Acute Diarrheal Diseases In a Zuni Community

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ACUTE DIARRHEAL diseases are a major health problem at the Zuni, N. Mex., Pueblo, as in most U.S. Indian communities. Living conditions are crowded and sanitation is poor in this relatively isolated community of 5,176 American Indians. Infectious diseases spread rapidly. Diarrheal diseases reach epidemic proportions each summer.

A total of 440 patient visits a year, or 4 percent of all hospital visits, including routine physical examinations, at the Public Health Service Indian Hospital in Zuni are for diarrhea. Thirty percent of all patients seen for diarrhea require hospitalization, amounting to 828 hospital days per year.

Materials and Methods

In June 1961, the physicians at the hospital began obtaining stool cultures on all patients with diarrhea. When a stool specimen could not be obtained, rectal swabs were taken. The specimens were stored in buffered glycerol saline solution until they could be cultured. They were routinely cultured on MacConkey's agar, *Salmonella* and *Shigella* agar, and in tetrathionate broth. The identification procedures of Edwards and Ewing (*1*) were followed.

Results and Discussion

The study included 582 episodes of diarrhea seen between June 1, 1961, and October 31, 1962, at the Zuni hospital. In this group there were 343 episodes, or 59 percent, in which no pathogenic organisms were cultured from the specimens, and 239 episodes, or 41 percent, in which pathogenic organisms were found. *Shigella* was found in 173 episodes; *Escherichia coli* in 68 episodes; and *Salmonella* in 17 episodes. In one instance *Salmonella arizona* type 026H29–30 was cultured from the stool, the first time that this organism has been found in man. In 20 episodes pathogenic *E. coli* and *Shigella* were cultured from the same stool specimen.

The incidence of diarrheal disease, as reflected by the number of stool specimens examined, increased markedly from June through October (fig. 1). Although there is a relationship between the season and the number of specimens in which the *Shigella* organisms were found, no such seasonal variation could be demonstrated for the pathogenic *E. coli.*

During the period studied, there were 24 cases of *Shigella sonnei* and 28 cases of *Shigella boydii.* The remainder were *Shigella flexneri.* Of the 20 cases of *S. boydii* seen in 1961, 16 occurred from August 17 to September 3. There were 17 cases of *S. sonnei* in 1962, all occurring between September 4 and October 17. This suggests that these organisms were introduced into the Zuni Pueblo community during the second week of August when the various Indian tribes intermingle at the nearby Gallup Indian ceremonial.

The study group included patients of all ages, from the newborn to one man whose age has been estimated at 107 years by the Bureau of Indian Affairs. Children under 5 years of age were the most susceptible to diarrheal disease (fig. 2). The age-specific attack rate demon-

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strated dramatically that the acute enteric infections were epidemic in those under 5 and endemic in those age 5 and older. The attack rate for those under 5, in the 17-month period of the study, was 24 episodes per 100 children. In those 5 and older it was 1.4 episodes per 100 persons. One could postulate that repeated exposures in those under 5 imparts partial immunity.

