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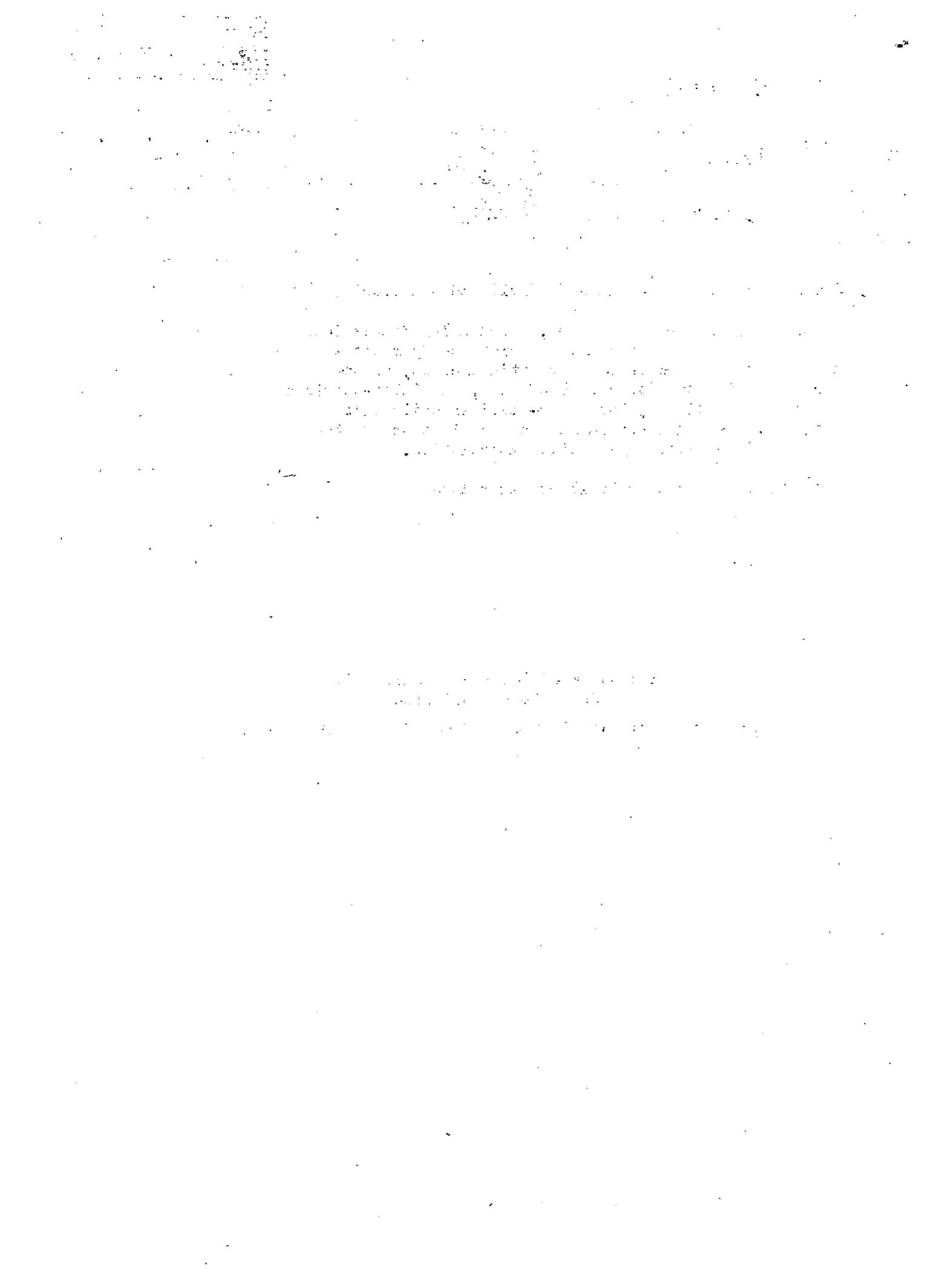
SECOND INTERAMERICAN SEMINAR ON CIVIL REGISTRATION

Organized by the United Nations, through its Statistical Office, the Bureau of Technical Assistance Operations and the Economic Commission for Latin America, in co-operation with the Government of Peru, the Inter-American Statistical Institute, the Inter-American Children's Institute, the Pan American Health Organization and the Inter-American Civil Registration Association.

Lima, Peru, 30 November to 11 December 1964

METHODS OF EVALUATING COMPLETENESS  
OF CIVIL REGISTRATION

Presented by: Statistical Office of the United Nations



## METHODS OF EVALUATING COMPLETENESS OF CIVIL REGISTRATION

1. The United Nations recommendations for the improvement of vital statistics, <sup>1/</sup> gives the critical evaluation of the vital statistics system a very prominent place. The Principle devoted to this topic states inter alia that "The elements of the evaluation programmes will vary in detail according to the degree of development of the system, but should include at some stage intensive studies of the degree of completeness of registration and of statistical reporting of events, with a view to evaluating the quantitative accuracy of vital statistics." In view of the fundamental need for reliable vital statistics in estimating and projecting population growth rates, in planning health programmes, in developing housing programmes and as a component of research aimed at elucidating the demographic aspects of economic and social development, it is important that their quantitative accuracy be evaluated continuously.

2. Errors in the quantitative accuracy or completeness of coverage of traditional vital statistics are, for all practical purposes, errors of under-registration. One may say almost categorically that the chances of inflation or over-registration occurring in connexion with vital statistics is almost zero. Duplicate registration is theoretically possible but, in fact, very unlikely, except in the sense that a birth may be registered twice because of the failure of the birth index to confirm a previous registration. The potential number of these duplicates is, however, so small in relation to the universe that this source of error may safely be disregarded. Errors of omission are the real problem.

3. Under-registration is brought about primarily by failure of the informant to report or give evidence of the vital event to the registrar. Registration of birth should be advantageous to the parent of the child, providing as it does the proof required for participation in social security and child health schemes and other benefits. Registration of marriage is advantageous to the partners in respect of family-oriented Governmental programmes and especially it is a safeguard for the wife in that it guarantees her support. On the other hand, registration of foetal or of post-natal death, except insofar as inheritance is concerned, confers no benefit on the informant, and since in many situations, it may in fact be detrimental to the economic situation in that certain benefits are withdrawn, the informant may tend to neglect the formality of death registration if at all possible. This may be true in connexion with deaths at all ages, but it is particularly obvious in regard to infant deaths and foetal deaths. Registration of deaths of infants who die during the first few days of life is often overlooked, just as the young children tend to be omitted from the census of population. This omission is naturally more prevalent in rural areas where unconventional disposal of the body may be accomplished more easily than in urban areas. Likewise, it is more prevalent in less highly organized societies where public administration authorities are not so effectively deployed.

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<sup>1/</sup> Principles for a Vital Statistics System (United Nations publication, Sales No.: 53.XVII.8), Principle 106.

