD-9. For example, E887 (fracture, cause unspecified) is assigned in ICD-9 when a fracture is specified on the death certificate without specificity regarding the external cause of the fracture. This category was often grouped in ICD-9 with unintentional falls, assuming that the unspecified external cause would be, in most instances, a fall. In ICD-10, no such category exists and these deaths would be classified to X59 (exposure to unspecified factor), a much less specific category and one not amenable to grouping with unintentional falls.

More detailed analysis of changes in injury mortality coding between ICD-9 and ICD-10 is possible using the comparability data file published by NCHS and available on the NCHS website (45). This data file contains individual 1996 mortality records coded by both ICD-9 and ICD-10.

Classification of terrorism-related deaths

A new set of codes and guidelines were developed by NCHS to classify deaths that occurred as the result of the terrorist attacks on September 11, 2001 (58,59). The codes were developed within the framework of ICD-10 and include *U01-*U02 for terrorism involving an assault (homicide) and *U03 for terrorism involving intentional self-harm (suicide). More detail regarding the structure of the codes and inclusion terms is available at <http://www.cdc.gov/nchs/about/otheract/icd9/appendix1.htm>. The asterisk (*) preceding these codes indicates that the code was introduced by the United States, but is not officially part of the ICD. The codes were placed in the "U" Chapter of ICD-10 as this chapter was reserved specifically for "future additions and changes and for possible interim classifications to solve difficulties arising at the national and international levels between revisions (11)." To maintain international comparability in reporting homicide and suicide rates, terrorist assaults/homicides (*U01-*U02) are included in general tabulations with other homicides (*U01-*U02, X85-Y09, Y87.1) and terrorist intentional self-harm/suicides (*U03) are included with suicides (*U03, X60-X84, Y87.0).

Ranking leading mechanisms of injury death

Leading mechanisms of injury death are ranked according to the number of deaths assigned to rankable mechanisms in the external cause of injury mortality matrix (see table C—rankable mechanisms are indicated by the symbol "#") using a procedure consistent with that used to rank leading causes of death (7,60). Vaguely defined categories were summarily excluded from selection as rankable mechanisms. These included all categories beginning with the words "other" or "unspecified." Among the remaining mechanism categories, decisions were made to select as rankable the mechanisms of injury death considered most useful from a public health perspective, with the following condition: the rankable mechanisms must be mutually exclusive. If a category representing a subtotal (such as Fire/hot object or substance or motor vehicle traffic) is selected as a rankable mechanism, its component parts are not selected as rankable.

Race and Hispanic origin

Race and Hispanic origin are reported separately on the death certificate. Therefore, data shown by race include persons of Hispanic or non-Hispanic origin, and data for Hispanic origin include persons of any race. In this report, unless otherwise specified, deaths of Hispanic origin are included in the totals for each race group—white, black, American Indian, and Asian or Pacific Islander (API)—according to the decedent's race as reported on the death certificate. Data shown for Hispanic persons include all persons of Hispanic origin of any race.

Mortality data for the Hispanic-origin population are based on deaths to residents of all 50 States and the District of Columbia. Data year 1997 was the first year that mortality data for the Hispanic population were available for the entire United States.

Quality of race and Hispanic origin data—Death rates for Hispanic, American Indian, and API persons should be interpreted with caution because of inconsistencies in reporting race and ethnicity on the death certificate as compared with race and ethnicity on censuses, surveys, and birth certificates. Studies have shown underreporting on death certificates of American Indians, API, and Hispanic decedents; and undercounts of these groups in the censuses (61,62).

A number of studies have been conducted on the reliability of race and ethnicity reported on the death certificate by comparing race on the death certificate with that reported on another data collection instrument, such as the census or a survey. Differences may arise because of differences in who provides race information on the compared records. Race information on the death certificate is reported by the funeral director as provided by an informant or in the absence of an informant, on the basis of observation. In contrast, race on the census or on the Current Population Survey (CPS) is obtained while the individual is alive and is self-reported or reported by another member of the household familiar with the individual and, therefore, may be considered more valid. A high level of agreement between the death certificate and the census or survey report is essential to assure unbiased death rates by race.

Studies (62,63) show that a person self-reported as American Indian or Asian on census or survey records is sometimes reported as white on the death certificate. The net effect of misclassification is an underestimation of deaths and death rates for races other than white and black. In addition, undercoverage of minority groups in the census and resultant population estimates, introduces biases into death rates by race (61,64). Estimates of the approximate effect of the combined bias due to race misclassification on death certificates and underenumeration on the 1990 census are as follows: white, -1.0 percent; black, -5.0; American Indian, +20.6; Asian or Pacific Islander, +10.7 (61).

