Acute Respiratory Infections in Children Living in Two Low Income Communites of Rio de Janeiro, Brazil

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Community studies of non-hospitalized children are essential to obtain a more thorough understanding of acute respiratory infections (ARI) and provide important information for public health authorities. This study identified a total ARI incidence rate (IR) of 4.5 per 100 child-weeks at risk and 0.78 for lower respiratory tract infections (LRI). Disease duration averaged less than one week and produced a total time ill with ARI of 5.8% and for LRI 1.2%. No clear seasonal variation was observed, the sex-specific IR showed a higher proportion of boys becoming ill with ARI and LRI and the peak age-specific IR occurred in infants of 6-11 months. Correlation with risk factors of the child (breastfeeding, vaccination, diarrheal disease, undernourishment) and the environment (crowding, living conditions, maternal age and education) showed marginal increases in the rate ratios, making it difficult to propose clear-cuts targets for action to lower the ARI and LRI morbidity. The importance of an integral maternal-child health care program and public education in the early recognition of LRI is discussed.

Key words: acute respiratory infections - incidence - Brazil - low income population - risk factor

Acute respiratory infections (ARI) continue to have a large impact on childhood health. It is important because of the large number of deaths as well as the impact of disease burden on growth and development in young children. This paper describes the results of a community study carried out between April 1987 and September 1989 in two low income populations within the city of Rio de Janeiro, Brazil.

Our understanding of ARI in the community remains incomplete and the development of preventive strategies requires a more thorough assessment of risk factors (such as undernourishment, vaccine coverage, parental education level, etc.). This is essential for public health authorities who need information that can produce direct and efficacious control measures which would lower the disease morbidity and thus lessening the human suffering and costs due to this important disease group. Health center based studies may have selection bias and these findings can not often be generalized to the community population.

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MATERIALS AND METHODS

Study population - Rio de Janeiro, a sub-tropical city had 5.7 million inhabitants according to the 1980 census (IBGE 1983) with an average winter temperature of 18°C and average summer temperature of 28°C. In 1981, Rio de Janeiro had 377 shanty towns with a total population of 1.7 million (IPLANRIO 1983), representing 34% of the city population.

Two low income communities [Cruzada São Sebastião (CZSB) and Santa Marta (SM)] were selected for active surveillance because of their location near the Instituto Fernandes Figueira (IFF) hospital. The SM community is a densely populated shanty town, housing over 4,800 people (in 1986) on a steep hill side in the Botafogo section of the city and is about 10 min by bus from the IFF hospital. Community access is via steep and narrow steps and walkways; sanitation is poor with an open sewage system. The CZSB community houses 3,600 people (in 1986) in seven story apartments located in ten blocks. It has a good water supply system and is directly connected to the city' sewage system.

A census of the communities was undertaken, during the final months of 1986 and the beginning of 1987, to identify children under the age of two. Of the 337 children (63% under two years of age) identified, 229 (68%) were enrolled as the remainder were not at home during the daytime. New children were also recruited (mainly newborns) during the study period and a total of 262 children entered the study.

The study was approved by the Research Committee of the IFF and followed guidelines of the Fundação Oswaldo Cruz on clinical research involving human subjects. Informed consent was obtained from the parents or guardians by means of a verbal explanation of the study and a written consent form.

Sociodemographic and anthropometric monitoring - Health workers were trained to complete the risk factor questionnaires and recognize specific signs and symptoms of ARI, both explained in a Field Work Manual provided to each worker which defined each question and standardized approaches for data collection. One of the authors (PRM) supervised the field workers and their performance. Baseline sociodemographic data were obtained and included family structure, socioeconomic status, family health and living condition. Information about the child included gestation information, breast feeding, vaccinations and history of previous diseases.

Weight and height were measured periodically during the home visits. The weight for age was compared to the National Center for Health Statistics/Centers for Disease Control (NCHS/CDC) reference population values and the mean values calculated with the use of the CDC Anthropometric Software Package 3.0 (CDC 1987). This reference data was used to make result comparable with other BOSTID studies. Person with < 80% of the population reference population were considered undernourished.

Surveillance of ARI morbidity - Weekly home visits were made by health workers. Information on ARI was based on parental or guardian's recall with confirmation by the health worker's observation which included counting respiratory frequency. If the child was not at home this was recorded and the child not considered at risk.