4. The effect of varying registration procedures and their control on the completeness with which registration may be made, have been stressed in another paper prepared for this Seminar.<sup>2/</sup> These include the concept of compulsory registration in the basic law and the measures to induce compliance; the pattern of organization set up to register vital events; the number, location, identity and qualifications of the registrar; the identity of the responsible informant; the time allowed for registering; the cost of registering - all of these, plus the intangibles which originate in a tradition of acceptance and respect for registration as a worthwhile and important obligation, have a decided effect on the completeness with which vital events are registered. The paragraphs which follow deal with the methods of measuring the degree of completeness with which vital events are registered.

5. Detection of under-registration, and assessment of the extent of omissions or conversely the completeness of registration, may be accomplished in two ways which, for convenience, may be designated as the direct and the indirect methods.

6. The direct method is the more fundamental and refined one which consists of checking the individual entries on the register against corresponding records from an independent source to discover omissions. This is analogous to a postcensal field check of the population census whereby a set of independent records are produced in such a way as to be considered more accurate than the originals and which, therefore, can be used to produce additions to them.

7. The indirect method of detecting and possibly assessing the extent of omissions is the analytical procedure which consists in (1) scrutinizing for plausibility and consistency the statistical results derived from the records in the register and comparing these for compatibility with corresponding numerical data from another time period or from a similar geographical area and (2) comparing results from the registers with corresponding aggregates and rates obtained from an independent source.

8. In principle, consideration of the applicability of these two general methods could be based on the fact that refined measurement techniques become less and less important where under-registration is obviously great, because precision is necessary only in those areas where registration is relatively complete but where there is appreciable variation on a geographic or ethnic basis. In practice, however, efforts should always be made to bear both the direct and indirect methods for evaluating the reliability of vital statistics. Indirect or analytical evaluation will normally be part of almost any analysis of vital statistics since it gives the first rough approximations of accuracy which may be useful in focusing the direct evaluation procedures. Tests based on direct matching are required to

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<sup>2/</sup> Continuing Control Measures to Ensure the Completeness of Registration by Charles R. Council (Seminar document ST/ECLA/CONF.19/L.6).

determine the reasons for under-registration and its geographic or ethnic variation, with enough precision to enable remedial measures to be effectively deployed. The analytical approach being the easiest to apply, will be discussed first, followed by a brief explanation of the direct testing procedures.

9. Since applicability of the evaluation measures can be documented most effectively in terms of livebirth and death registration, the methods described below will be set forth in terms of those two registers. The evaluation of the completeness of the marriage registers is complicated by the fact that "incompleteness" of marriage statistics involves the fact that only legal marriages are recorded officially in the vital statistics. In Latin America, for example, it will be evident from the census results on marital status, that many more persons report themselves as "married", than could have resulted from the legally recorded number of marriage. The excess consists obviously of persons living in consensual or common law unions of the permanent or transient type; and it is interesting to note that women almost invariably exceed men in the numbers of persons recorded as "married" and "consensually married". Hence, the low marriage rates (3.4 to 5 per 1,000 population in Latin America) are consistent with low proportions of population reported as "married" (conversely high percentages single). Under these circumstances, "completeness" in the sense used here is not applicable to marriage registers and all that can be done is to verify that the calculated marriage rates are consistent with low proportions of population reported as "married" at the census, and with the corollary, high levels of illegitimacy in the birth rates. The application of the methods to evaluation of registers of foetal deaths, divorces, adoptions, legitimations, recognitions, annulments and legal separations, the other events for which data are collected by the registration method, requires further study.

#### COMPARISON OF STATISTICAL AGGREGATES (INDIRECT METHOD)

10. An indication that vital statistics may be unreliable (and hence registers incomplete) can be had from an examination of the tabulated results with a view to ascertaining how closely they conform to predetermined norms, established through demographic analysis of statistics considered complete and reliable. Examination of the size of frequencies and of the level of the rates for plausibility will provide first guides; the internal consistency of distributions, or lack of it, will be useful; the comparison of the patterns displayed by frequencies and rates with expected configurations can be revealing.

#### STATISTICS OBTAINED FROM THE REGISTERS

##### Consistency of totals

11. The simplest approach consists of comparing the tabulated total frequencies derived from the current birth and death register with corresponding data from a recent previous year. For example, the total number of deaths reported for a year (or some part thereof) should be

/roughly of

roughly of the same order of magnitude as the number reported for the previous year (or period) barring epidemics or other catastrophies which contributed to excessive mortality, and large migrations of population which would tend to increase or decrease the incidence of death. Similarly, the total number of births which occur should remain relatively stable from year to year. Marked changes should be viewed as registration artefacts. This type of analysis is particularly pertinent to data for small geographic areas. The relationship between the number of births and deaths reported to have occurred for the same area and time period may also provide a valuable clue. This ratio varies rather widely between countries, but within one country it should be comparatively stable, spatially and over time. Hence, a steady index may be indicative of reliability.

12. The conclusions to be drawn from these comparisons are valid because the tabulated number of births and deaths should be the number of either event which occurred during a specified time period. For the same reason, the cross-classification of births registered during any year by the date of occurrence will reveal at once the proportion of delayed registrations, i.e., those births which were not registered in the year of their occurrence or at least by the year-end cut-off period provided by the law. The number of registrations taking place outside the statutory time limit for current registration provides a measure of the under-registration of births and deaths for any year in the past and will also provide an indication of the improvement in registration completeness or lack of it.

#### Consistency of distributions

13. The degree of internal consistency displayed by attribute distributions of vital statistics is also a useful point of departure in assessing reliability.

14. Sex: For biological reasons the ratio of male to female births can vary only within rather narrow limits. This upper limit of the sex ratio at birth is usually about 107 males per 100 females, while the lower limit may be 102. Any ratio outside this range should be regarded as indicative of sex linked under-registration. When a population consists of more or less equal numbers of males and females, and provided no extraneous disturbing elements such as a war intervenes, the total of male deaths should slightly outnumber female deaths. The exact level of the sex ratio for deaths of all ages depends on a variety of factors, but one might at least expect rather similar gross indices for the various geographic subdivisions of a country. Marked deviations over time or between areas would indicate the need for investigation of the completeness with which deaths or births were being registered.

15. Age differentials in the sex ratio at death should also be examined. As a general rule, more males than females die in infancy, childhood and adolescence. For the duration of the child-bearing age, female deaths may outnumber male deaths, but at older ages they consistently do so. Marked geographic variations in this mortality pattern, sharp fluctuations of any of the age-specific sex ratios over time, or abrupt changes in level between

/ratios for

ratios for different age groups, would probably be indicative of irregularities in registration or in age reporting. With special reference to infant deaths, it may be noted that where infant mortality is high, the sex ratio is usually in the range of 110-120 male deaths per 100 female deaths. Masculinity ratios in the order of 130-140 per 100 often accompany low infant mortality rates. Sharp fluctuations or consistent variations from these patterns may be viewed as indicative of possible omissions in infant death registration.

