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This report examines the analytic approaches and describes project goals, sampling design, and organizational aspects of the field operations. Results are presented for rural and urban fertility trends, differential fertility and levels of mortality and natural increase. Tables list the methodological and analytic problems posed by migration and the results from the application of the alternatives to the dual record system. A comparison of the different techniques using the same set of data is discussed. Cost reduction studies conclude that less expensive dual record projects are possible and that these projects will be able to produce high quality data. This work is oriented toward demographers, statisticians, and other institutional staff persons who want to compare the estimates of vital data and rates from registration systems and censuses with the estimates from such alternative methodologies as the single and dual system approaches.

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New Approaches to the Measurement of Vital Rates in Developing Countries

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The report is reprinted here with certain modifications and alterations which have been introduced by the authors, Francis C. Madigan and Alejandro N. Herrin, for this reprinting. An abstract in English, French, and Spanish has also been added. With these exceptions, the copy has been prepared directly from the original text and therefore does not conform to the regular POPLAB format and editorial style.

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to our readers || à nos lecteurs || a nuestros lectores

An abstract in English appears at the end of the publication.
Un résumé en français est donné à la fin de cette publication.
Un resumen en español aparece al final de esta publicación.

I. OVERVIEW

This work is primarily oriented toward demographers, statisticians, and other institutional personnel interested in comparing the estimation of vital data and rates from registration systems and censuses with estimation from such alternative methodologies as single and dual system approaches. Especially intended as an audience are those personnel whose institutions are considering using some estimation technique other than the registration system-census data procedure. Such institutions are apt to be located in developing countries. We believe, however, that some interest may also exist in the employment of such approaches in the institutions of developed countries. The flexibility of these new approaches to estimation of vital rates helps in rapidly obtaining accurate data outside the legal constraints of the registration system. Thus, they may be used to obtain information on such subjects as vital rates by religious affiliation, or by social class.

These alternative methodologies seem likely to be applied on a wider scale in developing countries where the level of personnel training may be less, and so we have assumed no mathematics beyond college algebra. We do, however, assume familiarity with standard rates and measures of population statistics such as crude and specific rates, general and total fertility rates, age standardization, and the functions and uses of the life table.

A second important audience we hope will find the substance of this work useful and interesting is composed of administrators of health or population programs, both in developing countries and in international assistance agencies. These administrators must decide whether or not to measure the impact which their programs have had upon the birth, death, and growth rates of population. For example, considerable evidence suggests an association between high infant and child mortality and high fertility. Some population writers have gone so far as to state their conviction that where levels of infant and child mortality are high, high fertility will not decline significantly until infant and child mortality levels have declined. If administrators determine to spend some measure of program resources to determine the impact their programs have had, they do so to make more enlightened decisions whether to change, modify, or retain particular features of their programs.

We hope that this report may help such administrators in their decisions whether to expend program resources in measurement, and in determining which alternative methods of estimation of rates and data they might employ.

Two research situations may be distinguished by the administrator and by the general reader of research material. The first situation occurs when the goal of a project is collecting absolute numbers of events which took place within a given

time context. The second exists when a project's goal relates to obtaining relative numbers regarding population characteristics.

The first situation deals with obtaining complete counts of objects which exist, or events which have occurred during a given period of time. The second situation concerns the biases which non-response may inject into the data collected. The first type of research attends to problems of underenumeration and overenumeration; the second type tends to be more engaged with properly weighting the scores or percentages of segments of respondents, especially segments where non-response has been heavier. Research upon size of population at a definite point in time, or births in a population during a particular calendar year, would be examples of the first type of research. Attitude research in a given population would be an example of the second.

This distinction underlies the origin of dual record and other techniques which have been devised to better estimate the true number of births and deaths which have occurred in a country or segment of a country. The timeliness of the appearance of these techniques is not accidental.

Frequently, developing nations in the modern world are characterized by high birth rates, by high rates of population growth, and by registration systems of low efficiency, if such systems exist at all. Such countries frequently mount a population program to reduce the growth rate of their people to one which their developing economies can more easily handle. But they are plagued by the absence of reliable data on the number of births and deaths which have occurred, although reasonably good data on the absolute size of the population, and on its age, sex, and other characteristics at particular points of time may be available. Good censuses can be taken by governments willing to pay the costs in consultation, training of personnel, careful execution of the census and analysis of its data. But the establishment, or the upgrading (where a system already exists), of a registration system (where households report births and deaths to the government), depends as much upon the understanding and cooperation of the citizenry as upon the registration officials. Where roads do not exist to link many villages with the town center, where distances are great between potential reporter of vital event and government office in which the event should be reported, where attendance of a physician or nurse at a birth or death is unusual, and where considerable time and effort in making the trip to town are required to register an event, registration is likely to seriously underreport the number of vital events. The situation is not likely to improve until roads and other related infrastructure also improve. Some have said this will require 20 years. Others have called such statements optimistic.

The principal methodologies worked out to estimate vital rates as closely as possible are sample registration areas, the various Brass techniques, the Bogue Pregnancy History approach, the Cho-Grabill Own Children method, multi-round surveys, and the dual record system inquiry. The other techniques will receive attention later in this work. At present, the theoretical basis of the dual record approach and its application in the southern Philippines in Misamis Oriental Province will be described.

The principle behind the dual record approach tested here for estimating the true number of vital events is not new. The idea has been known for decades as a

special means for gauging the degree of underregistration of vital statistics in developed nations. However, it seems to have been first thought of as a field technique for collecting data by Chandrasekaran and Deming (1949), who reportedly were first to modify the following previously known formula:

$$n = \frac{n_1 n_2}{m}$$

where n is the true number of cases, n_1 is the number of cases caught by the registration system or some other form of inquiry, n_2 is the number of cases caught by some post-enumeration survey or other postperiod data collection method, and m is the number of cases caught independently by each of these two independent inquiries.

Chandrasekaran and Deming split the formula down to:

$$n = \frac{(u_1 + m)(u_2 + m)}{m}$$

or to the equivalent form:

$$n = m + u_1 + u_2 + \frac{u_1 u_2}{m}$$

where u_1 and u_2 are the cases caught uniquely and independently by each of the two systems. The other symbols have the same meaning as above, and n_1 and n_2 are equal, respectively, to $u_1 + m$ and $u_2 + m$. They proceeded to point out that $m + u_1 + u_2$ are equal to the sum of the cases observed by the two systems, either jointly but independently, or by one or the other of the two systems uniquely, and that, therefore, $\frac{u_1 u_2}{m}$ must estimate the cases missed by both systems which have nevertheless occurred.

The basic principle of the dual record approach is the familiar theorem of joint independent probability which states that the product of two independent probabilities is equal to their joint probability. This may be symbolized as follows:

$$P_{12} = P_1 \times P_2$$

where P_1 is the probability of the first outcome, P_2 is the probability of the second outcome, and P_{12} is the joint probability of their outcomes. For example, if P_1 is the probability of a red-haired child in a certain family line, and if P_2 is the probability of a boy child, then (provided these probabilities are independent of each other), P_{12} would be the product of P_1 and P_2, that is, the probability of a red-haired, boy child.

Let P_1 be defined as the ratio of n_1, the number of cases caught by system one of a dual record system (known empirically) during a certain time period with respect to a certain population, divided by n, the true (but unknown) number of

cases, that is, n_1/n. Similarly, let P_2 be defined as the ratio of n_2, the number of cases caught by system two of the dual record system, divided by n, the true (but unknown) number of cases. Let P_{12} be defined as the ratio of m, the number of cases caught by both systems, each independently of each other, to n, that is, m/n.

The theorem of joint independent probability can be stated in the following form:

$$P_1 = \frac{P_{12}}{P_2}$$

Substituting the definitions of P_{12} and P_2 in this formula, one obtains:

$$P_1 = \frac{m/n}{n_2/n} = \frac{m}{n_2}$$

Thus $$P_1 = \frac{n_1}{n} = \frac{m}{n_2}$$

Therefore, inverting, $\frac{n}{n_1} = \frac{n_2}{m}$ and $n = \frac{n_1 n_2}{m}$

It is this derivation that was used, prior to Chandrasekaran-Deming's work, in measuring the completeness of vital registration in developed countries. Given its validity, the application of it to the field situation of two systems, as outlined earlier, is readily seen to follow.

It is apparent, therefore, that a dual record system can estimate the coverage of each of its two systems, that is, the proportion of births (deaths) out of the true number of cases caught independently by the system in question, namely, $P_1 = n_1/n$ and $P_2 = n_2/n$. It is also evident that a dual record system can estimate the observed joint coverage of the two systems as a unit, namely, $(m + u_1 + u_2)/n$. Finally it is clear that a dual record system can estimate the true number of vital events of a given population within a given time duration in several different ways: a) n_1/P_1, b) n_2/P_2, c) $n_1 n_2/m$. With the true number of cases as numerator data, and number of persons in the population at median point of the time duration as denominator (obtainable in the survey), the true vital rate can be accurately estimated.

None of the single system alternative approaches to estimating level of fertility or mortality can estimate the coverage of events by its single system. Such approaches, therefore, cannot estimate true number of cases nor true rates with the confidence of the dual system approach.

A large literature exists upon the dual record approach, most of which can be found referenced in Marks, Seltzer, and Krotki (1974) and in the several series of the International Program of Laboratories for Population Statistics (POPLAB), University of North Carolina at Chapel Hill (Linder 1971, Madigan 1973, Madigan and Abernathy 1975, Madigan et al. 1973). With the availability of these publications, it does not seem necessary to further describe a dual record system, except to explain necessary aspects of the Philippine application.

II. MINDANAO CENTER FOR POPULATION STUDIES PROJECT: A BRIEF DESCRIPTION

Historical Background

The Philippine Population Laboratory (POPLAB)* started on April 1, 1971, with the signing of a contract by Xavier University, the University of North Carolina at Chapel Hill, and AID (the Agency for International Development). As members of a collaborating group of research institutions, these signers authorized a multinational study of approaches to the accurate measurement of vital statistics, especially, although not exclusively, through employment of the dual record methodology. The study organization was headed by the International Program of Laboratories for Population Statistics of the Department of Biostatistics of the University of North Carolina at Chapel Hill, which provided technical assistance in the form of university faculty consultants to the institutions carrying out the application of the dual method inquiry in specific countries (Linder 1971). The Philippine Population Laboratory project terminated on May 31, 1976, after receiving support for five years from AID, from the Commission on Population of the Republic of the Philippines, and from the Interdisciplinary Communications Program of the Smithsonian Institution. Field work began with mapping activities in connection with selected project areas and terminated in October 1975. Periods of coverage of the dual record system extended from September 1, 1971, to June 30, 1975--almost four full years.

Sample Selection

The original concept of a population laboratory which guided the establishment of the Philippine POPLAB required the selection of one or more small geographical areas whose population might be studied in semi-experimental conditions. Such areas could be distinguished by clearcut external boundaries, certain types of communities, contiguity of units, accessibility to Cagayan-based researchers, and low-cost logistics. It was not considered necessary that study areas be representative of larger universes so that inferences might be possible from one to the other. Major consideration was given to methodological problems of population measurement, not to the production of data for substantive usage.

Two methodological samples were chosen on the basis of the criteria just mentioned (clearcut boundaries, contiguity, accessibility, et cetera). The first of these was the Cagayan de Oro City center or Cagayan Poblacion. A 75 percent, one-stage, cluster probability sample was drawn from this poblacion, with probability of selection proportionate to population size as enumerated in the 1970 Census. The clusters were the enumeration districts of that Census. The second 1971 sample was a contiguous rural area, of approximately 104 square kilometers, covering parts of

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*The Philippine Population Laboratory has been described at length elsewhere (Madigan 1973, Madigan and Abernathy 1975). Only descriptive material required for the immediate purpose of this report will be presented here.

four municipalities, whose easternmost boundary was approximately 18.5 kilometers westward by road from the Cagayan de Oro city hall. A small western slice of El Salvador Municipality, the northern half of Alubijid Municipality, almost the entirety of Laguindingan Municipality, and an eastern strip of Gitagum Municipality constitute this rural sample.

Provinces are divided into chartered cities and municipalities. Chartered cities can be considered subprovinces, containing both urban and rural areas. Municipalities in some ways approximate counties in the United States, and generally consist of a town center (municipal poblacion) surrounded by rural villages and territory.

Definitions

The 1970 Census was taken on a usual place of residence basis. The POPLAB samples were chosen to include populations as of May 6, 1970 (the census date) of about 20,000 residents each. Resident was defined differently for POPLAB research purposes than for the census which asks usual place of residence. For POPLAB, it was defined as a person who has lived or intends to live in the house or sample area of interview for 90 days, who sleeps in the house of interview more than in any other house, or as much as in any other house provided spouse does not live in that other house. A student was defined as an unmarried or currently married person less than 25 years of age whose main occupation at time of interview (or at time of event in relation to childbirth or death) was study. Unmarried students were enumerated as residents where their parents lived. Married students were counted as residents where their spouses lived. A migrant was defined as a person who has moved across a sitio boundary intending to stay in the new locality or away from the old locality at least 90 days. A sitio is a small, quasi-political subdivision of a barangay (formerly called a barrio in the Philippines). Definitions of live birth and of fetal death were those of WHO(World Health Organization).

The large and continuous influx of short-term visitors into and out of Cagayan de Oro, and their anticipated effects on birth and death rates, influenced the decision on choice of a de facto or a de jure population in favor of the modified de jure definition given above. Births and deaths of residents would, therefore, be included. However, a complete account of all births and deaths relating to residents, or which occurred within the area of study, was kept to be sure that some events would not be omitted or others included inappropriately.

Probability Samples of 1973

Despite the methodological orientation of the Philippine POPLAB, the desire for substantive data on the part of administrators interested in the impact of the Philippine population program brought pressure on POPLAB to produce such data almost from the start. This pressure mounted as time went on. In addition, enlarging the sample areas would permit study areas to be rotated, thus avoiding respondent fatigue, as well as creating more favorable conditions for several quasi-experiments which POPLAB wished to carry out.

In early 1973, POPLAB began to implement plans for drawing a cluster probability sample from Misamis Oriental Province. Selection of barrios and poblacion

districts was by probabilities proportional to size. Overall equality of sampling ratios per cluster sample was not a goal, because one of the experiments contemplated required varying the size of study populations from cluster to cluster. The design called for a sample of approximately 40,000 additional persons drawn from three geographic strata into which the province (Misamis Oriental) had been divided: The northeast municipal area including Gingoog City, the Cagayan de Oro area, and the southwest municipal area. In the two municipal segments, the primary sampling unit was the municipality.

Municipalities were assigned sets of numbers according to their population size. After the municipalities had been selected by using tables containing random numbers, barrios (which have more recently come to be called barangays) were selected in the second stage of sampling. The sampling design called for barrios (hereafter called barangays) to be dispersed in location in Cagayan de Oro City and in the municipal southwestern segment but to be clustered in the northeastern segment. This setting would enable comparison of the advantages and disadvantages of dual record operations in dispersed versus contiguous areas of 2,500 to 5,000 persons (single versus clusters of barangays), and to compare both types of operations with those carried out in the original urban and rural areas. Barangays in the entire urban area of Cagayan de Oro (not just in the poblacion) and in the rural southwestern segment were assigned sets of numbers proportional to their population size. Barangays in the northeastern segment were also assigned such sets of numbers but after the initial barangay had been picked by means of tables of random numbers, barangay clusters were formed in accordance with a predetermined plan. At the time of the inauguration of the new sample, the 1971 samples had grown to approximately 24,000 persons each. The new samples added about 43,000 persons to this total, so that POPLAB operations were being carried out with an overall sample of 91,000 persons.

It should be added that interpenetration of samples was deliberately permitted since it would afford an advantage in comparing methodological and probability samples. Whether or not samples units fell within both 1971 and 1973 samples was left to chance, however.

Systems Operations

It cannot be overemphasized that the success of a dual record system depends largely upon the quality of local area maps. It is through such maps that the members of the two data-gathering systems are kept within strictly the same areas so that the reports on the population are limited to and include all of the population under study. Because of in- and out-migrations, mapping operations had to be continuous. Workers of the recording system updated their maps continuously. Whenever maps became unclear because of corrections, workers handed them over to their supervisors who passed them on to the mapping unit for revision. Copies of the updated maps were then returned to the supervisors. The Philippine POPLAB maps of local areas (unit areas of work) carry the symbols, numbered, of all dwelling units within the local area, as well as helpful local detail (including of course orientation of map to north) relating to boundaries and local regions of the unit area. The numbers of houses correspond to numbers on lists of dwelling units, and the same numbers are found upon red tin plates in black lettering, tacked to the outside of the dwelling units in question.

MEASUREMENT OF VITAL RATES

At the end of initial mapping operations in the two original methodological areas, baseline surveys were fielded to obtain household listings of residents, their ages, sex, marital status, and relationship to household head. The urban baseline survey began on July 23, 1971, and ended five weeks later. The rural baseline survey began on September 1 and ended toward the end of November. These surveys made possible estimates of population midway through the study period by geometric interpolation by age groups between the population enumerated later by the first regular survey round and the baseline population by age group.

The Continuous Recording System was set up in August in the urban area, and began its operations September 1, 1971. The system was set up in the rural area as soon as possible after the mapping was completed.

The Continuous Recording System (called STAR, an acronym from the title used to designate it in its early stages) in some dual systems carries out its work of continuous observation and recording of vital events by frequent door-to-door canvasses of all households in the study population, and in other dual systems by designating a set of community contacts (informants) upon whom it relies to identify households in which vital events have occurred. The Philippine POPLAB began research operations through its continuous observation system by a bimonthly door-to-door canvas of each household, coupled with a question asked of all households visited each day, relating to neighborhood events. (Table 1)

Zone offices were set up in both urban and rural areas, and a zone director and a supervisory staff were recruited and trained. Adequate supervision of recorders (STARs) was recognized as critical to the success of this system, and this aspect was emphasized during training. Candidates for recorder positions were informed that their work would be continuously scrutinized and checked. Zone directors, assisted by STAR supervisors, bore overall responsibility for supervision. STARs in the methodological areas worked one hour a day, five days a week, at a scheduled hour of the day. Before going to work, they filled out a location-of-work form, indicating exactly where they would be working. They left the forms at a prearranged place. Thus, they were easily located for spot checks in the field by supervisors. An alertness reward of ₱3.00 (about $0.40) was paid, over and above hourly wages, to the STAR or to the survey interviewer who first discovered a vital event. The amount of this award was believed enough to stimulate energetic efforts to uncover events by STAR recorders and by survey interviewers, but too little to induce workers into collusion by sharing information for mutual profit. Before an alertness premium was paid, a supervisor made a field visit to verify the facts of the case.

Workers of the Continuous Recording System were to be residents of areas where they were to work, usually barangays or neighborhoods from 30 to 60 households, or residents of nearby areas. It was thought this would make their bimonthly visits more acceptable to respondents. On the other hand, survey interviewers (called ROVER system workers, an acronym based upon an early title given to the survey system) were not permitted to interview in an area where they had previously resided or where they had previously been assigned to interview. In addition, although POPLAB attempted to retain the services of STAR workers as long as they performed well, POPLAB did not attempt to retain interviewers. (POPLAB did re-employ some who had given good service during the preceding survey round.) Interviewers worked during

the training sessions preceding each survey round, during the surveys, and for a short time afterwards in editing household forms. Nearly all interviewers had some college education. The training program lasted from two weeks to a month, and involved learning concepts, studying interview methodology, role playing, and practicing field interviews under supervision. Both STAR and ROVER schedules were worked out in English and translated into Cebuano Binisaya, the local language. This translation was then given to an average respondent who knew some English and the respondent was asked to translate it back into English. Schedules were in turn pretested to assure accuracy.

Surveys were carried out in all areas every six months during the first two survey rounds. After that, subsampling took place because of quasi-experimental

TABLE 1

Illustration of Adjustments to Data: Calculation of Numbers of Currently Married Women, Births, and Birth Rates by Occupation of Husband for Currently Married Women, 25-29, Period Five (July-December 1973), Rural Methodological Sample

Occupational Level of Husband	Number of Women		Number of Births		Birth Rates	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
	(1)	(2)[a]	(3)	(4)[c]	(5)[b]	(6)[c]
Professional	3	3.14	1	1.086	318.5	692.0
Paraprofessional	10	10.49	2	2.172	190.7	414.2
Clerical	6	6.29	3	3.259	477.0	1036.3
Skilled	27	28.31	3	3.259	106.0	230.2
Semiskilled	180	188.76	27	29.328	143.0	310.8
Manual	324	339.76	70	76.034	206.0	447.7
Special Category	5	5.24	3	3.259	572.5	1244.0
Total	555	582	109	118.397	185.6	403.2

[a]Adjusted by prorating those women for whom information on occupation of husband was not available.

[b]Unadjusted birth rates calculated by dividing the births reported in the survey by the adjusted number of women shown in column 2.

[c]The adjusted birth rates were calculated by multiplying the unadjusted occupation specific rates by the ratio of the annualized age-specific rate for all currently married women adjusted by the Chandrasekaran-Deming formula and calculated on the basis of the mid-point population to the unadjusted age-specific rate for all currently married women; for the present illustration this ratio was 403.2/185.6. The adjusted number of births was calculated similarly, except that the annualization factor was excluded.

studies and to avoid respondent fatigue. However, the first, second, fifth, and eighth survey rounds covered the entire populations of the two methodological areas, and the sixth and eighth covered the entire sample populations of the three provincial strata. The continuous recording system always covers 100 percent of the sample areas. Like STAR workers, ROVER interviewers were paid on an hourly, not on a per interview basis, so that they might not be tempted to hurry interviews. Supervisors were paid by the day.

System Independence

It is basic to the dual record methodology, which rests upon the joint, independent probability theorem, that the two systems gather their data independently of one another.

Attempts were made to build up the morale of the workers in each system to the point where they would be unwilling to share information across systems. The importance of independence for the reporting of events, and of the reported events for the statistical estimates of Philippine population data was stressed in training and reemphasized at frequent intervals. It was also incorporated into the training manuals. Workers were explicitly told that their effectiveness would not, and rightly could not, be judged by comparison with the worker of the other system who had covered the same unit area as they had, and no such comparisons of individual workers were divulged to workers. Recorders were not permitted to work in their areas during the days when a ROVER was conducting interviews there. Recorders handed in all data and forms and these were kept in a sealed envelope in the zone office, during the days of interview in the work area of the particular STAR. The contents of these envelopes were returned to them only on the day after the ROVER had completed his or her interviews in that area. STARs residing in areas of work were not allowed to act as respondents to ROVERs coming to the household for interview, unless they were the only qualified respondent in the household. In that case, they were to give information only about their own household.

Separate offices and sets of supervisors and directors were set up for each system. The interview system operated directly out of the central office, while the recording system operated out of zone offices. This way, STARs and ROVERs would not get to know one another by meeting outside offices when coming to turn in data. Finally, as previously mentioned, ROVER interviewers were not encouraged to participate in subsequent survey rounds, were not assigned to interview twice in the same place if they did participate in more than one round. and were not permitted to interview in areas where they had ever resided.

Except for the randomized response questions to be discussed later, the rate of refusals and non-response to questions or to interviews, was very low--less than 2 percent. However, this did not occur without callbacks to obtain data from persons not at home and other difficulties. In the first round, one small religious sect was found in both urban and rural areas whose members refused to be interviewed unless their minister gave permission. When approached, he hesitated for several weeks. Finally, through the office of the mayor of Cagayan de Oro City, the urban zone director persuaded the minister to grant consent. In addition, the residents of some urban commercial districts rebuffed ROVER workers when they requested appointments for interviews. Interviewers had been instructed to accept such

reactions cheerfully and to retreat pleasantly, but to reappear several days later and again ask for an appointment. The technique usually worked. Where it did not, the urban zone director intervened and almost always obtained the interview after one, two, or three visits. Further details on the two systems of the Philippine POPLAB may be found in previous publications (Madigan 1973, Madigan and Abernathy 1975).

III. URBAN AND RURAL FERTILITY LEVELS IN MISAMIS ORIENTAL

Qualifications

Mapping, conceptualizing, training workers, performing field operations, supervising, matching, and data processing were carried out with painstaking care. The dual system coverage of birth events was at least 95 percent of births and 86 percent of deaths. Refusals to be interviewed never exceeded 2 percent. The data, therefore, may be considered reliable.

Illegitimate births were not distinguished from legitimate births in computing the birth rates for all women (as distinguished from currently married women). The Philippines is a shame culture rather than a guilt culture. While it is not considered an embarrassment to become pregnant out of wedlock, bearing a child out of wedlock is considered especially embarrassing. Parents of an unmarried girl who has conceived will press the family of the man involved to marry their daughter. As a result there has been, at least until recently, relatively little illegitimacy; and where it occurs, it tends to be concealed. Illegitimate children are often reported as legitimate. A check upon MCPS (Mindanao Center for Population Studies) data on children ever born during one period revealed that less than two-tenths of one percent of all births were reported to be illegitimate, whereas it seemed clear from other evidence that the number of such births was higher. For this reason MCPS workers were instructed not to embarrass respondents by insisting on answers to a question about legitimacy lest such insistence lead to concealment of births out of shame. Since an insignificant number of births was reported as illegitimate, the cost of tabulations to remove them from numerators of fertility rates of currently married women was considered unjustifiable. Inclusion of such cases probably helped balance out the inevitable few live born infants whom mothers forgot to report, despite prodding of their memories.

Consensual marriage is recognized in the Philippines. In the MCPS study a couple who had lived together for a year was considered married and their children legitimate if born after they had begun to live together.

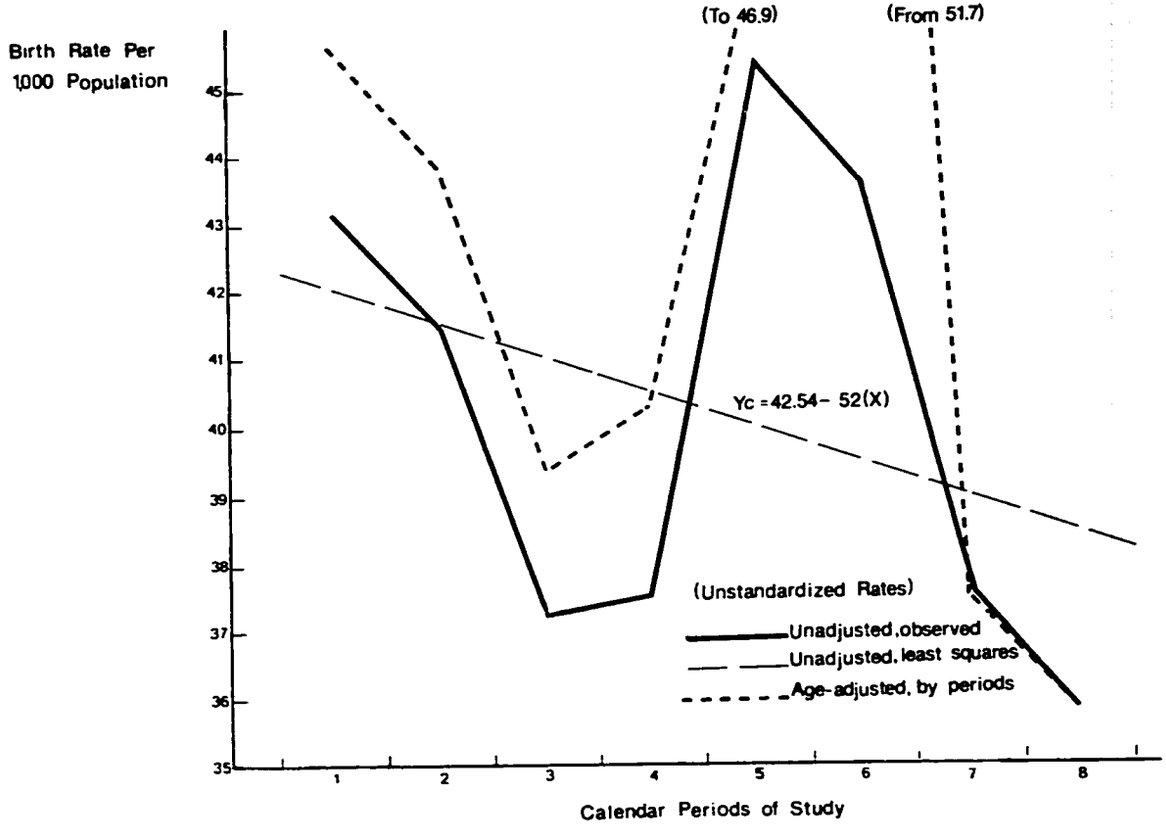
Urban (Cagayan Poblacion) Birth Rates

Crude birth rates. The crude birth rates experienced in the Cagayan de Oro Poblacion over eight periods (each six months in length except the first which was four months long) reveal a population with high fertility characteristics. These rates per thousand persons from period one (September 1 to December 31, 1971) to period eight (January 1 to June 30, 1975) are: 43.1, 41.5, 37.2, 37.5, 45.4, 43.6, 37.5, and 35.8.

Graphing these (Figure 1) reveals a downward trend in fertility, which the least squares line in the same figure brings out more clearly. Although this trend is not significant at .05, it is nevertheless interesting because it is downward, and fairly consistently so, except for periods five and six. While the decline may be due to sampling variance as the statistical test reveals, it nevertheless is in a

FIGURE 1

Urban Crude Birth Rates, Cagayan, 1971-1975



direction comforting to those concerned with the birth and growth rates vis-à-vis development and resources. Since it has occurred following the implementation of a vigorous family planning program, this decline may be a real decline and due to such factors as delayed marriage and birth regulation, despite the lack of statistical evidence to support this view.

Age standardization of these rates (with the population of period eight, urban areas, as standard population) shifts upwards the fertility level in all periods but period eight. It also shows period six fertility considerably higher than that of even period five, a pattern which the general fertility rates also reflect. The rates, shown below, indicate a greater decline to periods seven and eight than the unstandardized set exhibit.

1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
45.5	43.8	39.3	40.3	46.9	51.7	37.5	35.8

It is instructive to compare the unstandardized crude rates of the dual system with the rates obtained by each single urban system by itself. Workers in both systems were well trained and highly motivated, striving to achieve full coverage. They and their supervisors may have thought they had at times reached this goal. Yet they fell well below such completeness.

The coverage rates of the different systems tell the story. These are expressed in percentages of all cases caught by the system, and are:

66.4	79.4	91.5	87.8	86.6	89.5	84.1	87.2	Survey
87.0	80.9	82.0	90.1	96.4	92.5	91.6	95.2	Recorders
95.6	96.1	98.5	98.8	99.5	99.2	98.7	99.4	Dual

The dangers of depending upon a simple survey for the collection of vital data are apparent. Comparison of the survey rates over the eight periods with coverage rates of the same survey makes clear the difficulty of distinguishing between declines in rates due to changes in fertility and declines due to less complete coverage. (Special techniques depending upon a single survey such as the Brass techniques and the Own Children approach are not in question here.)

It is also evident that differences between the rates observed by the dual system ($m + u_1 + u_2$) and those estimated by it through the Chandrasekaran-Deming formula were in no case large. In fact, these differences never exceeded 4.4 percent of the true rate. The observed dual rates are: 41.2, 39.9, 36.6, 37.1, 45.2, 43.3, 37.1, and 35.6.

General fertility rates. The general fertility rates for women ages 15-49 estimated from the dual system by the Chandrasekaran-Deming formula exhibit period changes fairly similar to those of the crude birth rates. However, these peak in the sixth rather than the fifth period, as Figure 2 shows. These are: 141.1, 137.6, 123.5, 125.1, 148.3, 159.6, 121.5, and 113.7.

Standardization of these rates on the eighth period tend to make them somewhat higher in the earlier periods and somewhat lower in the seventh period. These are: 144.4, 139.2, 124.7, 127.9, 148.7, 164.0, 119.0, and 113.7.

The same picture is presented by both standardized and unstandardized general fertility rates, however.

It is in contrast to rates for all women that those for the currently married have particular utility. Rates for all women may vary due to changes in the distribution of married and unmarried women, especially if there are increases or other changes in age of women at first marriage, as well as increases or decreases of widowhood or of marriage break-up. The rates of the currently married permit one to remove these obscuring factors so that the comparison of the rates of the currently married with those for all women ages 15-49, reveals and separates the effects of factors that operate only within marriage (such as family planning).

The general fertility rates for the currently married are quite high. One should bear in mind, however, that each of these women is subject to pregnancy outcome during each year, unlike single or separated women. The set of rates, like those for the entire population (crude rates) or for all women ages 15-49, exhibit a general downward trend in fertility. This trend is probably best represented by the least squares line, also shown in Figure 2. The rates are: 346.8, 326.5, 289.0, 293.7, 350.9, 306.6, 286.6, and 273.4.

These rates, over the eight periods, drop from 346.8 births per 1,000 currently married women to 273.4 births, a decline of 21 percent. While a small decline in comparison to dramatic declines in fertility among populations passing through demographic transition from high to low birth rates, it is nevertheless impressive. It is a decline within the ranks of currently married women and, therefore, not attributable to delay in entering marriage or to population distribution based on migrational change.

Standardization does not greatly change the picture. The rates, which tend to be slightly higher in the earlier periods and slightly lower in the later periods than the nonstandardized rates, are: 349.1, 334.3, 298.5, 290.0, 354.0, 297.8, 283.2, and 273.4.

As before, the population of period eight for currently married women was used as standard. Looking more closely at the rates, one notices that the rates of the currently married approach more closely the pattern of crude rates by period than the general fertility rates for all women. This fact increases the impression of a true decline in fertility.

Age-specific birth rates. Age-specific fertility is a somewhat more accurate way to look at fertility behavior. Again the fertility of all women and of currently married women is contrasted. Table 2 exhibits the age-specific fertility of women by five-year age groups and by periods.

