

TREATMENT OF CHILDREN SUFFERING FROM SEVERE MALNUTRITION IN AN AREA OF SANTIAGO, CHILE¹

C. Castillo D.,² V. Salvatierra,³ M. C. Mejías,⁴ E. Olmos,⁵
M. P. Guzmán,⁶ A. Manríquez,⁶ and R. Puentes⁷

Despite considerable recent progress, infant and young child malnutrition remains a serious problem in Chile. The study reported here, based on patient records from southeastern Santiago, seeks to assess the current situation and to suggest effective countermeasures.

Introduction

The Southeastern Metropolitan Area of Santiago, Chile, where the study reported here was performed, includes several densely populated urban communities (La Florida, La Granja, and Puente Alto) as well as some rural communities. Overall, as of 1980 the study area had a total population of approximately 550,000 people, who together constituted about a twentieth of the national population.

Within the area, the 10 outpatient health centers of the Southeastern Metropolitan Health Service delivered health care to 47,352 children under six years of age during 1980. Those served included some 77.5 per cent of the assigned infant population and approximately two-thirds of the area's total child population in this age group.

The most common type of infant malnutrition in this area, as well as in the country as a

whole, has been primary malnutrition caused by a low intake of nutrients associated with a wide range of socioeconomic factors related to poverty. In the long run, therefore, the solution to this serious medical and social problem will depend upon progress against underdevelopment.

In the meantime, however, action within the health sector itself has made considerable headway in reducing the incidence and prevalence of malnutrition; and this downward trend has contributed to a marked decline in infant mortality (1, 2). It should be stressed here that programs of food distribution (providing milk and other items) and family planning are playing significant roles. In this regard, the protection against malnutrition that is afforded by the supplementary food program seems particularly important (3). (It should be noted that besides providing food, the program encourages and facilitates access by mothers and children to health facilities—mainly for supervision and monitoring of pregnancy and lactation and provision of well-baby care—4.)

A noteworthy drop in the birth rate encouraged by the family planning program has also proved effective in reducing the numbers of infants exposed to the risks of malnutrition and malnutrition-related death—especially because the program has given preference to people of low socioeconomic status with large families.

In addition, the work of both these pro-

¹Also appearing in Spanish in the *Boletín de la Oficina Sanitaria Panamericana*, 95(2):173-181, 1983.

²Pediatrician, Institute of Nutrition and Food Technology, University of Chile, Santiago, Chile; and Pediatric Service, Sótero del Río Hospital, Southeastern Metropolitan Health Service, Santiago, Chile.

³Nurse, Pediatric Service, Sótero del Río Hospital.

⁴Social worker, Pediatric Service, Sótero del Río Hospital.

⁵Nutritionist, Pediatric Service, Sótero del Río Hospital.

⁶Medical intern, Catholic University of Chile.

⁷Physician, Department of Pediatrics, Catholic University of Chile; and Pediatric Service, Sótero del Río Hospital.

grams has been complemented by health education programs directed at prevention and control of communicable diseases, encouragement of breast-feeding, promotion of immunizations, and so forth.

Table 1 shows how the birth rate and infant mortality have declined, both in Chile (1, 5) and in the Southeastern Metropolitan Area, during the period 1970-1980. During this decade the Infant Malnutrition Control Program of the Southeastern Metropolitan Health Service was gradually improving. Preventive measures and early treatment came to be provided through the outpatient health centers; a specialized Infant Nutrition Center adjoining the area's central facility, the Sótero del Río Hospital, was treating severely malnourished children on an outpatient basis; and hospital rooms were being allotted to children with advanced malnutrition or serious illness involving malnutrition. In addition, the Macul Nutritional Inpatient Recovery Center—run by a private state-supported corporation (CONIN)⁸—provided inpatient care for children referred to it whose recovery required more than outpatient care. A simple diagram of this health care system is shown in Figure 1.

Table 1. Birth rates and infant mortality in Chile and the Southeastern Metropolitan Health Area of Santiago, 1970-1980.

Year	Live births per 1,000 inhabitants		Infant deaths per 1,000 live births	
	Chile	Southeastern Metropolitan Health Area	Chile	Southeastern Metropolitan Health Area
1970	27.9	27.6	79.3	66.3
1971	28.7	29.2	70.5	58.4
1972	28.7	28.0	71.1	54.2
1973	28.1	26.6	65.2	53.4
1974	26.7	25.9	63.3	40.7
1975	25.2	22.6	55.4	41.2
1976	23.9	20.8	54.0	36.4
1977	22.8	18.9	47.5	33.8
1978	22.1	19.1	38.7	25.8
1979	22.3	19.9	36.3	22.9
1980	22.8	22.2	31.8	21.2

Within the area, particular emphasis has been placed on the recuperation of children with severe early malnutrition, through the participation of health teams working with both outpatients and hospitalized subjects. This work is additional to that directed at prevention, diagnosis, and early treatment of malnutrition among infants.