16. Age: Since it is suspected that deficiencies in death registration may perhaps be greater in respect of infants than of persons at older ages, a study of the ratio of infant deaths to deaths at all ages may produce useful results. The proportion that infant deaths form of deaths at all ages is relatively stable for any one area. Between countries with low mortality and fertility and those with high mortality and fertility, the ratio may vary between 15 and 30 per cent, but it should not vary greatly from area to area within a country, nor should it evidence sharp fluctuations over time within one country's experience. Lack of stability in the ratio may be indicative that death registration is especially defective among infants.

17. Examination of a distribution of infant deaths by month of age also can provide an indication of which deaths may be being omitted from the registers. It is known that infant mortality is highest during the first few days of life and that in most countries it declines smoothly and continuously in the succeeding weeks and months. Since the distribution of deaths over the first year of life follows a consistent pattern over time, though at varying levels, marked divergence from the pattern may be indicative that deaths at some age groups tend not to be registered as completely as they should be. These aberrations will be evident in the absolute numbers; they do not depend on rates as do age-specific death rates.

#### Credibility of rates

18. The relationships of frequencies which might indicate under-registration of births and deaths have been outlined above. When these absolute numbers are divided by the corresponding population groups, other meaningful indicators of apparent deficiencies in registration completeness may emerge. The first of these indicators is the level of the crude general birth rate.

19. Crude birth rate: Crude birth rates lower than 15 per 1,000 population or much higher than 50 have rarely been observed in normal populations where data are known to be accurate. If the rate falls below 15, the completeness of registration would be open to question.

20. It is also useful to compare the level of the birth rate with population statistics by age. In general, a high birth rate is accompanied by a high percentage of children in the population and a low rate by a low percentage of children. A useful test called the "forty per cent test" has

/been devised

been devised by Wertheim <sup>3/</sup> who demonstrates that a population of which 40 per cent or more are less than 15 years of age is likely to have a crude birth rate of at least 40 per 1,000 population. A lower birth rate associated with a high proportion of population under 15 years of age would bear investigation.

21. Crude death rate: Crude death rates based on accurate statistics are rarely lower than about 8 deaths per thousand, unless the population concerned has an atypical age distribution. For example, the crude death rate among the Jewish population of Israel was 5.5 per 1,000 in 1959, while rates in other economically comparable countries, where registration was considered complete, ranged much higher. However, the Jewish population of Israel is heavily concentrated at the younger ages where mortality is light; therefore, since the crude rate is a weighted average of age-specific rates, it is lower than it would be among an equally healthy but older population. If very low crude death rates persist in a population whose age distribution is not abnormal, there is an indicated need to explore the possibility of deaths having been omitted or of the population base being unreliable.

22. Other things being equal, the range of the crude death rate for geographic sub-divisions of a country or territory should not be wide. This being so, examination of the pattern of geographical variation in the rates should reveal sub-national areas in which excessive under-registration of deaths might be suspected. This assessment of credibility should naturally include a parallel examination of the reliability of the population component of the rates. The aim should be an evaluation of the stability of the geographic pattern over time, and the implications in terms of the probable reliability of the national average.

23. A second relationship may also have relevance. Low death rates are normally found only in association with low birth rates. A recorded death rate of 10-15 per 1,000 is normally found in association with a birth rate of 15-25 per 1,000. If the death rate which accompanies a low birth rate is either extremely low or abnormally high, the accuracy of the basic mortality statistics may be suspect.

24. Differentials in death rates specific for marital status also provide a pattern against which observed rates may be evaluated. Death rates among married persons are usually lower than those for the single, widowed and divorced. This is true for both males and females and for all ages. Deviations from this pattern are indicative of need for further analysis concerning the numerator or the denominator of the rates.

25. Age-sex specific rates: The patterns of mortality rates specific for age and sex afford perhaps the best clues to possible deficiencies.

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3/ Wertheim, W.F., "The Forty Percent Test: A useful demographic technique", Proceedings of the World Population Conference, 1954, Papers: Volume VI. (United Nations publication, Sales N°: 55.XIII.8 (Vol. VI), pp. 215-226.

In the first place, age-specific death rates for males are generally higher than those for females throughout the entire age span unless there is an excess of maternal mortality in the population or a fatal disease which is sex-specific. Secondly, among the various age groups, mortality is invariably very much higher under one year of age than it is at any other age throughout the life span. From the high point achieved at infancy, mortality rates decrease smoothly, continuously but rapidly, creating a U-shaped curve. Deviations from the pattern of excess male mortality, or rates at variance with the U-shaped curve, indicate the need for special explanations, in terms of population risk, cause of death, or under-registration.

26. The shape of the infant mortality rate curve by age reflects the same pattern as is evidenced by the absolute numbers, because each rate by age is computed against the same total of live births and is, therefore, a ratio rather than a rate in the probability sense. As noted above, mortality is usually highest at the youngest infant age; thereafter, it decreases smoothly. Deviations from this half U-shaped pattern may indicate under-registration of death or inaccurate infant age reporting.

27. The absolute level of the infant mortality rate is not a useful index for indicating under-registration of infant deaths because it is affected also by the completeness of registration of the live births which constitute the denominator of the rate. However, in general terms, the level of the infant mortality rate should be consistent with the level of the age-specific rates and their weighted average, the crude death rate. Using this relationship, the Population Branch of the United Nations, Bureau of Social Affairs, has synthesized the age variations in life-table mortality among 50 countries for the period 1900-1950 into a set of model life tables.<sup>4/</sup> This series of 40 life tables in transition from high to low levels of mortality cover at equal intervals the entire range of mortality encountered in the world and they describe the average relationship between mortality in various age-sex groups for a group of countries at different mortality levels. When the life-table mortality rates observed for a specified country are compared with those of the model which it most closely matches in respect of the infant mortality or childhood mortality rate, variations indicate potential inaccuracy in the observed data. In other words, the model life tables may be used to test the accuracy of existing sex and age-specific mortality rates.

28. The model tables have been used for this purpose inter alia in respect of Costa Rica, El Salvador and Guatemala, using the 1950 life-table mortality rates for infants to enter the model tables. Thus, the 1950 life-table infant mortality for Costa Rica, both sexes, was compared

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<sup>4/</sup> Age and Sex Patterns of Mortality: Model Life-Tables for Under-developed Countries. ST/SOA/SER.A/22. (United Nations publication, Sales No 55.XIII.9).

with the average value of Model Life Tables 16 and 17; El Salvador was compared to Model Tables 15 and 16 and Guatemala with Model Tables 17 and 18. The results of the comparisons show that in the case of Costa Rica, the differences above age 5 are as small as could be expected. However, mortality at age 1-4 appears too large in comparison with infant mortality, a relationship which may be due to under-registration of infant death, overstatement of births or inflation of the mortality rate at age 1-4, due perhaps to omissions in the census at those ages. For Guatemala and El Salvador, discrepancies are of a systematic type which could indicate that the infant mortality rates shown in the life tables are entirely too low in comparison with mortality at other ages. Such anomalies suggest the need for further investigation.

