COMPARISONS AMONG COUNTRIES

The Epidemiology of Acute Respiratory Tract Infection in Young Children: Comparison of Findings from Several Developing Countries

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Investigators from 10 countries studied the epidemiology of acute respiratory tract infection (ARI) among children 0–59 months old. Data on incidence rates, by age, gender, and season; on pathogenic agents; on case-fatality rates; and on selected risk factor findings are presented. Incidence rates from six of the community-based studies ranged from 12.7 to 16.8 new episodes of ARI per 100 child-weeks at risk, and rates of lower respiratory tract infection (LRI) ranged from 0.2 to 3.4 new episodes per 100 child-weeks at risk. Children spend from 21.7% to 40.8% of observed weeks with ARI and from 1% to 14.4% of observed weeks with LRI. The incidence rates for ARI are highest in younger children. Viruses, especially respiratory syncytial virus, are isolated more frequently than bacteria from children with episodes of LRI. Risk factors exhibited different patterns of association with ARI in different studies. Interventions could have great impact on high risk levels common in the study populations. These studies provide interesting and useful data on the epidemiologic dynamics of ARI.

Investigators from 10 countries studied the epidemiology of acute respiratory tract infection (ARI) among young children. The data provided the opportunity to compare the epidemiology of ARI in different developing countries, to explore the commonality of pathogenic agents and risk factors, and to assess differences in findings for clues about the epidemiology of this worldwide killer of young children.

These projects of the Board on Science and Technology for International Development (BOSTID) of the National Research Council used similar case definitions and methods of ascertainment (see Bale [1] for a complete description of the program). The in-

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LRI and smoking, and the patterns differ in direction and strength of association.

When the presence of smokers in the household affects the incidence rate of ARI, the APE is 25.5%-34%. Incidence of LRI remains higher in households without smokers in Uruguay and among young children in Colombia.

Summary and Discussion
The BOSTID projects that studied the epidemiology of ARI in young children included 10 countries, which produced a coordinated set of selected data. Analysis of those data makes up this synthesis.

Summary of Findings
(1) Incidence rates from the BOSTID studies range from 12.7 to 16.8 new episodes of ARI per 100 child-weeks at risk, with one study reporting 27.5 episodes per 100 child-weeks at risk after the inclusion of mild URI, which other studies excluded. Rates of LRI range from 0.2 to 8.1 new episodes per 100 child-weeks at risk. The number of episodes of ARI (whether URI or LRI) depends on the methods used.

(2) Most episodes – whether ARI or LRI – last <2 weeks, although variation in the median duration occurs in some study populations.

(3) Children spent on average from 21.7% to 40.1% of their observed weeks with signs of respiratory tract infection and from <1% to as much as 14.4% of observed weeks with episodes of LRI.

(4) The incidence rates of respiratory tract infection, especially of LRI, are higher in younger than in older children in all studies. Risk factor analysis enhances this finding: in all studies the incidence rates of respiratory tract infection are higher in children <18 months of age no matter what the other characteristics are.

(5) The incidence rates of respiratory tract infection are slightly higher in boys than in girls in all studies.

(6) Study sites vary in the patterns of ARI and LRI over the months of the year. Patterns of LRI do not necessarily coincide with ARI patterns.

(7) Viral agents were recovered more frequently than bacterial agents.

(8) RSV is the virus most frequently identified.

(9) S. pneumoniae and H. influenzae are the predominant bacteria isolated from children with LRI in all studies.

(10) More cases of LRI are ascertained by auscultation in the home than by screening for symptoms of LRI and referring potentially infected children to a clinic for physical examination. This is important to note when interpreting other studies, and methodology research needs to be done to verify the finding.

(11) Case-fatality ratios are somewhat higher for girls than for boys even though the incidence rates of disease are higher among boys and boys predominate among both inpatients and outpatients.

(12) The case-fatality ratios are highest among the youngest of children <1 year of age.

(13) The risk factors we examined exhibited dissimilar patterns of association with the incidence rates of respiratory tract infection among the different studies. Risk factors seem to perform differently in some societies and study populations. Generally, these factors are as follows.

Maternal age: the incidence rates of respiratory tract infection tend to be higher among younger children of younger mothers, but young maternal age is not consistently associated with higher incidence rates.

Maternal education: the rates of respiratory tract infection are not necessarily higher among children of less-educated mothers.

