

## Status and control measures of pinworm infections among school children in the Republic of Marshall Islands (2018)

<b>Project</b>	Status and control measures of pinworm infections among school children in the Republic of Marshall Islands (2018)	<b>Author</b>	Department of Molecular Parasitology and Tropical Diseases, Taipei Medical University, Taiwan Prof., Chia-Kwung Fan, LL.M., Ph.D. ; Technician, Ai-Wen Yin
<b>Date</b>	2018/10/20-2018/11/12		

### Part One. Project Goal : Epidemiological investigation and control on pinworm infection for primary schoolchildren in the Republic of Marshall Islands

1. Pinworm samples collection : 2018/10/23-2018/11/6
2. Pinworm samples examined at laboratory: 2018/10/31-2018/11/6
3. Paper publication — 「*Enterobius vermicularis* infection: prevalence and risk factors among preschool children in elementary school in capital area, Republic of the Marshall Islands」 is under preparation for publication.

### Part Two. Performing contents and progress:

#### Working schedule of epidemiological investigation and control on pinworm infection for primary schoolchildren in the Republic of Marshall Islands

Date	Time	Status
10/20(Sat)	7:40-11:55	Arrival in Guam (TPE-GUM)
	13:20 ~	Stay at Guam for one night.
10/21(Sun)	7:40~	Transfer from Guam to Majuro (GUM-MAJ)
	15:30-17:00	Due to aircraft mechanical failure, return to Guam
	18:50~	Fly to Majuro
10/22(Mon)	2:30	Arrived in Marshall, Ms. Wang, Yingting (Ingrid), a nurse at the Taiwan Health Center, come to pick up to hotel.
	3:00-3:30	Check-in Lojkar hotel
	11:30-12:00	Go to Taiwan health center in the Republic of the Marshall Islands at Majuro Hospital
	12:00-14:00	Buy Internet and cell phone credits
	14:00-17:00	Inform consent explanation conference in Laura ES-Majuro
	17:30-18:30	Go to Woja ES-Majuro, confirm screening schedule with principal.
10/23(Tue)	10:00-13:00	Screening at Laura ES-Majuro (approximately 80 students)
	12:00-14:00	Lunch
	14:00-17:00	Prepare inform consents, screening instruction sheets, and print student roster
	17:30-18:30	Inform consent explanation conference in Ajeltake ES-Majuro
	18:45-19:45	Prepare inform consents, screening instruction sheets, and print student roster
10/24(Wed)	9:00-10:30	Screening at Ajeltake ES-Majuro (approximately 50 students)
	11:00-12:00	Organize the checklist, questionnaire, and consent form
10/25(Thu)	9:00-12:50	Prepare inform consents, screening instruction sheets, and print student roster
	14:00-17:00	Samples examined at hospital laboratory
	18:00-20:00	Purchase daily consuming necessity
10/26(Fri)	9:30-11:00	Go to Rairok ES-Majuro, confirm screening schedule with principal.
	13:30-17:00	Screening at Ajeltake ES-Majuro again (approximately 40 students)
10/27(Sat)	9:45-16:00	Organize the checklist and document the results of the questionnaire
10/28(Sun)	9:45-16:00	Organize the checklist and document the results of the questionnaire