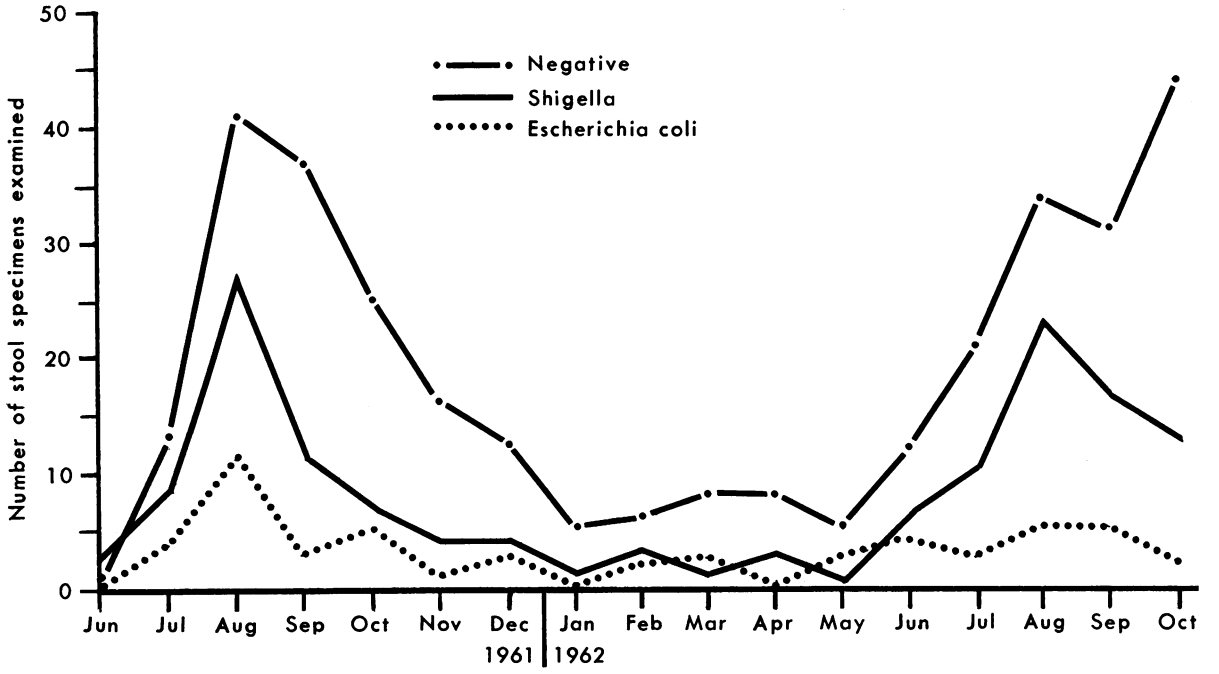
One of the difficulties encountered in treating these enteric diseases was the inability of the physician to differentiate clinically the type of infection. In general, the diarrheal illnesses seen in Zuni were self-limited regardless of whether a pathogenic organism was cultured. The proportion of patients hospitalized with each type of illness (fig. 3) indicates that shigellosis and pathogenic *E. coli* enterocolitis are no more severe than nonspecific diarrhea. Only patients with *Salmonella* infections required significantly longer and more frequent hospitalization than those with other diarrheas. The small child and infant, because of their susceptibility to dehydration, often have relatively severe cases of enterocolitis. However, the increased morbidity associated with the *Salmonella* infections can not be attributed only to age since 8 of the 17 cases were in persons 5 years old or older. Sixty-five of the 68 cases of *E. coli* infection were in children under age 5, and yet the morbidity was less severe than in cases of *Salmonella* infection.

The *Shigella* convulsion is now a well-recognized entity (*2*, *3*). In this series 2 percent of the patients with *Shigella* infections convulsed compared with 0.9 percent of those with nonspecific diarrhea.

The choice of antibiotics is another difficulty encountered in treating enteric illnesses. The physicians at Zuni felt, from the beginning, that antibiotics should be an inherent part of the therapy because of the high incidence of *Shigella* dysentery. A review of the literature showed that sulfonamides, streptomycin, ampicillin, furazolidone, chloramphenicol, tetracycline, and other antibiotics have all been used to treat shigellosis (*4–15*). The development of antibiotic resistant *Shigella* organisms also has been reported (*16*, *17*).

At the Zuni Hospital, many of these medications have been used, but the sulfonamides were relied upon most heavily. The choice of anti-

Figure 1. Bacterial isolation from specimens from diarrheal disease patients, seen at Public Health Service Indian Hospital, June 1961–October 1962



biotic depended upon the severity of the illness, whether parenteral administration was needed, and the state of hydration. If the patient was dehydrated, the sulfonamide preparations were usually not chosen. The outpatients received a 4-day course of therapy, and the inpatients were treated as long as necessary. Manufacturers' recommended doses were used. Other therapy

Figure 2. Diarrheal disease patients at Public Health Service Indian Hospital, by month and age group, June 1961–October 1962

