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Abstract

This paper expands on previous research that has documented relatively high levels of inconsistency in age information for elderly African Americans. Drawing on a sample of death certificates for Maryland-born African Americans purportedly aged 65-79 at death in 1985, the validity of age data in both death certificates and social security records is examined by linkage to a birth record. The commonly assumed relationship between availability of birth registration and quality of age reporting also is investigated.

Among matches to a birth record, age on social security records is significantly more accurate than on death records. Age agreement between matched death and social security records closely reflects age validity as determined from birth records. Findings based on logistic regression analysis support the hypothesized birth registration effect: controlling for demographic characteristics, persons with a birth certificate exhibited greater age agreement on linked death certificates and social security records (odds ratio = 2.3).

The Accuracy of Age Reporting among Elderly African Americans:
Evidence of a Birth Registration Effect

Empirical research in the epidemiology and demography of aging depends on the accurate measurement of biological age. Observers have long been aware that relatively high levels of age misreporting exist for African Americans, especially at advanced ages (Zelnik 1969; Bayo 1972; Elo and Preston 1994). Because of age misreporting, death rates for minorities in the United States have long been viewed with suspicion and racial differentials in death rates have been difficult to measure. Observations such as the White/Black mortality crossover pattern--the trend of higher death rates for Blacks than for Whites at younger ages, eventual convergence, and then lower rates past 75 or 80 years--have led to much controversy. This pattern has been especially difficult to evaluate, with some demographers ascribing the phenomenon to artifacts of the data such as underenumeration and/or age misreporting, and others to "mortality selection" (Manton 1982; Coale and Kisker 1986).

Over time it is likely that declines in age misreporting levels have been of sufficient magnitude to affect reported mortality trends. For example, the increase in recent years in mortality levels for Blacks 75-84 years of age relative to those for Whites may have been due to reductions in unreliable age statement. Indeed, data from a number of studies suggest improvements in age reporting have occurred over time. The Matched Records Study of 1960, which evaluated age reliability using a linked sample of census forms and death certificates, found that only 45% of nonwhite male and 37% of nonwhite female matched records had the same age reported in both sources (National Center for Health Statistics 1968). More recently, a linked records study, limited to deaths occurring in Texas and Massachusetts in 1987, compared

ages on death records and matching social security records and found 73% agreement on exact age for Blacks aged 65 or older (compared with 95% agreement for non-Hispanic Whites) (Kestenbaum 1992). A subsequent replication of this study for a national sample of African Americans dying in 1985 found 63% agreement on exact age between the matching death certificate and social security record for persons aged 65-84 and 62% among those aged 85 and older (Elo, Rosenwaike, Hill and Cheney 1994). (See Elo and Preston 1994, for a summary of the empirical literature).

Unfortunately, in each of these matched records studies there has been no way of establishing whether age consistency reflects age accuracy. Since both death certificates and social security files (including the closely-related Medicare enrollment files) currently serve as important data sources for epidemiological and demographic studies, there is obvious value in determining whether "true" ages are being reported in these records. Hambright (1969) has suggested an approach that corroborates age information using the decedent's birth certificate, the document of highest probative value. Because birth registration in the United States was seriously deficient well into the present century, such an approach is not yet feasible for a national sample of aged decedents. As late as 1959, a birth certificate could be located for less than one-third of a sample made up of persons aged 45 years and over (National Center for Health Statistics 1968). This percentage would undoubtedly have been lower for Blacks since they were predominantly born in southern states, which were among the last to join the Birth Registration Area. It was not until 1933 that the entire United States was included for the first time, and even after this date Black births suffered from substantial underregistration. A national study in 1939-40 indicated that about one Black birth in five was not registered (Shapiro 1950).

These patterns imply that it was not until African Americans now in their sixties were born that most Black births were registered.

The need for improvement in the quality of mortality data for minority populations has long been recognized (Kitagawa and Hauser 1973; Armstrong, Wing, and Tyroler 1995). However, empirical investigation of factors assumed to influence age misreporting has largely been neglected. It is widely believed that possession of a birth certificate leads to improvements in age reporting (Hambright 1969; Blytheway 1990). With the rapid expansion of the Birth Registration Area after its establishment in 1915, an increasing proportion of the elderly African American population will possess birth certificates in the coming years. Recent evidence that age reliability has improved among younger cohorts (Elo, Rosenwaike, Hill, and Cheney 1994) suggests more accuracy in death certificate age. Many factors may have accounted for improvements in age reporting among elderly African Americans, but it is likely that the growth of birth registration over time in itself may be one of the major contributors.