Case definition - Children were considered to have a respiratory infection if the child had a cough, throat pain, earache, difficulty breathing, stridor, and/or wheezing. Coryza was not considered for case definition of ARI. LRI were defined as cases having dyspnea, tachypnea (RF>50 ipm) or when a clinical diagnose of LRI was made by a physician.

Weekly visits were initiated in June 1987 in the SM community, but interrupted temporarily (August and September) during that year because of community violence. Visits began in CZSB during October 1987. A child was considered at risk for ARI if he or she was present and did not have an ARI on any day of the previous week. The field surveillance was stopped in both communities in September of 1989.

For purpose of data analysis the following points were considered: (1) only children that had been visited at least two weeks were included in the analysis; (2) a disease episode was considered new when the child had been symptom free for a week prior to the visit; (3) incidence rates were calculated by using a denominator of child-weeks at risk and a numerator of the sum of new ARI episodes. The data was transformed to represent the number of new cases per 100 child-weeks (IR). The child was considered at risk when it was not sick during the previous week and if they were sick before they were not eligible during that week. Weeks that the child was absent were not considered in the denominator.

RESULTS

The socioeconomic characteristics of the population under surveillance are summarized in Tables I and II. Homes in the SM community were mainly huts (76%) while in the CZSB they were all apartments. Crowding within the homes was higher in the CZSB. Employment rates of the guardians were similar in both communities but in the CZSB a larger proportion of other family members were economically active. Both communities had equal access to medical care through the Instituto Nacional de Seguridade Social (INSS), the national public health care system. Maternal educational levels were low with 34% being illiterate and 53% having gone to primary school (both incomplete and completed) and rates were higher in the SM community.

The characteristics of the children under surveillance are reviewed in Table II. A small predominance of male children existed. The average child's age, at the study onset (first weekly visit), was 14 months and was slightly higher in the CZSB. The termination average age was 30 months and was similar in both communities. Parental information about prenatal care, type of delivery and child birth weight were compared and revealed that the prenatal care coverage was better and the number of overweight was higher in the CZSB community while the percentage of children born at term and those born by vaginal delivery was higher in the SM community. The birth order data showed, in the CZSB, that the study children were mainly (75%) the first or second child (74%) and this percentage (60%) was lower in the SM. Incomplete vaccination (based on vaccination records) percentage was higher (63%) in SM when compared (37%) to CZSB. Hospitalization, before the study in the SM children was higher [33 hospitalizations, mainly due to respiratory problems (48%) and diarrheal diseases (39%)] and contrasted to just seven hospitaliza-

TABLE I

Socioeconomic characteristics of the study children registered in the community study on acute respiratory infections - Rio de Janeiro, Brazil

Environmental characteristics	Santa Marta No. (%)	Community Cruzada São Sebastião No. (%) value	Total No. (%)
Housing			
hut	141 (76)	0 (-)	141 (43)
brick house	44 (24)	0 (-)	44 (13)
apartament	0 (-)	143 (100)	143 (44)
Crowding			
< 3 persons/room	80 (48)	30 (21)	110 (61)
≥ 3 persons/room	88 (52)	111 (79)	191 (63)
Employment of guardians			
employed	217 (61)	154 (59)	371 (61)
unemployed	31 (9)	16 (6)	47 (8)
housewife/retired	108 (30)	82 (31)	190 (31)
Other family members economically active	42 (24)	66 (46)	108 (34)
Family income in minimum salaries[a]			
≤ 1 MS	62 (43)	15 (11)	77 (28)
1 - 3 MS	73 (51)	77 (57)	150 (54)
> 3 MS	9 (6)	42 (31)	51 (18)
Maternal education			
ileterate	85 (52)	14 (11)	99 (34)
primary level	72 (44)	80 (66)	152 (53)
secondary level	7 (4)	28 (23)	35 (12)
university level	1 (1)	2 (2)	3 (1)

a: approximately US$ 50.00

tions in the CZSB. Nine of the SM children had been hospitalized (all diseases) at least twice, one child three times and two others had four hospitalizations The first weight for age determination identified 7% of the children to be undernourished and was similar in both communities.