#### ESTIMATES FROM CENSUS RESULTS

##### Balancing equation

29. On a slightly more complex level, the accuracy of the aggregate number of births and deaths reported during intercensal years may be evaluated by utilizing the results of two successive censuses of population to estimate natality and mortality <sup>5/</sup> by the "balancing equation method".

30. Evaluation of death registration is based on the fact that the number of persons reported above a selected age at a recent census were alive at the previous census and, at that time, younger by the number of years in the intercensal period. Since enumeration at young ages is often deficient, and since it is desirable to eliminate the potential error of the birth component, it is preferable to work with the population initially aged 5 years and over. The intercensal decrease in the chosen population cohort should be the number of deaths which occurred in this age group over the period, minus the immigrants of those ages received plus the emigrants lost. If there is a substantial discrepancy between the enumerated decrease and the decrease accounted for by deaths and migration, further investigation is indicated. It would be necessary, for example, to obtain information concerning the completeness of enumeration of the two censuses and of the accuracy of migration statistics, but even in the absence of proof of census completeness it is probable that most of the error can be attributed to deficient death registration. For the application of this method to statistics for Brazil, see Methods of Using Census Statistics for the Calculation of Life Tables and other Demographic Measures, Chapter I. <sup>6/</sup>

<sup>5/</sup> For additional details and examples of the application of the method, see Methods of Appraisal of Quality of Basic Data for Population Estimates. Manual II. ST/SOA/SER.A/23. (United Nations publication, Sales N° 56.XIII.2), pp. 24-29.

<sup>6/</sup> Methods of using Census Statistics for the Calculation of Life Tables and other Demographic Measures (with Applications to the Population in Brazil). ST/SOA/Ser.A/7. (United Nations publication, Sales N° 50.XIII.3), Chapter I.

31. The balancing equation method can also be used to approximate the number of live births which must have occurred at various years in the past to produce the population enumerated at various ages. Comparison with registered births for the same years provides a measure of the completeness of registration. The most obvious application of this test which is known as the "reverse-survival" would involve relating the number of children under one year of age enumerated in the census to the number of live births registered in the 12 months preceding the census, minus the number of infant deaths in the same period. Unless there has been extensive migratory movement, the number of children surviving until the census date should be the number enumerated under one year of age. 7/

32. Unfortunately, however, as noted above enumeration of young children in the census is known to be markedly deficient in most countries and for this reason the number of births estimated from the children under one year of age at the census will often understate the true number and comparison with registered births will not give a valid estimate of completeness. To eliminate this underenumeration factor, it is customary to begin with population over five years of age, usually children 5-9 years. The number of children enumerated in the selected age group is increased by a life-table survival coefficient or the actual number of deaths recorded at these ages, to determine the number of births that gave rise to the group. Depending on the age groups of population used, estimates of the number of births for several decades can thus be obtained. Moreover, using results of two censuses suitably separated in time, two estimates for the same decade can be obtained. The accuracy of results depends on the accuracy of the population statistics by age, especially the count of children, and also on the reliability of the survival rates or the registration of death. The method has been applied widely but examples in Latin America are the studies made in Brazil to establish a birth rate in the absence of civil registration, 8/ and in Costa Rica 9/ and in Chile 10/ to determine the completeness of birth registration by this technique.

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7/ For more details of the method and its application, see Handbook of Vital Statistics Methods, (United Nations publication, Sales N° 55.XVII.1), p. 201, and Methods of Appraisal of Quality of Basic Data for Population Estimates. Manual II, op.cit.

8/ Methods of Using Census Statistics for the Calculation of Life Tables and other Demographic Measures (with Applications to the Population in Brazil), op.cit., Chapter II.

9/ Jiménez, Ricardo Jiménez, Exactitud del Registro de Nacimientos y Algunos Análisis Demográficos de Costa Rica, Ministerio de Economía y Hacienda - Dirección General de Estadística y Censos. San José, Costa Rica, 1957; pp. 23.

10/ Cabello, O., Integralidad del Registro de Nacimientos y Oportunidad de la Inscripción en Chile, 1920-1953. Reprinted from Estadística, Journal of the Inter American Statistical Institute, June, 1956, Vol. XIV, N° 51.

Lifetime fertility data from censuses

33. Another source of information on the probable level of the birth rate may be found in the retrospective data collected in many population censuses and surveys on the total number of children born to each woman during her lifetime. Generally, these data are collected for all women of reproductive age and beyond, and are tabulated for five-year age groups, at least throughout the child-bearing years. If these data are accurate, estimates of age-specific birth rates can be derived from them by "differencing" the average numbers of births reported for women of successive age groups. From these, an estimate of the crude incidence of births in the total population can be derived, but because of the systematic errors in the base data, such derived rates almost always underestimate the true birth rate.

34. Reports on lifetime births generally suffer from serious under-reporting since older women, in particular, fail to report all the children born to them. Children who died young, many years before, are especially likely to be overlooked. It has been found that reports on life-time births by young women, say up to 25 or 30 years of age, may be fairly accurate, but for older women they are subject to increasing error with advancing age. 11/ Nonetheless, Mortara estimated the birth rate of Brazil by this method and obtained a result consistent with that obtained by reverse-survival. 12/

35. For purposes of demographic research, estimates of the probable level of the crude birth rates in the countries of Latin America have been prepared mostly by the reverse-survival method (see para. 31 above). Comparison of these with the rates derived from the civil registers will indicate that the latter are probably deficient. The rates obtained from the civil registers and those estimated are set forth in Table A on page 11.

ESTIMATES FROM SURVEY RESULTS

36. In theory, the level of the birth rate can be determined by asking women whether they have given birth to a child during a given time period in the immediate past and whether a death had occurred in the household during the same period. Before the civil registration system was perfected in Canada and the United States such a question was included in the population census. In Canada, this enumeration of births and deaths was so poor that in 1911 the method was abandoned. In the United States, deaths were enumerated at the censuses beginning in 1850. Comparison with even the rudimentary rates derived from the registers showed the enumerated deaths to be markedly understated and the mortality census schedule was abandoned in 1900.

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11/ Conditions and Trends in Fertility in the World. Population Bulletin of the United Nations, N° 7 - 1964, (United Nations publication, Sales N° 64. XIII.2), (in press).

12/ Methods of Using Census Statistics for the Calculation of Life Tables and other Demographic Measures (with Applications to the Population in Brazil), op.cit., Chapter IV.