The National Longitudinal Mortality Study (NLMS) examined the reliability of Hispanic origin reported on 43,520 death certificates with that reported on a total of 12 Current Population Surveys conducted by the U.S. Bureau of the Census for the years 1979–85 (61). In this study, agreement—on a record-by-record basis—was 89.7 percent for any report of Hispanic origin. The ratio of deaths for CPS divided by deaths for death certificate was 1.07 indicating net underreporting of Hispanic origin on death certificates by 7 percent as compared with self-reports on the surveys. Death rates for the Hispanic-origin population are also affected by undercoverage of this population group in

the census and resultant population estimates; the estimated net correction, taking into account both sources of bias, is 1.6 percent (61,64).

Other races and race not stated—Beginning in 1992 all records coded as "Other races" (0.04 percent of the total deaths in 2002) were assigned to the specified race of the previous record. Records for which race was unknown, not stated, or not classifiable (0.08 percent) were assigned the racial designation of the previous record.

Population bases for computing rates

Population estimates represent the population at risk of dying in a specified group. The populations used for computing death rates in this report are estimates for July 1, 2002, and were produced under a collaborative arrangement with the U.S. Census Bureau (65). Reflecting the new standards for the classification of race and ethnicity issued in 1997 by the U.S. Office of Management and Budget (OMB), Census 2000 included an option for individuals to report more than one race, as appropriate, for themselves and household members (66). In addition, the standards specified five minimum race categories to be used for tabulation (American Indian or Alaska Native, Asian, black or African American, Native Hawaiian or Other Pacific Islander, and white). This is a modification of the previous 1977 OMB standards in which only four race categories were specified (Asian and Pacific Islander persons were treated as a single group) and respondents were classified as only one of the four (67). Death certificates currently collect only one race for the decedent according to the 1977 OMB guidelines and are thus incompatible with population data based on the 2000 Census for calculating death rates.

In order to produce 2000 populations with race categories comparable to those used on the death certificate, the enumerated population data with multiple race categories was "bridged" back to single race categories. In addition, the 2000 census counts were modified to be consistent with the old OMB racial categories, i.e., data for Asian persons and Native Hawaiians or other Pacific Islanders were combined into a single category: Asian or Pacific Islanders. The procedures used to produce the "bridged" populations are described in separate publications (68,69). It is anticipated that "bridged" population data will be used over the next few years for computing population-based rates. Beginning with deaths occurring in 2003, a few States will collect multiple race data on the death certificate. Once all States begin collecting data on race according to the new OMB standards, it is expected that the use of "bridged" populations will be discontinued.

It is important to emphasize that the population data used to calculate the race-specific mortality statistics presented in this report are based on special estimation procedures and are not true counts. The estimation procedures used to develop these populations are subject to error. Smaller populations, e.g., American Indians, are likely to be affected much more than larger populations (68). While the nature and magnitude of these errors is unknown, the potential for error should be kept in mind when evaluating trends and differentials. Over the next several years, additional information will be incorporated in the estimation procedures, resulting in more robust race-specific population estimates.

Population estimates by race, sex, and the age categories presented in this report are shown in table III. Population estimates by Hispanic origin, race for the non-Hispanic population, sex, and age are shown in table IV. Population estimates for each State are shown in table V (70).

Computing rates

Death rates in this report are on an annual basis per 100,000 estimated population residing in the specified area or in a specified group. Comparisons made in the text among rates, unless otherwise specified, are statistically significant at the 0.05 level of significance.

Age-adjusted rates (R') are used to compare relative mortality risks among groups and over time. However, they should be viewed as relative indexes rather than as actual measures of mortality risk. They were computed by the direct method, that is, by applying age-specific death rates (R_i) to the U.S. standard population (w_i) (table VI).

$$R' = \sum w_i R_i$$

Beginning with the 1999 data year, a new population standard was adopted by NCHS for use in age-adjusting death rates. Based on the projected year 2000 population of the United States, the new standard replaces the 1940 standard population that had been used for over 50 years. The new population standard affects levels of mortality and to some extent trends and group comparisons. Of particular note are the effects on race comparison of mortality. For detailed discussion, see "Age Standardization of Death Rates: Implementation of the Year 2000 Standard" (71).

All age-adjusted rates shown in this report are based on the year 2000 standard population. The year 2000 standard population and corresponding weights used for computing age-adjusted rates and standard errors are shown in table VI.

