

**Medicaid Analytic Extract (MAX)  
Date of Death Auxiliary File,  
1999–2008**

Final Report

January 31, 2012

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Shinu Verghese  
Denise Whalen



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Policy Research

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## CONTENTS

ACRONYMS .....	ix
I      INTRODUCTION .....	1
A.   Background.....	1
B.   What Is the Death Master File, and Why Is It Used? .....	2
C.   MAX Person-Summary Files .....	4
D.   2008 DOD Auxiliary File.....	5
E.   Organization of Report.....	5
II     CREATION OF DOD AUXILIARY FILE.....	7
A.   Methodology .....	7
B.   Contents of the 2008 DOD File .....	8
III    RESULTS .....	9
A.   Limitations.....	9
B.   Linkage Across States .....	10
C.   Linkage Over Time.....	10
D.   Summary .....	10
REFERENCES .....	17
APPENDIX A: DATA-PROCESSING STEPS.....	A-1
APPENDIX B: FILE LAYOUT .....	B-1
APPENDIX C: LINKAGE TABLES BY YEAR .....	C-1

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## TABLES

III.1	Linkage of MAX PS Records to SSA Death Master File, 1999–2008 MAX .....	11
III.2	Number of PS Records with SSA DOD, 1999–2008 MAX .....	12
III.3	Percentage of PS Records with SSA DOD, 1999–2008 MAX .....	14

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## ACRONYMS

BIRLS	Beneficiary Identification Records Locator Subsystem
CER	Comparative effectiveness research
CHIP	Children's Health Insurance Program
CMS	Centers for Medicare & Medicaid Services
DMF	Death Master File
DOB	Date of birth
DOD files	Date of death files
EDB	Medicare Enrollment Database
ID	Identification number
IRS	Internal Revenue Service
MAX	Medicaid Analytic eXtract
MSIS	Medicaid Statistical Information System
NCHS	National Center for Health Statistics
NDI	National Death Index
PS	Person-Summary file
SSA	Social Security Administration
SSN	Social Security number
VA	Veterans Affairs

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## **I. INTRODUCTION**

### **A. Background**

Beginning in 1999, all states and the District of Columbia were required to report Medicaid enrollee eligibility and claims data in a standard format into the Medicaid Statistical Information System (MSIS). Mathematica Policy Research, on behalf of the Centers for Medicare & Medicaid Services (CMS), has produced research files derived from these data for each state by calendar year. These files are known as the Medicaid Analytic eXtract (MAX) files. As the quality of the Medicaid data submitted by the states has improved over the years, they have come to be regarded as among the most important research tools for measuring Medicaid enrollment and understanding patterns of Medicaid service use and expenditures across states and over time.

Heightened interest in and expanded funding for comparative effectiveness research (CER) on the Medicaid population has increased the use of MAX data recently. CER researchers often use death as an outcome measure, typically measuring duration until death or including an indicator of death in a time period. To support these analyses, the MAX person-summary (PS) file contains three dates of death: (1) the MSIS date of death, which is reported by the state in the MSIS file; (2) the Medicare Enrollment Database (EDB) date of death, which is linked to the MAX PS file during MAX production (and is available only for people who are dually enrolled in Medicare and Medicaid); and (3) the date of death extracted from the Social Security Administration's (SSA) Death Master File (DMF), which is linked to the MAX PS file during MAX production. All three date of death (DOD) files are right-censored, meaning they contain dates of death that occurred prior to or during the MAX file year (no one in the MAX 2007 PS file, for example, has a date of death after 2007).

To support CER, it is beneficial to have the most up-to-date information on the date of death, including deaths that occurred after the MAX file year. Consequently, Mathematica

created a single 2008 DOD auxiliary file containing records for each MAX year from 1999 to 2008. The file contains DMF DODs as of October 2011 and the linkage variables necessary to link the DMF DOD to the MAX PS files. The 2008 DOD auxiliary file uses a later update of the DMF (October 2011) than was used in the creation of the MAX PS files from 1999 to 2008. Therefore, the 2008 DOD auxiliary file contains a more complete reporting of dates of death than the MAX PS files:

- Dates of death that occurred prior to or during the MAX file year, previously included in the MAX PS file
- Corrections to dates of death included in the MAX PS file
- Additional dates of death for the MAX file year, not included in the MAX PS file
- Dates of death that occurred after the MAX file year, not included in the MAX PS file

## **B. What Is the Death Master File, and Why Is It Used?**

There are several large databases of mortality information that could have been used for the construction of the 2008 DOD auxiliary file. The National Death Index (NDI), produced by the National Center for Health Statistics (NCHS), is a central repository of death records collected by the states' vital statistics offices (NCHS 2010). The Beneficiary Identification Records Locator Subsystem (BIRLS) Death File, an extract of Veterans Affairs (VA) beneficiary death records, is collected from family members, VA hospitals, and VA cemeteries (VA 2010). The Internal Revenue Service (IRS) collects date of death via tax returns and estate tax returns (IRS 2010). The DMF is an SSA data file compiled from SSA payment records as well as information collected from relatives of the deceased individual, funeral directors, financial institutions, postal authorities, and other government agencies (Social Security Administration 2010).

Each of these data sources has strengths and weaknesses. The NDI includes the date of death, the death certificate number, and multiple causes of death. The NDI, however, is costly to

use (\$350 plus 15 cents per record) and has almost a two-year lag between the date of death and reporting of the death in the NDI. Records in the BIRLS death file include the date of death and broad categories for the cause of death (for example, combat, natural, unknown, and other). BIRLS records are updated monthly, but because only veterans are included in the database, they represent a small subset of Medicaid deaths and would not be sufficient for this project. While the IRS records would include a much broader segment of the population, IRS data are restricted and therefore could not be used for this project. The DMF records include the date of death but not the cause of death. As noted on the SSA website, the DMF does not, by design, include a death record for all decedents and SSA does not guarantee the veracity of the file. However, the DMF is updated monthly, made publicly available through a subscription fee, and considered a fairly complete source of mortality data (Hill and Rosenwaike 2001; Schisterman and Whitcomb 2004; Boyle and Decoufle 1990). Consequently, researchers rely on the NDI or the DMF for information about deaths. The NDI is regarded as the “best” source of death information in terms of accurately matching death records of those known to be deceased (Boyle and Decoufle 1990; Curb et al. 1985; Kraut et al. 1992). Research indicates that when compared to known deaths, the NDI identifies 93 to 98 percent, whereas the DMF identifies 78 to 96 percent (Boyle and Decoufle 1990; Curb et al. 1985; Kraut et al. 1992; Wentworth et al. 1983; Hermansen et al. 2009). These findings are mirrored in other studies that report that the DMF identifies 90 to 98 percent of records found in the NDI (Curb et al. 1985; Buchanich et al. 2005; Sohn et al. 2006). .

Despite the slightly lower match rate, the DMF has several benefits. As previously mentioned, compared to the NDI, the DMF is less costly, takes less time to access, and has a shorter time lag in information availability. The DMF is also less affected by misreporting of Social Security Numbers (SSN), and it includes deaths abroad (Hill and Rosenwaike 2001; Sesso et al. 2000; Hill 2001). The DMF reliability levels are higher for some cohorts—particularly

those over age 65 (Hill and Rosenwaike 2001; Schisterman and Whitcomb 2004; Curb et al. 1985; Wentworth et al. 1983). Accuracy is also higher for men than for women (Curb et al. 1985; Sesso et al. 2000; Hill 2001), for whites than for African Americans (Schisterman and Whitcomb 2004; Curb et al. 1985), for married than for unmarried individuals (Curb et al. 1985; Wentworth et al. 1983), and for American-born than for foreign-born individuals (Schisterman and Whitcomb 2004).

Upon comparing the aforementioned benefits and limitations of the NDI and DMF, CMS chose the DMF as the data source for the 2008 DOD auxiliary file. To support this project and others at CMS, the agency purchased the DMF directly from SSA. Every month CMS obtains an update file from SSA and uses it to add new deaths and update existing records in the database. The version of the DMF which we used for this work is the version as of October 29, 2011. Unlike the public-use version, which can be readily purchased on the SSA website, this one is a federal agency version, which is a more complete, unrestricted source of DOD information.

### **C. MAX Person-Summary Files**

The MAX PS file contains one record for each person who is enrolled in either Medicaid or the Children's Health Insurance Program (CHIP) in the MAX calendar year in that state. It contains information about eligibility, demographics, summary expenditures, and service use. There are 51 files (one for each state and the District of Columbia, hereafter referred to as the "51 states") for each year from 1999 to 2008. Each file uniquely identifies a person by the MSIS identification number (MSIS ID). States may choose to use their own state-assigned identifier, unique to and within that state, or the SSN as their MSIS ID. MSIS instructions to states indicate that an enrolled person should be assigned one and only one MSIS ID over time, but states do sometimes change MSIS IDs for federal reporting in MSIS.



#### **D. 2008 DOD Auxiliary File**

For calendar year 2008, the DOD auxiliary file is a single file that contains a record for each person in the MAX PS files 1999–2008 for all 51 states that linked to SSA DMF and had a non-missing date of death. To merge the DOD auxiliary records with MAX PS records, the researcher will simply merge the files by state and MSIS ID. The 2008 DOD auxiliary file is sorted in the appropriate order to facilitate this linkage.

#### **E. Organization of Report**

In the rest of this report, we further describe the 2008 DOD auxiliary file. In Chapter II, we describe the creation of the file and the contents of the file, and in Chapter III we summarize the linkage results. In Appendix A, we provide a data flow diagram describing how the file was created, in Appendix B we include the file layout and data dictionary, and in Appendix C we provide the linkage results by year.

