

# The Cebu Longitudinal Health and Nutrition Survey: Two Decades Later

*Many valuable lessons can be drawn from the 23-year history of the Cebu Longitudinal Health and Nutrition Survey, the longest health and nutrition panel study in the Philippines and among the longest such studies in Asia. The survey offers an example for other developing country settings.*

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This article discusses the 23-year history of the Cebu Longitudinal Health and Nutrition Survey (CLHNS), which was started in 1983 in collaboration with the Carolina Population Center of the University of North Carolina at Chapel Hill (CPC-UNC), the Office of Population Studies of the University of San Carlos (OPS-USC) and the Nutrition Center of the Philippines (NCP). After briefly presenting information on its origins and development in this introductory section,

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the methodologies and strategies used in the research and some of its major findings and contributions are discussed, before analysing the challenges and lessons learned from the study. The article ends by identifying some best practices and offering some recommendations for other longitudinal studies.

The origin of CLHNS can be traced to the controversy surrounding the determinants and consequences of infant feeding in the early 1980s, which prompted several international companies producing infant formula to approach Barry Popkin, a noted expert on nutrition, asking him to develop a long-term research project to explore some of the unresolved issues concerning this matter (Adair and Popkin, 2001). Popkin formed a research group which included economists John Akin and David Guilkey from CPC-UNC, demographer Wilhelm Flieger from OPS-USC and Florentino Solon, Director of the Nutrition Center of the Philippines. Metro Cebu was chosen as the research site because of its environmental and socio-economic diversity <sup>1</sup>(Adair and Popkin, 2001).

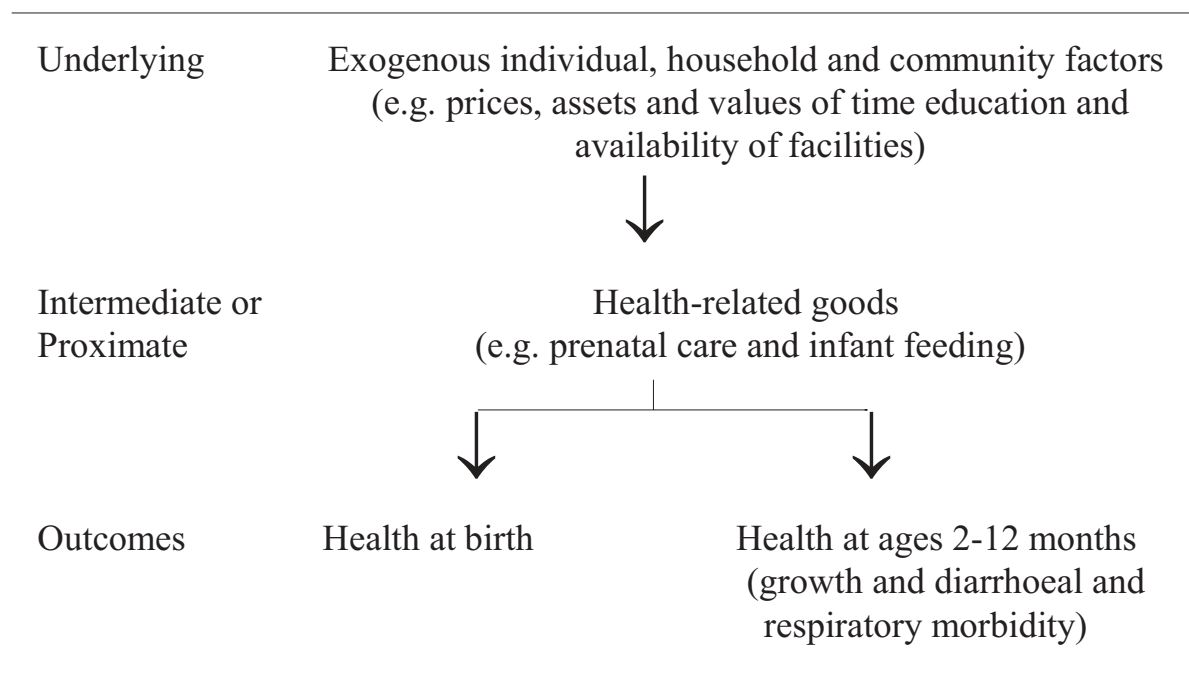
The study started with the objective of understanding infant feeding practices, the determinants and consequences of infant feeding and maternal and child health practices, and the effects of ecological factors on birth and health outcomes. The initial years of the project also investigated how infant feeding decisions were made, the frequency of feeding events using milk and non-milk feeding and the effects of feeding patterns on mothers and households (OPS-USC, CPC-UNC and NCP, 1989).