While age at marriage has increased steadily since 1935 until recently (Smith 1975, Madigan et al, 1972, pp. 50-57), and therefore plays some part in the fertility decline of all women, this variable cannot explain the decline in the fertility of currently married women shown in Table 2 between periods one and two and periods seven and eight for ages 20-34. While sampling variation also enters the picture, the data certainly convey the impression of women using family planning measures to restrict their fertility. The slower decline in fertility of women ages 35-44 may

FIGURE 2

General Fertility Rates Over Time, All Women and Currently Married Women

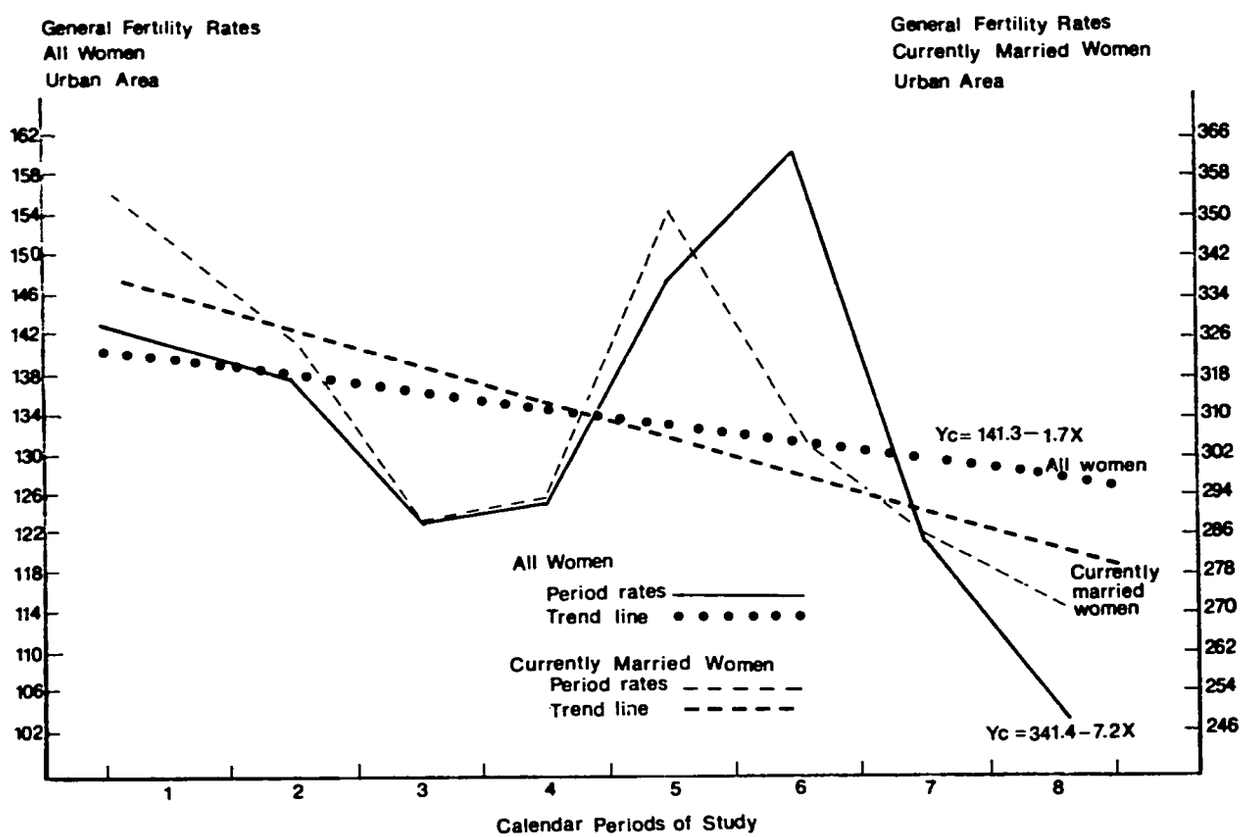


TABLE 2

Annualized Age-Specific Urban Birth Rates for Women and Currently Married Women, Periods One to Eight, Methodological Sample, Misamis Oriental Province

Age of Women	BIRTH RATES PER 1,000 — Periods							
	1[a]	2[b]	3[c]	4[d]	5[e]	6[f]	7[g]	8[h]
				All Women				
15-19	25.1	46.4	42.4	45.8	51.8	85.5	30.3	47.9
20-24	196.6	157.7	193.3	139.8	192.3	229.8	154.4	133.6
25-29	276.8	275.0	187.5	276.1	281.1	280.8	231.0	189.3
30-34	280.8	232.2	187.0	207.9	227.3	161.3	202.3	184.2
35-39	119.1	155.3	106.8	130.4	129.9	148.1	99.7	150.0
40-44	67.3	67.4	66.8	38.4	76.9	95.1	70.1	61.4
45-49	0.0	15.0	12.3	0.0	13.0	0.0	12.0	5.8
GFR[i]	141.1	137.6	123.5	125.1	148.3	159.6	121.5	113.7
TFR[j]	4,828.6	4,745.0	3,980.9	4,192.0	4,861.5	5,002.6	3,999.0	3,861.0
GRR[k]	2,356.4	2,315.6	1,942.7	2,045.7	2,372.4	2,441.3	1,951.5	1,884.2
				Currently Married Women				
15-19	527.9	883.0	700.6	783.4	776.5	750.0	503.3	747.0
20-24	639.2	507.0	616.5	449.1	612.5	506.0	486.5	428.0
25-29	443.8	437.2	311.2	419.8	464.1	377.8	376.2	315.4
30-34	356.5	296.4	235.2	204.9	294.0	196.2	258.6	243.0
35-39	143.3	178.0	127.5	161.2	158.5	175.8	122.9	147.0
40-44	82.3	82.0	81.0	48.0	96.1	117.0	87.5	78.9
45-49	0.0	18.9	15.4	0.0	16.4	0.0	16.8	7.7
GFR[i]	346.8	326.5	289.0	293.7	350.9	306.6	286.6	273.4
TFR[j]	10,964.7	12,012.5	10,437.3	10,332.0	12,090.5	10,614.1	9,259.0	9,834.4
GRR[k]	5,350.8	5,862.1	5,093.4	5,042.0	5,900.2	5,179.7	4,518.4	4,799.2

[a]September 1-December 31, 1971
[b]January 1-June 30, 1972
[c]July 1-December 31, 1972
[d]January 1-June 30, 1973
[e]July 1-December 31, 1973
[f]January 1-June 30, 1974
[g]July 1-December 31, 1974
[h]January 1-June 30, 1975
[i]General fertility rate
[j]Total fertility rate
[k]Gross reproduction rate (.488 TFR)

be due to the consistently lower fertility which these women have exhibited throughout the eight periods. It may be that if birth control is being practiced at present by a substantial group of women, women of these ages initiated the practice. This hypothesis would be consistent with the belief that pressures such as high costs of education and support of already living children compelled women who may already have had large families to limit further children. A recent food shortage (1973) and a subsequent period of high inflation (1974) may have sharpened such pressures.

Calendar rates. A somewhat different perspective is furnished by looking at fertility for calendar years. The rates are presented in the form of unweighted averages to cancel out possible seasonal variations. Five years can be observed if one is willing to accept the last four months of 1971 and the first six months of 1975 in place of a full year's coverage. Obviously some danger is present in so doing because fluctuations tend to be larger during shorter periods. The advantage, however, is the larger time frame, and if results are used with caution, advantages may outweigh disadvantages. The crude rates and the general fertility rates were:

1971	*1972*	*1973*	*1974*	*1975*	
43.1	39.4	41.4	40.6	35.8	Crude birth rates
141.1	130.6	136.7	140.6	113.7	General fertility rates
346.8	307.8	322.2	296.6	273.4	General fertility rates, currently married

The effect of presenting calendar year rates is to diminish the effects of periods five and six, which go, respectively, with period four to complete 1973 and with period seven to begin calendar year 1974. Since periods four and seven were relatively low fertility periods, the effect of condensing the period rates into calendar year rates makes the higher rates of periods five and six look like seasonal variation.

The age-specific rates by calendar year, subject to the same limitations for 1971 and 1975 as the more general rates, are found in Table 3. These rates again tend to smooth out the effects of periods five and six by distributing them within two different calendar years, although this is more true of rates for the currently married than for women in general. This latter difference may be seen by checking the general fertility, the total fertility, and the gross reproduction rates in the last three lines of the lower panel of the table and comparing these with similar measures for all women.

The high total fertilities of currently married women will be more comprehensible if one remembers children conceived illegitimately are generally born legitimate in the Philippines, and secondly that only currently married women are in the base of these rates. Total fertility would be considerably less if widowed and separated women had been included.

Rural Birth Rates, 1971 Sample

Crude birth rates. The crude birth rates for the Alubijid-Laguindingan area (with slices of El Salvador and Gitagum Municipalities) represent a decline from a high of 48 births per thousand persons to a low of slightly less than 30 within a period of 4 years. This decline took place within an area which had just received

TABLE 3

Annualized Age-Specific Urban Birth Rates for Women, and Currently Married Women, 1971 to 1975, Methodological Sample, Misamis Oriental Province

Age of Women	BIRTH RATES PER 1,000				
	Years				
	1971[a]	1972[b]	1973[c]	1974[d]	1975[e]
	All Women				
15-19	25.1	44.4	48.8	57.9	47.9
20-24	196.6	175.5	166.1	192.1	133.6
25-29	276.8	231.3	278.6	255.9	189.3
30-34	280.8	209.6	217.6	181.8	184.2
35-39	119.1	131.1	130.2	123.9	150.0
40-44	67.3	67.1	57.7	82.6	61.4
45-49	0.0	13.7	6.5	6.0	5.8
GFR[f]	141.1	130.6	136.7	140.6	113.7
TFR[g]	4,828.6	4,363.5	4,527.5	4,501.0	3,861.0
GRR[h]	2,356.4	2,129.4	2,209.4	2,196.5	1,884.2
	Currently Married Women				
15-19	527.9	791.8	780.0	626.7	747.0
20-24	639.2	561.8	530.8	496.3	428.0
25-29	443.8	374.2	442.0	377.0	315.4
30-34	356.5	265.8	249.5	227.4	243.0
35-39	143.3	152.8	159.9	149.4	147.0
40-44	82.3	81.5	72.1	102.3	78.9
45-49	0.0	17.2	16.4	16.8	7.7
GFR[f]	346.8	307.8	322.2	296.6	273.4
TFR[g]	10,964.7	11,225.5	11,253.5	9,979.5	9,834.4
GRR[h]	5,350.8	5,478.0	5,491.7	4,870.0	4,799.2

[a]Rate for September 1-December 31, 1971
[b]Unweighted average of six-month period rates 2 and 3
[c]Unweighted average of six-month period rates 4 and 5
[d]Unweighted average of six-month period rates 6 and 7
[e]Rates for January 1-June 30, 1975

[f]General fertility rate
[g]Total fertility rate
[h]Gross reproduction rate (.488 TFR)

electrification on a large scale through a rural electric service cooperative. The rates are: 45.8, 39.6, 48.0, 38.0, 39.1, 31.6, 31.1, and 29.9.

Most households in areas where maintenance of lines was feasible have become members of the cooperative and have had electric lines run to their homes. Of these, 16.3 percent are estimated to have used electricity during 1971, 20.7 percent in 1972, 45.8 percent in 1973, 11.8 percent in 1974, and 5.4 percent in 1975. During the first half of 1973 (period four), some nine to fifteen months after a substantial number (more than 37 percent) of homes had been electrified, the level of fertility of this rural sample area (where the headquarters of MORESCO [Misamis Oriental Rural Electric Service Cooperative] are located) began to decline and the trend continued through the four succeeding six-month periods. Figure 3 locates the six-month rates of this trend over time, and shows the least-squares regression line of the decline. The trend is significant at beyond .05, as are the differences between highest and lowest rates. The correlation between rate and period is one of -87.

It would be naive to assume that simple illumination, or activity associated with illumination, constitutes the basis of this decline. However, desire may exist to not only meet regular monthly electricity bills but also to obtain some of the appliances and facilities which electricity powers (for example, irons, small hot plates, electric water pumps cooperatively purchased, and so forth). Such desires may in turn interact with family planning services now available in the MORESCO area to postpone childbirths or even to reduce the number of anticipated births.

Coverages of the two rural systems and of the dual unit had been high during the eight periods. In percents these are:

1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	
92.4	92.3	93.1	95.3	96.4	96.3	94.9	96.9	Survey
92.6	96.8	98.2	98.5	99.1	87.8	94.9	98.0	Recorders
99.4	99.7	99.9	99.9	99.9	99.6	99.7	99.9	Dual

Part of the reason for high coverage is the visibility of life in rural municipalities. It is difficult to conceal matters from neighbors. The other reason is the commitment of workers and their supervisors in the two rural systems.

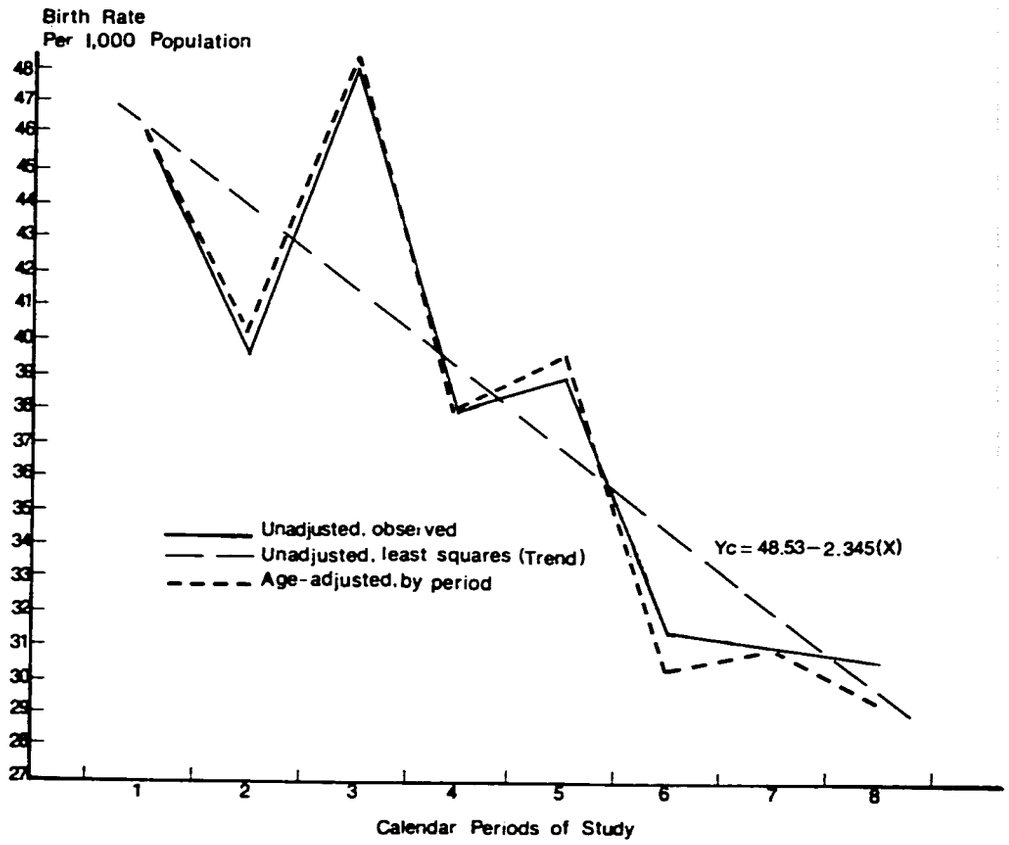
General fertility rates. The general fertility rates for all rural women reflect the decline found above in the crude rates. After the third period (where like the crude rates, the general fertility level peaked), there was a continuous downward trend through the eighth period: 212.8, 184.5, 221.7, 174.2, 180.4, 136.4, 142.2, and 135.2.

The general fertility rate for currently married women followed, at a higher level, a fairly similar pattern. The rates were: 353.1, 299.6, 369.0, 289.5, 297.9, 236.6, 232.8, and 224.0.

Age-standardized rates. Standardization did not greatly affect either the crude rates or the two sets of rates for women ages 15-49. (The population of period seven was used as the standard population.)

FIGURE 3

Rural Birth Rates, Rural Reference Area 2, 1971-1975



45.8	40.2	48.2	37.9	39.7	30.4	31.1	29.5	Crude birth rates
209.7	184.1	220.7	173.6	181.8	139.3	142.2	135.3	General fertility rates
350.5	296.6	360.9	285.0	297.9	246.6	232.8	225.1	Currently married women*

The age-specific rates for women and for currently married women are particularly useful here for investigating the age groups most responsible for the decline in fertility. If the rates shown in Table 4 of women for the two highest early periods, periods one and three, are compared with those of the two last periods, seven and eight, women ages 25-39 have had the greatest fertility reduction. These ages are not those usually affected by age at first marriage. One is led rather to hypothesize fertility restriction as the major means of reduction in births.

The rates for currently married women support this view. Again comparing the rates of Table 4 for the same periods, this time for currently married women, one observes that greatest percentage reductions in births per thousand currently married women come in the same groups, ages 25-39, although the differences are not as large between ages 15-24 and 25-39 as the differences for all women.

Almost the same impression is conveyed by these rates as by previously examined urban rates, namely, that women ages 25-39 are taking the lead in restricting their fertility. Older women may also be practicing birth control, as their rates have been consistently low. In fact, women ages 35-44 may have led the way because of previously mentioned economic pressures--food, clothing, and education of children already born.

Calendar rates. Putting the crude rates in calendar form reveals a steady downward decline year by year from 1971 through 1975: 45.8, 43.8, 38.6, 31.4, and 29.9.

This downward trend is more impressive than that shown by the period rates, perhaps because seasonal variation has been cancelled out.

Even more impressive are the declines for the fertility of women ages 15-49:

1971	*1972*	*1973*	*1974*	*1975*	
212.8	203.1	177.3	139.3	135.2	All women
353.1	334.3	293.7	234.7	224.0	Currently married women

Age-specific rates by calendar year will be found in Table 5. Especially impressive are the declines in rates for women 20-39, and for currently married women 25-29 and 30-39. The gross reproduction rates for women of all marital statuses and for currently married women are also interesting, declining from 3.4 to 2.2 and from 6.2 to 4.0, respectively.

The behavior of these rural fertility levels should be of interest to administrators of population control programs in developing countries in general but

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*Fertility rate, ages 15-49.

TABLE 4

Annualized Age-Specific Rural Birth Rates for Women, and Currently Married Women, Periods One to Eight, Methodological Sample, Misamis Oriental Province

Age of Women	BIRTH RATES PER 1,000							
	Periods							
	1[a]	2[b]	3[c]	4[d]	5[e]	6[f]	7[g]	8[h]
	All Women							
15-19	92.8	77.7	85.8	72.7	97.6	85.5	66.5	60.6
20-24	350.3	287.2	386.8	253.6	283.0	180.5	213.3	236.1
25-29	334.2	315.9	308.5	311.3	318.6	293.4	248.9	215.1
30-34	262.1	258.1	366.0	250.3	237.9	203.2	184.2	177.0
35-39	290.5	215.9	257.6	204.6	168.2	91.2	164.0	136.6
40-44	51.1	80.5	81.6	53.9	96.1	53.0	79.5	77.3
45-49	32.5	15.3	0.0	41.6	4.8	0.0	9.7	4.8
GFR[i]	212.8	184.5	221.7	174.2	180.4	136.4	142.2	135.2
TFR[j]	7,067.5	6,253.0	7,431.4	5,940.0	6,030.5	4,534.6	4,830.0	4,536.6
GRR[k]	3,448.9	3,051.5	3,626.5	2,898.7	2,942.9	2,212.9	2,357.0	2,213.9
	Currently Married Women							
15-19	766.4	566.7	698.4	507.8	701.2	842.7	468.5	496.3
20-24	632.4	493.4	673.8	450.7	507.4	341.2	388.4	424.3
25-29	432.2	402.5	387.7	404.6	403.2	375.9	311.7	269.4
30-34	293.7	281.8	416.4	287.7	274.5	233.9	211.9	205.3
35-39	319.6	237.7	280.6	226.6	182.4	100.2	180.8	150.4
40-44	58.4	93.4	91.2	60.6	111.2	59.8	91.2	87.1
45-49	36.9	17.5	0.0	47.9	5.4	0.0	11.2	5.4
GFR[i]	353.1	299.6	369.0	289.5	297.9	236.6	232.8	224.0
TFR[j]	12,697.8	10,465.0	12,740.2	9,929.5	10,926.5	9,768.5	8,318.4	8,190.7
GRR[k]	6,196.5	5,106.9	6,217.2	4,845.6	5,332.1	4,767.0	4,059.4	3,997.0

[a]September 1-December 31, 1971
[b]January 1-June 30, 1972
[c]July 1-December 31, 1972
[d]January 1-June 30, 1973
[e]July 1-December 31, 1973
[f]January 1-June 30, 1974
[g]July 1-December 31, 1974
[h]January 1-June 30, 1975
[i]General fertility rate
[j]Total fertility rate
[k]Gross reproduction rate (.488 TFR)

TABLE 5

Annualized Age-Specific Rural Birth Rates for Women, and Currently Married Women, Calendar Years 1971 to 1975, Methodological Sample, Misamis Oriental Province

Age of Women	BIRTH RATES PER 1,000				
	Years				
	1971[a]	1972[b]	1973[c]	1974[d]	1975[e]
	All Women				
15-19	92.8	81.8	85.2	76.0	60.6
20-24	350.3	337.0	268.3	196.9	236.1
25-29	334.2	312.2	315.0	271.3	215.1
30-34	262.1	312.1	244.1	193.7	177.0
35-39	290.5	236.8	186.4	127.6	136.6
40-44	51.1	81.1	75.0	66.3	77.3
45-49	32.5	7.7	23.2	4.9	4.8
GFR[f]	212.8	203.1	177.3	139.3	135.2
TFR[g]	7,067.5	6,842.2	5,885.3	4,683.0	4,536.6
GRR[h]	3,448.9	3,339.0	2,920.8	2,285.3	2,213.9
	Currently Married Women				
15-19	766.4	632.6	604.5	655.6	496.3
20-24	632.4	583.6	479.1	364.8	424.3
25-29	432.2	395.1	403.9	343.8	269.4
30-34	293.7	349.1	281.1	222.9	205.3
35-39	319.6	259.2	204.5	140.5	150.4
40-44	58.4	92.3	85.9	75.5	87.1
45-49	36.9	8.8	26.7	5.6	5.4
GFR[f]	353.1	334.3	293.7	234.7	224.0
TFR[g]	12,697.8	11,602.0	10,427.8	9,043.5	8,190.7
GRR[h]	6,196.5	5,662.1	5,088.8	4,413.2	3,997.0

[a]Rate for September 1-December 31, 1971
[b]Unweighted average of six-month period rates 2 and 3
[c]Unweighted average of six-month period rates 4 and 5
[d]Unweighted average of six-month period rates 6 and 7
[e]Rates for January 1-June 30, 1975

[f]General fertility rate
[g]Total fertility rate
[h]Gross reproduction rate (.488 TFR)

especially to those in South and Southeast Asia. Here is a rural area which, despite so-called rural traditionalism, has substantially reduced its birth rate in three to four years time. The dynamics of this change in mentality deserve documentation. It is tempting, at least for the present, to hypothesize that the interaction of the abundant and cheap electricity in the area (from the Maria Cristina hydroelectric power station in Lanao del Norte) and of a family planning program in the same area are responsible for the decline, by precipitating desires that compete with the birth of another child.

Probability Sample, Misamis Oriental, Birth Rates

Urban sample 1973 (July 1973-June 1975). Crude birth rates in this probability sample whose parameters had covered the entire urban area of Cagayan de Oro City, not just its poblacion, did not differ much from those of the poblacion, although they were a bit higher, especially in period eight (January 1-June 30, 1975). These rates were:

5	*6*	*7*	*8*	*1973**	*1974*	*1975**	
45.4	43.6	37.6	35.8	45.4	40.6	35.8	Urban sample 1971
45.8	39.0	44.7	40.5	45.8	41.8	40.5	Urban sample 1973
							Coverage sample 1973
83.9	87.4	94.8	85.5	83.9	91.1	85.5	Survey
87.0	96.8	93.9	98.8	87.0	95.4	93.9	Recorders
97.9	99.6	99.7	99.8	97.9	99.7	99.8	Dual

General fertility rates followed a closely similar pattern as did the fertility rates for currently married women. They are:

5	*6*	*7*	*8*	*1973**	*1974*	*1975**	
185.6	160.0	178.6	162.0	185.6	169.3	162.0	General fertility rates
328.2	272.3	324.2	280.1	328.2	298.2	280.1	Currently married women

The municipal southwest. This sample is of particular interest since it covers the entire MORESCO area (excluding five city barrios of Cagayan which MORESCO has also agreed to electrify). The methodological sample is restricted to a contiguous segment of parts of four municipalities belonging to the ten municipalities serviced by MORESCO. The methodological sample is also about three times as large.

The crude rates are:

5	*6*	*7*	*8*	*1973***	*1974*	*1975**
51.1	32.1	39.3	35.6	51.1	35.7	35.0

Rates for the same period for the rural, methodological sample are:

*Six months only (period 5).
**Period 5 only.

39.1	31.1	31.6	29.9	39.1*	31.4	29.9

The abbreviated time span for which rates on the entire MORESCO area are available suggests a decline that began later than that in the methodological sample and which has not yet gone as far. In fact, this would be consistent with the history of the MORESCO project. Its earliest service was extended to households nearer to its headquarters (within the methodological sample), and gradually service radiated outwards through the area. It will be interesting to continue study of this larger area to see whether fertility of the larger area follows the course of that determined for the methodological sample.

The general fertility rates follow the same approximate pattern as the crude rates and are:

5	*6*	*7*	*8*	*1973*	*1974*	*1975*	
238.4	156.1	182.4	169.7	238.4	169.2	169.7	General fertility rates

The municipal northeast. This region, outside the MORESCO area, but subject to the family planning program of the Commission on Population, like the remainder of the province,** presents a kind of foil to the MORESCO segment of the southeast. It is not electrified, except for small segments in the southern part of the region, and for small areas around poblacions which have small diesel generators. Electricity, where it exists on a diesel basis, is expensive and restricted. The rates of this area, therefore, indicate what is occurring on the basis of the family planning program and other factors, excluding electrification.

The crude rates for the northeast area are:

5	*6*	*7*	*8*	*1973*	*1974*	*1975*
40.9	35.7	40.3	35.5	40.9	38.0	35.5

On the face of it, these rates do not appear different from those of the municipal southwest, although they begin at a lower level, and the 1974 rate is higher than the southwestern rate. The lower initial level in the northeast segment may be attributed to the presence of family planning agencies, other than those of the Department of Health, for a longer period of time and through a more diffused area.

Again the general fertility rates have followed rather closely the pattern of the crude rates and are:

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*Urban sample 1973 covered the entire urban area of Cagayan de Oro City; urban sample 1971, however, covered only the poblacion and was earlier designated Cagayan Poblacion.

**This province is one of the provinces selected by the Commission for its Total Integrated Development Approach, a program which tries to cooperate with other governmental agencies to promote their work and in return seeks the cooperation of these agencies in promoting family planning.

5	*6*	*7*	*8*	*1973*	*1974*	*1975*	
186.5	167.3	188.8	161.7	186.5	178.0	161.7	General fertility rates
342.1	287.4	324.5	276.8	342.1	306.0	276.8	Currently married women

Provincial rates. From the probability sample of Cagayan, the municipal southwest, and the municipal northeast, provincial rates can be inferred for Misamis Oriental Province. Less defensibly, but with a larger sample population, provincial rates can be derived from the fertility of the methodological samples added to the above probability samples. These two sets of rates are called here A estimates (probability sample) and B estimates (all samples). In both cases, rates and their population weights are added into the proper geographic stratum (Cagayan, southwest, northeast).

The crude birth estimates for Misamis Oriental were:

5	*6*	*7*	*8*	*1973*	*1974*	*1975*	
45.1	35.0	40.7	35.9	45.1	37.8	35.9	A Estimates
41.3	35.2	37.7	33.9	41.3	36.4	33.9	B Estimates

As might have been expected, these rates are not in precisely the same pattern as any one of the individual sample areas, but reflect a composition of the three strata values. They do, however, continue to reflect a declining fertility.

General fertility patterns of the provincial population were close to those of the crude birth rates:

	5	*6*	*7*	*8*	*1973*	*1974*	*1975*	
General fertility rates	194.4	161.7	185.0	164.5	194.4	193.4	164.5	A Estimates
	180.2	165.0	167.7	149.6	180.2	166.4	149.6	B Estimates
Currently married women	342.4	269.9	311.9	274.9	342.4	290.9	274.9	A Estimates
	329.9	283.0	293.6	261.3	329.9	288.3	261.3	B Estimates

These general fertility patterns and crude birth rates reveal a provincial fertility which has declined during the period from July 1, 1973 (the beginning of period five) through June 30, 1975 (the end of period eight). This overall decline, however, is less rapid than in the methodological sample or in the municipal southwest.

Standardized rates. To preserve the comparison with rates previously given for the methodological samples, the provincial A estimates were standardized on the period seven, rural population. The crude rate for period five decreased moderately but the other rates were little affected:

	5	*6*	*7*	*8*	*1973*	*1974*	*1975*
Crude birth rate	42.8	35.8	40.4	35.4	42.8	38.1	35.4
General fertility rate	196.0	164.0	184.9	164.3	196.0	174.4	164.3
Currently married women	365.1	278.0	319.5	284.0	365.1	298.8	284.0

Age-specific rates. Age-specific fertility rates for the three geographic strata--Cagayan de Oro City, the municipal southwestern segment, and the municipal northeastern segment--reveal that the decline in fertility occurs among women ages 25-39 and among the currently married somewhat less than among women of all marital

statuses. This circumstance might indicate that delayed marriage plays a larger part in the decline of provincial fertility than in Cagayan de Oro or in the methodological samples.

Standard errors of birth rates. Standard errors for the crude birth rates are given below in annualized form.* These generally were larger when the population was smaller, although not always if the size of the populations did not differ much. Variances of births and of coverage also affected the statistic, as in periods one and two. However, the effect of subsampling is evident in periods where 25 to 50 percent of the area was covered by the survey, for example, period six (25%), period three (50%), and period seven (50%). These estimates were computed for the methodological areas as though for a probability sample drawn from an infinite universe to indicate the approximate size such standard errors would have in a nationwide or other large-scale sample. In terms of births per 1,000 persons, standard errors were as follows:

1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	
3.6	2.8	5.7	4.6	2.8	7.1	5.6	2.5	Cagayan
1.6	2.6	3.4	2.7	2.1	4.1	3.5	2.1	Rural

*Dr. Eli S. Marks of the U.S. Bureau of the Census derived the formulas of these variance computations. The formulas used were relvariance formulas as follows:

$$(1)\quad v(n)^2 = \frac{s(n_1)^2}{E(n_1)^2} + \frac{s(n_2)^2}{E(n_2)^2} + \frac{s(m)^2}{E(m)^2} + \frac{2s(n_1n_2)}{E(n_1)E(n_2)} - \frac{2s(n_1m)}{E(n_1)E(m)} - \frac{2s(n_2m)}{E(n_2)E(m)}$$

where component variances were of the form:

$$s(n_1)^2 = \frac{\sum_{i=1}^{k}\left(\frac{n_{1i}}{P_i} - n_1\right)^2}{k(k-1)}$$

$$(2)\quad s(w_1)^2 = \frac{1}{E(n_2)^2}\left[s(m)^2 + W_1 s(n_2)^2 - 2W_1 \text{ rho } (mn_2) \cdot s(m) \cdot s(n_2)\right]$$

$$(3)\quad s(r_1)^2 = \frac{1}{B^2}\left[s(n_1)^2 + R_1{}^2 s(b)^2 - 2R_1 \text{ rho } (n_1b)s(n_1)s(b)\right]$$

$$(4)\quad s(r)^2 = \frac{1}{W_1^2}\left[s(r_1)^2 + R^2 s(w_1)^2 - 2R \text{ rho } (r_1w_1)s(r_1)s(w_1)\right]$$

and where, besides symbols already previously explained, W_1 is the expected value of the coverage rate, w_1; rho(mn_2) is the product moment correlation coefficient of m_i/P_i and N_2/P_i; P_i are the sampling ratios; B is the expected value of the population base, b, from each of the k sample clusters; R_1 is the expected value of the vital rates, r_1, reported from system 1 for each of the k sample clusters, and R is the expected value of the vital rates, r, based on the reports from both systems and the Chandrasekaran-Deming correction and, of course, the population bases from each cluster.

IV. DIFFERENTIAL FERTILITY BY EDUCATION AND OCCUPATION

One way to study a possible decline in fertility is to compare various categories of the population in terms of birth rates. Such analysis is often useful in understanding the nature of such a decline, pinpointing more precisely among what groups of people it is taking place, and understanding the dynamics of such a decline.

The decline in both urban and rural fertility documented in the preceding chapter furnishes sufficient motivation for such an analysis. The data presented in this chapter were used to investigate the possibility of differential fertility by educational category of women (all women and currently married women) and by occupational category of husband (currently married women) for periods two to seven of the methodological samples.

The predominant relationship between fertility and level of education and occupation often observed in first-world and second-world countries is an inverse one. Biological evidence would suggest that improved nutrition (seemingly a consequence of improved educational and occupational status and, therefore, of income status) is associated with higher fecundity and fewer fetal losses. Also, increased income might reasonably be expected to lead to increased investment in children or consumption of goods, as economists have suggested. If so, the relationship between fertility and socioeconomic categories would be positive at the deepest level.

One economist has suggested that differential access by economic categories to birth control information plus changed tastes for children relative to other goods may underlie the inverse relationships observed (Easterlin, 1966). In developing countries like the Philippines, traditionalism and cultural values may inhibit acceptance of family planning. Change in the evaluation of children in relation to other goods, from an economic point of view, presupposes the accessibility of such other goods (for example, rheostatically controlled electric irons cannot be used in regions where electricity is unavailable).

Further, mechanisms must exist for inducing behavioral modifications which result in changed tastes. Among such mechanisms undoubtedly are opportunities for learning new behavioral patterns as well as rewards of improved economic status and prestige. The presence or absence of such mechanisms may best be indicated by examination of fertility in terms of educational attainment and of occupational status.

In the long run, economic development and other social change can be expected to influence educational and occupational distribution and, to the extent that these variables influence fertility, to produce changes in birth rates. In the short run, however, the impact of social change may manifest itself in the differential responses of socioeconomic categories to changes in the larger society. The value of children in competition with other values, and the outlook upon birth regulation may change more rapidly among particular educational and occupational categories if the opportunities and rewards of social change are differentially experienced by diverse social categories.

MEASUREMENT OF VITAL RATES

The procedure is to examine current, rather than cumulative, fertility. This permits focus upon recent and dynamic aspects of fertility behavior in a society under rapid social change.

Data--Procedures and Qualifications

As stated previously, rates reported by period are for those subsample areas covered by the survey. Experimental reasons as well as budgetary considerations led us to restrict sample coverage. Seasonal variation was avoided by condensing the rates into annual calendar year rates. This was accomplished by giving each period equal weight in computing annual rates. If this had not been done, real dangers would exist that seasonal variation would confound analysis of trends over time.

A rough guide to interpretation of results has been prepared in Table 6, which presents standard errors for selected proportions under the assumption that the underlying distribution is binomial, and which treats the educational data as though each subsample were drawn as a simple random sample. Table 7 presents similar standard errors based upon the same assumptions for occupational data.

However, something must be said for a weighting scheme that assigns weights proportional to numbers of persons enumerated in each round. This approach should yield smaller standard errors. Therefore, indexes based on data for the entire three-year period have been calculated on a per person basis, since the comparison in this case is across either occupational or educational categories.

Fertility by Educational Categories

Urban areas. There is a striking decrease in the proportion of college-trained women from 1972 to 1974 but especially in 1974, and a consequent increase of women in low educational brackets, especially of women who have completed less than five grades of school. This finding raises questions for research. Is this change due to older residents moving into better homes outside the poblacion and being replaced in their former homes by poorer in-migrants? Or is it due more to simple in-migration? It seems likely that it is due to both. A second finding is that except for women who have completed less than five grades of school, college-trained women seem more likely to be married than the others. This fact may indicate delayed marriage until some years of college have been completed by a substantial number of women still going through grade and high school.

