Chapter 13
Semi-supercentenarians in the United States

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Supercentenarians – persons who attained age 110 – who last resided in the United States and were alive and age 110+ at some time during the 20-year period from 1980 to 1999 were the subject of a chapter in Part II ("country reports") of the Demographic Research Monograph entitled Supercentenarians (Maier et al. 2010). We write now a companion piece dealing with semi-supercentenarians – persons who did not attain age 110 but came close, namely men who attained age 105 and women who attained age 108 – who last resided in the United States and were born between 1870 and 1899.

While the term "semi-supercentenarian" is generally used in this volume to refer to persons of both sexes who attained age 105 but not 110, the ages 105 and 108 were chosen so that there might be approximately the same numbers of male semi-supercentenarians and female semi-supercentenarians.

In any country, the number of semi-supercentenarians (as defined for this chapter) will be much greater than the number of supercentenarians, by a factor probably more than 5. Since for the United States the validation of attainment of extreme age is labor-intensive, so that the examination of *all* semi-supercentenarian candidates is hardly feasible, we selected for examination a 10 percent sample of candidates, based on the 8th digit of the social security number – the nearly universal identifier in the United States. This allows for a random, representative selection.

As of this writing, the United States has contributed to the International Database on Longevity (IDL) 338 verified semi-supercentenarians who last resided in the United States and were born in the last three decades of the nineteenth century. We were also able to add 16 verified supercentenarians to the collection of U.S. supercentenarians already in the IDL files. The records used to authenticate the ages at

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death of all these cases will be included in the IDL document file to the extent possible. While with respect to supercentenarians the United States' contribution was larger than the total contributions of all other IDL countries, this is not the case for semi-supercentenarians, given that validation was undertaken only for a 1-in-10 sample and that for females attainment of age 108 was required.

Of course, the true number of semi-supercentenarians in scope of our investigation (born 1870–1899, resided in the U.S. at death) is more than 10 times the number that we validated, because surely some not validated candidates truly are semi-supercentenarians. Also, we undoubtedly failed to identify some candidates because of the conservative identification methods we used.

In this essay we discuss at length how U.S. semi-supercentenarians were identified. We also tabulate their characteristics, and compare the distributions of these characteristics between semi-supercentenarians and supercentenarians. The essay also includes a short discussion of the mortality experience of these extreme aged.

At the outset we wish to recognize the collaborative nature of the project and acknowledge the significant role played by the Program on Population, Policy, and Aging at Duke University under the leadership of Dr. James Vaupel. Earlier in the project we benefited from the collaboration of the Population Studies Center at the University of Pennsylvania under the leadership of Dr. Samuel Preston, as well as from assistance by Mr. Robert Young.

13.1 Casting the Net and Passing Muster

Except for countries with very accurate population registries, a systematic search for semi-supercentenarians proceeds through two stages. First a net is cast to "capture" possible semi-supercentenarians. Then the candidates' credentials are critically examined and only those passing inspection receive the stamp of authentication. The net should be wide and the examination rigorous.

In countries without population registries but with centralized death registration, typically the semi-supercentenarian net is cast to grab decedents with recorded ages on the death certificate of 105–109 for men and 108 or 109 for women. Personal information (name and parents' names, date and place of birth) needed in the next stage is collected from the certificate. However, this approach is not feasible in the United States, due to its non-centralized system for death registration.

In the United States the registration of vital events is generally performed by State government: there are registrars in each of the 50 States, and in Washington, DC and New York City, as well. It is true that each year the registration jurisdictions send copies of their files to a Federal agency – the National Center for Health Statistics (NCHS) – that merges the State files and makes a national public-use file available for research. However, the NCHS removes personal identifiers such as names and social security numbers in producing the public-use file, and a file lacking the personal identifiers needed to proceed to the validation stage of semi-supercentenarian identification is of no use to us. The National Center does maintain

a publicly-available data system from which the personal identifiers have *not* been removed called the National Death Index (NDI), but this is a system designed to only determine persons' vital status or provide cause-of-death information for known decedents, rather than to produce a list of decedents according to some criteria. More on the National Death Index will come later.