CLHNS was one of the first large-scale population-based surveys designed with a conceptual framework that was similar to what would eventually become known as Mosley and Chen's (1984) framework for child survival. The framework argues that individual household and community variables affect a set of proximate health behaviours (infant feeding and use of preventive health care), which in turn influence health outcomes including morbidity and growth (Adair and Popkin, 2001). As shown in figure 1, the framework used by the study examines the underlying individual and community factors (prices, assets, values of time, education and availability of facilities), intermediate or proximate factors (health-related "goods" such as prenatal care and infant feeding) affecting health outcomes at birth (health at birth, birth weight and gestational age) and health at ages 2-12 months (growth and diarrhoeal and respiratory morbidity).

Although the CLHNS was originally intended for a two-year follow-up of infants, subsequent surveys were conducted in 1991-1992, 1994-1995, 1998-1999, 2002 and 2005 on these cohorts of mothers and children to pursue a variety of enquiries on different aspects of the mother and child's development to be described in greater detail in a later section of this article. For each new research

objective, specialized modules were developed and added to the core/basic modules retained from earlier rounds, building on the large information database of CLHNS. The evolutionary nature of CLHNS is what makes the study unique.

**Figure 1. Initial research framework relating underlying intermediate and outcome variables**



Source: OPS-USC, CPC-UNC, NCP (1989), Cebu Study Team (1991).

### **Methodology, data and attrition**

CLHNS used a stratified single-stage cluster-sampling procedure to select 33 *barangays*, (the Filipino term for a village or district), indicating the smaller administrative units in the Philippines, of which 17 were urban<sup>2</sup> and 16 rural in Metro Cebu; a cohort of pregnant women from those locations were to be included in the study. Stratification was by urban or rural residence (defined by the census) and the *barangay* served as the cluster. Infants born between 1 May 1983 and 30 April 1984 and their mothers served as the baseline sample of 3,327 mother-and-child pairs. A 12-month birth cohort was recruited to account for seasonality as a possible determinant of child growth, morbidity, mortality, maternal fertility and nutritional patterns (Adair and Popkin, 2001). Data were collected on all the infants born in the sample *barangays* and on their mothers. Interviews and measurements were undertaken immediately after each birth, then at two-month intervals for 24 months. Data on the mother and child within a day or two of the bimonthly anniversary of each child's birth over a two-year period were

collected to capture the sequence of feeding events, the dynamics of breastfeeding, feeding behaviour and the factors affecting feeding decisions at each point in time.

Several strategies were used to collect information and ensure data quality. These covered different stages of the project from sampling and training to data collection. To start, a household census was undertaken to identify pregnant women to be included in the study. A house-to-house survey was conducted in the 33 sample *barangays* in 1982 and 1983. All women who were in their third trimester of pregnancy at that time and who subsequently gave birth between 1 May 1983 and 30 April 1984 were recruited for the study (Gultiano, 1999a).

Community preparation was made with visits to provincial, municipal and *barangay* officials prior to the survey to inform officials of the planned project and obtain their permission to conduct the study in their jurisdiction, and to get their support and acceptance for the survey to be conducted in their community. Meetings informed the populace or community concerned of the study to be undertaken. Official permits were also obtained from administrative officials in all cities and municipalities and from health officials and military authorities (OPS-USC, CPC-UNC and NCP, 1989).