Table 8 presents data for the general fertility of women and of currently married women by educational categories (highest grade completed). Across years, the observed rates for all women show a slight downward gradient through high school, but the fertility of college-trained women is high. The average three-year relative rates for all women, from those with less than five grades through college-trained women, are,in order: 104.7, 98.3, 96.7, and 105.7. The figures suggest that fertility is lower for women who have completed intermediate and high school grades, and higher for both college-trained women and those in the lowest educational category.

Age standardization changes this picture, however. The fertility of women with less than college education increases, while that of college-trained women decreases.

TABLE 6

Estimated Standard Errors for Educational Differentials

1972

Highest Grade Completed	N_1	N_2	$(1/N_1 + 1/N_2)$	Standard Errors				
P				.10	.20	.30	.40	.50
Urban								
Less than 5	406	251	.0064	.024	.032	.037	.039	.040
5-7	1772	913	.0016	.012	.016	.019	.019	.020
8-11	2569	1403	.0011	.010	.013	.015	.016	.016
College or more	1989	1201	.0013	.011	.014	.017	.018	.018
Rural								
Less than 5	1541	771	.0019	.013	.018	.020	.022	.022
5-7	1843	918	.0016	.012	.016	.019	.020	.020
8-11	1273	650	.0023	.014	.019	.022	.024	.024
College or more	496	356	.0048	.021	.028	.032	.034	.035

1973

Highest Grade Completed	N_1	N_2	$(1/N_1 + 1/N_2)$	Standard Errors				
P				.10	.20	.30	.40	.50
Urban								
Less than 5	357	461	.0049	.021	.028	.032	.034	.035
5-7	1483	1959	.0011	.010	.014	.016	.017	.018
8-11	2222	2915	.0007	.008	.011	.013	.014	.014
College or more	1787	2183	.0010	.010	.013	.015	.016	.016
Rural								
Less than 5	1121	1496	.0015	.012	.016	.018	.019	.020
5-7	1387	1907	.0012	.010	.014	.016	.017	.018
8-11	1057	1346	.0016	.012	.016	.019	.020	.020
College or more	474	507	.0040	.019	.025	.029	.031	.032

TABLE 6 (*continued*)

Highest Grade Completed	N_1	N_2	$(1/N_1 + 1/N_2)$	Standard Errors				
			1974					
P				.10	.20	.30	.40	.50
Urban								
Less than 5	185	258	.0092	.029	.038	.044	.047	.048
5-7	523	955	.0029	.016	.022	.025	.027	.027
8-11	718	1512	.0020	.014	.018	.021	.022	.023
College or more	318	1182	.0039	.019	.025	.029	.031	.032
Rural								
Less than 5	281	691	.0050	.021	.028	.032	.035	.035
5-7	468	943	.0031	.017	.023	.026	.028	.028
8-11	371	652	.0042	.020	.026	.030	.032	.032
College or more	207	267	.0085	.028	.037	.042	.045	.046

TABLE 7

Estimated Standard Errors for Occupational Differentials

Year			1972					
	N_1	N_2	$(1/N_1 + 1/N_2)$	Standard Errors				
P				.10	.20	.30	.40	.50
Urban								
Professional & Paraprofessional	314	181	.0087	.028	.037	.043	.046	.047
Clerical	380	234	.0069	.025	.034	.038	.041	.042
Skilled	661	293	.0049	.021	.028	.032	.034	.035
Semiskilled	1061	564	.0027	.016	.021	.024	.026	.026
Manual	401	264	.0062	.024	.032	.036	.039	.040

TABLE 7 (*continued*)

	N_1	N_2	$(1/N_1 + 1/N_2)$	Standard Errors				
P				.10	.20	.30	.40	.50
Rural								
Professional & Paraprofessional	79	75	.0259	.048	.064	.074	.079	.080
Clerical	36	23	.0712	.080	.107	.122	.131	.133
Skilled	121	86	.0198	.042	.056	.065	.069	.070
Semiskilled	1237	559	.0025	.015	.020	.023	.025	.025
Manual	1619	862	.0017	.013	.017	.019	.021	.021

1973

P				.10	.20	.30	.40	.50
Urban								
Professional & Paraprofessional	383	480	.0046	.020	.027	.031	.034	.034
Clerical	318	370	.0058	.023	.030	.035	.037	.038
Skilled	394	564	.0043	.020	.026	.030	.032	.033
Semiskilled	827	1093	.0021	.014	.018	.021	.022	.023
Manual	376	519	.0045	.020	.027	.031	.033	.034
Rural								
Professional & Paraprofessional	83	96	.0224	.045	.060	.069	.073	.075
Clerical	49	50	.0404	.060	.080	.092	.098	.100
Skilled	116	159	.0149	.037	.049	.056	.060	.061
Semiskilled	931	1134	.0019	.013	.018	.020	.022	.022
Manual	1239	1727	.0013	.011	.015	.017	.018	.019

1974

P				.10	.20	.30	.40	.50
Urban								
Professional & Paraprofessional	62	204	.0210	.044	.058	.066	.071	.072
Clerical	65	232	.0196	.042	.056	.064	.069	.070
Skilled	122	305	.0114	.032	.043	.049	.052	.054
Semiskilled	420	578	.0041	.019	.026	.029	.031	.032
Manual	195	255	.0090	.028	.038	.044	.047	.048

TABLE 7 (*continued*)

	N_1	N_2	$(1/N_1 + 1/N_2)$	Standard Errors				
P				.10	.20	.30	.40	.50
Rural								
Professional & Paraprofessional	62	57	.0336	.055	.073	.084	.090	.092
Clerical	27	59	.0539	.070	.093	.106	.114	.116
Skilled	62	93	.0268	.049	.066	.075	.080	.082
Semiskilled	286	597	.0051	.022	.029	.033	.035	.036
Manual	358	733	.0041	.019	.026	.030	.032	.032

TABLE 8

Observed and Indirectly Age-Standardized General Fertility Rates for Women and Currently Married Women, 15-49, by Educational Level, Calendar Year and Period of Observation, Urban Areas

GENERAL FERTILITY RATES, ALL WOMEN						
Highest Grade Completed	Observed			Indirectly Standardized[a]		
	1972	1973	1974	1972	1973	1974
Less than 5	137.6	115.5	174.3	157.7	129.0	191.0
5-7	133.2	139.2	129.8	141.2	148.5	136.9
8-11	134.3	132.6	127.0	151.2	151.1	134.4
College or more	125.8	138.4	165.8	102.1	110.6	133.8
	Relative Rates (136.0 = 100)					
Less than 5	101	85	128	116	95	140
5-7	98	102	95	104	109	101
8-11	99	98	93	111	111	99
College or more	93	102	122	75	81	98

TABLE 8 (*continued*)

GENERAL FERTILITY RATES, CURRENTLY MARRIED WOMEN						
Highest Grade Completed	Observed			Indirectly Standardized[b]		
	1972	1973	1974	1972	1973	1974
Less than 5	278.5	208.3	315.8	319.2	232.6	346.1
5-7	310.5	339.4	268.8	329.1	362.1	283.6
8-11	343.9	356.4	298.2	387.2	406.1	315.6
College or more	277.9	302.0	331.7	225.6	241.3	267.7
	Relative Rates (302.6 = 100)					
Less than 5	92	69	104	105	77	114
5-7	103	112	89	109	120	94
8-11	114	118	99	128	134	104
College or more	92	100	110	75	80	88

[a]Average rates for calendar years 1972, 1973, and 1974 used as standard.
[b]Average rates for calendar years 1972, 1973, and 1974 for currently married women used as standard.

This is seen in the standardized relative rates. The unweighted averages of the relative rates for the three years are, from lowest to highest educational category: 117.0, 104.7, 107.0, and 84.7. It was a distributional quirk that made the fertility of college-educated women appear higher.

How much of the lower fertility of college women is due to delay of first marriage? The answer to the question is furnished by the rates of the currently married women also shown in Table 8. The unweighted averages across the three years for the observed rates are: 268, 306, 333, and 304. Except for college women, these rates suggest positive rather than negative association between fertility and highest grade completed. The rate for college women nevertheless is below average in the set and is the second lowest fertility. However, this rate is not relatively as low as, and as much below average as, the standardized rate for all women of college attainment. One may ask whether this difference is principally due to the effect of delaying first marriage. Standardization of the rates of currently married women provides a negative answer. The unweighted averages for the three calendar years become, from lowest to highest educational categories: 299.3, 324.9, 369.6, and 244.8. While the general effect of standardization has been to raise the level of fertility, in the case of college-trained women it has lowered this level. The decline is greater than that found among all women. The conclusion is that delayed marriage is not sufficient to account for most of the difference in fertility between college-trained women and those with lower educational achievement. Fertility restriction within marriage by one of the family planning measures like

periodic continence, the pill, or the IUD, appears more responsible for the decline in fertility than delay in marriage, although that undoubtedly plays some part.

Returning to the distribution of fertility for the standardized rates for currently married women, one observes an "i" curve, low at both ends, high in the middle. Presumably the lower fertility of the college-trained women is associated with their greater ease in access to family planning knowledge and services, as well as to their desires for various practicable goods, whose purchase would conflict with having another child. What then could explain the fertility of women with less than five years education who exhibit the second lowest fertility of the four groups? The authors hypothesize that the lower fertility of this category is both a) bound up with hard financial times of the past four years (marked by a food shortage felt most by the lowest economic class and price inflation without wage increases or employment opportunities), and b) connected with increased desires for more of the less expensive modern goods found in Philippine cities.

Rural areas. Unlike urban women, women of rural sample areas exhibited an increase in educational level over time. Across the three years, women who had completed less than five grades of elementary school decreased by 15 percent (29.46 to 25.05) while the percentage of women who had completed higher grades increased by off-setting amounts. Net migration presumably accounted for most of these changes. The area has been electrified since 1971, and may have attracted women in-migrants with higher educational qualifications who could benefit from some of the increased employment opportunities in the area.

Fertility differentials of rural women by educational categories are shown in Table 9. The observed rates of women of all marital statuses, ages 15-49, indicate the presence of inverse differential fertility. The unweighted averages of the relative rates for the three calendar years, from lowest to highest grades completed, are: 119, 115, 65, and 82.

Thus higher fertility is exhibited by women with less education according to the Western model. Age standardization does not change this pattern of inverse differential fertility, but makes it more clear-cut. The two extremes are more distinct and the inversion exhibited by the unstandardized rates for college-trained women disappears. The average rates are 128, 109, 74, and 65.

This inverse fertility is striking. It certainly suggests a real decline in fertility, beginning with the better educated. Another striking feature of the data is the decline in fertility across the years from 1972 to 1974 within categories. A close look at each category of education except that of women who have completed one or more years of college shows that in almost every case as one goes from 1972 to 1973 to 1974, fertility declines--with few exceptions at almost every step.

It is not clear why women who have completed one or more years of college do not exhibit a similar decline in the third year. Perhaps the rates fluctuate more because of the smaller sample of such women. Perhaps, too, they have been practicing family planning longer (as evidenced by their lower fertility) and further declines in their fertility cannot be expected to be so rapid.

The data just given on currently married women raise questions as to the part

TABLE 9

Observed and Age-Standardized General Fertility Rates for Women and Currently Married Women, 15-49, by Educational Level, Calendar Year and Period of Observation, Rural Areas

GENERAL FERTILITY RATES, ALL WOMEN

Highest Grade Completed	Observed			Indirectly Standardized[a]		
	1972	1973	1974	1972	1973	1974
Less than 5	240.8	213.2	162.9	256.6	231.4	177.9
5-7	248.4	197.2	152.8	234.0	187.5	147.8
8-11	121.6	129.6	90.5	137.6	143.8	105.1
College or more	131.5	135.2	157.0	107.3	106.3	123.2
	Relative Rates (173.2 = 100)					
Less than 5	139	123	94	148	134	103
5-7	143	113	88	135	108	85
8-11	70	74	52	79	83	61
College or more	76	78	91	62	61	71

GENERAL FERTILITY RATES, CURRENTLY MARRIED WOMEN

Highest Grade Completed	Observed			Indirectly Standardized[b]		
	1972	1973	1974	1972	1973	1974
Less than 5	326.3	283.1	213.2	347.7	307.3	232.8
5-7	368.3	294.5	231.9	347.0	280.0	224.3
8-11	301.7	318.3	236.4	341.4	353.1	274.5
College or more	292.2	286.7	298.0	238.4	225.4	233.8
	Relative Rates (285.5 = 100)					
Less than 5	114	99	75	122	108	82
5-7	129	103	81	122	98	79
8-11	106	111	83	120	124	96
College or more	102	100	104	84	79	82

[a]Average rates for calendar years 1972, 1973, and 1974 used as standard.
[b]Average rates for calendar years 1972, 1973, and 1974 for currently married women used as standard.

delayed marriage plays in the decline in fertility observed across calendar years and with increases in level of occupation. These data indicate that a moderate amount of the decline may be due to delayed marriage. The observed rates show less decline in all categories of education, including women with one or more years of college education. The rates continue to decline across calendar years, however. It should be emphasized again that these are current rates, not cumulative rates; therefore, they reflect only the experience of the years in question. Consequently, they are a sensitive instrument for measurement.

The age-standardized rates reveal the trends more accurately. These were somewhat obscured by different distributions by calendar year. They generally continue not only to reflect a decline in fertility across calendar years within marriage (although not from delayed marriage) but also a large decline by college-trained women from the level of women with less education. The level of fertility of women with less than college education does not differ much by educational category when age differences of married women are allowed for.

It would seem, therefore, that delayed marriage has played a rather important role in the fertility decline of these rural women with less than college education during the years 1972 to 1974. It played a less important though perhaps still substantial part in the fertility reduction of women who had completed at least one year of college. The conclusion seems to be that college women have led the way in the practice of family planning. This appears to be an important point in relation to family planning program plans and policy.

Fertility by Occupational Class

Urban areas. Respondents were asked to describe their husbands' occupations in terms of the industry worked in and the precise kind of work performed. A great number of such occupations were obtained and were categorized into five occupational status classes: professional and paraprofessional, clerical, skilled, semiskilled, and manual. The distribution is chiefly notable for a small decline in clerical (14.10 to 12.18 percent) and skilled workers (21.94 to 17.51 percent) and a small gain in number of semiskilled (37.32 to 40.95 percent) and manual workers (15.26 to 18.49 percent) over the three calendar years. Some of these differences may have been due to sampling, although as has been said previously, in-migration and suburban out-migration occurred on a large scale.

Lowest fertility for both observed and standardized rates is exhibited by the wives of professionals and paraprofessionals. For observed rates as shown in Table 10, the unweighted annual averages across the three years are, from professional to manual categories: 232.2, 298.0, 289.2, 327.1, and 356.0.

When the rates are age-standardized, the same categories in the same order are characterized by the following rates: 289.6, 323.3, 293.3, 307.2, and 339.8.

After standardization, some inverse fertility remains between prestige ranking of occupations and fertility. Wives of professionals and of paraprofessionals have lowest fertility and wives of manual laborers highest. But the wives of clerical workers have high fertility and those of skilled and semiskilled workers rather low fertility.

TABLE 10

Observed and Age-Standardized General Fertility Rates of Currently Married Women, 15-49, by Husband's Occupational Status and Year and Period of Observation, Urban Areas

Occupational Status	GENERAL FERTILITY RATES					
	Unstandardized			Indirectly Standardized		
	1972	1973	1974	1972	1973	1974
Professional and paraprofessional	292.8	197.5	206.3	377.3	252.5	238.9
Clerical	305.1	307.8	281.0	335.9	324.6	309.4
Skilled	207.6	308.6	351.3	219.5	301.9	358.6
Semiskilled	320.6	360.2	300.4	304.6	339.6	277.4
Manual	400.4	377.6	290.1	380.9	357.4	281.0
	Relative Rates (308.9 = 100)					
Professional and paraprofessional	95	64	67	122	82	77
Clerical	99	100	91	109	105	100
Skilled	67	100	114	71	98	116
Semiskilled	104	117	97	99	110	90
Manual	130	122	94	123	116	91

The high fertility of the wives of manual laborers is not altogether surprising, as it reflects a common finding of differential fertility studies. Nor is the finding that professionals and paraprofessionals exhibit lower fertility unusual, since the educational data just examined revealed that currently married women with college training exhibited lower fertility. Presumably, the wives of professionals and paraprofessionals would be predominantly from this educational category. Perhaps the wives of the skilled and semiskilled include more women from the lowest educational category, which may explain why this category had low fertility--that is, because of social emulation and aspirations. It is clear that professionals and paraprofessionals (upper-level business executives, high-ranking government officials, dentists, engineers, and so forth) represent a set of people whose fertility is low in comparison with other occupational and educational categories of the urban population. Perhaps an implication for population communication policy is that such people are attracted to the practice of family planning. Therefore, less funds need be expended upon communications addressed towards them and more upon such people as clerical workers and the skilled and the semiskilled, who are both more numerous and harder to influence.

Rural areas. The difference in distribution of currently married wives by the

occupational class of their husbands in urban and rural areas is striking. An aspect of rural Philippine society which perhaps is characteristic of developing countries, in general, immediately stands out. The percentage of professionals and paraprofessionals is much smaller than in urban areas, and the percentage of manual laborers much larger. Most of the latter are farmers, fishermen, or persons engaged in other outdoor occupations. In the Philippines, professionals who do live in rural areas tend to live in the poblacions (town centers) of municipalities. The number of clerical workers is also much smaller in rural areas, and they tend to be a poorer and less educated group than their city counterparts. The one occupational category that tends to be represented to about the same degree in both rural and urban societies is the semiskilled worker. However, semiskilled workers living in rural areas tend to be somewhat poorer and less well trained.

The changes in proportions over the years seem small enough to be due to sampling variation. However, the in- and out-migrations were also large enough to make some contribution to such change.

The fertility differentials of wives by occupational class of husbands by rural area are shown in Table 11. The order of observed fertility level by occupational class from lowest to highest for these years is skilled, semiskilled, professionals and paraprofessionals, manual laborers, and clerically employed. Unweighted average general fertility rates observed per thousand for the three-year period are: 199, 212, 260, 345, and 384.

These rates appear to show that lowest fertility was found among the skilled. The higher fertility of professionals and paraprofessionals is somewhat surprising. Rural professionals and paraprofessionals may be a somewhat different type than their urban counterparts. Sampling variance may also have played a part as their number is small.

Since education had related negatively to fertility level, it seemed reasonable to combine the skilled, professional and paraprofessional classes in view of their higher educational achievements as well as the limited number of cases of each in the rural sample. Similarly it seemed desirable to combine clerical (in the rural areas, these people typically showed low educational achievement) with the manual category, again because of the small number of clerical workers reported.

The results of these combinations for each of the three years 1) for the wives of professionals, paraprofessionals, and skilled workers, 2) for the wives of semiskilled workers and, 3) for the wives of clerical and manual workers are:

	Observed			Standardized		
	1972	*1973*	*1974*	*1972*	*1973*	*1974*
1)	250.9	192.3	230.0	317.1	221.1	261.9
2)	241.7	207.6	185.2	265.5	192.8	192.8
3)	411.1	367.5	260.6	380.8	253.3	253.3

Lowest fertility throughout the three years was exhibited by the semiskilled category, both in standardized and in unstandardized rates. This is brought out

TABLE 11

Observed and Age-Standardized General Fertility Rates of Currently Married Women, 15-49, by Husband's Occupational Status and Year and Period of Observation, Rural Areas

Occupational Status	GENERAL FERTILITY RATES					
	Unstandardized			Indirectly Standardized		
	1972	1973	1974	1972	1973	1974
Professional and paraprofessional	285.1	227.1	267.8	374.6	278.4	337.2
Clerical	340.0	568.4	244.0	466.2	652.4	254.2
Skilled	225.3	169.4	201.0	274.2	184.0	204.0
Semiskilled	241.7	207.6	185.2	265.5	221.9	192.8
Manual	412.8	360.8	261.9	378.8	334.2	253.2
	Relative Rates (287.6 = 100)					
Professional and paraprofessional	99	79	93	130	97	117
Clerical	118	198	85	162	227	88
Skilled	78	59	70	95	64	71
Semiskilled	84	72	64	92	77	67
Manual	143	125	91	132	116	88

more clearly by the three-year averages for the three categories, given in order from highest to lowest prestige rankings, that is, in the order above of 1), 2), and 3):

Observed			Standardized		
224.4	211.5	346.4	266.7	226.7	326.2

Cumulative fertility. The approach used stressed current fertility. This choice was motivated by the desire to see what categories may have contributed to the decline in fertility noted in both rural and urban areas during the four years covered by the dual record operations. Mention should be made of the work done by Michael A. Costello, a doctoral candidate at the University of Chicago. Mr. Costello did field work in Cagayan de Oro City for his dissertation in connection with data being gathered by the MCPS dual record system. His intent was a longer look at differential fertility, not just over the calendar years 1971-1975, but over the entire childbearing periods of the women in his sample.

His work, now in progress, suggests rather regular patterns of inverse differential fertility by educational class of wife, both rural and urban. He also found, on the one hand, about the same fertility existed for urban wives with husbands in professional, paraprofessional, and white collar occupations. On the other hand, he found higher fertility for the skilled, unskilled, and semiskilled, in that order. In the rural area, he found that the professional and paraprofessional category had lowest fertility, followed by white collar workers, skilled, semiskilled, and unskilled, in that order.

These results are not only interesting but quite compatible with those found by the current fertility approach. Differences are attributable to the longer time interval covered in the cumulative fertility methodology and to the effects of delayed marriage upon number of children ever born. Women who have gone through high school or college may have delayed their marriages. If so, it would show up in their cumulative birth rates, not only by educational categories but by occupational groups where education would play a greater or smaller part in obtaining employment in such fields.

Conclusion. In concluding this section on differential fertility from current birth rates, the authors point to rural and urban differences in categories of low and high fertility. Perhaps this is the most important point for population program administrators to keep in mind when designing their programs. A program for rural areas need not necessarily be the same as one designed for urban areas, and on the basis of the foregoing data, one would think it should not be. Secondly, a policy decision must be made on whether to concentrate first on those people more receptive to family planning measures, leaving the others to follow suit, or to concentrate upon the more difficult target groups on the assumption that those who are more receptive to family planning will need less inducement to practice it, if it is simply made available to them. The larger populations in the manual category provide some reason for choice of the second alternative.

V. LEVELS OF MORTALITY AND NATURAL INCREASE IN URBAN AND RURAL MISAMIS ORIENTAL

In the Philippines, considerably more attention and research has been devoted to the subject of fertility than to the topic of mortality. To some extent many phases of mortality remain unexplored.

Reports from the vital registration system throw little light on this subject. Despite strenuous efforts by the Registrar General to improve registration of births and deaths, cooperation of the general public remains apathetic. In mountainous terrain (such as characterizes many of the islands of the Philippines, and especially Mindanao) where roads linking the hamlets and villages with the town centers where registration must take place are often non-existent, and where trails tend to be arduous and tortuous, farmers and their wives are unlikely to be mindful of their civic obligation to register a new birth or death (particularly the death of a small child or an aged relative). Deaths are likely to be followed quickly by local burial without official permits or other legalities. The local padre or minister (from a town center) will be asked to bless the grave if he chances to visit during the next three or four months. Moreover, evidence exists that young children and even aged relatives who have died in the town center are often removed for a quiet unregistered burial in the sitios or barangays.

In this vein, a governmental survey estimated that 39.7 percent of all births and 30.0 percent of all deaths had not been registered during the preceding year. In the census region of northeastern Mindanao (which includes Misamis Oriental Province), the survey estimated that only 36.7 percent of births and only 22.0 percent of deaths had been registered (Philippines, Bureau of the Census and Statistics 1965).

Background

Mortality has declined since the last century in the Philippines. Since fertility did not greatly increase over its traditional level, the apparent large increase in population size and rate of population growth could not have occurred without this decline in mortality.

Better medical services, better nutrition, educational advances, and socioeconomic improvement have all contributed to a reduction of death rates in the country. Especially important has been the application of modern epidemiology and modern sanitation to previously existing conditions. For example, a vigorous campaign against malaria has placed this once endemic disease under much greater control.

Severe cholera epidemics raged in the Philippines during the years 1879, 1889, and 1890. Letters from that time describe whole towns decimated by epidemics and abandoned by their people. The death rate of 1879 is said to have been 106.3 per thousand persons (U.S. Bureau of the Census 1905, p. 17). The average death rate seems to have been about 40 per thousand between 1876 and 1898 (Madigan et al. 1972, p. 142).

As late as the beginning of the present century, the mortality rate had not

greatly improved. The crude death rate reported for 1902 was 63.3 deaths per thousand and that for 1903 was 47.2 (Madigan et al. 1972, p. 143). Since that date, intercensal death rates per thousand population have been estimated (Aromin 1961, p. 4) as follows:

1903-18	*1918-39*	*1939-48*	*1948-60*
29.8	26.8	29.9	17.2

Causes of death. Cause of death has been hard to estimate accurately for the same reason that makes mortality level difficult to estimate accurately--underregistration. Most of the deaths, especially those occurring earlier in the present century, were unattended by doctors, nurses, or other medically trained personnel. Thus most reports of cause of death were not reliable. Cause of death information had to be compiled from those deaths attended by physicians; the dangers of bias in such a selected sample are evident.

Nevertheless, it is clear that at the turn of the century the major causes of death were the acute infectious-contagious diseases like malaria, smallpox, and cholera, together with tuberculosis and beri-beri, whereas today gastroenteritis, respiratory disease, cardiovascular disease, and cancer are some major causes of death (Madigan et al. 1972, pp. 151-152). The change from predominance of acute infectious-contagious diseasesto chronic-organic diseases has resulted in a longer life span associated with diseases of advancing age and breakdown of bodily functions.

Cagayan rates, 1953-1962. In an earlier study of the central death rates of Cagayan de Oro respondents and of their close relatives (not necessarily resident in Cagayan), the following death rates were found (Madigan et al. 1972, p. 156):

Period	*Both Sexes*	*Male*	*Female*
1953-1957	6.6	6.6	6.7
1958-1962	7.5	7.6	7.3
1962	5.2	4.9	5.5

At that time, these death rates seemed too low. They were, however, based upon what appeared to be complete data about the respondent's immediate relatives (parents, siblings, and children); no persons were to be omitted from the declared relatives, living and deceased. Interviews were conducted carefully and the percentage of non-response was low.

Mortality Estimates in the Dual Record Study: Methodological Samples

Coverages of the two systems and the dual unit. Coverages of death have not been as high as coverages of birth. From the beginning of the dual record field work, interviewers and recorders noticed a greater reluctance of respondents to reply to questions relating to dead family members. They reported this difficulty and mainly attributed it to the cultural belief that it is unlucky to speak about death in connection with your own family as death might be brought upon the remaining members. Coverages of death in the urban area were less satisfactory than in the rural sample, although they improved over time. Nevertheless, rural coverages of mortality remained consistently higher than urban coverages. Urban coverages by period for the two systems and the dual unit are:

Unit	PERIOD								
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*Average*
Survey	48.5	70.8	84.4	91.2	83.3	76.9	65.1	79.3	74.9
Recorders	72.7	81.0	77.1	81.3	87.9	76.9	77.8	85.5	80.0
Dual	86.0	94.4	96.4	98.4	98.0	94.7	92.2	97.0	94.6

As can be seen, after the first period dual record coverage was always above 90 percent, and generally about 95 percent or better. The recording system was consistently better than the survey system but the survey system chalked up the highest coverage of the two systems in the fourth round (although it had also achieved lowest score of the two systems in the first round). Since intensive efforts involving incentives, morale building, and supervising were constantly being made to improve the reporting of death events, it is clear that special difficulty attaches to obtaining this datum in the Cagayan de Oro hinterland.

Rural workers reported the same difficulty. Their coverages of mortality were, nevertheless, greater. For periods in the same order, coverages are:

Unit									
									Average
Survey	78.8	83.5	90.9	96.6	89.3	82.8	97.7	84.9	88.1
Recorders	89.1	95.9	97.6	96.6	100.0	96.0	87.5	96.6	94.9
Dual	97.7	99.3	99.8	99.9	100.0	99.3	99.7	99.5	99.4

Again recorders outdid the survey. The dual record coverage (observed over "true" estimated number of deaths) was never below 97.7 percent.

Crude rates: Urban and rural. Death rates presented in this section are central rates: that is, they are based on total population size at midpoint of the study period, and on deaths during the period, $({}_n m_x)$. It should be emphasized that these are de jure, or residential deaths--that is, the deaths of persons who at time of death were residents within the sample areas. Such deaths are opposed to de facto, or place of occurrence deaths. This distinction is pertinent, because place of occurrence deaths in the Philippines are always higher in the cities, and especially the larger cities--not because the cities are less healthy to live in but because the larger and better hospitals (in fact, most of the hospitals) are in the cities or provincial capitals (where the capital is not a city). The more seriously sick from outlying municipal areas travel to and enter these hospitals, and consequently many of them die in the cities. It is quite important to keep this distinction in mind when trying to judge levels of mortality in the Philippines by comparing different urban sites, both among themselves and with rural localities.

The crude death rates observed per thousand persons for the methodological samples by order of period are:

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Urban	6.4	8.0	6.7	7.7	9.1	11.1	8.7	7.6
Rural	7.6	7.5	7.4	6.7	10.0	10.2	8.3	5.7

The rates for the three different strata of the provincial probability sample and for the province for the same time periods are fairly similar:

	5	*6*	*7*	*8*
Urban probability sample	15.1	9.9	6.5	7.5
Rural southwest probability sample	8.7	10.1	5.6	11.1
Rural northeast probability sample	10.8	12.0	12.2	10.1
Provincial probability sample	10.8	11.2	9.0	10.0

Calendar rates (again with the qualification that the first rate covers only the last four months of 1971 and the last rate only the first six months of 1975) bring out mortality more clearly because they eliminate seasonal variation (which can be large). They are:

	1971	*1972*	*1973*	*1974*	*1975*
Urban methodological	6.4	7.4	8.4	9.9	7.6
Rural methodological	7.6	7.4	8.4	9.2	5.7
Urban probability	--	--	15.1	8.2	7.5
Municipal southwest	--	--	8.7	7.8	11.1
Municipal northeast	--	--	10.8	12.1	10.1

Age standardization of these rates adjusted them in terms of the population of period eight (urban) and of period seven (rural). The effect was to smooth away some of the differences. The standardized rates for the methodological samples are:

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Urban	6.7	8.3	6.6	7.7	8.8	9.9	8.7	7.6
Rural	7.5	7.1	6.8	6.3	9.6	9.8	7.8	5.7

Calendar year standardized rates are:

	1971	*1972*	*1973*	*1974*	*1975*
Urban	6.7	7.4	8.2	9.3	7.6
Rural	7.5	7.0	8.0	8.8	5.7

Infant mortality. Infant mortality should be carefully distinguished from central death rates for children under one year of age, which will be exhibited in the tables of age-specific death rates. Infant mortality is a measure of the children less than one year of age who have died during the past year (or other time period) per thousand live births for the year under consideration. The central death rate for children under one is a measure of the number of children under one who died during the previous year per thousand children under one year of age living at midpoint of the year. The difference in base can make these two rates differ substantially. The infant mortality rate on the other hand tends to be fairly close to the mortality rate for children under one year of age of the life table ($_1q_0$).

Infant mortality for the methodological samples during the eight study periods increased over time:

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Urban	53.3	66.6	36.0	65.6	78.7	120.0	95.8	82.5
Rural	40.9	62.5	64.9	66.8	88.2	107.5	81.5	33.6

This increase can be seen more clearly in the rates for calendar years:

	1971	*1972*	*1973*	*1974*	*1975*
Urban	53.3	51.3	72.2	107.9	82.5
Rural	40.9	63.7	77.5	94.5	33.6

These rates give a rather different picture than those for the probability sample which from the second half of 1973 onward are:

	1973	*1974*	*1975*
Urban probability	42.6	52.8	62.0
Municipal southwest	77.7	53.2	59.6
Municipal northeast	100.1	87.3	73.2
Province probability	83.3	70.2	66.8

Only the urban probability sample showed increasing mortality over the two-year period. However, the general level of infant mortality, as evidenced by the provincial rates, was high and not very different in level from the methodological samples.

Age-specific mortality. Age-specific mortality by sex is shown in Tables 12 and 13 for the urban and rural methodological samples. Examination of the tables brings out the differences between males and females. As in most countries, males at almost every age had higher mortality than females--in both urban and rural populations. The pattern of mortality also is clear in these tables. Moderate to high death rates are experienced by children under age one, followed by quite substantial mortality during the next four years of life. Rates for ages 5-9 fall very low and reach their lowest point for ages 10-14. After this, mortality climbs slowly until ages 40-44 when it begins to take a sharp upturn. The pattern seems to differ somewhat from any of the four families of the Princeton life tables (Coale and Demeny 1966). It starts higher, bottoms out lower, and rises more slowly during the adolescent and young adult ages. It perhaps is closer in pattern to the Model East tables than to others.

Graduated rates for calendar years corresponding to the periods shown in these tables of observed rates will be found in Table 14. The chief function of this table is to iron out some of the random variation of observed rates so that a more consistent picture of the mortality curve underlying observed period rates may be obtained.

Two different estimates (A and B) of age-specific death rates by sex are presented in Table 15 for Misamis Oriental Province. Both estimates show a small male decline in mortality over the four six-month periods. The A estimate does not show much net change in female death rates over the four periods, but the B estimate indicates a slight decline. These results are fairly consistent with results for the same time periods in the methodological samples.