The distribution of weeks observed per child (Table III) during the study period showed that 44% of the children were observed for more than one year. Incidence rates comparison between children that were visited more or less than one year showed no significant difference. Disease duration analysis showed that most of ARI cases resolved within one week and in 87% lasted less than or equal to two weeks. Very few cases (1%) lasted longer then one month. Of the LRI, 59% resolved within a week, 25% in two weeks, 14% lasted three weeks and 2% lasted for four weeks.

Incidence rates - During the two year period 262 children had a total of 12,283 home visits of observation. The child weeks at risk equaled 11,646. During these visits 522 ARI cases were identified (IR of 4.5 per 100 child weeks or 2.5 episodes per child-year). In SM community 333 cases and an IR of 3.9 was obtained, while in CZSB community 189 cases were identified and an IR of 6.0. The number of weeks that these children were sick was 678 weeks (percent time ill of 5.7%). LRI were seen in 73 cases in SM (IR= 0.87) and was lower in CZSB where 12 cases produced an IR of 0.38.

ARI incidence varied over the study period but no seasonal pattern was detected, yet an overall decrease in IR was observed over the study time. There was an initial relatively high ARI incidence rate in the months of May through July of 1987 (winter months) and was followed by a second increase during spring (October 1987 through January 1988). ARI rates were low in the autumn of 1988 and increased slowly during the first semester and reached the highest level in the spring (September/ October) of that year, after which the rates remained at the same level through the first semester of 1989.

The analysis of certain risk factors of ARI is shown in Table IV. Gender-specific ARI incidence

TABLE II

Characteristics of the study children registered in the acute respiratory infection community study

Child's risk factors	Community Santa Marta No. (%)	Cruzada São Sebastião No. (%) value	Total No. (%)
Sex			
male	80 (42)	71 (50)	151 (46)
female	109 (58)	71 (50)	180 (54)
Age at first visit (months)			
0-5	30 (19)	16 (13)	46 (17)
6-11	48 (31)	29 (24)	77 (28)
12-23	55 (35)	50 (41)	105 (38)
24-35	20 (13)	24 (20)	44 (16)
36-47	2 (-)	3 (-)	5 (-)
48-59	0 (-)	0 (-)	0 (-)
Age at last visit (months)			
0-5	3 (2)	2 (2)	5 (2)
6-11	15 (10)	9 (7)	24 (9)
12-23	30 (19)	22 (18)	52 (19)
24-35	42 (27)	45 (37)	87 (31)
36-47	46 (30)	32 (26)	78 (28)
48-59	19 (12)	12 (10)	31 (11)
Pregnancy			
normal gestation	170 (90)	113 (84)	238 (88)
w/prenatal care	151 (80)	122 (90)	273 (85)
at term delivery	171 (92)	109 (80)	280 (87)
vaginal delivery	144 (77)	94 (68)	238 (73)
hospital	181 (96)	136 (99)	317 (97)
Birth weight			
≤ 2.5 kg	30 (16)	21 (15)	51 (16)
2.6 - 4.0 kg	144 (77)	100 (71)	244 (74)
4.0 kg	14 (7)	19 (14)	33 (10)
Birth order			
1-2	110 (60)	101 (74)	311 (74)
3-4	40 (22)	30 (22)	70 (17)
≥ 5	33 (18)	6 (4)	39 (9)
Breastfeeding			
only breast	23 (12)	23 (17)	46 (14)
mixed	85 (45)	48 (32)	133 (41)
weened			
0-1 months	72 (58)	47 (48)	119 (54)
2-3 months	29 (23)	31 (32)	60 (27)
4-5 months	11 (9)	9 (9)	20 (9)
6-11 months	12 (10)	10 (10)	22 (10)
Vaccines			
complete	57 (37)	81 (63)	138 (48)
incomplete	99 (63)	48 (37)	147 (52)
Hospitalizations	33	7	40
diarrhea	13 (39)	3 (43)	16 (40)
respiratory infection	16 (48)	1 (14)	17 (42)
other	4 (12)	3 (43)	7 (18)
Malnutrition			
normal	51 (92)	115 (93)	167 (93)
undernourished	4 (8)	8 (7)	12 (7)

TABLE III

Time distribuition of surveillance in the acute respiratory infection community study