10/29(Mon)	10:00-14:00	Screening at Woja ES-Majuro (23 students)
	14:30-17:30	Organize the checklist, questionnaire, and consent form
	17:45~18:20	Screening at Laura ES-Majuro again (approximately 40 students)
	18:00~19:00	Go to Majuro Baptist ES-Majuro, confirm screening schedule with principal. (However, upon arrival, it is found that the previously confirmed explanation and screening time need to be rescheduled.)
	19:10-19:20	Counting screening materials
10/30(Tue)	9:00-15:00	Organize the checklist and document the results of the questionnaire
10/31(Wed)	9:00~13:00	Specimen examined at hospital laboratory
	14:00~17:00	Organize the checklist and document the results of the questionnaire
	17:30~19:00	Inform consent explanation conference in Delap SDA-ES-Majuro
11/1(Thu)	9:00-11:50	Screening at Delap SDA-ES-Majuro ( 32 students)
	15:30-18:00	Organize the checklist, questionnaire, and consent form
11/2(Fri)	10:00-17:30	Organize the checklist and document the results of the questionnaire
11/3(Sat)	10:00-17:00	Specimen examined at hospital laboratory, organize the checklist and document the results of the questionnaire
11/4(Sun)	9:00-11:00	Organize the checklist and document the results of the questionnaire
	13:30-16:30	Specimen examined at hospital laboratory, organize the checklist and document the results of the questionnaire
	18:00-21:00	Dinner
11/5(Mon)	9:00-11:00	Inform consent explanation conference in Majuro Baptist ES-Majuro, and screening (27 students)
	15:00-18:00	Specimen examined at hospital laboratory, organize the checklist and document the results of the questionnaire
11/6(Tue)	9:00-11:00	Organize the checklist and document the results of the questionnaire
	14:30-18:00	Specimen examined at hospital laboratory, organize the checklist and document the results of the questionnaire
	18:00~	Dinner
11/7(Wed)	11:00~12:30	Training course for med technicians held by Prof. Fan at Majuro hospital (1 <sup>st</sup> day)
11/8(Thu)	11:00~12:30	Training course for med technicians held by Prof. Fan at Majuro hospital (2nd day)
11/9(Fri)	11:00~12:30	Training course for med technicians held by Prof. Fan at Majuro hospital (3rd day)
	14:00-18:00	Report the screening results and the plan of next 2-yr project of head lice screening and control to Mrs. Julia, Principle Secretary, Ministry of Health, RMIs
11/10(Sat)	10:00-17:00	Visit Julia's personal islet
11/11(Sun)	10:00-13:00	Packaging
	19:00~	Fly to Honolulu (HNL)
11/12(Mon)	3:00~	Arrived in Honolulu, stay one night (Local time)
	7:30~19:00	Back to Taiwan (HNL-TPE)

### Three. Project assessment:

#### 1. Method :

In the epidemiological investigation and control project on pinworm infection for primary schoolchildren in the Republic of Marshall Islands (RMI), six primary schools in the island were enrolled to screen for pinworm infection in Majuro, the RMI capital. Yingting Wang, a nurse at the Taiwan Health Center in RMI, first contacted and communicated with principals the school screening program, inviting parents to participate in the screening briefing session, and after the briefing session, parents were free to choose whether or not to agree their kids to participate in the project. However, parents who failed to attend the briefing meeting will reserve a paper consent form, which will be forwarded to the parents by the principal or teacher, to decide to join or not after reading the informed consent. To cooperate with the schools, Ingrid, parasite team, and Marshallese nurse arranged sufficient time for them to participate in medical examinations, questionnaires interview, etc.

Since we have cooperated with public and private schools in the parasite screening program in the past few years, we have established a good connection and consensus. School principals and teachers are very willing to assist this project, and they all actively communicate with parents to remind them to join. By the help in translation from Marshallese nurse, most parents show good recognition of the screening program.

#### 2. Epidemiological investigation and control project on pinworm infection for primary schoolchildren in the Republic of Marshall Islands (RMI):

Totally, six primary schools in the island were enrolled to screen for pinworm infection in Majuro. Perianal specimen was collected by adhesive scotch tape method and the clothes site of belly and hip and the grounds and tables in the classroom were inspected by using cellophane tape method to detect any ova contamination. We divided into two different areas of rural and urban. Among them, WES [Woja], LES [Laura] and AES [Ajeltake] are classified into the rural area, while RRES [Riorak], MBCA [Rita] and SDA [Delap] are classified into the urban area.

The total positive infection rate of pinworm infection in this study was 11.8% (41/346) (Table 1 & Figure 1), and the prevalence in each region was as following: 4.3% (1/23) in WES [Woja], 25.0% (29/116) in LES [Laura], 4.5% (4/89) in AES [Ajeltake], 3.4% (2/59) in RRES [Riorak], 7.4% (2/27) in MBCA [Rita], and 9.4% (3/32) in SDA [Delap], respectively. Noteworthy, one case was found to have whipworm co-infection. In the questionnaire survey of the risk factors in the residential area, students who live in the rural area (15.35%, 35/228) have significantly higher prevalence than those who live in the urban area (5.93%, 7/118) ( $p = 0.01$ ). It may be explained by that some schools such as LES, MBCA and SDA have not completed the deworming campaign before our screening that the infection rate may be influenced (Table 2).

