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ABSTRACT

This report presents (1) information on the incidence, causes, development, transmission, control and prevention of parasitic infections and (2) a report of how Hawaiian Follow Through Students infected by parasites were identified and provided with treatment. The students were enrolled in kindgergarten through third grade classes at three elementary schools. Three of the 27 children screened had parasitic intestinal diseases. Two additional cases may have escaped detection. Also included in this report are descriptions of the procedures developed for contacting parents, teachers and children, collecting stool specimens, and providing follow-up services. It is noted that children with infections may show signs of poor motor coordination, restlessness, inability to sit still and inability to focus on school work. Parasitic intestinal infections can affect how children learn and perform in school. A teacher's health observation form, a chart summarizing the data of the study and a stool specimen collection memo to parents are appended. (Author/RH)

INFORMATION AND GUIDELINES FOR IDENTIFICATION OF CHILDREN WITH PARASITIC INTESTINAL INFECTIONS

by

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and lastly,

The children who were cooperative as they participated in the screening procedures designed to identify parasitic intestinal infections.

FOREWORD

This paper on parasitic intestinal infections is a result of a special study by the Hawaii Follow Through Project Nurse, Mrs. Lorraine Doi, on the topic of parasitic intestinal infections. Focus of the study was on identification of students with parasitic intestinal infections. Detailed procedures were developed in servicing the students and their parents, including specific steps to be taken in coping with problems associated with the identification process. This paper includes information and guidelines for other health personnel involved in public health, especially as it involves children and their education. Copies of this paper are being distributed to serve as a reference for health education and public health services. Further assistance in reference to this paper is available from Mrs. Lorraine Doi at the Follow Through office located at Palolo School.

Charles G. Clark
Superintendent

PREFACE

It is the intent of the Health Services component of the Hawaii Follow Through project to develop a series of reports on how health services have been successfully rendered to students of grades kindergarten to three at Kaewai, Kaiulani, and Palolo Elementary Schools. The reports can be used by other schools as mini-handbooks to replicate the procedures developed for identifying and providing follow-up services to students with health problems related to parasitic intestinal infections.

This is the first of a series of reports, and it focuses on intestinal parasitic infections. This report presents (1) information on the problem, control, and prevention of parasitic infections and (2) a detailed report on how Follow Through students with the problem of parasitic infections were identified and serviced. The report also presents detailed information on the results of the identification and services efforts. Problems encountered and strategies developed for servicing the students with parasitic infections are presented in detail. This report could be used to replicate the identification and service procedures as tried and documented by the Follow Through project.

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Introduction

"Children attending school have the job of learning."[1] Just as poor health can hamper the job of learning, optimum health can serve to facilitate the learning process.

In an effort to seek optimum health conditions for children attending Hawaii Follow Through schools, youngsters enrolled in Follow Through classes are screened annually for vision and hearing, and parents are encouraged to have their children undergo annual dental screening and flouride applications to detect, as well as to prevent dental caries. Recipient Follow Through children are provided opportunities to receive tuberculin tests and complete physical examinations biennially. Complete blood counts (CBC's) and urine analyses (UA's) are included in the physical examinations (PE's).

Due to the fact that a substantial number of Follow Through (FT) children are in contact with and/or are recent migrants or immigrants from areas in which tropical parasitic intestinal infections prevail, the PE's for the 1977-78 school year also included stool examinations. These examinations were limited to youngsters whose physical examination findings suggested that they could be infected with intestinal parasites.

Although intestinal parasitic infections are generally asymptomatic and may not be detected for many years, they do present a health problem because these infections are communicable and are potentially hazardous. In isolated incidents, untreated parasitic infections may result in death.

The problem of unrecognized, potentially hazardous health conditions in school-aged children should lead concerned educators to question:

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[1]Quotation is based on a speech given by Dr. Robert Wiebe at a Hawaii Follow Through HPAC meeting held in January, 1978.

"To what extent could undetected, asymptomatic health conditions retard learning processes in school-aged children? Are there subtle, but observable clues available to classroom teachers that would suggest that children's learning may be hampered by physical health impairment?"

Purpose of the Paper

This paper presents (1) information on the problem, control, and prevention of parastic intestinal diseases and (2) a detailed report on how Follow Through project students with the problem of parasitic intestinal diseases were identified and serviced. The report also presents detailed information on the results of the identification and service efforts. Problems encountered and strategies developed for servicing the students with parasitic intestinal infections are presented in detail. This paper could be used to replicate the identification and service procedures as tried and documented by the Follow Through project.

Background Information

People travel more today than ever before. In addition to our tourist population, Hawaii has an influx of migrants and immigrants from the islands in the South Pacific as well as from Southeast Asia. These are areas in which parasitic intestinal infections are known to prevail. Although sanitation facilities are considered to be highly advanced in Hawaii, intestinal parasites can still be transmitted by undetected and untreated individuals who harbor the disease-causing parasites. Educators need to be alert to the existence of these conditions in our schools and communities.

Unlike the Tuberculosis Control program which provides compulsory screening and treatment for new foreign arrivals, as well as for commercial foodhandlers, new arrivals to the islands are not screened routinely for intestinal parasites. Children known to be infected with these parasites cannot be excluded from school regardless of their failure to report for medical treatment.

Incidence of Parasitic Intestinal Infections

In a survey conducted in 1973-74 in Oahu schools, grades K-3, out of a total of 390 children, 13.1% were infected with intestinal parasites. A comparison between 115 immigrant/migrant children and 275 U.S. born children demonstrated that 32.1% of 115 foreign born and 5.1% of the 275 U.S. born children were affected. In 1975, a single stool specimen survey of 86 children in Oahu schools conducted by Siddiqui and McKinney revealed a 12% incidence of intestinal parasites. Examinations of two or more specimen collected on different days increase thoroughness and accuracy of disease

identification; the number of persons identified with infections could increase with such additional examinations.

