Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

DISCUSSION

Erysipelothrix rhusiopathiae (formerly known as *E. insidosa*) is a nonmotile, non sporulating, nonencapsulated gram-positive microarophilic bacillus. This slow-growing organism tends to become pleomorphic and gram negative on prolonged incubation[3], and it can be mistaken for *Haemophilus influenzae* on Gram smear.

Poultry, fish, crab, and swine are frequently infected. Direct swine to man contact is the most significant mode of acquisition, whereas direct person-to-person transmission is rare. Erysipeloid is usually an occupational disease of butchers and fishermen.

Typically, one to seven days after an exposure to meat or fish products, a red maculopapular lesion appears. The lesion progresses by centrifugal spreading and central clearing, taking on a target-shaped appearance with a normal center, a bluish ring, and sometimes a red peripheral halo. The differential diagnosis includes *H. influenzae* cellulitis and erysipelas. Hoeprich[3] states, "The clinical appearance of erysipeloid is unique; once seen, the disease will always be recognized when encountered again." Usually there is no fever or leukocytosis, and the disease subsides spontaneously in three weeks. However, septicemia, septic arthritis, and endocarditis are occasional complications.

The appearance of the skin lesion in this case was typical. We recovered *E. rhusipathiae* from an aspirate of the center of the lesion, but it is usually recommended to obtain the specimen from the margin.[3, 5] We found only one other case report in the pediatric literature.[4] The fever and elevated blood count in our patient suggest a more severe involvement in this age group. The prognosis is good in adults with or without treatment, but penicillin therapy is advised[3]; we believe that this recommendation is especially warranted in infants.

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The use of gowns and masks to control respiratory illness in pediatric hospital personnel

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THE SPREAD of viral respiratory illness in hospitals poses a problem of considerable magnitude in wards for infants and small children. Nosocomial disease often lengthens the hospital stay and, in some instances, may be severe or even fatal.[1, 2] For certain viruses, particularly respiratory syncytial virus, there is a high frequency of infection in nursing, medical, and other staff[1, 3, 4] which probably also contributes to secondary spread to other infants.

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Children with respiratory disease are usually placed in isolation and hospital personnel may be cohorted or required to wear gowns when administering patient care. The efficacy of this approach in the control of RSV infections was supported by a study which showed a reduction in virus acquisition by infants,[3] but this study was not prospectively controlled and different years in different hospitals were compared. Moreover, no reduction in RSV infections of staff members was shown. We

Abbreviations used	
RSV:	respiratory syncytial virus
H:	handwashing alone
HG & M:	handwashing, gowning, and masking
NPS:	nasopharyngeal secretions

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therefore designed a prospective study to examine the effect of various control methods on the acquisition of symptomatic respiratory infections by medical personnel caring for infants with respiratory disease. The study took place in February and March of 1979, when RSV infections were widespread and influenza A/USSR virus was also present in the community.

MATERIALS AND METHODS

Study design. The infants' ward at The Children's Hospital of Denver consists of seven large rooms, two or more of which are designated as respiratory isolation rooms in the winter season. Each room contains four to six beds and one or two sinks. Before the study, routine precautions involved the use of gown and mask, which were put on before entering the room and discarded on exit. Personnel were required to wash hands with an iodine-based soap after entry, between patients, and before leaving the room.

All nursing, medical, and respiratory therapy personnel were solicited to participate in the study; 58 of the 70 available individuals participated and completed the study. Individuals were randomly assigned to either a handwashing alone or handwashing, gowning and masking group. All personnel signed consent forms before participating in the study and were paid $20 when the study was completed.

Nursing supervisors on all three shifts were provided with lists of staff assigned to each group. To assure adherence to the procedures, these lists were posted throughout the ward so that individuals entering a room were easily checked. Although compliance was not quantitated, daily surveillance by several of us (D. M. and I. O.) showed excellent co-operation throughout.

Patient and personnel sampling. Nasopharyngeal secretions were obtained by gentle manual suction[5] from all infants admitted to respiratory isolation rooms during the study. Personnel were cultured whenever symptomatic (rhinorrhea, fever, cough, wheezing) from five days before the onset of the study until the end of the eight-week period. Throat swabs, broken off in transport medium, or nasopharyngeal secretions were placed on ice and cultured within 30 minutes to three hours of collection. Sera were obtained from all study personnel at the onset of the study and two to three weeks after the eight-week period was over. Any individual in the H group who developed minor respiratory symptoms was asked to wear a mask until the symptoms abated. In both groups, those with more severe symptoms stayed away from work until they had recovered. Respiratory symptoms requiring mask in the H group were present for a total of 14.5% of the working time.