In addition to anal examination, the thumb inspection was also performed to collect samples from the left and right thumb of each kid, and only one suspected of pinworm egg was detected (Figure 2A, B).

According to the results of this screening project, both public and private primary school children actually have acquired pinworm infection and need to be aware of this severeness. In addition, family members are also required to receive treatment simultaneously to prevent the pinworm transmission between families.

In general, disease caused by *E. vermicularis* is relatively innocuous. Nevertheless, ova deposition may cause perineal, perianal, and even vaginal irritation that such a

constant itching may make infected persons to try to relieve irritation thus possibly leading to potentially debilitating sleep disturbance, impaired concentration, emotional instability, or enuresis. However, known serious consequences, these uncomfortable symptoms can result in weight loss, urinary tract infection, and even acute or chronic appendicitis which may lead to death without appropriate surgical treatment. Therefore, children who exhibit perianal pruritus and nocturnal restlessness should be suspected of pinworm infection.

In view of the strong and long sunny time daily in RMI, the recommended prevention method is to expose the quilts and other items outdoors for at least 2 hours to kill the pinworm ova that may contaminate the above substances. Moreover, the classroom will be cleaned by the teacher after class every day. It can reduce the pinworm transmission in the classroom, and educate the school teachers about this knowledge about how to reduce the possible pinworm contamination is also urgently needed. Regularly expose the tables and chairs of the classroom under the sun time for at least 2 hours is very effective in reducing the pinworm transmission.

In line with the WHO public health policy, MCH nurses regularly conduct the deworming campaign by giving each primary school child one tablet of Albendazole twice per year, including vitamin A supplement. In addition, girls of grade 6 will be arranged to receive the cervical cancer vaccine (HPV vaccine). Since Albendazole is mainly used to treat soil-transmitted helminths, present results of this screening indicate the pinworm infection rate is still high, reaching 11.8% (41/346) that regular and continuous screening and treatment are needed to reduce the repeated and persistent pinworm infection in school children.

#### **Four. Follow-up:**

In general, disease caused by *E. vermicularis* is relatively innocuous. Nevertheless, ova deposition may cause perineal, perianal, and even vaginal irritation that such a constant itching may make infected persons to try to relieve irritation thus possibly leading to potentially debilitating sleep disturbance, impaired concentration, emotional instability, or enuresis. However, known serious consequences, these uncomfortable symptoms can result in weight loss, urinary tract infection, and even acute or chronic appendicitis which may lead to death without appropriate surgical treatment. Therefore, children who exhibit perianal pruritus and nocturnal restlessness should be suspected of pinworm infection.

A previous study indicated that personality changes can be frequently observed in pinworm-infected children who felt shameful and inferior due to having 'worms'. However, children's discomfort is often overlooked by parents, despite pinworm infection may cause developmental and/or health problems. In particular, mothers can become distraught when they thought their child being infected by worms. Therefore, to treat pinworm infection can improve the quality of children's life, and the campaign for prevention and control measures against pinworm is recognized positively by the majority of parents.