Random variation

The mortality data presented in this report are not subject to sampling error. Mortality data, even based on complete counts, may be affected by random variation. That is, the number of deaths that actually occurred may be considered as one of a large series of possible results that could have arisen under the same circumstances (72,73). When the number of deaths is small (perhaps fewer than 100), random variation tends to be relatively large. Therefore, considerable caution must be observed in interpreting statistics based on small numbers of deaths.

Measuring random variability—To quantify the random variation associated with mortality statistics, one must make an assumption regarding the appropriate underlying distribution. Deaths, as infrequent events, can be viewed as deriving from a Poisson probability distribution. The Poisson distribution is simple conceptually and computationally, and provides reasonable, conservative variance estimates for mortality statistics when the probability of dying is relatively low (72). Using the properties of the Poisson distribution, the standard error (SE) associated with the number of deaths (D) is

$$1. \quad SE(D) = \sqrt{\text{var}(D)} = \sqrt{D}$$

where $\text{var}(D)$ denotes the variance of D .

The standard error associated with crude and age-specific death rates (R) assumes that the population denominator (P) is a constant and is

$$2. \quad SE(R) = \sqrt{\text{var}\left(\frac{D}{P}\right)} = \sqrt{\frac{1}{P^2} \text{var}(D)} = \sqrt{\frac{D}{P^2}} = \frac{R}{\sqrt{D}}$$

The coefficient of variation or relative standard error (RSE) is a useful measure of relative variation. The RSE is calculated by dividing the statistic (e.g., number of deaths, death rate) into its standard error and multiplying by 100. For the number of deaths

$$RSE(D) = 100 \frac{SE(D)}{D} = 100 \frac{\sqrt{D}}{D} = 100 \sqrt{\frac{1}{D}}$$

For crude and age-specific death rates

$$RSE(R) = 100 \frac{SE(R)}{R} = 100 \frac{R/\sqrt{D}}{R} = 100 \sqrt{\frac{1}{D}}$$

Thus,

$$3. \quad RSE(D) = RSE(R) = 100 \sqrt{\frac{1}{D}}$$

The standard error of the age-adjusted death rate (R') is

$$4. \quad SE(R') = \sqrt{\sum w_i^2 \text{var}(R_i)} = \sqrt{\sum w_i^2 \left(\frac{R_i}{D_i}\right)}$$

where

R_i = age-specific rate for the i th age group

w_i = age-specific standard weight for the i th age group from the U.S. standard population such that $\sum w_i = 1.0$ (see table VI and section titled "Computing rates" in "Technical Notes")

D_i = number of deaths for the i th age group

The RSE for the age-adjusted rate, $RSE(R')$, can easily be calculated by dividing $SE(R')$ from formula 4 by the age-adjusted death rate, R' , and multiplying by 100.

$$RSE(R') = 100 \frac{SE(R')}{R'}$$

Suppression of unreliable rates—Beginning with 1989 data, an asterisk is shown in place of a crude or age-specific death rate based on fewer than 20 deaths, the equivalent of an RSE of 23 percent or more. The limit of 20 deaths is a convenient, if somewhat arbitrary, benchmark, below which rates are considered to be too statistically unreliable for presentation. For age-adjusted death rates the suppression criterion is based on the sum of the age-specific deaths; i.e., if the sum of the age-specific deaths is less than 20, an asterisk is presented in place of the rate.

Confidence intervals and statistical tests based on 100 deaths or more—When the number of deaths is large, a normal approximation may be used in the calculation of confidence intervals and statistical tests. How large is to some extent a subjective judgment. In general, for crude and age-specific death rates, the normal approximation performs quite well when the number of deaths is 100 or greater. For age-adjusted rates, the criterion for use of the normal approximation is somewhat more complicated (44,71,74). Formula 5 is used to calculate lower and upper limits of the 95-percent confidence interval for the death rate when the normal approximation is appropriate.

Table III. Estimated population by age, race, and sex: United States, July 1, 2002