Table A

RECORDED AND ESTIMATED BIRTH AND DEATH RATES:  
LATIN AMERICAN COUNTRIES

(Rates per thousand population)

Country	Birth rates		Death rates	
	Recorded a/ (recent year)	Estimated b/ (1955-60)	Recorded a/ (recent year)	Estimated b/ (1955-60)
Argentina	21.8	23-24	7.9	8-9
Bolivia	17.4	41-45	5.8	20-25
Brazil	...	43-47	...	11-16
British Guiana	42.3 c/	...	7.9 c/	...
Chile	34.2	35-38	11.8 c/	12-13
Colombia	44.0 c/	43-46	11.7 c/	14-17
Costa Rica	49.9	45-50	8.5	9-13
Cuba	25.1 c/	30-34	5.8	9-13
Dominican Republic	33.0	48-54	8.4	16-20
Ecuador	44.2	45-50	13.5	15-20
El Salvador	48.6	44-48	10.8	14-18
Guadeloupe	36.0	...	8.0	...
Guatemala	47.7	48-52	17.3	20-24
Haiti	...	42-50	...	21-6
Honduras	47.3 c/	45-50	9.6 c/	15-20
Jamaica	39.6 c/	...	9.1 c/	...
Martinique	33.1	...	8.2	...
Mexico	45.0 c/	44-47	10.4 c/	13-16
Nicaragua	42.6 c/	45-52	7.1 c/	12-17
Panama	40.1	39-42	8.0	9-13
Paraguay	...	45-50	...	12-16
Peru	28.1 c/	42-48	8.5 c/	13-18
Puerto Rico	30.9	...	6.9	...
Surinam	44.5	...	8.2	...
Trinidad & Tobago	35.6	...	7.3	...
Uruguay	22.5 c/	19-22	7.8	7-9
Venezuela	42.8 c/	45-50	6.7	10-15

a/ Published in Population and Vital Statistics Report. Data available as of 1 July 1964. Statistical Papers, Series A, Vol. XVI, N° 3.

b/ Vital rates can be estimated in various ways and with varying degrees of approximation from appraisals of registration completeness, analysis of age composition of population, analysis of age composition of registered deaths, and inter-censal rates of population increase. The estimates presented here show the ranges in which the real values are most probably to be found. (Boletín Económico de América Latina, Vol. VII, N° 1, Oct. de 1962, Suplemento Estadístico, pp. 8, 53).

c/ Births and deaths tabulated by year of registration rather than year of occurrence, so they include delayed registration.

37. In recent years, questions on the number of births and deaths in a household have been included in sample surveys, primarily in areas where nationwide civil registers of births and deaths are either lacking completely or are very deficient. These are the types of household surveys described in more detail below in paras. 50-62, and also in the Handbook of Household Surveys.<sup>13/</sup>

38. The reliability of the results of such surveys is in most cases uncertain. Rigorous tests are required to identify the sampling and non-sampling errors involved. In the case of birth and deaths reporting, the non-sampling errors may be in the direction of understatement due to memory lapse or refusal to report; this appears particularly important in regard to deaths. On the other hand, there may be over-reporting as a result of the erroneous inclusion of events which occurred outside the time reference period, or outside the population under observation. Despite their own deficiencies, rates, especially birth rates obtained by the interview method have supplied a measure of the level of natality in countries where none has existed before <sup>14/</sup> and also a means of evaluating the rates obtained from civil registers as shown, for example, in India.<sup>15/</sup> No examples of the survey approach are available for Latin America except for several pilot projects, probably the most important of which is the Guanabara Demographic Pilot Survey - a joint project of the United Nations and the Government of Brazil. The principal aim of this experiment was to prove the suitability of the method rather than to obtain specific results. The 1960 census of population provided the frame, and demographic data were obtained directly from the households by interview. For more information, see the Report.<sup>16/</sup>

39. In Peru, a sample vital registration experiment was undertaken to test the feasibility of improving vital events registration. This sample used a representative area for estimating vital statistics and at the same time had as a major purpose the gathering of vital statistics. An analysis of the results showed that more omission existed in the registration of births than in the registration of deaths.<sup>17/</sup>

<sup>13/</sup> Handbook of Household Surveys, A Practical Guide for Inquiries on Levels of Living, (United Nations publication, Sales No 64.XVII.13), Chapter II.

<sup>14/</sup> Estimated rates are available for at least 21 countries in Africa where no other measure exists.

<sup>15/</sup> Mahalanobis, P.C. and Agit Das Gupta, "The Use of Sample Surveys in Demographic Studies in India", Proceedings of the World Population Conference, 1954, Papers: Volume VI. (United Nations publication, Sales No 55.XIII.8 (Vol.VI)) pp. 363-383.

<sup>16/</sup> Guanabara Demographic Pilot Survey. A joint project of the United Nations and the Government of Brazil. (United Nations publication, Sales No 64.XIII.3).

<sup>17/</sup> Cavanaugh, Joseph A., "Sample Vital Registration Experiment", International Population Conference, New York 1961, Tome II. London, 1963; pp. 363-371.

/40. Similarly,

40. Similarly, a pilot survey was also undertaken in Panama 18/ in 1963, in four districts, using the interviewing method. The results of this survey showed that the omission in the birth register was 2 per cent and omissions for the death registration was 6 per cent. It is not known what methodology was used, but in any case this pilot survey could be considered a step toward the accumulation of the experience regarding the use of the sample survey for vital registration evaluation.

41. It must be emphasized that the comparison of rates obtained by the interview method with those from the register does not constitute a satisfactory evaluation of the completeness of the registers because, as noted in para. 42, this method provides no guidance as to the reasons for incompleteness nor its geographic or other variation. Moreover, since the survey-derived rates are themselves subject to a wide margin of error, they cannot be considered as a bench-mark for evaluation of registration incompleteness until there is one-to-one matching of records as described in paras. 42-62.

#### COMPARISON OF INDIVIDUAL RECORDS (DIRECT METHOD)

42. The various indirect or analytical procedures for evaluating completeness of registration of births and deaths provide clues to the existence of under-registration based on the fact that discrepancies exist between the observed and the expected. The objective of the direct method of assessment of omissions is not only to detect under-registration but also to identify the cases of birth and death which failed to get registered and to obtain a verifiable measure of their number and characteristics. This is the method of evaluation which gives guidance for remedial action. Knowledge that a deficiency exists and some idea of its magnitude can be gained from indirect checking, but the indirect methods cannot identify the missing events, nor provide the means of correcting the registers. Nor can they identify the particular geographic areas or population groups in which under-registration of births and deaths is more prevalent.

43. The direct method of evaluating the accuracy of birth and death registers is essentially comparable to the direct method of evaluating population census results. It depends on the one-to-one matching of vital events from two independent sources, with the objective of assessing the extent of omissions or duplications (in other words, the proportion of events which have failed to be recorded in the registers or have been recorded twice) and also the accuracy of the response to questions on the fact, date of occurrence and characteristics of the birth and death.

44. As is the case with post-censal field checks of census returns, the independent records for checking the completeness and accuracy of the

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18/ Darbo, Adolfe Gaete, "Appraisal of Vital Statistics in Latin America". Milbank Memorial Fund Conference. Milbank Memorial Fund Quarterly. Vol. XLII, No 2, Part 2, p. 90.

registration of birth and death may come from two types of independent sources: (1) other registers or lists and (2) records obtained from a household survey. The procedure for utilizing those which have been found practicable in actual experience are further explained below.