Number of weeks observed	Santa Marta No. (%)	Community Cruzada São Sebastião No. (%) value	Total No. (%)
01- 10 weeks	12 (8)	24 (20)	36 (14)
11- 20 weeks	18 (12)	41 (35)	59 (23)
21- 30 weeks	6 (4)	11 (9)	17 (6)
31- 40 weeks	9 (6)	3 (3)	12 (5)
41- 50 weeks	14 (10)	10 (8)	24 (9)
51- 60 weeks	12 (8)	13 (11)	25 (10)
61- 70 weeks	4 (3)	10 (8)	14 (5)
71- 80 weeks	6 (4)	6 (5)	12 (5)
81- 90 weeks	33 (23)	0 (-)	33 (13)
91-100 weeks	30 (21)	0 (-)	30 (11)
Total	114	118	262

rate for males was slightly higher than females with RR of 1.1 and increased to 1.8 for LRI. Age-specific ARI and LRI incidence were higher in the 6-11 month age bracket, followed by the children in the first semester of life and the second year of life. The lowest ARI rates were encountered in children above the age of three years.

Children weaned at study onset and who had breastfed less than three months were at small increased risk of developing ARI and LRI. Vaccinations which were not complete at study onset showed an increased RR for LRI. The nutritional status evaluation showed an ARI ratio rate of 1.3 for children who were undernourished (<80% of reference population).

Children who had been hospitalized (all reasons) prior to the study showed an increased risk of acquiring ARI, but not LRI. The evaluation of the individual child having diarrhea or other diseases showed that the RR is less than one. The risk of LRI is 2.9 times higher in children with diarrhea, and identical for other diseases.

Characteristics of the family and housing as risk factors related to the incidence of ARI were investigated (Table V). Living conditions showed that the children that lived in crowded (>3 person/room) conditions and those living in houses/apartments were at increased risk of developing ARI. Children living in huts had greater risk (RR=1.2) of LRI, but the data on crowding was not conclusive. Having other young (<5 years old) children in the house was also a risk of increasing ARI and LRI.

Maternal age specific ARI and LRI incidence rates were lower in the younger mother (less than 25 years of age) with the exception of those who were under 17 years old where the ARI incidence was higher. Maternal education level was not associated with ARI or LRI incidence but paternal education was associated with an increased RR in fathers with secondary or tertiary level education, specially when LRI (RR=3.1) is concerned.

In the SM community 11 children were hospitalized, two of them had two hospitalizations. Of the 13 episodes, two (15%) had pneumonia, four (30%) had bronchitis and one child was hospitalized twice for tuberculosis. The other hospitalizations were due to gastroenteritis (two episodes), convulsion, hepatitis and a hernia operation. Two deaths occurred in this community, both at home. One child died after a high fever (suspected by attending physician to be dengue) and the mother left the community after this episode, so no further information could be obtained. The other child had cranial trauma and died from its consequences. In CZSB one child was hospitalized with meningitis (no sequalae) while another child had pneumonia in another hospital and died after being transferred to IFF.

DISCUSSION

Many problems in performing this study, caused by factors beyond the control of the study design, were encountered. A government hiring freeze, community related problems (drug gang wars, many social projects being done at the same time, mud slides with fatalities), difficult community access, social concepts (parents hiding information about pneumonias which neighbors could consider as tuberculosis, etc.) and ignorance about ARI (Sutmoller, unpublished data). These factors have to be considered when interpreting the results.

ARI studies in urban areas have shown an annual incidence rate of 5-8 per child-year (Sutton 1965, Kamath et al. 1969, Monto et al. 1971,

TABLE IV

Incidence rates according to epidemiologic characteristics in the acute respiratory infection (ARI) community study