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## II. CREATION OF DOD AUXILIARY FILE

### A. Methodology

The creation of the 2008 DOD auxiliary file involved seven steps. The first five steps were conducted for each state and for each of the 10 years of MAX data that were linked (1999–2008). See program DODAUX01 in Appendix A for details. The output was a set of 510 files. In the first step, we extracted identification information from the MAX PS file. In the second step, we extracted identification and death information from the DMF. In the third step, we merged DMF with each MAX state/year file. In the fourth step, we tabulated the number of linked records to ensure the linkage was working properly. In the fifth step, we saved the individual state/year file with only the requisite linkage and DOD variables. For 2008, two steps were added to merge the set of 510 files into a single 2008 DOD auxiliary file. In the sixth step, we concatenated all of the year files together for each of the 51 states, sorted by state, MSIS ID, and year; kept the latest (most recent) record for each MSIS ID—in the event that SSN or DOB had changed over time; and retained only the records that linked to the DMF and had a non-missing date of death. See program DODAUX02 in Appendix A for details. In the seventh and final step, we merged the separate 51 state files into the 2008 DOD auxiliary file but did not unduplicate records across states. See program DODAUX03 in Appendix A, for details. In Appendix A we provide a complete data flow diagram describing how the files were created.

Specifically, for each state for each year, we extracted the following information from the MAX PS file:

- MSIS ID
- State
- Year
- SSN
- Date of birth (DOB)

- MSIS DOD
- EDB DOD
- Medicare/Medicaid dual enrollment

We extracted the following information from the DMF:

- SSN
- DOB
- SSA DOD

We merged the MAX PS record to the DMF record via the SSN and DOB.

To assess the quality of the linkage, we tabulated the linked records by state and year. We discuss these tabulations in the next chapter.

## **B. Contents of the 2008 DOD File**

We wanted the DOD auxiliary file to be as small as possible so researchers could quickly and easily link it to the MAX PS file or to their specific research file. Consequently, we kept only a limited number of variables on the DOD auxiliary file:

- State
- MSIS ID
- SSA DOD

For 2008, the DOD auxiliary file contains records for all states and all years from 1999 to 2008 and is called MW00.@BF32955.US.PS.DOD.

### III. RESULTS

In this chapter, we present the linkage statistics by state for the link between MAX 1999-2008 to the SSA DMF. We recommend that researchers use these tables for quality control purposes (linkage statistics should match these statistics). It is important to remember that the DMF DOD in the DOD auxiliary file includes dates of death before, during, *and after* the MAX file year. Because the DOD auxiliary file is right-censored as of October 2011 (meaning there are no available dates of death after October 2011) instead of the end of the MAX year, the number of deceased individuals in this file will, by design, be much higher than the number of deceased individuals based on the existing DOD variables in the MAX PS files. Also, the number of deceased individuals evident in the linkage statistics is highest in the first year of MAX PS records (1999) and generally decreases with each succeeding year of MAX PS records to the last year (2008). This is because the probability of dying for any individual increases as the number of years between the year of the MAX PS record(s) and the date of the DMF used for the linkage (in this case October 29, 2011) increases. There are instances of reporting changes or corrections that may occur for individual states that cause small increases from one year to the next.

#### A. Limitations

The number of MAX PS records that linked to the DMF is a function of the accuracy of both the DMF and the SSN and DOB in the MAX PS file. The SSN in the PS file has not been verified, so there could be false positives and false negatives in these linkage results. The extent of the inaccuracy, which varies by state, is unknown at this time. The percent of records with missing SSN and DOB varies by state as well. If the SSN or DOB is missing on the MAX PS file (for example, for undocumented aliens, certain restricted benefit enrollees, presumptively eligible enrollees, or other enrollees), it is impossible to link to the DMF and obtain a date of

death. Researchers may want to classify these records differently because it is not known whether the person is deceased.

### **B. Linkage Across States**

Table III.1 shows the number of records in the 2008 DOD auxiliary file by state. The number of records varies considerably by state. In general, the number is related to the number of Medicaid enrollees in the state: for example, Wyoming has the fewest number of linkages, California has the highest. Table III.2 contains the number of MAX PS records with DMF DOD for each year from 1999 to 2008; and Table III.3 contains the percentage of MAX PS records with DMF DOD for each year from 1999 to 2008. Appendix C (Tables C.1 to C.10) contains comparable linkage results of the MAX PS to the DMF for each year from 1999 to 2008.

### **C. Linkage Over Time**

As shown in Table III.3, the percentage of MAX PS records that linked to the DMF is highest in 1999 and gradually reduces with each subsequent year. This downward trend is expected because the DMF DOD is the date of death for that person as of October 2011. With the passage of time, the number of deaths accumulates accordingly. In other words, Medicaid enrollees in 1999 have a greater likelihood of dying by October 2011 than do Medicaid enrollees in 2008, all other things being equal.

### **D. Summary**

Despite the previously identified limitations, the 2008 DOD auxiliary file provides MAX data users with two enhancements regarding deaths to Medicaid enrollees:

- All dates of death reported in the DMF through October 2011 including corrections to previously reported dates of death from earlier DMF files. Dates of death for persons enrolled in the year of the MAX file even if those deaths occurred after the year of the MAX file and were reported by October 2011

**Table III.1. Linkage of MAX PS Records to SSA Death Master File, 1999 2008 MAX**

State	Number of Records in the MAX DOD File
Alabama	192,730
Alaska	13,541
Arizona	159,163
Arkansas	124,547
California	992,327
Colorado	89,838
Connecticut	112,857
Delaware	25,032
District of Columbia	35,464
Florida	904,033
Georgia	294,990
Hawaii	35,861
Idaho	33,462
Illinois	475,050
Indiana	204,131
Iowa	95,845
Kansas	83,830
Kentucky	183,343
Louisiana	194,253
Maine	80,880
Maryland	150,604
Massachusetts	245,729
Michigan	298,875
Minnesota	219,630
Mississippi	150,861
Missouri	225,362
Montana	28,595
Nebraska	52,669
Nevada	48,549
New Hampshire	32,916
New Jersey	223,748
New Mexico	56,775
New York	716,970
North Carolina	342,788
North Dakota	24,007
Ohio	393,874
Oklahoma	174,275
Oregon	114,030
Pennsylvania	438,666
Rhode Island	42,784
South Carolina	172,659
South Dakota	26,274
Tennessee	285,344
Texas	639,045
Utah	37,467
Vermont	31,435
Virginia	192,499
Washington	173,532
West Virginia	81,484
Wisconsin	215,719
Wyoming	13,948
<b>United States</b>	<b>10,182,290</b>

Source: MAX Person Summary Records linked to SSA Death Master file, version 10/29/2011.

**Table III.2. Number of PS Records with SSA DOD, 1999 2008 MAX**

State	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Alabama	105,808	106,193	102,987	104,525	96,841	89,997	82,614	74,213	62,678	51,683
Alaska	7,246	7,176	7,011	6,831	6,506	6,084	5,652	5,032	4,342	3,518
Arizona	48,146	48,486	59,196	72,077	74,983	71,565	66,932	55,704	49,129	42,450
Arkansas	68,571	66,240	63,338	61,078	57,018	53,406	50,000	45,520	40,354	33,436
California	606,418	574,776	556,976	530,329	503,607	465,334	418,709	363,410	308,244	254,464
Colorado	43,982	43,525	42,069	40,622	37,491	34,856	33,750	31,108	27,513	23,672
Connecticut	57,054	55,347	55,436	53,697	51,161	47,121	42,875	38,198	33,263	28,085
Delaware	11,422	11,568	11,790	12,018	11,630	11,011	10,389	9,431	8,161	6,732
District of Columbia	16,435	16,188	17,716	13,788	13,012	12,424	11,314	10,028	8,552	7,041
Florida	280,996	290,957	284,064	287,546	266,849	252,925	235,758	209,622	177,114	153,652
Georgia	144,577	139,595	134,856	146,459	138,350	130,294	115,410	101,569	86,376	73,001
Hawaii	19,691	18,808	18,003	17,577	16,871	15,777	14,456	12,765	10,816	9,018
Idaho	13,475	13,806	14,162	13,960	13,463	12,710	12,605	11,554	10,205	8,805
Illinois	166,752	160,463	154,986	241,841	241,903	230,997	217,942	138,337	110,473	90,293
Indiana	93,264	92,450	91,130	89,322	84,614	80,636	74,644	66,204	58,282	50,951
Iowa	47,488	45,844	43,836	42,444	40,046	37,542	35,802	32,885	29,130	24,782
Kansas	39,178	37,919	36,944	35,802	33,768	31,894	30,389	27,558	24,660	21,261
Kentucky	105,706	102,528	97,436	93,388	84,839	77,768	70,612	63,223	54,900	45,638
Louisiana	101,834	102,766	99,654	98,673	91,939	87,004	80,082	69,802	59,146	49,561
Maine	33,274	32,628	54,585	54,966	31,009	28,567	26,703	24,816	25,920	21,689
Maryland	74,288	70,598	67,448	70,533	68,657	64,703	59,113	50,047	41,688	34,885
Massachusetts	140,610	137,604	132,208	123,425	111,925	98,647	90,837	82,403	71,386	61,910
Michigan	152,602	147,573	142,634	136,568	128,699	127,453	117,710	105,146	91,197	76,935
Minnesota	70,257	74,809	85,435	83,576	78,325	73,544	68,940	63,107	55,823	47,960
Mississippi	86,687	87,395	88,349	84,452	79,388	71,613	64,897	56,803	48,141	38,232
Missouri	117,241	115,959	114,564	111,524	105,727	100,666	88,578	74,778	63,983	53,656
Montana	13,509	13,203	12,785	12,243	11,387	10,491	9,759	8,666	7,454	6,352
Nebraska	26,266	25,424	24,682	23,859	22,386	20,756	19,394	17,587	15,336	12,805
Nevada	18,775	19,598	19,261	20,018	19,387	19,007	16,757	14,846	13,136	11,165
New Hampshire	14,438	14,262	13,753	13,885	13,358	12,668	11,798	10,741	9,569	8,178
New Jersey	122,057	117,644	112,669	106,219	99,420	91,501	84,779	74,111	63,341	52,316
New Mexico	29,658	28,825	27,832	27,297	26,260	24,687	22,878	20,707	17,945	15,021
New York	410,170	393,119	374,214	364,676	347,312	317,144	295,343	259,932	223,082	185,146
North Carolina	186,285	182,290	177,699	167,769	158,329	146,854	136,146	121,090	105,159	87,833
North Dakota	10,671	10,310	10,342	10,001	9,542	8,665	7,925	7,226	6,104	5,116
Ohio	184,605	179,704	177,941	174,258	169,153	157,408	151,622	137,952	121,581	102,352
Oklahoma	69,606	67,857	65,759	66,406	58,984	54,178	50,732	46,057	40,646	34,870
Oregon	57,016	56,245	55,460	55,574	50,187	43,676	38,307	33,734	29,290	25,222
Pennsylvania	218,448	215,491	206,017	200,441	191,906	183,630	171,418	154,320	134,328	114,112
Rhode Island	21,687	21,481	20,936	20,473	19,327	17,889	16,444	14,475	12,463	10,304