Despite such work, and despite the marked advances made in recent years, however, infant and young child malnutrition continues to be a common pathologic problem. Among other things, for example, in 1980 a total of 14.2 per cent of the infants receiving care from the Southeastern Metropolitan Health Service were classified as undernourished (Table 2). For that reason, there is an urgent need to make clear and objective assessments of the situation that can provide new information about the extent, characteristics, causes, and conditioning factors of severe malnutrition in infants and young children, as well as about the quality of the diagnostic and therapeutic management of each particular case and the effectiveness of the various therapeutic alternatives being offered.

The purpose of the study reported here was to provide some basic information that could contribute to a better understanding of the situation. Our specific objectives were as follows:

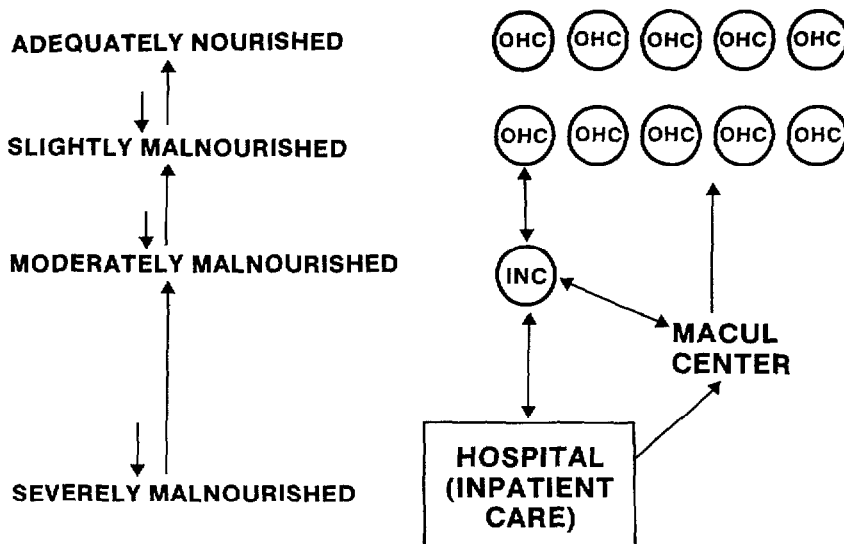
Table 2. Prevalences of malnutrition among infants receiving care from the Southeastern Metropolitan Health Service, by degree of malnutrition, 1977-1980.

% of children with:	Year			
	1977	1978	1979	1980
Grade I malnutrition	12.6	15.9	13.9	12.6
Grade II malnutrition	3.2	2.4	1.6	1.5
Grade III malnutrition	0.4	0.4	0.2	0.1
Some degree of malnutrition	16.2	18.7	15.7	14.2

Source: Ministry of Health, Southeastern Metropolitan Health Service, Personal Program Department.

⁸CONIN = Corporación para la Nutrición Infantil.

Figure 1. A schematic diagram of health facilities providing care for adequately nourished and malnourished children in the Southeastern Metropolitan Area of Santiago, Chile. Nutritional categories on the left provide a rough indication of the desired distribution; not all the children in a given category are treated only at the indicated facility.



OHC: Outpatient Health Centers

INC: Infant Nutrition Center

MACUL CENTER: Macul Nutritional Inpatient Recovery Center

HOSPITAL: 12 infant cribs available

1) To determine the number of infants and children under two years of age with grade III protein-calorie malnutrition, the number of infants (subjects under one year of age) with grade II protein-calorie malnutrition, and the level of the health system facilities providing care for each of these subjects during the study period.

2) To determine the frequency of primary and secondary malnutrition among these subjects.

3) To assess the quality of prior evaluations of these subjects' nutritional status.

4) To determine the incidence of premature birth and fetal malnutrition among the study subjects.

5) To compare the study children's responses to remedial treatment provided by outpatient health centers and by the Infant

Nutrition Center (INC) of the Sótero del Río Hospital.

6) To determine the influence of the Sótero del Río Hospital on these children's nutritional status.