Mortality level. As mentioned elsewhere, the authors have had serious reservations about the level of mortality rates reported by the two systems of the dual record system. But careful observation of the work of field personnel of both systems, from supervisors down, revealed no faults in procedure or even traces of collusion, and in fact convinced investigators at different times that work was being done exceptionally well. In addition, various procedures, already described in an

TABLE 12

Annualized Age-Specific Death Rates by Sex and Urban Areas, Periods One to Eight

Age at Exposure	PERIOD 1	2	3	4	5	6	7	8
				MALES				
0	130.6	103.7	37.9	83.3	118.4	144.5	104.6	92.8
1-4	2.9	11.3	10.8	15.1	18.6	14.9	13.7	8.6
5-9	2.7	1.6	2.8	1.9	5.7	0.0	5.7	1.4
10-14	0.0	5.6	3.2	2.2	0.0	0.0	3.4	0.0
15-19	0.0	3.0	3.0	1.9	0.0	0.0	0.0	2.8
20-24	0.0	1.6	2.8	7.4	0.0	0.0	0.0	2.5
25-29	0.0	4.5	8.1	2.7	4.1	8.8	3.8	9.1
30-34	10.1	0.0	5.4	0.0	7.6	0.0	0.0	5.5
35-39	7.1	8.2	0.0	4.7	3.5	13.9	7.0	3.1
40-44	0.0	0.0	9.4	6.0	4.5	0.0	19.9	9.3
45-49	37.1	21.3	12.4	0.0	18.2	0.0	0.0	11.4
50-54	27.2	0.0	14.4	20.1	7.7	0.0	30.0	15.1
55-59	19.8	11.3	39.5	25.9	10.5	0.0	21.6	31.8
60-64	25.6	15.4	25.8	37.5	41.4	0.0	75.9	12.2
65+	41.9	48.1	38.7	92.3	47.5	140.3	73.2	66.5
All ages	9.0	8.8	8.2	10.4	11.3	12.0	11.5	9.6
				FEMALES				
0	23.8	79.0	42.7	67.4	82.8	125.5	125.3	90.4
1-4	8.6	14.9	5.8	10.2	10.8	21.0	0.0	7.8
5-9	0.0	1.6	8.2	3.8	2.9	0.0	0.0	0.0
10-14	0.0	3.4	0.0	2.0	0.0	0.0	0.0	0.0
15-19	1.6	3.0	0.0	1.2	0.9	4.3	3.9	1.7
20-24	0.0	1.3	2.3	0.0	1.1	0.0	0.0	1.0
25-29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30-34	0.0	0.0	4.9	3.4	5.2	0.0	0.0	2.6
35-39	7.4	8.4	7.3	0.0	3.4	13.0	0.0	3.2
40-44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9
45-49	13.0	0.0	0.0	0.0	13.3	0.0	13.0	18.0
50-54	16.1	18.0	28.5	10.1	8.3	0.0	0.0	7.9
55-59	20.0	12.1	22.4	15.0	11.1	0.0	0.0	0.0
60-64	50.6	28.7	26.4	0.0	34.8	56.6	20.5	23.2
65+	21.5	60.5	20.6	47.6	70.8	55.2	75.7	36.8
All ages	4.1	7.3	5.4	5.3	6.9	10.2	6.2	5.9

TABLE 13

Annualized Age-Specific Death Rates by Sex, Rural Areas, Periods One to Eight

Age at Exposure	PERIODS 1	2	3	4	5	6	7	8
				MALES				
0	76.3	61.2	74.9	75.6	143.0	122.3	124.1	16.1
1-4	8.0	9.8	7.0	7.9	13.7	13.8	4.9	3.8
5-9	3.1	2.0	0.0	1.3	2.0	0.0	2.1	1.0
10-14	0.0	3.6	0.0	0.0	1.2	0.0	0.0	1.1
15-19	2.2	2.9	5.6	0.0	1.4	0.0	0.0	1.5
20-24	0.0	5.9	3.8	2.4	0.0	0.0	3.9	0.0
25-29	0.0	2.7	0.0	3.7	5.6	5.4	11.0	2.6
30-34	0.0	0.0	5.6	0.0	11.8	0.0	11.3	0.0
35-39	5.4	0.0	0.0	0.0	3.3	0.0	0.0	9.9
40-44	7.4	0.0	0.0	6.3	8.9	77.4	0.0	0.0
45-49	9.0	0.0	10.3	0.0	0.0	0.0	9.8	0.0
50-54	11.6	7.3	0.0	0.0	6.9	56.4	13.9	20.9
55-59	26.4	0.0	16.5	10.5	7.8	0.0	15.0	24.4
60-64	95.6	0.0	43.1	0.0	39.5	0.0	37.3	44.2
65+	54.0	53.3	34.7	90.7	79.6	45.1	62.8	52.4
All ages	9.3	7.0	7.4	7.4	12.1	11.6	10.7	5.4
				FEMALES				
0	22.0	70.8	97.4	65.9	54.2	102.6	50.5	52.2
1-4	12.4	7.8	14.7	1.7	9.9	10.1	2.5	10.5
5-9	1.6	2.1	2.0	0.0	2.1	0.0	4.3	0.0
10-14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19	0.0	1.5	0.0	1.8	0.0	0.0	0.0	0.0
20-24	0.0	4.1	4.0	2.7	4.1	0.0	0.0	0.0
25-29	0.0	0.0	0.0	0.0	5.4	10.9	0.0	2.5
30-34	0.0	0.0	0.0	12.0	3.0	0.0	5.9	0.0
35-39	5.3	3.5	0.0	0.0	0.0	0.0	7.1	3.3
40-44	0.0	0.0	9.1	0.0	0.0	0.0	35.3	4.6
45-49	8.1	15.4	0.0	0.0	9.5	0.0	9.7	0.0
50-54	12.6	0.0	0.0	0.0	0.0	28.6	0.0	6.9
55-59	15.6	9.8	0.0	12.4	35.4	0.0	0.0	8.6
60-64	32.5	22.0	0.0	25.0	10.7	42.3	0.0	22.4
65+	61.0	82.5	37.8	68.5	84.7	66.9	35.0	64.2
All ages	5.8	8.0	7.4	6.1	7.8	8.8	5.8	6.0

TABLE 14

Graduated Age-Specific Death Rates by Years, Sex and Area, Methodological Samples[a]

Ages[b]	MALES 1971[c]	1972	1973	1974	1975[d]	FEMALES 1971[c]	1972	1973	1974	1975[d]
					URBAN					
0	130.6	70.8	100.8	124.6	92.8	23.8	60.8	75.1	125.4	90.4
1-4	2.9	11.0	16.8	14.3	8.6	8.6	10.4	10.5	10.5	7.8
5-9	0.0	2.2	1.4	0.9	0.0	0.5	4.9	0.3	0.2	0.0
10-14	0.1	1.8	1.6	1.0	1.1	0.4	0.2	0.5	0.1	0.0
15-19	1.0	2.2	1.8	1.0	2.3	0.3	0.6	0.8	0.2	0.5
20-24	2.4	3.0	2.1	1.4	3.6	0.5	1.0	1.2	0.5	1.2
25-29	4.3	3.8	2.7	2.4	5.0	0.8	1.6	1.5	0.9	2.1
30-34	7.0	5.0	3.8	4.1	6.5	1.2	2.6	2.2	1.6	3.2
35-39	10.3	6.6	5.5	6.8	8.2	1.9	4.3	3.2	2.7	4.7
40-44	14.1	8.8	8.2	10.7	10.5	3.0	6.7	4.6	4.3	6.4
45-49	18.2	11.6	12.0	16.2	13.0	5.1	10.0	6.8	6.5	8.3
50-54	21.7	14.6	16.9	23.5	15.7	7.8	14.3	9.4	9.2	10.1
55-59	24.8	18.0	22.7	32.5	18.2	12.1	19.0	12.2	12.6	12.2
60-64	27.7	21.3	29.0	42.8	20.3	19.4	23.8	15.2	16.5	14.7
65+	41.9	43.4	69.9	58.4	66.5	21.5	40.6	59.2	65.5	36.8
					RURAL					
0	76.3	68.1	109.3	123.2	16.1	22.0	84.1	60.0	76.6	52.2
1-4	8.0	8.4	10.8	9.4	3.8	12.4	11.2	5.8	6.3	10.5
5-9	1.5	1.0	0.5	0.7	0.0	0.6	2.1	0.2	0.0	0.0
10-14	1.2	1.2	1.0	1.4	0.0	0.4	0.2	0.5	0.1	0.0
15-19	1.9	1.6	1.5	2.4	0.0	0.8	0.4	1.3	0.7	0.0
20-24	2.2	1.8	2.0	3.5	0.2	1.3	2.6	1.8	1.5	0.2
25-29	4.0	1.9	2.6	4.7	0.9	1.9	0.8	2.1	2.5	0.6
30-34	4.7	2.2	3.1	5.9	2.1	2.2	1.3	2.6	3.4	1.2
35-39	5.1	3.0	3.7	7.2	4.2	2.5	1.9	3.3	4.7	2.2
40-44	7.8	4.6	4.6	9.4	7.4	4.0	7.2	4.5	6.5	3.7
45-49	10.7	7.2	5.9	12.8	12.2	5.5	3.6	6.7	8.8	5.6
50-54	16.3	11.1	7.8	17.7	18.6	10.6	4.7	9.6	11.5	8.4
55-59	21.4	15.8	10.4	24.2	26.0	16.2	5.8	13.2	14.5	11.7
60-64	29.7	21.3	13.4	31.6	34.0	21.7	7.1	16.9	17.1	15.4
65+	54.0	44.0	85.2	54.0	52.4	61.0	60.2	76.6	51.0	64.2

[a]Graduated by Whittaker-Henderson Type A difference equations with constant at a=1.5 or a=2.0.

[b]Ages 0-4 and 65 and above not graduated.

[c]For September 1-December 31 annualized.

[d]January 1-June 30, 1975 annualized.

TABLE 15

Annualized Age-Sex Specific Death Rates, Misamis Oriental Province, July 1, 1973-June 30, 1975, by Six-Month Periods Five to Eight

Ages	Period 5[a]		Period 6[b]		Period 7[c]		Period 8	
	A[d]	B[e]	A	B	A	B	A	B
				MALES				
0	120.8	168.1	82.0	93.8	62.9	92.2	70.0	67.8
1-4	13.2	18.6	14.2	12.8	5.5	6.9	13.4	11.6
5-9	0.0	1.4	3.2	3.2	0.0	1.2	2.0	1.9
10-14	0.0	0.4	2.3	2.0	1.1	1.4	2.3	1.9
15-19	2.9	3.3	2.7	2.1	2.4	1.6	2.8	2.1
20-24	0.0	0.0	3.8	2.6	0.0	1.0	3.6	2.5
25-29	10.7	10.5	6.0	5.2	0.0	3.3	4.8	3.3
30-34	3.1	5.2	10.6	6.0	4.1	7.1	6.5	4.5
35-39	0.0	1.5	6.7	7.6	11.9	10.7	8.7	6.5
40-44	13.8	12.5	9.4	19.5	3.1	3.1	11.6	9.4
45-49	0.0	2.6	2.4	1.5	8.2	10.8	15.1	13.6
50-54	9.0	4.4	6.6	13.5	5.6	12.7	18.9	18.8
55-59	0.0	4.0	8.8	6.9	21.0	27.8	23.1	24.7
60-64	70.4	39.9	67.2	65.9	39.3	33.1	27.4	30.9
65+	213.9	71.1	101.1	93.3	87.0	76.6	68.9	52.0
All ages	12.1	12.8	11.8	11.8	8.0	9.9	10.5	9.5
				FEMALES				
0	98.9	60.3	65.9	81.7	96.8	43.6	71.9	62.5
1-4	22.9	12.7	15.7	15.6	12.4	10.3	14.5	13.3
5-9	1.6	1.3	7.5	6.8	3.3	4.4	1.3	0.4
10-14	0.0	0.0	2.6	2.0	0.0	0.0	1.4	0.6
15-19	0.0	0.1	3.2	2.7	1.3	1.8	1.5	0.8
20-24	2.1	1.6	3.3	3.3	1.2	0.2	1.9	1.3
25-29	0.0	1.7	3.4	3.5	6.0	6.0	2.6	2.0
30-34	0.0	0.7	3.6	2.1	3.4	4.9	3.9	3.0
35-39	7.2	7.7	5.3	6.1	3.2	5.0	5.6	4.3
40-44	0.0	0.0	5.8	5.1	4.0	12.7	7.9	6.7
45-49	0.0	4.9	2.4	2.4	4.3	8.5	10.8	7.9
50-54	0.0	1.2	12.1	11.2	30.8	21.9	14.4	10.2
55-59	0.0	12.7	14.3	14.3	13.9	13.9	18.4	12.9
60-64	39.4	48.0	19.1	22.6	11.6	4.9	22.6	15.9
65+	58.4	79.6	79.6	72.9	73.3	80.2	77.3	61.5
All ages	9.3	10.8	10.2	10.5	10.1	10.0	9.5	7.8

[a]Source of rates: Report 16.
[b]Source of rates: Report 17C.
[c]Source of rates: Report 19C.
[d]Based only upon the probability sample of 1973 with weights proportional to population size.
[e]Based upon both the probability of 1973 and the methodological samples of 1971 with weights proportional to population size.

earlier chapter,were used to motivate workers in each system to attempt to discover all deaths.

Two obvious questions arise: first, are the levels of mortality reported too low to be credible; and secondly, if they are too low, how can this low level be explained in terms of workers who seem to be trying hard to obtain complete coverage of deaths?

Checks on mortality. The question of level of mortality is an important one. It relates to natural increase or population growth rates, and permits one to judge whether a population program has succeeded in slowing down the rate of growth.

In an endeavor to discover whether crude (and age-adjusted) death rates computed from the reports of MCPS survey and recording systems seem too low to be credible, the authors had recourse to the Coale-Demeny model life tables.

With three parameters in mind--crude birth rate, rate of natural increase, and percent of population under age 20--entrance was made into the Coale-Demeny tables to discover the range of death rates corresponding to such parameters. Rate of natural increase was taken as 3.0 to 3.5 percent a year, as these are believed to have characterized Philippine populations in recent years. Populations were taken from the survey enumerations and birth rates from the dual record estimates. Percentage of population under 20 averaged about 52 percent in the urban and about 59 percent in the rural areas.

Results indicate a level of death rates corresponding to those found by the dual record system. For example, on entering the Model West table, Females, Level 19, with the above parameters, the corresponding death rates are found to be 7.2 to 7.7 deaths per thousand. Levels 20 and 21 gave corresponding death rates of 6.2 to 6.7, and of 5.2 to 5.8 deaths per thousand. The same tables for males gave the following results, in the same order: 8.4-8.9, 7.3-7.8, and 6.3-6.9.

Model East tables gave somewhat higher corresponding death rates. These are, in the same order:

Females	7.5-7.9	6.4-6.9	5.4-6.0
Males	8.9-9.3	7.7-8.2	6.7-7.2

These results are in the same general range as the rates found by the dual record system. The dual record system rates, then, (based upon the reports from the two systems) ought not to be dismissed on a priori grounds. They appear to be well within range of credible rates for populations with birth rates as high, with growth rates as large, and with such a large proportion of the population under age 20.

On empiric grounds, birth rates can be compared with crude death rates to see if resultant natural increases (RNI) computed by subtraction are reasonable in the light of typical Philippine growth patterns between censuses. This comparison is shown below for the urban methodological sample:

Crude birth rates	43.1	41.5	37.1	37.5	45.4	43.6	37.6	35.8
Crude death rates	6.4	8.0	6.7	7.7	9.1	11.1	8.7	7.6
RNI	36.7	33.5	30.4	29.8	36.3	32.5	28.9	28.2
RNI (percent)	3.7%	3.4%	3.0%	3.0%	3.6%	3.2%	2.9%	2.8%

The natural increases per annum, expressed as percentages in the preceding line, are within ranges experienced in recent years by Philippine provinces like Misamis Oriental, as gauged from intercensal growth rates shown in published data such as the 1960 and the 1970 Censuses. The rates above do not take migration into account, but are natural increase rates; the census rates for provinces include effects of migration. The rates given above are also in the range of Philippine intercensal increase, upon which international migration effects are negligible.

Results of comparing crude birth and death rates from the rural methodological sample over the eight periods yield fairly comparable, although somewhat higher, results:

Crude birth rates	45.8	39.6	48.0	38.0	39.1	31.6	31.1	29.9
Crude death rates	7.6	7.5	7.4	6.7	10.0	10.2	8.3	5.7
RNI	38.2	32.1	40.6	31.3	29.1	21.4	22.8	24.2
RNI (percent)	3.8%	3.2%	4.1%	3.1%	2.9%	2.1%	2.3%	2.4%

Flieger (1974), has raised a question about the levels of death rates found in the MCPS dual record study; he feels these levels may be too low.

Flieger's argument is mainly based upon a table he quotes in his paper. The table is based on the 1970 Vital Statistics Reports, and the 1960 and 1970 Census reports. He argues that the crude death rate for Manila shown in this table is 15.48, whereas the rates for Aklan, Agusan, Palawan, and Lanao del Sur, as well as others, are much lower. He attributes the difference to registration difficulties in the provinces, since Manila is believed to have relatively good registration. He concludes that Manila death rates should be lower in fact than those of the provinces and proceeds to standardize rates on the basis of the Metropolitan Manila population. On the basis of such reasoning, he concludes that the MCPS level of rates is too low to be credible.

This criticism may be correct. Yet, it seems possible that the table he argues from is based on deaths reported on the basis of place of occurrence rather than place of residence (Flieger 1974). Support for this statement is seen in the levels of infant mortality quoted for Manila in that table, namely, 180.2 and 125.1. It seems unlikely that such high infant mortality was experienced in Manila during 1970 on a place of residence basis. But such a high infant mortality is quite likely for Manila on a place of occurrence basis, as this would mean that all infants who were brought to Manila for treatment of serious disease and died there would be included in the numerators of rates. Since healthy babies from areas outside Manila would not be brought there and would not, therefore, get into the population base of the census, the place of occurrence rate would be much inflated over the place of residence rate. Undoubtedly underregistration also is found in the provincial data. But this does not affect the essential point that if the Manila rate is based on place of occurrence, it is likely to be much too high.

For this reason, the authors do not regard the arguments advanced against the level of the MCPS crude death rates as strong ones.

Nevertheless, several attempts were made to discover whether clandestine burials took place (which assuredly would not be reported to city and municipal authorities and would most likely be concealed from research workers inquiring about deaths during the period in which concealment took place). A second question presented itself. Given a death for which a burial permit was secured, but for which proper registration was for some reason not accomplished, would the respondent be willing to divulge the fact of this death to a researcher?

The first attempt made to gauge whether clandestine burials took place on a large scale was to ask respondents of the fourth survey round direct questions on reasons why people like neighbors or friends might clandestinely bury a family member or relative. The question limited the respondent to cases of friends or neighbors that they knew about personally, not gossip about which they were not sure. The question also assumed the fact of clandestine burial and asked why.

Some people denied the supposition, and insisted that such cases did not occur at all or rarely. The majority, however, did not reject the assumption and answered in terms of shame, embarrassment, fear, guilt, and uninvolvement. Presumably they had in mind the shame and embarrassment that might attend upon not being able to pay for the wake before and the nine-day novena after burial, as well as the cost of the funeral itself. Involvement might also refer to not wishing to bear the expenses of a less intimately connected relative's funeral. Guilt, at least on the part of some respondents, was associated with mothers' fears that neighbors would blame them for having neglected a child, for not having brought it to the doctor soon enough, and so forth.

A further question was asked to gauge the extent of such practice. Most urban respondents did not know of any cases of clandestine burial--or at least said that they did not.

Rural respondents knew of few clandestine burials where deaths were even hidden from neighbors and friends--or, again, said they did not know.

If one can accept such answers at face value, they seem to rule out any large-scale practice of concealment of death from neighbors and friends by urban and rural residents. Whether one can accept them is another question. But even if one can, they do not rule out the possibility that deaths may be underregistered on a large scale (out of fear of fine or other punishment by the government), and then concealed from research workers visiting houses and asking questions about such deaths. On this supposition, another question arises. Would neighbors and friends be willing to report deaths that had occurred in households in a locality, when the household itself might want to conceal a burial out of fear of some penalty from the government? The answer as it pertains to friends might well be negative. The friendship might be jeopardized if the household in question were to get into trouble because of the friend's candor. Filipinos are prudent on such matters. On the other hand, neighbors who are not close might be more willing to answer candidly but might remember or know less about the household.

In survey round three, another attempt had been made to delve into this matter

of underreported mortality. Respondents in approximately 4,000 rural and urban households were asked a set of three randomized response questions to determine whether the respondent in the preceding part of the interview had deliberately concealed a death from the interviewer, which actually had occurred to a household member during 1972; whether any death, concealed previously or not, had occurred to household members during 1972; and, finally, whether if a death had occurred, it had not been registered with the civil authorities.

The randomized response technique, developed by Warner (1965), is an interview technique designed to eliminate or at least reduce bias caused in sample surveys by refusal to respond, or by giving deliberately false information in response to sensitive questions. The basic structure of the technique is to present two questions to the respondent, the answers to each of which will be the same (for example, Yes, or No),together with a randomizing device which will select which question the respondent might answer according to some predetermined probability.

The interviewer does not know which question the device has selected for the respondent to answer because the interviewer is supposed to leave the room or turn his back while the selection is being made. Nor can the interviewer tell from the answer--because the answer is "Yes" or "No" or some similar answer--whichever question has been selected. The reply, therefore, does not cue the interviewer in to the personal situation of the respondent, nor to a secret if there is one. The rationale for using such a device is that there should no longer be reason for the respondent to give false responses, since the procedure does not and cannot identify that person as reacting to sensitive questions.

In the MCPS application of this technique, the randomizing device employed was a coin, belonging to the respondent whenever possible. The coin was tossed in the air. If it landed "heads," the respondent was supposed to answer the sensitive question. If it landed "tails," the respondent was then supposed to answer the non-sensitive question. The interviewer, after explaining the use of the coin toss and the relation of the result to the question to be answered, left the room if conveniently possible, or at least looked away.

The sensitive questions (or statements) include the following:

- A death occurred in 1972 to a resident of this household but for reasons of our own we did not report it earlier in this interview.
- A death occurred to a resident of this household in 1972.
- A death occurred in 1972 to a resident of this household but for reasons of our own we did not report it to the municipal (city) office for registration.

The non-sensitive statement in all three cases was, My mother was born in the month of April.

Given the known probability of the randomizing device, and given the known probability of a Yes (or similar) answer to the non-sensitive question, one can calculate maximum likelihood estimates of the proportions answering affirmatively to sensitive questions, and one can calculate the variance of such proportions.

Results of this application showed that 88 urban and 84 rural households were estimated to have concealed a death from the interviewer. Confidence limits (95 percent) were 46-130 (urban) and 42-126 (rural). Adding mean estimated deaths to those directly reported earlier in the interview raised the crude birth rates to 11.5 urban and 13.4 rural deaths per thousand. These rates compare with the dual record rates based upon deaths actually reported to workers of the dual record system as follows:

Dual record reports, urban	6.7 per thousand
Randomized response techniques, urban	11.5 per thousand
Dual record reports, rural	7.4 per thousand
Randomized response technique, rural	13.4 per thousand

This result was checked by the response to the second question upon total deaths during 1972 (concealed and not concealed). If the results were about the same, given sampling variation, this would confirm the results.

These second question responses totalled 167 urban and 124 rural deaths, with 95 percent confidence limits of 119-214 (urban) and 79-169 (rural) deaths. These deaths approximate the total deaths estimated in connection with the first question because the total deaths estimated from it fall within the 95 percent confidence limits of present estimates.

The rates that would be estimated on the basis of the second randomized response question alone compare with rates based on reports from the dual record system as follows:

Dual record reports, urban	6.7 per thousand
Randomized response technique, urban	13.3 per thousand
Dual record reports, rural	7.4 per thousand
Randomized response technique, rural	10.1 per thousand

The third question was asked to obtain a rough idea of the amount of non-registration. Two reasons existed for the question. First, interest was felt directly in the amount of local underregistration. Second, it was felt that the amount of underregistration might give clues to the amount and reason for purposive concealment from research workers making household visits, if such concealment should prove substantial.

A fine shade of distinction exists, however, between non-registration and purposive concealment. Failure to report a known death to an investigator inquiring about such deaths represents a conscious desire to conceal the death from the researcher. On the other hand, failure to register a death with civil authorities may or may not represent a desire to conceal the death. Rather than signalling concealment, such a failure to register may mean simply difficulties the household head encounters in terms of time, money, and transportation, to get to the place of registration and go through the registration process. When referring to non-registration of death, "non-reporting" is a more appropriate term than "concealment" for the purpose.

Estimates of deaths not registered were 108 in the urban area and 78 in the

rural area, with 95 percent confidence limits, respectively of 65-121 and 37-120. On the assumption that total deaths estimated in terms of the first question are approximately correct, this would imply that 75 percent of the urban and 47 percent of the rural deaths were not reported to civil authorities. These figures are impressively close to the percentage of deaths out of total deaths estimated to be purposively concealed in connection with the first question: 61 percent urban and 51 percent rural. This third question not only provides further confirmation of results of the first two questions, but indicates that a positive correlation probably exists between failure to report a death to civil authorities and purposive concealment of deaths from researchers making household visits. A more detailed account of this study is available elsewhere (Madigan, Abernathy, Herrin and Tan 1976).

Further questions. Evidence exists on both sides of the question regarding death rate levels. The arguments from the stable population tables and the natural increase data appear to indicate that the reported level of mortality may be correct. The argument from the model life tables also seems strong.

On the other hand, the feelings of demographers like Flieger and some senior MCPS staff themselves that the rates are too low, bolstered by the results of the randomized response study, appear valid. In fact, the randomized response results are especially striking, particularly since each of the three questions provides arguments of internal consistency.

The authors themselves are not entirely in agreement on the question. They do agree, however, that further research is needed on the whole question of Philippine mortality levels. Some fascinating points for research have been raised and these are crying for response. Possibly the best view at present is that both sides of the question may have some validity, and that the answer to the actual mortality level may lie between the levels determined by the different approaches. The question is obviously an important one, since the precise estimation of growth rate by natural increase of local areas and provinces of the Philippines depends upon its answer.

Coverage. A remark should be made about coverage in dual record reporting and purposive concealment. A dual record system confronted by purposive concealment of vital events from both its systems will not arrive at a true estimate of the rates for these vital events. However, this is no argument against dual record systems. They are based upon the joint independent probability theorem. If no probability exists of finding a case, they cannot be expected to distinguish possible existing cases without probability of a report from non-existing cases with probability of a report of no event. The same difficulty of course confronts single-system approaches more strongly. They have only one chance to obtain a report because they have only one system. If the respondent wants to conceal the data from the single-system worker, it will be easier than to conceal it from two workers coming independently and inquiring of the possibility of a given event in all houses of the neighborhood (as workers of both systems did in each house visited).

Natural Increase

It seems best to handle the topic of natural increase by means of upper and lower limits to natural increase. Upper limits are computed on the basis of

mortality levels reported by the dual record system; lower limits are computed on the basis of randomized response estimates of death rates. Correction factors, based on the ratio of randomized response estimates to dual estimates of period three rates, have been applied to the dual estimates for all periods.

Natural increases in terms of percents per annum for the eight periods in order from first to last for the urban methodological area are:

									Mean (unweighted)
High	3.7	3.4	3.0	3.0	3.6	3.2	2.9	2.8	3.2
Low	3.2	2.8	2.6	2.4	3.0	2.4	2.3	2.3	2.6

The same rates of natural increase for the rural methodological sample area are:

									Mean (unweighted)
High	3.8	3.2	4.1	3.1	2.9	2.1	2.3	2.4	3.0
Low	3.2	2.6	3.5	2.6	2.1	1.3	1.6	2.0	2.4

Whatever the mortality level, it is clear that the rate of natural increase has been moving downwards in these two populations over the eight periods.

Natural increase in terms of the three provincial strata and of the province itself (A estimates) also shows a downward trend, although this may be less clear unless comparison is made to the methodological trends over the eight periods, and unless calendar years are considered.

	Periods	*5*	*6*	*7*	*8*
Urban probability sample,	high	3.1	2.9	3.8	3.3
	low	2.0	2.2	3.4	2.8
Municipal southwest,	high	4.2	2.2	3.4	2.4
	low	3.5	1.4	2.9	1.6
Municipal northeast,	high	3.0	2.4	2.8	2.4
	low	2.1	1.4	1.8	1.8
Provincial probability sample,	high	3.4	2.4	3.2	2.6
(A estimates)	low	2.6	1.5	2.4	1.9

The next chapter will treat migration since this, as well as natural increase, affects growth of an area.

VI. URBAN AND RURAL MIGRATION: METHODOLOGICAL AND SUBSTANTIVE ASPECTS

Of all the demographic variables, migration is probably the least well understood. Often, only indirect measures are at hand. Even where direct measurement data are available from a census or a survey--such as place of residence at some definite point of time or place of birth--the volume of migration is clearly underestimated. Multiple moves by the same individual are not counted. Population registers theoretically provide data upon all moves, but tabulation of such data is relatively rare.

Yet migration is of considerable importance not only to demographers but to sociologists, economists, city and regional planners, and to city and regional administrators. Data on size, structure, and characteristics of a population are not only of interest to demographers but are of vital importance to any planning for a locality or a region. But these factors depend to a large extent upon migration.

Concepts

Migration is defined in this chapter as the crossing of a sitio boundary by a person with intention of staying in the new locality or remaining away from the old locality for 90 days. The short time span was put into the definition to be able to take account of relatively short-term, multiple moves.

Migration should be distinguished from mobility, which relates to short-distance moves or temporary changes of residence. This distinction is usually made by specifying a migration-defining boundary, typically the boundary of a major or minor civil division (United Nations 1970). In the present study, moves within a sitio are not considered migration but mobility.

The Cagayan de Oro Poblacion is a single sitio. The urban methodological sample falls entirely within the poblacion as it is a 75 percent probability sample of this sitio. Since the sample area is not coterminous with the poblacion, in some places a person may move across the sample area boundary without crossing the sitio boundary. Such moves are examples of mobility, not of migration. Moreover, to be registered by one of the MCPS workers, the migration had to be to or from the sample area as well as across the sitio boundary. Persons who moved out of the sample area without crossing the poblacion boundary ceased to be residents of the sample but were not migrants.

The rural methodological sample consists of about 104 square kilometers of territory and contains parts of four municipalities. It includes 123 sitios or parts of sitios. Where the sample area boundary cuts through a sitio, it is also possible for persons to move out of the sample area so as to cease being residents of the sample locality without crossing the local sitio boundary. Such persons are considered mobile in this study but not migrants. In general, then, only persons who cross sitio boundaries are considered migrants.

The definition was modified in the case of students, however. Students less than 25 years of age were considered part of their parents' or spouse's household and their moves to attend school were not considered migration.

This section may be concluded by pointing out that with only one sitio in the urban methodological sample, all migration was external in some sense. That is, either the origin or the destination of the migrant was external to the city poblacion. On the other hand, with 123 sitios comprising the rural methodological sample, migrations could be internal to the sample (from sitio A within the sample to sitio B) or external (place of origin or of destination outside the rural sample). This nomenclature will be employed in this chapter.

Methods of Data Collection

Several national and experimental dual record systems have collected data upon migration. These procedures are best known in the context of estimation of birth and death rates. The literature has been summarized in Marks et al. (1974).

Procedures in the MCPS study called for the recording system workers to make bimonthly house visits to every household in the sample area, and to fill out a record for every resident who had migrated during a specified time period. Subsequently, the same locality was covered by the survey system workers who also inquired about residents who had migrated during the same period of time and who recorded all such events. ("Resident" of course includes in-migrants, that is, persons staying or intending to stay 90 days.) Each migration event was subject then to detection by both the recording and the survey systems.

The data described in the present study refer to calendar year 1972. During the first half of that year, migration data were collected for the total population of both urban and rural methodological samples. During the second half of the year, however, because of the experiment on recall (which demanded that half the areas not be surveyed), a 50 percent subsample of these two areas was covered.

The data reported in this chapter are observed data. They consist of matched migrations reported by both systems, together with the migrations reported uniquely by each of the systems. No attempt has been made to apply the Chandrasekaran-Deming formula to estimate migrations missed by both systems. It appears that in a substantial number of migrations, particularly out-migrations, the survey system has considerably less probability of detecting events than has the recording system. In fact, the probability seems to be zero in some cases.

A study of the printouts offers quite strong evidence for the correctness of the matches that have been judged as such. Do the data contain criteria sufficiently sensitive to pair all records that actually should match? The authors believe that they do and also that they were applied with satisfactory rigor. Data on names, identification numbers, sex, and marital status would have to be very defective to cause numerous erroneous non-matches.

Volume and Direction of Migration

Urban areas. As previously explained, all migration in the urban area is external migration because only one sitio is involved. Tables 16 and 17 present

TABLE 16

In, Out, and Net Migration Rates by Period and Age Groups, Urban Methodological Sample, 1972

Age Groups	Population[a]	In-migrants[b]	Ratio	Out-migrants[b]	Ratio	Net Migration Rate
		JANUARY-JUNE				
<5	3,410	688	.202	666	.195	.007
5-14	5,154	908	.176	914	.177	-.001
15-24	6,561	3,231	.492	3,929	.599	-.107
25-34	3,565	999	.280	1,124	.315	-.035
35-44	1,891	366	.194	369	.195	-.001
45-54	1,115	171	.153	138	.124	.029
55-64	666	81	.122	101	.152	-.030
65+	366	42	.115	63	.172	-.057
Total	22,728	6,486	.285	7,304	.321	-.034
		JULY-DECEMBER				
<5	3,549	828	.233	952	.268	-.035
5-14	5,158	962	.186	1,052	.204	-.017
15-24	6,608	3,566	.540	3,594	.544	-.004
25-34	3,744	1,228	.328	1,408	.376	-.048
35-44	1,963	346	.176	434	.221	-.045
45-54	1,110	210	.189	196	.177	.012
55-64	728	120	.165	94	.129	.036
65+	399	56	.140	66	.165	-.025
Total	23,259	7,316	.314	7,796	.335	-.021

[a]Population at the end of the period.
[b]Age unknowns prorated.

TABLE 17

In, Out, and Net Migration Rates by Period and Age Groups, Rural Methodological Sample, 1972

Age Groups	Population[a]	In-migrants[b]	Ratio	Out-migrants[b]	Ratio	Net Migration Rate
		JANUARY-JUNE				
<5	4,114	330	.080	270	.066	+.014
5-14	7,415	489	.066	409	.055	+.011
15-24	4,883	678	.139	779	.160	-.021
25-34	2,761	286	.104	207	.075	+.029
35-44	2,054	134	.065	77	.037	+.028
45-54	1,314	64	.049	38	.029	+.020
55-64	834	34	.041	40	.048	-.007
65+	630	28	.044	21	.033	+.011
Total	24,005	2,043	.085	1,841	.077	+.008
		JULY-DECEMBER				
<5	4,351	342	.079	232	.053	+.026
5-14	7,386	440	.060	288	.039	+.021
15-24	4,995	812	.163	860	.172	-.009
25-34	2,846	326	.115	292	.103	+.012
35-44	2,111	108	.051	104	.049	+.002
45-54	1,356	48	.035	68	.050	-.015
55-64	859	46	.054	28	.033	+.021
65+	658	30	.046	32	.049	-.003
Total	24,562	2,152	.088	1,904	.078	+.010

[a]Population at the end of the period.
[b]Age unknowns prorated.

data on external migration in the urban and rural methodological samples. The volume may not seem so high if it is recalled that some of the migrations are of short distances and if one bears in mind that the record here includes multiple migrations, that is, all migrations from outside into and from inside out of the two sample areas.

The overall level of migration related to the urban sample can be seen from Table 16 to be fairly similar for both six-month periods. (Although data for the second period are based on a subsample, appropriate factors have been used to raise the estimates so that they relate to the whole sample.) While the volume of in-migration and out-migration is high, about 300 in-migrants per thousand persons for both periods and about 330 out-migrants, the magnitude of the net migration is relatively low, about 3.5 percent. This rate is negative, which means out-migrants exceed in-migrants. But this does not necessarily mean the net migration rate of Cagayan de Oro City is negative. It may reflect only the rate of migration from the poblacion. Much of this migration is suburbanization, in fact.

For the same age categories, in-migration rates tend to be similar in the two calendar periods. Table 16 reveals, however, that several differences occur in patterns of out-migration. During the second half of the year, more persons migrated who were less than age 15. More young adults (ages 15-34) and more middle-aged persons (ages 35-44) also out-migrated. On the other hand, fewer persons age 45 and above migrated from the poblacion.

Rural areas. Less migration to and from the rural methodological sample occurred than had been found in the Cagayan de Oro poblacion. This was partly a function of the large number of sitios and the large area of the rural sample in contrast to the one sitio and circumscribed area (less than 1.5 square kilometers) of the urban sample. In the rural area many of the migrations across a sitio boundary were internal to the sample, and are not tallied here, since the subject is external migration. In the urban sample, with only one sitio to the area, any migration had to be an external migration.

