

# UNDERREPORTING OF BIRTHS AND DEATHS IN HOUSEHOLD SURVEYS OF POPULATION CHANGE

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## A. Introduction

In this paper we report the results of a survey experiment that was conducted to investigate the effect of different counting rules on the completeness of enumeration of births and deaths in single retrospective surveys of population change. In this type of survey, households report retrospectively those births and deaths that occurred during a prior calendar period, also referred to as a reference period. Counting rules in the single retrospective survey specify the conditions for linking persons who experienced the vital events during the reference period to the housing units where they are eligible to be counted in the survey.

In the survey experiment, we investigated the following counting rules for enumerating births and deaths:

### Rule      Statement of Rule for Enumerating Deaths

- 1      The death is enumerated at the decedent's former residence.
- 2      The death is enumerated at a housing unit adjacent to the decedent's former residence.
- 3      The death is enumerated at the residences of surviving siblings exclusive of the decedent's former residence.
- 4      The death is enumerated at the residences of surviving children exclusive of the decedent's former residence.

### Rule      Statement of Rule for Enumerating Births

- 1      The birth is enumerated at the mother's residence at the time of birth.
- 2      The birth is enumerated at the mother's residence at the time of the survey.
- 3      The birth is enumerated at the housing unit adjacent to the mother's residence at the time of birth.
- 4      The birth is enumerated at the residences of maternal siblings exclusive of the mother's residence.
- 5      The birth is enumerated at the residence of maternal grandparents exclusive of the mother's residence.

Any one of the above counting rules or combinations of several of them might be adopted in the survey to enumerate births or deaths. Generally, surveys of population change adopt counting rules which have the property of linking every vital event that occurred during the reference period to one and only one housing unit

where it would be eligible to be enumerated in the survey. Clearly, it is desirable to adopt a rule that links every event to a household since the unlinked events would be missed in the survey. However, counting rules need not be restricted to those which uniquely link every event to one and only one housing unit, since unbiased estimates have been developed [Sirken, 1970a] for counting rules which link vital events to multiple housing units.

In designing the survey, the optimum counting rule strategy is the selection of counting rules which minimize the mean square error of the survey estimates. In prior reports, we [Sirken, 1970b, 1972] have investigated the effect of alternative counting rules on sampling errors of survey statistics. In this paper, we compare the bias due to underenumeration of births and deaths associated with different counting rules in single retrospective surveys of population change. This is an extension and refinement of a prior paper [Sirken and Royston, 1970] in which we compared the counting rule bias of different rules for enumerating White deaths in single retrospective surveys.

## B. Survey Experiment

The experiment was based on a sample of 284 noninstitutionalized deaths and 285 legitimate births that occurred in Los Angeles during the four month period July-October 1969. The sample events, approximately equally divided between Whites and Blacks, were selected from the vital record files of the Los Angeles County Department of Health.

The household survey experiment was conducted during the three month period January-March 1970. Thus, from three to nine months elapsed between the dates of occurrence of the sample events and the dates the households were contacted in the survey. The survey was fielded in two stages. First, interviews were conducted at the places of residence listed on the vital records of the sample events. We will henceforth refer to the residence address on the vital record as the key address. On the death record, it represents the usual place of residence of the decedent at the time of his death and on the birth record it represents the usual place of residence of the mother when the baby was born. Second, interviews were conducted in Los Angeles County at the housing units of the surviving siblings and children of the sample decedents and at the housing units of the maternal aunts, uncles and grandparents of the sample births. These interviews were limited, however, to relatives who were identified and whose addresses were ascertained in interviews that were completed at key addresses. Possibly other relatives existed who were not identified at key addresses and one might speculate that they would be less likely to

report the events than the relatives who were identified at key addresses.

The household respondent at the key address was asked to identify births and deaths which had occurred at that address during the prior 12 month period. The respondent at an address of the decedent's surviving siblings and children was asked to identify deaths that occurred during the prior 12 month period to any siblings and parents of persons living in the household at the time of the interview. And the respondent at an address of the mother's siblings and parents was asked to identify the births during the prior 12 month period of nieces, nephews, and grandchildren of persons living in the household at the time of the interview.

A proxy respondent rule was used at key households and at the households of relatives, namely any adult in the household was an eligible proxy respondent for himself and for all other household members. Perhaps the completeness of enumeration of vital events, particularly at households of relatives, would have been greater had the experiment used a self-respondent rule in which every adult responded for himself.

#### C. Findings for Deaths

The findings of the experiment with respect to deaths are summarized in Table 1 separately for Whites and Blacks. Counting rules 2, 3, and 4 are based on small samples making the analysis tenuous and difficult. The findings are presented primarily as illustrative rather than as firm estimates. For each counting rule, the proportion of deaths missed in the experiment was greater for Blacks than for Whites. For Blacks, the proportion missed was uniformly high, about 40-45 percent for each counting rule. For Whites, a larger proportion was missed at key housing units and at residences of surviving siblings than at the residences of surviving children and residences of neighbors. Migration of the decedent's household between the date of his death and the survey date contributed substantially to the number missed at the key housing units.