Table III.2. (continued)

State	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
South Carolina	83,139	81,869	80,174	79,391	98,427	92,816	84,154	55,069	46,312	38,552
South Dakota	13,096	12,789	12,292	12,057	11,405	10,594	9,780	8,905	7,679	6,461
Tennessee	187,542	175,254	171,287	164,758	151,887	140,286	123,936	100,473	84,128	70,962
Texas	329,043	324,626	316,192	308,301	293,376	275,301	255,084	229,608	199,460	168,194
Utah	15,915	15,375	15,050	15,429	15,571	14,738	13,816	12,140	10,370	8,594
Vermont	19,164	19,136	18,607	17,467	16,082	14,761	12,976	11,216	9,460	7,934
Virginia	100,200	96,165	91,869	87,687	82,272	77,743	72,084	64,859	56,066	47,589
Washington	84,387	83,585	82,208	78,169	73,702	69,383	64,003	55,683	48,623	41,312
West Virginia	43,951	41,860	39,795	38,379	35,703	33,120	30,351	29,263	25,871	21,950
Wisconsin	86,962	84,100	81,576	105,630	109,952	103,931	94,433	84,421	70,701	57,654
Wyoming	6,143	6,022	5,926	5,887	5,687	5,337	4,824	4,332	3,799	3,207
<b>United States</b>	<b>5,005,735</b>	<b>4,887,435</b>	<b>4,791,139</b>	<b>4,803,295</b>	<b>4,559,623</b>	<b>4,261,102</b>	<b>3,925,456</b>	<b>3,400,676</b>	<b>2,923,379</b>	<b>2,456,511</b>

Source: MAX Person Summary Records linked to SSA Death Master file, version 10/29/2011.

Table III.3. Percentage of PS Records with SSA DOD, 1999 2008 MAX

State	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Alabama	16.0	14.4	12.9	12.1	10.7	9.6	8.6	7.6	6.8	5.6
Alaska	6.9	6.3	5.8	5.4	5.0	4.6	4.2	3.8	3.4	2.7
Arizona	7.3	6.8	6.6	6.3	5.6	5.0	4.5	3.6	3.1	2.5
Arkansas	13.9	12.5	10.8	9.4	8.3	7.4	6.6	5.9	5.1	4.3
California	7.8	6.7	6.1	5.3	4.7	4.1	3.8	3.3	2.8	2.3
Colorado	12.1	11.2	9.9	9.0	7.6	6.0	5.2	4.8	4.3	3.6
Connecticut	13.6	13.0	12.0	10.8	10.0	9.0	8.1	7.1	6.2	5.0
Delaware	9.7	9.0	8.4	6.5	7.3	6.5	5.7	5.1	4.3	3.4
District of Columbia	11.1	10.7	10.9	8.9	8.2	7.6	6.7	5.9	5.0	4.0
Florida	13.2	12.5	11.0	10.3	9.1	8.6	7.7	6.9	6.0	4.8
Georgia	10.9	9.2	7.8	8.1	7.3	6.5	5.5	4.8	4.3	3.6
Hawaii	9.7	9.5	8.9	8.3	7.6	6.8	6.1	5.4	4.5	3.6
Idaho	10.0	8.7	7.7	7.0	6.4	5.6	5.4	5.0	4.3	3.6
Illinois	9.6	9.0	8.2	11.3	10.8	9.5	8.3	5.3	4.1	3.3
Indiana	13.4	11.9	10.7	9.6	8.7	7.9	7.0	6.2	5.4	4.4
Iowa	15.1	14.3	13.0	11.7	10.5	9.4	8.3	7.0	6.0	5.0
Kansas	15.1	13.9	12.4	11.4	9.2	8.3	8.4	7.6	6.9	5.9
Kentucky	15.2	13.7	12.5	11.6	10.2	9.1	7.9	7.1	6.1	4.9
Louisiana	12.4	11.8	10.7	9.3	8.1	7.2	6.4	5.5	5.1	4.1
Maine	16.0	14.7	16.4	15.0	10.3	9.1	8.2	7.4	7.2	6.0
Maryland	10.7	10.3	9.3	8.9	8.2	7.6	6.8	5.8	4.9	3.9
Massachusetts	13.1	12.2	11.3	10.0	9.3	8.3	7.2	6.3	5.2	3.8
Michigan	11.2	10.6	9.6	8.2	7.8	6.9	6.3	5.4	4.6	3.8
Minnesota	11.8	12.0	12.6	11.5	10.3	9.5	8.7	7.8	6.8	5.7
Mississippi	15.7	14.3	12.7	11.7	10.3	8.9	8.2	7.3	6.5	5.2
Missouri	13.0	11.5	10.6	9.9	8.9	8.1	7.3	6.7	5.9	4.9
Montana	13.7	12.2	11.0	10.2	9.2	8.2	7.6	6.7	5.8	4.8
Nebraska	11.5	10.6	9.7	8.9	8.4	7.9	7.4	6.7	5.9	4.8
Nevada	12.2	11.6	10.1	8.6	7.6	7.2	6.1	5.8	5.1	4.0
New Hampshire	13.5	13.0	12.2	11.0	9.8	8.9	8.1	7.2	6.3	5.2
New Jersey	13.5	12.1	10.6	9.2	8.6	8.1	7.5	6.2	5.2	4.1
New Mexico	7.8	7.0	6.3	5.8	5.2	4.7	4.3	4.0	3.4	2.7
New York	12.1	11.5	9.9	8.0	7.4	6.4	5.8	5.1	4.4	3.6
North Carolina	14.9	13.7	12.1	11.1	10.0	8.8	7.9	6.8	5.8	4.6
North Dakota	16.2	15.5	14.4	12.7	11.6	10.7	9.9	8.9	7.6	6.4
Ohio	13.2	12.2	10.2	9.5	8.6	7.7	7.1	6.4	5.6	4.6
Oklahoma	13.0	11.5	10.4	9.0	8.8	7.8	6.9	6.0	5.2	4.3

Table III.3. (continued)

State	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Oregon	10.2	9.6	8.8	8.3	7.8	7.2	6.8	6.1	5.4	4.4
Pennsylvania	12.9	12.8	12.3	11.5	10.4	9.2	8.4	7.3	6.3	5.1
Rhode Island	12.7	11.4	10.4	9.7	8.9	8.0	7.3	6.4	5.6	4.7
South Carolina	11.0	10.2	8.9	8.5	9.5	9.2	8.3	5.8	5.0	4.2
South Dakota	13.7	12.5	11.1	10.2	9.2	8.3	7.5	6.7	5.7	4.7
Tennessee	11.6	10.9	10.1	9.5	9.4	8.6	7.7	6.7	5.6	4.6
Texas	12.0	11.6	10.7	9.1	7.8	6.9	6.1	5.5	4.6	3.7
Utah	6.7	6.2	5.7	5.1	4.7	4.2	3.8	3.6	3.2	2.4
Vermont	13.3	12.6	11.7	10.7	9.7	8.8	7.8	6.8	5.8	4.5
Virginia	14.0	12.9	12.0	11.0	10.0	8.9	7.8	6.8	5.8	4.7
Washington	9.2	8.4	7.8	6.3	6.2	5.4	5.0	4.5	4.0	3.3
West Virginia	12.0	11.7	11.1	10.1	9.2	8.4	7.7	7.4	6.5	5.4
Wisconsin	15.0	13.3	11.8	12.9	11.9	10.5	9.1	8.0	6.7	5.1
Wyoming	11.7	11.1	9.7	8.3	7.2	6.6	5.9	5.4	4.8	4.1
<b>United States</b>	<b>11.5</b>	<b>10.5</b>	<b>9.6</b>	<b>8.7</b>	<b>7.9</b>	<b>7.1</b>	<b>6.4</b>	<b>5.5</b>	<b>4.7</b>	<b>3.8</b>

Source: MAX Person Summary Records linked to SSA Death Master file, version 10/29/2011.

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**APPENDIX A**  
**DATA-PROCESSING STEPS**

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## INTRODUCTION

### Summary of MAX DOD Auxiliary File Programs

We used three programs to create the MAX DOD Auxiliary File. The programs were written in SAS and were designed to maximize efficiency and re-usability.

1. DODAUX01 extracts identifiers and demographic data from the MAX PS file and merges it to the SSA DMF file using SSN and date of birth. The SSA date of death variable is appended to the output file. We executed the program for each state and the District of Columbia (hereafter referred to as “51 states”). (Steps 1-5)
2. DODAUX02 concatenates the files for all years for each state, sorts by state, MSIS ID and year, and keeps the latest record per MSIS ID to ensure one date of death per person.<sup>1</sup> In the last step, the program keeps only the records that linked to the DMF and have a non-missing date of death. (Step 6)
3. DODAUX03 concatenates files for all 51 states and retains the state code, the MSIS ID, and the SSA date of death. In the final step, it copies the file to tape cartridge to preserve it for a longer period of time. (Step 7)

### MAX DOD Auxiliary File

The MAX DOD Auxiliary File contains Medicaid enrollees (from the MAX PS files for 1999 through 2008) that linked to the SSA DMF and have a nonmissing date of death. The file includes the state code (STATE), Medicaid identification number (MSIS\_ID), and the SSA DMF date of death (SSA\_DOD).