Given these realities about death certificate files, we chose a different net, one that captures persons who at the time of their death in the target age ranges were enrolled in Part B of the Medicare program and resided in the United States. The Medicare program is a two-part Federal government health benefits program for persons ages 65 and over or disabled. Part A, providing hospitalization benefits, generally does not require premium payments from enrollees, in contrast to Part B, providing benefits for medical services, which is funded partly by premiums due from all program participants. The Medicare program is nearly universal: according to estimates from the U.S. Bureau of the Census, more than 96% of the population ages 70 and over participate in the program.

The Federal agency that administers the Medicare program is the Centers for Medicare and Medicaid Services (CMS) in the Department of Health and Human Services. However, the enrollment of most Medicare participants is performed by a different Federal agency, the Social Security Administration (SSA) – which explains why Medicare enrollment information is present on the SSA master file, the Master Beneficiary Record (MBR). The similar CMS master file, the Enrollment Data Base, receives enrollment information from the Master Beneficiary Record, and also receives a much smaller number of enrollment records from the Railroad Retirement Board (yet another Federal agency) for persons whose entitlement to Medicare derives from careers in the railroad industry. It was established some time ago (Kestenbaum 1992) with respect to the very old ages that (a) records of current enrollment in only Part A (for which premiums are generally not charged) and not Part B (which requires the participant to be up-to-date on his or her premium payments) are suspect, and that (b) the SSA master file is more accurate than the similar CMS master file.

Our net was cast to capture persons with records in the Master Beneficiary Record file as it stood in June 2011 that showed enrollment in Medicare Part B at the time of death in the target age ranges, a last address in the United States, and a date of birth in the period 1870–1899. Hence the omission of three small in-scope groups of semi-supercentenarians: those not enrolled in Medicare, those enrolled in Part A only, and those whose eligibility for Medicare derives from their career employment in jobs covered by the Railroad Retirement system (who will have a record in the CMS master file but not the SSA master file). Of course, in-scope semi-supercentenarians whose date of birth or date of death is recorded inaccurately on the MBR record may also be missed.

In fact, our net was cast to *also* capture persons who had attained age 110 according to the enrollment record, if they were not previously confirmed supercentenarians. This was done to capture semi-supercentenarians whose age at death was exaggerated on their enrollment record; in our earlier investigation of supercentenarians we had observed that several persons age 110 and above at death according

to their enrollment record were actually younger, and so may be semi-supercentenarians.

We had access to several electronic administrative files that contained records – including dates of birth – for many of our candidates. Specifically, we had access to extracts from (1) the Social Security Administration's "NUMIDENT" file of applications and re-applications for a social security number or card; (2) the Social Security Administration's Supplemental Security Record of enrollments in the Supplemental Security Income (Federal welfare) program; (3) the Centers for Medicare and Medicated Services' master enrollment file, mentioned earlier; and (4) the Office of Personnel Management's annuitant file of former Federal government employees. Because it is so rare to achieve the threshold ages of semi-supercentenarianship, we chose to eliminate any candidate who had a date of birth on any of these files that implied that the candidate did not achieve the threshold age.

Corroboration of candidates' dates of birth and death requires the presence on the record of personal information such as the parents' names and the place of birth – which the Medicare enrollment record does not have. But the enrollment record does (almost always) have the social security number, and with the social security number in hand we proceeded to obtain the needed information from another Social Security Administration file, namely the file of applications and reapplications for a social security number or card. Although, in fact, many of the old completed applications were not available electronically, we obtained microfilm copies from the agency's offsite storage facility in Boyers, Pennsylvania and examined them manually.

Since Medicare records, unlike death certificate records, occasionally have incorrect dates of death (e.g., the recorded date may be the date of recordation rather than the date of occurrence), the date of death requires corroboration, as well as the date of birth. Accordingly, we worked together with the Program on Population, Policy, and Aging at Duke University to submit our list of candidates for a search in the aforementioned National Death Index maintained by the National Center for Health Statistics. The NDI consists of a catalog of all registered deaths in the United States since 1979 and a procedure for searching in that catalog – using either the social security number or sets of selected personal identifiers – and reporting the results of the search, including the extent of agreement between the submitted record and the matching records. A sample of output from the NDI search is shown in Appendix 13.2. A few of our candidates were deceased before 1979; for them it was not possible to corroborate the date of death with the NDI.