Based on another study of patients referred to Tropical Medicine and Parasitic Disease Clinic at Children's Hospital in Honolulu in 1975, Siddiqui and McKinney found that 70 out of 125 or 56% of the patients had one or more parasites in their stools. The majority of the participants submitted only one stool specimen.

Occurrence of parasitic intestinal infections such as giardiasis is world wide. It is endemic at relatively high levels in the mountainous regions of Colorado and is known to exist at low levels throughout the U.S.[2]

Eveland, Kenney, and Yermakov report that routine analyses on 1,801 patients in New York City demonstrated that the majority of parasitic intestinal infections diagnosed in the laboratory were found among local residents who had never left New York. Of the 1,801 patients screened, 882 with symptoms, 19.5% were found to have parasitic intestinal infestations; 33.7% of the 919 without symptoms were positive for parasites. The authors attribute the high incidence rate to increasing travel to endemic areas, overpopulation, and overcrowding with resultant poor hygiene and pollution.

On the basis of 40 stool samples from 36 South Vietnamese orphans in Canada, 34 or 85% of the stools contained one or more parasites such as Trichuris trichura and Endolimox nana.

In the 1975 Hawaii Study by McKinney and Siddiqui (Tropical Disease Clinic at Children's Hospital), out of 157 patients identified with

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[2]Martin Wolfe, "Giardiasis," JAMA, Vol. 233, No. 13, Sept. 29, 1975, p. 1362.

parasitic intestinal diseases, the following were detected:

Diseases	Number	Percent
Trichuriasis (Whipworm)	57	36%
Anklyostomiasis (Hookworm)	33	21
Ascariasis	24	15
Giardiasis	18	11
E. Histolytica (Amebiasis)	8	5
Others - E. coli, Strongyloidiasis, Taeniasis (Tapeworm)	17	9

Of the 157 patients with identified parasitic intestinal diseases, 36 individuals had more than one type of infection.

Schultz reports that approximately one out of four persons in the world are infected by Ascaris lumbricoides: 400 million people have hookworm and 350 million are infected with Trichuris trichura. According to Schultz, "Center for Disease control has compiled data showing that virtually every parasitic intestinal disease known to man had been diagnosed recently in the U.S."[3] Unfortunately, diagnosis leading to successful management is often missed because it is usually unsuspected. He attributes physicians' difficulty in diagnosing tropical parasitic intestinal diseases due to insufficient training in medical schools. This opinion was also expressed by Dr. Wayne McKinney, a Honolulu pediatrician and specialist in tropical parasitic diseases, during an interview by this writer.

Literary research into the area of incidence of parasitic diseases suggests that one could expect to find individuals with intestinal parasites at the rate of 13% in the community. A teacher with a class of 25 children could expect to find approximately 2 to 3 children with

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[3]Myron G. Schultz, "Current Concepts in Parasitology," New England Journal of Medicine, Vol, 297, No. 23, Dec. 8, 1977, p. 1260.

intestinal parasitic infections.

However, according to experiences of Dr. W. McKinney, there is a strong likelihood that incidence of parasites in the community may be as high as 20%. Reasons cited are based on Dr. McKinney's findings as follows: 1) of these individuals with positive nematodes, only two thirds had eosinophilia; the remaining one third had normal eosinophil count (4% or less) and 2) incidence of giardiasis is probably higher because, in 50% of known cases, cysts were not found in stool specimen collected in routine manner. (This suggests that for every diagnosed case of giardiasis, there may be another undetected case. In addition, giardiasis and amebiasis are not accompanied by eosinophilia. Therefore, if the rate of intestinal parasite incidence were increased to 20%, the classroom teacher with 25 children could anticipate having 5 children infected with parasites.)

Causative Agents, Stages of Development, Mode of Transmission, and Control and Prevention

Although there are a number of parasitic intestinal infections, this section will be limited to a brief description of the more common parasitic intestinal diseases, their causative agents, stages of development, mode of transmission, and control and prevention. The major source for the following information on diseases and causative agents is Control of Communicable Diseases in Man by Abram Benenson.

Diseases and Causative Agents

1. Trichuriasis or whipworm disease is caused by a nematode Trichuris trichura. Condition is generally asymptomatic and detected only through stool examination. In cases of heavy infestations, individuals may experience periodic abdominal pain, bloody and loose stools with subsequent weight loss. Anemia may or may not accompany condition.

2. Ancylostomiasis or hookworm disease is usually caused by Nematode Necator americanus and Anculostoma duodenale. Organisms are approximately one centimeter (1 cm.) in length during the adult phase. The organism A. Ceylanicum occurs less frequently in

South East Asia and can also be harboured in cats and dogs. Parasites can be observed in stools of infested individuals with naked eyes.

Symptoms associated with hookworm disease are generally attributed to anemia and malnutrition. Individuals may appear to be listless, restless, and tired. Heavy infestations can cause retardation in physical and mental development. Coughing and inflammation of the trachea may be evident in some individuals. Those with light to moderate infestations may remain asymptomatic. Vaginal itching may be noted in females infected with hookworm.

3. Ascariasis is caused by a helminth Ascaris lumbricoides which ranges from 20 to 35 cm. in length. As many as 50 to 100% of population are infected in areas where sanitation is poor.[4] Markell states that Stoll calculated that a total of 18,000 tons of Ascaris eggs are produced annually by worms affecting the people of China alone.[5] The disease is characterized by variable or absence of symptoms depending on the degree of infestation. Digestive and nutritional disturbances including abdominal pain, vomiting, restlessness, and disturbed sleep may be experienced by heavily infested persons. Respiratory problems such as coughing spasms and difficulty in breathing, with or without fever, may also accompany the disease. In some individuals, adult helminths migrate to the liver, gall bladder, appendix, and/or peritoneal cavity with the possibility of resultant death.