A *barangay* reporting system was established to obtain reliable and speedy information about infant births and infant deaths that occurred within the sample *barangays*. One or two residents in the *barangay* were hired as regular reporters to provide the needed information and updates on the sample children directly to the survey teams or the office.

Traditional health workers and midwives were enlisted to report all the births they attended in the sample *barangays*. Incentives were given for incidents reported within three days, considered the ideal time to gather information since data on the infant food intake could also be obtained, and even more incentives were given if births were reported immediately and infants weighed using the scale provided by the project. Birth interviews taken more than two weeks after the birth were ruled as unreliable because of recall problems and measurement bias. These midwives and traditional healers were also asked to report women who became pregnant after the household listing in March 1983 and those who were missed during the operations. These reports were verified by field personnel; this strategy resulted in 430 women who were either newly pregnant or had been overlooked (OPS-USC, CPC-UNC and NCP, 1989).

Intensive training of field personnel ensured the quality of data collection. Seasoned OPS staff served as field supervisors. Nurses were hired for the administration of gestational age tests. Field supervisors and staff were also

trained to obtain reliable information on infant morbidity, especially diarrhoea, measles and respiratory infections, anthropometric measurements, gestational age and dietary intake recall under the supervision of health, child and nutrition experts from the Cebu Institute of Medicine and University of the Philippines at Los Baños (OPS-USC, CPC-UNC and NCP, 1989).

A permanent team was assigned in designated sample *barangays* for the first two years of the study. Data collection was done on a bimonthly basis. This strategy distributed the work evenly across rural, urban and island sample *barangays*, and facilitated timely data collection by the survey team members familiar with the survey site whose presence in the community was already accepted. To avoid bias in reporting or documentation that may have arisen owing to the familiarity of the interviewer with the respondent's history, assignments among field interviewers were made at random. This strategy also proved useful in validating previously collected data and identifying interviewers who were not doing their job efficiently.

Regular checks were in place to ensure good quality data. Apart from the intensive training of interviewers, interobserver reliability was periodically assessed. All completed questionnaires were edited for consistency in the field and in the office. Data entry included range checks; questionable responses were sent back for a reinterview.

The construction of a data entry software program suitable for longitudinal data and creation of unique identification cards was done to suit the longitudinal, hierarchical data structure and complexity of data, which included special modules in different survey rounds. Unique identification numbers were generated for each mother and child in order to facilitate the merging of data files from different survey rounds.

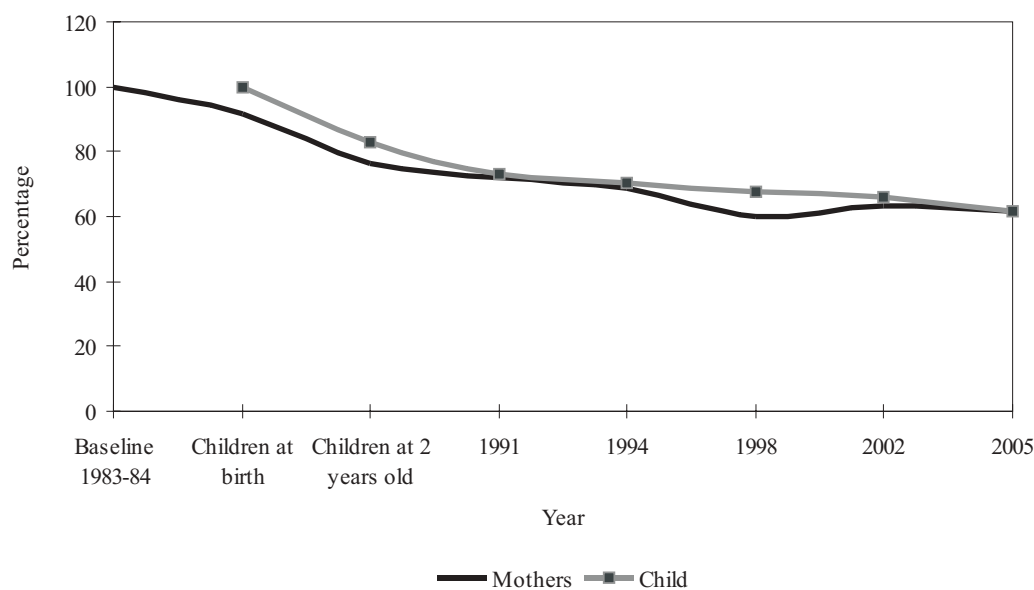
The study ensured that the conduct of the study was ethically sound. Apart from seeking clearance from the institutional review board, the research team underwent training in the ethical conduct of research. Verbal or written informed consent was obtained before proceeding with the interviews or data collection. Written informed consent was obtained when biological specimens (blood and saliva) were collected in later surveys. For sensitive topics, a sealed envelope was used to respect the privacy of the respondents and enhance the response rates, such as on the study of pubertal development when adolescents were asked to self-evaluate their status relative to a set of line drawings of the different stages of puberty.