Age	All races			White			Black			American Indian			Asian or Pacific Islander		
	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female
Total	288,368,706	141,660,980	146,707,726	234,746,440	115,966,453	118,779,987	37,747,692	17,978,612	19,769,080	3,076,095	1,535,463	1,540,632	12,798,479	6,180,452	6,618,027
Less than 1 year	4,033,719	2,063,824	1,969,895	3,130,730	1,602,846	1,527,884	674,576	344,210	330,366	41,724	21,297	20,427	186,689	95,471	91,218
1-4 years	15,575,428	7,961,545	7,613,883	12,126,969	6,212,014	5,914,955	2,539,378	1,290,224	1,249,154	199,139	101,419	97,720	709,942	357,888	352,054
5-9 years	19,900,837	10,187,683	9,713,174	15,456,522	7,932,180	7,524,342	3,291,067	1,671,470	1,619,597	276,708	140,297	136,411	876,540	443,716	432,824
10-14 years	21,136,449	10,824,896	10,311,553	16,426,008	8,431,022	7,994,986	3,513,744	1,782,740	1,731,004	305,909	155,034	150,875	890,788	456,100	434,688
15-19 years	20,376,151	10,471,128	9,905,023	16,019,451	8,254,924	7,764,527	3,172,349	1,612,894	1,559,455	292,760	149,492	143,268	891,591	453,818	437,773
20-24 years	20,213,632	10,350,141	9,863,491	15,933,490	8,226,899	7,706,591	3,025,875	1,494,112	1,531,763	264,526	137,125	127,401	989,741	492,005	497,736
25-34 years	39,928,304	20,202,776	19,725,528	31,626,394	16,214,420	15,411,974	5,444,534	2,589,128	2,855,406	459,579	236,699	222,880	2,397,797	1,162,529	1,235,268
35-44 years	44,916,606	22,366,506	22,550,100	36,482,845	18,367,816	18,115,029	5,805,202	2,725,753	3,079,449	470,480	232,958	237,522	2,158,079	1,039,979	1,118,100
45-54 years	40,083,937	19,676,321	20,407,616	33,347,010	16,552,991	16,794,019	4,651,519	2,148,656	2,502,863	373,524	181,328	192,196	1,711,884	793,346	918,538
55-64 years	26,601,726	12,784,311	13,817,415	22,761,178	11,045,418	11,715,760	2,640,870	1,176,912	1,463,958	210,022	101,396	108,626	989,656	460,585	529,071
65 years and over	35,601,917	14,771,869	20,830,048	31,435,843	13,125,923	18,309,920	2,988,578	1,142,513	1,846,065	181,724	78,418	103,306	995,772	425,015	570,757
65-74 years	18,274,215	8,301,005	9,973,210	15,878,159	7,288,211	8,589,948	1,687,536	700,654	986,882	110,349	50,750	59,599	598,171	261,390	336,781
75-84 years	12,734,633	5,081,056	7,653,577	11,405,718	4,580,254	6,825,464	964,301	348,584	615,717	53,892	22,071	31,821	310,722	130,147	180,575
85 years and over	4,593,069	1,389,808	3,203,261	4,151,966	1,257,458	2,894,508	336,741	93,275	243,466	17,483	5,597	11,886	86,879	33,478	53,401

NOTE: These population estimates are based on the 2000 Census; see "Technical Notes."

SOURCE: U.S. Census Bureau.

Table IV. Estimated population by age, Hispanic origin, race for non-Hispanic population, and sex: United States, July 1, 2002

Age	All origins			Hispanic			Non-Hispanic			Non-Hispanic white			Non-Hispanic black		
	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female
Total	288,368,706	141,660,980	146,707,726	38,761,304	19,991,226	18,770,078	249,607,402	121,669,754	127,937,648	198,691,529	97,328,705	101,362,824	36,145,193	17,191,516	18,953,677
Less than 1 year	4,033,719	2,063,824	1,969,895	833,933	426,383	407,550	3,199,786	1,637,441	1,562,345	2,337,889	1,197,524	1,140,365	647,046	330,090	316,956
1-4 years	15,575,428	7,961,545	7,613,883	3,127,779	1,598,115	1,529,664	12,447,649	6,363,430	6,084,219	9,224,405	4,728,800	4,495,605	2,402,138	1,220,181	1,181,957
5-9 years	19,900,837	10,187,683	9,713,174	3,729,897	1,910,015	1,819,882	16,170,940	8,277,648	7,893,292	12,028,891	6,176,261	5,852,630	3,112,035	1,580,131	1,531,904
10-14 years	21,136,449	10,824,896	10,311,553	3,535,140	1,810,519	1,724,621	17,601,309	9,014,377	8,586,932	13,174,392	6,764,493	6,409,899	3,348,133	1,698,583	1,649,550
15-19 years	20,376,151	10,471,128	9,905,023	3,197,168	1,664,488	1,532,680	17,178,983	8,806,640	8,372,343	13,066,442	6,715,438	6,351,004	3,033,725	1,541,764	1,491,961
20-24 years	20,213,632	10,350,141	9,863,491	3,606,505	1,991,936	1,614,569	16,607,127	8,358,205	8,248,922	12,587,099	6,370,712	6,216,387	2,874,571	1,417,125	1,457,446
25-34 years	39,928,304	20,202,776	19,725,528	7,332,062	3,978,236	3,353,826	32,596,242	16,224,540	16,371,702	24,775,910	12,480,105	12,295,805	5,160,980	2,451,380	2,709,600
35-44 years	44,916,606	22,366,506	22,550,100	5,808,458	3,026,851	2,781,607	39,108,148	19,339,655	19,768,493	31,065,197	15,533,926	15,531,271	5,576,846	2,618,049	2,960,597
45-54 years	40,083,937	19,676,321	20,407,616	3,654,900	1,823,307	1,831,593	36,429,037	17,853,014	18,576,023	29,942,672	14,851,443	15,091,229	4,502,817	2,077,847	2,424,970
55-64 years	26,601,726	12,784,311	13,817,415	1,974,793	934,703	1,040,090	24,626,933	11,849,608	12,777,325	20,908,117	10,167,732	10,740,385	2,566,235	1,142,737	1,423,498
65 years and over	35,601,917	14,771,869	20,830,048	1,960,669	826,673	1,133,996	33,641,248	13,945,196	19,696,052	29,580,515	12,342,271	17,238,244	2,920,867	1,115,629	1,805,238
65-74 years	18,274,215	8,301,005	9,973,210	1,180,765	523,210	657,555	17,093,450	7,777,795	9,315,655	14,762,715	6,793,121	7,969,594	1,645,906	683,007	962,899
75-84 years	12,734,633	5,081,056	7,653,577	599,503	243,698	355,805	12,135,130	4,837,358	7,297,772	10,836,937	4,348,361	6,488,576	944,343	341,210	603,133
85 years and over	4,593,069	1,389,808	3,203,261	180,401	59,765	120,636	4,412,668	1,330,043	3,082,625	3,980,863	1,200,789	2,780,074	330,618	91,412	239,206