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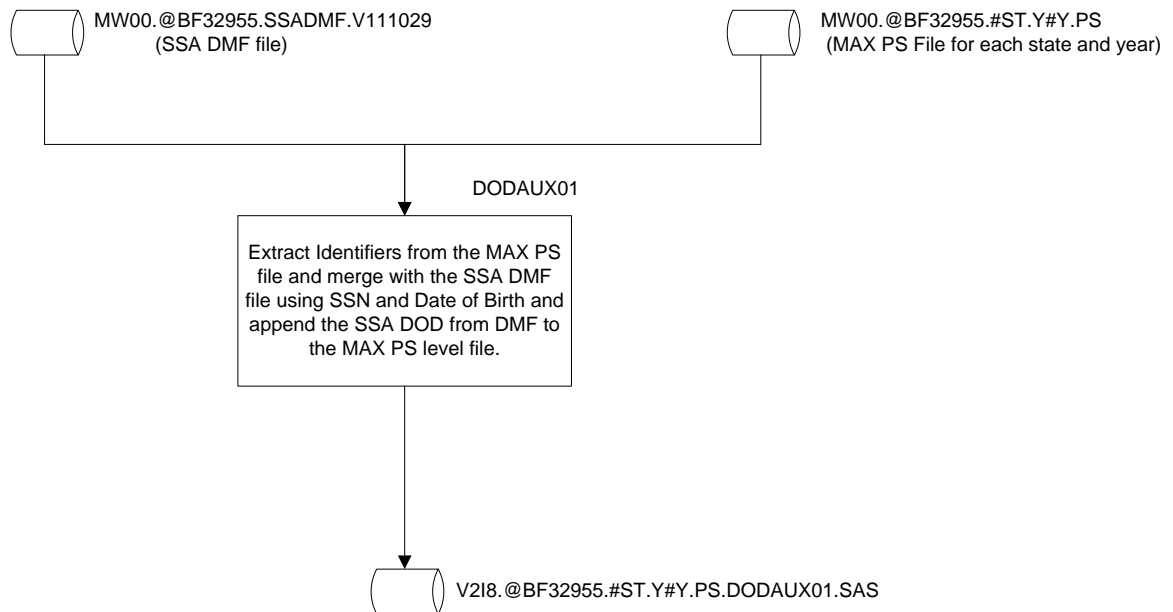
<sup>1</sup> A state’s Medicaid agency may eventually learn that the SSN or date of birth for a Medicaid enrollee was incorrect. When this happens, the state changes the SSN and/or date of birth on the person’s enrollment record. Consequently, there are instances in the MAX PS files in which a Medicaid enrollee (as identified by STATE and MSIS\_ID) has more than one SSN and/or date of birth over time. Therefore, we *could* encounter a situation in which more than one date of death was assigned to the same person, at different times. Our algorithm assumes that the latest (most recent) SSN is the most accurate and uses the corresponding date of death associated with that SSN and date of birth.

## MAX DOD AUXILIARY FILE DATA-PROCESSING STEPS

## DOD AUX01

Extract identifiers and demographic data from MAX PS files and merge with SSA DMF file using  
SSN and Date of Birth

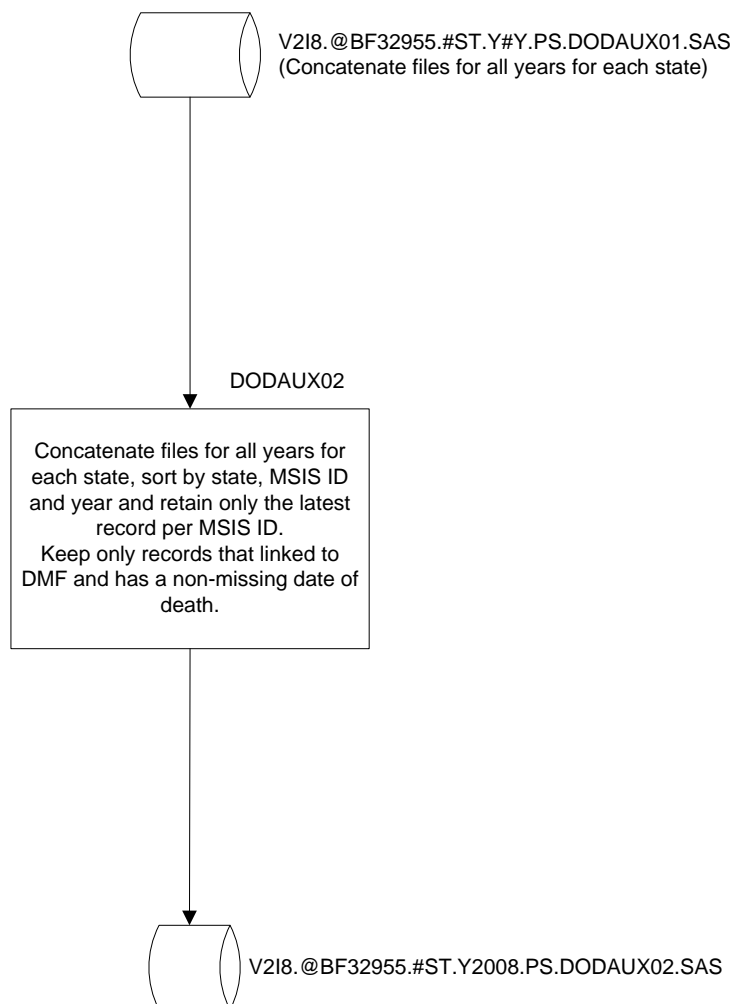
DOD AUX01 CLIST submits this program for each year (#Y) for each state (#ST)



MAX DOD AUXILIARY FILE DATA-PROCESSING STEPS  
DOD AUX02

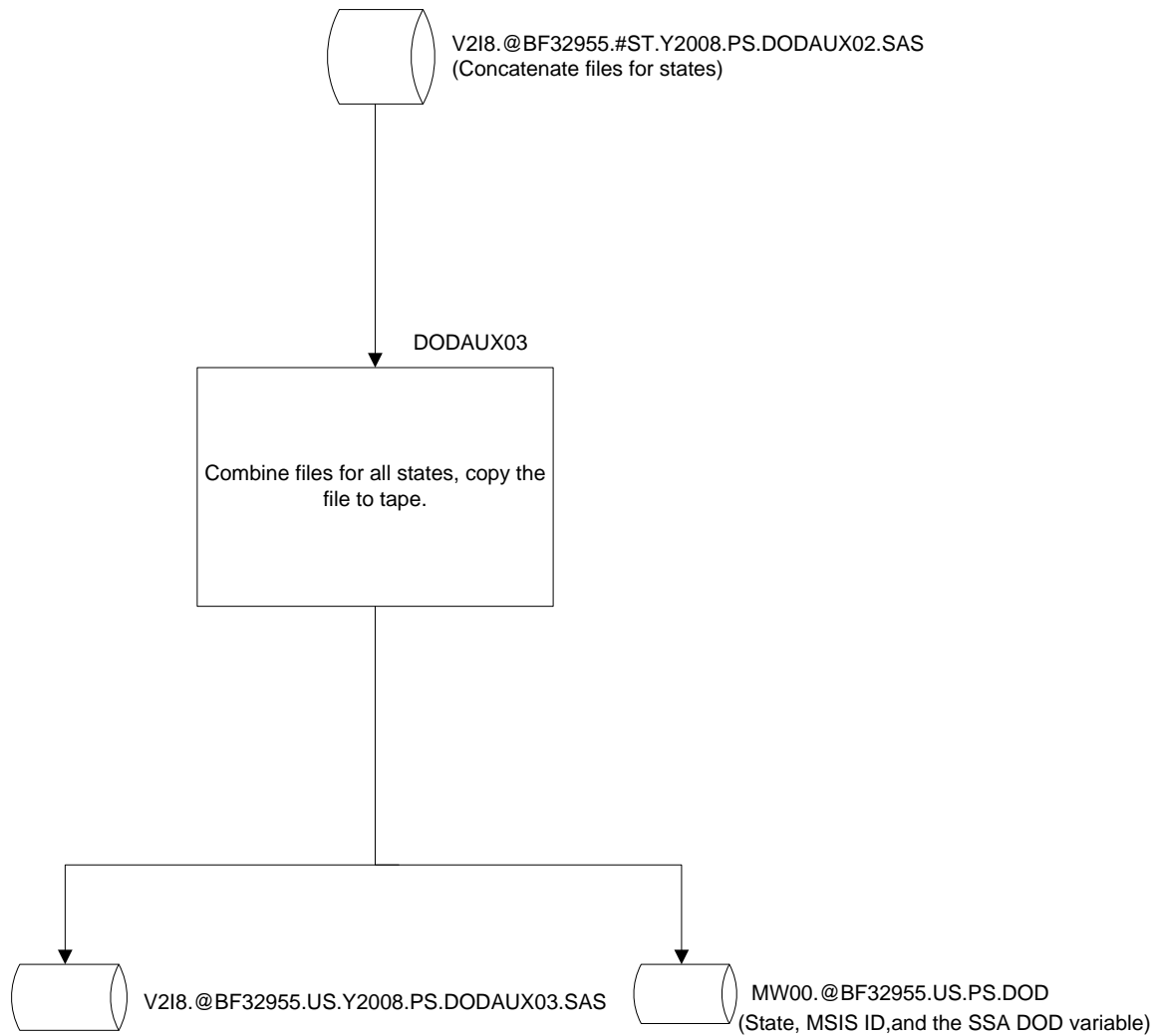
Concatenate output files from DOD AUX01 for years 1999 through 2008 for each state, sort by state, MSIS ID, and year, and retain only the latest record per MSIS ID. Keep only records that linked to DMF and have a non-missing date of death.