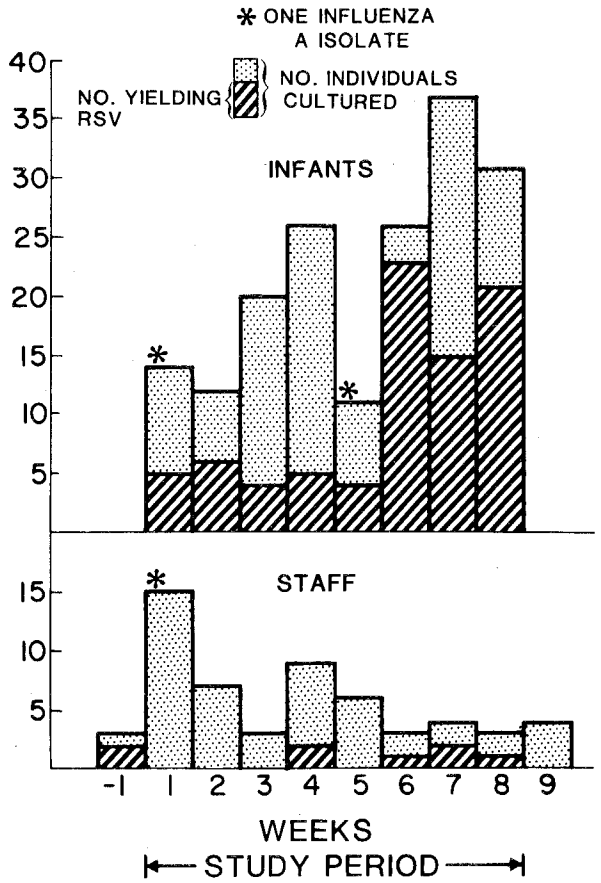

Figure. The course of the RSV epidemic. Positive RSV cultures are displayed by week. Serologic and immunofluorescent data are not shown.

Collection of clinical data. To document length of illness and hours of exposure, each participant completed a card at the end of the daily shift which recorded his or her code number, hours worked in respiratory isolation rooms, and any symptoms (rhinorrhea, fever, cough, or wheezing) for that day. These cards were collected daily by the nursing supervisor; anyone not completing a card was notified, and this deficiency was rectified. Any symptomatic or absent individual was called and arrangements were made to obtain a viral culture.

Virologic techniques. NPS and throat swabs were cultured on HEp-2 cells monitored for sensitivity to RSV. In addition, Madin-Darby canine kidney cells for detection of influenza viruses were inoculated with specimens during the first five weeks of the study. Technical problems precluded continuing this practice throughout.

Infants' and some adults' NPS were also processed for rapid detection of RSV by immunofluorescence.[6]

Paired sera from adults were tested by complement

Table. Viral infections and illness in study subjects

	Handwashing (n = 30)	*Handwashing gown and mask (n = 28)*	P *value**
No. of respiratory samples taken during acute illness	27	22	–
No. of samples yielding RSV (culture or immunofluorescence)	4	2	–
No. of RSV infections by seroconversion alone	0	3	–
Total No. with RSV infection during study period	4	5	≥ 0.20
Other viral infections (culture or seroconversion)	4	2	≥ 0.20
Total proven viral infections	8	7	≥ 0.20
No. of individuals ill	19	17	0.94
Total No. of illnesses	27	22	
Mean No. of illnesses per individual (range)	0.9 (0-2)	0.78 (0-2)	0.56
No. of days ill	127	124	
Mean No. of days ill per individual (range)	4.2 (0-19)	4.4 (0-24)	0.89
No. of individuals with > 1 illness	8	4	0.24
No. of episodes of absenteeism	5	5	

*Fischer exact test.

fixation for antibody to RSV, influenza A and B, parainfluenza 1, 2, and 3, adenovirus, and coronaviruses OC43 and 229E. Neutralization antibody to RSV was measured by plaque reduction.[7] Hemagglutination inhibition tests for influenza A/USSR/90 and 92 and influenza B/HK were performed by standard methods.[8] A fourfold rise in antibody measured by any of these methods was considered to indicate infection.