Weight-for-age measure: the impact of a low weight-for-age measure appears to be most important among children >18 months of age.

Sharing of sleeping room: as a measure of crowding, this variable has mixed results, mostly showing a lack of positive association.

Smoking in the household: presence of a smoker in the child’s household is not regularly associated with increased rates of ARI, although in some study groups there is a positive effect.

Discussion
For all the risk factors, the strength of association with incidence rates of ARI or LRI is modest (indicated by the RRadj). Although the RRadj values are often statistically significant, they usually are closer to 1.0 than to 2.0 (1.0 means there is no association between the risk factor and incidence rates; 2.0 means a doubling of rates between the high- and low-risk levels). Most of the analyzed risk factors relate to socioeconomic status, and in the BOSTID studies the general socioeconomic status of study subjects was more alike than different, which would decrease the RRadj. Also, the socioeconomic factors were self-
reported and were remeasured once or twice a year. Since human communities change constantly, random misclassification could have occurred during the study, thereby resulting in a further reduction in the RR.

Even though the RRs are of modest magnitude, the effect that an intervention could have is often large precisely because some of the high-risk levels are common in the study populations (using the attributable proportion as an indicator). More work on risk factors is necessary to determine why they increase the risk of disease: currently, surrogates are being measured for the behaviors, habits, and conditions that enhance transmission of agents or the susceptibility of the child. Although the study populations appear similarly poverty-stricken, there are variations in the incidence rates within those studied, and the reasons for the differences need further elucidation. Furthermore, the duration of illness and percentage of time ill need analysis for associated risk factors. Risk factors for acquiring an ARI (incidence rates) may differ from those associated with large amounts of time spent ill with ARI.

Laboratory techniques need improvement, as outlined by McIntosh [8]. Studies that identify pathogenic agents are difficult to do, yet information about the distribution of agents and the characteristics of the accompanying illnesses would be very useful in attempts at proper treatment or prevention of ARI.

The BOSTID studies used similar and comparable methods so the conditions of ARI recorded in each study were similar. Other published studies, e.g., that by James [9] or the Tecumseh study in the United States [10], used different methods of ascertainment and case definitions, thus making the incidence rates found in those studies not strictly comparable to those in the BOSTID studies. Study methods differ in important ways from those in the BOSTID studies; e.g., two of the most cited studies from the United States [11, 12] used daily diaries reinforced with weekly or biweekly home visits from projected staff to detect episodes of ARI. Freij and Wall [13] showed that more frequent notation of episodes produces more cases of ARI than do the once-a-week visits used in the BOSTID studies. Furthermore, both the Cleveland [11] and the Seattle [12] studies included illnesses of simple rhinitis or the sniffles, illnesses excluded by BOSTID. This inclusion results in a further increase in the number of cases identified in the United States studies.

In the study by Black et al. [14] in Bangladesh, children spent 60% of their observed days in the study with signs of ARI, a percentage higher than the maximum of 40% found in the BOSTID studies. Although the signs and symptoms ascertained in Bangladesh were similar to those in the case definition of BOSTID, the methods of ascertainment differ. In Bangladesh home visits occurred every 2 days for collection of data regarding daily signs of ARI. In the BOSTID studies home visits occurred once a week, so that an illness that occurred during the last week could be documented. These are important methodologic differences to keep in mind when comparisons of data on ARI are made.

Further analysis of the incidence and duration of ARI on an individual study basis would be interesting. As suggested by the work of Freij and Wall [13], the incidence rates of ARI might be lower in children with illnesses of long duration, but the time spent being ill may be greater. Another possibility is that, as in the United States, the illnesses of long duration may actually be sequential infections with no intervening asymptomatic period [15], but further investigation of this is needed in developing countries.

Each new episode of respiratory tract infection can be an invitation to more serious disease with potential progression to death, especially in children living in disadvantaged environments, who have lowered resistance to infection. Apparently small differences in incidence rates of ARI can be important, especially between developed and developing countries, since different incidence rates represent different population averages and, perhaps, a different mix of illness. Thus, knowledge of the dynamics of the epidemiology of respiratory tract infections is critical for intervention. Children not only die of respiratory tract infection but also are ill for long periods of time, a burden that affects growth and energy for learning. Prevention of respiratory tract infection is possible but only if we accept that as a desirable goal.

References