#### NAMES OBTAINED FROM REGISTERS OR LISTS

45. Registers or lists against which the civil register of live birth and death may be checked include other more or less comprehensive lists, the most useful of which are (1) notifications of birth or death which originate within hospitals or with the medical attendant; and (2) ecclesiastical records of baptisms and burial, and interment records of burial.

46. Notifications: A list of births and deaths which is obviously not comprehensive but may be independent is the notification register. Many countries arrange for the physician or midwife who attended a woman in childbirth or the authorities of the hospital in which the birth occurred to notify the registrar of each such occurrence. Similarly, the medical attendant of a person during his terminal illness, the person who administers the hospital where the deceased died, or in case there were no attendant, the person who examined the body after death are obliged to notify the registrar of these cases. With respect to deaths, this obligation is often limited to deaths from infectious diseases and it is additional to the obligation of the physician to certify to the cause of death by means of the medical certificate. Thus, the attendant's notifications constitute secondary lists of births and deaths, and matching of the civil register entries to these lists can reveal events which failed to be legally registered. Such a measure of omissions, like that derived from baptism and cemetery lists (see below) constitute only an indication, not an over-all evaluation. It is a technique which assists in improving completeness and as such it is usually carried out routinely wherever the two sets of records exist.

47. Baptismal records: In many countries of the world, a church official may not baptize a newborn infant until he is satisfied that the birth has been registered in the appropriate civil register. However, to make sure that no cases escape, the baptism register should routinely be checked, name-for-name, against the register of births.

48. Cemetery records: For legal and sanitary reasons primarily, but also incidentally for assuring the comprehensive nature of the death registers, most countries provide that issuance of a permit for disposal of a dead body is dependent upon the prior registration of the death in the official register and the obtaining of a death certificate. This provision is rooted in the obligation and right of the State to determine the fact and the cause of death in terms of whether it was due to natural causes or to some criminal occurrence which might call for police action in line with protection of the rights of its citizens. Hence, such a provision should ensure that all deaths, criminal and natural, would be recorded. However, it appears that in some parts of the world this provision is not always complied with. It is known that in the case of young infants, especially

/infants dying

infants dying in rural areas, organized cemeteries are not always used for burial, and even arrangements for burial of adults is sometimes made with a religious or private organizations rather than with civil authorities. Therefore, cemetery or other burial lists do provide the most accessible register of deaths for checking purposes, especially in urban areas, and the number and identity of entries in the cemetery records which do not appear on the death register should constitute one indication of the incompleteness of the latter.

49. School enrollment: Another list which is often used to amend the birth register is the school-enrollment register. Although the national law often calls for submission of a birth certificate to prove age at time of entering school, obtaining this certificate necessitates a late registration of birth; these could be utilized as described in paragraph 12. In other cases, the list of school children entering for the first time is checked routinely to the appropriate birth register. This technique has been applied with good results in Canada.

#### HOUSEHOLD-INTERVIEW RECORDS

50. Another method of generating information on the number of births and deaths which may have occurred in a country is the household-interview method. This is a canvass of households designed to cover either all the population individually, in which case it is known as a census, or a representative sample of the population, in which case it is called a sample survey. The technique consists essentially of enquiring of each household whether (1) there had been a birth to any member of the household during a selected period; and (2) whether any member of the household had died during a specific time period. In addition to the fact of birth or death, enough information on the characteristics of the newborn and of the decedent is collected to allow the event to be matched with an entry in the appropriate birth or death register. The degree to which the births and deaths reported in the survey, are not able to be found in the registers constitutes the degree of under-registration.

51. The retrospective survey provides for birth and death statistics the same sort of checking device as is provided by a post-censal field check of population enumeration. In both cases, the matching of the two independent sets of records, results in four categories of "matches": (1) there will be a number of births and deaths which are recorded on both the register and the survey; (2) there will be births and deaths recorded on the official registers but omitted from the survey list; (3) there will be births and deaths recorded on the survey list but omitted from the official registers; and (4) there will be a hypothetical group of births and deaths which escaped being listed either on the register or in the survey. For practical purposes, it is assumed that the fourth group will be very small, and that the third group constitutes a good approximation to the omissions from the registers. It is an analysis of this group (Group 3) which will provide an evaluation of the degree of under-registration and also an indication of where and what

/type of

type of remedial action is indicated. Analysis of the second group, that is, the registered births and deaths which were not reported on the survey, provides some measure of the accuracy of the survey method of data collection.

#### Population census

52. The most comprehensive household survey which has been used for checking a civil register is the population census. A number of countries have in the past utilized the enumeration to carry out a birth-registration test. In such a test, a special schedule, called an "infant card", is filled out by the enumerator for infants born during a selected period (usually three or four months) preceding the census. Each of these cards, representing an infant under 3 or 4 months of age, is then checked with the birth register to ascertain whether a corresponding birth record is on file.

53. The cases in which a corresponding birth record is found constitute a set of matched records; a second group will consist of births registered but not enumerated at the census; a third group will consist of infants enumerated for whom no birth record could be located; and a fourth group which escaped registration and enumeration can be assumed. After taking account of infant deaths in the interval between birth and the census date, and with some assumptions for Group 4, the third group, as noted in para. 51, provides an estimate of the probable under-registration.

54. Limitations: The procedure is theoretically sound as a device for obtaining an independent list of birth records for evaluating the official birth register, but it must be noted that it is expensive and time consuming and may result in delaying the normal population enumeration and tabulation. Moreover, it can be done only when a census is taken, which is most often decennially. A more flexible method utilizes the sample household survey technique for generating the independent list of births and deaths. Dependence on a sample of the population rather than on the population of the whole country materially reduces the amount of work involved.

55. It should be pointed out that none of the Latin American countries which tested birth registration by the one-to-one matching of "infant cards" to registers was successful in evaluating completeness. The principal problem appeared to be the tendency to record the name of the infant differently on the civil register and the census, thus making the matching procedure inordinately difficult if not impossible. The fact that the coverage was nation-wide and for a short time period (3 months), should have simplified the matching procedure, since, theoretically, mobility could have been taken into account. But, apparently the matching of records by manual means proved very time consuming and so difficult as to be impossible. Perhaps with mechanical data processing, and more effective matching procedures these difficulties could be overcome. But, even with mechanical matching, the census may not be the best medium for collecting the required information. Ad hoc sample surveys where control of interview and response can be more effectively applied appear to be better suited for the purpose.