NOTE: These population estimates are based on the 2000 Census; see "Technical Notes."

SOURCE: U.S. Census Bureau.

$$5. \quad L(R) = R - 1.96(SE(R)) \quad \text{and} \quad U(R) = R + 1.96(SE(R))$$

where $L(R)$ and $U(R)$ are the lower and upper limits of the confidence interval, respectively. The resulting 95 percent confidence interval can be interpreted to mean that the chances are 95 in 100 that the "true" death rate falls between $L(R)$ and $U(R)$. For example, suppose that the crude death rate for all injuries is 55.2 per 100,000 population based on 157,078 deaths. Lower and upper limits of the 95 percent confidence intervals using formula 5 are calculated as

$$L(55.2) = 55.2 - 1.96(.14) = 54.9 \quad \text{and} \\ U(55.2) = 55.2 + 1.96(.14) = 55.5$$

Thus, the chances are 95 in 100 that the true death rate for all injuries is between 54.9 and 55.5. Formula 5 can also be used to calculate 95-percent confidence intervals for the number of deaths, age-adjusted death rates, and other mortality statistics when the normal approximation is appropriate by replacing R with D , R' , etc.

When testing the difference between two rates, R_1 and R_2 (each based on 100 or more deaths), the normal approximation may be used to calculate a test statistic, z , such that

$$6. \quad z = \frac{R_1 - R_2}{\sqrt{SE(R_1)^2 + SE(R_2)^2}}$$

If $|z| \geq 1.96$ then the difference between the rates is statistically significant at the 0.05-level. If $|z| < 1.96$ then the difference is not statistically significant. Formula 6 can also be used to perform tests

Table VI. United States standard population by age: Numbers and proportions (weights)

Age	Number	Weights (w)
All ages	1,000,000	1.000000
Under 1 year	13,818	0.013818
1-4 years	55,317	0.055317
5-14 years	145,565	0.145565
15-24 years	138,646	0.138646
25-34 years	135,573	0.135573
35-44 years	162,613	0.162613
45-54 years	134,834	0.134834
55-64 years	87,247	0.087247
65-74 years	66,037	0.066037
75-84 years	44,842	0.044842
85 years and over	15,508	0.015508

for other mortality statistics when the normal approximation is appropriate (when both statistics being compared meet the normal criteria) by replacing R_1 and R_2 with D_1 and D_2 , R'_1 and R'_2 , etc. Suppose that the age-adjusted death rate for firearm is 10.3 per 100,000 U.S. standard population in year 1 (R'_1) and 10.2 per 100,000 U.S. standard population in year 2 (R'_2). The standard error for each of these figures, $SE(R'_1)$ and $SE(R'_2)$, is calculated using formula 4. Using formula 6, one can test if the decrease in the age-adjusted rate is statistically significant.

$$z = \frac{10.3 - 10.2}{\sqrt{(0.06)^2 + (0.06)^2}} = 1.18$$

Table V. Estimated population for the United States and each State, 2002

[Populations for the United States are postcensal estimates produced in 2002 based on the 2000 census estimated as of July 1, 2002. Populations for each State are postcensal estimates in 2003 based on the 2000 census estimated as of July 1, 2002. State populations do not add to U.S. total]