4. Giardiasis is caused by a flagellated protozoan Giardia lamblia. The disease, which is often asymptomatic, can be characterized by a variety of intestinal symptoms such as intermittent mid-epigastric cramps, chronic diarrhea, frequent mushy foul smelling stools, and abdominal distension. Vomiting, chills, and fever may also be experienced by infected individuals. Infected, asymptomatic untreated persons are capable of discharging Giardia cysts which are hardy and resistant to environmental temperature changes. Giardiasis can easily be mistaken for stomach ulcers or gall bladder disease.

5. Amebiasis is caused by a protozoan parasite Entamoeba histolytica. However, according to Dr. Wayne McKinney, it is essential that infected individuals be treated because there is a 6% mortality rate in untreated individuals. In addition, 8% of those infected are known to develop liver abscess. Although rare, brain and lung abscesses have known to occur in amebiasis.

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[4]Edward K. Markell and Marietta Voge, Medical Parasitology, (Philadelphia: W.B. Saunders, 1971), p. 218.

[5]Markell, p. 219.

Like giardiasis, symptoms noted in Amebiasis can vary from an acute episode of chills, fever, bloody or mucoid diarrhea, to mild periodic abdominal discomfort characterized by bloody or mucoid diarrhea with alternating periods of constipation and/or periods of well being.

Mode of Transmission

Parasitic worms such as Trichuris trichura, the hookworm, and Ascaris lumbricoides lay their eggs or ova in the intestinal tracts of infected individuals. The ova are then discharged in the feces. In order to become infective, the ova must incubate in soil for a period of time. (Trichuris - 3 weeks, hookworm - 7 to 10 days, Ascaris - 2 weeks or longer). The period of time in which the ova incubate is referred to as the incubation period. At the end of the incubation period, the Trichuris and Ascaris become infective ova and the hookworm eggs hatch to become infective larvae.

Children playing in contaminated soil can easily ingest infective ova and larvae as they place contaminated fingers in their mouths, as well as on their food. Individuals walking on contaminated soil can transport infective organisms on their shoes and slippers into their homes. Youngsters playing on floors can readily pick up and ingest infective eggs and larvae. Flies also transmit infective organisms as they move from contaminated soil to food. Vegetables grown in contaminated soil and, eaten raw, may be another source of these diseases.

The infective hookworm larvae can also penetrate the skin. Therefore, barefooted individuals can become infected as they walk on contaminated areas. Usually there is itching at the site of larvae penetration. Once the infective hookworm larvae enters the body, they are transported to the lungs by the circulatory system, they migrate up the trachea to the throat,

and enter the digestive tract by being swallowed by the infected host. Upon reaching the small intestine, the hookworm larvae attach themselves to the intestinal walls, mature, and produce eggs within 6 to 7 weeks. Persons infected with hookworms can spread the disease as long as they harbor the organisms. Fortunately, the larvae's infective period in soil is limited to several weeks.

The Ascaris helminths migrate to the lungs via the circulatory system after ingested infective ova hatch in the small intestine. Like the hookworm, the Ascaris helminths travel up the trachea, are swallowed, mature, and mate in the intestinal tract. Eggs leave the body in feces and become infective as they incubate in the soil. Both Ascaris and Trichuris ova remain infective in soil for indefinite periods of time.

Unlike the worms, the Giardia lamblia and Entamoeba histolytica are protozoa that can be transmitted directly from person to person. As trophozoites, the Giardia and E. histolytica have difficulty surviving outside the body. However, in the form of cysts, the organisms are highly resistant to environmental changes. Asymptomatic individuals harboring Giardia and E. histolytica cysts can transmit cysts to others through contamination of hands and food. Contaminated water in areas with poor sanitation facilities is often the source of infection in epidemic situations. Both types of cysts are known to resist chlorine. Giardia can survive in tepid and cold water for as long as one to three months. However, Giardia cysts can be destroyed by heating contaminated water to 122^{o} F. Authorities generally recommend that infected individuals be treated even if they are asymptomatic, due to the danger of transmitting the disease to others. E. histolytica in contaminated water can be

destroyed by iodine, high concentrations of chlorine, or boiling.

Control and Prevention

Control and prevention of parasitic intestinal infections include three major areas: 1) establishment of adequate sanitation facilities for monitoring water supply and sewage disposal; 2) education of concerned individuals re control measures, and 3) identification and treatment of infected individuals.

1. Establishment of adequate sanitation facilities: Provision of adequate facilities for disposal of feces is most important. Although Hawaii is considered to have a highly developed sanitary water and disposal system, failure to utilize the system can lead to spread of parasitic intestinal disease.

2. Education of the general public re control measures: Since the failure to utilize existing toilet facilities can contribute to the spread of parasitic intestinal infections, it is imperative that children learn to utilize toilets. Campers tenting in remote areas should be informed of the dangers of defecating in the soil.

   Campers and picknickers can learn to protect themselves by wearing shoes or slippers when walking in areas where there is a chance that soil may be contaminated with feces.

   Through learning and carrying out good personal hygiene practices, individuals can best protect themselves from becoming infected, as well as from spreading the parasites, should they harbor the infective organisms. Basic personal hygiene practices include:

   a. Always wash hands thoroughly before handling food and after utilizing toilet facilities.

   b. When using a public bathroom, turn off faucets with a paper towel after washing hands.

   c. Keep soiled hands and objects away from one's mouth.

   d. Always wash fruits and vegetables well; if plants are from areas where parasitic intestinal organisms are known to prevail, peel fruits and vegetables that are in contact with soil.

   e. Prevent flies from coming in contact with food.

Identification and Treatment of Infected Individuals

Diagnosis is based on microscopic examination of feces. Since organisms lay eggs or form cysts periodically, instead of continuously, two to three specimen at least 2 to 3 days apart is recommended. If possible, feces should be examined while warm; however, if delayed, specimen may be kept at room temperature for 2 to 3 hours and/or refrigerated for as long as 14 days or longer.

Laboratory technicians examining stools should be skilled in identifying the various types of parasites, ova, and cysts. In many situations, laboratory personnel are not familiar with organisms causing parasitic diseases.