Risk factor	Total No. of child-weeks at risk	Total No. of ARI episodes	ARI incidence rate (100/ch-wk)	RR	Total No. of LRI episodes	LRI incidence rate (100/ch-wk)	RR
Sex							
male	5076	239	4.7	1.1	48	0.95	1.8
female	6570	283	4.3	...	35	0.53	...
Age (months)							
0- 5	317	17	5.4	2.1	2	0.63	1.2
6-11	1003	80	8.0	3.1	15	1.50	2.9
12-23	3634	189	5.2	2.0	31	0.85	1.6
24-35	4400	177	4.0	...	26	0.59	...
36-47	1944	50	2.6	...	6	0.30	...
48-59	348	9	2.6	...	3	0.86	...
Pregnancy							
gestation							
abnormal	1249	61	4.9	1.1	11	0.88	1.3
normal	10305	456	4.4	...	71	0.69	...
prenatal care							
no	1249	61	4.9	1.1	11	0.88	1.3
yes	9539	412	4.3	...	62	0.65	...
delivery							
premature	877	46	5.2	1.2	9	1.03	1.5
at term	10281	449	4.4	...	71	0.69	...
Birth weight gr.							
≤ 1500	259	16	6.2	1.4	6	2.32	3.7
1600-2400	1202	50	4.2	...	5	0.42	...
> 2500	9810	428	4.4	...	65	0.66	...
Breastfeeding[a]							
< 2 months	1619	81	5.0	1.2	0	–	–
2-3 months	1234	65	5.3	1.3	14	1.13	1.2
4-6 months	1129	48	4.3	...	11	0.97	...
7-11 months	505	19	3.8	...	0	–	...
Vaccines[a]							
incomplete	5521	272	5.1	1.2	49	0.89	1.5
complete	4660	196	4.2	...	28	0.60	...
Nutritional status							
malnourished	1083	61	5.6	1.3	8	0.74	1.0
normal	9411	395	4.2	...	72	0.77	...
Prev. hospitalized							
yes	837	43	5.1	1.2	6	0.72	1.0
no	10614	471	4.4	...	73	0.69	...
Diarrheal disease							
yes	8846	360	4.1	0.7	75	0.85	2.9
no diarrhea	2714	159	5.9	...	8	0.29	
Other diseases							
yes	6660	248	3.7	0.6	44	0.66	1.0
no disease	3810	224	5.9	...	26	0.68	

a: status at study entry; ch-wks: child-weeks; RR: relative risk; LRI: lower respiratory infections

Berman et al. 1983, Pio et al. 1985, Lang et al. 1986), and were higher than the rate reported in this study. Yet the 4.5 episodes per 100 child-weeks in this study compares with other community studies done in developing countries (Table VI). It was lower than the other BOSTID studies (Selwyn 1990) where the rates varied from 12.7 to 16.8 and in a previous study in another Rio

TABLE V

Incidence rates according to environmental characteristics in the accute respiratory infection (ARI) community study

Risk factor	Total No. of child-weeks at risk	Total No. of ARI episodes	ARI incidence rate (100/ch-wk)	RR	Total No. of LRI episodes	LRI incidence rate (100/ch-wk)	RR
Housing							
hut	6438	261	4.0	0.8	50	0.78	1.2
house/apart.	4983	252	5.1	...	32	0.64	...
Crowding (persons/room)							
> 3 persons	4869	246	5.1	1.4	31	0.64	0.9
2-3 persons	2265	95	4.2	1.2	23	1.02	1.5
< 2 persons	3943	143	3.6	...	27	0.68	...
Siblings under 5 y							
3 others	1244	47	3.8	1.0	0	–	...
2 others	934	59	6.1	1.6	10	1.07	1.4
1 other	3679	188	5.1	1.3	32	0.87	1.1
study child	5695	223	3.9	...	43	0.76	...
Family income in minimum salaries[a]							
≤ 1 MS	3144	137	4.4	0.9	31	0.99	2.4
1-3 MS	4910	233	4.7	0.9	33	0.67	1.6
> 3 MS	1189	57	5.0	...	5	0.42	...
Maternal age years							
< 17	14	1	7.1	1.4	0	–	...
17-19	1831	59	3.2	0.6	6	0.33	0.4
20-24	2399	95	4.0	0.8	11	0.46	0.5
25-29	2714	151	5.6	...	30	1.11	...
30-34	2050	104	5.1	...	21	1.02	...
35-39	1138	52	4.6	...	21	0.44	...
40-45	192	8	4.2	...	0	–	...
Maternal education							
≤ prim. level	9257	420	4.5	1.0	37	0.40	0.1
≥ sec. level	1112	52	4.7	...	37	3.33	...
Paternal education							
≤ prim. level	6495	277	4.3	0.7	38	0.59	0.3
≥ sec. level	1158	68	5.9	...	21	1.81	...

a: minimum salarie aprox. US$ 50.00; h-wks: child weeks; RR: relative risk; LRI: lower respiratory infections

community (Sutmoller & Nascimento 1983) but was similar to studies in the Philippines (Tupasi et al. 1990) and Mexico (Datta et al. 1982), India (Delgado et al. 1988), Guatemala (Vathanophas et al. 1990). The selection of URI with cough in Guatamala, the moderate or severe URI criteria in the Thailand study and the study in Trinidad (Sutton 1965) with febrile cases, produced similar rates as in the present study.