This study seeks to advance our current understanding of age misreporting among the African American elderly through 1) the investigation of the validity of age reporting in a sample of matched death and social security records and 2) an empirical test of the hypothesized birth registration effect. Because of the importance of obtaining birth records for a substantial proportion of the study group, we limited our sample to decedents reported on the death certificate as born in Maryland, the first southern state to be admitted to the Birth Registration Area (in 1916) (Shapiro 1950) and a state found to have better birth certificate availability for elderly persons (all races combined) than most other southern states (Deutch 1973).

Method

Subjects for this study, drawn from death certificate files, consist of all Maryland-born Blacks who died during the first five months of 1985 and who were reported to be 65 to 79 years old at the time of death. (The reported years of birth for subjects in the study sample ranged between 1905 and 1920.) The sample of 666 records chosen included persons who resided in Maryland at the time of death as well as those residing elsewhere in the United States. Seven records for decedents reported as born in Maryland according to the death certificate were excluded on the basis of strong evidence they were born elsewhere (enumeration records from the publicly-available 1920 census), reducing the sample size to 659. Decedents purportedly born before 1905 were not included in the study because of inadequate birth registration coverage.

Social Security Administration records for the sample were obtained from the Death Master File (DMF), a publicly available data file of deceased social security enrollees (Aziz and Buckler 1992). The sample of death certificates of Maryland-born Blacks was matched to a subset of DMF records limited to decedents whose month and year of death occurred in the period from December 1984 to June 1985. Two computerized linkage procedures were used. The first procedure linked DMF records using the individual's social security number (SSN) as given on the death certificate. Because of the possibility that the SSN reported on the death certificate was not correct, we required first and last name agreement in the two files, allowing for minor spelling differences. This led to matches for about 80% of cases. The second procedure was performed for the remaining unmatched records for which an SSN was available; it allowed for a one or two digit variation in the reported SSN, but required that names, state of residence at time of death, and month and year of death all agreed exactly. With these procedures we

successfully linked 598 cases (91% of the sample) to a social security record.

Birth record linkage was accomplished using microfilm indexes of registered births held by the Maryland State Archives from two separate sources: Maryland county records and Baltimore City records. (Baltimore City was an independent registration area in the first half of this century.) The county indexes (which were 10-12 year compilations) were searched for a ten-year period and the Baltimore City indexes (which were annual) were searched for a five-year period surrounding the year of birth reported on the death certificate. Potential birth record matches were assessed based on the level of agreement of six characteristics common to both the death certificate and the Maryland birth record indexes: subject's last name at birth, subject's first name, father's first name, mother's first name, subject's birthday (not including birth year), and county of birth (when available from the death certificate or other sources). Four additional matching variables were also considered when available: subject's middle name, father's middle name, mother's middle name, and mother's maiden name.

Following a conservative approach, all birth record linkages were screened in a follow-up examination which required:

1) Agreement on the decedent's last name, although slight spelling differences were accepted.

2) Agreement on at least one of the parents' first names reported on the death certificate or other sources. Common variations of first names (e.g., Francis/Frank) were allowed.

3) Agreement on the county of birth reported on birth and death records (or another source of information), when such information was available. If the counties

reported were adjacent, a match also was accepted.

4) Perfect agreement of the birth record month and day of birth with that reported on the death certificate or the linked social security record if the decedent's first name was not reported on the linked birth record. (This rule was designed to reduce the probability of false matches to siblings.)

For a small sample of records we also obtained corroborating evidence (e.g., birth certificate copies) from the Division of Vital Records of the Maryland Department of Health and Mental Hygiene.

We located a matching birth record for 217 cases, about one-third of those searched; 199 of these cases were matched to both birth and social security records. Most of our analyses are based on the latter group, for which three-way record linkage was achieved. Because birth registration in Maryland greatly improved from 1905 to 1920, we anticipated that a higher proportion of purportedly younger cases--decedents reported to have been born in 1915 or later--would be successfully matched to birth records relative to older cases. As expected, the putative age of the decedent (actually the year of birth) was a major factor in determining the likelihood of obtaining a birth certificate match. While 53% of decedents aged 65-69 years (according to the death certificate) were matched, match success fell precipitously as putative age at death increased: 30% of decedents reported to be aged 70-74 years, and only 15% reported to be aged 75-79 years were matched.