A persistent follow-up of sample mothers and children was done using all possible means. Visits were scheduled to accommodate the work and school

schedules of the respondents, including, if needed, conducting interviews at their schools or places of work. Tokens and “bother fees” were given to the participating mothers to compensate for the opportunity costs or the income they would have otherwise earned if they had been working.

This careful planning helped to address the issue of attrition, a common problem in longitudinal studies. Although not all respondents could be retained (see figure 2), after more than 20 years, the retention rate is still comparable to, if not better than, other cohort studies worldwide. In 2005, of the original 3,327 mothers 2,080 were still participating in the survey. Attrition among children was similar to that of the mothers. From an original cohort of 3,080 single live-birth children, only 1,903 remained in 2005, representing the same percentage as that of the mothers (Gultiano, 2006).

**Figure 2. Percentage of mothers and children included in the rounds of the Cebu Longitudinal Health and Nutrition Survey**



The leading cause of attrition has been migration outside of Metro Cebu, accounting for a loss of about 3 in 10 mothers and a fourth of the children in 2002 (Perez, 2003). Deaths accounted for a very small percentage of the loss of sample mothers and children. As expected, the death of children was higher in the earlier ages up to the first year of life (Perez, 2003). Refusals for interview were rather low across the years, ranging from less than 1 per cent to about 2 per cent for both mothers and children (Perez, 2003). Because of inevitable attrition, the latest sample of children in 2005 is considered to be biased towards rural and poor households with fewer modern amenities or assets and less educated parents (Perez and Cinco, 2007; Bas, 2007, Carba and Tan, 2007). Another noted bias is towards

older mothers (Adair and others, 1997). It is therefore important to test for selection biases in the analysis of more recent data.

### **Wealth of information**

CLHNS data are rich and varied, covering three generations in more than two decades. The data and measurements included in the successive surveys were tailored to serve the objectives of each survey. The baseline, birth interview survey and the periodic surveys until each child was two years old were meant to measure the determinants of infant feeding and feeding practices and determine the influence of ecological factors on health outcomes (birth weight, mortality and infections during the first two years of life). The baseline survey (in the sixth or seventh month of pregnancy) focused on maternal health behaviour, diet (assessed using a 24-hour recall) and health status, and the household's socio-economic environment. Anthropometric measurements, particularly height, weight and arm circumference, were taken by trained field personnel. Key informants have provided information on *barangay* characteristics, educational facilities, social services, public utilities, *barangay* organizations, commercial establishments and the price of milk, infant foods and other foods and commodities in each community.

The birth interviews have included questions on delivery practices, and health and infant feeding during the first days of the infant's life. Infant weights were recorded by health personnel or traditional health providers, and then weight and length were measured by project interviewers. Gestational age was assessed using the Ballard assessment method,<sup>3</sup> for all infants born weighing less than 2.5 kg, or whose mothers had complications during pregnancy or whose gestational age could not be obtained from indicators normally supplied by the mothers (OPS-USC, CPC-UNC and NCP, 1989). Bimonthly surveys provided detailed information on infant and maternal diet, mother and infant anthropometry and morbidity, lactational patterns, physical activity and nutritional status, socio-economic household changes, health practices and behaviour, family planning and other child-spacing factors. Special modules were also administered during these rounds to assess water usage and quality, the incidence of diarrhoea and the influence of media advertising on breastfeeding and the feeding of infants. Community-level information included a survey of health professionals' knowledge, attitudes and practices, and community characteristics (taken biannually), food markets (bimonthly), water quality (quarterly) and family planning facilities and personnel (twice) (OPS-USC, CPC-UNC, NCP, 1989).