For both periods, as Table 17 shows, there were approximately 86 in-migrants per thousand persons and 78 out-migrants in the rural area. Net migration was positive (in-migration greater than out-migration) and at a level of about 1 percent. In each period the number of in-migrants was about the same. Although age patterns of in-migration varied by period, these variations appear to be random.

Out-migration, however, followed quite different patterns in the two periods. During the first part of the year, the number of child out-migrants (ages 0-14) was larger, whereas in the second half of the year the number of these out-migrants was smaller. On the other hand, the out-migration of older people followed the opposite pattern; fewer older persons migrated in the first part of the year, and more in the second.

As a further attempt to delve into this thinly explored subject of Philippine internal migration, an independent estimate of migration was made by application of the balancing equation to each age group of the January 1972 population to produce an expected population at the beginning of July. The difference between the actual population enumerated at that date and the expected population is taken as a measure of the net migration which occurred between January and July.

This method of course is limited. It cannot take account of multiple migrations but only of residential location at the two points beginning and ending the period. It can be expected then to differ from estimates of net migration produced by the direct method. Further, inconsistencies in age reporting by respondents at the two dates of enumeration led to reported differences in age patterns of migration. Level of migration by the balancing equation method is also sensitive to differential completeness of enumeration in the two surveys. For example, should coverage be more complete in the July survey, apparent in-migration would be increased and apparent out-migration decreased, with resulting change in the magnitude of net migration.

Finally, the indirect estimates obtained through the balancing equation relate to residents present or not present in the two enumerations and, therefore, to movements in and out of the sample areas; the direct estimates refer to migrations as defined in this study--movements in and out of the urban poblacions and of the rural aggregation of sitios. Despite these drawbacks, the indirect method offered the only further alternative mode of making migration estimates.

The procedure was as follows. The children ages 0-4 were adjusted to July by subtracting one-tenth of the population ages ½-5, adding births, and subtracting deaths of children ages 0-4 which occurred during the interval. The other age groups up to the last (but not including it) were aged up to July by subtracting one-twentieth of the population ages ½ to 10, adding the amount subtracted from the previous age group, and subtracting deaths to persons in the age group in question. The last age group was aged forward by adding the amount subtracted from the number of persons ages 55-64 and by subtracting deaths.

Despite the differences between the two approaches and the differences to be expected in magnitude of migrations, results checked fairly well where some comparability was possible. The direction of net migration was the general point of comparison. This was fairly similar for both indirect and direct estimates for each age group, with few exceptions. The volume of migration, of course, limited to net migration between start and completion of this period of study, was expected to be less and, in fact, was less.

Urban Migration Characteristics

The population of the urban area was seen as highly mobile. Some 30 percent moved into the study area from outside the poblacion during a six-month period and slightly more than 30 percent moved out.

By far the heaviest volume of migration occurred among persons ages 15-24. Excluding unknown ages, 49 percent of the in-migrants and 49 percent of the out-migrants were accounted for by persons belonging to this age group. Next in magnitude of migration were persons ages 25-34. Sixteen percent of all in-migrants and 17 percent of all out-migrants belonged in this age group. Nearly two-thirds of all migrants were accounted for by these two age groups combined. About 25 percent of all migrants were less than 15 years old, while somewhat more than 10 percent were 35 years of age or older. Migration in and out of the urban area, apparently, is an activity of the young with relatively little participation of the middle-aged and of the elderly.

Women were more mobile than men. Of all in-migrants during 1972, 59 percent were female and 57 percent of all out-migrants were also female. Of persons ages 15-24, where migration was most frequent there were more female than male migrants for both in- and out-migration.

Motives behind migration. The major reason given for urban migrations related to employment. The next largest category was simply accompaniment of the household head. Returning home was a third important reason for migration out of the poblacion. Reasons of education and/or marriage averaged about 4 percent for both in- and out-migrants, but this category would have been larger if students had been classified as residents independently of their parents' residence. For persons 15 years of age or older, the same categories of motivation predominate, except that the employment factor is, of course, more important and accompanying household head is less important.

Origin and destination of urban migrants. Where do in-migrants come from and where do out-migrants go? In 1972 only 23 percent of the in-migrants had come from some other part of Cagayan de Oro but 35 percent had out-migrated to some place in the city, presumably to the districts surrounding the poblacion and the suburbs. Further, 24 percent had come from parts of Misamis Oriental Province but only 17 percent had returned there. Evidently, the city is exerting a brain drain of sorts upon the province. A fairly large proportion, 29 percent, had come from other parts of Mindanao Island, and a fairly large proportion out-migrated back to other places on the island. Migration to and from other islands of the Philippines almost balanced, with a positive net in-migration of 2 percent.

Intended length of stay. The vast majority of in-migrants intended to stay an indefinitely long period of time or permanently, as shown by the data below. It seems probable that many migrants were unable to specify their future plans with any degree of certainty because these depended upon employment opportunities here and elsewhere. Expected duration of stay was reported in percent form thus:

Category of Migrant	*Less than 6 Months*	*6-11 Months*	*12-23 Months*	*Indefinite or Permanent*	*Total*
In-migrants	4.8	0.9	2.6	91.7	100.0
Out-migrants	14.4	7.9	9.7	68.0	100.0

The proportion of persons reported as intending to stay away less than six months is larger than the proportion of in-migrants expecting to stay in Cagayan less than six months. Perhaps migrants express more uncertainty about chances of success in finding employment at home before they leave than in the new destination after arrival.

Marital status. The majority of migrants, both male and female, were single. This remained true even when children ages 0-14 were excluded. The highest proportion of singles is observed for female in-migrants and the lowest proportion is observed for female out-migrants, possibly reflecting the high proportion of single women who come to the city seeking domestic employment. As the following data show, the proportion of single males is rather similar among both in- and out-migrants. Separated and widowed people do not constitute a large percentage of the migrants.

		Single	*Married*	*Widowed*	*Separated*	*Total*
Male:	In-migrants	56.8	41.9	1.1	0.2	100.0
	Out-migrants	60.2	35.0	2.2	2.6	100.0
Female:	In-migrants	69.8	26.8	2.5	0.9	100.0
	Out-migrants	53.2	39.4	4.9	2.5	100.0

Relationship to household of interview. A relatively large percentage of in- and out-migrants were not relatives of the head of the household where they resided or had resided. Such persons included boarders, maids, guards, and other servants. Relatives outside the household head's family of procreation were also well represented among the migrants. Approximately 43 percent of in-migrants and 40 percent of out-migrants were household heads with their spouses and children.

Category	*Household Head/Spouse*	*Children*	*Other Relatives*	*Non-Relatives*	*Other Persons*	*Total Persons*
In-migrants	20.0	23.1	22.6	27.8	6.5	100.0
Out-migrants	16.7	23.7	20.6	25.2	13.8	100.0

Limiting the population of migrants to persons age 15 and above increases the proportion of household heads and spouses, of relatives, and of non-relatives among in-migrants and decreases the proportion of children. It slightly decreases the proportion of other relatives among out-migrants and cuts the proportion of children in half, while increasing the proportion of non-relatives. It also increases the proportion of "other" for both in- and out-migration.

Characteristics of Rural External Migrants

Age and sex. As was true of urban migrants, the most prevalent ages for migration both into and out of the rural study area were 15 to 24. Further, like the urban case, only 16 percent of both in- and out-migrants were more than 34 years old.

Unlike urban migrants, however, approximately the same number of males and females migrated into the rural study area, while slightly more males than females migrated from it.

Reason underlying migration. The largest category of motives for migration among males was employment, as was true in the urban area. Among females, however, the largest category of motives was accompaniment of household head, which was in second place for males. Returning to one's home continued to be the third largest category of motivation. Marriage and/or education continued at about the same level except for female out-migrants in which group the percentage increased slightly. The data are:

Migration Category	*Seeking or Found Work*	*Marriage/ Education*	*Returning Home*	*Accompanying Head of Household*	*Other*	*Total*
Male						
In-migrants	36.7	3.8	9.4	35.4	14.7	100.0
Out-migrants	43.1	3.4	12.4	24.9	16.2	100.0
Female						
In-migrants	22.1	4.7	6.3	51.1	15.8	100.0
Out-migrants	22.0	6.4	12.0	43.4	16.2	100.0

Origin and destination of rural migrants. The largest percentage of migrants moved from or to other localities of Misamis Oriental Province. About 18 percent migrated to or from Cagayan de Oro, and about 37 percent came from or went to other municipalities of the province. This finding is interesting since it shows (unlike the educated guesses of many demographers about the matter) that the volume of rural-to-rural migration in the southern Philippines may exceed the volume of rural-to-urban migration. At least in this case of Misamis Oriental, the volume of out-migrants from parts of Misamis Oriental outside Cagayan de Oro to the rural sample and of out-migrants from the rural sample to other parts of Misamis Oriental exceeded the volume of migrants from the city to the sample and from the sample to the city by a factor of more than two.

Intended length of stay. Fewer rural than urban in-migrants planned a permanent or at least an indefinitely long stay. And fewer out-migrants planned to reside away permanently or for an indefinitely long duration. This may be a reflection of seasonal rural job opportunities. Unlike the urban area, interestingly enough, the proportion planning to stay away from their last residence less than six months is higher among in- than out-migrants. In-migrants are less likely to be intending permanent or indefinitely long periods of residence than out-migrants, again in contrast to the urban data.

Marital status. In-migrant women, age 15 and over, are much more likely to be married than urban women in-migrants. As in the urban study area, however, single men predominate among male in-migrants and out-migrants. Proportions married are similar to those found among the urban in-migrants. The data follow:

	Single	*Married*	*Widowed*	*Separated*	*Total*
Male					
In-migrants	51.7	42.9	3.2	2.2	100.0
Out-migrants	60.2	35.0	2.2	2.6	100.0
Female					
In-migrants	46.0	47.7	4.6	1.7	100.0
Out-migrants	53.2	39.4	4.9	2.5	100.0

Relationship to household of interview. Rural migration seems to be more heavily weighted with the movements of entire families rather than of lone individuals, than is urban migration. At least, the data give this impression. The household head and his family of procreation comprised slightly more than 50 percent of both in- and out-migrants. Other relatives accounted for a third of the in-migrants and about 30 percent of the out-migrants. Only 10 percent of the rural migrants

were non-relatives, as compared with some 25 percent of the urban migrants.

When children ages 0-14 are excluded from the data, the component of children in the migrations remains large, although less so than in the preceding data set. A substantial segment of this group is composed of children.

Rural Internal Migrants

Persons who cross sitio boundaries without leaving the overall study area are of course out-migrants from the sitio where they have resided and in-migrants of the sitio of new residence. Such migrants are counted both in place of origin and of destination. To avoid redundancies, only in-migration records were used in tabulating data for this presentation.

The total number of internal migrants was 3,184, of whom 50.9 percent were male and 49.1 percent female, about three-fourths as many persons as in the rural streams of in- or out-migration. The highest concentration of internal migrants is found in the group of persons ages 15-24 but larger proportions of internal migrants were children less than age 15.

The main reason stated for migration was accompaniment of household head with reasons connected with employment in second place. But when children less than age 15 were excluded, the main motive for male migration was related to employment. Little difference was discovered between internal and external rural migrants in terms of duration of stay.

A rather striking difference between internal and external migrants is the marital status of persons age 15 and older. The majority of external migrants are single. The majority of internal migrants are married. This is consistent with the tendency for internal migrants to be accompanying the household head to a greater degree in internal migration. Also consistent is the relationship to household head. Slightly more than 50 percent of external migrants were household heads or spouses of household heads.

Qualifications of Migration Data

First, the data are localized. They refer to migration in just two areas of Misamis Oriental Province, although a fairly substantial population size is involved. Second, it is likely that the survey was unable to pick up as many moves of short duration or as many multiple moves by the same individual as the recording system. Third, unlike the matching of births and deaths for which errors are known to be less than two percent and standard errors of such matching error considerably smaller, the precise extent of matching error has not yet been determined, although it is believed to be quite small.* For these reasons, it would seem that applications of these data to other areas should be made with caution.

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*The method used to determine the "true" match status of a set of records from reports of the recording and from reports of the survey system is described in Madigan and Wells (1976), which also describes the establishment of an explicit set of matching rules, and the determination of the estimated proportion of associated error and the standard errors of these statistics.

Readers desiring more detailed information on migration are referred to Cabaraban et al. (1976).

VII. ALTERNATIVES TO THE DUAL RECORD METHODOLOGY: A MATERNAL HISTORY APPROACH TO GATHERING CURRENT FERTILITY DATA

The preceding chapters have detailed the application of the dual record methodology to a developing country, the Philippines. These three chapters relate to those approaches, alternative or supplementary to the dual record methodology, for gathering adequate vital statistical data in localities where the national registration system, if indeed one exists, does not provide reliable data. Those approaches will be treated which have been studied and compared with the dual record approach by the Mindanao Center for Population Studies in terms of data produced in the local cultural context. The approaches in particular have been the Brass techniques outlined in the work on tropical Africa (Brass et al. 1968) and the Own Children method (Cho 1970, Grabill and Cho 1965). First, attention is given to a modified usage of the maternal history approach (Bogue and Bogue 1970, World Fertility Survey 1975).

The Maternal History Approach

In a 1963 pregnancy history study by RIMCU (Research Institute for Mindanao Culture) a probability sample of 2,074 households was drawn from the Cagayan de Oro City population, covering a population of about 12,500 persons. While this population resided in Cagayan as of 1963, the interviews revealed that only 24.2 percent of all persons residing in the RIMCU sample in 1963 had been born in Cagayan de Oro City. The biggest contributors to the city population had been the rural areas of Misamis Oriental, which had been the birthplace of 22.6 percent of all 1963 male residents of the sample and of 32.6 percent of all 1963 female residents. Rural areas in other Mindanao provinces and in other Philippine islands had also contributed substantial numbers of persons to the 1963 population.

The data, then, for 1963 and to a large extent 1962 represented an urban sample. But the further back one went through the maternal history approach into the earlier years of pregnancy of each woman, the more likely it was that one was dealing no longer with urban fertility but with rural fertility. In addition, the proportion of in-migrants was so large that the fertility of this sample five or ten years earlier was not precisely the fertility of a Cagayan population, but the fertility of a population composed of a number of places. More correctly, it should be designated the fertility for such and such a year or years of a population which resided in Cagayan in 1963.

These difficulties could be handled by obtaining the migration history of each person of the household interviewed and especially of the women respondents, and separating data for rural residence in earlier years from the data of urban residents. In fact, however, this is not usually done.

Another difficulty with the maternal history approach is respondent fatigue. The method involves a precise questioning of respondents about their pregnancies, a probing of their (sometimes sorrowful or unpleasant) recollections, and an exacting scrutiny of their answers, as well as of the intervals of more than a certain number of months between their declared pregnancies. Despite attempts to maintain good

respondent rapport throughout the interview, RIMCU interviewers sometimes find themselves faced with impatient respondents. In such circumstances, it is not beyond possibility that some respondents may give inaccurate data to hasten the interview. Despite editing and consistency checks, such data may not always be easy to discover.

Abbreviated Pregnancy History Approach

Most current fertility investigations ask whether the female respondent has had a live birth during the preceding 12 months or some other defined period. They are generally also interested in whether pregnancies have terminated in full-term or still-born babies, or other fetal loss, and ask questions directed toward this end. The main point generally is to be sure that infants born alive are not reported as still-born, although following up interests in questions of fetal wastage may also be an objective.

The Mindanao Center for Population Studies began in its fourth period of study (January 1-June 30, 1973) to experiment with a modified and abbreviated pregnancy history approach to cover all the same material just described--live births, fetal loss, and infant mortality--in a more logical and orderly fashion. The method worked so smoothly that it was further developed for the fifth period and thereafter incorporated into schedules used for gathering fertility data during subsequent periods.

Briefly, the approach to obtaining fertility data begins with a question on pregnancies experienced during the period under observation for births (for example, the preceding six months) plus the six months antecedent to this. Any pregnancies mentioned are followed to term and categorized (with appropriate detail upon date and place of termination) as live births, or still-born children. Where the woman is still pregnant, this fact is noted for the next research round. Each live birth is then followed up to determine present status of the child (deceased, still living).

The advantages of the method are greater assurance that women do not forget to mention a child that lived briefly, as they sometimes do when queried directly only about live births, or even a still-living child that somehow they overlook because of its recent birth or some other cause. In addition, questions upon fetal loss and infant mortality flow smoothly and with logical transition from this kind of approach. This technique is an especial benefit in the southern Philippines where people do not like to talk about their dead. Further, the smooth transition into infant and fetal mortality paves the way for an easy transition to the subject of mortality among other members of the household.

Approaching the subject of infant mortality and even more of general mortality after discussing only live births with the respondent is a delicate moment in interviews in the southern Philippines, and a smooth, logical flow of ideas from fertility to mortality definitely benefits the interview atmosphere and helps to ensure good receptivity on the part of interviewers on their next round--a point of particular importance for recurrent research on the same households.

A disadvantage of the approach is that it increases the time scope to be covered and at times produces data which are out of scope (for example, a pregnancy that began some months before the in-scope period for births and aborted before this

in-scope period had begun). Nevertheless, the advantages seem greatly to exceed disadvantages. The authors recommend the procedure in circumstances where fetal, infant mortality, and live birth data are to be collected, especially in cultures where the subject of death is considered indelicate or even somewhat taboo.

VIII. ALTERNATIVES TO THE DUAL RECORD METHODOLOGY: THE BRASS TECHNIQUES

Professor William Brass of the London School of Hygiene and Tropical Medicine has invented several new methodologies for the estimation of vital rates in developing countries. In particular, in a joint work with others on the countries of tropical Africa, Brass et al. (1968) presented a set of methods for estimating levels of fertility and of mortality in the English-speaking countries of tropical Africa, where registration systems either do not exist or are not reliable. These 1968 methods of estimating fertility and mortality were tried in the MCPS samples in the first and second semesters of the calendar year 1972.

Fertility Estimates

The techniques are described at length elsewhere (Brass et al. 1968) and need not be discussed in detail here. The fertility measures are based upon the splicing together of two indicators: 1) reports of children ever born for women ages 20-24 (or for women ages 25-29) are used to determine level of fertility and 2) pattern of fertility is obtained from current fertility. Current fertility is corrected by a ratio formed by P_2/F_2 where P_2 is the number of children ever born of women ages 20-24 and F_2 is the cumulation of current fertility up to the midpoint of each age interval. The procedure assumes that age-specific fertility has remained constant over time; therefore, average number of children ever born at any age equals the cumulative fertility of preceding ages. Weights are derived from a polynomial equation on the basis of inputs obtained empirically from the fertility schedule of the women under study. These weights are employed to calibrate the observed age-specific current fertility rates to cumulation at the midpoint of each age interval.

The method was worked out primarily for application in tropical Africa, but it has been applied with some success to other peoples and cultures. The degree of success has depended on the amount of divergence between assumptions of the method (which relate to tropical African countries) and actual conditions of the population to whom the method is applied.

The following assumptions are made:

- The fertility of women ages 15-29 has remained constant during the recent past.

- The age pattern of fertility resembles typical age relationships in populations which practice little or no birth control.

- The number of divorced, separated, and widowed women is not unusually large among women ages 30-45.

These assumptions are not clearly met by the Misamis Oriental data. First, it is unlikely that the fertility of women ages 15-29 in the two 1971 sample study areas had remained constant in the recent past up through 1972, the year to be studied by means of the Brass methodology. Although women of the rural population may

have been less affected than urban women, female age at first marriage appears to have been rising during the past two decades in Misamis Oriental Province and in Cagayan de Oro City in particular (Madigan et al. 1972, Smith 1975).

Second, the age patterns of fertility may have undergone some change between 1960 and 1972. Age-specific birth rates of the dual record project suggest little change in fertility of married women below age 30 since 1960, but do suggest that the fertility of older married women may have declined somewhat by 1972.

The evidence on age patterns of declining fecundity is scanty, but such age patterns appear similar to previous years in both rural and urban areas.

The number of widowed women, of annulments, of known separations, and of other dissolutions of marriage does not seem to have been unusually high either shortly before or during 1972.

Women are believed for social reasons to somewhat understate their age in census enumerations and surveys in north Mindanao. The extent to which this is done is not precisely known. The amount of understatement is probably on the order of five years or less.

Procedure. Age-specific current fertility data were obtained for two six-month periods, January 1-June 30 and July 1-December 31, 1972 by two surveys, one of which was carried out in July-August 1972 and the second of which was carried out in January-February 1973. These surveys were the regular MCPS survey rounds two and three. Each set of rates (one for each period) was annualized. These annualized rates represented the current fertility used as stage one of the Brass technique for estimating fertility. Data on number of children ever born were also gathered in the same survey.

The questions asked in each of the two surveys were similar. However, several differences in procedure distinguished the two rounds. In the July 1972 round, children ever born data were obtained by sex for a) children living at home, b) children living away, and c) children deceased. The January 1973 round collected data on the same three categories of children but for both sexes combined.

In the 1972 round, data on children ever born were asked for all women, including the respondent. In the 1973 round, instructions emphasized avoiding, as far as possible, use of single women as respondents for the children ever born questions. This increased the proportion of non-response for these questions but presumably increased the proportion of more knowledgeable persons among proxy respondents as well as restricting the number of proxy respondents.

In the 1972 round, all households in both study areas (urban and rural methodological samples) were interviewed. In the 1973 round, because of an experiment on recall, a subsample of the households in each sample area was interviewed.

The data. Reported number of children ever born increased with age of women up to age 50, but declined thereafter, for both urban and rural women. No reason existed for the belief that women age 50 or older had had lower fertility than later cohorts. These declines in the reporting of children by older women were, therefore, attributed to errors of recall.

Single women, whether self- or proxy-reporting, declared few births, and almost all of these births had survived until interview. A probable explanation is that only those children of single women were reported to interviewers whose presence in the house was obvious. Children who were away or who had died were probably not reported.

In the urban area, self-reporting married women consistently declared larger numbers of children ever born and less surviving children than were attributed to proxy-reported married women.

Results show, too, that rural women had borne larger numbers of children than had urban women. If the 0-14 age group is excluded, fertility was at least 16 percent higher in each rural age group, and ranged as much as 36 percent higher in younger age groups.

Computations of average number of children ever born and of children surviving. Computation of average number of children ever born to single women took account of the probable underreporting of children revealed by the unlikely survival ratios. Where average number of children ever born of self-reporting and proxy-reporting single women were different, the higher reported average was taken for both categories. This higher figure was then divided by the survival ratio computed for self-reporting married women belonging to the same age group. The result was used to obtain the corrected number of children ever born for single women. The increase of children ever born for all women because of this correction proved negligible, however.

In the urban area, the average number of children ever born of proxy-reported married women was raised to the level of the children of self-reported married women. The survival ratios of these children ever born used for the proxy-reported women were also taken from those computed for the self-reported women. The assumption of these corrections is that differences between self-reported and proxy-reported women are due more to understatement of children and of deaths among children under age one because of forgetfulness or ignorance than they are due to real differences between self-reported and proxy-reported women. While it is possible that Cagayan women who are proxy-reported differ to some extent from self-reporting women because a larger proportion of the proxy-reported women may be working women, the number of Cagayan working women practicing fertility control in 1972 appeared small. It seems that forgetfulness or ignorance was the more likely hypothesis. An aunt, for instance, may have been quite unaware that before the niece had come to live with her, the niece had had a child who died almost at birth.

Similar procedures were used to compute the children ever born of all women in the rural sample area. In computing children ever born of single women, however, the higher of the two categories, self-reporting and proxy-reporting, was divided by the survival ratio of children ever born of ever-married women rather than by the survival ratio of the children of self-reported, ever-married women. In the rural area the overall survival ratios of these two categories of ever-married women were fairly similar.

A rough check can affirm the consistency of children-ever-born data through application of an approximation formula:

$$\frac{P_3^2}{P_2} \doteq P_7$$

This formula for the corrected urban data yields 6.4 for P_3^2/P_2 which checks with 6.4 children ever born for P_7. (P_1 is the average number of children ever born for the first age group, women ages 15-19, P_2 is the average number of children ever born for the second age group at time of interview, ages 20-24 and so forth. P_7 is the average number of children ever born for women ages 45-49 at time of interview.) The rural value of the P_3^2/P_2 was 7.6, which checks fairly well with the P_7 of 7.8. The data were judged internally consistent enough for application of the Brass techniques.

Fertility results. Tables 18 and 19 present the fertility rates estimated by the Brass techniques and compare these with both the current fertility rates collected directly in the survey and unadjusted, such as a simple survey might produce, and with the dual record rates. Table 18 relates to the data for the period, January 1-June 30, 1972 and Table 19 relates to the data for the following six-month period.

TABLE 18

Comparison of Fertility Estimates Obtained by Single Survey, Brass Method, and Dual Record System, Cagayan Poblacion, and Rural Areas, Western Misamis Oriental Province, January 1-June 30, 1972, per Thousand Women, Annualized

	URBAN AREA			RURAL AREA		
Ages of Women	Single Survey[a]	Brass Approach[b]	Dual Records	Single Survey[a]	Brass Approach[b]	Dual Records
15-19	34.2	41.1	46.4	71.6	94.3	77.6
20-24	122.7	147.4	157.7	268.1	353.2	286.8
25-29	227.0	272.8	275.0	289.3	381.1	315.8
30-34	179.4	215.6	232.2	244.5	322.1	258.0
35-39	125.2	150.4	155.3	187.6	247.1	215.8
40-44	53.8	64.6	67.4	75.5	99.5	80.4
45-49	14.3	17.2	15.0	15.3	20.1	15.3
TFR	3,783.0	4,545.5	4,745.0	5,759.8	7,587.1	6,248.5
GRR	1,846.1	2,218.2	2,315.6	2,810.8	3,702.5	3,049.3
CBR[c]	32.8	39.4	41.5	36.5	48.1	39.6

[a]Based upon MCPS survey round two conducted in July-August 1972.
[b]Adjusted age-specific fertility rates based upon P_2/F_2 raising factor.
[c]Expected births divided by urban sample population as of April 1972 × 1000.

TABLE 19

Comparison of Fertility Estimates per Thousand Women Obtained by Single Survey, Brass Method, and Dual Record System, Cagayan Poblacion, and Rural Areas, Western Misamis Oriental Province, July 1-December 31, 1972, Annualized

Ages of Women	URBAN AREA			RURAL AREA		
	Single Survey[a]	Brass Approach[b]	Dual Records	Single Survey[a]	Brass Approach[b]	Dual Records
15-19	34.8	36.3	42.4	77.6	84.4	85.8
20-24	174.9	182.4	193.3	342.0	371.9	386.8
25-29	174.6	182.0	187.5	302.7	329.2	308.5
30-34	179.5	187.1	187.0	347.6	378.0	366.0
35-39	105.1	109.6	106.8	243.7	265.0	257.6
40-44	56.4	58.8	66.8	81.5	88.6	81.6
45-49	12.1	12.6	12.3	0.0	0.0	0.0
TFR	3,687.1	3,844.1	3,980.9	6,975.5	7,585.5	7,430.5
GRR	1,799.3	1,875.9	1,942.7	3,404.0	3,701.7	3,626.1
CBR[c]	34.1	35.5	37.2	44.7	48.5	48.0

[a]Based upon MCPS survey round three conducted in January-February 1973.
[b]Adjusted age-specific fertility rates based upon the P_2/F_2 raising factor.
[c]Expected births divided by the urban sample population (50%) of September 1, 1972.

The concurrence of rates estimated in Table 18 for the urban area by the Brass and by the dual record method is close. The Brass estimates fell only 4.4 percent short of the dual record results. Agreement in pattern is also close. In the rural area, however, while agreement in age pattern of fertility is again close, the Brass estimate appears to have overestimated fertility overshooting the dual record results by 21.5 percent. Incidentally, the P_2/F_2 ratios proved better correction factors than the P_3/F_3 set.

The concurrence of rates for the second six-month period, shown in Table 19, is close for both urban and rural sets of rates. The Brass estimates fell short of the dual record results by 4.8 percent in the urban population and were 1.0 percent larger for the rural population. Again, age patterns of fertility in both urban and rural sets of rates were very similar.

The concurrence of rates for calendar year 1972 was also close. For the seven age groups for the urban area, these were:

	1	*2*	*3*	*4*	*5*	*6*	*7*
Brass	38.7	164.9	227.4	201.4	130.0	61.7	14.9
Dual	44.4	175.5	231.2	209.6	131.0	67.1	13.6

These urban Brass estimates fell short of the dual record level by approximately 4 percent. The total fertility rate per thousand persons for the simple survey was 3,735 births, whereas that for the Brass estimate was 4,195 and that for the dual record system was 4,362.

For the same seven age groups, the rural estimates for calendar 1972 were:

Brass	89.4	362.6	355.2	350.0	256.0	94.0	10.0
Dual	81.7	336.8	312.2	312.0	236.7	81.0	7.6

These Brass estimates were not as high as those for the first period, but exceeded the dual record rates by approximately 11 percent. The age patterns of fertility were again very close. Total fertility rates per thousand women were 6,366.5 for the simple survey, 7,586.0 for the Brass estimate, and 6,840.0 for the dual record system.

Conclusions. On the basis of these tests, the Brass fertility methodology has proved quite robust. Despite failure to satisfy several important assumptions of the method, the approach produced estimates that were generally close to the dual record results. If total fertility is made the point of comparison, in three out of four semestral cases the Brass estimates came within 2.1, 3.4, and 4.2 percent of the dual record rates. In the fourth case (that of the first rural trial), the deviation of the Brass estimate was 21.4 percent. For the course of the calendar year as a whole, the deviation for the urban area was 3.8 percent and for the rural area, 10.9 percent.

In the period and rural locality in question, a large drop in fertility had occurred, from a crude birth rate level of 45.8 births per thousand to one of 39.6 per thousand. Most probably this decline was due to seasonal variability.

It is suggested that estimates may be more accurate where fertility declines, if any, are gradual. Fertility levels for periods of sharp fertility decline may be substantially overestimated. But since one does not know which periods are likely to be characterized by such declines, it may be hazardous to use the Brass technique as a method of judging the effects of specific family planning program approaches applied for six months to a year in selected populations, for example, the Philippine TIDA (Total Integrated Development Approach) in certain experimental provinces.

Finally, evidence already presented suggests that in cultures like the Philippines, where the shame of illegitimacy runs high, the costs of interviewing single women about their possible previous births do not seem justified by the quality of data obtained. These costs should be reckoned not only in economic terms but also in terms of loss of rapport with respondents, especially if the same households are to be visited recurrently for some time.

The evidence already given also suggests the desirability of either limiting Brass-type or Cho-type census or survey questions to self-reporting women respondents, or to separate the tabulations of the responses for self-reporting and proxy-reporting respondents for separate analysis and for possible correction of the proxy-reported data if this should seem warranted by the differences found. A short discussion paper on the points of these last two paragraphs has been prepared by the

MCPS which may possibly lead to further publication and/or research upon this topic within the next two years.

Mortality Estimates

The Brass mortality estimates tested in the second and third survey rounds related to childhood mortality. Since that time Brass has devised several methods based on orphanhood to estimate adult mortality (Brass and Hill 1973).

Assumptions of methodology. Assumptions made for the childhood mortality estimates are more stringent and demanding than those made for fertility. These are: 1) The age-specific schedules of both fertility and of mortality should have been approximately constant during the recent past. 2) The age and parity of mothers should not have been closely associated with infant mortality. 3) In reports by women of children ever born, omissions of living and omissions of deceased children should have been made at approximately equal rates. 4) The age patterns of infant and of child mortality should approximate those of model life tables.

The demands of these assumptions appear to be met by the Misamis Oriental data even less satisfactorily than those for estimation of fertility. Crude and age-specific birth rates appear to have declined since 1960. This decline by 1972 seemed largely a result of an increase of women's age at first marriage, but may also have included a small component caused by a decline in marital fertility, especially among women age 30 and over. Mortality, both crude and age specific, seems rather clearly to have declined between 1960 and 1972. It seems likely that age patterns within the mortality schedule may also have changed because of disproportionate declines within particular age groups. Probably no important linear association is found in Misamis Oriental data between age and parity of mothers on the one hand and infant mortality on the other. Nevertheless, a U-shaped curvilinear association may well be present which would appear if the two half-segments of the U-curve were to be analyzed separately. The MCPS experience suggests that rates of omission of deceased children exceed the rates of omission of still living children. Finally, patterns of infant and childhood mortality in Misamis Oriental Province do not appear to closely approximate the patterns of any of the four families of model life tables prepared by Coale and Demeny (1966).

An additional problem besets the user of the Misamis Oriental data. The randomized response applications already described in the chapter on mortality levels appear to show substantial purposeful non-reporting of mortality. Would respondents be more willing to report deaths in a more general way as number of children not surviving out of children ever born than they would be to report specific deaths by name of deceased and date of death? One might speculate that they would.

Thus the assumptions for making Brass mortality estimates are not well satisfied. Nevertheless, Brass mortality procedures have given fairly good results in other situations where basic assumptions were not adequately met. The intent of this section is to observe the degree of bias such estimates might contain when based upon data such as that described above for Misamis Oriental Province.

Data and procedures. In the urban data from the July 1972 round, the proportion of deceased children among children ever born did not increase smoothly or

steadily with advancing age of mother. The conversion can be accomplished by subtracting proportion of surviving children from unity.

These proportions of deceased children were, by age group of mother, from ages 15-19 to 45-49: .0769, .0765, .0592, .0672, .1073, .0914, and .0961.

Accordingly, these proportions were treated in the following ways to attempt to discover the underlying curve of mortality:

- Application of the Brass multipliers (for adjusting proportions of children deceased out of all children to an early or late average start of childbearing found among women of the population) directly to the unadjusted proportions.

- Graduation of the proportions. This was done by means of difference equations (Whittaker-Henderson Type A equations). The Brass multipliers were then applied to these graduated proportions.

- Graduation of the product of the unadjusted proportions and of the Brass multipliers through the same type of difference equations.

- Selection of values at different age points from the unadjusted proportions through which a consistent mortality curve might be drawn, by analogy to a curve from a model life table selected because it is close to the values originally selected as basis.

The adjusted proportions of deceased children (after multiplication by the Brass correction factors cited above) produce an approximation to life table mortality rates from birth to time of interview. These rates (${}_xq_0$) can be converted to the more usual age-specific mortality rates (${}_nq_x$) and then converted to central death rates (${}_nm_x$) for comparison with the central death rates estimated by the dual record system The conversion of the specific mortality rates to central death rates was accomplished a) by reverse use of the Reed-Merrell tables and b) by interpolation between m_x values associated with q_x values in the Coale-Demeny Model West tables for levels 16-18. Results of the two procedures gave nearly comparable values except for children less than age one. For these the Reed-Merrell tables incorporate a correction factor for U.S. data which is not applicable to the present case.

In the urban data for the January 1973 round, once again proportions of deceased among children ever born did not increase steadily or smoothly with age. These proportions were (by age group of mother from ages 15-19 to 45-49): .1200, .0825, .0774, .0850, .1352, .1252, and .1087.