Materials and Methods

Visits were made to the 10 outpatient health centers in the study area, where the records of all infants and young children (both those being actively monitored and those being passively monitored—not attending the facility) during the period 31 March-1 October 1980 were reviewed. The same procedure was followed with regard to children being monitored at the Infant Nutrition Center, those discharged from the Pediatric Service of the Sótero del Río Hospital, and those referred to the Macul

Nutritional Center during the same period.

On the basis of these reviews, all children under two years of age who were classified as having grade III protein-calorie malnutrition (PCM) and all those under one year of age with grade II PCM were included in the investigation. The various facilities' assessments of the children's nutritional status were performed in accordance with national standards, using the growth charts of the International Infancy Center of Paris (M. Sempé). That is, a child was classified as having grade III malnutrition when its weight-for-age was more than three standard deviations below the norm, as having grade II malnutrition when its weight-for-age was between two and three standard deviations below the norm, and as having grade I malnutrition when its weight-for-age was between one and two standard deviations below the norm. The data in the records were considered to have provided the basis for making all these assessments.

The quality of these previous assessments was then reevaluated by the investigators for each of the study children, using the same norms and tables and comparing the resulting classification with the recorded data. In the case of a premature infant, an age correction was made by subtracting the number of weeks needed to reach 40 weeks of gestation from the infant's chronological age. No age correction was made for full-term infants whose records showed them to have been small for their gestational ages (6).

Each study subject's recorded birth-weight and gestational age at birth was determined by reviewing the records at the obstetric service of the Sótero del Río Hospital. These records are based upon the routine physical examination conducted by the physician in charge of the newborn and, in some cases, upon a neurologic examination. This information could not be obtained for some of the study children who were born outside the Southeastern Metropolitan Area.

In order to gauge the study children's response to treatment, those cared for only at

the outpatient health centers were compared with those monitored for three months or more by the Infant Nutrition Center. The response to treatment was considered positive if a change in the child's grade of malnutrition (from III to II or from II to I) indicated an improvement. Such a positive response, therefore, did not mean the child had attained the normal weight for its age group (7).

Results

The records for the six-month study period indicated that, within the survey population, 102 children under two years old had grade III PCM, while 388 of those under one year old had grade II PCM. Of these 490 children, 425 were monitored as outpatients at the peripheral health posts or the Infant Nutrition Center. The remaining 65 children, whose malnutrition was diagnosed during their hospitalization, were not previously monitored as subjects with severe malnutrition. The overall breakdown of the 490 study children, by degree of malnutrition and level of health care received, is shown in Table 3.

With regard to etiology, most of these children (89 per cent) were found to be suffering from primary malnutrition, with secondary malnutrition resulting from some other medical cause accounting for only 11 per cent of the cases. The most important causes of these secondary malnutrition cases were genetic defects, severe neurologic damage (cerebral paralysis), congenital cardiopathies, and celiac disease. Other, less frequent causes were malformation of the digestive or genitourinary tract and endocrinopathies (hypothyroidism).

The review provided by this study indicated that the Infant Nutrition Center had tended to assess these children's nutritional status more accurately than the outpatient health centers. Findings relating to this point are shown in Table 4. It is interesting to note, however, that most of the inappropriately classified children were assigned a poorer nutritional status

Table 3. Health care facilities serving the study children with differing degrees of malnutrition, by degree of malnutrition and level of care (May-October 1980).

Level of care	Subjects <2 years old with grade III PCM		Subjects <1 year old with grade II PCM		Total	
	No.	% of study children	No.	% of study children	No.	% of study children
Peripheral health post (PHP)	36	7	250	51	286	58
PHP + Infant Nutrition Center	8	1.5	20	4	28	6
Infant Nutrition Center	3	1	24	5	27	6
Macul Center	8	1.5	12	2	20	4
Hospital ^a	47	10	82	17	129	26
Total	102	21	388	79	490	100

^aThe Sótero del Río Hospital, which provided the highest level of health care for malnourished children, typically received patients who had initially received outpatient care before being referred to the hospital.

Table 4. The accuracy with which the attending malnourished study children's nutritional status was assessed by the peripheral health posts and Infant Nutrition Center.

Nature of recorded evaluation of nutritional status	Facility evaluating status:			
	Infant Nutrition Center		Peripheral health post	
	No. of children	%	No. of children	%
Correct	78	89	235	71
Incorrect	10	11	96	29
<i>Actual status worse than evaluation</i>	3	3	5	2
<i>Actual status better than evaluation</i>	7	8	91	27
Total	88	100	331	100

than they appear to have had; this tendency was particularly pronounced at the outpatient health centers. Our review of these apparently inaccurate assessments showed that most of the subjects involved were children with low birth-weights, for whom the nutritional standards are not clear.