Area	Total	Area	Total
United States	288,368,706		
Alabama	4,486,508	Montana	909,453
Alaska	643,786	Nebraska	1,729,180
Arizona	5,456,453	Nevada	2,173,491
Arkansas	2,710,079	New Hampshire	1,275,056
California	35,116,033	New Jersey	8,590,303
Colorado	4,506,542	New Mexico	1,855,059
Connecticut	3,460,503	New York	19,157,532
Delaware	807,385	North Carolina	8,320,146
District of Columbia	570,898	North Dakota	634,110
Florida	16,713,149	Ohio	11,421,268
Georgia	8,560,310	Oklahoma	3,493,714
Hawaii	1,244,898	Oregon	3,521,515
Idaho	1,341,131	Pennsylvania	12,335,091
Illinois	12,600,620	Rhode Island	1,069,725
Indiana	6,159,068	South Carolina	4,107,183
Iowa	2,936,760	South Dakota	761,063
Kansas	2,715,884	Tennessee	5,797,289
Kentucky	4,092,891	Texas	21,779,893
Louisiana	4,482,646	Utah	2,316,256
Maine	1,294,466	Vermont	616,592
Maryland	5,458,137	Virginia	7,293,542
Massachusetts	6,427,803	Washington	6,068,996
Michigan	10,050,446	West Virginia	1,801,873
Minnesota	5,019,720	Wisconsin	5,441,196
Mississippi	2,871,782	Wyoming	498,703
Missouri	5,672,579		

SOURCE: U.S. Census Bureau; see "Technical Notes."

Because $z = 1.18 < 1.96$, the increase from year 1 to year 2 in the age-adjusted death rate for firearm injuries is not statistically significant.

Confidence intervals and statistical tests based on fewer than 100 deaths—When the number of deaths is not large (less than 100), the Poisson distribution cannot be approximated by the normal distribution. The normal distribution is a symmetric distribution with a range from $-\infty$ to $+\infty$. As a result, confidence intervals based on the normal distribution also have this range. The number of deaths or the death rate, however, cannot be less than zero. When the number of deaths is very small, approximating confidence intervals for deaths and death rates using the normal distribution will sometimes produce lower confidence limits that are negative. The Poisson distribution, in contrast, is an asymmetric distribution with zero as a lower bound. Thus, confidence limits based on this distribution will never be less than zero. A simple method based on the more general family of gamma distributions, of which the Poisson is a member, can be used to approximate confidence intervals for deaths and death rates when the number of deaths is small (44,71,74). For more information regarding how the gamma method is derived, see "Derivation of the gamma method" at the end of this section.

Calculations using the gamma method can be made using commonly available spreadsheet programs or statistical software (e.g., Excel, SAS) that include an inverse gamma function. In Excel, the function "gammainv (probability, alpha, beta)" returns values associated with the inverse gamma function for a given probability between 0 and 1. For a 95-percent confidence interval, the probability associated with the lower limit is $.05/2 = .025$ and the probability associated with the upper limit is $1 - (.05/2) = .975$. Alpha and beta are parameters associated with the gamma distribution. For the number of deaths and crude and age-specific death rates, $\alpha = D$ (the number of deaths) and $\beta = 1$. In Excel, the following formulas can be used to calculate lower and upper limits of the 95-percent confidence interval for the number of deaths and crude and age-specific death rates

$$L(D) = \text{GAMMAINV}(.025, D, 1) \text{ and } U(D) = \text{GAMMAINV}(.975, D + 1, 1)$$

Confidence limits for the death rate are then calculated by dividing $L(D)$ and $U(D)$ by the population (P) at risk of dying (see formula 13).

Alternatively, limits for the 95-percent confidence interval can be estimated using the lower and upper confidence limit factors shown in table VII. For the number of deaths, D , and the death rate, R ,

$$7. L(D) = L \times D \text{ and } U(D) = U \times D$$

$$8. L(R) = L \times R \text{ and } U(R) = U \times R$$

where L and U in formulas 7 and 8 are the lower and upper confidence limit factors which correspond to the appropriate number of deaths, D , in table VII. For example, suppose that the suicide rate for males aged 14 is 4.2 per 100,000 and based on 88 deaths. Applying formula 8, values for L and U from table VII for 88 deaths are multiplied by the death rate, 4.2, such that

$$L(R) = L(4.2) = 0.802029 \times 4.2 = 3.4 \text{ and}$$

$$U(R) = U(4.2) = 1.232028 \times 4.2 = 5.2$$

These confidence limits indicate that the chances are 95 out of 100 that the actual suicide rate for males aged 14 years is between 3.4 and 5.2 per 100,000.