ARI incidence rates varied among these two communities, being 1.5 times more frequent in CZSB community. The reason for this may be that poor parental recognition of ARI symptoms, specially in SM community, played a role and possibly caused an underestimation to occur in this study for overall ARI rates. As mentioned, the information was based on parental or guardian's recall and only recorded as an episode if confirmed by the health worker's observations with the BOSTID criteria. This was different from a previous study (Sutmoller, unpublished data) in which the child was examined by health workers and included if mild ARI signs, such as coryza, was observed. Indirect data collection about disease from persons, who may not have known everything that happened within the family, or the lack of knowledge about the symptoms of ARI, can also be a possible explanation. Other diseases, especially frequent diarrhea and cutaneous infections in SM community, may possibly have overriden the mild ARI symptoms and thus not reported.

TABLE VI

Comparison of acute respiratory infection incidence rates in community studies in children less than 5 years age

Author	Country	ARI	LRI
Selwyn	Kenya	12.7	0.4
	Nigeria	15.5	...
	Papua New Guinea	...	2.6
	Phillipines	13.3	3.4
	Thailand	27.5	0.2
	Colombia	13.2	3.4
	Uruguay	15.4	8.1
	Guatemala	16.8	0.6
Tupasi	Phillipines	5.0-7.7	...
Mata	Costa Rica	12.4	4.9
Gomes	Mexico	5.4-5.0	1.2-1.1
Delgado	Guatemala	8.5(3.8)	1.5
Datta	India	4.6	...
Vathanophas	Thailand	(4.1)	

ARI = acute respiratory infection with cough or moderate or severe upper respiratory infection
LRI = lower respiratory infection

The LRI incidence of 0.73 per 100 child-weeks was similar to the rates found in the BOSTID studies (Selwyn 1990) which varied from 0.2 to 8.1 and other studies in developing countries which ranged from 1.1 to 4.9. This result was slightly higher than the 0.5 rate found in a previous study in Rio de Janeiro (Sutmoller & Nascimento 1983). In an outpatient study in a well defined community in Colombia (Berman et al. 1983) estimated 0.48 LRI episodes per 100 children were seen and similar to estimates made in Panama (Ngalikpima 1983). The wide range of incidence rates probably reflect methodological differences, but these rates are higher than observed in developed countries where the rates vary from .06 to 0.17 LRI per 100 child-weeks (0.03 to 0.09 per child year; Pio et al. 1985).

Children with no ARI symptoms during the study period represented 28% of the study group. This was lower (18%) in SM community where the children were studied for a longer period. In the other BOSTID studies (Selwyn 1990) the percentage ranged from 5-20%.

Average ARI disease duration was less than one week in this study but was slightly longer (<2 weeks) in CZSB community. In a few cases lasted longer than three weeks and the total time ill with ARI (5.8%). This disease duration is similar to those found in the other studies (Selwyn 1990) where disease duration ranged from < 1 week to > 10 weeks, but the total time ill was lower than reported. The shorter disease duration may possibly confirm that guardians did not recognize all ARI symptoms, so ARI episode was finalized sooner. Total disease duration of LRI was 1.2% and compares to 0.3% to 14.4% of observed weeks in the BOSTID studies (Selwyn 1990).

Although the incidence rates varied over the study period no clear seasonal pattern was observed for ARI during the two years which concurs with other BOSTID community studies (Selwyn 1990) and the previous study in Rio (Sutmoller, unpublished data). A decrease in IR was observed in the second study year and was also observed in other BOSTID studies.

Sex-specific incidence rates for both ARI and LRI were higher for boys. The ARI ratio rate was 1.1 and was similar to the other BOSTID studies (Selwyn 1990, Vathanophas et al. 1990) that showed a predominance of males and an RR value of 1.0-1.1. For LRI the proportion of sick boys was much higher (RR=1.8) and this rate was higher than in other studies where the RR varied from less than 1.0 to 1.4. In the developing countries, studies (Berman et al. 1983, Hortal et al. 1990) done in health care settings, often show higher proportion of males being consulted for ARI. This was also found in hospital component of the present study.