Individuals with parasitic infections may have eosinophilia, a condition in which there is an increase in blood eosinophils. Eosinophils are a specific type of white blood cells which increase when an individual has a parasitic infection or an allergic condition. Individuals with protozoan infections such as giardiasis or long standing, chronic worm infections often do not have eosinophilia.

Infected persons may have behavioral manifestions evidenced by restlessness, irritability, fatigue, and lowered resistance to other infections such as colds and impetigo.

Parasitic intestinal infections can be treated with specific medication. It is generally recommended that, whenever an individual is found to have a parasitic infection, all members of the same household be referred for diagnosis and treatment.

Preliminary Investigation and Plans

As the Hawaii Follow Through Project Nurse, the writer first became aware of the problem of parasitic intestinal infections when Children's Hospital Out-Patient Clinic referred a migrant family of four school-aged children to her. The children's pre-school siblings were known to have hookworm infestation and giardiasis. Parents had repeatedly failed to follow through on diagnostic and treatment recommendations. Hospital personnel had requested that Follow Through (FT) Nurse urge parents to have children return to the clinic for medical attention.

Initial investigation into the problem of parasitic intestinal infections indicated that there are a number of families who fail to complete needed treatment for these diseases. Although these conditions are potentially highly contagious, children cannot be excluded from school even if they are known to be infected. Further research revealed a varying degree of opinions as to the seriousness of the problem of intestinal parasitic infections among the physicians in our community. Statements ranged from, "It's not a problem because of Hawaii's advanced sanitary facilities and parasites have considerable diffi- ty surviving outside of the human body" to "There is great danger of parasites being transmitted by unsuspecting and/or inadequately treated persons harboring organisms -- especially because a large number of migrants and immigrants are employed in food service type jobs."

A study conducted in 1974 by Mrs. H. Fantz, former Follow Through Nurse, demonstrated that 12% of 86 children receiving PE's had parasitic infections. Approximately 5% of the infections were due to pinworms; and

7% were caused by other ova and parasites.

The problem of probable parasitic intestinal infections among the children enrolled in Hawaii Follow Through Project and the need to identify these children was first presented to Mrs. Elizabeth Gilkeson, Bank Street consultant, in September, 1977. Follow Through Nurse was given tentative, verbal approval to arrange for routine stool examinations for ova and parasites (O and P) as a part of the Follow Through PE's for 1977-78 school year. At this time, the cost of stool examination quoted by Children's Hospital laboratory was $9.80 per specimen. A total of 3 specimen per child was recommended. It was estimated that approximately 75-85 children would be receiving PE's. Therefore the estimated cost for 80 children with 3 specimen per child at $9.80 per specimen was $2,352.00. (Eighty children X 3 specimen X $9.80)

Initial plans included routine stool examinations for O and P for all FT children scheduled for PE's during the 1977-78 school year. However, upon contacting Dr. Wasim Siddiqui, Ph.D., University of Hawaii, John A. Burns School of Medicine Laboratory, it was explained that the laboratory would not be able to handle a mass screening program due to lack of "manpower." Nevertheless, Dr. Siddiqui agreed to participate in a study for a selected number of children, on condition that financial arrangements and stool collection be handled through Children's Hospital laboratory. Dr. Herbert Uemura, Chief Pathologist at Children's Hospital, agreed to the stool collection at $5.50 per specimen, or $16.50 per child.

Dr. Robert Wiebe, M.D., Chief of Ambulatory Services at Kapiolani Children's Hospital, contracted to do the Follow Through PE's, recommended that children with elevated eosinophil counts of 5% or greater be referred

for stool studies.

With the preceding arrangements, it was confirmed:

1. That stool examination for ova and parasites be carried out on children with eosinophil counts of 5% or greater, for a total of 3 specimen per child,

2. That the specimen be delivered to Children's Hospital laboratory at the cost of $5.50 per specimen,

3. That the specimen be examined by the University of Hawaii John A. Burns School of Medicine laboratory personnel who are highly skilled in identifying parasitic organisms.

The following steps were formulated for this study:

1. Inform parents of possible stool examinations and explain reasons for the examinations:

   a. At the time parents consent to their children receiving Follow Through PE's; explain that stool examinations may be ordered by the doctor.

   b. If the doctor recommends stool examinations, explain to parents that elevated eosinophil counts may also be due to allergies.

   c. Request that parents assist their children in the stool collection procedures. Place emphasis on the need to keep specimen in the refrigerator if obtained on the day prior to delivery to school.

   d. Reassure parents and children of the facts that parasitic intestinal diseases can be treated adequately if detected and that an untreated, undetected condition may affect learning.

2. Arrange with teachers to permit FT Nurse to meet with children scheduled for stool studies.

3. Meet with children in small groups of 4 to 5 to explain purposes and demonstrate stool collection procedures. Provide parents with written instructions and materials.

   a. Materials: plastic container, cardboard cover, 2 tongue blades, memo to parents with instructions for stool collection, small plastic bag, and 1 sheet old newspaper.

b. Procedure:

1) Instruct children to defecate on two layers of newspaper.
2) Demonstrate how to pick up stools with 2 tongue blades and place in plastic cup.
3) Cover plastic cup containing specimen with labeled cardboard lid.
4) Place covered plastic cup in plastic bag and seal with tie.
5) Wrap tongue blades in newspaper and discard in rubbish can.
6) Explain importance of keeping specimen in a cold environment if obtained during the preceding day. Suggest placing the sealed plastic bag in paper bags and storing on lowest shelf in refrigerator. Permit children to express their views on the subject.

4. Provide classroom teachers with names of children who are to submit specimen.

5. Collect specimen at school sites once a week with provision for alternate days for children who fail to or are unable to submit specimen. Attempt to complete collection within a month.

Specimen pick up days: Kaiulani - Mondays with Wednesdays as alternate

Palolo - Tuesdays, Thursdays as alternate

6. Deliver specimen to Children's Hospital laboratory by 10:00 a.m. Refrigerate specimen that cannot be delivered within two hours after school begins.