Although the calculations are similar, confidence intervals based on small numbers for age-adjusted death rates are somewhat more complicated (44,71). Refer to the most recent version of the "Mortality Technical Appendix" for more details (44).

When comparing the difference between two rates, R_1 and R_2 , where one or both of the rates are based on fewer than 100 deaths, a comparison of 95 percent confidence intervals may be used as a statistical test. If the 95 percent confidence intervals do not overlap, then the difference can be said to be statistically significant at the 0.05-level. A simple rule of thumb is: if $R_1 > R_2$ then test if $L(R_1) > U(R_2)$ or if $R_2 > R_1$ then test if $L(R_2) > U(R_1)$. Positive tests denote statistical significance at the 0.05 level. For example, suppose that males aged 14 years have a suicide rate (R_1) of 4.2 based on 88 deaths and females aged 14 years have a suicide rate (R_2) of 1.7 per 100,000 based on 34 deaths. The upper and lower limits of the 95-percent confidence limits for R_1 and R_2 calculated using formula 8 would be

$$L(R_1) = L(4.2) = 0.802029 \times 4.2 = 3.4 \text{ and}$$

$$U(R_1) = U(4.2) = 1.232028 \times 4.2 = 5.2$$

$$L(R_2) = L(1.7) = 0.692529 \times 1.7 = 1.2 \text{ and}$$

$$U(R_2) = U(1.7) = 1.397400 \times 1.7 = 2.4$$

Because $R_1 > R_2$ and $L(R_1) > U(R_2)$, it can be concluded that the difference between the suicide rates for males aged 14 years and females of the same age is statistically significant at the 0.05 level. That is, taking into account random variability, females aged 14 years have a suicide rate that is significantly lower than that for males 14 years of age.

This test may also be used to perform tests for other statistics when the normal approximation is not appropriate for one or both of the statistics being compared by replacing the R_1 and R_2 with D_1 and D_2 , R'_1 and R'_2 , etc.

Users of the method of comparing confidence intervals should be aware that this method is a conservative test for statistical significance. That is, the difference between two rates may, in fact, be statistically significant even though confidence intervals for the two rates overlap (75). Thus, caution should be observed when interpreting a nonsignificant difference between two rates, especially when the lower and upper limits being compared overlap only slightly.

Derivation of the gamma method—For a random variable X that follows a gamma distribution $\Gamma(y, z)$, where y and z are the parameters that determine the shape of the distribution, $E(X) = yz$ and $\text{Var}(X) = yz^2$ (76). For the number of deaths, D , $E(D) = D$ and $\text{Var}(D) = D$. It follows that $y = D$ and $z = 1$ and thus,

$$9. D \sim \Gamma(D, 1)$$

From equation 9, it is clear that the shape of the distribution of deaths depends only on the number of deaths.

For the death rate, R , $E(R) = R$ and $\text{Var}(R) = D/P^2$. It follows, in this case, that $y = D$ and $z = P^{-1}$ and thus,

$$10. R \sim \Gamma(D, P^{-1})$$

A useful property of the gamma distribution is that for $X \sim \Gamma(y, z)$, one can divide X by z such that $X/z \sim \Gamma(y, 1)$. This converts the gamma distribution into a simplified, standard form dependent only on parameter y . Expressing equation 10 in its simplified form gives

Table VII. Lower and upper 95-percent confidence limit factors for the number of deaths and death rate when the number of deaths is less than 100