At the same time, the study data underlined the important part that fetal malnutrition and premature birth play in severe PCM cases (Table 5). Overall, delivery data on birth-weights and gestational ages were available for

only 90 per cent of the study children. However, those data showed that at least 25.5 per cent of all the study children were small for their gestational age, or premature, or both.

It was also found that a disproportionate share of the study children who were premature or small for their gestational age at birth received care at the Infant Nutrition Center or the hospital instead of the outpatient health centers. This was presumably because the delicacy of these children's conditions made it necessary to refer many of them to higher levels of care.

Regarding the study children's response to treatment, that response was significantly better ($p < 0.001$) at the Infant Nutrition Center than at the outpatient health centers. This was true for children with grade II PCM as well as for those with grade III PCM. Overall, 73 per cent of the children with grade II PCM who received centralized care showed improvement, as compared to only 31 per cent of those with grade II PCM who did not.

Regarding the response to hospitalization, 67 per cent of the 129 moderately and severely malnourished study children who were hospitalized during the study period exhibited no marked change in nutritional status (Table 6). At the same time, the nutritional status of only

Table 5. The prevalences of prematurity and low birth-weight among the moderately and severely malnourished study children.

Classification of newborns	Classification (by gestational age and birth-weight) of seriously malnourished study children receiving care at different facilities			
	Children at peripheral health posts (%)	Children at the Infant Nutrition Center (%)	Hospitalized children (%)	Total (%)
Full-term; adequate weight for gestational age	68.6	60.0	57.4	64.5
Premature; adequate weight for gestational age	10.1	16.3	14.7	12.1
Full-term; low weight for gestational age	10.8	12.7	11.6	11.3
Premature; low weight for gestational age	1.7	5.5	1.6	2.1
No information	8.8	5.5	14.7	10.0

Table 6. Changes in nutritional status occurring during the hospitalization of 129 moderately and severely malnourished study children.

Changes in subjects' nutritional status	Hospitalized study children	
	No.	%
No change	86	67
Improvement	7	5
Deterioration	27	21
Incomplete data	9	7
Total	129	100

5 per cent showed improvement, while that of 21 per cent declined, the latter's nutritional status being worse at discharge than upon admission. The factors undoubtedly responsible for this situation were partly the pathologies that caused many of these children to be hospitalized in the first place, partly shortcomings in the nutritional management of their cases, and partly intervening pathologies acquired at the hospital. The length of these children's hospital stays ranged from two to 152 days, the average length of hospitalization being 47 days.

Discussion

These findings bring out a number of noteworthy points. To begin with, the number of

infants and young children with serious cases of malnutrition during the study period was obviously significant. Official figures on malnutrition in the study area during this same period indicated that 360 infants (subjects under one year old) were suffering from grade II malnutrition, and that 97 children under the age of two were suffering from grade III malnutrition, bringing the total to 457. The difference between these figures and those obtained in this study was due mainly to a significant number of hospitalized children whose nutritional status worsened during their period of hospitalization.

Many of the moderately and severely malnourished study children (about a third of those with grade III malnutrition and two-thirds of those with grade II malnutrition) received care only at the outpatient health centers. Considering that any health team would have had difficulty treating these children, and that only a minority showed some improvement after three months of effective control at the outpatient centers, there appears good reason to insist that the treatment of such cases should be referred to or coordinated with centers that are diagnostically and therapeutically more sophisticated. In addition, it should always be remembered that if such care is provided, easy economic and geographic access to it is required.

Another point that should be noted is the differences in the treatment provided at the health posts and at the Infant Nutrition Center. At the posts, cases of malnutrition are usually detected by a trained nurse, and their subsequent treatment and followup is performed mainly by a professional nutritionist. A physician intervenes only to treat associated pathologies.

In contrast, a child attending the Infant Nutrition Center is given comprehensive multi-professional care. Each time the child comes to the center with its mother, it is seen in turn by a pediatrician, a nurse, a nutritionist, and a social worker. In essence, an assessment is made of the child's nutritional status, psychomotor development, and psychomotor stimulation; the child's individually prescribed diet, related nutrition education, and related social work are evaluated; and concurrent pathologies are diagnosed and treated. The goal of many of these actions is to help change the attitude of the mother or person looking after the child, so that the child can recover in its own home with more lasting results than if it had received temporary inpatient care.