The specialized follow-ups produced a wealth of information on related topics. The first follow-up of the mother-and-child pairs was undertaken in the

period 1991-1992, when the children were eight years old, to follow the growth, intellectual development and early schooling status of the offspring. The 1991-1992 survey included the child's complete schooling history and administration of non-verbal intelligence tests and the measurement of the next youngest sibling's anthropometrics. Subsequent surveys were conducted in 1994-1995, 1998-1999, 2002 and 2005, with each survey looking at a different perspective of the mother and child's development. The 1994-1995 survey focused on women's status, family planning use and labour force participation of the mothers and the relationship between school achievement and nutritional status of the children (Gultiano, 2006). A module on household decision-making included questions designed to measure autonomy in several realms. Questions concerning the mothers' aspirations for their children were also asked during this round. Detailed in-depth interviews on a subset of 60 mothers were undertaken to explore how family planning decisions were made, the consequences of family planning use, the various aspects of their lives involving work, autonomy, status and aspirations (Gultiano, 1999b; Avila and Wong, 2001). Achievement tests in mathematics and in the English and Cebuano languages were administered to children who were then 10-11 years old.

The 1998-1999 survey round focused on adolescent reproductive health and sexual behaviour. During this round, the sample children were interviewed for the first time. Apart from the data collected in earlier rounds, adolescents were asked additional information about their physical development, using drawings for sensitive questions; work history; pregnancy history; breastfeeding practices; marital status; marriage and cohabitation; sexual relations; reproductive health; family, peer and media influence; risky behaviour; communication with parents; and daily activities. Blood pressure readings were also taken on all respondents. Blood and saliva samples were taken from a selected subset of 600 adolescents, including all who were small at birth (weighing less than 2.6 kg), and a random sample of those who weighed more than 2.6 kg. Samples were analysed for hemoglobin, lipids, glucose, insulin, immune and thymic function and blood type. Saliva samples were analysed for cortisol levels.

For the mothers, complete reproductive histories added information on menopause; information was also collected to provide baseline measures for future studies of ageing, including a cognitive function memory test and questions about activities of daily living. Mothers were also asked questions reflecting their psychological health and communication with their daughters or sons. During this round, in-depth interviews with a subsample of fathers were undertaken to determine their views on family planning and women's work.



The more recent 2002 and 2005 survey rounds examined how childhood health and nutritional status affected educational attainment work patterns and the wages of young adults. The 2002 survey included a separate module on intimate partner violence/aggression, decision-making, financial management and parental status and body image and the start of the life-history matrix.<sup>4</sup> Additional anthropometrics included waist circumference and subscapular skinfold thickness. During this round, both the adult children and their spouses were included in the survey because of the interest in the domestic behaviour of wives and their husbands. The spouses were asked the same questions as the sample adult children. Modules on entertainment facilities, major business establishments, job availability and a special module on government financing and resources were also included in this round.

The most recent survey (2005) added interviews with husbands of the mothers, and information about the children born to index children, thus adding a third generation to the study. Questions about perceived stress were asked of mothers and their husbands during this round. Fasting blood samples were taken from the mothers and their children, now young adults. Husbands were interviewed using the same survey forms, but they provided no blood samples. In addition to the storage of plasma for assessment of a wide range of chronic disease biomarkers, DNA was extracted for future genetic analysis.

### **Major findings and contributions**

The CLHNS data, which are publicly available, have enabled many scientists to conduct demographic, health, social and psychological research. Although the results relate to the Philippine context, some of the findings also have relevance for other developing countries. An exhaustive description is beyond the scope of this article, but a few of the main results are briefly mentioned to provide an impression of the relevance of CLHNS for knowledge, policy and action.