Although most match failures probably can be attributed to non-registration of births, there are other reasons why successful matches may not have been found. These include possible changes in names over the life course, poor reporting of individual and parental information on

the death certificate, and incorrect death certificate reporting of the state of birth as Maryland. (As noted above, for a number of instances we found census information providing a state of birth other than Maryland; these known cases were excluded.) Undoubtedly, some of the birth records of our sample could not be identified because a considerable number of entries in the official birth record indexes for the period of interest do not give the first name of the newborn. As stated above, when a newborn's name was lacking on the birth record, we used conservative procedures for validating the match to avoid false linkage to a sibling.

Results

In the first phase of our analyses we investigated the validity of age reporting in death and social security records for the 199 cases for which both social security and birth record matches were located. Among the subjects for whom a three-way match was available (Table 1), the age reported in social security records agreed with the age based on birth certificate information more frequently than did the age on death certificates (P = 0.008, t-test). About 84% of subjects had the same exact age recorded on their death certificate as that calculated from a birth certificate; on the other hand, exact age agreement was 92% between the social security age and the birth certificate age. Among the 32 cases where the death certificate age was inaccurately reported, age understatement was more common (19 cases) than was age exaggeration (13 cases). Conversely, among the 15 cases for which age was misstated in social security records, age overstatement was more common (10 cases) than age understatement (5 cases). In both death and social security records the majority of misstatements report ages which diverged from the true age by one year.

Availability of a matched birth record allowed us to examine to what extent age consistency among matched death and social security records denoted age accuracy (Table 2). Of the 169 three-way matched cases for which death and social security ages agreed, 161 (95%) also agreed with the matched birth certificate while 8 (5%) did not. The death certificate age was more likely to be incorrect than the social security age if disagreements existed. Of the 30 three-way matched cases for which death certificate and social security ages were found to be inconsistent with each other, social security age was accurately reported in 23 cases (77%), while death certificate age was accurately reported in 6 cases (20%); in only one of the 30 inconsistent cases was age inaccurately reported in both sources.

In the second phase of our investigation we analyzed age agreement between the death record and the Social Security Administration record among the 199 decedents for whom we located a Maryland birth record in comparison with similar data for the 399 decedents for whom no birth record was found. As hypothesized, age agreement was substantially better among the group for which a record of birth was obtained (Table 3). Agreement occurred in about 85% of cases matched to a birth record compared with only about 70% of the unmatched cases. Among the group without a birth certificate match, disagreements in age reporting in the two record sources increased with advancing age of the decedent, although such differences were not statistically significant (Table 3).

Among inconsistent cases, both the matched group and the unmatched group of death certificates were more apt to report a younger age than were social security records. It is of interest to note that this finding contrasts with the frequent assertion of age exaggeration on death records among the elderly. Indeed, in both groups at least two thirds of the discrepant cases

reported a younger age on the death certificate relative to the social security age, although the magnitude of disagreements was much greater for the unmatched group (Table 4). The pattern of net age understatement is consistent with that found using a large nationally-representative sample by Elo, Rosenwaike, Hill, and Cheney (1994).

We employed dichotomous logistic regression to examine whether this apparent birth certificate effect on age agreement persisted within a multivariate framework that controlled for potentially confounding variables (Table 5). Without controls, records with a birth certificate match exhibited 2.37 greater odds of age agreement ($e^{0.86103}$, Model 1). Model 2 adds controls for death certificate age (in single years), sex, marital status (i.e., married, widowed, other) and migration status (persons with a state of residence at time of death reported to be outside of Maryland were classified as migrants; all others were classified as non-migrants). These potentially confounding variables failed to be significant independent predictors of age disagreement at the P = .05 level. The presence of a matching birth record was the only significant predictor of age agreement; holding all other variables constant, a birth certificate match improved the odds of consistent age reporting by a factor of 2.29 ($e^{0.82815}$).