Statistical analysis. Data were analyzed by the Student t test, Chi square, or the Fischer exact test, depending on the data base. All data collected were entered in a computer program which performed a regression of dependent to independent variables looking for high "t" statistics in the regression coefficient and the correlations among the variables.

RESULTS

Personnel. Of the 70 individuals available for study, nine nurses elected not to participate, and three withdrew from the study. Two of these individuals were in the HG&M group and one in the H group. Only one withdrew because of distaste for the procedures. Two left for other employment. Thus, 58 personnel completed the study and form the base for this analysis. There was no significant difference in age, experience on the pediatric ward, number with children under 10 years of age at home, or degree of exposure in the respiratory isolation rooms within the two groups.

Viral infections and symptomatic illness. During the study, 177 patients were admitted to the respiratory isolation rooms; 87 (49%) yielded RSV by culture or fluorescence. Sixty-eight of the 87 were positive by both techniques. Ten additional samples were positive by culture only and four by fluorescence alone. RSV was isolated throughout the course of the study. By contrast, influenza virus was recovered only twice from children and appears, in comparison to RSV, to have had a lesser impact on the study group (Figure).

On the day before the study began, three symptomatic personnel were cultured and RSV was recovered from two of them. In addition, one symptomatic individual, who had only this one illness during the study period and from whom RSV was not recovered, developed a fourfold rise in antibody to RSV. These three infections were not included in our analysis, and the three individuals were omitted from analysis of RSV infections since they would presumably have at least partial immunity to RSV reinfection during the study period. They were, however, introduced into the study after recovery and included in analysis of subsequent illnesses.

During the first week of the study, three additional individuals, who had been ill but unavailable during the prior week, were sampled. None was infected with RSV but influenza A was grown from one throat culture and the other two both had evidence of influenza A by serologic testing. These three illnesses were not included

in the analysis below since they predated the onset of the study. Influenza A virus was not recovered from any other staff members during the study period, although four infections were detected by serologic means.

There were four proven RSV infections in the H group and five in the HG&M groups (Table). Six other viral infections—four with influenza A virus and two with parainfluenza virus type 3—occurred among the staff, all detected by antibody titer rise. The number of such infections, like those with RSV, did not differ between the two study groups.

As with specific viral infections, there was no difference between the two groups with respect to number of illnesses, number of days ill, number of individuals with more than one illness, and absenteeism (Table).

Since gowning and masking did not appear to influence either illness or specific virus infection, we attempted to correlate other possible factors. Both age and number of hours of exposure were correlated with illness. In a multiple regression analysis (coefficient of determination = 0.25) younger personnel ($P = 0.02$), and those who spent more than 30 hours in the study rooms ($P = 0.04$) tended to be ill more often. In a similar analysis, hours of exposure were also correlated (correlation coefficient = 0.25) specifically with RSV infection ($P = 0.03$). In addition, prestudy serum RSV neutralizing antibody correlated with protection (correlation coefficient = 0.31, $P = 0.02$).

DISCUSSION

The best method for control of respiratory infections among hospital staff remains to be determined. We were unable to demonstrate any effect of adding the use of both gown and mask to the usual handwashing routine on the development of illness in personnel caring for infants with respiratory disease. Specific viral infections were identified in only 15 of 49 illnesses (31%). RSV was the most frequent agent found, being present during nine illnesses (18%) during the study. Although RSV infections were fewer than expected, the trend followed the more general one, that gown and mask had no discernible effect on risk of acquisition.

It was unfortunate that the study began at a time when RSV infections were already occurring among the staff. RSV infections in infants were frequent, and had we begun a week earlier the number of acquisitions by staff might have been larger, and the data for RSV therefore somewhat more convincing. However, it was the practice before the onset of the study to use handwashing, mask and gown in the isolation areas, and infections acquired before the study reflected that policy. Culturing asymptomatic personnel might also have increased the number of RSV infections. We chose not to do so, however, since prior studies had shown RSV infections among staff to be largely symptomatic.[3]

It might be argued that the reason for the lack of effect was the heavy exposure all adults have to respiratory viral illness in the community at large. Against this hypothesis, however, is our finding that both illness and RSV infection were significantly associated with longer hours of exposure in the isolation rooms.

Other possible reasons for lack of effect are poor compliance with the study protocol, and modes of virus spread which would not be blocked by the use of mask and gown. Although we did not measure compliance, we did monitor it carefully during two of the three daily shifts, and the same enforcement measures were used at night as during the day.