CLHNS has provided evidence about the importance of intrauterine development and early child development, especially in the first two years of life, and the implications of these aspects. Studies on prenatal care have shown the positive impacts on the health of infants and mothers.<sup>5</sup> These were complemented by studies on low birth weight and stunting and their respective impacts in childhood. Illness during early life was shown to affect growth as well as academic performance in late childhood. The link between intrauterine growth and consequences later in life has also been explored using the CLHNS dataset supporting the foetal programming or the development origins of a health and development hypothesis.

CLHNS has also yielded several studies on the positive effects of breastfeeding; the negative effects of breastfeeding, particularly on the mothers; the factors influencing breastfeeding; and the effects of breastfeeding on amenorrhoea. Studies on weaning focused on the effects of early weaning, infant feeding practices, use of breastmilk substitutes and supplementation.

The wide range of data collected in CLHNS from the 1980s to 2005 on the mothers, their children and more recently on their grandchildren provide vast opportunities for intergenerational studies that explore the influence of nutrition on the growth of children and the subsequent generation and parent-child studies from biological and social perspectives. The data also make possible the investigation of epidemiological and nutrition transitions in a developing country. Metro Cebu provides an excellent backdrop for these analyses, considering that it has experienced rapid modernization and development in the past several decades. Cebu Province has been experiencing the double burden of both infectious diseases and degenerative disorders (Quiza, 2006). Similarly, the population offers examples of both undernutrition and overnutrition (obesity and overweight) as observed in the recent 2003 National Nutrition Survey (Food and Nutrition Research Institute, 2006).

CLHNS data have been used to examine nutritional transition, maternal education and employment, human capital formation and childbearing, and to explore issues related to gender, adolescent and reproductive health, domestic violence and family planning.

Besides these content topics, a number of methodological issues could also be explored, including the effect of endogeneity and the use of structured questionnaires versus in-depth interviews.

These and many other outputs have brought recognition to CLHNS as one of the prime birth cohorts in a developing country, as reflected also in the inclusion of CLHNS in the COHORTS Study Group, a collaboration of research efforts from five sites, namely Brazil, Guatemala, India, the Philippines (Cebu) and South Africa, funded by the Wellcome Trust. Among the many contributions of CLHNS in building knowledge and capacity is the use of its findings in continuing education programmes of the Philippine Pediatrics Society, the Philippine Obstetrics and Gynecology Society and the Philippine Society for Nutrition and Dietetics and in academic publications. Its data have been elaborated in more than 100 publications and in numerous dissertations and conference papers. Most importantly, the results of CLHNS have had impacts on policies and interventions. According to Adair and Popkin (2001), the first World Bank strategy on health financing and environmental health policy used findings drawn

from the Cebu study. Likewise, the policy of UNICEF on the ingestion of breastmilk substitutes during infancy and the Asian Development Bank's programmes on the early health development of children have used findings from CLHNS.

### **Challenges and lessons**

Several challenges were encountered in the conduct of CLHNS. These included ensuring the follow-up of the sample mothers and children, having a dedicated team of researchers, ensuring good data quality and database management, and securing funds for subsequent activities.

Following the sample mothers and children was done using all available sources of information (past and current, including that provided by their neighbours); however, resources were inadequate to follow respondents moving outside of Metro Cebu. Ethical questions also had to be taken into consideration, especially in studying populations in which severe health outcomes were being measured. Interviewers were trained to refer individuals in need of mental or physical health care, even if doing so implied losing a case. As mentioned previously, the survey staff had to go to great lengths to track those remaining within the boundaries of the survey in order to reduce attrition to a minimum.

In addition to retaining the respondents, it was a challenging task to retain the staff and maintain a dedicated team of researchers to follow up the cohorts owing to competitive job offers. In trying not to lose trained survey personnel who were familiar with CLHNS, benefits and good compensation were provided, although job security could not be guaranteed.