With respect to corroboration of the date of birth, clearly a certificate of birth is the ideal evidentiary record. Unfortunately, given the belated development of extensive U.S. birth registration, more often than not a certificate of birth either does not exist or cannot be found. A satisfactory alternative to the birth certificate for establishing date of birth is a record from an early census, when our semi-supercentenarians

were very young. In the United States censuses are conducted decennially, in years ending in '0', and are confidential for 72 years, after which they are available to the public.

The 1890 census records were destroyed by fire, and therefore our preferred censuses are the 1880 census and the 1900 census. We did, however, validate with the 1910 census and even the 1920 census, as long as the age at the time of the census was under 25. In actual fact, most of our validations were from the 1900 census. Not only was the 1900 census the earliest census available for most of our candidates, but the 1900 census collected not only age, but month and year of birth, as well, making our validations more precise.

The Church of Latter-Day Saints has embarked on an ambitious and arduous undertaking to computerize and index census records and develop software for searching the computerized, indexed files. This system of records and search software is publicly available on www.ancestry.com, for a modest subscription fee. To illustrate the search process, we show in Appendix 13.1 (a) a record that is input to the search, (b) the page from the census manuscript that is returned by the search, and (c) the summary page returned by the search which presents the census information in a standard, easy-to-read format.

While U.S. decennial census records are the centerpiece of this system, the collection includes some State censuses and some censuses conducted in countries other than the United States. Indeed, we validated 9 candidate semi-supercentenarians with early State census records (New York, Kansas, Minnesota, Wisconsin, Florida) and 11 with early non-U.S. census records (Canada, Ireland, England, Sweden).

After rejecting candidates who either (a) were not semi-supercentenarians according to a Social Security Administration record or an early census record or a National Death Index record, or (b) could not be found in the National Death Index, we were left with 565 candidates to search for in early census records. We were able to validate 338 of the candidates, or 60%.

Why wasn't the validation rate higher? First of all, about half of the failures were for foreign-born persons. Some of these foreign-born persons immigrated after age 25, or attained age 25 before they were first enumerated in a census, or were first enumerated in the now-unavailable 1890 census and attained age 25 before the next census. Others may have immigrated without their parents, and are therefore difficult to locate in a census record. Second, the destruction by fire of the 1890 census records limited our options, particularly for persons born in the 1880s. Table 13.1 shows the results of the validation effort for 5-year birth cohorts.

Table 13.1 Validation results for 5-year birth cohorts of semi-supercentenarians (10% sample)

Year of birth	All cases	Validated
1870–1874	37	10
1875–1879	54	34
1880–1884	83	37
1885–1889	133	73
1890–1894	132	92
1895–1899	126	92
Total	565	338

13.2 Characteristics and Mortality of Semi-supercentenarians

The validated semi-supercentenarians are categorized by age at death and sex in Table 13.2. Age at death is the difference in completed years between the date of death on the death certificate, obtained from the NDI search, and the preferred date of birth. We preferred the latest among the dates of birth on the early census record and the set of SSA (and CMS) records – unless there was compelling evidence on the census record to discredit the date recorded on SSA records.

At combined ages 108 and 109, females outnumber males by 6.5 to 1. This appears to be roughly consistent with the approximately 9 to 1 sex ratio for validated supercentenarians that we had observed in earlier work.

The progression from one age to the next for males is not as smooth as we hoped for, which is not unexpected when dealing with small numbers of persons, but the overall pattern seems in line with our earlier finding for *supercentenarians* of an annual probability of death of 0.5 or slightly more. For females, the small number of deaths at age 109, relative to the number at age 108, suggests a probability of mortality of more than 0.5 at age 108, but again with a caveat about the sparseness of the data.

In a paper appearing in the *North American Actuarial Journal* (the journal of the U.S. Society of Actuaries) in 2002 on the subject of extreme-age mortality in the United States during the decade 1990–1999 (Kestenbaum and Ferguson 2002), we published "best" estimates of probabilities of death, q_x, unsmoothed, based on a subset of the Medicare Part B experience during the decade. Those estimates were:

Age	105	106	107	108	109
Men	0.470	0.451	0.479	0.535	0.545
Women	–	–	–	0.507	0.567

The pattern suggests that the probability of death is increasing over the 5 ages from something below 0.5 to something above 0.5.