There were two distinctly different reasons why vital events were not enumerated in the experiment. They were missed either because contact was not established with the household or because the events were not reported in interviews that were conducted. For both Blacks and Whites, more of the deaths were missed because events were not reported in conducted interviews than because interviews were not conducted (including not-at-homes, and vacant housing units). We had a problem in deciding whether to classify refusals as "interview conducted" or "interview not conducted." We decided it made more sense to consider them as conducted interviews since contact was established with the household. In the earlier report [Sirken and Royston, 1970], missed deaths were subdivided into two groups depending on whether or not the interview was completed, and in that report refusals were classified as

interviews that were not completed. Consequently, the statistics presented in the two reports may appear to be somewhat inconsistent.

Since there is variation among the counting rules in the proportion of interviews that were conducted, we have estimated  $\rho$  for each counting rule. This parameter represents the proportion of events that were missed in the subsample of households where interviews were conducted. Estimates of  $\rho$  separately for White and Black deaths are presented in Table 2. For every counting rule, the estimates of  $\rho$  are uniformly lower for Whites than for Blacks. For both Whites and Blacks, however, the estimate of  $\rho$  is smallest for counting rule 4. That is, fewer White and Black deaths were missed at the housing units of surviving children than at the housing units linked to deaths by counting rules 1, 2, and 3.

#### D. Findings for Births

The findings for births are summarized in Table 3. For both Blacks and Whites less than 5 percent of the births were missed by rule 2, which links births to the mother's survey residence. For each of the four other rules, the proportion of Black births missed in the survey substantially exceeds the proportion of missed White births. Exclusive of rule 2, the proportion of White births than were missed ranged from 10 percent for births linked to grandparents to 14 percent for births linked to neighbors and for Blacks the proportion of deaths missed ranged from 34 percent for births linked to key addresses to about 60 percent for the other rules.

Estimates of  $\rho$  for births are presented in Table 4. For both Whites and Blacks rule 2 linking births to the mother's survey residence stands out prominently as the best rule. Estimates of  $\rho$  for the other rules ranged for Whites from about 10 percent to 20 percent and for Blacks from about 18 percent to about 60 percent. It may be of interest to note that the four White births missed at the household of grandparents were due to refusals.

#### E. Summary

We have presented findings based on a small survey experiment that was conducted to determine the effect of counting rules on the completeness of enumeration of births and deaths in single retrospective surveys of population change. Although the experiment was based on small samples of vital events and was subject to other design limitations, it appears (1) that counting rules have a substantial effect on the extent of underenumeration of births and deaths in household surveys and (2) that enumeration of births and deaths was more complete for Whites than for Blacks regardless of the counting rule used in the experiment. Also, we believe that the overall level of enumeration completeness in the survey experiment could be substantially improved by increases in survey resources and improvement in the survey methodology.

Table 1. Percent of adult deaths by color that were missed, by type of counting rule tested in the survey experiment

Color	Counting Rule <sup>1</sup> for Enumerating Deaths			
	1	2	3	4
<b>WHITE</b>				
Number of deaths	139	25	15	29
Total percent	100	100	100	100
Deaths reported	65	76	67	83
Deaths missed	35	24	33	17
Interview conducted	25	20	27	14
Interview not conducted	10	4	7	3
<b>BLACK</b>				
Number of deaths	145	30	12	26
Total percent	100	100	100	100
Deaths reported	55	60	58	58
Deaths missed	45	40	42	42
Interview conducted	28	33	42	12
Interview not conducted	17	7	0	31

<sup>1</sup>See text for definition of counting rules.

Table 3. Percent of legitimate births by color that were missed, by type of counting rule tested in the survey experiment

Color	Counting Rule <sup>1</sup> for Enumerating Births				
	1	2	3	4	5
<b>WHITE</b>					
Number of births	148	119	29	47	42
Total percent	100	100	100	100	100
Births reported	81	99	76	85	90
Births missed	19	1	24	15	10
Interview conducted	15	1	17	11	10
Interview not conducted	4	0	7	4	0
<b>BLACK</b>					
Number of births	137	90	29	29	20
Total percent	100	100	100	100	100
Births reported	66	97	34	34	45
Births missed	34	3	66	66	55
Interview conducted	15	3	52	55	40
Interview not conducted	20	0	14	10	15

<sup>1</sup>See text for definition of counting rules.

Table 2. Estimates of  $\rho$  for Deaths by Counting Rule and Color

Color	Counting Rule <sup>1</sup> for Enumerating Deaths			
	1	2	3	4
<b>WHITE</b>				
Number of interviews	125	24	14	28
$\rho$	.28	.21	.29	.14
<b>BLACK</b>				
Number of interviews	120	28	12	18
$\rho$	.33	.34	.42	.17

<sup>1</sup>See text for definition of counting rules.

$\rho$  = The proportion of vital events that were not enumerated in households where the interviews were conducted.

Table 4. Estimates of  $\rho$  for Births by Counting Rule and Color

Color	Counting Rule <sup>1</sup> for Enumerating Births				
	1	2	3	4	5
<b>WHITE</b>					
Number of interviews	142	119	27	45	42
$\rho$	.15	.01	.19	.11	.10
<b>BLACK</b>					
Number of interviews	110	90	25	26	17
$\rho$	.18	.03	.60	.62	.47

<sup>1</sup>See text for definitions of counting rules.

$\rho$  = The proportion of vital events that were not enumerated in households where the interviews were conducted.

### References

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