It would appear from our experience that this form of treating moderate and severe infant and young child malnutrition could be more broadly developed throughout the country and could also be effectively employed in other countries with similar situations. The activities involved are relatively low in cost (8), and there is little likelihood that a patient will relapse after an intermediate-term follow-up period has been completed (9, 10).

However, it is also true that many of these children cannot be given effective outpatient treatment because they face very deficient home situations. In such cases, there is the alternative of admitting the children to inpatient nutritional recovery centers. Although in this case the mother participates less in the child's recovery, the immediate concern is to prevent the child from dying and to see that it returns home in the best possible condition. At the same time, of course, it is essential that appropriate education and social work be pro-

vided for the family unit, in an effort to prevent relapse of the patient and development of new malnutrition cases in other children (11). Within this context, therefore, it is clear that the diagnosis and treatment of seriously malnourished children can provide a good starting point for planning and carrying out intersectoral activities among extremely poor families (12).

Another important point is that among the study children suffering from moderate or severe malnutrition, many (about 26 per cent) had experienced fetal malnutrition or premature birth. (In this vein, it is worth noting that around 10 per cent of all children born in the Southeastern Metropolitan Area have low birth-weights.) Among the 26 per cent involved, about half had suffered from intrauterine malnutrition in which maternal health problems—including nutritional problems—had played a part (13).

It is clear that children whose weight at birth is low, and whose risk of disease or death is high (14-16), require both specialized medical care and special home care—the latter often being hard to secure for children of families with low socioeconomic status. It therefore appears that the important thing is to avoid low birth-weights as much as possible, and then give to low birth-weight infants adequate care and treatment—in order to prevent severe infant malnutrition and thereby reduce the risk of death among infants and preschool children.

It is also necessary that standards be set for classifying the nutritional status of low birth-weight children. At the very least, such standards should include a correction factor that takes account of the subjects' degree of prematurity and that is applied for the first year or two of life.

There is also a need for guidelines on special patterns of feeding for children with low birth-weights—so as to permit prescription of adequate formulas and appropriate supplementation of their diets with iron, other minerals, vitamins, and so forth.

In addition, such children need to receive

frequent health care from a number of professionals delivering comprehensive treatment. Therefore, as all these things taken together suggest, it appears necessary to define a sub-program for these children's care that will clearly assign resources, responsibility, and objectives at each level of care and that will provide for adequate coordination between those levels.

One very important task in the management of malnourished children, whether they are treated as hospital inpatients or not, is the prevention and treatment of communicable disease. It is known that seriously malnourished children experience major immune system alterations, mainly with regard to cellular immunity. This circumstance tends to subject them to unusually frequent and severe bouts of various infections, and these in turn aggravate their malnutrition (17).

For this reason, besides administering timely immunizations to severely malnourished children, routine measures should be taken to prevent them from being exposed to subclinical communicable disease, and all infections

that they develop should receive rapid and effective treatment. All this requires the existence and application of very precise guidelines governing the work of the health teams involved.

Finally, the work reported here has shown that hospital care did not improve the average nutritional status of the hospitalized study children, and that in a considerable number of cases their nutritional status deteriorated. While there are known reasons for this state of affairs, there also seems good reason to further investigate the structure of hospital care, as well as etiologic and other factors conditioning such in-hospital deterioration, in order to correct observed deficiencies. In this context, strict nutritional supervision, application of adequate standards for feeding and psychomotor stimulation of hospitalized children, and measures calculated to improve the diagnosis, treatment, and control of communicable disease must provide the foundation for improving the hospital's contribution to effective prevention and treatment of malnutrition.

SUMMARY

Despite marked progress in recent years, infant and young child malnutrition remains a serious health problem in Chile. To help define the nature of that problem better, researchers working in the Southeastern Metropolitan Area of Santiago conducted a survey of infants classified as having grade II protein-calorie malnutrition (PCM) and children under two years old classified as having grade III PCM during the period 31 March-1 October 1980. The survey, based on a review of health facility records for all children in the area receiving care during the study period, found a total of 388 infants with grade II PCM and 102 subjects under two with grade III PCM.

The study also found that the subjects who received comprehensive professional outpatient care at the area's Infant Nutrition Center fared significantly better than those cared for at outpatient health centers. The authors therefore recommend that the treatment of such children should be referred to or coordinated with centers that are diag-

nostically and therapeutically more sophisticated than the outpatient health centers. In this vein, it appears that the style of treatment provided by the Infant Nutrition Center could be developed more broadly throughout Chile and could be effectively employed in other countries with similar situations.