Number of deaths (D)	Lower confidence limit (L)	Upper confidence limit (U)	Number of deaths (D)	Lower confidence limit (L)	Upper confidence limit (U)
1	0.025318	5.571643	51	0.744566	1.314815
2	0.121105	3.612344	52	0.746848	1.311367
3	0.206224	2.922424	53	0.749069	1.308025
4	0.272466	2.560397	54	0.751231	1.304783
5	0.324697	2.333666	55	0.753337	1.301637
6	0.366982	2.176579	56	0.755389	1.298583
7	0.402052	2.060382	57	0.757390	1.295616
8	0.431729	1.970399	58	0.759342	1.292732
9	0.457264	1.898311	59	0.761246	1.289927
10	0.479539	1.839036	60	0.763105	1.287198
11	0.499196	1.789276	61	0.764921	1.284542
12	0.516715	1.746799	62	0.766694	1.281955
13	0.532458	1.710030	63	0.768427	1.279434
14	0.546709	1.677830	64	0.770122	1.276978
15	0.559692	1.649348	65	0.771779	1.274582
16	0.571586	1.623937	66	0.773400	1.272245
17	0.582537	1.601097	67	0.774986	1.269965
18	0.592663	1.580431	68	0.776539	1.267738
19	0.602065	1.561624	69	0.778060	1.265564
20	0.610826	1.544419	70	0.779549	1.263440
21	0.619016	1.528806	71	0.781008	1.261364
22	0.626695	1.514012	72	0.782438	1.259335
23	0.633914	1.500491	73	0.783840	1.257350
24	0.640719	1.487921	74	0.785215	1.255408
25	0.647147	1.476197	75	0.786563	1.253509
26	0.653233	1.465232	76	0.787886	1.251649
27	0.659006	1.454947	77	0.789184	1.249828
28	0.664493	1.445278	78	0.790459	1.248045
29	0.669716	1.436167	79	0.791709	1.246298
30	0.674696	1.427562	80	0.792938	1.244587
31	0.679451	1.419420	81	0.794144	1.242909
32	0.683999	1.411702	82	0.795330	1.241264
33	0.688354	1.404372	83	0.796494	1.239650
34	0.692529	1.397400	84	0.797639	1.238068
35	0.696537	1.390758	85	0.798764	1.236515
36	0.700388	1.384422	86	0.799871	1.234992
37	0.704092	1.378368	87	0.800959	1.233496
38	0.707660	1.372578	88	0.802029	1.232028
39	0.711098	1.367033	89	0.803082	1.230586
40	0.714415	1.361716	90	0.804118	1.229170
41	0.717617	1.356613	91	0.805138	1.227778
42	0.720712	1.351709	92	0.806141	1.226411
43	0.723705	1.346993	93	0.807129	1.225068
44	0.726602	1.342453	94	0.808102	1.223747
45	0.729407	1.338079	95	0.809060	1.222448
46	0.732126	1.333860	96	0.810003	1.221171
47	0.734762	1.329788	97	0.810933	1.219915
48	0.737321	1.325855	98	0.811848	1.218680
49	0.739806	1.322053	99	0.812751	1.217464
50	0.742219	1.318375			

11. $\frac{R}{P^{-1}} = D \sim \Gamma(D, 1)$

From equation 11, it is clear that the shape of the distribution of the death rate is also dependent solely on the number of deaths.

Using the results of equations 9 and 11, one can use the inverse gamma distribution to calculate upper and lower confidence limits. Lower and upper 100(1 - α) percent confidence limits for the number of deaths, L(D) and U(D), are estimated as

12. $L(D) = \Gamma^{-1}_{(D,1)}(\alpha/2)$ and $U(D) = \Gamma^{-1}_{(D+1,1)}(1 - \alpha/2)$

where Γ^{-1} represents the inverse of the gamma distribution and D + 1 in the formula for U(D) reflects a continuity correction made

necessary by the fact that D is a discrete random variable and the gamma distribution is a continuous distribution. For a 95-percent confidence interval, α = .05. For the death rate, it can be shown that

13. $L(R) = \frac{L(D)}{P}$ and $U(R) = \frac{U(D)}{P}$

For more detail regarding the derivation of the gamma method and its application to age-adjusted death rates and other mortality statistics, see references (44,71,74).

SAS statements

Suppose that one wanted to know the number of unintentional falls with any mention of a head injury. One could use the following SAS statements to obtain this information from the multiple cause mortality file:

```
ARRAY RECAX(20) $ RECAX1-RECAX20; /*RECAX1-RECAX20 CORRESPOND TO THE 20
RECORD AXIS FIELDS IN THE MORTALITY FILE*/
```

```
HEAD=0;
DO I=1 TO 20;
  IF RECAX(I) >='S000' AND RECAX(I) <'S099' THEN HEAD = 1; /*FLAG HEAD INJURIES*/
END;
/*SELECT ALL UNDERLYING CAUSE OF DEATH DUE TO FALLS*/
IF UC >='W00' AND UC <='W19'; /*UC IS THE UNDERLYING CAUSE OF DEATH*/
PROC FREQ;
  TABLES HEAD; /*RETURNS A FREQUENCY DISTRIBUTION FOR THE VARIABLE "HEAD"
WHERE 1=HEAD INJURIES*/
```

```
RUN;
```

If one were interested in the total number of mentions of head injury (more than one head injury could be listed on the death certificate, e.g., skull fracture and intracranial injury), then the DO loop in the previous example would be modified as below:

```
DO I=1 TO 20;
  IF RECAX(I) >='S000' AND RECAX(I) <'S099' THEN HEAD=HEAD+1;
END;
```

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