In the face of staff turn-over, high-quality training, technological development and maintenance of survey protocols were employed to ensure high-quality comparable data over the years. This was not an easy task, as consistency checks for each survey round and across survey rounds are complex. Managing data files for the longitudinal data was a major concern in view of the advancements made in computer technology over time and the volume of information to be processed in addition to constructing longitudinal data files that would be comparable across many survey rounds. Although data quality can be safeguarded with proper checks (editing in the field and office, and by machine), the employment of competent human resources to handle quality control proved expensive. These costs warranted the high quality of CLHNS data when compared with what is available from many developing country surveys, but they put pressure on fund-raising efforts.

Securing funds to continue with CLHNS was time-consuming, particularly in a climate of increased competition for fewer resources. By diversifying the study and defining a wide range of important health and social issues that could be uniquely addressed by CLHNS data, the authors have been quite successful in obtaining funding from a wide range of sources, including government, international organizations, research foundations, universities, industry and the United States National Institutes of Health, among other sources.

In addressing these and many other challenges for more than two decades, valuable lessons have been learned in the conduct of a longitudinal study, from which the following best practices could be identified:

- Documenting the procedures from each survey round is essential for creating user-friendly data sets. With proper and careful documentation of the developments and uniqueness included in each survey round, users can become aware of the history to guide them in understanding the data set.
- Maintaining a database to store the information from the different survey rounds is an important function as such a database is a major asset that needs to be supported by the development of computer programs which enable efficient data encoding, editing, archiving and use of the longitudinal data across surveys.
- Tracking or surveillance of the cohort of mothers and children ought to be carefully planned in order to know their whereabouts, the major events in their lives (e.g. graduation, employment, marriage, new births) and to update some measures. The master list of respondents should be frequently updated to facilitate the follow-up of respondents for the subsequent survey rounds. Tracking is very important in order to document the many events happening in the transition from adolescence to adulthood; it also enhances the rates of follow-up.
- Hiring a team of competent and dedicated researchers is critical to the success of the longitudinal study. Having them well trained and equipped with the skills to measure the information is a must for ensuring good data quality. Conducting standardized training programmes across surveys minimizes intra- and inter- interviewer bias. Although CLHNS has been fortunate to have some interviewers since the start, new interviewers had to be trained and undergo the same training process as the others.
- Enlisting of qualified local residents to serve as part of the survey team is an efficient way of getting timely information. Having local reporters to

report the birth of a child facilitated the entry of the survey team and the gathering of information within the first few days after the birth, thus minimizing recall problems. Enlisting traditional health providers as part of the research team also proved to be beneficial since this step assured community acceptance of the survey team.

- Apart from field, office and machine editing to ensure the quality of the data, monitoring the interviewers ought to be carried out to prevent erroneous data reporting. Although problems of faulty reporting of data may have been avoided with the imposition of allowance deductions for erroneous data, having the same interviewers returning to the participant may lead to some bias in reporting. To avoid behavioural contamination resulting from frequent follow-ups by the same survey team in the same sample *barangay*, starting in 1991 the interviewers were randomly assigned to the mothers, thus ensuring that the interviewers would not interview the same mothers.
- Establishing good rapport with the community, particularly the elders and natural leaders who influence the other community members, facilitates cooperation, which is key to the success of the study. On the down side, close interaction can be a taxing experience for some interviewers. In some cases, interviewers were asked for financial assistance to support the hospitalization or burial of a family member; in most of these cases, interviewers made contributions in their personal capacity.
- In ensuring long-lasting participation, it is important to inform respondents of the study and to be sensitive to their beliefs, customs and perceptions so that intrusion into the privacy or personal lives of the respondents would be acceptable, and survey operations would not be stifled. For example, during field tests of the anthropometric equipment, the survey team found that some participants perceived the measuring activity to be similar to measuring someone for a coffin; therefore, they adjusted the infantometer by removing its sides and painting it with lively colours to dispel such notions.
- Explaining the purpose of the study is crucial in getting the study participants' cooperation. Although some mothers had misperceptions and expressed anxiety when a test (Ballard assessment method) for determining the gestational maturity of newborn infants was administered, an explanation of the reasons for the measurements and the purpose of the study appeased them, after which they cooperated. Refusal of respondents to join the study can be best handled by providing them

with information on the benefits of the study. Providing a “bother fee” or token payment may also be useful in maintaining their cooperation.