/56. Examples:

56. Examples: The countries which have used the census of population to check birth registration include Scotland, Canada, United States, Panama, Puerto Rico, Venezuela, Paraguay and Chile. Both birth and death registration completeness were checked in connexion with the census of Yugoslavia and Ceylon. A brief description of these activities, together with references to the original reports, may be found in the Handbook of Vital Statistics Methods.<sup>19/</sup>

#### Sample survey

57. So far as is known, checking of civil registers by data obtained from sample surveys of households has not been carried out on a very wide scale to date. As noted in paragraph 38, the sample survey technique has been used rather extensively in Africa to obtain estimates of the crude birth and death rate and hence of the rate of population growth where the traditional civil registration system is lacking or unreliable, but it appears that register evaluation by the survey method is not so prevalent either in Africa or elsewhere. Nevertheless, some salient features of the method are described in some detail below on the theory that it should form part of any procedure for checking the civil registers now in existence and certainly be included in any experiment or system of civil registration adopted in the future. <sup>20/</sup>

58. (a) Scope of survey: The inquiry envisioned is a sample household survey in the areas covered by the civil registers being evaluated. Modern sampling methods enable an index of completeness to be calculated from results obtained from a fraction of the total population, so long as it is a probability sample. In the case of the birth-registration test utilizing the census of population described above, the scope was nation-wide and based on the schedules for all the households. However, to bring the project into workable proportions, the births during only the three previous months were recorded. The sample survey scheme is more limited in population coverage but more extensive in the time period of reference, see paragraph 60.

59. (b) Timing of the survey (period of observation): A field check on the accuracy of vital statistics can take place at any time, since it depends on a method completely independent of the civil registers. But, as in the case of a post-censal field check, the longer the interval between the registration and the survey, the more differences there will be between the register and the survey records because of deaths and migration. Extension of the interval also increases the chance of omission in the survey due to memory lapse and name changes. On the other hand, the events reported in the survey for the time period immediately preceding will certainly exceed those registered because of the time lag in registration. A statutory time period is allowed by law but this registration time period is seldom strictly adhered to. In practice, the period is often as much as a year.

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<sup>19/</sup> Handbook of Vital Statistics Methods, op.cit., pp. 204-207.

<sup>20/</sup> For a detailed discussion of the household interview method of obtaining information on births and deaths, see Chapter II of the Handbook of Household Surveys op.cit.

60. The most effective timing of the survey should, therefore, provide the most complete register and survey list for matching, taking into account the statutory and actual period during which registrations of birth and death should and are usually made and also the factor of memory lapse. The exact period will need to be decided for each country but a period of six to twelve months is indicated.

61. (c) Type of sample: The field check on the completeness of civil registers should be carried out in a probability sample of civil registration areas, small enough to minimize the cost of the operation but large enough to give an evaluation for determination of the degree of completeness for the parts of the country where civil registrations is compulsory.

62. The importance of designing a probability sample for checking purposes is further emphasized by the fact that the field check will be the source of demographic information independent of the registers and these quantitative results must originate in a random sample rather than a purposive one in order that they may be used as valid estimates of the true birth and death rates.

63. (d) Sampling unit: In order that the records from the survey can be matched to records in the civil register, it is imperative that the ultimate sampling unit be the registration district. Thus the sample will be chosen from a list of basic registration districts, and every household in the district will be canvassed. Since the ultimate objective is to match to the civil registers, no other type of sample will suffice. The survey area must coincide with a defined portion of the registration areas.

64. (e) Size of the sample: The size of the sample depends on the nature of the inquiry, and the length of the period of observation. The longer the observation period, the smaller the sample may be, but in deciding the balance between these two elements, account must be taken of the potential increase in non-sampling errors when the period of reporting is extended unduly.

65. (f) Interviewers: As is the case in any survey, the accuracy of the results depends in large part on the skill and ingenuity of the interviewers. For obtaining information on births and deaths, the corps of interviewers should be selected and trained with care. They will need to be aware of customs, language, environment and taboos of the population they will interview. They should also belong, if possible, to the same ethnic group as the persons being interviewed. In some areas, it may be necessary to employ only women interviewers inasmuch as in a survey of the type envisioned responses will normally be sought from the women of the household, as well as from the head.

/66. (g) Informant:

66. (g) Informant: Information on births must be obtained from each woman in the household who is in the child-bearing age. This is important because the nominal head of the household will not necessarily have knowledge of births which may have occurred to women members who have joined the household within the period under observation. Questions on the number of births will also be put to the head of the household, but only for checking purposes.

67. Information on the deaths which have occurred among the household members as constituted twelve months previously will normally be obtained from the head of the household. However, in the case of any member reported as "widowed" a question should be put concerning the circumstances of the death of the spouse, so as to make sure it has been reported if appropriate to the survey.

68. (h) Contents of the test schedule: The questions to be asked in a field survey designed to check civil registers should include information which will identify the event in the register. Items required for this purpose in case of a birth include the following:

- Name of child
- Name of father
- Name of mother
- Age of father
- Age of mother
- Place of birth
- Place of registration
- Date of birth
- Date of registration
- Sex of child
- Ethnic characteristic of child
- Is child still living

For a death the following items of information must be available:

- Name of decedent
- Age of decedent
- Sex of decedent
- Date of death
- Place of death
- Date of registration
- Place of registration
- For infants: Name of father
- Name of mother

69. The items set forth above are necessary for matching reports of birth and death to the civil registers because the unit of matching in this case is an individual rather than a household as it was in the case of the post-censal field check. Since names change, this piece of information will not be unique and must be supplemented by other identifying

/data. Information

data. Information on the place where the birth and death occurred is especially important because of the fact that populations are mobile and vital events are normally registered in the place where they occurred. Hence, some births and deaths reported in the survey may refer to infants and deceased persons whose birth and death were recorded in a registration district outside the one chosen in the sample. Similarly, some registered events will not turn up in the survey because the household involved is now living in another registration district. Unless a national index of births and deaths is available, these will have to be excluded from the test results before any conclusions are drawn from them.

70. Each of the substantive items of information included could be checked for accuracy when the match is made to the civil registers.

71. (i) Testing procedures: When the completed schedules from the survey are assembled, the next step is to search for the events recorded in the relevant civil register. Sample survey events which occurred outside the civil registration district being tested should first be excluded; the remaining events, which allegedly occurred and were registered in the sample civil registration district, would then be sought in the official register, using the items of information recorded for identification of a match. As in any matching process, rules will need to be established to determine what constitutes a "match" because the reliability of the results depends in large part on the precision of the matching operation, but these will need to be set up in accord with local conditions.

72. The results of the matching operation should yield three groups of certificates comparable to those mentioned in para. 51: (1) matches; (2) births or deaths found in the civil registers but not reported in the survey; and (3) births or deaths reported in survey but not found in the registers. A fourth group of events which escaped both registration and surveying is assumed. Events in groups two and three are then further investigated to eliminate any which should not be considered as a mismatch. Group two of births is checked to the death register to take account of liveborn infants who died in the interval since registration. For deaths not turned up in the survey, attempts are made to determine if the death eliminated or removed the corresponding household from the district, thus making it impossible for the survey to reflect the death. When the cases in groups two and three have been minimized by procedural checking, the percentages derived from the three groups which remain may be used to estimate under- or over-registration of births or deaths. The survey results combined with the register may also provide an estimate of the rates of natality and mortality.