Peak incidence of ARI in the 6-11 month age bracket show 8.0 episodes per 100 child-weeks and occurs when most children are weaned, when nutritional deficiencies may commence and the maternal antibodies have decreased. This makes the child susceptible to infections and if associated to other risk factors may make them more susceptible to severe LRI. This was also found in most of the BOSTID studies (Selwyn 1990). For LRI the highest rate was also in the 6-11 month year old bracket (2.9/100 child-weeks) slightly different from most of the BOSTID studies, which showed higher or equal rate in the 0-5 month old, but was similar to the Philippines study. The higher rates in infants was also observed in studies from the developed (Berman & McIntoch 1985) and in developing countries (Tupasi et al. 1990).

Good prenatal care, which can possibly avoid premature deliveries, was shown to be important specially to diminish the risk of LRI. Other studies did not mention this as a risk factor but observed the low birth weight. In our study this was also increased for ARI (RR=1.4) and LRI (RR=3.7) in children with very low birth weights (less than 1500 grams). If children under 2500 grams were considered, no difference was found and this is compatible with the findings in the Uruguay study (Hortal et al. 1990).

Breast feeding practices are believed by most health professionals to diminish ARI morbidity. In our study the longer breast fed children had a lower ARI incidence rate. Few authors (Grulee et al. 1934, Stevenson 1947, Frank et al. 1982) have investigated morbi-mortality, and although varying in results, they showed a lower incidence in breast fed children. Other studies (Mohs 1983, Barros Filho et al. 1985) showed no clear difference in ARI incidence, but Frank et al. (1982) noted a possible diminished frequency of severe cases in the breast fed children.

Vaccination coverage was not and important factor for ARI and compares with the Uruguay study (Hortal et al. 1990) which found no increased ARI risk, but the RR for LRI was 1.5.

Diarrhea was observed as a possible risk factor in this study and specially related to LRI. This was also observed in other BOSTID studies and specially in Bangladesh. This may also be an explanation for a possible underestimation of ARI in the SM community where diarrhea disease was very frequent. Guardians of the children know about diarrheal disease through the media coverage (oral rehydration solution, early recognition of dehydration) and its frequency.

Undernourishment was associated with a small increased (RR=1.3) risk for ARI in these children but they were not at greater risk for LRI. This is in accordance with the BOSTID studies (Selwyn 1990) that produced variable results. This observation is interesting, as although most pediatricians consider this relationship important, it is not apparent in these studies. It may be that only when the child has a pronounced dystrophy combined with other nutrition related complication such as dehydration, hypovitaminosis may the correlation of increased ARI and LRI become more apparent.

Living conditions showed that the children that lived in crowded conditions and having other young children in the home increased the risk of ARI, and corresponds studies of day care settings. Most of the crowding occurred in the apartments of the CZSB and may explain the higher rate encountered. LRI results for crowding was inconclusive but children having other siblings in the home or living in huts had a slightly higher risk.

Maternal age was a risk in the very young (<17 years) mothers and was lowest in the 18-25 year old bracket and is comparable with the other BOSTID (Selwyn 1990) studies the mothers under 20 were considered at risk. This could possibly be due to less crowding in these homes. Maternal education level in this study showed no disease incidence and in the BOSTID studies (Selwyn 1990) these findings were inconclusive difference but paternal education level did show a difference (secondary or tertiary level education the RR was 1.4 and increased for LRI to 3.1). Reasons for this need to be studied further.

The Brazilian Ministry of Health has a health care program for women (prenatal and obstetrical care) and children (breastfeeding, growth and development follow-up, vaccination, diarrheal diseases and respiratory infections). The RR for LRI for these items are shown in Table VII and it can be observed that the proposed program actions would, in conjunction, possibly decrease the ARI and LRI incidence. An example of this would be the Costa Rica (Mata 1978) experience which made large headway in improving the general condition of life (increased the individual resistance to infectious agents), better coverage of primary health care to the population with diverse but systematic action in the diagnosis, prevention and treatment of infectious diseases and better norms and application of health care in hospitals and health centers with a better institutional health system.

This study is relevant for planning future ARI studies and give tools for government agencies to plan efficacious public health programs that can support the UNICEF plans to reduce by half the childhood mortality before the turn of the century.

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