DOD AUX02 CLIST submits this program for each state (#ST)



MAX DOD AUXILIARY FILE DATA-PROCESSING STEPS  
DODAU03

Concatenate output files from DODAU02 for all states, and copy file to tape.



**APPENDIX B**  
**FILE LAYOUT**

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**MAX DOD AUXILIARY FILE  
FILE LAYOUT  
1999–2008**

<b>ELEMENT NUMBER:</b>	<b>ELEMENT NAME:</b>	<b>TYPE:</b>	<b>LENGTH:</b>	<b>BEG:</b>	<b>END:</b>
****	MAX DOD Auxiliary File	REC	30	1	30
1	State	CHAR	2	1	2
2	MSIS ID	CHAR	20	3	22
3	Date of Death	NUM	8	23	30

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**APPENDIX C**  
**LINKAGE TABLES BY YEAR**

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**Table C.1. Linkage of MAX PS Records to SSA Death Master File, 1999**

State	Number of Person Summary Records	Number Matched to SSA DMF	Percent Matched to SSA DMF	Number with SSN and DOB	Percent Matched Among People with SSN and DOB
Alabama	660,824	105,808	16.0	654,069	16.1
Alaska	104,950	7,246	6.9	99,222	7.1
Arizona	661,459	48,146	7.3	648,013	7.2
Arkansas	493,696	68,571	13.9	449,945	15.1
California	7,731,625	606,418	7.8	5,665,234	10.7
Colorado	364,517	43,982	12.1	322,766	13.4
Connecticut	418,566	57,054	13.6	407,382	14.0
Delaware	117,229	11,422	9.7	111,081	10.3
District of Columbia	147,489	16,435	11.1	141,613	11.5
Florida	2,135,116	280,996	13.2	2,051,375	13.6
Georgia	1,330,992	144,577	10.9	1,130,814	12.6
Hawaii	203,594	19,691	9.7	199,352	9.8
Idaho	134,691	13,475	10.0	130,608	10.3
Illinois	1,729,208	166,752	9.6	1,663,331	10.0
Indiana	696,978	93,264	13.4	679,633	13.7
Iowa	315,004	47,488	15.1	310,260	15.3
Kansas	260,006	39,178	15.1	250,243	15.5
Kentucky	696,726	105,706	15.2	672,153	15.7
Louisiana	824,147	101,834	12.4	783,215	13.0
Maine	207,869	33,274	16.0	201,017	16.4
Maryland	691,506	74,288	10.7	654,902	11.3
Massachusetts	1,074,232	140,610	13.1	1,013,875	13.8
Michigan	1,368,133	152,602	11.2	1,256,329	12.1
Minnesota	596,416	70,257	11.8	574,230	12.2
Mississippi	553,018	86,687	15.7	526,457	16.5
Missouri	898,767	117,241	13.0	855,718	13.7
Montana	98,870	13,509	13.7	91,432	14.5
Nebraska	227,661	26,266	11.5	217,506	12.1
Nevada	153,519	18,775	12.2	135,782	13.6
New Hampshire	107,127	14,438	13.5	105,371	13.7
New Jersey	905,802	122,057	13.5	809,963	15.0
New Mexico	380,456	29,658	7.8	370,177	8.0
New York	3,403,888	410,170	12.1	3,047,077	13.3
North Carolina	1,253,691	186,285	14.9	1,221,709	15.2
North Dakota	65,865	10,671	16.2	62,203	17.1
Ohio	1,393,580	184,605	13.2	1,349,933	13.5
Oklahoma	534,663	69,606	13.0	508,838	13.7
Oregon	560,337	57,016	10.2	534,083	10.7
Pennsylvania	1,696,058	218,448	12.9	1,680,155	13.0
Rhode Island	170,934	21,687	12.7	169,491	12.8
South Carolina	758,480	83,139	11.0	719,217	11.6
South Dakota	95,531	13,096	13.7	92,295	14.2
Tennessee	1,613,135	187,542	11.6	1,541,222	11.9
Texas	2,741,035	329,043	12.0	2,539,227	12.9
Utah	236,759	15,915	6.7	206,401	7.7
Vermont	143,603	19,164	13.3	142,630	13.4
Virginia	713,629	100,200	14.0	672,595	14.9
Washington	918,272	84,387	9.2	852,920	9.6
West Virginia	364,904	43,951	12.0	340,291	12.8
Wisconsin	580,098	86,962	15.0	562,231	15.5
Wyoming	52,454	6,143	11.7	50,235	12.2
<b>United States</b>	<b>43,587,109</b>	<b>5,005,735</b>	<b>11.5</b>	<b>39,475,821</b>	<b>12.6</b>

Source: MAX Person Summary Records linked to SSA Death Master file, version 10/29/2011.

**Table C.2. Linkage of MAX PS Records to SSA Death Master File, 2000**

State	Number of Person Summary Records	Number Matched to SSA DMF	Percent Matched to SSA DMF	Number with SSN and DOB	Percent Matched Among People with SSN and DOB
Alabama	739,055	106,193	14.4	731,471	14.5
Alaska	114,251	7,176	6.3	108,089	6.5
Arizona	713,169	48,486	6.8	696,764	6.7
Arkansas	530,978	66,240	12.5	469,471	13.7
California	8,634,905	574,776	6.7	5,721,409	10.0
Colorado	388,242	43,525	11.2	339,171	12.7
Connecticut	424,855	55,347	13.0	410,184	13.5
Delaware	128,247	11,568	9.0	117,338	9.8
District of Columbia	151,713	16,188	10.7	145,386	11.1
Florida	2,334,173	290,957	12.5	2,230,302	13.0
Georgia	1,520,645	139,595	9.2	1,353,496	10.2
Hawaii	197,969	18,808	9.5	189,236	8.9
Idaho	158,350	13,806	8.7	152,806	9.0
Illinois	1,786,132	160,463	9.0	1,719,146	9.3
Indiana	776,394	92,450	11.9	753,482	12.3
Iowa	320,120	45,844	14.3	316,178	14.5
Kansas	273,392	37,919	13.9	262,288	14.3
Kentucky	749,007	102,528	13.7	723,188	14.1
Louisiana	869,535	102,766	11.8	830,386	12.4
Maine	221,552	32,628	14.7	210,638	15.2
Maryland	684,685	70,598	10.3	653,238	10.8
Massachusetts	1,131,670	137,604	12.2	1,062,390	12.9
Michigan	1,396,890	147,573	10.6	1,294,645	11.4
Minnesota	625,397	74,809	12.0	595,095	12.6
Mississippi	610,253	87,395	14.3	575,901	15.1
Missouri	1,008,624	115,959	11.5	945,197	12.2
Montana	108,259	13,203	12.2	100,506	13.0
Nebraska	239,639	25,424	10.6	228,061	11.1
Nevada	168,352	19,598	11.6	154,367	12.7
New Hampshire	109,680	14,262	13.0	107,440	13.3
New Jersey	969,670	117,644	12.1	865,791	13.6
New Mexico	411,661	28,825	7.0	397,803	7.2
New York	3,425,582	393,119	11.5	3,054,411	12.8
North Carolina	1,326,155	182,290	13.7	1,289,868	14.1
North Dakota	66,542	10,310	15.5	64,977	15.8
Ohio	1,472,784	179,704	12.2	1,410,893	12.5
Oklahoma	591,857	67,857	11.5	560,869	12.1
Oregon	583,989	56,245	9.6	550,857	10.2
Pennsylvania	1,683,650	215,491	12.8	1,666,669	12.9
Rhode Island	188,425	21,481	11.4	185,242	11.6
South Carolina	806,240	81,869	10.2	773,934	10.6
South Dakota	102,675	12,789	12.5	98,562	13.0
Tennessee	1,607,688	175,254	10.9	1,534,392	11.2
Texas	2,800,108	324,626	11.6	2,616,765	12.4
Utah	246,758	15,375	6.2	217,775	7.0
Vermont	151,532	19,136	12.6	149,347	12.6
Virginia	742,867	96,165	12.9	708,408	13.6
Washington	996,589	83,585	8.4	931,187	8.7
West Virginia	358,208	41,860	11.7	335,008	12.4
Wisconsin	631,041	84,100	13.3	614,676	13.7
Wyoming	54,328	6,022	11.1	50,590	11.8
<b>United States</b>	<b>46,334,482</b>	<b>4,887,435</b>	<b>10.5</b>	<b>41,275,293</b>	<b>11.8</b>

Source: MAX Person Summary Records linked to SSA Death Master file, version 10/29/2011.