Discussion

Previous matched record studies have documented serious problems in the consistency of age reporting for aged African Americans. However, these studies have not used birth certificates to measure levels of age accuracy. The first phase of our study examined age validity on death and social security records for an elderly African American population (although not the oldest old) born in Maryland. This state was selected because of its sizable Black population

and because an unusually high proportion of elderly persons bo rn there were known to have birth certificates. Exact age agreement between the social secur ity record and the death certificate was high--substantially greater than that observed between death certificates and census ages fo r Whites in the 1960 Matched Records Study (National Center for Health Statistics 1968), an d greater than that of Blacks shown in a linkage of 1987 death records with the Social Securit y Administration's Master Beneficiary Record for decedents 65-84 years of age (Kestenbau m 1992). Age agreement on matched death and soci al security records was found to closely reflect age accuracy as determined from birth records. The quality of age reporting on social security records was significantly better than that observed on death records, and in cases of ag e disagreement the death certificate ag e was more likely than the social security age to be in error. These results should not be surprising for a number of reasons. First, social security data ar e obtained through self-reporting whereas death certificate information is supplied by prox y respondents who may not always be aware of the decedent 's correct age. Further, with the advent of the Medicare program evidence of proof of age upon entitlement was required by the Social Security Administration (Kestenbaum 1992).

The high levels of age disagreement found among elderly Blacks in matched record s studies have gener ally been attributed to "the fact that they do not have birth certificates and do not know their age" (National Center for Health Statistic s 1968, p. 25). Nevertheless, prior to this study, litt le in the way of compelling empirical evidence to support this interpretation had been presented. The results from the second phase of our analyses support the hypothesized birt h registration effect: in a multivariate logistic regression model controlling for age, sex, marita l status, and migration status, cases for which a b irth certificate match was attained were about 2.3

times more likely to display exact age agreement on linked death and social security records. In a nationally representative matched records study of age reporting--limited to the social security record and the death certificate--these sociodemographic variables were found to be associated with inconsistency in age reporting (Elo, Rosenwaike, Hill, and Cheney 1994). As we have noted, the presence of a matching birth certificate was the only significant predictor in our model. Besides incomplete birth registration, it is likely that other factors, such as literacy, contribute to inaccurate age reporting among an elderly population. Unfortunately, our data sources lack information on educational characteristics, making it impossible to control for this potential confounder or to gauge its independent effect.

The birth certificate effect described above may be responsible for the high levels of valid age reporting observed in both death and social security records for which a birth record was found (Tables 1 and 2). In view of the fact that most similarly aged African Americans nationally were unlikely to have had their births registered, the low level of age inaccuracy reported in these tables probably understates that typical among this population. Given that relatively few U.S. Blacks 65-79 years of age in 1985 had birth certificates, the proportion of death records among this population with age correctly reported was not likely to be above the approximately 70% agreement between the linked social security-death certificate data observed in Table 3. The fact that Blacks 80 years and over were even less likely to have birth certificates than were the 65-79 year-olds of the present study strongly suggests still higher levels of age misreporting among the oldest old. If reporting error mounts with advancing age, in part as a function of the unavailability of a birth certificate, then it is in the measurement of death rates for the oldest old that error will be the greatest.

Since our study group specifically excluded persons with death certificate ages of 80 years or more, we cannot directly comment on how misreporting of age among the oldest old can substantially affect death rates for this group. However, a recent study by Preston, Elo, Rosenwaike, and Hill (1995) that attempted to verify the age of the oldest old by linking death records with records of a census conducted when the decedent was a child supports the hypothesis that the Black/White mortality crossover is an artifact of errors in age reporting. If observed death rates for Blacks create the impression that they have lower mortality and greater life expectancy in old age than is actually the case, it is important that gerontological researchers understand that such data may reflect misreporting and not be a real phenomenon. Fortunately, relatively high quality data sources are available which allow investigators to validate age of elderly research subjects. The present study, for example, demonstrates that the Social Security Administration's Death Master File offers age data for individuals included in mortality studies which may be more accurate than that provided on the death certificate. Although in many instances age validation is not a viable alternative, researchers involved with studies of age-sensitive processes need to be mindful of the threat inaccurate age reporting presents to the validity of their research findings.