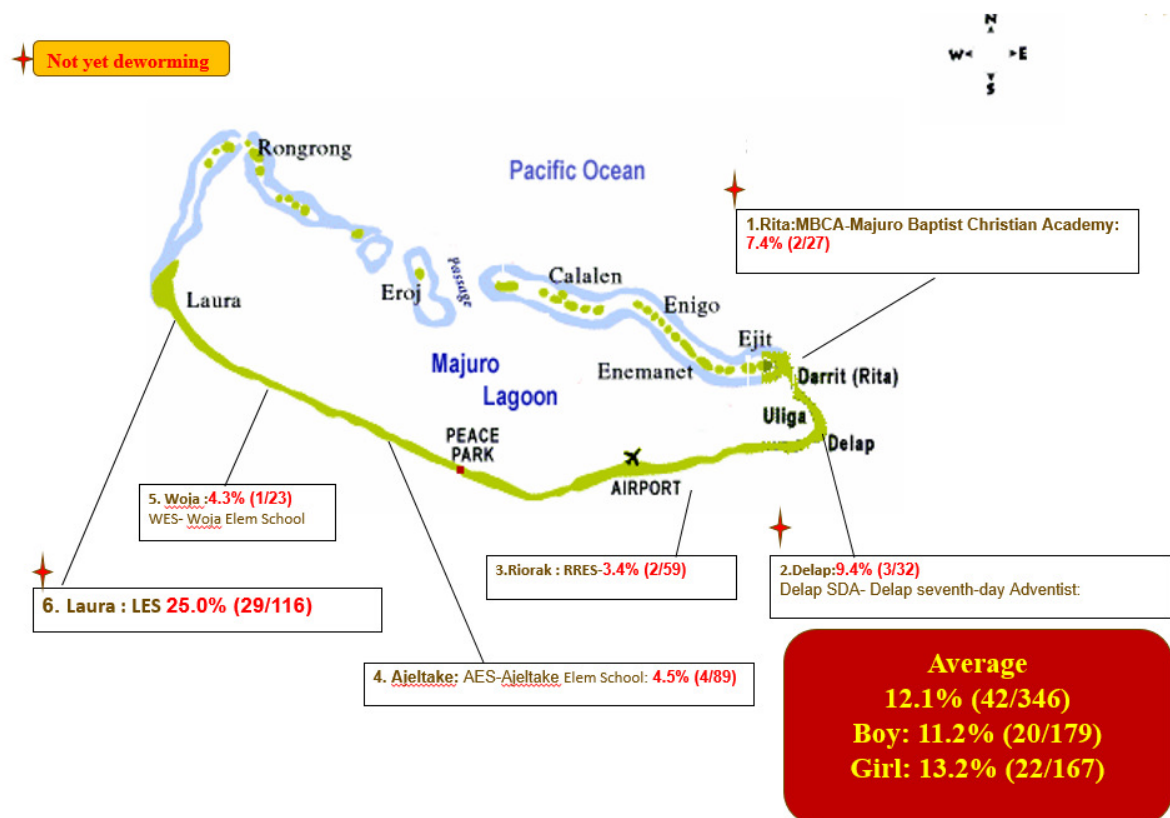
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**Table 1. Prevalence of pinworm infection among primary school children in Majuro, RMI**

SCHOOL	TOTAL STUDENT	SLIDE RESULT(E.V)	POSITIVE RATE
LES	116	29	25.0%
AES	89	4	4.5%
WES	23	1	4.3%
RRES	59	2	3.4%
SDA	32	3	9.4%
MBCA	27	2	7.4%
<b>TOTAL</b>	<b>346</b>	<b>410</b>	<b>11.8%</b>

**LES: Laura ES-Majuro**  
**AES: Ajeltake ES-Majuro**  
**WES: Woja ES-Majuro**  
**RRES: Rairok ES-Majuro**  
**SDA: Delap SDA-ES-Majuro**  
**MBCA: Majuro Baptist ES-Majuro**