Finally, it may be that the viruses involved elude the barriers set up by means of gown and mask. Recent data from Hall and Douglas[9] indicate that RSV can be successfully transmitted through fomites on the hands, which are then put in contact with either the conjunctivae or the nasal mucosa. Another possible mode of spread demonstrated in that study was by means of large infected droplets. Rhinoviruses, which might have been present but would not have been detected in this study, have been clearly shown to spread more efficiently by hand-to-nose or hand-to-eye contact than by aerosols.[10] Influenza, on the other hand, is thought to spread through droplet nuclei, against which masks might be an inefficient barrier. Thus any one of a number of candidate respiratory viruses could bypass gown or mask and render their use ineffective.

We can draw no conclusions regarding intrahospital spread to other infants. Indeed, the major function of masks may be to prevent the spread of respiratory viruses from personnel to infants, rather than the other way around. Nevertheless, we believe that we have shown that the cumbersome and expensive use of gowns and masks serves little if any function in protecting personnel. We recommend that, whenever possible, older, more experienced staff should care for children at high risk of severe respiratory viral illness, and that gown and mask should not be used in an attempt to prevent personnel illness in wards with a high density of acute respiratory infections. The utility of gown and mask in preventing spread to other infants, of other barriers such as gloves or goggles, and of cohorting of personnel remains to be proven.

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Nonantibiotic-associated enterocolitis caused by Clostridium difficile *in an infant*

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THE ROLE of toxin-producing strains of *Clostridium difficile* in the pathogenesis of pseudomembranous colitis has been firmly established.[1-3] In both adults and children this disease is generally observed in the setting of recent antibiotic exposure.[1-4] Several reports have appeared describing adults with pseudomembranous colitis without prior antibiotic therapy.[3, 5-7] This report describes an infant with severe enterocolitis associated with *C. difficile* toxin in the stools and in whom there was no prior antibiotic exposure.

CASE REPORT

A 4-month-old female infant was admitted to Hartford Hospital because of bloody diarrhea. She had been born after an uneventful term pregnancy and delivery. Feedings had consisted solely of breast milk for the first three months. The mother had been taking no medication. At three months of age a cow milk formula (Enfamil, Mead Johnson & Company) was introduced, and the patient developed watery diarrhea within several days. Treatment with an oral glucose-electrolyte solution (Pedialyte, Ross Laboratories) and then a soy formula (ProSobee, Mead Johnson & Company) was followed quickly by return of the stools to normal. Re-introduction of the cow milk formula at age 3½ months was attempted, and the patient rapidly developed diarrhea which prompted admission to a local hospital.

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On admission she was mildly dehydrated and having approximately six to eight watery stools per day which were guaiac positive. The hematocrit was 37%, WBC count 10,000 cells/mm^3 with 30% polys, 13% bands, 48% lymphocytes, and 9% monocytes. Three stools were negative for enteric pathogens as well as for ova and parasites. Treatment with intravenous fluid therapy was instituted. When attempts to introduce an elemental formula (Pregestimil, Mead Johnson & Company) were unsuccessful, she was transferred to Hartford Hospital.

On admission her general physical examination was normal with the exception of a heart rate of 140 beats/minute. Laboratory evaluation included: Electrolytes (mEq/L) Na 132, K 4.4, Cl 99, HCO_3 19; BUN 8 mg/dl, albumin 4.5 gm/dl; hematocrit 38%, WBC count 9,600 cells/mm^3 with 32% polys, 5% bands, 56% lymphocytes, 7% monocytes; platelet count 905,000, reticulocyte count 2%, sedimentation rate 66 mm/hour. Careful separation of stool and urine revealed watery, bloody stools weighing approximately 400 to 600 gm/day. Stool Gram stain revealed abundant polymorphonuclear leukocytes and mixed flora. Stool electrolyte concentrations (mEq/L) were Na 106, K 19, Cl 98. Three stools were negative for enteric pathogens (*Salmonella, Shigella, Campylobacter,* and *Yersinia*) as well as for ova and parasites.

Sigmoidoscopy revealed granular and friable mucosa without any pseudomembranes. Rectal biopsy showed an intact surface epithelium with minor loss of nuclear polarity. The epithelium showed regenerative changes characterized by increased mitotic figures and hyperchromatic nuclei and loss of goblet cells. A moderate increase in mononuclear cells within the lamina propria, consisting mainly of mature lymphocytes, was present with focal involvement of the muscularis mucosa. Brown and Brenn stain for bacteria were negative.

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