Treatment of the data followed the same pattern as in the preceding analysis for the round two survey data.

Child mortality results, urban data. Table 20 compares age-specific death rates obtained by the above-mentioned procedures with those obtained from the dual record system. The four sets of rates given as Brass estimates are the four sets derived by procedures described previously. The table also compares total expected deaths for ages 0-19 for which it employs the Cagayan de Oro 1970 Census distribution as the standard population.

TABLE 20

Central Death Rate Estimates ($_nm_x$) for Childhood Years, and Expected Deaths from Applying Dual Record and Brass-Type Rates to Standard Populations, Urban and Rural Methodological Samples, Misamis Oriental Province, January-June, July-December, and Entire Calendar Year 1972

	DEATH RATES PER THOUSAND SPECIFIED PERSONS												
	DUAL RECORD SYSTEM						BRASS SURVEY TECHNIQUES						
	AGES						AGES						
Brass Survey	0	1-4	5-9	10-14	15-19	E[a]	0	1-4	5-9	10-14	15-19	E[a]	Set Symbol
Urban													
2[b]	91.9	13.1	1.6	4.4	3.0	554.3[e]	73.7	0.0	9.4	0.0	1.1	350.3	A
							63.7	6.2	1.9	1.3	1.8	325.4	B
							65.1	6.8	1.6	1.6	1.8	336.8	C
							73.7	8.3	2.8	1.2	2.6	403.3	D
3[c]	40.2	8.4	5.5	1.5	1.1	336.1[e]	78.8	3.4	12.0	0.0	0.0	436.0	A
							79.8	9.1	2.7	2.0	2.5	437.8	B
							76.8	10.8	2.7	2.7	2.6	462.2	C
							78.8	8.8	2.3	2.4	2.2	426.3	D
2-3[d]	66.0	10.8	3.6	3.0	2.0	445.2[e]	76.2	8.6	2.6	1.8	2.4	414.8[g]	
Rural													
2[b]	65.8	8.9	2.0	1.8	2.2	107.3[f]	73.8	11.7	5.2	6.4	3.2	162.5	
3[c]	85.3	10.8	1.0	0.0	2.7	122.1[f]	67.0	11.9	5.1	9.6	0.0	150.9	A
							66.4	13.4	4.8	4.0	4.6	147.7	B
2-3[d]	75.6	9.8	1.5	0.9	2.4	114.7[f]	70.1	12.6	5.0	5.2	3.9	155.1[h]	

[a]Expected deaths from applying specified rates to standard population.
[b]Survey round two of July 1972, covering January 1-June 30, 1972.
[c]Survey round three of January 1973, covering July 1-December 31, 1972.
[d]Average of results for survey rounds two and three.
[e]Population of Cagayan de Oro as enumerated in 1970 Census used as standard population.
[f]Population of rural sample as of April 1, 1972, used as standard population.
[g](D of Survey 2 + D of Survey 3) ÷ 2.
[h](Survey 2 and B of Survey 3) ÷ 2.

For the January-June period, the dual record rates are higher than the Brass estimates for all but children ages 5-9. In addition, the set of estimates closest to the dual record rates produced 27 percent fewer expected deaths from the standard population (the Cagayan de Oro 1970 population, ages 0-19).

For the July-December period, on the other hand, the Brass estimates are higher than the dual record rates, although in the age 5-9 group the dual record rate was larger than three of the four results from the different procedures employed to obtain Brass estimates. The dual record rates produced 27.3 percent less expected deaths for this period than the Brass estimates when applied to the standard population.

The two sets of rates come closer together for the entire calendar year 1972. If two sets of rates based upon the same procedure for estimating Brass rates are taken, the D set is preferable. The Brass estimates would indicate greater mortality under age 1, and the dual rates greater mortality at ages 1-14. The dual rates would exceed the Brass estimates of expected deaths by 7.3 percent.

Results, rural data. In the January to June data gathered by the second survey in the rural area, proportions of the deceased among children ever born increased with age. It was not necessary to graduate these proportions but simply to apply to them the Brass multipliers, thus producing the approximate mortality rates from birth to interview ($_xq_0$). These rates were converted to conventional abridged life table mortality rates ($_nq_x$) and then to central death rates ($_nm_x$) by the same procedures as employed for the urban data.

Table 20 shows that the Brass mortality estimates for the second rural survey were higher for all age groups studied, and that standardization (this time utilizing the rural sample population of April 1, 1972, as the standard population) produced 34.0 percent fewer expected deaths for the dual record data than for the Brass estimates.

Proportions of children deceased among those ever born did not increase with equal smoothness in the data for the rural area gathered by survey round three for the period July-December. The rates were graduated with an A-type Whittaker-Henderson difference equation and the Brass correction factors were applied to the ungraduated and to the graduated set of proportions to produce the $_xq_0$ rates. These were transformed into $_nq_x$ and $_nm_x$ rates, as was done previously, and the results are shown in Table 20. Each of these sets of Brass estimates are at a lower level than the Brass estimate for the preceding six months, but both sets are higher than the dual record set for the corresponding period, also shown in the left-hand side of the table.

Rates for the entire calendar year 1972 are shown for the rural area on the last line of Table 20. Levels and patterns of mortality are somewhat different, as can be seen. The dual rates exhibit higher mortality for children less than age one, but lower mortality thereafter. Expected deaths produced by the dual record system were 26 percent less than those produced by the Brass estimates, using the graduated set for the second half of the year.

Conclusions. The Brass procedures estimated a somewhat lower urban death rate over the course of 1972 than the dual record rate--6.8 percent if the smaller rate is divided by the larger and the result subtracted from unity. However, this was because the dual record estimates for the first half of the year were considerably larger than the Brass estimates. In the second part of the year the Brass estimates were actually larger than the dual record rates.

The rural death rates estimated by the Brass techniques were not only larger than the dual record rates for the calendar year 1972, but for each of its two semesters as well. Differences were considerably larger during the first six months than during the second.

Ordinarily, differences from a dual record estimate would be taken as error since a dual record system has a built-in self-correcting device, its coverage rates. However, if purposive concealment of vital events takes place, neither system of a dual record project will be able to uncover the concealed cases, nor will the joint probability theorem be able to estimate the number of such missed cases. The same concealment would presumably affect research workers of a single system if they should ask for specific data about deaths, for example, names and dates. It is possible, however, that should a dual system or a single system ask only for general rather than specific data (for example, number of children still living out of number ever born), persons concealing specific deaths might nevertheless be willing to provide the more general data. This approach might be thought to present little danger for them of penalization for non-registration of the death or deaths of persons they did not declare to the registration authorities, and whom they may have illegally buried.

If purposive concealment of death takes place on a substantial scale, therefore, Brass estimates may be closer to the true level of mortality than dual record results. The foregoing chapter on dual record mortality level which detailed the results of the randomized response investigation would appear to indicate that such substantial purposive concealment does take place. More research is needed upon this point.

Granting that purposive concealment of death does take place on a large scale, and that mortality level is higher than the dual record rates would indicate, it is not clear whether the Brass estimates approach such a level more closely because people mentioned deaths in a general way which they concealed when specifically asked about them, or because of errors which fortunately happened to be in the right direction. The data failed to satisfy important assumptions of the method. That is, people may not have concealed fewer deaths, but may have reported the same proportions of deaths out of a larger number of deaths that had occurred to the children of older women when mortality was higher. In addition to the decline in mortality which has taken place in Misamis Oriental since 1960, a decline in fertility has also taken place. This decline may have shifted the mean of the fertility schedule enough to cause selection of Brass multipliers that were too high. In fact, the highest percentage deviation of the Brass approach from the dual record results was for the rural area data from the second survey. This period is precisely a time when seasonal fluctuation caused a sharp decline in fertility in this rural population.

In short, if the deviation of the Brass estimates for childhood mortality are in the right direction, a point not completely clear at the present time, they may be in this direction for the wrong reason--that is, not because they obtain a greater percentage of actual deaths but because of errors caused by failure of data to meet assumptions of the method. If this second reason should be the cause of the higher estimates in the present case, one could not be sure of such a happy outcome on other sets of data.

Clearly, more research is needed upon the subjects of level of mortality and of purposive concealment of death in the southern Philippines, and in the Philippines as a whole.

In summary, then, the Brass fertility estimates, despite failure to satisfy assumptions of the methodology, have produced fairly good estimates of level and pattern of fertility. The one time they were considerably in excess of the true rate was during a sharp fertility decline. This event suggests strongly that they are not appropriate instruments for documenting the short-term effects of family planning programs.

Difficulties with Brass child mortality data caused by possible large-scale purposive concealment of death by respondents preclude at this time a final judgment on the validity of the Brass method in this application.

A more detailed account of Brass applications in the southern Philippines will be found in Report 20 of the Mindanao Center for Population Studies (Madigan, Herrin, and Cabaraban 1976).

IX. ALTERNATIVES TO THE DUAL RECORD METHODOLOGY: OWN CHILDREN METHOD

The Own Children method was originally proposed by Grabill and Cho (1965) and was thereafter strengthened and refined by Cho (1970). The method requires that each child in households of interview be clearly linked to its own mother and that the necessary data be obtained to crossclassify children whose mothers live in the house of interview by own age and by age of mother. The method depends for its accuracy upon correct age reporting of young children and will be no more accurate than the age data of the census or survey upon which the application of the method is based (Cho 1970).

Data Adjustments

The data on numbers of children living with mothers in house of interview gathered in a census or survey must be adjusted for children not living with mothers and for children deceased during the decade preceding the census or survey. Data for such adjustment may be gathered in the census or survey itself or may be gathered otherwise. The data must also be adjusted for the mortality of women, again for the decade preceding the study.

Cho (1970) notes that where the level of mortality has fallen substantially as it has in most countries today, variations in mortality which are plausible for the population under study are unlikely to affect fertility estimates in any significant way. He also indicates that where no appropriate life table is readily available, the Brass estimates of childhood mortality described in the chapter preceding may be substituted. He also points out that the proportion of children less than 10 years of age not living in the same household as their mothers appears to be very small.

Cho feels that the method is a powerful technique for estimating fertility under the following conditions:

- The data on children's ages are reasonably accurate.
- Most young children live in the same household as their mothers and their relationship to family or head of household is clear.
- Mortality has been relatively low in the years preceding the survey.

After the category of own children has been cross-tabulated by age and by age of mother, the frequencies are corrected for children living in other households and (where appropriate) for underenumeration. They are then reverse survived from census date or median survey date to year of birth. The mothers of these children are also reverse survived back to median point of each of the years (usually 10) for which rates are desired. Where appropriate, numbers of these women have also been corrected for underenumeration. Simple division of births estimated for a year by number of women of the proper age group estimated at midpoint of that year produces the estimate of age-specific fertility for the particular age group for the specified year. Cho (1970) notes, however, that the data for specific fertility for

particular calendar years (or other years) are best combined into five-year age groups. The broader age groups have smaller variances and are in addition more convenient for analysis as well as for handling than the one-year groups.

Procedures

Data for application of the Own Children method were gathered during survey round five (January 1974) of the dual record study. During this survey round, all of the methodological samples were covered--3,998 urban and 4,125 rural households. The urban population included 11,572 males and 12,821 females. The rural sample, slightly smaller, covered 12,276 males and 11,908 females. Median date of interview was January 29, 1974, in the urban sample and February 3, 1974, in the rural sample. In each household, a respondent (usually the female head of household) was asked to provide information on all persons residing in that house who were members of her household, to give the dates of birth of each, and, for children 10 years of age and less, besides being careful to give their ages accurately, to indicate their mothers.

Children age 10 and less who were living away from their mother's household were obtained by age in a separate interview by workers of the recording system, who also obtained number of children living with their mothers. From these data, proportions of children under age 10 living elsewhere than with their mothers were obtained. Such children were relatively few in number; 98.2 percent of all children under age 5 were found to be living with their mothers in the same households, as were 96.9 percent of all children ages 5 to 9. These proportions are quite similar to those which Cho (1970) cites for Korea from the 1966 Korean Census.

The age reporting for children found in the MCPS urban and rural samples was found to compare favorably with that of the 1950 U.S. Census (Madigan and Herrin 1976a). Error in age reporting for women ages 15-54 was found to be somewhat higher in the MCPS samples than in the 1950 U.S. Census reports, but its nature suggests that inaccuracies would balance out in 2 to 3 years. The average of absolute deviations from a blended age estimate (3 × frequencies at the declared age divided by the sum of frequencies at the age declared, the previous age, and the next age, in single years of age) was 14.1 for the urban area, 10.5 for the rural area, and 8.4 for the 1950 U.S. Census data (Madigan and Herrin 1976a, Table 21-3). This seemed acceptably good age reporting, especially since age reporting of women ages 15-54 is not as critical for the Own Children methodology as is the age reporting of children. In addition, data for individual years of age of mothers were intended for combination into 5-year age groups of mothers by calendar years, as Cho advises.

Reverse survival procedures: Estimation of 1970-1973 ratios, children ages 0-9. Levels of mortality in the Philippines are not precisely known. Death registration is known to be seriously deficient and rates based upon registration data and census projections are believed to provide seriously biased estimates. Further, mortality has been much less intensively studied than fertility by demographers. Several life tables have been constructed, but assumptions necessarily made in their computations raise serious doubts as to their applicability to general Philippine populations.

Mortality levels in Misamis Oriental have been studied even less than levels in the Philippines in general. For this reason, age-specific mortality levels were estimated from the age-sex specific central death rates of the MCPS dual records

study. Death rates for single years of age (m_x) were derived from these by graphic techniques and these m_x rates were transformed to probabilities of dying (q_x) by the actuarial formula for single years of age:

$$q_x = \frac{m_x}{[1 - .5m_x]}$$

and by reference to a standard table (U.S. Life Table 1971). Resulting probabilities were graduated graphically and forced to yield as many survivors at first moment of age 1, of age 5, and of age 10 as had been produced by ${}_1q_0$, the ${}_4q_1$, and the ${}_5q_5$ rates, based on the observed data, which had also been computed by means of the Reed-Merrell Tables (1939), except for the ${}_1q_0$ for which, as stated above, the familiar actuarial formula cited was used.

Survivors at exact age x were derived by sex from these rates and from these were obtained the stationary populations at ages 0-9. Finally, survival ratios by sex were derived from the stationary populations from birth to midpoints of particular years by the formula L_a/l_0. Finally, survival ratios were combined into a single ratio for both sexes by means of the following sex ratios:

Ages	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Sex Ratios	106	105	105	104	104	104	103	103	103	103

These sex ratios were based upon careful examination of Philippine Census, MCPS, and U.S. data. Philippine census results for 1960 average about 106 for the entire 10 years (which seems too high). MCPS data begin at above 113 for below 1 year of age (which also seems too high) and fall to 97.8 by age 9 (which seems too low). American census data for 1950 decline from more than 104 at birth to about 101.5 at age 9. The sex ratios used take account of the high initial sex ratios of the Philippine census and of the MCPS data, and attempt to make a reasonable compromise between the slow decline of the Philippine census data and the rapid decline of the MCPS data, using the American data as a guide (Madigan and Herrin 1976a).

The survival ratios thus derived actually relate to the period September 1971-December 1973. However, they were employed to estimate mortality for the years 1970-1973.

Estimation of 1964-1969 survival ratios, children ages 0-9. MCPS mortality data by sex for 1971-1973 were compared by graphic techniques with Model West life tables (Coale and Demeny 1966), and Tables 17 for males and 19 for females were selected as closest fits to the MCPS data for ages 0-9. The assumption was made that mortality had declined during the period 1965 to 1972, and that the result had been an increase in expectation of life of 2.5 years for this period (1965-1972). The assumption was based on experience with conditions of life in Misamis Oriental during this period.

Correction factors were, therefore, obtained from Model West Tables 16 and 17 for males and 18 and 19 for females, which would produce the rates of the higher mortality table (for example, 16 for males) when multiplied by the rates of the lower mortality table (for example, 17 for males). On the other hand, division of

the lower mortality table ${}_nq_x$ by the correction factors would produce the rates of the higher mortality table.

These correction factors were then applied to the 1971-1973 MCPS mortality rates by sex to obtain a (higher) 1964 set of mortality rates for ages 0-9. By the same processes described above, a set of 1964 survival ratios were computed from these 1964 rates.

Finally, the 1964 and the 1970-1973 ratios were averaged to produce an "in between" set of survival ratios for children ages 0-9. These survival ratios were used for the years 1964-1969 (Madigan and Herrin 1976a).

Survival ratios of women ages 10-54. MCPS central death rates, 1971-1973, for women ages 10-54, urban and rural, were converted into 5-year mortality rates (${}_5q_x$). By procedures similar to those described previously, 1-year mortality rates were obtained for ages 10-54. Survivorship values (l_x) were derived from these. Stationary populations were obtained from these by the formula:

$$L_x = \frac{l_x + l_{x+1}}{2}$$

Survival ratios were obtained from these 1-year stationary population values by the formula:

$$\text{S.R.} = \frac{L_a}{L_{(a-i+\frac{1}{2})}}$$

Results

Age-specific and total fertility for the 10 years 1964-1973, by 5-year age groups, have been computed by application of the Own Children methodology.

Over all 10 calendar years, the urban data exhibit a pattern of highest fertility for women ages 25-29. Women ages 30-34 made the second largest contribution to fertility.

Patterns of fertility have changed most in two urban age groups, namely, for women ages 20-24 and 35-39. In 1964 and down through 1970 (the year the Commission on Population began to mount a population program), the fertility level of urban women ages 35-39 was higher than that of women 20-24. Beginning in 1971, however, the fertility of women 35-39 declined below the level of fertility of women 20-24, and it has since remained below this level.

This decline warrants further inspection as it has been substantial. Its average level between 1964 and 1970 was 197 births per thousand persons. Its average for 1971-1973 was 123.9 births per thousand. This suggests that this was the age group especially in which urban families began to feel the economic brunt of having more children and increasing their family size in the fashion of their mothers and grandmothers. It is also important to note that, unlike the case for urban women ages 20-24, delayed marriage has little effect in Misamis Oriental Province on the

current fertility of women ages 35-39, almost all of whom are married.

The rural data, on the other hand, exhibit somewhat different characteristics. While fertility is generally highest among women of the rural sample at ages 25-29, it is not nearly as apparent as in the urban area. In calendar years 1967 and 1969 there are inversions. The fertility of rural women 35-39 also declined less rapidly than that of women 20-24.

These Own Children estimates exhibit a marked decline in fertility for both urban and rural areas over the ten calendar years studied. These are perhaps most clearly manifested in the total fertility rates. Dividing the total fertility for each calendar year by that of 1964 and multiplying the result by 100 produces the following set of ratios for urban fertility:

1964	*1965*	*1966*	*1967*	*1968*	*1969*	*1970*	*1971*	*1972*	*1973*
100.0	88.8	83.3	81.8	86.4	78.4	79.8	80.0	65.1	72.6

Ratios for the rural area exhibit a less steep but nevertheless rather consistent decline:

1964	*1965*	*1966*	*1967*	*1968*	*1969*	*1970*	*1971*	*1972*	*1973*
100.0	104.3	101.9	94.5	92.3	94.9	93.2	92.6	83.3	77.9

MCPS has dual record data for comparison purposes only for the years 1971, 1972, and 1973. The reader is reminded of the qualifications of these data, however. The 1971 data cover only the months September 1-December 31. The data for 1972 are based upon a complete sample for January 1-June 30, and upon a 50 pe cent probability subsample for July 1-December 31. Rates of both semesters are given equal weight to eliminate seasonal variation. The 1973 rates are based upon a 75 percent probability subsample for January 1-June 30 and upon a complete sample for July 1-December 31, with rates for each semester again receiving equal weight. (The subsampling was necessitated by the recall experiment to be discussed in the next chapter).

The Own Children data are also different in another way. They are longitudinal data in that they are limited to a fixed population interviewed at one survey date. No one can leave this population except by death, and no one can enter it after the original survey. Deaths are estimated and accounted for by the survival rates. Given the survival rates, one can estimate and replace in the population base and in the births of the numerator those that have died. Children living away are also replaced in the numerator of the proper calendar year.

Since the mix of households in a recurrent census, survey, or other study will change from one round to another through migration, marriage, birth, and death, it would be surprising if the fertility of the censused or surveyed areas also did not change. Comparison of the fertility of such areas on the basis of recurrent studies from year to year with the fertility of such areas on the basis of one survey at the end of the period to be studied is likely to disclose real differences in levels and patterns of fertility between the two sets of results on what looks like the same population at first sight. This might easily happen even under conditions of perfectly complete recording of children and of births in both sets of data.

In short, it is difficult to find data to compare validly to the Own Children

sets of data. Data like the MCPS or recurrent population survey data are really not data on the same populations (because of migration and so forth) but only on populations living in the same areas at different points of time.

Nevertheless, total fertility rates from the dual record data were used in the point of comparison. These were shown in Table 2 for the urban area and in Table 4 for the rural area and were as follows:

	1971	*1972*	*1973*
Urban	4,828.6	4,363.5	4,527.5
Rural	7,067.5	6,842.2	5,885.3

In the urban area, the Own Children estimates were 8 percent lower than the dual record rates for 1971 [(1 - O.C./D.R.) × 100], 13 percent lower for 1972, and 6 percent lower for 1973. If these three years can be taken as a base for projection, one might estimate that the Own Children rates would average about 9 percent lower than the dual record rates for the decade 1964-1973 in the urban area. If this range of difference should hold for crude birth rates, this could mean that if the dual record birth rate were 40 per thousand for an area, that the Own Children method might estimate it as closely as about 36.4 births per thousand.

The rural Own Children estimates were closer to the dual record rates. In a previous chapter it was noted that the volume of rural migration was considerably less than that experienced by the urban sample. Thus the difference in mix of households was less between the different MCPS populations in the same areas at different enumeration periods. This may be the reason why the Own Children estimates for the rural area come closer to the dual record rural rates than do these estimates for the urban area to the urban dual record rates.

Comparison of the Own Children total fertility rates with the dual record total fertility rates for the same years shows that the Own Children rates were 3 percent lower in 1973, 11 percent lower in 1972, and 4 percent lower in 1971. Again, if one takes the average of these 3 years as an indication of the decade average, this could mean that the Own Children estimates would average about 6 percent lower for the decade 1964-1973 in the rural area. If this range of difference should hold for crude birth rates as well as total fertilities, it could mean that given a dual record rate of 40 per thousand for the area, the Own Children method might estimate it as closely as 37.6.

Conclusions. The Own Children method produced rates that were uniformly lower than the dual record rates for the years 1971, 1972, and 1973, in both rural and urban sample areas. This may relate to the levels of mortality chosen by the MCPS for the reverse survival of the Own Children data and of their mothers.

The differences between Own Children rates and the dual record rates, however, were not constant but varied from year to year. The explanation, as presented above, may well be real differences in fertility between the populations of the areas studied at different time periods, especially because of migration. Such differences are reflected in the dual record rates, but not in the Own Children rates which are based on only one population, that at the time of the single survey.

This raises some problems for use and interpretation of results of the Own

Children methodology. What is generally desired from population surveys and registration data are sets of rates for areas for calendar years. The rates desired are usually not those of the population that happens to be there in the last year of the study back through the preceding years, but the rates of the actual populations of the area, for example, of New York State, as these populations changed from year to year through migration, birth, and death. The Own Children method does not produce such results but can only relate to the population of the one survey upon which it is based. Unless in-migrants and out-migrants have similar characteristics, rates may differ in level and patterns as a result. The method would seem, therefore, to be more applicable to national samples (presuming negligible international migration) than to making estimates for provinces or local areas.

The methodology may be of greater utility for comparing fertility by socioeconomic or cultural categories which may be less heterogeneous and where rates as a result may be less affected by migration.

Another source of deviation from dual record rates is the underreporting of births or of children. The percentage of births missed by the fifth survey was 13 percent in urban areas and 4 percent in rural areas. The Own Children methodology does not require that 100 percent of the households be covered, but rather that those households covered be a representative sample (usually best guaranteed by a probability sample). Almost certainly, however, some births were missed in households actually covered by interviewers (infants who died soon after birth, illegitimate children who were not reported, and so on). This occurred despite numerous checks made by interviewers trying to obtain complete enumeration.

The Own Children method seems primarily formulated for incorporation in census enumerations. Census data in many countries are usually obtained from the female head of household. Where she is not available, another knowledgeable person is generally asked to furnish all information. Unless specifically directed otherwise, census enumerators usually do not care to shift from one to another respondent in the course of a household interview.*

As an MCPS report has shown (Madigan, Herrin, and Cabaraban 1976), lack of distinction between self-reporting and proxy-reported women may lead to a substantial bias in the reporting of children.

If the biases found for simply reporting numbers of children ever born, as obtained in the Brass techniques, can be substantial when such data are furnished by proxies, how much more substantial is error likely to be should age of children be furnished by proxy respondents?

A suggested procedure to counter such bias would be to tabulate and analyze data separately of self-reporting and proxy-reported women, and to compare results. It seems likely that the fertility of proxy-reported women (who may be employed in business enterprises, or who may be doing the family shopping, marketing, and other business because of low fecundity/fertility) may be somewhat different from the

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*A more detailed account of Own Children applications in the southern Philippines will be found in Report 21 of the Mindanao Center for Population Studies (Madigan and Herrin 1976a).

fertility of self-reporting women. After some experience, it might be possible to derive correction factors for use with proxy-reported data which would make possible incorporation of proxy-reported with self-reported data.

A final comment seems useful. It appears that Brass, Own Children, and maternal history approaches tend in successive years to deviate from true rates by differing percentage margins. All of these methods are single-system approaches and as a result cannot adequately estimate their coverages of events. This makes them less useful for estimating and comparing the fertility level for two successive years--to discover, for example, what effect some new population program approach has had. An important decline effect may be missed for this reason, or thought to exist where it does not. However, these single system approaches may be useful for gauging general level of fertility in a population without intent at such calibration as would distinguish year A from year B, as, for example, in some countries of tropical Africa where registration may be non-existent or incomplete.

The dual record system approach has the characteristic of being able to estimate its coverage; for this reason it is highly desirable as a method of comparing the fertility of two successive years and similar highly calibrated objectives. But the dual record system is expensive, at least as it has been conceived up to date. The next chapters will detail attempts to reduce costs of dual record systems to a point where they would not cost much more than a single survey or where they could be integrated with a census. Use of this information, it is hoped, will lead to a more widespread adoption of dual record systems.

X. COST REDUCTION STUDIES: INVESTIGATION OF MEMORY LAPSE IN RECALL OF BIRTHS

Two key ideas have emerged from the foregoing chapters: 1) That the data gathered by a dual record system have distinct advantages in accuracy of level and in measuring short-term changes in fertility and mortality because of the built-in "altimeter" of coverage rates which a single system approach cannot furnish, and 2) that dual record systems are more expensive than single record systems.

From the beginning, there has been at the Mindanao Center for Population Studies an interest in decreasing costs of a dual record approach without loss of data quality. For this reason, studies were undertaken during the course of the project to assay the results in terms of data quality that might ensue if certain economies were taken to reduce costs in each of the two systems, and similarly to reduce costs of the matching of records from the two systems. The matching study, as the subject of a paper already prepared for publication (Madigan and Wells 1976), is not discussed in the present work. It should be noted, however, that if an objective, explicit set of matching rules can be devised that permits alert clerical staff to match records with a minimum and known degree of error, and thus to be substituted for highly trained and experienced senior staff matching the same set of records on the basis of implicit and subjective matching rules, obviously a costly item can be reduced to a fairly minor expense. The matching study has shown this is possible.

The studies discussed here regarding the interview system relate to a) frequency of surveys, b) size of worker unit (with regard to the recording or special registration system), c) approach to be used in data gathering, and d) degree of employment (part-time, full-time) to be utilized. The present chapter is concerned with frequency of surveys to be conducted by the interview system.

Recall of Births over Intervals of Six, Twelve, and Eighteen Months

Many different types of survey research gather retrospective data from their respondents. The quality of these data depend on the accuracy of the survey respondents' recall. Recall error or memory lapse is only one type of a whole set of errors and biases that can infect a set of data. Recall error is nevertheless an important contributory source of error since it directly affects the substance of the information that comes from the respondent. As such, this source of error deserves careful study, and in fact considerable attention has been given to the topic of forgetting, with experimental psychologists undertaking a large share of the research that has been done. Investigation and analysis has also focussed on forgetting in the more specific contexts of survey research in general (Belson n.d.), of the reporting of expenditures in surveys (Neter and Waksberg 1965), of the reporting of automobile accident injuries in surveys (Cash and Moss 1972), and specifically in relation to demographic inquiries (Sen Gupta et al. 1958; Som and Das 1959, Som 1959, and 1973).

MEASUREMENT OF VITAL RATES

Research Design

An important contribution could be made, it was felt, to theoretical knowledge of the forgetting processes in connection with survey research by a dual record study of the question. By means of coverage rates, the precise point at which memory begins to become obscure can be more accurately pinpointed, and through comparison, some knowledge of the degree of forgetting can be realized. Such knowledge would have the more practical purpose of distinguishing levels of remembering and forgetting which are still acceptable and levels which are not.

A practical goal of the present study was the weighing of the advantages and disadvantages of conducting a survey at annual rather than semiannual intervals, and also of conducting a survey every 18 months instead of semiannually or annually. The chief advantage in an annual or even an 18-month interval survey would be the saving in fielding, supervising, analyzing, and publishing of the mid-year or even, in the case of the 18-month interval, of an annual survey. This saving would obviously be considerable as it would greatly reduce costs of operation of one of the two systems. The chief disadvantage, on the other hand, would be a loss in quality of data resulting from sacrificing one of the two semiannual surveys. The goal of the study was to determine whether one of the two surveys conducted each year in a dual record study like the MCPS project could be dropped without substantial loss in data quality, and further, whether one survey every 18 months would provide data of sufficiently high quality.

The design of this research specified that this investigation would be carried on in a dual record system whose continuous recording system utilizes house visits (with or without the employment of community contacts, that is, informants, as well). This is an important qualification of the present study.

The recall studied was of live births, or of any products of gestation which had given at least one clear indication of life when completely outside the mother's body. More particularly, the object of inquiry was de jure births, that is, births to women who were residents at time of birth. It did not matter where the birth took place as long as the woman was a resident of the sample area. Residents, as previously mentioned, were persons who had already resided or were planning to reside (after already coming to live) in the area of study for 90 days (or more). De facto births, defined here as births within the study area to nonresident women (because of hospitalization and so forth) were not in-scope births. Nevertheless, complete coverage of all de facto births was also attempted to learn whether such events had transpired and to be sure that each of these had been excluded from the in-scope events. Births to nonresidents at the time of birth, which had been reported to one of the MCPS workers, but which had occurred outside the study area (for example, births to in-migrant mothers who were residents at time of interview but not at time of birth) were also carefully followed up and excluded.

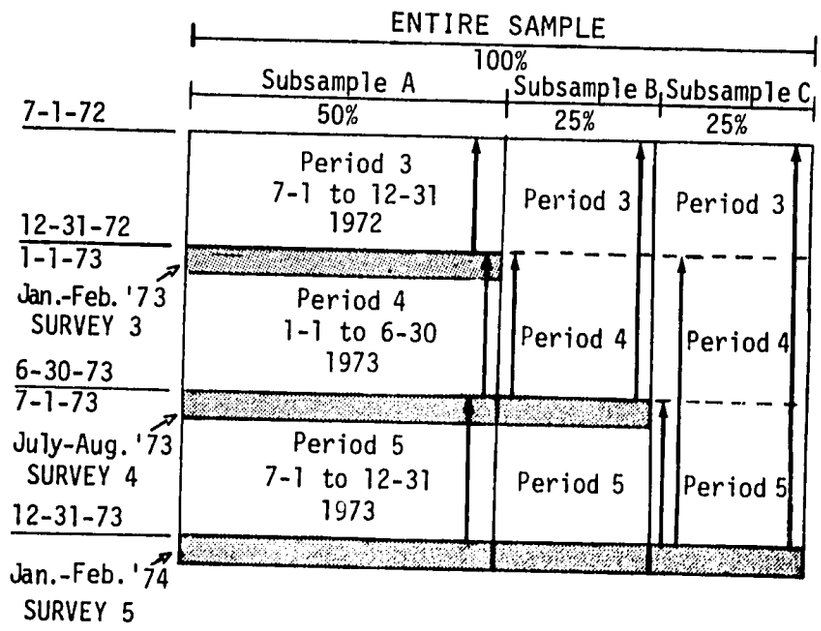
Rural and urban methodological sample areas were divided into halves by probability sampling proportional to size. Chunk or block units were drawn into the subsample until approximately 50 percent of the population of both the urban and the rural methodological samples had been included in the areas selected. (A chunk in MCPS terminology is the largest division of the sample area. A block is a subdivision of a chunk. A unit area is a subdivision of a block.) The urban and rural subsamples thus selected were called Subsample A. Selection into Subsample A meant,

for the areas drawn, the assignment of all households within them to survey interviews every six months to elicit information retrospectively on births which had occurred to persons living in the household and neighborhood during the preceding calendar six months of the in-scope period. The end of this period was usually a few days to several weeks before interview.

As shown in Figure 4, the remaining half of the sample areas (not drawn into Subsample A), was then divided into two approximately equal parts (each containing about .25 of the sample population), by drawing blocks and unit areas into Subsample B, again by probability proportional to size, until approximately .25 of the total sample (urban or rural) had been drawn. Selection into Subsample B, rural or urban, meant, for an area, assignment of all its households to interview only in the second and third of three survey rounds.

FIGURE 4

Subsamples A, B, and C with Their Recall Periods



After 12 months, in the second of these 3 survey rounds, all households in Subsample B were interviewed to elicit information retrospectively upon births which had occurred to persons living in the household and in the neighborhood during the preceding calendar 12 months of the in-scope period. Six months later, in the third of the 3 survey rounds, all households in Subsample B were again interviewed, this time to elicit information retrospectively upon births which had occurred to persons living in the household and living in the neighborhood during the preceding 6 months of the in-scope period.

Areas which had been drawn into neither Subsample A nor Subsample B were incorporated into Subsample C (approximately .25 of the entire sample). Incorporation into Subsample C meant that households within an area were to be interviewed only once in 18 months. This would occur only in the third of the three surveys, when they would be interviewed to elicit information retrospectively upon births which had occurred to persons living in the household and living in the neighborhood during the preceding eighteen months of the in-scope period.

Intent was to study effects of varying durations on recall of births, while procedures of the other of the two dual record systems, the continuous recording system, were kept constant. As a design feature, therefore, regular work protocols of the continuous recording system in Subsample A, Subsample B, and Subsample C were continued without change. The practical objective of the study was to distinguish variations in efficiency of recall when frequency of interview was varied, but frequency of the rounds of continuous recording system workers, who made short home visits (about 5-10 minutes) every two months was kept unchanged in all subsamples.

Figure 4 also shows the approximate point in time from which each survey was launched. The first day of interview never preceded the end of a period, and median date of interview was late in the month following the last day of a period, or was early in the subsequent month.

Although interview periods overlapped the period following (for example, survey round three took place during the first weeks of period four of observation), data from the period following that of investigation were excluded from consideration in computing coverage rates. That is, data from a preceding survey (or any other survey) were not combined with data for that survey which directly followed the period of interest.