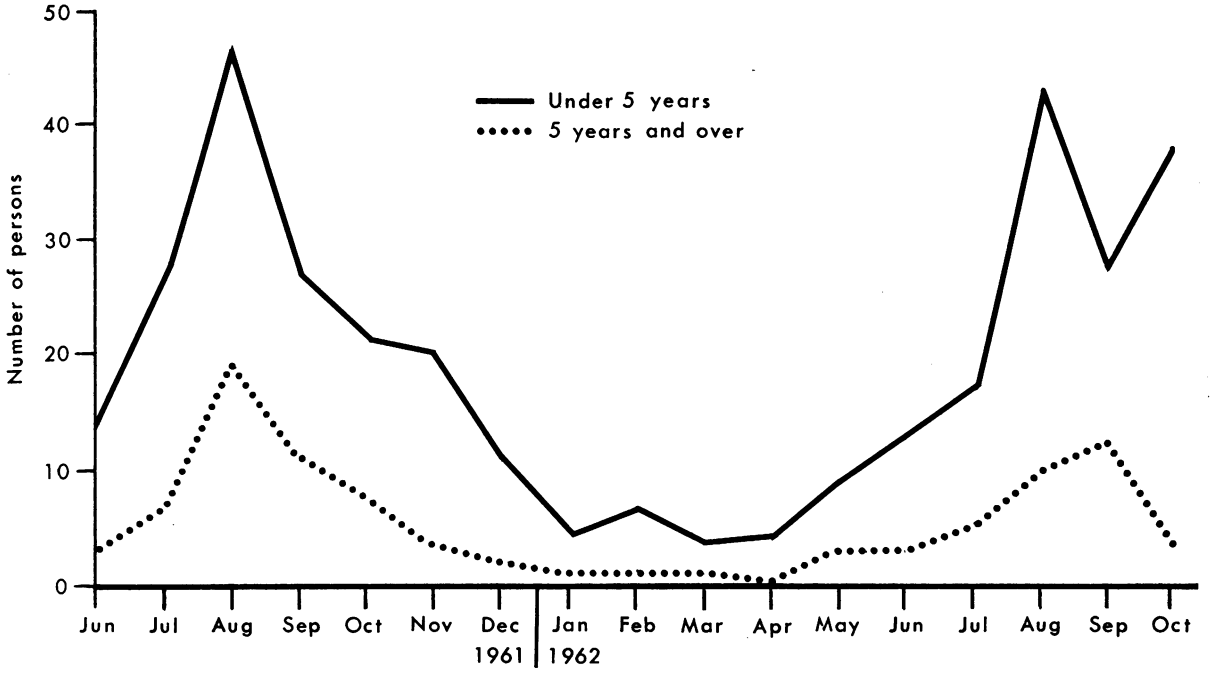
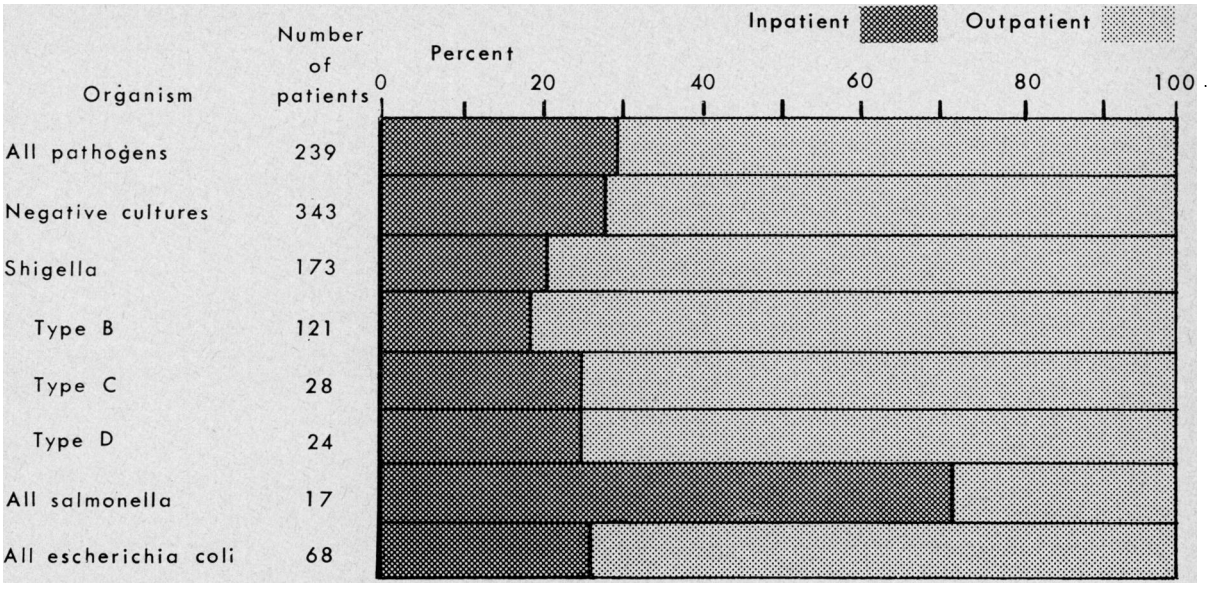


Figure 3. Proportion of patients with diarrhea requiring hospital treatment, by type of bacteria isolated, Public Health Service Indian Hospital



NOTE: 20 patients were infected with more than 1 organism and are included under both organisms.

included intravenous fluids when necessary, aspirin, paregoric, belladonna, and kaopectate.