**Table C.3. Linkage of MAX PS Records to SSA Death Master File, 2001**

State	Number of Person Summary Records	Number Matched to SSA DMF	Percent Matched to SSA DMF	Number with SSN and DOB	Percent Matched Among People with SSN and DOB
Alabama	797,224	102,987	12.9	784,625	13.0
Alaska	120,074	7,011	5.8	113,405	6.0
Arizona	898,060	59,196	6.6	893,261	6.6
Arkansas	587,684	63,338	10.8	516,536	11.9
California	9,153,196	556,976	6.1	5,795,164	9.6
Colorado	422,963	42,069	9.9	370,021	11.3
Connecticut	462,886	55,436	12.0	445,923	12.4
Delaware	139,907	11,790	8.4	124,830	9.4
District of Columbia	162,086	17,716	10.9	146,457	10.4
Florida	2,582,010	284,064	11.0	2,467,661	11.5
Georgia	1,722,114	134,856	7.8	1,552,068	8.5
Hawaii	202,429	18,003	8.9	192,697	8.6
Idaho	184,566	14,162	7.7	178,195	7.9
Illinois	1,882,237	154,986	8.2	1,812,087	8.4
Indiana	855,232	91,130	10.7	826,879	11.0
Iowa	338,145	43,836	13.0	331,288	13.1
Kansas	297,213	36,944	12.4	284,601	12.8
Kentucky	782,538	97,436	12.5	757,754	12.8
Louisiana	932,216	99,654	10.7	904,249	11.0
Maine	331,998	54,585	16.4	323,030	16.8
Maryland	722,068	67,448	9.3	690,654	9.7
Massachusetts	1,166,242	132,208	11.3	1,089,341	12.0
Michigan	1,481,790	142,634	9.6	1,353,816	10.5
Minnesota	677,329	85,435	12.6	650,693	13.1
Mississippi	695,868	88,349	12.7	657,939	13.4
Missouri	1,085,041	114,564	10.6	1,012,936	11.3
Montana	116,063	12,785	11.0	107,816	11.7
Nebraska	254,831	24,682	9.7	240,769	10.2
Nevada	190,951	19,261	10.1	164,159	11.4
New Hampshire	112,602	13,753	12.2	109,755	12.5
New Jersey	1,059,581	112,669	10.6	943,091	11.9
New Mexico	439,608	27,832	6.3	415,535	6.6
New York	3,774,727	374,214	9.9	3,126,873	11.9
North Carolina	1,473,871	177,699	12.1	1,433,424	12.4
North Dakota	71,762	10,342	14.4	70,120	14.6
Ohio	1,749,855	177,941	10.2	1,680,645	10.4
Oklahoma	635,258	65,759	10.4	604,318	10.9
Oregon	629,008	55,460	8.8	589,887	9.4
Pennsylvania	1,668,793	206,017	12.3	1,650,894	12.4
Rhode Island	200,703	20,936	10.4	196,476	10.7
South Carolina	904,335	80,174	8.9	870,596	9.2
South Dakota	111,130	12,292	11.1	106,508	11.5
Tennessee	1,693,143	171,287	10.1	1,628,195	10.3
Texas	2,952,397	316,192	10.7	2,764,723	11.4
Utah	264,182	15,050	5.7	236,507	6.3
Vermont	159,555	18,607	11.7	154,735	11.6
Virginia	765,098	91,869	12.0	724,314	12.7
Washington	1,057,034	82,208	7.8	980,924	8.1
West Virginia	359,170	39,795	11.1	336,309	11.7
Wisconsin	690,762	81,576	11.8	671,273	12.1
Wyoming	60,781	5,926	9.7	56,439	10.4
<b>United States</b>	<b>50,078,316</b>	<b>4,791,139</b>	<b>9.6</b>	<b>44,140,395</b>	<b>10.8</b>

Source: MAX Person Summary Records linked to SSA Death Master file, version 10/29/2011.

**Table C.4. Linkage of MAX PS Records to SSA Death Master File, 2002**

State	Number of Person Summary Records	Number Matched to SSA DMF	Percent Matched to SSA DMF	Number with SSN and DOB	Percent Matched Among People with SSN and DOB
Alabama	867,197	104,525	12.1	855,400	12.1
Alaska	125,662	6,831	5.4	118,599	5.6
Arizona	1,143,522	72,077	6.3	1,136,165	6.3
Arkansas	648,072	61,078	9.4	585,553	10.3
California	10,082,104	530,329	5.3	6,206,979	8.5
Colorado	453,722	40,622	9.0	404,930	9.9
Connecticut	497,180	53,697	10.8	482,143	11.1
Delaware	185,121	12,018	6.5	140,871	8.5
District of Columbia	154,771	13,788	8.9	148,540	9.3
Florida	2,799,154	287,546	10.3	2,707,347	10.6
Georgia	1,812,987	146,459	8.1	1,684,472	8.7
Hawaii	212,288	17,577	8.3	206,618	8.4
Idaho	199,892	13,960	7.0	195,421	7.1
Illinois	2,132,554	241,841	11.3	2,070,840	11.7
Indiana	931,109	89,322	9.6	901,869	9.9
Iowa	363,677	42,444	11.7	360,321	11.8
Kansas	314,827	35,802	11.4	305,575	11.6
Kentucky	806,549	93,388	11.6	786,323	11.9
Louisiana	1,065,810	98,673	9.3	1,045,214	9.4
Maine	366,299	54,966	15.0	356,258	15.3
Maryland	794,396	70,533	8.9	764,721	9.2
Massachusetts	1,228,684	123,425	10.0	1,134,651	10.9
Michigan	1,671,047	136,568	8.2	1,480,980	9.2
Minnesota	725,283	83,576	11.5	692,725	12.1
Mississippi	723,179	84,452	11.7	673,515	12.4
Missouri	1,130,756	111,524	9.9	1,097,765	10.2
Montana	120,433	12,243	10.2	112,679	10.7
Nebraska	268,953	23,859	8.9	253,723	9.4
Nevada	233,404	20,018	8.6	219,256	9.1
New Hampshire	126,754	13,885	11.0	124,843	11.1
New Jersey	1,153,998	106,219	9.2	999,315	10.6
New Mexico	471,366	27,297	5.8	456,610	6.0
New York	4,546,162	364,676	8.0	3,802,276	9.5
North Carolina	1,505,412	167,769	11.1	1,463,977	11.5
North Dakota	78,454	10,001	12.7	76,816	12.9
Ohio	1,839,178	174,258	9.5	1,811,772	9.6
Oklahoma	740,089	66,406	9.0	699,380	9.4
Oregon	670,388	55,574	8.3	630,230	8.8
Pennsylvania	1,738,198	200,441	11.5	1,721,248	11.6
Rhode Island	211,750	20,473	9.7	206,799	9.9
South Carolina	933,817	79,391	8.5	898,348	8.8
South Dakota	118,781	12,057	10.2	113,888	10.6
Tennessee	1,730,087	164,758	9.5	1,660,084	9.8
Texas	3,376,384	308,301	9.1	3,195,273	9.6
Utah	300,166	15,429	5.1	272,809	5.6
Vermont	163,438	17,467	10.7	159,997	10.6
Virginia	799,254	87,687	11.0	763,266	11.5
Washington	1,232,363	78,169	6.3	1,068,500	7.2
West Virginia	381,079	38,379	10.1	362,146	10.6
Wisconsin	817,420	105,630	12.9	798,092	13.2
Wyoming	70,686	5,887	8.3	65,765	8.9
<b>United States</b>	<b>55,063,856</b>	<b>4,803,295</b>	<b>8.7</b>	<b>48,480,887</b>	<b>9.9</b>

Source: MAX Person Summary Records linked to SSA Death Master file, version 10/29/2011.

**Table C.5. Linkage of MAX PS Records to SSA Death Master File, 2003**

State	Number of Person Summary Records	Number Matched to SSA DMF	Percent Matched to SSA DMF	Number with SSN and DOB	Percent Matched Among People with SSN and DOB
Alabama	902,076	96,841	10.7	890,554	10.8
Alaska	129,876	6,506	5.0	122,590	5.2
Arizona	1,348,521	74,983	5.6	1,327,943	5.6
Arkansas	688,523	57,018	8.3	626,524	9.0
California	10,796,820	503,607	4.7	6,650,771	7.5
Colorado	490,189	37,491	7.6	431,698	8.6
Connecticut	512,033	51,161	10.0	496,013	10.3
Delaware	160,133	11,630	7.3	147,696	7.8
District of Columbia	159,222	13,012	8.2	153,022	8.5
Florida	2,920,400	266,849	9.1	2,823,081	9.5
Georgia	1,887,197	138,350	7.3	1,734,303	8.0
Hawaii	222,754	16,871	7.6	217,853	7.7
Idaho	211,920	13,463	6.4	205,905	6.5
Illinois	2,246,388	241,903	10.8	2,183,394	11.1
Indiana	967,366	84,614	8.7	933,540	9.0
Iowa	382,894	40,046	10.5	379,344	10.6
Kansas	367,051	33,768	9.2	324,644	10.2
Kentucky	829,891	84,839	10.2	796,049	10.7
Louisiana	1,130,663	91,939	8.1	1,057,413	8.7
Maine	300,579	31,009	10.3	291,374	10.5
Maryland	841,004	68,657	8.2	812,324	8.4
Massachusetts	1,197,415	111,925	9.3	1,102,867	10.1
Michigan	1,660,124	128,699	7.8	1,516,385	8.4
Minnesota	762,630	78,325	10.3	738,451	10.6
Mississippi	768,803	79,388	10.3	726,494	10.9
Missouri	1,186,348	105,727	8.9	1,151,654	9.2
Montana	123,500	11,387	9.2	115,999	9.7
Nebraska	265,606	22,386	8.4	250,793	8.9
Nevada	254,259	19,387	7.6	245,491	7.9
New Hampshire	136,134	13,358	9.8	133,613	10.0
New Jersey	1,150,025	99,420	8.6	1,038,261	9.6
New Mexico	502,532	26,260	5.2	487,024	5.4
New York	4,698,972	347,312	7.4	4,270,056	8.1
North Carolina	1,588,095	158,329	10.0	1,544,911	10.2
North Dakota	82,203	9,542	11.6	80,356	11.8
Ohio	1,961,986	169,153	8.6	1,931,668	8.8
Oklahoma	670,326	58,984	8.8	652,556	9.0
Oregon	641,656	50,187	7.8	600,651	8.4
Pennsylvania	1,848,912	191,906	10.4	1,791,574	10.6
Rhode Island	217,797	19,327	8.9	211,613	9.1
South Carolina	1,034,679	98,427	9.5	989,269	9.9
South Dakota	124,028	11,405	9.2	118,807	9.6
Tennessee	1,610,768	151,887	9.4	1,582,935	9.5
Texas	3,746,761	293,376	7.8	3,558,653	8.2
Utah	330,618	15,571	4.7	303,685	5.1
Vermont	165,479	16,082	9.7	162,820	9.7
Virginia	825,879	82,272	10.0	785,892	10.5
Washington	1,194,901	73,702	6.2	1,089,710	6.7
West Virginia	388,420	35,703	9.2	369,053	9.7
Wisconsin	926,043	109,952	11.9	905,836	12.1
Wyoming	78,490	5,687	7.2	75,725	7.4
<b>United States</b>	<b>57,638,889</b>	<b>4,559,623</b>	<b>7.9</b>	<b>51,138,837</b>	<b>8.9</b>

Source: MAX Person Summary Records linked to SSA Death Master file, version 10/29/2011.