In addition, survey interviewers were not permitted to interview twice in the same unit area, and interviewers were not assigned to areas in which they had once resided.

Coverage rates, as mentioned previously, were the statistic by which recall efficiency was measured. These are defined here as the percentage of the true total of in-scope births of residents caught by the survey system interviewers working within the geographical and methodological limits (one, two, or three surveys per eighteen months) of the subsample. True total of births is estimated by the Chandrasekaran-Deming formula:

$$\frac{n_1 n_2}{m}$$

where n_1 is the number of births found by system one independently of system two, and n_2 is the number of births found by system two independently of system one, and where m is the number of births independently found by both systems.

Comparison of Subsample Coverages, Urban Area

For period five, the survey system of Subsample B exhibited better coverage of the areas assigned it than either Subsample A or Subsample C, and Subsample A coverage was somewhat better than Subsample C. Coverage of the births of male infants was in almost all cases superior to female coverage and though survey coverage levels were acceptable in all three subsamples, coverages turned in by the recording system workers were superior in every case. The differences between coverages of the survey subsamples were not significant at the .05 level, although the coverages of the recorders were significantly better at .05 than those of the survey system.

In period four, Subsample A coverage of the interviewers was significantly better than the coverage of Subsample B for the reporting of both male births and births of infants of both sexes. While Subsample A was favored in the comparison of female children, the difference was not significant.

The indication for Subsample B from the period four comparison (whose interviewers also covered in the same interview the months July 1-December 31, 1972, that is, period three of study) is that survey coverage of equal duration was less complete in Subsample B than in Subsample A, and by a fairly wide margin. This result counsels caution in comparing coverage data from period three and in interpreting differences which favor six months duration over twelve months duration. On the basis of these period four results, comparison of twelve-month and six-month coverages should take account of a component due either to less effective interviewing in Subsample B or greater respondent difficulty (including inferior respondent recall for six months in comparison with Subsample A respondents) or to an interaction of these factors.

Comparison of the mean coverages of all six-month recall periods of Subsample A with those of Subsample B shows that mean coverages for six months in Subsample A were significantly higher than those of Subsample B for males and for infants of both sexes but not for females (although Subsample A rates were higher here, too). This result, based upon several rounds and many different interviewers, suggests that obtaining high coverage was more difficult in Subsample B than in A. Each set of areas has what had been considered a good mix of residential, business, and market areas. However, Subsample B has a somewhat larger share of market-commercial areas, and this may account for the persistent differences. MCPS interviewers have found it sometimes more difficult to interview households whose members are engaged in market and commercial business enterprises as a family or a household.

Table 21 compares mean coverages. There is, of course, no mean for Subsample C since only one period of six-month recall from interview data is available, and this is used in lieu of a mean. The twelve-month data are based upon coverages of Subsamples B and C only for the periods July 1, 1972-June 30, 1973, and January 1-December 31, 1973, respectively. The six-month data are found in top and bottom panels of the left side of the table, and the twelve-month data on top and bottom panels of the right side of the table.

TABLE 21

Comparison of Coverage Rates of Twelve-Month Recall with Coverage Rates of Six-Month Recall, Subsamples B and C for Twelve Months, and Averages of Subsamples A, B, and C, Urban Areas

Sex Categories	System	SIX-MONTH RECALL Subsamples		TWELVE-MONTH RECALL Subsamples	
		B		B	C
Mean Periods 4-5 B Male	Cont. Rec.[a]	93.1		88.2	96.2
	Interview	82.0		61.9	80.0
	Dual	98.3		95.5	99.2
Female	Cont. Rec.	95.8		94.3	90.1
	Interview	88.4		75.9	82.0
	Dual	99.5		98.6	99.2
Both	Cont. Rec.	94.6		91.3	93.2
	Interview	84.9		68.5	80.9
	Dual	99.0		97.3	98.7
		A	C	Mean of B and C	
3-5 A Male	Cont. Rec.	90.1	100.0	92.2	
	Interview	93.3	84.1	71.0	
	Dual	99.5	100.0	97.4	
Female	Cont. Rec.	87.6	94.2	92.2	
	Interview	91.3	84.5	79.0	
	Dual	99.2	99.1	98.9	
Both	Cont. Rec.	88.8	97.1	92.2	
	Interview	92.3	84.3	74.7	
	Dual	99.4	99.6	98.0	

[a]Continuous Recording System.

Comparison of the twelve-month coverages of Subsamples B and C shows that in every case Subsample B coverages are lower. On the other hand, the twelve-month coverages of Subsample C are in every case lower than the mean six-month coverages of Subsample A and Subsample B, and are inferior to the coverages of Subsample C itself for period five only. The differences between the mean coverages of Subsample A for six months and Subsample C for twelve months are significant. Further, the mean survey coverages for six months of Subsamples A, B, and C are significantly greater than the mean coverages for twelve months of Subsamples B and C. This last comparison is shown in Table 22.

TABLE 22

Comparison of Coverage Rates of Six-Month, Twelve-Month, and Eighteen-Month Recall Periods, Subsamples A, B, and C, by Respective Coverage Rates, Urban Areas

Sex Categories	System	Average Six-Month Coverage Rate	Average Twelve-Month Coverage Rate	Eighteen-Month Coverage Rate
		Subsamples A, B, C[a]	Subsamples B, C	Subsample C
Male	Cont. Rec.[b]	92.8	92.2	86.4
	Interview	88.0	71.0	72.6
	Dual	99.2	97.4	96.3
Female	Cont. Rec.	91.4	92.2	89.3
	Interview	89.2	79.0	74.1
	Dual	99.3	98.9	97.2
Both	Cont. Rec.	92.1	92.2	87.7
	Interview	88.5	74.7	73.3
	Dual	99.3	98.0	96.7

[a]Periods 3, 4, 5 for which six-month recall data available, as follows: 2(B mean) + 3(A mean) + (C period 5 results).
[b]Continuous Recording System.

Recall that coverages for only six months retrospectively from date of interview were inferior in period four for Subsample B in comparison to Subsample A, and were inferior in period five for Subsample C in comparison to Subsample A (although to a lesser degree than Subsample B in period four). Did respondents of these subsamples themselves present greater difficulties than Subsample A respondents or was worker performance superior in Subsample A? A check upon this problem is provided by the continuous recording system workers. During these periods, the nature of their tasks did not change, that is, they made short visits every two months to each household. The mean coverages of recorders in Subsample B for period four were in every case less than in Subsample A. (Although recorders are placed in six-month and twelve-month locations in the table, this does not signal any change from their bimonthly visit, but only means that results shown are averages for two six-month periods.) On the other hand, the coverages of recorders in period five in Subsample C were superior in every case to that of recorders in Subsample A. This result suggests that Subsample B in period four did objectively present greater difficulties for survey workers than Subsample A. This does not seem true of Subsample C, however. Since Subsample C coverages for 12 months are less than Subsample A coverages for 6 months, one is led to attribute the difference to recall lapses rather than to

respondent or interviewer variability.

Table 22 also shows that the 18-month survey coverage of Subsample C is only slightly less (and not significantly so) than the mean survey coverage of Subsamples B and C for 12 months. However, before concluding that 18-month coverage is only negligibly less complete than 12-month coverage, one must take into account several considerations which follow.

Table 23 breaks out from the 12- and 18-month coverages, the coverages, respectively, of the seventh to the twelfth, and of the thirteenth to the eighteenth months. A focus upon these particular months rather than upon the 12- and 18-month periods reveals a steady deterioration of coverage from 1-6 through 7-12 to 13-18 months. The same approximate pattern appears in survey coverages for each sex separately and for both sexes together.

Coverage drops from 88.5 percent for births of children of both sexes in months 1-6 to 68.9 in months 7-12 and down to 52.3 percent for months 13-18. These are large and significant drops.

In assessing these data, the careful observer may also note a slight downward gradient in the recording system results for the same periods in which the 7-12 month recall of the survey took place (in period three of Subsample B and in period four of Subsample C), and a large dip downwards in the period of the 13-18 month recall (period three in Subsample C). However, this decline of the recording system was due to another reason. What looks like a decline of recording system coverage from time of interview looking backwards was actually an improvement in the efficiency of the recording system from third to fourth to fifth period. This will be seen more readily in the following data giving the recording system coverage rates for all areas covered in each period of observation:

Periods	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Coverages	87.0	80.9	82.0	90.1	96.4	92.5	91.6	95.2

The decline of the survey coverage cannot, however, be attributed to the same cause. Coverage of the survey system as a whole was as good in period three as it was in periods four and five, as the following data show:

Periods	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Coverages	66.4	79.4	91.5	87.8	86.6	89.5	84.1	87.2

In short, the decline in survey coverage is clearly due to a decline in respondent recall for 7-12 as opposed to 1-6 months, and to a similar decline in recall for 13-18 as opposed to 7-12 months. Taking both sexes together (although the decline was less serious for female than male babies), the decline from 1-6 months to 7-12 months was one of 19.6 percentage points, and that from 7-12 to 13-18 months was one of an additional 16.6 points.

Comparison of Coverages, Rural Area

The characteristics of these rural coverage rates are quite different than those of the urban rates. The visibility of life in most rural communities may account for these differences.

TABLE 23

Comparison of Coverage Rates Pertaining to Recall of Births, 1-6, 7-12, and 13-18 Months before Interview, Urban Areas

Sex	System	RECALL PERIODS		
		1-6 Months[a]	7-12 Months[b]	13-18 Months[c]
Male	Cont. Rec.[d]	92.8	90.2	62.8
	Interview	88.0	65.2	54.0
	Dual	99.2	96.4	82.9
Female	Cont. Rec.	91.4	90.0	85.7
	Interview	89.2	73.0	50.0
	Dual	99.3	97.6	92.9
Both	Cont. Rec.	92.1	90.2	70.3
	Interview	88.5	68.9	52.3
	Dual	99.3	97.0	85.8

[a]Periods 3, 4, 5 for which six-month recall data available, as follows: [2(B mean) + 3(A mean) + (C period 5 results)] ÷ 6.
[b]Unweighted average: [(B results, period 3) + (C results period 4)] ÷ 2.
[c]C results, period 3.
[d]Continuous Recording System.

Few differences are found between subsample coverages, and all rates are quite superior. Table 24 shows that overall coverages for 12 months for Subsamples B and C compare favorably with the 6-month coverages of Subsamples A, B, and C.

Table 25 compares coverages for 6-, 12-, and 18-month durations. A difference is found between 6- and 12-month coverages on the one hand and 18-month coverage on the other, but is not large. Eighteen-month coverage, absolutely speaking, is still quite good.

Table 26 presents the crucial data for judgment upon the cost benefits of alternative frequencies of surveys. In it, one discovers little difference between the 1-6 and the 7-12 month coverages. Different and lower coverage, however, occurs for the 13-18 month retrospective recall. Nevertheless, survey coverage remains acceptably high, averaging (for both sexes) 88.3 percent while dual record coverage averages 99.1 percent.

Implications

Substantially less recall of births takes place for the period 7-12 months before interview than takes place for the period 1-6 months before interview. This remains true even after allowing for a small contribution in Subsample B because of

TABLE 24

Comparison of Coverage Rates of Twelve-Month Recall with Coverage Rates of Six-Month Recall, Subsamples B and C for Twelve Months, and Averages of Subsample A, B, and C, Rural Areas

	System	SIX-MONTH RECALL Subsamples	TWELVE-MONTH RECALL Subsamples	
Mean Periods		B	B	C
4-5 B Male	Cont. Rec.[a]	100.0	98.2	98.2
	Interview	98.2	98.2	94.7
	Dual	100.0	100.0	99.9
Female	Cont. Rec.	100.0	97.5	98.1
	Interview	96.2	97.5	98.1
	Dual	100.0	99.9	100.0
Both	Cont. Rec.	100.0	97.9	100.0
	Interview	97.4	97.9	97.4
	Dual	100.0	100.0	100.0

		A	C	Mean of B & C
3-5[b] A Male	Cont. Rec.	98.8	100.0	98.2
	Interview	97.5	94.8	96.4
	Dual	100.0	100.0	100.0
Female	Cont. Rec.	97.3	100.0	97.8
	Interview	97.2	100.0	97.8
	Dual	99.9	100.0	100.0
Both	Cont. Rec.	98.1	100.0	99.0
	Interview	97.4	97.4	97.6
	Dual	100.0	100.0	100.0

[a]Continuous Recording System.
[b]Unweighted mean.

TABLE 25

Comparison of Coverage Rates of Six-Month, Twelve-Month, and Eighteen-Month Recall Periods, Subsamples A, B, and C, by Respective Coverage Rates, Rural Areas

Sex Categories	System	Average Six-Month Coverage Rate	Average Twelve-Month Coverage Rate	Average Eighteen-Month Coverage Rate
		Subsamples A, B, C[a]	Subsamples B, C[b]	Subsample C[c]
Male	Cont. Rec.[d]	99.4	98.2	95.7
	Interview	97.3	96.4	93.8
	Dual	100.0	100.0	99.7
Female	Cont. Rec.	98.6	97.8	97.3
	Interview	97.3	97.8	94.7
	Dual	100.0	100.0	99.9
Both	Cont. Rec.	99.0	99.0	96.5
	Interview	97.4	97.6	94.2
	Dual	100.0	100.0	99.8

[a]Period 3, 4, 5 for which six-month recall data available, as follows: [2(B mean) + 3(A mean) + (C period 5 results)] ÷ 6.
[b]Unweighted average: [(B results, period 3) + (C results, period 4)] ÷ 2.
[c]C results, period 3.
[d]Continuous Recording System.

greater difficulties with respondents or less efficient interview techniques. Further, urban recall of births again drops substantially from the period 7-12 months before interview to the period 13-18 months before interview.

Do the benefits in decreased costs obtained by omitting the mid-year survey outweigh the loss in quality of data caused by the decrease in coverage occasioned by this omission? What is the result of omitting the first two surveys in an 18-month period such as one beginning in July of year X and ending at the end of December in year X + 1, with the survey following in January of year X + 2?

The answer to such questions must depend to some extent upon the goals pursued by particular projects and upon the values of persons making the assessment. Several principles can be formulated relevant to policy decisions, however.

The first principle is that whether quality of data is seriously compromised depends to a great extent upon dual record coverage, that is, number of matched cases plus number of cases uniquely discovered by each of the systems independently. This comes down to saying that lower coverage can be tolerated in one system if

TABLE 26

Comparison of Coverage Rates Pertaining to Recall of Births, 1-6, 7-12, and 13-18 Months before Interview, Rural Areas

Sex	System	RECALL PERIODS		
		1-6 Months[a]	7-12 Months[b]	13-18 Months[c]
Male	Cont. Rec.[d]	99.4	96.1	87.5
	Interview	97.3	96.2	90.3
	Dual	100.0	99.8	98.8
Female	Cont. Rec.	98.6	95.4	95.2
	Interview	97.3	97.8	87.0
	Dual	100.0	99.9	99.4
Both	Cont. Rec.	99.0	95.4	91.9
	Interview	97.4	97.0	88.3
	Dual	100.0	99.8	99.1

[a]Periods 3, 4, 5 for which six-month recall data available, as follows: [2(B mean) + 3(A mean) + (C period 5 results)] ÷ 6.
[b]Mean of coverages of Subsample B, period 3, and of Subsample C, period 4.
[c]C results, period 3.
[d]Continuous Recording System.

performance of the other system is superior.

The second principle is that a lower limit must be set to coverage in either of the two systems. If coverage should fall to 40 percent or below in either system, for example, morale in that system is likely to be affected. Mediocre standards of performance might well be passed through attitudes displayed to members of the better system with the passage of time.

A practical way of gauging application of these two principles to a dual record system is examination of dual record coverage. If one system's coverage is high enough to make a quality result out of the ratio of observed to true total births of both systems together (dual coverage), and if the other system's coverage is not below some minimal level, say 60 percent, then the lower coverage of the first system seems tolerable. This system should be encouraged to strive to improve its coverage as time passes.

When is a ratio of observed to true total births for dual coverage a quality result? The answer will differ in different project situations and in terms of the values of various assessors.

The senior author of the present work approaches the answer from both a cost-benefit point of view and also from the viewpoint of the project itself, especially

whether its main goal is substantive estimates or methodological contributions. In a substantive estimate-oriented project, when overall observed cases (dual record coverage) reach 90 percent of the true total and when neither system's coverage rate is below 60 percent, the benefits obtained by omitting one (or two) surveys seem to him to outweigh the quality benefits gained by adding a second (or third) survey to increase coverage from 90 to say 95 percent. A good estimate of the true number of events can be made from the Chandrasekaran-Deming application from a dual record coverage of 90 percent. This judgment of benefits might be quite different if the project were heavily methodological in character.

Data of the MCPS study. Taking the point of the study to be (as it was) application to substantively oriented projects in a significant sample of a developing nation, the data lead one to judge that in both rural and urban areas the benefits of omitting the mid-year survey would considerably outweigh any disadvantages. The difference between a dual record coverage of 96.4 percent, the lowest level achieved in rural and urban areas for a 7-12 month coverage in four trials, and 99.3 percent, the highest mean level achieved by the semiannual surveys, is not a benefit to justify the cost of an additional survey, especially when the known coverage rates permit one to estimate the difference between the total achieved and the true total.

But it is understood that this conclusion is reached on the assumption that the method of the recording system is a bimonthly house visit to inquire of births and deaths, and that this frequency is not changed.

On the other hand, coverage for the period 13-18 months before interview of the urban area seems too low to place confidence in such an arrangement. First, inclusion of such low coverage survey data reduces dual coverage of births of both male infants and of infants of both sexes to a point well below 90 percent. Coverages in the survey system range from 50 to 54 percent of all births. Serious biases might well creep into the estimates by applying the Chandrasekaran-Deming formula to such data. The benefits of cutting out the expenses of the additional second out of three surveys are not justified because of the resultant loss of quality of data. Even though less expensive, considerable funds are still required to mount a dual record project utilizing one survey every 18 months. To do so in an urban environment like that of Cagayan de Oro, which may be quite typical of difficulties to be encountered in other cities of the developing world, would seem to be false economy that could waste the money to be spent in any case.

The objection might be raised that a quite different picture and resulting judgment might be forthcoming if attention had been paid rather to the data for 18 months as a whole as shown in Table 21. This objection rests upon a misapprehension. Table 21 without the correction of Table 22 which shows the values for the 13-18 month period might lead the unwary to picture an acceptable average coverage rate that stretches in homogeneous fashion over the entire 18 months. Such a homogeneous coverage rate does not exist, but coverages differ for each 6-month period. It is necessary to look specifically at the weakest link in this three-period chain, and to make one's judgment on the biases likely to affect the data for the period 13-18 months before interview. Such judgment can hardly be favorable in view of possible biases.

Rural data for the period 13-18 months before interview lead to a different conclusion. They seem sufficient to justify a single survey once in 18 months.

Adding a second survey merely to increase the quality of data would seem an unjustifiable cost. Other considerations might enter into the practical judgment, however, especially given the urban result. The desire to publish annual rates (which would give some difficulties in the case of surveys once in 18 months), the desire to have similar urban and rural procedures, and the difficulties of handling 18-month long periods, could lead one to settle upon an annual survey in the rural as well as the urban areas of a country. However, such considerations are irrelevant here where the point is simply whether added quality of data justifies costs.

Conclusion

In summary, then, the conclusion of this study is that the Mindanao Center for Population Studies project, and those dual record projects whose continuous recording systems make short visits to each household every two or three months, could in both rural and urban areas decrease frequency of survey from two to one per year without serious loss of quality of data. Further, one survey every eighteen months in rural but not in urban areas would produce data of sufficiently high quality. The assumption of these conclusions is that frequency of house visits of the recording system is not to be changed.

XI. COST REDUCTION STUDIES

The previous chapter considered survey frequency as a potential means of cutting costs in a dual record project concerned with gathering substantive data. The present chapter continues the inquiry into several modes of reducing costs without appreciably affecting quality of data, in projects concerned with substantive data production.

Earliest dual record studies seem largely to have used surveys to check vital registration (Marks et al. 1974). Later dual record studies in Asia (Chandrasekaran and Deming 1949, Wells and Agrawal 1967, Agrawal 1969, Pakistan Institute 1968 and 1971, National Statistics Office, Thailand 1969, Haceteppe University 1970, Seltzer 1969, Abernathy and Lunde 1970, and Wells 1971) began to use separate and special continuous recording systems (not merely the regular civil registration). Some of these used house visits, others used an approach based upon community contacts or informants. In the course of these projects and of later work done in Turkey, Africa, South America, and in the Philippines, questions have surfaced as to the advantages of the house visit approach vis-à-vis the community contacts approach, of part-time vis-à-vis full-time workers in a recording system, and of optimal size of population which a recorder should be assigned to cover.

In fact, several studies have been carried out along these lines but as yet the questions have not been solved. In fact, these questions are quite complex, if one is looking for an optimum answer. For instance, size of population is suggested (Marks et al. 1974) at 3,000-6,000 per full-time worker. This figure takes account of sampling error, non-sampling error, matching error, and costs. The extent of range in the suggestion, however, is large and lack of specificity needs narrowing down through the provision of data upon the point.

There are probably no all-encompassing answers to some of these points. What may seem a reasonable population size on one kind of terrain, for instance a flat and easily traversed area in which dwelling units cluster, may prove quite beyond possibilities of adequate coverage in a mountainous area where people tend to live on comparatively isolated farms. A community contact approach may work much more effectively in a culture where people are sociable and where gossip has large play, but be inadequate in a culture where people tend to be clannish, taciturn, and secretive with strangers.

Nevertheless, the general dimensions of the answers will become clearer when a more abundant literature builds up on studies of different approaches, population sizes, and employment arrangements with workers (full-or part-time). However, besides this general orientation towards contributing to methodological knowledge, the MCPS also had a more practical goal--how to reduce costs of a dual record project in the Philippines and in countries like the Philippines.

Cost-Benefit Implications

The study of data-gathering approaches investigates coverage of birth and of death by recorders utilizing a) a house visit approach only, b) a community contacts

(informants) approach only, and c) a combination of these approaches in which equal time is given to use of both approaches. On the basis of early MCPS experience, the house visit approach seemed to be more effective as a data-gathering means than either of the other alternatives. However, the approach is more expensive and time-consuming than either of the other two approaches, while the community contacts approach is the least expensive. Further it was believed that use of the community contacts approach would increase the independence of the two systems, as it would provide each system with a distinctively different data-gathering approach. House visits by the recorders to each household at regular intervals (every two or three months in the experimental areas) does not differ from, although it is shorter than, a survey interview. Use of a community contacts approach would not only cut costs considerably, but would probably reduce respondent fatigue. The important question to be answered, however, relates to the quality of the data. If data were seriously downgraded by substitution of a community contacts approach, then the benefits of any savings would be vitiated.

The study also focusses upon employment arrangements. Part-time (four hours a day) workers are believed more acceptable to respondents, because they are more likely to be working in or near their own neighborhoods and local areas. This is particularly so if the recorders are married women ages 25-40 and if their visits are looked upon by respondents as more in the nature of a friendly neighborhood call than a business matter. However, part-time workers are more expensive than full-time workers for two reasons. First, greater inducements are necessary to persuade them to take the job precisely because it is part time. Therefore, higher hourly pay or other special benefits are usually necessary to attract them to the job. Secondly, more highly paid supervisors are necessary to oversee their work.

If full-time workers are as effective in obtaining coverage of birth and death events, substitution of full-time for part-time workers would lower costs of field workers per respondent, would require fewer supervisors, and would cut training costs in two ways. First there would be fewer persons to train, and secondly, because the turnover rate of full-time workers is much lower, it would decrease training costs of new workers. Turnover is greater among part-time workers because they are often dissatisfied with a job that is not full time.

Actual optimum population size, taking costs and coverage into account, formed the third interest of the study. First, the differences in coverage obtained by full-time and by part-time workers might possibly vary out of proportion to their hours of labor in view of morale differentials. Secondly, differences in coverage between various population sizes may be fairly minimal up to some reasonable maximum and above some reasonable minimum points so that workers may be assigned larger areas without significant loss in coverage of vital events and in quality of data. Questions about such matters have important implications in terms of costs. If a single worker can handle a population of size X as effectively or almost as effectively as a population only half its size, the budget for workers can be cut in half. The implications, however, of larger areas per worker for variance sizes are more complex and require separate investigation.

Research Design and Implementation

A two factor (2 × 3 levels) completely randomized design was chosen for this study. Two replications were to be made for each cell during each study period.

The cell entries were to be coverage rates rather than number of vital events. The coverage rates are superior for measurement because unlike vital events they do not fluctuate from seasonal causes or decline because of decline in fertility or mortality rather than because of varying effectiveness of size, approach, and work arrangement.

The design took the following typical form:

WORK	*House Visit*	*Equal-Time Combination*	*Community Contacts*
Full-time	X_{111} X_{112}	X_{211} X_{212}	X_{311} X_{312}
Part-time	X_{121} X_{122}	X_{221} X_{222}	X_{321} X_{322}

The cell entries, X_{ijk}, in the particular case are the coverage rates of the ith approach, of the jth employment arrangement, and the kth replication. For the study of the relative effectiveness of the two employment arrangements in alternative area sizes, and of the interaction between these two factors, the sample data were reclassified by area size (small, medium, large) and by employment arrangement.

The assignment of study areas to each cell was handled as follows. First, the localities previously drawn for the Misamis Oriental provincial probability sample of 1973 were grouped into nine different worker-assignments. Grouping was in terms of geographical proximity. Six of these geographically bundled worker assignments were randomly selected to fill the six cells for full-time workers under the three different approaches. The remaining three worker-assignments were split into two segments each of roughly equal population with close attention to providing clearcut boundaries and to care for worker convenience of transportation and travel on foot. These "halves" were then assigned randomly to the six slots for half-time workers.

Two or more workers from each of the nine areas were trained on each of the three methods without divulging which workers would use which method. The best worker (as evidenced in training) was then retained for each of the full-time areas, and the best two workers for each area that had been split into two parts were retained as half-time workers. Each worker was then trained specifically in the method to be used during the next year of work (July 1, 1973-June 30, 1974).

The importance to the experiment of using only the method assigned the worker was explained, and prolonged and careful attempts were made to motivate him (her) to employ only this assigned method. The person was also carefully supervised in the field for use of the proper method, with dismissal as the sanction for use of other methods. To the best of the supervisors' and other administrators' knowledge, no methods but the assigned ones were used by the workers.

On July 1, 1974, and for the ensuing year through June 30, 1975, the MCPS planned and carried out a change in tasks of workers. Tasks were again assigned randomly but with the qualifications that no worker should receive the same task a second time, and that each of the three tasks should be carried out in two full-time and in two half-time worker-assignment areas. As before, workers were thoroughly

trained in the new method assigned them, and the necessity of using only that method was underscored.

A further word may profitably be added regarding population-area assignments per worker. While admittedly size of physical (geographical) area, ruggedness of terrain, and density of population are important considerations, size in the present investigation was defined entirely in terms of population magnitude. This was defined in turn:

Employment	*Small*	*Medium*	*Large*
Full-time	Under 3,800	3,800-4,699	4,700 persons or more
Half-time	Under 2,200	2,200-2,599	2,600 persons or more

In practice, the smallest area-population size assigned a full-time worker was one of 3,274 resident persons, and the largest assigned was one of 5,681 residents. The smallest area-population assigned a half-time worker was one of 1,596 residents and the largest, one of 2,726 residents.

The experiments were conducted over four periods or two years of observation. These periods correspond to the following inclusive dates and subsample area coverages:

Period	*Inclusive dates*	*Subsample Coverage (%)*
5	July 1-December 31, 1973	25
6	January 1-June 30, 1974	100
7	July 1-December 31, 1974	50
8	January 1-June 30, 1975	100

Hypotheses Tested

All hypotheses were tested at the .05 level of significance. These hypotheses (separately for births and deaths) were as follows:

- The community contacts approach is not significantly related to lower coverage of birth (death) events than the house visit approach.

- Full-time workers are not significantly associated with lower coverage of birth (death) events than half-time workers.

- Larger-sized area-population assignments are not significantly related to lower coverages of birth (death) events than smaller-sized population assignments.

Summary of Results

None of the hypotheses could be rejected at the .05 level of significance, although some significant differences were found. In general, full-time workers did as well as part-time workers in discovering birth and death events. House visits resulted in higher coverages for both full-time and part-time workers than community contacts, but the differences were too small to justify the extra expense of the house visit approach. For deaths, larger-sized population assignments actually were associated, although not significantly, with higher coverages than smaller population assignments. For births, full-time workers in smaller population assignment

areas did slightly better than workers in larger population areas but the differences were quite small, certainly not enough to justify the added expense of the house visit approach. (Best coverages were turned in by workers in medium-sized areas.) Part-time workers did about as well in large as in small areas, and in fact in the two 100 percent subsamples of periods six and eight, they did better.

Conclusion

The field data obtained during four periods of observation (especially during the two more crucial periods six and eight, when a tune-up preparatory period had preceded and when a 100 percent subsample was utilized) have provided no evidence to cause rejection of the hypotheses set up earlier for testing. Therefore, all three sets of results indicate that the three cost-reducing alternatives can be adopted in cultures and conditions like those of the southern Philippines.

The cost-benefit implications are evident. It is possible to design new dual record projects for the southern Philippines and developing countries with cultures and terrain like that of the Philippines which will take advantage of this new knowledge and which will be considerably less expensive to mount while maintaining sufficiently high quality data.

Limitations of space have precluded presentation here of a great number of tables and detailed descriptions of the results of the recall and of the size-work-approach studies which are exhibited in Reports 22 and 25 of the Dual Record Project of the Mindanao Center for Population Studies. Readers interested in further details about these studies are referred to these reports.

XII. IMPLICATIONS OF THE MISAMIS ORIENTAL STUDIES

It is not an easy task for the senior staff of a large, five-year project to review the work of their organization and then with neither exaggeration nor diminution, attempt to detail its practical implications to administrators of population programs, policymakers, and directors of statistical offices charged with the national measurement of such population parameters as birth and death rates. In this attempt, the authors are impressed with their experience that such administrators typically find themselves possessed of long lists of obligations and agenda to be carried out by their programs and organizations (often accompanied with no little political pressure) and a shortage of funds to accomplish these agenda and obligations.

Research Needs

Executives charged with implementing population policy in developing countries seem more often impressed by the urgency of slowing down the growth of their burgeoning populations than by the necessity of measuring accurately the increases caused by this growth. Usually they feel intensely the necessity of reducing rates of natural increase. They are generally less enthusiastic about allocating funds from their budgets to measure precise level of increase at specified times.

In roughly parallel fashion, administrators of census and vital registration agencies (where such exist) usually feel a need to upgrade their census and/or vital statistics establishments. They display less interest in making budgetary allocations for approaches which they often perceive as temporary stop-gaps until their census and vital statistics systems are adequate to provide reliable measurement of fertility and mortality levels.

Yet in many developing countries lack of infrastructure makes the bulk of the people, upon whom the success of vital registration rests, apathetic about, even evasive of, their responsibilities to supply registration information to the proper office. Absence of cheap and facile means of communication so often associates registration with large difficulties, if not outright hardships, that adequate coverage of vital events by the national registration system in many countries seems 20 years away at best.

After sitting with population program administrators at budgetary meetings, one can understand their desire to allocate resources where action is needed most and to be niggardly in expending funds upon measurement and similar research activities. However, administrators need a valid gauge of the effects upon the birth rates and the natural increase rates which current program emphases and experiments are producing. They cannot depend upon the unreliable rates computed from the traditional census and vital statistics combination. They must initiate research that will estimate as well as possible the effectiveness these emphases and special programs have had. The alternative is a judgment based upon guesses and impressions. This is not a rational mode of procedure. It can prove misleading and highly wasteful of project funds.

Similarly, directors of statistical offices or bureaus will need objective indicators of the present state (improvement or retrogression) of their census and vital registration establishments outside the ambit of these systems themselves. It is suggested here that the needs of these two organizations are complementary, and that some type of cost-sharing may be feasible.

Both types of administrators need accurate and precise fertility and mortality information. In modern developing countries, however, both are typically more interested in fertility than mortality data. Nevertheless, both may accept the view that before the probability of a substantial reduction in fertility becomes large, infant and child mortality must decline to a point where most children live into adulthood.

Granted that both kinds of administrators admit a need for research to evaluate their programs from year to year in accordance with demonstrated effect of special emphases, lines of endeavor, and new inputs, what kinds of research are to be engaged in, by whom, and how much of one's budget should be expended upon such research? This section may provide some help in finding practical answers to these questions. Eventually, of course, only administrators themselves can make such decisions, and in doing so they will inevitably be harried by innumerable political, economic, and social pressures often bearing little relationship to the rational functioning of their organizations. Nevertheless, they must think through the decisions they make, and the implications of the present study have relevance to these.

What Kind of Research?

A population program in a developing country in danger of overpopulation aims at reducing the rate of natural increase by inducing a decline in level of fertility. If national emigration was ever seriously considered to be a practical method by which a developing country could cope with this problem, that day has ended.

A national program does well to count numbers of new acceptors, and to keep accurate tally on number and continuation rates of older acceptors. Such service statistics by themselves, however, will be insufficient. They give insight only into the internal working of the system. They do not allow one to gauge the effects of the program upon national fertility and growth. If great stress is put upon such service data, further danger exists that program success will be equated with production of new acceptors. A program may then find itself rewarding family planning clinics and services in proportion to the numbers of new acceptors they report, a practice likely to result in padded lists of acceptors supplied by clinics and services. Such lists may seriously mislead administrators about the impact which their program is having upon the birth rate and population growth. Interviewers in the southern Philippines have occasionally mentioned sight of whole strings of anti-ovulant pills lined up on shelves of houses they have visited. Asked about these, respondents replied, "I don't use them but accepted them to help out the motivator."

The critical test of a population program is its effect upon the birth and growth rates. Without accurate data, administrators have no way of gauging the impact the program is having and the success with which it is carrying out its function.

MEASUREMENT OF VITAL RATES

Data from Dual Record Sources

A wealth of precise and accurate data on fertility, mortality, natural increase, and even migration, if desired, is available from a dual record system. The first main implication for population program administrators is that a dual record system can provide the kind of data they need to make rational judgments on how large inputs they made were associated or not associated with changes in levels of fertility and mortality preexisting these inputs, or how they modified trends already in motion. As a consequence of this implication, they should feel greater motivation at general meetings of bureaus and departments to support budgetary requests of directors of census, registration, or other statistical officers who wish to carry out dual record research upon vital data, even to considering sharing the expenses of such a project from their own budget if necessary.

It is evident from the preceding sections that a dual record system is flexible, sensitive, and adapted to the measurement of short-term as well as long-term influences. Its sensitivity is due to an ability to measure current fertility for the in-scope period selected, as well as to a self-correcting capacity through its coverage estimator. Its flexibility comes from its employment of two systems which allow for a number of design potentials. Its adaptability is due to the fact that one or the other of its systems is always in the field and thus available for the quick collection of needed items of data.