7. Procedure to be repeated for second and third specimen.

8. Refer children with positive findings and their families to their attending physicians. Discuss control measures, significance of diagnosis and treatment regimen.

Results of the Study

The stool screening for parasitic intestinal infections involved a total of 27 children: Kaiulani 13 and Palolo 14. Although Palolo had 15 children scheduled originally, one child assigned code P6 (Palolo 6) moved to another school before the study began. (For

reference purposes, each child will be identified by either P (Palolo) or K (Kaiulani), a number, and hypothetical initials.) Data concerning this study will exclude information pertinent to child P4 PR.

The stool collection process extended over a period of ten weeks beginning on January 8, 1978 and ending on March 23, 1978. Twenty-four children completed their participation in the study with either 3 negative specimen or positive results, two submitted 1 specimen each which were negative, and 1 child failed to submit a single specimen.

Selection of Children for the Study

A total of 68 children received Follow Through physical examinations in December 1977: Kaiulani 37, Palolo 31. Of this number, 10 Kaiulani children and 15 Palolo children had eosinophil counts greater than 5 mgm %. Three Kaiulani children were added for study because of the following reasons:

1. Child K4 FB had eosinophil 3% which is normal. However, child was included in study because sibling had an elevated eosinophil count. Results were negative.

2. Child K8 RA, eosinophil 4% had hemoglobin 11 mgm % with symptoms suggesting possible anemia with some decrease in fine motor coordination during PE. According to teacher, child had been observed to "stare into space" at periodic intervals. Results were negative.

3. Child K13 MT was included in study after sibling was reported to have stools positive for Trichuris. Results were negative.

Parent Contact

In general, parents appeared to be receptive to having their children participate in the stool screening process at the time consent for the PE's was given. Several parents indicated they were experienced in collecting stools for examinations.

A total of 18 of the 27 children were accompanied by their parents or parent substitutes at the time of the PE's. Explanations concerning elevated eosinophil counts and need for stool examinations were given by the examining physician, and reinforced by the FT Nurse. Other parents were contacted by telephone or home visits. Every effort was made to communicate with parents throughout the course of the study, either in person, per telephone, and/or through written communication. In isolated situations, written communication was the major means of parent contact since parents could not be reached by phone nor through home visits.

Parent P10, SF, whose child did not submit a single specimen, agreed to the procedure at the time consent for PE was given. Nevertheless, it was quite difficult to contact the parent throughout the study. When approached early in March, 1978, following three unsuccessful home visits, parent P10 SF stated that she had reminded her child to obtain specimen repeatedly. She reassured FT Nurse that she did not object to having specimen placed in the refrigerator although child's explanation for failing to bring in specimen was parent's refusal to allow specimen to remain in it.

In five situations, parents experienced considerable difficulty in encouraging children to produce stool specimen. Child K5 MC became constipated and parent found it necessary to take child to attending physician. Parent of K6 FB threatened to deprive her child of a school excursion unless the specimen was produced. According to parents of K9 KM and P3 KC who submitted one specimen each, they talked to children, but were still unsuccessful in obtaining specimen. Another child P15 TK

took three weeks to submit the first specimen, another three weeks for the second, and two and a half for the third.

In each situation, an effort was made to convey to parents the importance of avoiding negative approaches to the stool collection procedures. It is the FT Nurse's belief that adverse feelings concerning PE and laboratory tests could affect individuals' lifetime attitudes towards medical procedures. Individuals who realize that unpleasant diagnostic and treatment procedures can be beneficial are more apt to adhere to recommended medical regime. While it was important for parents to have children submit specimen, FT Nurse felt that it was even more important to have children develop positive attitudes towards health care.

Parents were encouraged to be patient, to discuss importance of procedures with their children, and to refrain from threatening them. Parent K6 FB allowed her child to join the excursion after FT Nurse explained that the field trip was important to the child and that deprivation of this opportunity could cause the child to react negatively to the process. As a result, the child willingly produced specimen on the morning of the scheduled excursion. Subsequent specimen were obtained without problems. Child's attitude remained positive throughout the study.

Parents of children K9 KM and P3 KC, who contributed only a single specimen each, were advised to seek medical attention should their children develop gastro-intestinal symptoms, become unusually irritable or show signs of tiredness and fatigue. Significance of handwashing aspects of personal hygience was stressed. Both children had known allergic conditions -- hopefully, the only causes of the eosinophilia.

Communicating with Teachers

Teachers and educational assistants (EA's) were provided with names of children and dates specimen were to be collected. They were given and asked to distribute containers with instructions to parents one to two days prior to the collection dates. They also provided valuable assistance by reminding children to submit specimen. In addition, they reinforced personal hygiene practices in the classroom.

Contact with Children

FT Nurse met with children in small groups of five to seven children, either in an adjoining empty classroom or in the corner of their classroom. They were quite familiar with this procedure since similiar meetings pertinent to PE's such as urine collection, blood tests, and height and weight taking were conducted earlier in the semester. Children had also been informed of scheduled stool collections at the time they received their physical examinations. Brief explanations of purposes of tests were given; they were encouraged to raise questions.

Detailed instructions re materials to be used and procedures for collection were given. Children were attentive and responsive. According to a number of parents, children seemed to prefer collecting their own specimen and did not need their parents' help -- particularly the eight year olds. A majority of the children were 7 year olds.

As a result of a follow-up meeting with a group of children, the procedure was revised. Children informed FT Nurse that it was quite difficult to handle the stools with the tongue blades. Therefore, they were provided with paper cups which could be placed in the plastic cups. In this way, children could defecate directly into paper cups, place the cups with the stool into plastic containers and cover.

Children were provided with the following information concerning parasitic intestinal diseases:

1. Conditions are communicable, but spread of disease can be prevented through good personal hygiene practices and proper use of sanitary facilities.

2. Individuals are usually unaware of infections due to absence of symptoms; however, diseases can become serious in the future. Infections could cause discomfort and affect learning.