In general, these therapeutic regimens were satisfactory and all of the antibiotics seemed to be equally effective. Most patients, except those with *Salmonella* infections, responded in 2 to 4 days.

The table compares the effectiveness of the various antibiotics in cases of shigellosis. It can be seen from the untreated cases that shigellosis is a self-limited disease of less than 30 days duration. Unfortunately a large number of patients failed to return for followup, complicating the interpretation of the results. Despite this difficulty, it can be seen that triple sulfonamide (sulfadiazine, sulfamerazine, sulfamethazine) and furazolidone, which were used in a large number of cases, have similar results. A larger proportion of the patients treated with furazolidone had persistent *Shigella* in the followup stool cultures. Sulfisoxazole, used only six times, appears to be unusually effective. This would appear to warrant further investigation.

The two deaths in the series represented 0.4 percent of those studied. The first death was a 9-month-old infant with a history of green liquid stools for 1 week who was brought to the hospital in critical condition with severe dehydration. The stool cultures produced no pathogenic organisms. Despite treatment with fluids, antibiotics, oxygen, and digitalis, the infant died 24 hours after admission. The second death was a 2-day-old infant who was born at home and who had been placed in hot sand for the better part of 2 days as a purification rite. He was admitted to the hospital in critical condition with severe dehydration, diarrhea, jaundice, omphalitis, and peritonitis. Stool cultures were negative. He was treated with oxygen, antibiotics, and fluids but died 12 hours after admission.

Summary

A study was made of 582 episodes of diarrhea seen at the Public Health Service Indian Hospital, Zuni, N. Mex., between June 1, 1961, and October 31, 1962. No pathogens were cultured from specimens taken in 59 percent, or 343 episodes. Of the 239 episodes in which pathogens were found, *Shigella* was isolated in 173; *Escherichia coli* in 68; and *Salmonella* in 17. *E. coli* and *Shigella* were cultured from the same stool specimen in 20 of the episodes.

All age groups were included in the study. The most susceptible age group was those under 5 years. Most illnesses were benign and self-limited. Unusual severity indicated a *Salmonella* infection.

Antibiotics were used in treating the patients. The sulfonamides were relied upon most heavily. The triple sulfonamide (sulfadiazine, sulfamerazine, sulfamethazine) and furazolidone were used in a large number of cases and showed similar results, except that furazolidone-treated cases had a higher proportion of persistently positive cultures. Sulfisoxazole appeared to be unusually effective, though used only six times. There were two deaths, both the result of severe dehydration.

Clinical and bacteriological response of patients treated with selected drugs for shigellosis at the Public Health Service Indian Hospital, June 1961 to October 1962

Drug administered	Clinical response within 30 days				Repeated cultures within 30 days		
	Total number	Asymptomatic	Recurrence	Unknown	Negative	Positive	Unknown
None	8	5	2	1	4	1	3
Trisulfapyrimidines	69	48	9	12	33	10	26
Furazolidone	47	30	8	9	22	12	13
Tetracycline	18	10	4	4	11	3	4
Sulfisoxazole	6	6	0	0	6	0	0
Chloramphenicol	12	9	2	1	6	3	3
Penicillin and one of these	11	11	0	0	4	1	6
Neomycin	2	1	1	0	0	2	0
Total	173	120	26	27	86	32	55

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Fingerprint Analysis

The Neurological and Sensory Disease Service Branch, Public Health Service, is studying the value of fingerprint analysis in detecting neurological abnormalities among newborn infants, by investigating the palm and fingerprints of patients with various neurological disorders, including hydrocephalus and mongolism.

Unusual patterns have been reported in the medical literature in patients with organic brain syndrome, neuroses, various congenital and genetic diseases, Wilson's disease, diplegia, and schizophrenia. Mongolism is also associated with dermatoglyphic abnormalities, which can be used diagnostically in doubtful cases. Fingerprint analysis will have a wider application as a diagnostic tool if the study can establish the way in which dermatoglyphic patterns differ among people with various neurological deficits and persons with no known abnormality.

Finger and palm prints of 5,000 patients in three Virginia institutions, Lynchburg Training School and Hospital, Petersburg Training School, and Central State Hospital in Petersburg, will be studied.