Table 13.2 Validated semi-supercentenarians, by age at death and sex

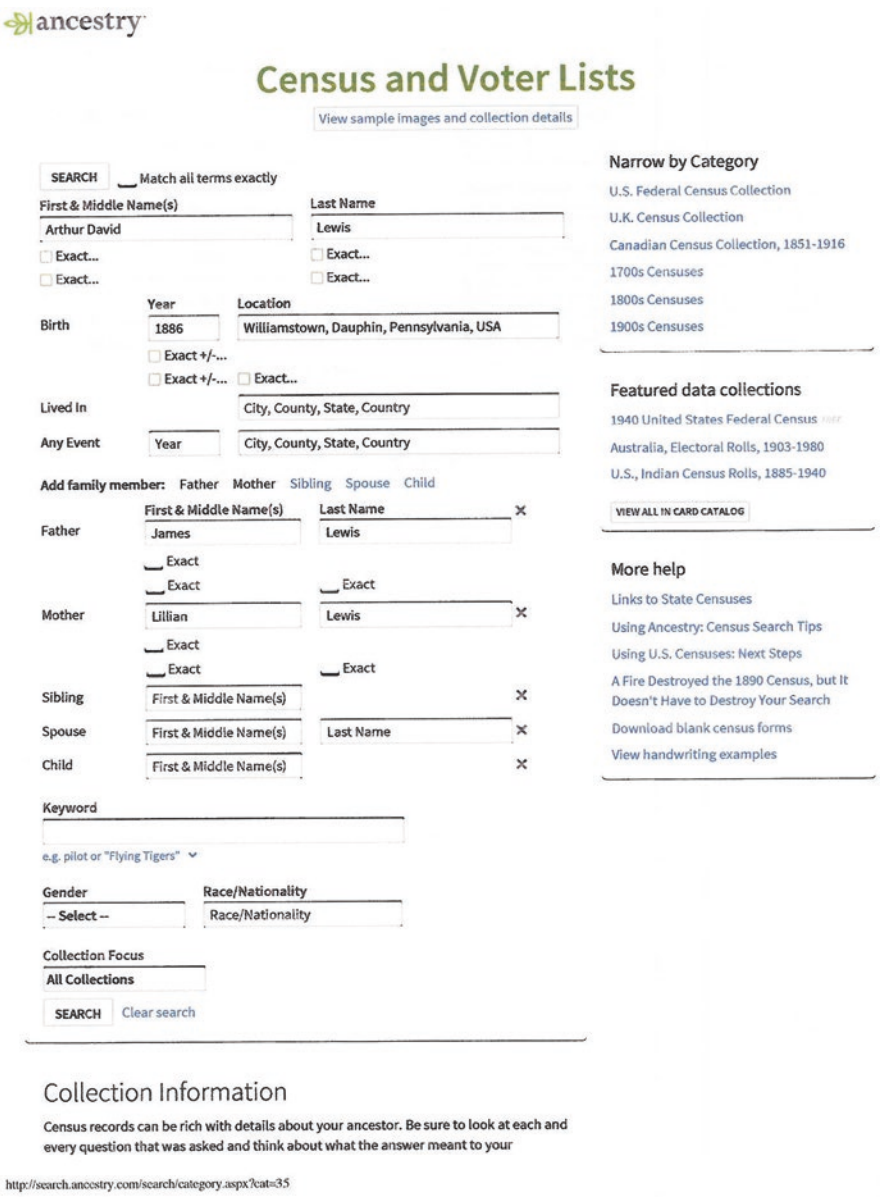
Age at death	Males	Females
105	81	–
106	32	–
107	29	–
108	17	124
109	9	46
Total, all ages	168	170
Total X 10	1680	1700

Only 18 of the confirmed semi-supercentenarians are foreign-born. The State in which were born the largest number of confirmed semi-supercentenarians is Pennsylvania, with 26, followed by Texas (20), and Ohio and Minnesota (16). Pennsylvania, Texas, and Ohio were also in the top five for confirmed supercentenarians; New York was first there.