**Figure 1. Map shows the prevalence in the participant primary school in Majuro**

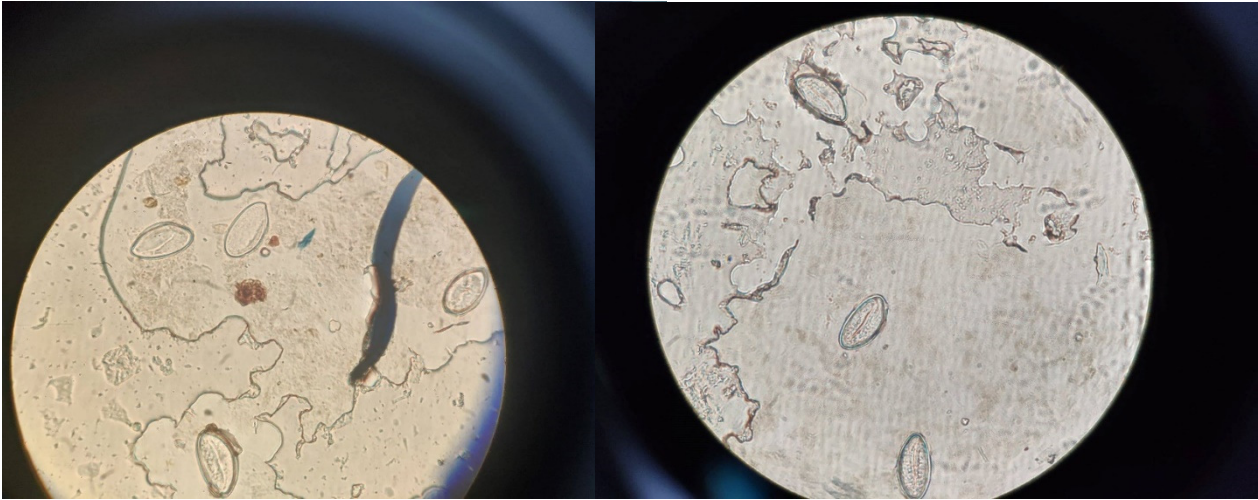


**Table 2. Risk factors analysis for pinworm infection among primary school children in Majuro, RMI**

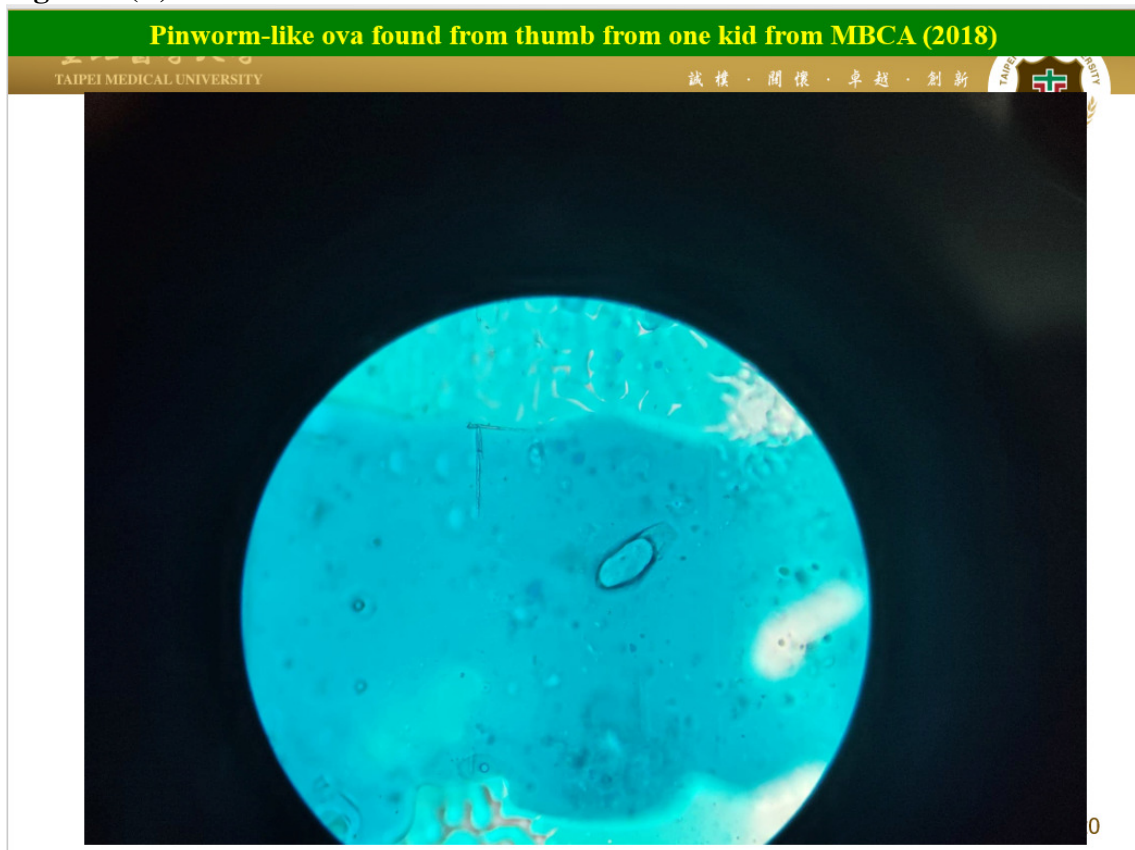
Variables	EV		p-value*
	Positive Case	Infection Rate (%)	
<b>Gender</b>			
Female (N=167)	22	13.17	0.56
Male (N=179)	20	11.17	
<b>Age</b>			
<= 8 yrs (N=143)	17	11.89	0.9
> 8 yrs (N=203)	25	12.32	
<b>URBAN</b>			
No (N=228)	35	15.35	<b>0.01*</b>
Yes (N=118)	7	5.93	
<b>Father's Occupation</b>			
No (N=55)	8	14.55	0.65
Yes (N=268)	33	12.31	
<b>Mother's Occupation</b>			
No (N=236)	33	13.98	0.1
Yes (N=103)	8	7.77	
<b>Having elder brother</b>			
No (N=93)	10	10.75	0.68
Yes (N=251)	31	12.35	
<b>Having elder sister</b>			
No (N=111)	9	8.11	0.13
Yes (N=232)	32	13.79	
<b>Having younger brother</b>			
No (N=131)	14	10.69	0.57
Yes (N=212)	27	12.74	
<b>Having younger sister</b>			
No (N=160)	18	11.25	0.71
Yes (N=183)	23	12.57	
<b>Total (N=346)</b>	<b>42</b>	<b>12.14</b>	