73. Limitations: Despite its apparent simplicity, the survey method of generating an independent list of births or deaths for matching to the civil registers in order to evaluate their completeness is subject to many sources of error. The overriding disadvantages are those of any

/household survey,

household survey, namely dependence (1) on the willingness of the informant to give information; (2) on his knowledge of the event; and (3) on his ability to remember well enough to place the event correctly in time and space.

74. Willingness to divulge information is especially important in connexion with death surveys. There has long been a feeling that, even in modern societies, there is a reluctance to mention or discuss a death which had occurred in the household and hence there would be considerable deliberate under-reporting. Indications from small-scale experimental inquiries in industrialized countries have tended to disprove this thesis but it cannot be denied that in some societies there are likely to be strong superstitions which prevent the revealing of a death, especially of young and unnamed children. This is one of the reasons why the list of deaths generated by a survey will often be only a partial list, as is evident from the low death rates estimated by this technique in some countries where civil registration of death is not established. However, it is likely that reluctance to mention a death to an interviewer would be correlated with failure to register it with the proper authorities. Hence, this particular disadvantage of the survey method is probably more damaging to its use as a means of measuring mortality levels, where civil registration does not exist, than it is in connexion with checking completeness of the death registers. These unreported deaths would likely form part of the hypothetical "not reported/not registered" fourth group mentioned above which may constitute a larger proportion of the total than is generally assumed. Unfortunately, there is no perfectly reliable technique for estimating the size of this group.

75. Even if the informant has no basic inhibitions about discussing the birth or death, the success of the survey technique is dependent on his ability to remember the event and to place it correctly in time and space. It is probably true that memory lapse, especially memory of events in their proper time, accounts for most of the omissions in survey results. One remedy might be to shorten the time period covered by the inquiry, but when a household demographic survey is conducted on a sample basis, either the sample size has to be increased unduly or the period of inquiry must be kept long in order that an adequate number of births and deaths may fall in the sample. Increasing the size of the sample would increase costs; prolongation of the time period for reporting tends to increase memory lapse and so thereby decrease precision.

76. Failure to place the birth or death correctly in time will not completely invalidate this technique for checking purposes. It will increase the difficulty of locating the event in the register and, if the survey-reported events are used as measures of natality and mortality, it may also have the effect of inflating the rates for the time period in question. But failure of the survey to place the birth or death correctly in space presents a more serious problem. In a demographic survey, the informant is asked to give information about

/births and

births and deaths which occurred among residents of the household, while the civil register, on the other hand, records births and deaths which occurred in the area, irrespective of habitual residence. Failure to obtain information on the place where the survey-reported birth or death occurred may result in non-productive searching of the registers and consequent understatement of registration completeness. This is so because if a birth or death occurred outside the jurisdiction of the register being examined, it would normally have been registered in another area. Similarly, failure to find a matching survey-reported birth or death for each event on the registers may be due to the fact that the mother or the decedent, as the case may be, was a non-resident or a prior resident of the area. Either result will to some extent impair the utility of the name-matching technique to measure the quantitative completeness of coverage of birth and death registers.

77. A more important problem in using the household survey technique in measuring completeness of death registration is that often, the occurrence of the death of an individual eliminates the single-person household which he constituted or breaks up the household of which he was head. In the first, there remains no one who has knowledge of the fact to report it in a survey; in the second case, there is the likelihood that the broken family group will be dispersed outside the registration area under study and the death will not be reported in the survey.

78. Examples: The only example of the use of the results of a sample survey of births and deaths to check a civil register (and also of civil registration data to check the results of the sample survey) was carried out in Mysore State, India, in 1951. The objectives of the experiment were inter alia to indicate the levels of the birth and death rates, and to test a method of obtaining data on births and deaths, but, in the course of this, the data from the survey were cross-checked with independent data to assess accuracy and one of the independent sources was the civil register. For the results of the experiment, reference should be made to the Report. 21/

79. In Indonesia, a pilot survey to evaluate the completeness of birth and death registration in some parts of the country was carried out in January 1964. The study included a comparison of the numbers registered and reported as well as an attempt at case-by-case matching to establish

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21/ The Mysore Population Study: Report of a field survey carried out in selected areas of Mysore State, India (United Nations publication, Sales No.: 61.XIII.3).

the cause of under-registration. 22/ It is planned to extend the study to other parts of Indonesia.

80. A sample household survey involving one-to-one matching of records has been designed to check the accuracy and assist in the initiation and improvement of a pilot civil registration scheme being established in Kenya with the help of a United Nations adviser. The main purpose of the survey is to determine how well the pilot registration scheme in selected areas is working but matching has not yet been attempted. In recognition of the difficulties, it will be undertaken first in one small sub-location. 23/

81. A somewhat similar project has been operating in Senegal since 1962 with the assistance of a United Nations adviser. It is designed to test and improve civil registration, which was introduced in 1961, and it has been set up in a purposively selected pilot zone covering about 40,000 persons. The procedure consists in the village chief continuously recording vital events in his village and reporting these to a Centre monthly. A supervisor verifies and amends reports of village chief by bi-monthly visits to the households in the villages. An initial census of the area was carried out and continuing surveys are planned to estimate vital rates but it is hoped to extend the system to a probability rather than a purposive sample of rural areas. 24/

82. In India, a Sample Registration Scheme has been launched, the objectives of which are to improve registration in a sample of areas, and to check on completeness by semi-annual house-to-house surveys. The results of the registration and the survey would be matched and omissions corrected. Pilot projects are being conducted as a prelude to initiation of the Scheme. 25/

83. A similar experiment is underway in Pakistan designed to develop a technique for currently estimating the rate of population growth, using both the household survey and registers as sources of information on births and deaths. 26/

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22/ Unpublished paper entitled, "A Study of the Completeness of Birth and Death Registration and Statistics in Indonesia", by Kozo Ueda (United Nations consultant in Indonesia).

23/ Methods and Problems of Civil Registration and Vital Statistics Collection in Africa (United Nations document E/CN.14/CAS.3/8), paras. 121-128; and information on the file in the Statistical Office of the United Nations.

24/ Ibid., paras. 113-120.

25/ Information on file in the Statistical Office of the United Nations.

26/ Krotki, Karol J., "First Report on the Population Growth Estimation Experiment", International Population Conference, Ottawa, 21-26 August 1963. Liege, 1964. pp. 159-173.

84. A plan for an experiment along the same lines has been drawn for Thailand. <sup>27/</sup> The objective is to determine current growth patterns and also measure the extent of under-registration of births and deaths. Records of birth and death obtained by means of a household interview survey will be manually matched to births and deaths on the civil registers and follow-back techniques will be developed to investigate large numbers not registered, or not recorded in the survey. The survey will be continued until the registration system yields accurate and consistent data.

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<sup>27/</sup> Survey of Population Changes: Study Outline. Office of National Statistics, Bangkok. Thailand, July 1964. Mimeo. 18 pp.