Example of Dual Record System Data

The data available from the Mindanao Center for Population Studies cover the four years September 1, 1971, to June 30, 1975. They relate to fertility, mortality, natural increase, and migration. These data primarily refer to levels and changes in fertility and mortality in one province, Misamis Oriental, but also present an insightful picture of the kinds of migration and their patterns that take place within the limits of this province.

Many provinces of the Philippines resemble Misamis Oriental with its agricultural economy based upon coconut, corn, and a limited rice production. These areas are inhabited by a largely rural people who endeavor to make a living and improve their lot in life within a framework of the values and traditions of lowland Filipino culture groups. What has produced fertility change in Misamis Oriental may prove to be generalizable to other parts of the Philippines where conditions are similar.

Misamis Oriental is one of the Philippine provinces, although it is not the Philippines. From it some check may be made upon the effectiveness of the population program in the Philippines. Just as a doctor checks general bodily health by taking the temperature or pulse at one location, so a check upon the results of the population program in Misamis Oriental can give some impression as to the effectiveness of the population program in general.

Quality of the data. The MCPS fertility data are the only data for a set of Philippine populations which have a self-checking device that indicates completeness of coverage for each system separately and for the matched results of both systems together, and which estimate with precision (especially because rates of coverage were high and collusion judged to be absent on the basis of painstaking supervision

and careful checks) the true level of fertility, crude and age specific. The two National Demographic Surveys that have been carried out thus far have been the work of competent institutions under direction of highly qualified demographers. The method used, however, was the maternal history approach perfected by Bogue and Bogue (1970). With all its advantages, this method remains a single system method. Every single system method is likely to miss some relevant cases, and its coverage will probably not be uniform in the various regions and provinces of the country. Because it has no means of estimating its coverage, the maternal history approach, like other single system approaches, leaves uncertain the precise level of fertility for any given year. Further, a bunching or heaping of births and pregnancies typically seems to occur in the lists of pregnancies and their terminations which women give when reporting their own maternal history to interviewers. The NDS surveys apparently did not permit proxy reports which are generally not encouraged in maternal history data. Where they are tolerated, such reports are apt to further obscure the true level of fertility.

The National Census and Statistics Office (formerly the Bureau of the Census and Statistics) for several years implemented a national dual record system in the Philippines. Direction of this project was capable and competent. However, from the outset, its administrators were faced with a major difficulty. While the survey system was under their effective control, the continuous special registration system in important ways was not subject to their full jurisdiction. The general registration system was of no great help to them in this problem. The continuous special registration system appears to have introduced serious biases into provincial and regional estimates. It is hard to be confident of a national result based upon averages of these provincial and regional estimates.

Main features of the Misamis Oriental fertility data. These data deserve careful examination by administrators of the Commission on Population and by other population policymakers of the Philippines. But they are also relevant to the decisions which must be made by administrators of population programs and of statistical offices in other developing countries.

Both urban and rural data of the dual record project of the Mindanao Center for Population Studies exhibit a decline in fertility over the period September 1971 through June 1975. This decline may in some part be attributable to the increasing age at first marriage of young women. However, as has been shown in the section on fertility, a substantial decline also occurs in the birth rates of currently married women; this portion of the decline cannot be attributed either to delayed first marriage or to an increase in incidence of widowhood or of other marriage dissolution.

Comparison of age-specific rates for all women and for currently married women over the years from 1971 through June 1975 makes it clear that currently married women ages 20 to 34 have reduced their fertility. This change also appears in the total fertility and the gross reproduction rates. Presumably these women have accomplished this reduction by using the means available, that is, the various family planning services and clinics accessible to them. These institutions present, generally, a selection of methods from rhythm to the IUD, to offer each person a method compatible with that person's conscience.

The decline thus far registered in the urban MCPS sample area has not proved significant at the .05 level of probability, but this trend is moving in a

direction that leads one to believe that it will soon become significant. (This dual record project has discontinued field work, and closed entirely at the end of its five-year contract on May 31, 1976.) The trend in the rural sample area is already significant at the .05 level. In the provincial probability sample, only two years of data have been collected, not enough to warrant speaking of a trend. But the movement of fertility in this sample has been downwards over these two years.

Administrators of population programs in developing countries will be interested in asking why fertility in this approximately 25,000 person rural sample has declined more rapidly than in the same sized sample of the city of Cagayan de Oro. Secondly, they may wonder whether births have merely been postponed in this rural area or whether their number has actually been reduced from the viewpoint of eventual completed family size.

The answer to the first question may furnish the key to motivation of rural populations to reduce their birth rates. At present, the only well documented case history of a rural Philippine population that has voluntarily reduced its fertility by a significant amount over a short period of some four years is the population of this rural methodological sample. That this reduction was accomplished by family planning seems evident since the decline appears in the rates for currently married women.

The studies of the Mindanao Center did not include questions aimed at uncovering the dynamics of this change. They were directed toward measurement of what was happening as accurately as possible, not measurement of why. That is, they were oriented toward measurement of crude and age-specific birth rates, not toward knowledge, attitude, and practice questions with regard to family planning.

Nevertheless, the project staff were aware that a large-scale rural electric service cooperative was beginning to supply members of the cooperative with electricity towards the end of 1971, especially near its headquarters which are situated in the center of the methodological sample. They also noted that some nine months after electricity had reached a substantial and increasing number of subscribers, the birth rate of residents of this rural area began to decline.

Accordingly, in another study they undertook, not connected contractually with the dual records project but directed toward study of important sociocultural effects of this electrification cooperative (the Misamis Oriental Rural Electric Service Cooperative), they asked respondents whether they had purchased electrical appliances and/or facilities beyond the illumination itself. They also asked why people of the respondent's neighborhood might be practicing family planning.

Replies revealed the purchase of many small appliances and other convenience items. The essential point seems to be this: These were purchases which a poor family might make with effort and hard saving, but which would not be much beyond their means. The purchase was costly enough, however, to prevent them from investing for some time in a competing desire or good--such as another birth with its various expenses. The purchases included among other things thermostatically controlled electric irons, hot plates, motors to power sewing machines which were previously manually powered, small refrigerators, electric (as opposed to battery) radios, and membership in cooperative pure water neighborhood associations which

were buying an electric pump. The most frequent purchase was an iron. One who has never been forced by lack of electricity to iron clothes with a coal-heated iron will hardly understand the appeal of a thermostatically controlled electric iron. Likewise a person who has never shared with a poor family the experience of such prized food as meat or fish spoiling because not kept in cold storage can scarcely grasp the attraction for these families of a small refrigerator where meat, fish, and other foods can be protected from spoilage by heat and insects.

The types of reply to both questions suggested to the MCPS staff that couples were not practicing family planning because they had illumination at night or for such simplistic reasons, but because the availability of electricity had interacted with the availability of family planning services (which were already present) in ways important for a population control program.

These couples wanted, and apparently wanted strongly, some of the electricity-dependent conveniences and appliances which they could have if they scraped and saved. However, they apparently felt they could not have these if they also had another birth. In other words, they were faced with a choice whereby they could not have both desired alternatives. Family planning services were at hand to show them how to avoid the competing birth. They chose to use these services and to avoid the birth.

The second question, raised previously, is also important. Are these couples merely postponing a birth or have they reduced the number of children they will eventually have in their completed families? The response to the question on why neighbors were practicing family planning would suggest that a substantial number intended only to postpone a birth or two. These answers mainly stressed economic hard times. In the context of simultaneous payments for illumination and appliances, such answers indicated a rational weighing of alternative costs. However, in countries where a substantial birth rate decline has occurred through use of family planning, rarely if ever has fertility returned to its former high level. Apparently, after one desire has been achieved through regulation of births by couples, other felt needs suggest themselves. This is to say that where a substantial fertility decline has once occurred, having another birth becomes more a question of choice between alternatives than of simply following traditional behavior. In addition, when a woman postpones a birth for one or two years, she eliminates fertility from these years of her fertile period. In the years that follow, she may find it less possible to bear as many children as she would like since earlier years tend to be more fecund than later years. Nevertheless, it is not impossible for the birth rate to rebound upwards after a decline occasioned by an infrastructure such as electrification.

Implications of rural fertility decline. Administrators of population programs may wonder about the point of this experience. It is not practicable for them to think of setting up electrification projects in even a few, much less the many diverse rural areas of their countries. Some may also have had the experience in their own countries that electrification projects were not associated with decline in rural fertility.

The point is not electrification at all. It is rather that this experience shows that rural women can be persuaded to reduce their fertility, and rapidly, if the right key can be found to motivate them to do so.

While it may not be possible to provide electrification for rural people on a large scale, the experience from this electrification project in western Misamis Oriental Province of the Philippines may be generalizable The key to persuading rural people to reduce fertility may be found in a study of ways to provide such people with opportunities to purchase items they really need and want, or would want if the items were displayed to them. The purchases must be practicable from their own small savings and by dint of a real effort. This opportunity should not be conceived of as a government giveaway program in any sense. Such an approach would conflict with the essential ingredient of competition on the level of scarce resources for the goods which they desire. If really needed and worthwhile items are made available to them in a range of prices they can afford albeit with some effort (perhaps with little or no government fanfare), and if family planning services are available in the local area, the same conflict between desire for goods and bearing another child may be resolved in favor of goods through use of family planning services, just as it was apparently resolved among the 25,000 persons of the MCPS rural sample.

Differential fertility data. Differential fertility data are useful in such a context. For example, differential fertility by education of wife and occupation of husband may reveal which categories of the general population have felt more strongly a desire to limit their children. Such data could reveal not only which types of people have in the past been better targets for family planning services and offerings. They may also show which kinds of people are today probably more attracted to postponing a birth to attain some good or desire.

After age standardization had cleared away differences because of population distribution in the MCPS urban methodological sample, it was currently married women with highest and with lowest education who had low current fertility. After age standardization of data by occupation of husband of currently married women, the relationship expected in view of the educational data was that the wives of professionals and paraprofessionals would exhibit lower fertility than the other wives. But the low fertility of wives of husbands with skilled and semiskilled occupations was less expected. Perhaps this low fertility is related to needs and wants such families have to satisfy aspirations for social emulation, especially in education of their children. Perhaps, too, women with less education are more likely to marry husbands engaged in skilled and semiskilled occupations than husbands engaged in clerical work.

In the rural areas an inverse differential fertility by educational class was found and standardization accentuated this differential, rather than softening it. However, a considerable proportion of this differential appears due to delay of first marriage by younger women. Standardized rates for currently married women show sharp differences between the fertility of women with one or more completed years of college education and those with less educational achievement, but not much difference in fertility by education within the last category of women (with less than one year of college). Thus women with some college education seem to have led the way to reduction of fertility in the rural sample.

The wives of skilled and semiskilled workers of the rural sample took the lead in reducing their fertility. The fertility of professionals and paraprofessionals was higher. This at first surprising finding may be less so if one reflects that professionals and paraprofessionals who locate in rural areas may be somewhat

different types than their urban counterparts--more the country squire and less the busy, competitive urban professional.

These rural differentials may give further clues as to kinds of appliances and conveniences which aroused desires that interacted with available family planning services. Wives of husbands in the skilled trades may have been more attracted to a motor for their sewing machine or an iron since they presumably do their own housework. Their husbands may be thinking of power tools. Women with college education may have been attracted more to luxury or higher cost items like stereo sets, larger refrigerators, electric fans, or even television receivers.

Relevant features of Misamis Oriental mortality data. Reliable data on level of mortality are also relevant to decisions which population program and statistical bureau administrators as well as health department officers and policymakers must make. Without good data on mortality, the population program administrator finds it hard to gauge what a particular program is accomplishing with respect to natural increase, even if good fertility data are available. If the death rate has fallen faster than the birth rate, and if the administrator does not know this, it will be difficult to explain to higher policymakers why, despite the decline in birth rate attributable to the administrator's own program, the rate of growth remains as high if not higher than before. Besides powerful humane reasons for desiring to reduce mortality levels to the extent possible, the administrator also has reason to believe that declines in mortality will eventually lead to further declines in fertility. On the other hand, if mortality is increasing over the past several years, this should be a source of concern. Besides the increased human suffering involved, it may mean that people who might otherwise postpone a child will now decide not to do so because they fear that more of their children will die before reaching adulthood.

An objection may be raised against the dual record system with respect to the mortality data it provided in the MCPS case. It may be argued that despite its expense, the dual record system did not provide reliable data. Purposive concealment may obscure the true level of mortality.

That such concealment may in fact hide the actual level of mortality is true. However, this is not because of a dual record approach but in spite of it. If substantial purposive concealment actually occurs, a single system approach would have done less well because, besides missing the same concealed cases, it would probably miss some non-concealed deaths through coverage failure.

Secondly, without a dual record approach, it is unlikely that the suspicion would have arisen that substantial purposive concealment was occurring. Low levels of mortality would have been attributed to coverage errors.

Only the simultaneous concurrence of quite low level mortality with high coverage rates in a carefully trained and carefully supervised dual record study originally led to the suspicion and then to the hypothesis of widespread purposive concealment.

It is not certain that significant purposive concealment of death occurs. The death rates reported, especially during periods five through seven, are within the range of mortality levels that would occur in a stable population with the same

parameters of population structure, birth rates, and natural increase. If substantial concealment in fact has not occurred, or if it has, but if the percentage of concealment has remained fairly constant over time, then mortality in both urban and rural MCPS areas increased during periods five through seven.

At the same time fertility in the urban area rose. The increase in mortality would have tended to contain an otherwise large natural increase. In the rural area, the declining fertility would have combined with the increasing mortality to lower natural increase considerably.

In general, policymakers and health department administrators should be concerned by such increases in mortality over a four-year, eight-period duration. A serious food shortage and a large inflation occurred in the Philippines during the same period and are probably associated with these results. The danger is that such hard times may weaken younger children's resistance. An epidemic of the dimensions of the Asian flu which swept through many countries some years ago might cause considerable damage in such a case.

Main features of the Misamis Oriental migration data. The close account kept in a dual record system of multiple migration into and from the methodological samples can provide administrators with important knowledge of the dimensions of migration that take place in the urban and rural areas of their countries. These proved large in the southern Philippines case. Nor were these southern Philippine migrations by any means confined to the hinterlands of the two samples. In the urban sample, 53 percent of all in-migrants had come from another island of the Philippines or at least from a province other than Misamis Oriental. Forty-eight percent of the out-migrants were moving to another island or at least to another province. Forty-seven percent of the rural in-migrants and 43 percent of the out-migrants had either come from or were going to another province or even another island. In short, these were substantial moves that took place.

Reasons for migration into and out of these southern Philippine localities, rural and urban, to a large extent boiled down to seeking work or accompanying a household head who was seeking work. Implications for policymakers of developing countries are not inconsiderable. In each area of these two Philippine samples, the stream of in-migrants that replaced the stream of out-migrants had much the same characteristics of age, reason for migration, origin or destination, and marital status. The impression conveyed by these characteristics and by the amount of net migration is of a random, rather than a well-organized, search for improved economic opportunities. Taken at face value, such results as these would seem to indicate that migration is not redistributing the population in an efficient way. Population program directors and policymakers of developing countries would be greatly helped in many decisions by such data. A cost-benefit study of migration, including both economic and psychological costs to migrants, as well as the social costs incurred by the areas of origin and of destination, might be a valuable contribution, as Myers (1975) suggests, to a fuller understanding of such migration processes by these administrators and for learning how best to cope with them.

The MCPS migration data also reinforce another point developed earlier. That was the powerful ordering which economic motivation exerts on way of life. Finding that people are willing to leave home to travel to strange areas to obtain

employment strengthens reasons for thinking that they will also adopt family planning to obtain strongly desired economic goals.

If better economic opportunities could be established in rural areas, through large-scale or light but labor-intensive factory enterprises, employment opportunities might simultaneously hold people in the rural areas rather than attract them to city slums, and provide women with motivation (such as better adaptation to work patterns) for greater use of family planning. It would seem evident that the quality of life would improve if people could remain in their homes in rural areas, while they enjoy some benefits of city life in the form of regular cash wages.

Kinds of Research Approaches

The implications of previous sections of this chapter and of previous chapters are that a dual record approach can supply the administrators of population programs and the directors of statistical offices and bureaus with the kinds of data they need, precise levels of fertility, mortality, natural increase, and even of migration, to make decisions about inputs, special emphases, and allocations.

However, dual record research is somewhat more expensive than single system research. Administrators will presumably want to know at this point whether this data gathering function cannot be performed by one of the less expensive methods with at least satisfactory precision for their own purposes. In the following sections, implications of the different MCPS studies detailed in preceding sections will be examined from this point of view.

Single round simple retrospective surveys. The first type of research approach likely to present itself to the population program administrator and to the director of a statistical office as a source for obtaining precise estimates of birth and death rates is the single round simple retrospective survey. (The word "simple" will be dropped from the term hereafter, but it should be understood that the Brass, Own Children, and maternal history techniques are not included here.) These surveys are straightforward, flexible, usually short, relatively inexpensive, and fairly easy to administer.

First, the coverage rates already presented from the surveys carried out by the MCPS present evidence of how a well-trained, well-motivated, and well-supervised set of field interviewers, despite earnest efforts, failed to obtain complete coverage of vital events, and what is worse, failed to preserve a uniform rate of coverage from survey to survey. These surveys from the point of collection of data are no different from the single round retrospective surveys discussed here.

Confirmation of these results is provided by demographers. For example, Mauldin (1966) reviewed the performance of the U.S. Current Population Survey, a well-planned and well-supervised operation. He found that the October 1962 survey round had undercounted births by 23 percent and deaths by 14 to 28 percent. He decided from these results that use of such surveys to provide estimates of births and deaths is not advisable. He stated that they tend to underreport vital events and that such undercounting cannot be assumed to remain constant over time, place, and categories of people. One cannot even assume that there will be an undercount on all occasions. He concluded his review by stating that single round retrospective surveys cannot be relied upon to provide valid or reliable estimates of births

and of deaths. Another confirmation is provided by the work of Brass, Bogue, and Cho. If single round retrospective surveys could provide reliable estimates of birth and death rates, they would obviously not have labored so long and hard to produce the analytic methods which they have developed.

Brass techniques. These effective and well-designed techniques for estimating fertility and childhood mortality levels have been described in a previous section. While they require a census or a survey for their implementation and while these are expensive undertakings, the census will presumably be carried out at regular intervals in any case, and a special survey is less expensive than a dual record project.

These techniques furnish or allow for the computation of age-specific fertility, total fertility, and gross reproduction rates. Generally crude birth rates should also be obtainable from them. It would be more difficult to obtain differential fertility from the technique unless one either 1) should take a sample large enough to join current fertility with children ever born within class categories or 2) should assume that the overall multiplying factors could be uniformly applied to current fertility within categories, which seems highly questionable. Presumably educational and occupational categories would have different fertility and mortality schedules for several reasons including different average age at first marriage and differential access to medical benefits.

The Brass techniques, however, were principally devised to measure level of fertility in countries where birth rates have been constant over the recent past, and to measure childhood mortality where both fertility and mortality schedules have remained constant during recent years. The main difficulty with such assumptions for administrators of population programs in developing countries and directors of statistical bureaus who may wish to support such population programs with the data that they need is this: They want data which show whether birth rates have been constant in the previous year or two. If rates based on the Brass technique assume constancy of fertility and/or mortality in the previous year, presumably they will not be accurate estimators of fertility or mortality for that year if in fact the desired decline has taken place.

While a preceding section noted that the Brass technique applications in the southern Philippines produced good results for determining the level of fertility for a general period, it also furnished evidence that the techniques, because of their design assumptions, cannot give the kind of precise annual information which the population program director most wishes.

Nor will the childhood mortality estimates be more useful to the administrator of a population program and to the director of a statistical bureau or office. Again, the kind of data most desired are childhood mortality estimates for situations where fertility and mortality schedules are both changing. But these situations are exactly those ruled out by the assumptions and by the intent of the method.

Own Children methodology. This is a superior method of obtaining level of fertility data under certain conditions. One of the limitations for use of this method in developing countries is the need for accurate age data of children. The data obtained in the Philippines seemed satisfactory for application of the approach, but it may be difficult in numerous developing countries to obtain

child-age data of the necessary quality.

Another limitation is the need for mortality data for computation of the survival ratios needed for reverse survival of children and women to derive fertility estimates. The southern Philippine experience with underregistration of deaths and possible purposive concealment suggests that accurate death rate estimation may be a source of difficulty in applying this method in several other developing countries. Cho's statement, cited in the section on the Own Children method, may be true where more knowledge of mortality levels is available. But where knowledge is meager, errors in estimating general level of mortality can introduce larger differences in fertility than Cho had anticipated.

Like the Brass techniques, the Own Children method is designed for somewhat different objectives than those of the population program administrator and of the director of the statistical bureau who wishes to produce data that will help the population program. The population program administrator needs to know what happened to fertility levels last year or even during the past six months when a particular approach was emphasized. The Own Children method compares a range of rates extending over as long as 10 years. The director of the statistical office and the administrator of the population program are more interested in the fertility of specific groups of people actually present in the sample areas of study when particular techniques were tried. The administrator has made specific inputs into some areas at particular times. He or she wants to know how those populations were affected, rather than to get the birth rates of other populations. The Own Children method presents the fertility over a number of years not of these groups but of the one sample that resided in the area of study at the time of interview. As was seen in the chapter on migration, considerable turnover in population may develop over several years through migration even in rural areas of developing countries.

Coverage presents another difficulty. Presumably most women report accurately all their own children living at home. However, a varying amount of underreporting of children probably takes place for a number of reasons. Proxy reporting for another woman ranks high on this list. As a single system method, the Own Children approach has no way of measuring its own coverage of events, and no way of knowing accurately whether its reverse survival procedures are leading to correct estimates of births for the calendar years of interest. Like the Brass method, data for the Own Children method are likely to be gathered in a census. Therefore a substantial proportion of the data will be gathered from proxy respondents who are apt to underreport children of other women living in the same dwelling units as their mothers.

The Own Children method seems well adapted for obtaining differential fertility data. However, these data will be useful to administrators of population programs only if they also have accurate and precise estimates of level of fertility for the areas of interest. The MCPS studies would seem to indicate that administrators cannot be sure that the Own Children method provides precise estimates for any particular calendar year of interest. Like the Brass rates, they are not designed for such work. They are more useful in supplying estimates of fertility levels for a series of years where it is not crucial that fertility in this or that year be precise.

Maternal history approach. Like the preceding two single system approaches, this methodology, which has been elaborated by Bogue at the University of Chicago, produces results much superior to the simple single round retrospective survey.

Nevertheless the maternal history approach, despite the expense of long and detailed questioning (and sometimes because of respondent fatigue this questioning engenders) can miss pregnancies and births that occurred to the people who are interviewed. Unlike the dual record method, it has no way of estimating undercoverage and correcting for omissions.

Women in developing countries have a tendency to report pregnancies and births in such a manner that a heaping of pregnancies and births occurs. Because of recall errors some births are pushed one way or another across boundaries of particular years so that more pregnancies and births are reported for particular years than actually occurred and less for other years than actually took place. Data are usually edited on the basis of what was more likely to happen in average cases to remove such heaping. Events may be misplaced in the editing as well as in the recall process of the respondent. Women sometimes forget to report their most recent child in their efforts to cover their whole pregnancy history. Others under detailed questioning and probing may lose patience and answer inaccurately to shorten the interview.

Because of heaping and related editing, the maternal history approach, like the Brass and the Own Children approaches, does not seem flexible enough to satisfy the need of a population program administrator to catch short-term changes in fertility to pinpoint the effectiveness of a new program emphasis or an input made experimentally in a particular year such as that preceding the interview.

It should be noted in conclusion that the maternal history approach also does nothing to improve the reporting of unlisted women. Thus it does not guarantee improvement in coverage of births. In the Mysore study, for example, a set of interviewers using a maternal history approach recorded fewer current births than a simple survey of the same households with a retrospective question on births (United Nations 1961).

Dual Record Approach More Useful for Population Programs

The implication of the preceding sections is that for the particular needs of the administrator of a population program and for a statistical office that wishes to have accurate yearly indicators of completeness of registration, the dual record methodology has the flexibility and accuracy required. A dual record system can accurately estimate births and deaths from year to year, and even for shorter periods. Its built-in mechanism for calculating coverage and for correcting for underreporting is of tremendous advantage to population administrators. No other system of estimation yet devised has all these advantages.

Cost of a dual record system. A dual record project is not more expensive than a census, obviously, but is more costly than a single round survey, whether simple or analytic (as the Brass, Own Children, or maternal history type).

How expensive is too expensive? A luxury may be too expensive at even a low relative cost. It is not needed. But on the other hand a necessity can be afforded. An administrator of a population program needs data that show the true impact his program is having on the birth and growth rates of the country. If these data are necessary, then the cost of obtaining them can hardly be too much.

How much should a population administrator be willing to spend on research? Five to ten percent of his budget would not seem too much. This should cover the costs of a small national dual record project without provincial or regional pretensions.

Normally, the population administrator's program would not carry on this project itself but would look to another office or bureau to do so in a way that would serve adequately. The director of a statistical office would gain from having a statistical system built up in his office, but if his office were too tied up in other business to undertake this, he could subcontract it to a university entity competent to handle it, or to another government institution.

The implications of the MCPS studies are that less expensive dual record projects are possible than have been current in the past, and that such projects will be competent to turn out high quality data.

The MCPS studies have shown that frequency of surveys in that project could be cut from two to one a year. This would mean halving survey expenses. The direct implication of this is that in other dual record projects where continuous recording systems are carrying out bimonthly or trimonthly household visits, similar economies can be made. In projects where the continuous recording system uses community contacts or informants, this may not be so true. Further research is necessary. However, there is reason to believe that a yearly survey will prove sufficient for these projects, too. In fact, the house visits of the recording system workers, which cover events only since the last visit, do not seem likely to remind respondents of events before that time any more than the visit of a recorder to the home to fill out a birth or death form after obtaining notice from the community contact of the birth or death. Thus recall over the past year seems likely to be much the same when either system or a combination of the two systems is used.

Continuous recording system. The use of full-time workers, the assignment to each worker of areas with 4,500-5,500 persons or about 750 to 1,100 households per worker (size being modified somewhat by terrain problems) with three to four rounds in every locality per year, and the use of community contacts (with perhaps some house visits for housewife contacts) in the continuous recording system should cut costs of a dual record project substantially. The design of the two years of MCPS study show that all these elements can be joined together and operated simultaneously without sacrificing quality of data.

Cost figures. It is difficult to give cost figures in general as salary scales and travel expenses vary widely from country to country. However, use of the economies stated above together with good project management could reduce costs to only 60 to 75 percent of those of dual record projects using two surveys per year, part-time workers in relatively small areas, and house visits as characteristic features. Thus if costs of a particular project using the latter set of characteristics had averaged $90,000 a year, applying these economies might bring costs down as low as $54,000 to $68,000 a year.

CONCLUSION

Two main implications stand out from the studies of the MCPS. The first is that rural people will lower their fertility in response to economic or other

advantages they wish to obtain if the desire for another child competes with attainment of these goals, provided that adequate family planning services are available to make such limitation practicable for them. The key to inducing such a rural decline may consist in the discovery of advantages or items within their means for the attainment of which they would save and make such sacrifices as the postponement of a presently desired birth through family planning means. A program of bringing together buyers and sellers of such items or advantages, of popularizing a product through free advertisement, or even of helping marketers to display products by underwriting some of the costs of display might prove to be the necessary catalyst. Costs of such a program need not be large.

The second implication is that the dual record system, and only the dual record system, of all estimation methods known today, can supply the population program administrator of a developing country without adequate vital registration with the data necessary to discover the impact the population program is having on the birth and growth rates of a given country. Without such data, it is hard to see how a program director can make rational decisions on making and on retaining particular program inputs. But without such rationality of decision, considerable amounts of program funds may be wasted.

Implementation of such a dual record system could best be accomplished through the national statistics office or bureau, or subcontracted by an institution such as MCPS. Possible costs of such a program could be shared between the statistics office and the population program, as the project would benefit both institutions.

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ABSTRACT

New Approaches to the Measurement of Vital Rates in Developing Countries

The Mindanao Center for Population Studies (MCPS) at Xavier University in the southern Philippines began methodological experimentation with the dual record system for the measurement of population change in 1971. In response to demand by Philippine planning authorities, the project was eventually expanded during its analytic phase to include a number of alternative population measurement devices. It was hoped that this added dimension would yield comparative information concerning which technique(s) could provide the most reliable vital rates at the lowest cost. The data collected through the dual record system permitted the application of other analytic approaches without returning to the field for additional collection of information. The analytic methods specifically used included the Brass techniques for both fertility and mortality measurement, and, for fertility measurement, the Grabill and Cho "own-children" method and the Bogue pregnancy history approach.

The first two chapters of this report describe the project's goals, the sampling design used, and the organizational aspects of the field operations. Chapters 3 through 5 deal with results for rural and urban fertility trends, with differential fertility, and with the levels of mortality and of natural increase. Chapter 6 is devoted to migration and the unique methodological and substantive analytic problems posed by this phenomenon. Chapters 7 through 9 describe the results from the application of the three alternatives to the dual record system. The two chapters that follow address the specific issue of costs for a dual record system, with emphasis on means for keeping expenditures to a minimum.

The final chapter compares the results of all four techniques as applied to the same set of data and describes the advantages and shortcomings of each. The authors suggest two main implications of the MCPS studies. The first is that rural people will lower their fertility in response to economic or other advantages they wish to obtain if the desire for another child competes with the attainment of these goals, provided adequate family planning services are available. The second implication is that the dual record system, in the authors' opinion, is currently the best estimation method known that can supply the population program administrator of a developing country, lacking adequate vital registration, with the data necessary to measure the impact of a family planning program on the birth and growth rates of a given country. The MCPS studies have shown that less expensive dual record projects than those of the past are possible and that such projects will be able to produce high quality data.

RÉSUMÉ

Nouvelles conceptions de la mesure des taux démographiques dans les pays en développement

Le Mindanao Center for Population Studies (MCPS) de l'Université Xavier dans le sud des Philippines avait entrepris une expérience méthodologique avec le système de double collecte pour mesurer l'évolution de la population en 1971. Sur la demande des autorités philippines responsables de la planification, le projet avait été ultérieurement élargi, dans sa phase d'analyse, pour inclure un certain nombre d'autres méthodes de mesure de la population. Cette nouvelle dimension devait apporter, espérait-on, des informations comparatives sur la ou les techniques capables de donner les taux démographiques les plus fiables aux moindres frais. Les données recueillies par le système de double collecte ont permis d'appliquer diverses méthodes analytiques sans devoir retourner sur le terrain pour rassembler des informations complémentaires. Les méthodes d'analyse précisément utilisées étaient notamment les techniques de Brass pour les mesures conjointes de fécondité et de mortalité et, pour les mesures de fécondité, la méthode des "propres enfants" de Grabill et Cho ainsi que l'histoire de la grossesse de Bogue.

Les deux premiers chapitres du rapport décrivent les objectifs du programme, le plan de sondage utilisé et l'organisation des opérations sur le terrain. Les chapitres 3 à 5 traitent des résultats relatifs aux tendances de la fécondité dans les villes et dans les campagnes, ainsi que de la fécondité différentielle, des niveaux de mortalité et du taux d'accroissement naturel. Le chapitre 6 est consacré à la migration et aux problèmes d'analyse particuliers qu'engendre ce phénomène, tant pour ce qui est des questions de méthodologie que de fond. Les chapitres 7 à 9 décrivent les résultats de l'application des trois autres techniques au système de double collecte. Les deux chapitres suivants abordent la question particulière des coûts d'un système de double collecte et soulignent les moyens de réduire les dépenses au minimum.

Le dernier chapitre compare les résultats des quatre techniques appliquées à un même ensemble de données et décrit les avantages et les inconvénients de chacune. Les deux grands enseignements qui tirent les auteurs des travaux du MCPS sont: premièrement, que les habitants des campagnes réduiront leur fécondité en fonction d'avantages économiques ou autres qu'ils convoitent, si le désir d'avoir un enfant de plus entre en compétition avec ces objectifs, à condition toutefois qu'il existe des services de planning familial appropriés. Deuxièmement, le système de double collecte est, à l'avis des auteurs, la meilleure méthode d'estimation actuellement connue, capable de donner à l'administrateur du programme démographique d'un pays en développement les données nécessaires pour mesurer l'effet d'un programme de planning familial sur les taux de natalité et d'accroissement d'un pays donné, lorsque ce pays n'est pas doté d'un bon système d'enregistrement des déclarations d'état civil. Les travaux du MCPS ont démontré qu'il est possible de réaliser des programmes de double collecte à moindres frais que par le passé et que ces programmes peuvent produire des données de qualité.

RESUMEN

Nuevos Enfoques en la Medición de Tasas Vitales en los Países en Vías de Desarrollo

El "Mindanao Center for Population Studies" (MCPS) (Centro de Estudios de Población) de "Xavier University" en el sur de las Filipinas inició en 1971 investigaciones metodológicas con el sistema de doble registro para medir cambios en la población. En respuesta a una demanda del departamento de planificación Filipino, la fase analítica del proyecto fue extendida a fin de incluir una serie de instrumentos alternativos para la medición de la población. Se esperaba que esta nueva dimensión proporcionara información comparativa con respecto a cual(es) técnica(s) proporcionaría(n) las tasas vitales más confiables al menor costo. Los datos recolectados a través del sistema de doble registro permitieron la aplicación de otros enfoques analíticos sin tener que volver a terreno a recolectar información adicional. Los métodos analíticos utilizados incluyen las técnicas de Brass para la medición de la fecundidad y mortalidad, el método de "los hijos propios" de Grabill y Cho y el enfoque de la historia de embarazos de Bogue, para medir la fecundidad.

Los primeros dos capítulos de este informe describen los objetivos del proyecto, el diseño muestral utilizado y la organización de las operaciones de terreno. Los Capítulos 3 a 5 tratan sobre las tendencias de la fecundidad en zonas rurales y urbanas, los diferenciales de fecundidad y los niveles de mortalidad y crecimiento natural. El Capítulo 6 está dedicado a la migración y los problemas metodológicos y analíticos únicos presentados por este fenómeno. Los Capítulos 7 a 9 describen los resultados obtenidos a través de la aplicación de tres métodos alternativos al sistema de doble registro. Los dos capítulos siguientes se refieren al item específico del costo del sistema de doble registro, enfatizando los medios de mantener los gastos en un mínimo.

El capítulo final compara los resultados de las cuatro técnicas aplicadas al mismo conjunto de datos y describe las ventajas y desventajas de cada una. Los autores sugieren dos implicaciones principales derivadas del estudio realizado por el MCPS. La primera es que la población rural reducirá su fecundidad si desea obtener ventajas económicas o de otro tipo y el deseo de otro hijo dificulta la obtención de estas metas, siempre que cuente con servicios de planificación familiar. La segunda implicación es que el sistema de doble registro, en opinión de los autores, es el mejor método de estimación conocido actualmente capaz de proporcionar al director del programa de población de un país en vías de desarrollo, que no cuente con registros vitales adecuados, los datos necesarios para medir el impacto de un programa de planificación familiar en las tasas de nacimiento y crecimiento. Los estudios realizados por el MCPS han demonstrado que es posible utilizar un sistema de doble registro más barato que en el pasado y que tal sistema será capaz de producir datos de alta calidad.

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