**Table C.6. Linkage of MAX PS Records to SSA Death Master File, 2004**

State	Number of Person Summary Records	Number Matched to SSA DMF	Percent Matched to SSA DMF	Number with SSN and DOB	Percent Matched Among People with SSN and DOB
Alabama	932,893	89,997	9.6	920,391	9.7
Alaska	131,300	6,084	4.6	123,830	4.8
Arizona	1,440,255	71,565	5.0	1,416,804	5.0
Arkansas	725,408	53,406	7.4	652,634	7.9
California	11,218,039	465,334	4.1	6,821,398	6.8
Colorado	580,106	34,856	6.0	538,720	6.4
Connecticut	522,658	47,121	9.0	503,319	9.4
Delaware	169,933	11,011	6.5	156,518	7.0
District of Columbia	164,352	12,424	7.6	158,584	7.8
Florida	2,936,906	252,925	8.6	2,824,921	9.0
Georgia	2,016,379	130,294	6.5	1,874,737	6.9
Hawaii	230,608	15,777	6.8	225,271	7.0
Idaho	225,025	12,710	5.6	215,822	5.9
Illinois	2,440,929	230,997	9.5	2,373,072	9.7
Indiana	1,026,274	80,636	7.9	982,398	8.1
Iowa	401,458	37,542	9.4	389,340	9.5
Kansas	382,505	31,894	8.3	339,067	9.3
Kentucky	852,066	77,768	9.1	829,918	9.4
Louisiana	1,215,412	87,004	7.2	1,169,247	7.4
Maine	315,370	28,567	9.1	308,879	9.2
Maryland	854,343	64,703	7.6	827,912	7.8
Massachusetts	1,186,540	98,647	8.3	1,069,780	9.2
Michigan	1,838,747	127,453	6.9	1,683,812	7.5
Minnesota	776,857	73,544	9.5	756,573	9.7
Mississippi	801,071	71,613	8.9	745,091	9.6
Missouri	1,243,452	100,666	8.1	1,214,614	8.3
Montana	127,468	10,491	8.2	124,689	8.4
Nebraska	264,006	20,756	7.9	249,023	8.3
Nevada	262,256	19,007	7.2	261,084	7.3
New Hampshire	142,071	12,668	8.9	140,425	9.0
New Jersey	1,129,947	91,501	8.1	1,041,358	8.8
New Mexico	523,975	24,687	4.7	514,598	4.8
New York	4,967,110	317,144	6.4	4,596,686	6.9
North Carolina	1,663,192	146,854	8.8	1,621,542	9.1
North Dakota	81,240	8,665	10.7	78,369	11.0
Ohio	2,044,300	157,408	7.7	2,013,247	7.8
Oklahoma	692,147	54,178	7.8	673,646	8.0
Oregon	602,938	43,676	7.2	561,136	7.8
Pennsylvania	1,987,856	183,630	9.2	1,905,850	9.5
Rhode Island	222,673	17,889	8.0	216,662	8.3
South Carolina	1,008,133	92,816	9.2	959,734	9.7
South Dakota	127,888	10,594	8.3	123,295	8.6
Tennessee	1,633,614	140,286	8.6	1,624,486	8.6
Texas	3,992,874	275,301	6.9	3,797,244	7.2
Utah	347,448	14,738	4.2	320,837	4.6
Vermont	168,697	14,761	8.8	165,544	8.7
Virginia	876,388	77,743	8.9	843,585	9.2
Washington	1,281,970	69,383	5.4	1,112,447	6.2
West Virginia	396,039	33,120	8.4	380,634	8.7
Wisconsin	990,431	103,931	10.5	963,024	10.8
Wyoming	80,599	5,337	6.6	77,836	6.8
<b>United States</b>	<b>60,244,146</b>	<b>4,261,102</b>	<b>7.1</b>	<b>53,489,633</b>	<b>7.9</b>

Source: MAX Person Summary Records linked to SSA Death Master file, version 10/29/2011.



**Table C.7. Linkage of MAX PS Records to SSA Death Master File, 2005**

State	Number of Person Summary Records	Number Matched to SSA DMF	Percent Matched to SSA DMF	Number with SSN and DOB	Percent Matched Among People with SSN and DOB
Alabama	963,526	82,614	8.6	948,357	8.7
Alaska	133,699	5,652	4.2	129,081	4.3
Arizona	1,491,569	66,932	4.5	1,444,520	4.6
Arkansas	762,193	50,000	6.6	693,106	6.9
California	10,924,768	418,709	3.8	6,813,647	6.1
Colorado	645,965	33,750	5.2	566,275	5.9
Connecticut	531,515	42,875	8.1	509,240	8.3
Delaware	181,053	10,389	5.7	163,998	6.3
District of Columbia	167,845	11,314	6.7	162,061	7.0
Florida	3,059,524	235,758	7.7	2,952,428	8.0
Georgia	2,107,826	115,410	5.5	1,958,926	5.9
Hawaii	237,736	14,456	6.1	231,817	6.2
Idaho	233,765	12,605	5.4	226,832	5.6
Illinois	2,612,709	217,942	8.3	2,540,896	8.6
Indiana	1,060,392	74,644	7.0	1,015,463	7.3
Iowa	430,985	35,802	8.3	423,487	8.4
Kansas	361,325	30,389	8.4	351,363	8.6
Kentucky	894,282	70,612	7.9	864,899	8.2
Louisiana	1,244,886	80,082	6.4	1,136,745	7.0
Maine	327,491	26,703	8.2	324,759	8.2
Maryland	868,686	59,113	6.8	841,483	7.0
Massachusetts	1,255,313	90,837	7.2	1,122,136	8.1
Michigan	1,878,812	117,710	6.3	1,737,621	6.8
Minnesota	792,366	68,940	8.7	771,514	8.9
Mississippi	787,537	64,897	8.2	740,926	8.8
Missouri	1,219,756	88,578	7.3	1,201,436	7.4
Montana	129,052	9,759	7.6	126,982	7.6
Nebraska	261,841	19,394	7.4	246,670	7.8
Nevada	272,739	16,757	6.1	237,631	7.0
New Hampshire	145,834	11,798	8.1	144,534	8.2
New Jersey	1,134,761	84,779	7.5	1,063,290	8.0
New Mexico	530,733	22,878	4.3	519,320	4.4
New York	5,118,695	295,343	5.8	4,755,424	6.2
North Carolina	1,729,575	136,146	7.9	1,693,714	8.0
North Dakota	79,961	7,925	9.9	78,290	10.1
Ohio	2,127,176	151,622	7.1	2,097,288	7.2
Oklahoma	730,873	50,732	6.9	709,676	7.1
Oregon	565,361	38,307	6.8	526,082	7.3
Pennsylvania	2,038,176	171,418	8.4	2,014,937	8.5
Rhode Island	224,884	16,444	7.3	217,647	7.6
South Carolina	1,012,763	84,154	8.3	966,445	8.7
South Dakota	130,988	9,780	7.5	127,364	7.7
Tennessee	1,607,615	123,936	7.7	1,580,916	7.8
Texas	4,164,091	255,084	6.1	3,905,663	6.5
Utah	359,506	13,816	3.8	333,378	4.1
Vermont	165,860	12,976	7.8	162,608	7.8
Virginia	928,642	72,084	7.8	885,869	8.1
Washington	1,285,090	64,003	5.0	1,141,515	5.5
West Virginia	393,616	30,351	7.7	382,862	7.9
Wisconsin	1,034,583	94,433	9.1	996,154	9.5
Wyoming	81,599	4,824	5.9	77,638	6.2
<b>United States</b>	<b>61,429,538</b>	<b>3,925,456</b>	<b>6.4</b>	<b>54,864,913</b>	<b>7.1</b>

Source: MAX Person Summary Records linked to SSA Death Master file, version 10/29/2011.