It also appears, however, that many malnourished children cannot be treated effectively as outpatients because they have very unsatisfactory home environments. One alternative approach in such cases is to admit the child as an inpatient to a special nutritional recovery center.

Hospitalization, which typically occurs when the child is suffering from one or more pathologic conditions besides malnutrition, constitutes another alternative. However, the present survey found that the nutritional status of hospitalized study children did not improve, on the average, and some subjects experienced a marked nutritional deterioration.

Another important point is that over a quarter of

the malnourished study children had low birth-weights or had been delivered prematurely. This underscores the importance of avoiding low birth-weights as much as possible, and then giving low

birth-weight infants adequate care and treatment. In addition, clear standards should be established for the feeding of low birth-weight children and for determining their nutritional status.

REFERENCES

- (1) Kaempffer R., A. M., and E. Medina. La salud infantil en Chile durante la década del setenta. *Rev Chil Pediatr* 53(5):468-480, 1982.
- (2) Medina, L. E., and A. M. Kaempffer R. An analysis of health progress in Chile. *Bull Pan Am Health Organ* 17(3), 1983.
- (3) Solimano, G., H. Unda, and A. Alvarez. Programa nacional de leche. *Cuadernos Médico Sociales* 13(4):10-23, 1972.
- (4) González, N., and A. Infante. Programas de alimentación complementaria del sector salud en Chile. *Bol Of Sanit Panam* 89(6):563-571, 1980.
- (5) Ministerio de Salud. *Indicadores biodemográficos, Chile, 1972-1981*. Santiago, 1982.
- (6) Cruise, M. O. A longitudinal study of the growth of low birth weight infants: I. Velocity and distance growth, birth to 3 years. *Pediatrics* 51:620-628, 1973.
- (7) Fisberg, M., J. Alvear, R. Puentes, and R. Uauy. Treatment of Moderate and Severe Malnutrition at the Primary Health Care Center. (Abstract). In: *XXII Congresso Brasileiro de Pediatria, Recife, 1981*.
- (8) Puentes, R., E. Isla, and M. C. Mejías. Desnutrición calórico-proteica severa del lactante: Costo de recuperación con tratamiento ambulatorio. *Rev Chil Pediatr* (in press).
- (9) Puentes, R., R. Morales, E. Isla, I. Domínguez, M. C. Mejías, and C. G. Hernández. Desnutrición calórico-proteica severa del lactante: Evaluación de actividades de recuperación. *Rev Chil Pediatr* 48:193-202, 1977.
- (10) Puentes Rojas, R., S. Ibáñez, E. Isla, and M. C. Mejías. Desnutrición proteinocalórica severa del lactante. *Bol Med Hosp Infant Mex* 36:701-710, 1979.
- (11) Riumalló, J., and F. Monckeberg. El programa de centros cerrados de recuperación nutricional en Chile (summary). *Revista Chilena de Nutrición* 8:16, 1980.
- (12) Monckeberg, F. *Crear para compartir: Compartir para seguir creando*. Ed. Andrés Bello, Santiago, Chile, 1980.
- (13) Osofsky, H., and E. O'Connell. Nutritional Factors in Pregnancy Affecting Fetal Growth and Subsequent Infant Development. In: R. Suskind. *Pediatric Nutrition*. Raven Press, New York, 1981.
- (14) Chandra, R. K. Fetal malnutrition and postnatal immunocompetence. *Am J Dis Child* 129:450, 1975.
- (15) Muñoz, H., H. Ramos, R. Robinson, G. Rivera, M. Rathcamp, V. Razmilic, P. Rias, F. Rivas, A. Robles, E. Rodillo, and M. L. Rodríguez. Tendencias de la mortalidad perinatal por causas durante los últimos años en Chile. *Rev Chil Pediatr* 50(6):81-89, 1979.
- (16) Muñoz, H., P. Barraza, C. Bustamante, E. Bustos, M. Cañas, M. del Río, V. Díaz, C. Dinen, D. Figueroa, L. M. Gómez, E. Herrera, R. Hurtado, and J. Jara. Sobrevida intrahospitalaria del recién nacido de 2,000 grs. o menos. *Rev Chil Pediatr* 49:219-227, 1978.
- (17) Chandra, R. K. Interaction of nutrition, infection, and immune response. *Acta Paediatr Scand* 68:137-144, 1979.