3. If identified, disease can be treated successfully with medications.

4. Individuals should not be ashamed if they are found to harbor organisms.

Collecting Specimen

Specimen collection, which extended over a ten week period, proved to be time consuming. It took approximately two to three hours on collection days to:

1. Gather specimen from individuals in the classrooms. Although children were instructed to take specimen directly to FT Nurse's office, or leave them at a designated place in the classrooms, at specific times, a number of children failed to submit specimen because they either "forgot them at home" or "could not obtain specimen." Much time was then spent in discussing importance of carrying out procedures as well as in contacting parents to enlist their help. In selected instances, home visits were made for picking up specimen. On two occasions children took specimen to school on wrong days. This necessitated going to two schools on the same day. Palolo and Kaiulani are 7 miles apart.

2. Deliver specimen to Children's Hospital laboratory which is 1.5 miles from Kaiulani School and 7 miles from Palolo School.

3. Since stool collection is considered to be a rather unpleasant task, FT Nurse hesitated in recruiting assistance from school personnel in procedures dealing with direct handling of specimen. Every effort was made to ensure cleanliness and to reduce odor from specimen. Those who expressed hints of negative attitudes were reassured of the normalcy of their feelings. However, they were informed that such procedures could help promote learning through improving health and/or may even save someone's life.

Approximately eight to fifteen hours per week were devoted to the

collection and delivery of specimen.

Test Data and Follow-up

Each child's eosinophil and hemoglobin report, allergic status, behavior manifestations, and stool test results are summarized in the attached chart. See Appendix B. The study revealed the following information:

1. Of the 27 children screened for ova and parasites, 21 children or 78%, submitted three negative stool specimen each.

2. Three children out of the 27, or 11%, did not complete the test. Two children submitted one negative specimen, one did not submit any specimen.

3. Three children out of 27, or 11%, had positive findings in their first specimen and were referred with their families for medical advice and treatment.

   a. Two children were positive for Trichuris. They were treated for their conditions.

   b. One child had stools that were positive for Giardia cysts. Child and family were referred to their attending physician who reported that treatment was not indicated at this time due to child's asymptomatic status.

Report of Health Data for Children with Positive Findings

1. Child K7 MM: Eosinophil count was 6%. Child reported to be healthy by teacher in November, 1977. Reported to have moderate hearing loss in both ears in September, 1976 but normal audiometric report in March 1978. According to parent, child visited a South Pacific island in 1973 and vomited long worms about two years prior to PE and was treated for worms at the time. Upon referral for positive Trichuris, child and family members were treated by attending physician. Medication ½ tablet Vermox twice daily for three days.

   In May, 1978, at least one month following treatment, classroom teacher was asked to complete a Teacher Health Observation form for child. Teacher observed the following: 1) spells of staring into space, 2) restlessness, 3) periodic explosive behavior, and 4) appearance of enjoying classroom cooking activities. An additional comment included "child often 'reluctant' to try solving new problems -- e.g. will say 'I don't know how!' even before instructor begins. Child also speaks in very loud voice -- often to the point of shouting."

2. Child P1 LC: Eosinophil count was 5%. Found to have serous otitis media, runny nose, and dental caries at the time he was given his PE. Gross motor coordination was normal although questionable fine motor coordination.

   In December, 1977, the teacher observations included 1) persistent runny nose, poor hearing or ear discharge with somewhat poor coordination in handwriting.

   Child and family were referred to attending physician for positive Trichuris, as well as for impetigo like lesions, on January 26, 1978. Child was treated for Trichuris. Approximat one to two weeks following treatment, child's teacher questione FT Nurse re medication given.

   "What miracle drug did the doctor give P1 LC?" Teacher remarke that "child seemed like another person -- where he was unable to concentrate for more than 5 to 10 minutes, child could now sit for as long as an hour and work on the same thing." Teacher also noted marked improvement in P1 LC's coordination as exhibited in his handwriting.

   In June, 1978, child continued to display positive behavior; nasal condition had improved. Teacher commented, "Child has ma much gain in his work habits. His handwriting shows better coordination -- handwriting legible. Listening habits have improved."

3. Child P8 CJ: Eosinophil was 5%. Child found to be healthy upo PE with many scars due to eczema. Had ears pierced about 1½ years earlier with resulting reaction to earrings. Teacher noted that child appeared to be healthy in October, 1977. However, as FT Nurse met with children in small groups, child seemed to be quite restless with short attention. Friendly, verbal behavior was also displayed.

   Prior to submitting specimen, child P8 CJ had been ill with diarrhea. Stool specimen submitted was positive for Giardia cysts. Child and family were referred to attending physician for treatment. Upon receipt of physician's report, M.D. had written "no treatment indicated due to asymptomatic status."

Discussion Pertinent to Findings

Although the charts in Appendix B are inclusive, this discussion will be limited to children with positive stool specimen. Prior to beginning this study, the writer had been under the impression that individuals with parasitic intestinal infections were always anemic.

Both literary research and this study seem to indicate that this is not necessarily the case. In Hawaii, hemoglobin count of 12 mgm-% is considered to be normal. Readings for the three children positive for ova and parasites are as follows: Child K7 MM, 11,7; Child P1 LC, 12,3; and Child P8 CJ, 13.

In reviewing the descriptions of the children, it seems that further investigation into K7 MM's behavior is warranted. One would have anticipated an improvement in her behavior. Perhaps the child had not been treated adequately or could have a recurrence. Her loud talking may be environmental since her parents are known to be quite boisterous. Although her hearing report was normal in 1978, she does have a history of past abnormal hearing.

Although Child P8 CJ's attending physician felt that treatment is not indicated due to child's asymptomatic status, review of the literature by authorities in the field strongly suggest treating all Giardia cyst carriers due to the dangers of transmitting the disease to others. Physicians vary in their school of thought on this matter. There is a risk involved with the medication used for treating giardiasis. There are physicians who believe that reinfection is highly likely because of a high prevalence of Giardia lamblia in Hawaii, and it is not worth the risk of treating a symptomatic individual who may easily become infected again. Under these circumstances, it is most important that parents be informed of the symptoms of giardiasis so that they may seek medical attention should they occur. Since giardiasis generally does not affect the eosinophil count, on the basis of Child P8 CJ's history of eczema, one might infer that an allergic condition may have been responsible for

the child's 5% eosinophil.