- Engaging the community in the study can be fostered by devising ways for “giving back to the community”. By informing the respondents of the study results through informal conversations or tangible forms (such as information brochures in vernacular languages, growth charts and blood readings) study participants were made aware of the relevance of the study to their lives and those of other people.
- Preserving continuity by maintaining questions in different survey rounds. In cases where questions may be flawed or inadequate, better questions can be incorporated in subsequent rounds. The analysis of CLHNS also paved the way for learning what to include and improve in subsequent rounds of the survey.
- Eliciting institutional collaboration among institutions plays a major role in helping to continue the cohort study. With support, training and collaboration among institutions, studies on CLHNS still continue.
- Observing proper research ethics is necessary; this involves maintaining transparency about the study. Informed consent is to be sought and the decision of subjects to participate or not participate in the study or submit specimens has to be respected. In sharing information, the anonymity and confidentiality of personal information should be ensured. With these practices and the constant assurance of confidentiality, participants appreciate the value of the research and their participation.
- Disseminating results to major stakeholders (such as funding organizations, academia, and governmental and non-governmental organizations) and the making of survey data available are vital for building knowledge and allowing for the provision of inputs to policy measures and interventions.

In conclusion, based on the CLHNS experience and summing up the lessons learned and the good practices identified, the authors would like to make the following recommendations. First, future endeavours on longitudinal studies should be culture- and people-sensitive so that the survey is understood by, and acceptable to, the participants, and beliefs and misconceptions of the sample population can be addressed early during the survey. Second, there is a need for transparency about the study, ensuring informed consent, respecting the rights and decisions of people to participate or not participate in the study or to submit

specimens. Third, there is a need to return to the people and obtain feedback on the results of the study either formally or informally so that they will appreciate the value of the research and their participation in it. Fourth, the different processes and experiences of different survey rounds should be documented, archived and shared with other users so that these can serve as learning experiences for other researchers. Fifth and lastly, it is necessary to disseminate and popularize the technical findings of the studies among key stakeholders so that the findings can serve their purpose and be utilized as inputs to policy measures and interventions, future research efforts and advancing scientific pursuits.

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### **Endnotes**

1. Metro Cebu, the second major metropolitan area in the Philippines, has a population of 3.3 million as of the last census (2000). Cebu Province provides a good backdrop for the conduct of socio-economic, demographic and health surveys since it is an island province and one of the fastest growing metropolitan areas in the country. The social, economic and health changes that the country has been experiencing are reflected in Cebu; the rapid epidemiological and nutritional transitions happening in Cebu typify those of any developing country in Asia (Adair and Popkin, 2001).
2. At the start of CLHNS there were 243 *barangays* in Metro Cebu, of which 155 were urban and 88 were classified as rural by the National Statistics Office. With the revised classification of the Office of Population, according to more stringent socio-economic criteria for the purposes of sample stratification, only 95 *barangays* were considered urban while 148 remained rural. Drawing separately from the two clusters, 17 urban *barangays* and 16 *barangays* were randomly drawn. There was an oversampling of the urban *barangay*, with the assumption that health care and infant feeding patterns are more diverse in the urban setting than in rural ones (Gultiano, 1999a).
3. Trained nurses were employed to administer the Dubowitz-Ballard test of gestational maturity (OPS-USC, CPC-UNC and NCP, 1989).
4. The life-history matrix is an instrument for recording and sequencing various events in a person's life. The matrix in the study included nine major aspects of the child's life, namely education, occupation, residence, romantic relationships, sexual experience, marriage, pregnancy, family planning and major illnesses. The matrix shows how changes in one event or milestone relates to changes in the other events or milestones.

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