The field work should be completed in the next 6 months, and the analysis of data will probably be available within a year.

Federal Publications

Public Health Service Film Catalog, 1964–65. *PHS Publication No. 776; revised October 1964; 103 pages; 75 cents.* Revises list of health and medical films available from the Public Health Service Audiovisual Facility, Communicable Disease Center in Atlanta. The 2-year span represents a change from fiscal year to calendar year publication.

Hospital Electrical Facilities. *PHS Publication No. 930–D–16; March 1965; by Noyce C. Griffin; 31 pages; 30 cents.* Presents up-to-date guidelines for the provision of adequate electrical facilities for hospitals. Discusses codes and standards, service mains, equipment, communication systems, and special installations. This publication is a revision of PHS Publication No. 818.

Health Statistics From the U.S. National Health Survey. National Center for Health Statistics

DEVELOPMENT AND MAINTENANCE OF A NATIONAL INVENTORY OF HOSPITALS AND INSTITUTIONS. *PHS Publication No. 1000, Series 1, No. 3; February 1965; 25 pages; 25 cents.*

SELECTED DENTAL FINDINGS IN ADULTS, BY AGE, RACE, AND SEX, United States, 1960–1962. *PHS Publication No. 1000, Series 11, No. 7; February 1965; 35 pages; 30 cents.*

Community Health Services Project Grants Information Statement. *PHS Publication No. 1289; 1965; 20 pages.* Provides prospective applicant organizations and others interested in the health services grant programs of the Public Health Service with information about the Community Health Services Project Grants Program. Includes essential information to assist an applicant organization in applying for a grant. Sets forth basic policies and conditions governing the making of awards and the expenditure of grant funds. Summarizes principal procedures followed in operating the program. Discusses miscellaneous topics pertinent to Community Health Services grants.

Public Health Service Grants and Awards, Fiscal Year 1964. Part I. Research grants. *PHS Publication No. 1233, Part I; 1965; 594 pages; $1.50.* Gives tabular details on the nature, distribution, and individual amounts of 16,320 Public Health Service research grants awarded during fiscal year 1964. Grants in fiscal year 1964 were made to 1,241 institutions in the United States and 382 institutions in 49 other countries. Funds total $528,980,763 compared with a total of $449,681,185 for 15,939 grants awarded during fiscal year 1963. Grants by the Public Health Service are in support of research studies aimed at major diseases and other public health problems as well as the discovery of fundamental knowledge in biomedical sciences.

Directory of Poison Control Centers. *PHS Publication No. 1278; March 1965; 88 pages; 20 cents.* Compiled from data furnished by State health departments to the National Clearinghouse for Poison Control Centers. Lists poison control centers throughout the United States indicating location, address, telephone number, and names of director and assistant director. Also lists centers which provide to physicians, on a 24-hour basis, information on the toxicity of products. Recommends treatment when these poisonous and potentially poisonous substances are ingested.

The Protection and Promotion of Mental Health in Schools. *PHS Publication No. 1226, Mental Health Monograph 5; 1964; prepared by Nadine M. Lambert, with the assistance of Eli M. Bower, Gerald Caplan, John N. Duggan, William G. Hollister, Donald C. Klein, Nevitt Sanford, and Daniel Schrieber; 57 pages; 40 cents.* Outlines steps primary and secondary schools can take toward the prevention of mental and emotional disorders in children. Eight educators and behavioral scientists discuss the school's role in the development of personality and its potential to assist in preventing learning and behavior problems in children. Emphasizes the need for action before problems grow to full size, and if possible, before they have a foothold. Preventive programs must aim at building strengths in children that will help them avoid behavior problems. Discusses the importance and potential of such preventive programs, followed by presentation of specific programs and how they may be applied to the work of school personnel.

Cardiopulmonary Resuscitation Techniques. Perspectives in training and application. *PHS Publication No. 1276; February 1965; 28 pages; 20 cents.* Proceedings of symposium on cardiac arrest presented at the annual field staff conference, Heart Disease Control Program in Los Angeles, Calif., October 22, 1963. Presents participants' experiences in developing local training programs in cardiopulmonary resuscitation for professional medical and paramedical personnel. Reviews general guidelines, organizational problems, and pitfalls. Outlines a sample testing method and mentions some basic teaching aids. Also includes a presentation of current practice in this field in Prague and Moscow.

This section carries announcements of new publications prepared by the Public Health Service and of selected publications prepared with Federal support.

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