Based on P1 LC's dramatic improvement in behavior immediately after treatment, the writer believes that, in this situation, parasitic intestinal infection did affect Child P1 LC's health to the extent that it handicapped the youngster's ability to learn at an optimum rate.

Parasitic conditions can lower one's resistance to a disease, thus causing children to have frequent infections such as runny nose and impetigo. Perhaps, even poor fine motor coordination may be a subtle clue to poor health. In the absence of dramatic abdominal symptoms, an eosinophil count coupled with below-par behavior may be the only indication of possible parasitic infections.

Conclusion

Three out of 27, or 11% of the children screened for parasitic intestinal infections at Kaiulani and Palolo Schools during the 1977-78 school year had positive results with a chance that there may be two additional children left undetected. It is imperative, in view of possible infectious cases within one's own environment, that everyone practice good personal hygiene measures at all times. This is especially critical where children participate in cooking activities at school. One cannot over-emphasize the importance of proper handwashing before handling foods, as well as after using toilet facilities. Parasitic intestinal infections are contagious and proper handwashing can help prevent transmission of the disease.

Although authorities recommend three stool specimen, in the Follow Through study, all three children were identified with positive findings

with the first specimen. However, it is important to require the usual multiple number of specimen as long as funds are available to insure accuracy of diagnosis.

This study has shown that parasitic intestinal infections can affect how children learn and perform in school. Children with infections may show signs of poor motor coordination, restlessness and inability to sit still, and inability to focus on school work. It is important to follow up such signs with recommendations for medical check-up. With proper diagnosis and treatment, a child with a parasitic intestinal infection can be cured and relieved of discomfort to the extent that he/she can attend to school work unhampered by poor health.

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APPENDIX A
PROJECT FOLLOW THROUGH

8/78

Medical Component — Kaulkeolani Children's Hospital

Teacher's Health Observations

Name of Pupil_____ School_____ Team_____

Date Form Completed_____ Teacher_____

Status: FT___ NFT___

Circle the code number and underline the specific observations which are descriptive of this child.

Code No.	Behavioral Characteristics	Code No.	Behavioral Characteristics
1.	Consistently absent from school.	22.	Frequent urination, wets pants, or soils self with bowel movement.
2.	Unclear speech.	23.	Underweight or skinny.
3.	Spells of inattention, staring into space.	24.	Overweight or obese.
4.	Sleepy, lethargic, inactive, sluggish or often fatigued.	25.	Short for age.
5.	Nervous, jittery, restless, tics or grimacing.	26.	Tall for age.
6.	Withdrawn, shy, or unusually compliant.	27.	Appears ravenous at lunch or snack time.
7.	Aggressive, boisterous, involved in classroom conflicts, or fights.	28.	Takes more food than he can eat.
8.	Temper tantrums, impulsive or explosive behavior.	29.	Refers in conversation to food eaten at home.
9.	Poorly coordinated, clumsy.	30.	Steals food from other children.
10.	Pale or sallow skin.	31.	Eats leftover food on another child's plate with or without teacher/child permission.
11.	Persistent skin rash.	32.	Stops at store or vending wagon to purchase food items on way to or from school.
12.	Sores on skin.	33.	Brings non-nutritious lunches/ snacks to school.
13.	Many bruises.	34.	Is reluctant to try a new food.
14.	Frequent colds.	35.	Indicates dislike for or refuses to eat foods served at school.
15.	Persistent cough, wheezing, shortness of breath.	36.	Has allergic reactions to certain foods.
16.	Persistent runny nose.	37.	Arrives at school without breakfast.
17.	Poor hearing or ear discharge.	38.	Appears to enjoy classroom cooking activities.
18.	Poor oral hygiene, halitosis, or many decayed teeth.		
19.	Poor body hygiene.		
20.	Headaches.		
21.	Stomachaches, vomiting.		

What is your opinion of this child's health?

_____ Healthy

_____ Specific Problem(s) as Noted but Generally Healthy

_____ Not in Good Health

Further Observations and explanation of items circled above.

CHART: SUMMARY OF DATA Appendix B

EOS- Eosinophil
HGB- Hemoglobir

CODE NAME	LABORATORY TEST EOS %	HGB.	PARENTS ATTENDED	KNOWN ALLERGIES PHYSICAL EXAM.	TEACHER HEALTH OBSERVATION BEHAVIORAL CHARACTERISTICS	O'A & TEST
K1 AW	5	12.4	Yes	None PE-normal	Restless Healthy	3 ne
K2 SA	7	11.7	Yes	Allergic to raw fish, shrimp, chicken, penicillin, Asthma PE-normal	Healthy	3 neg
K3 BS	5	12.5	Yes	PE-normal	Healthy	3 neg
K4 FB	3	12.1	Yes	PE-Healthy Sibling had elevated eos	spells of inattention staring into space nervous, jittery, restless, tics or grimacing	3 neg
K5 MC	11	12.0	No	PE- normal Strabismus--under care of M.D.	Cross-eyed	3 neg
K6 FB	6	12.1	Yes	Allergic to milk in infancy PE-hearing loss, with nerve damage dental caries-under care	Healthy	3 neg
K7 MM	6	11.7	Yes	PE-normal. History of worms 2 years ago	Healthy	2 spec positi Trichu Referr treat

CHART: SUMMARY OF DATA--Cont'd Appendix p.