Some cautions are warranted in interpreting our age validation results. There are reasons to believe that vastly improving birth registration completeness in Maryland during the 1905 to 1920 period slightly favors birth record linkage for cases where true age was understated on the death certificate. Further, because we limited our birth certificate searches in Baltimore City to a relatively short period (a five-year window centered around the purported birth year), we may have missed a number of birth certificate matches where the true year of birth fell outside the

search period. Nevertheless, the large decrease between the number of linked death and social security records for which age reports disagreed by one year and those where age disagreed by two years suggests that few matches were missed as a consequence of these search procedures.

The results of the present study indicate that birth registration may well be an important determinant of accurate age reporting. This is an encouraging finding because it suggests that as more and more Blacks born during a period of rapidly expanding birth registration coverage grow older the quality of age reporting among the African American elderly will substantially improve. In consequence, official mortality rates and measures of life expectancy for the elderly should have increasing validity.

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TABLE 1

Age Accuracy of Death Certificates and Social Security Records as Determined from Age Calculated from Matched Birth Certificates

Age at Death (Relative to Birth Record Age)	Death Certificates N	Death Certificates %	SSA Records N	SSA Records %
Total records	199	100.0	199	100.0
Age accurately reported	167	83.9	184	92.5
Age understated	19	9.5	5	2.5
1 year younger	14	7.0	3	1.5
2 years younger	3	1.5	2	1.0
3 years younger	2	1.0	-	-
Age overstated	13	6.5	10	5.0
1 year older	9	4.5	7	3.5
2 years older	2	1.0	2	1.0
4 years older	1	0.5	1	0.5
6 years older	1	0.5	-	-

TABLE 2

Three-way Comparison of Exact Age Agreement among Death Records Matched to Both Social Security and Birth Records

Number of Records with Exact Agreement on Age	N	%
All 3 records agree	161	80.9
Only 2 records agree	37	18.6
SSA and birth record	23	11.6
Death and birth record	6	3.0
SSA and death record	8	4.0
None agree	1	0.5
Total	199	100.0

TABLE 3

Percent Exact Agreement between the Death Certificate Age and the Social Security Age by Reported Age and Availability of a Birth Record

Death Certificate Age	Total		Birth Record Found		Birth Record Not Found	
	N	%	N	%	N	%
Total	598	75.3	199	84.9	399	70.4
65-69 years	208	79.8	111	82.9	97	76.3
70-74 years	197	73.6	59	83.1	138	69.6
75-79 years	193	72.0	29	96.6	164	67.7
Age-adjusted[1]	598	75.3	199	87.4	399	71.3

[1] The age distribution of the total sample was used as the population standard for age adjustment.

TABLE 4

Percent Agreement on Age Between Matched Death and Social Security Records, by Birth Record Availability

Age on Death Certificate Relative to SSA Age	Birth Record Found		Birth Record Not Found	
	N	%	N	%
Same year of age	169	84.9	281	70.4
Younger age	20	10.1	84	21.1
1 year younger	15	7.5	40	10.0
2 years younger	3	1.5	15	3.8
3 years younger	2	1.0	6	1.5
4 years younger	0	-	6	1.5
5+ yrs younger	0	-	17	4.3
Older age	10	5.0	34	8.5
1 year older	8	4.0	23	5.8
2 years older	1	0.5	6	1.5
3+ yrs older	1	0.5	5	1.3
Total	199	100.0	399	100.0

TABLE 5

Estimated Coefficients for Logistic Regression Models Predicting Age Agreement between Matched Social Security and Death Certificate Records

Independent Variable	Model 1	Model 2
Birth record match?		
No	---	---
Yes	.86103*	.82815*
	(.22646)	(.24014)
Age on death record		-.00924
		(.02379)
Sex		
Female		---
Male		-.01146
		(.20762)
Marital status		
Married		---
Widowed		-.04095
		(.23988)
Other[1]		-.42073
		(.25042)
Migrant status[2]		
Nonmigrant		---
Migrant		-.42073
		(.20121)
Constant	.86767*	1.67105
	(.10970)	(1.74294)
Sample size	598	598
Degrees of freedom	1	6
Likelihood chi^2	15.92	19.17
Pseudo R^2	0.0238	0.0286

--- Reference Category. Standard errors in parentheses.
* Significant at P = .01 level.
[1] Other includes never married, divorced, and unknown.
[2] Migrants are all persons for whom the state of birth differs from the state of residence at time of death.

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