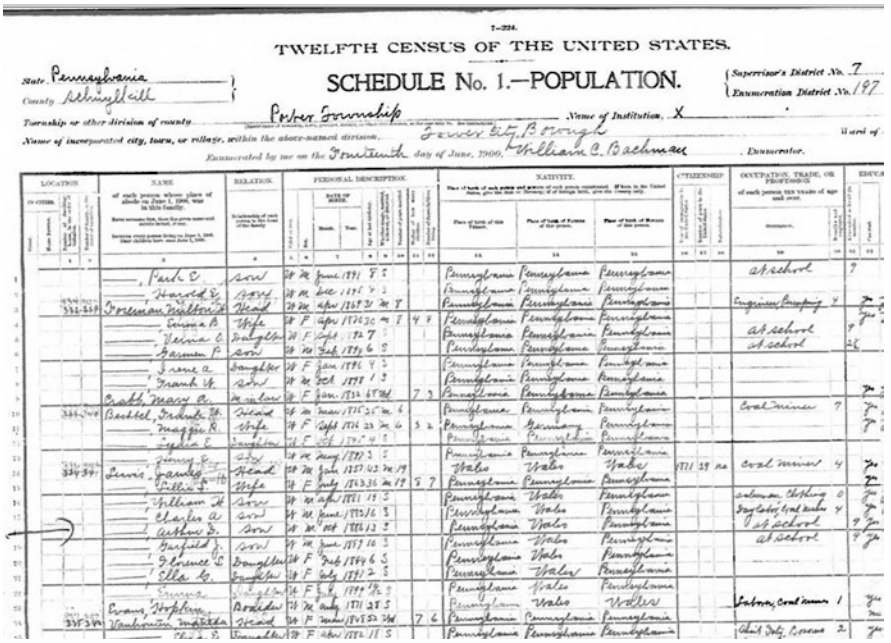
Acknowledgement The assistance of Renee Ferguson is gratefully acknowledged.

Appendix

Appendix 13.1 Sample Ancestry.com Search



Appendix 13.2 Sample Ancestry.com Search, Cont'd



TWELFTH CENSUS OF THE UNITED STATES.

SCHEDULE No. 1.—POPULATION.

State Pennsylvania
County Schuylkill
Township or other division of county Porter Township
Name of Institution, X
Name of incorporated city, town, or village, within the above-named division. Sewer Dist. Borough
Enumerated by me on the Twentieth day of June, 1900. William C. Bachman, Enumerator.

Supervisor's District No. 7
Enumeration District No. 197

Appendix 13.3 Sample Ancestry.com Search, Cont'd

1900 United States Federal Census for Arthur D Lewis

Record Index

Surname: Lewis
Given Name: Arthur D
Relationship: Son
Race: White
Gender: Male
Age: 13
Marital Status: Single
Birthplace: Pennsylvania
Father's Birthplace: Wales
Mother's Birthplace: Pennsylvania
Residence: Porter, Schuylkill, Pennsylvania

Source Information

Record Url: http://search.ancestry.com/cgi-bin/sse.dll?indiv=1&db=1900usfedcen&h=42513073

Source Citation: Year: *1900*; Census Place: *Porter, Schuylkill, Pennsylvania*; Roll: *1485*; Page: *18A*; Enumeration District: *0197*; FHL microfilm: *1241485*

Source Information: *Ancestry.com. 1900 United States Federal Census [database on-line]. Provo, UT, USA: Ancestry.com Operations Inc, 2004. Original data: United States of America, Bureau of the Census. Twelfth Census of the United States, 1900. Washington, D.C.: National Archives and Records Administration, 1900. T623, 1854 rolls.*