CODE NAME	LABORATORY TEST EOS %	Hgb Mgm %	PARENTS ATTENDED	KNOWN ALLERGIES PHYSICAL EXAM.	TEACHER HEALTH OBS. BEHAVIORAL CHARACT.	OVA & PARASITE TEST RESULTS
C8 RA	4	11.0	Yes	Asthma as a small child PE-some decrease in fine motor coordination, staring spells-vision?	Healthy	3 negative
C9 ML	18	12.4	No	Under M.D. care for allergy, seen monthly On Benadryl as needed. Ecaema. PE--essentially well	lethargic, allergic child--on anti-histamines	1 negative
C10 MM	13	10.9	Yes	Asthma-onset at 3 yrs. History of low blood count PE-impetigo Referred for low hgb- Attending physician's report--thalassemia	frequent colds	3 negative
K11 AD	5	12.8	Yes	Allergy-skin rash under care of M.D. PE-normal except for skin	nervous, jittery, restless or grimacing	3 negative
K12 IS	6	13.0	No	Reacts to mosquito bites. PE-question otitis media, otherwise normal	jittery, restless, tics or grimacing	3 negative
K13 MT	1	11.4	Yes	No allergies. Healthy child Sibling positive for Trichuris	Healthy	3 negative
P1 LC	5	12.3	No	No allergies PE-rhinitis, congested pharynx, cavities	persistent runny nose, poor hearing or ear discharge; handwriting coordination (?)	1 positive for Trichuris Referred and treated

CHART: SUMMARY OF DATA--Cont'd Appendix p.

CODE NAME	LABORATORY TEST EOS %	Hgb Mgm %	PARENTS ATTENDED	KNOWN ALLERGIES PHYSICAL EXAM.	TEACHER HEALTH OBS. BEHAVIORAL CHARACTER.	OVA & PARASIT TEST RESULT
P2 TM	6	11.6	No	History of asthma, well since 6 yrs. PE-slow child, neuro problems, vision-tend toward exophoria	spells of inattention, staring into space, eyes seem crossed, slow in grasping concept being taught, healthy	3 negative
P3 KC	10	11.7	Yes	Bronchitis at 2 mo. PE-normal	Healthy	1 negative
P4 HM	6	13.1	Yes	No allergies PE-orthodontic malocclusion	Healthy	3 negative
P5 LJ	5	11.8	Yes	Asthmatic in infancy	Healthy	3 negative
P6 PR	Elevated eosinophil--moved to another school					
P7 AA	8	12.1	Yes	Asthmatic --last attack 2 years ago PE-pulmonic sounds--referred for cardiac evaluation, old impetigo scars	Healthy	3 negative
P8 JA	5	13	No	Eczema for 1½ years PE-normal with many scars	Healthy	1 positive for Giardia cysts Referred--physician reported "no treatment indicated in asymtomatic status"

CHART: SUMMARY OF DATA--Cont'd Appendix p.

CODE NAME	LABORATORY TESTS EOS % Hgb Mgm %	PARENTS ATTENDED	KNOWN ALLERGIES PHYSICAL EXAM.	TEACHER HEALTH OBS. BEHAVIORAL CHARACT.	OVA & PARASITE TEST RESULT
P9 FF	10 12.2	No	No known allergies PE-normal with dental caries	Poor oral hygiene, halitosis, many decayed teeth; refers in conversation to food eaten at home; arrives @ school without breakfast	3 negative
P10 SF	6 12.1	No	No known allergies PE-normal	Involved in classroom fights, Generally healthy	No specimen
P11 TR	5 11.9	Yes	History of eczema and asthma until 5 years PE-needs dental care	Nervous, appears to be driven by desire to excel in academics	3 negative
P12 KR	15 12.5	No	Allergic to shoyu PE-Frail, small child with pyuria and mild hearing loss, frequently absent	shy, skinny or underweight, short for age	3 negative
P13 TM	5 11.9	Yes	Asthma--last attack 1 year ago; WBC in urine-and abscess on chest-referred for f.u.; treated for worms 4 years ago	aggressive; tall for age; arrives @ school without breakfast	3 negative

CHART: SUMMARY OF DATA--Cont'd Appendix p.

CODE NAME	LABORATORY TESTS ROS%	Hgb Mgm %	PARENTS ATTENDED	KNOWN ALLERGIES PHYSICAL EXAM.	TEACHER HEALTH OBS. BEHAVIORAL CHARACT.	OVA & PARASITE TEST RESULT
P14 PA	7	12.0	Yes	Asthma-allergic to milk PE-0-2 Red Blood Cells in Urine, Repeat in 1 year	Pale skin; arrives @ school without breakfast	3 negative
P15 KT	5	12.4	Yes	No known allergies PE-slightly obese; scarred tympanic membrane left ear	spells of inattention, staring into space; sleepy; nervous, jittery, restless; aggressive; impulsive Sleeps late at night Hearing defect	3 negative

APPENDIX C
PROJECT FOLLOW THROUGH

MEMO TO: _____

FROM: _____

SUBJECT: Stool Specimen Collection

DATE: _____

As explained during the physical examination, we will need a stool specimen (doo doo) from your child _____ (name) on _____ (date).

I am sending home a plastic container and two tongue blades to help you collect the stool.@

1. Collect stool (doo doo) with tongue blades.*
2. Place stool in plastic cup and cover tightly.
3. Wrap tongue blade in newspaper and discard in rubbish can.
4. It is important to keep the stool specimen in a cold place if it is collected the night before your child brings it to school. A good place is the refrigerator. Place the container with stool in a paper bag and place in refrigerator. It will be clean and will not affect the food in the refrigerator. (I know this gives you a funny feeling but it is a safe way of doing this. Just be sure the paper bag and your hands are clean.)
5. Have your child bring the specimen to school on _____ (date)

@ Materials were labeled with child's name and identification number and placed in baggies for children to take home. Specimen were placed in baggies and paper bags by the children.

* As a result of the discussion with the children (see p. 18), the procedure was changed to include:
  1. Collect stool (doo doo) by defecating directly into paper cup.
  2. Place cup with stools into plastic cup, then cover tightly. with cardboard lid.
  3. Wash hands well with soap and water.
  4. Place container with stool specimen into baggie and tie.
  5. It is important ...clean.)
  6. Have your child ...school on _____.