**Table C.8. Linkage of MAX PS Records to SSA Death Master File, 2006**

State	Number of Person Summary Records	Number Matched to SSA DMF	Percent Matched to SSA DMF	Number with SSN and DOB	Percent Matched Among People with SSN and DOB
Alabama	976,361	74,213	7.6	959,750	7.7
Alaska	131,586	5,032	3.8	126,193	4.0
Arizona	1,533,874	55,704	3.6	1,362,949	3.6
Arkansas	771,587	45,520	5.9	678,438	6.4
California	10,946,644	363,410	3.3	6,772,068	5.4
Colorado	642,575	31,108	4.8	582,030	5.3
Connecticut	534,495	38,198	7.1	512,561	7.5
Delaware	185,602	9,431	5.1	166,375	5.6
District of Columbia	169,814	10,028	5.9	161,596	6.2
Florida	3,042,834	209,622	6.9	2,912,317	7.2
Georgia	2,101,713	101,569	4.8	1,929,911	5.3
Hawaii	238,226	12,765	5.4	226,168	5.6
Idaho	230,815	11,554	5.0	222,610	5.2
Illinois	2,602,268	138,337	5.3	2,527,054	5.5
Indiana	1,067,016	66,204	6.2	1,034,623	6.4
Iowa	468,572	32,885	7.0	461,164	7.1
Kansas	361,498	27,558	7.6	353,288	7.8
Kentucky	893,225	63,223	7.1	881,535	7.2
Louisiana	1,273,978	69,802	5.5	1,159,643	6.0
Maine	337,424	24,816	7.4	334,521	7.4
Maryland	867,649	50,047	5.8	837,345	6.0
Massachusetts	1,315,266	82,403	6.3	1,187,396	6.9
Michigan	1,958,996	105,146	5.4	1,817,166	5.8
Minnesota	809,009	63,107	7.8	780,111	8.1
Mississippi	777,471	56,803	7.3	733,037	7.7
Missouri	1,115,164	74,778	6.7	1,090,625	6.9
Montana	129,162	8,666	6.7	125,857	6.8
Nebraska	262,403	17,587	6.7	247,696	7.1
Nevada	256,955	14,846	5.8	232,032	6.3
New Hampshire	148,759	10,741	7.2	147,059	7.3
New Jersey	1,190,176	74,111	6.2	1,117,511	6.6
New Mexico	521,785	20,707	4.0	505,960	4.1
New York	5,123,013	259,932	5.1	4,725,196	5.5
North Carolina	1,782,760	121,090	6.8	1,738,793	7.0
North Dakota	80,920	7,226	8.9	79,430	9.1
Ohio	2,157,415	137,952	6.4	2,126,376	6.5
Oklahoma	763,254	46,057	6.0	736,693	6.3
Oregon	554,749	33,734	6.1	510,043	6.6
Pennsylvania	2,111,259	154,320	7.3	2,077,605	7.4
Rhode Island	225,873	14,475	6.4	218,515	6.6
South Carolina	949,921	55,069	5.8	902,224	6.1
South Dakota	132,647	8,905	6.7	129,140	6.9
Tennessee	1,499,759	100,473	6.7	1,463,298	6.9
Texas	4,184,402	229,608	5.5	3,938,368	5.8
Utah	339,648	12,140	3.6	327,699	3.7
Vermont	164,682	11,216	6.8	161,354	6.9
Virginia	956,145	64,859	6.8	901,167	7.2
Washington	1,245,992	55,683	4.5	1,147,388	4.8
West Virginia	393,607	29,263	7.4	392,745	7.4
Wisconsin	1,051,903	84,421	8.0	1,008,902	8.4
Wyoming	80,790	4,332	5.4	77,244	5.6
<b>United States</b>	<b>61,661,641</b>	<b>3,400,676</b>	<b>5.5</b>	<b>54,848,769</b>	<b>6.2</b>

Source: MAX Person Summary Records linked to SSA Death Master file, version 10/29/2011

**Table C.9. Linkage of MAX PS Records to SSA Death Master File, 2007**

State	Number of Person Summary Records	Number Matched to SSA DMF	Percent Matched to SSA DMF	Number with SSN and DOB	Percent Matched Among People with SSN and DOB
Alabama	919,048	62,678	6.8	874,738	7.1
Alaska	126,886	4,342	3.4	122,276	3.5
Arizona	1,572,541	49,129	3.1	1,414,571	3.3
Arkansas	786,248	40,354	5.1	735,288	5.4
California	10,987,805	308,244	2.8	6,817,003	4.5
Colorado	640,071	27,513	4.3	583,898	4.7
Connecticut	539,182	33,263	6.2	521,744	6.4
Delaware	188,695	8,161	4.3	169,289	4.8
District of Columbia	171,417	8,552	5.0	162,268	5.3
Florida	2,935,675	177,114	6.0	2,731,448	6.4
Georgia	2,014,312	86,376	4.3	1,791,051	4.8
Hawaii	240,375	10,816	4.5	228,970	4.7
Idaho	236,261	10,205	4.3	224,529	4.5
Illinois	2,671,131	110,473	4.1	2,595,837	4.3
Indiana	1,085,057	58,282	5.4	1,054,500	5.5
Iowa	484,526	29,130	6.0	476,037	6.1
Kansas	356,752	24,660	6.9	346,752	7.1
Kentucky	901,094	54,900	6.1	885,849	6.2
Louisiana	1,161,542	59,146	5.1	1,113,899	5.3
Maine	361,555	25,920	7.2	358,369	7.2
Maryland	856,476	41,688	4.9	825,452	5.0
Massachusetts	1,363,950	71,386	5.2	1,224,445	5.8
Michigan	1,982,608	91,197	4.6	1,805,244	5.0
Minnesota	823,723	55,823	6.8	798,670	7.0
Mississippi	746,010	48,141	6.5	720,998	6.7
Missouri	1,078,266	63,983	5.9	1,046,617	6.1
Montana	128,821	7,454	5.8	125,446	5.9
Nebraska	262,022	15,336	5.9	249,541	6.1
Nevada	259,843	13,136	5.1	234,168	5.6
New Hampshire	151,043	9,569	6.3	149,398	6.4
New Jersey	1,227,083	63,341	5.2	1,151,139	5.5
New Mexico	532,636	17,945	3.4	517,305	3.4
New York	5,038,798	223,082	4.4	4,630,059	4.8
North Carolina	1,822,975	105,159	5.8	1,776,497	5.9
North Dakota	80,594	6,104	7.6	78,878	7.7
Ohio	2,173,685	121,581	5.6	2,137,433	5.7
Oklahoma	786,992	40,646	5.2	741,816	5.4
Oregon	545,787	29,290	5.4	498,314	5.9
Pennsylvania	2,134,737	134,328	6.3	2,071,843	6.5
Rhode Island	222,340	12,463	5.6	215,431	5.8
South Carolina	917,726	46,312	5.0	871,888	5.3
South Dakota	133,795	7,679	5.7	129,738	5.9
Tennessee	1,494,749	84,128	5.6	1,443,075	5.8
Texas	4,313,350	199,460	4.6	4,023,412	5.0
Utah	327,812	10,370	3.2	313,990	3.3
Vermont	164,339	9,460	5.8	161,195	5.8
Virginia	965,390	56,066	5.8	913,278	6.1
Washington	1,227,878	48,623	4.0	1,150,076	4.2
West Virginia	397,462	25,871	6.5	395,483	6.5
Wisconsin	1,053,300	70,701	6.7	1,004,805	7.0
Wyoming	78,360	3,799	4.8	74,903	5.0
<b>United States</b>	<b>61,672,723</b>	<b>2,923,379</b>	<b>4.7</b>	<b>54,688,853</b>	<b>5.3</b>

Source: MAX Person Summary Records linked to SSA Death Master file, version 10/29/2011.

**Table C.10. Linkage of MAX PS Records to SSA Death Master File, 2008**

State	Number of Person Summary Records	Number Matched to SSA DMF	Percent Matched to SSA DMF	Number with SSN and DOB	Percent Matched Among People with SSN and DOB
Alabama	928,272	51,683	5.6	878,103	5.9
Alaska	128,385	3,518	2.7	124,375	2.8
Arizona	1,681,279	42,450	2.5	1,510,333	2.8
Arkansas	783,320	33,436	4.3	755,510	4.4
California	11,183,571	254,464	2.3	7,024,554	3.6
Colorado	666,240	23,672	3.6	613,385	3.9
Connecticut	562,239	28,085	5.0	543,258	5.2
Delaware	199,084	6,732	3.4	182,707	3.7
District of Columbia	174,457	7,041	4.0	164,093	4.3
Florida	3,170,489	153,652	4.8	3,015,636	5.1
Georgia	2,017,823	73,001	3.6	1,851,269	3.9
Hawaii	252,266	9,018	3.6	239,382	3.8
Idaho	243,016	8,805	3.6	232,254	3.8
Illinois	2,774,091	90,293	3.3	2,701,067	3.3
Indiana	1,154,292	50,951	4.4	1,121,996	4.5
Iowa	499,396	24,782	5.0	486,330	5.1
Kansas	362,794	21,261	5.9	352,899	6.0
Kentucky	926,354	45,638	4.9	904,209	5.0
Louisiana	1,219,892	49,561	4.1	1,159,356	4.3
Maine	361,611	21,689	6.0	358,657	6.0
Maryland	900,240	34,885	3.9	863,358	4.0
Massachusetts	1,633,841	61,910	3.8	1,475,299	4.2
Michigan	2,034,731	76,935	3.8	1,935,802	4.0
Minnesota	846,213	47,960	5.7	827,410	5.8
Mississippi	740,415	38,232	5.2	718,389	5.3
Missouri	1,096,123	53,656	4.9	1,074,183	5.0
Montana	131,160	6,352	4.8	127,711	5.0
Nebraska	265,282	12,805	4.8	252,507	5.1
Nevada	279,492	11,165	4.0	255,621	4.4
New Hampshire	157,524	8,178	5.2	155,672	5.3
New Jersey	1,276,190	52,316	4.1	1,198,860	4.4
New Mexico	565,298	15,021	2.7	550,473	2.7
New York	5,112,507	185,146	3.6	4,720,396	3.9
North Carolina	1,902,108	87,833	4.6	1,859,933	4.7
North Dakota	79,323	5,116	6.4	77,470	6.6
Ohio	2,212,338	102,352	4.6	2,137,786	4.8
Oklahoma	811,952	34,870	4.3	768,489	4.5
Oregon	577,932	25,222	4.4	537,071	4.7
Pennsylvania	2,233,017	114,112	5.1	2,205,209	5.2
Rhode Island	218,104	10,304	4.7	211,301	4.9
South Carolina	919,466	38,552	4.2	880,278	4.4
South Dakota	136,061	6,461	4.7	131,966	4.9
Tennessee	1,542,353	70,962	4.6	1,486,879	4.8
Texas	4,488,332	168,194	3.7	4,142,682	4.1
Utah	350,893	8,594	2.4	326,957	2.6
Vermont	176,697	7,934	4.5	173,718	4.6
Virginia	1,006,083	47,589	4.7	956,744	5.0
Washington	1,243,536	41,312	3.3	1,175,535	3.5
West Virginia	404,206	21,950	5.4	401,163	5.5
Wisconsin	1,133,714	57,654	5.1	1,091,607	5.3
Wyoming	78,645	3,207	4.1	74,281	4.3
<b>United States</b>	<b>63,842,647</b>	<b>2,456,511</b>	<b>3.8</b>	<b>57,014,123</b>	<b>4.3</b>

Source: MAX Person Summary Records linked to SSA Death Master file, version 10/29/2011.

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