Appendix 13.4 Sample National Death Index Results

Mississippi	005999	02/24/1987	I	B	X	-	X	- - - - - - - - -	X	X	+13				X		-	0
California	201081	12/31/1985	I	B	N	-		- - - - - - X - X	X		-01		X	X	X		-	0
New York City	049216	09/10/1991	I	B	X	-		- - - - - - - X X	X	X	+19			X			-	0
California	161290	08/28/2012	X	-	N	-	N	- - - - - - - - -	X	X	+56		X	X			-	0
Maryland	032092	12/02/1982	I	B	X	-	X	?	X	X	+73						-	0
California	036569	02/18/1986	I	B	N	-		- - - - - - - - -	X		-01						-	0
California	059657	04/13/1982	X	-	X	-		X - - - - - - - -	X		-01		X		X		-	0
California	038272	02/21/1994	I	B	X	-	?	- X - - - - - - -	X	X	+26						-	0
South Carolina	013329	05/11/1998	I	B	X	-		X - - X - - - - -	X	X	+75						-	0

USER RECORD: (POSSIBLE MATCHES = 017) NDI Search No: 2001-K051#01 CONTROL NO: 179181884A USER DATA: 61992

POSSIBLE DECEDENT NAME	FATHER'S SURNAME	S S N	BIRTH DATE MO DAY YEAR	AGE	SEX	RACE	Marital Status	Res State	Birth State
ARTHUR LEWIS	-	1 7 9 1 8 1 8 8 4	10 / 06 / 1886	105	M	WH	-	PA	-

POSSIBLE NDI RECORD MATCHES (IN RANKED ORDER)

STATE OF DEATH	CERTIFICATE NUMBER	DATE OF DEATH	FN	MI	LN	FATHER'S SURNAME	LN/ FS	S S N	BIRTH MO	DATE DAY	+/- YEAR	AGE	SEX	RACE	Marital Status	Res State	Birth State	Status Code
*Pennsylvania	055428	06/24/1992	X	-	X	-	-	X X X X X X X X X	X	X	X	X	X	X	-	X	-	1
Texas	061681	03/21/2006	X	-	X	-	-	- - - - - - X - -	X	X	+28		X	X	-		-	0
North Carolina	040491	08/19/1998	X	-	X	-	-	- - - X - - - - -	X	X	+21		X	X	-		-	0
Louisiana	033533	11/23/1984	I	B	X	-	-	- - - X - X - - -	X	X	+19		X		-		-	0
California	053639	03/22/1998	I	B	X	-	-	- - - - - - - - -	X	X	+28				-		-	0
Texas	107876	10/16/1997	I	B	X	-	-	- - - - - - - - -	X	X	+22			X	-		-	0
Florida	031345	03/12/1983	I	B	X	-	-	- X X - - - - X -	X	X	+12			X	-		-	0
Texas	010981	02/09/1989	I	B	N	-	-	- - - - - - - X -	X	X	+45		X	X	-		-	0
New York	063627	09/15/1979	I	B	X	-	-	- - - X - - X - -	X		-01			X	-		-	0
Maryland	020735	07/05/1998	I	B	X	-	-	- - - - X - - - -	X	X	+49				-		-	0
Connecticut	029184	09/08/1995	I	B	X	-	-	- - - - - - - - -	X	X	+18				-		-	0
Ohio	096331	12/28/1980	I	B	X	-	-	- - X - - - - - -	X	X	+25				-		-	0
Michigan	025231	04/19/2008	I	B	N	-	-	- X - - - - - - -	X	X	+28				-		-	0
New Jersey	054499	09/26/1993	I	B	N	-	-	- - - - - - - X -	X	X	+28			X	-		-	0
California	042718	02/20/1988	X	-	N	-	-	- - - - X - - - -	X	X	+51			X	-		-	0
Texas	130728	10/27/2010	I	B	N	-	-	- - - - - X - - -	X	X	+48				-		-	0
Texas	037227	04/04/2006	I	B	N	-	-	- - - X - - - - -	X	X	+77				-		-	0

References

Kestenbaum, B. (1992). A description of the extreme aged population based on improved Medicare enrollment data. *Demography, 29*, 565–580.

Kestenbaum, B., & Ferguson, B. R. (2002). Mortality of the extreme aged in the United States in the 1990's, based on improved Medicare data. *North American Actuarial Journal, 6*(3), 38–44.

Maier, H., Gampe, J., Jeune, B., Robine, J.-M., & Vaupel, J. W. (Eds.). (2010). *Supercentenarians* (Demographic research monographs (A series of the Max Planck Institute for Demographic Research)). Berlin: Springer Verlag.