\*: Chi-square test

**Figure 2 (A) Pinworm ova detected by "Scotch tape test" and examined under microscope 400x:**



**Figure 2 (B) Pinworm-like ova found from the thumb of one child in MBCA**



## 2. Training course of diagnostic skill on pinworm infection for medical technicians:

During the three-day pinworm diagnosis and identification course, a total of 8 technicians participated in the pre-test using PPT and their average score was 46.25 (Table 3A, B). Six technicians participated in the post-test and then the test results were 58.33 points (Table 3A). The score improves 12 points, indicating their progress in diagnostic ability after the training course. The training course helps the technicians of the medical laboratory of MCH improve the diagnostic skills. The director of the laboratory, Paul and the technicians participated in this course quite enthusiastically.

However, due to the busy working schedule in the hospital, how to arrange the appropriate training course hours for the technicians to learn more effectively remains a big challenge that needs to be discussed more.

**Table 3 (A) Pre-test and Post-test of Technician in Majuro Hospital**

Pre-test		Post-test	
人次	score	人次	score
1	60	1	70
2	70	2	80
3	50	3	50
4	0	4	40
5	40	5	60
6	50	6	50
7	50		
8	50		
<b>Average</b>		<b>Average</b>	
46.25		58.33	

**Table 3 (B) Program of Training Workshop for Technician in Majuro Hospital  
Training Course for Diagnosis of Intestinal Parasites & *Enterobius vermicularis*  
Infection (2018)**

**Professor, Chia-Kwung Fan, LL.M, PhD**

*Department of Molecular Parasitology and Tropical Diseases, Taipei Medical  
University, Taiwan*

**Location: Lab Med Department, Majuro hospital**

7th WED	8th THU	9th WED
<b>11:00-11:50</b> 1. PPT examination (70%) 2. Microscopic examination (30%)	<b>11:00-11:50</b> Current status of Intestinal Parasites & <i>Enterobius vermicularis</i> Infection among pre-schoolchildren and prevention measures in Marshall Islands	<b>11:00-11:50</b> <b>Post-test</b> 1. PPT examination (70%) 2. Microscopic examination (30%) <b>Certificate Awarding</b>
<b>11:50-12:40</b> Introduction of Intestinal Parasites & <i>Enterobius vermicularis</i>	<b>13:00-13:40</b> Status of Intestinal Parasites & <i>Enterobius vermicularis</i> Infection among pre-schoolchildren in Taipei, Taiwan	
<b>12:40-13:00</b>		



Introduction of how to perform MIF & prepare a glass adhered with Scotch tape for pinworm infection.		
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**Five. Difficulty, challenge and required improvements during project execution**

Prior to commence of the screening campaign, negotiation should be given to school and parents. After finalized agreement, we may need more manpower to participate in this activity e.g., add extra 2 personnel to our team will be much beneficial to our work effectiveness because it will be helpful to expedite our examination efficiency and obtained more specimen for analysis. Moreover, if Marshallese MOH may assign extra 2 public nurses to help in this project will be beneficial to our work flow.

**Six. Suggestions for similar plans in the future:**

Due to the many times in collaboration experience between parasite team and MOH, their understanding on routine screening of parasitic infections for schoolchildren in many participant schools and public nurses of MOH is very well. To our suggestions, MOH nurses may undertake the screening activity annually and regularly like what we had done the pinworm screening for primary school children with low grades in the past time in Taiwan and this campaign must be allocated into one of their annual items for children’s health examination. It will have benefits in reducing the pinworm transmission through intensively active treatment of infected children along with a public health education under the inadequate hygienic environment. In addition, our screening project undertaken in October may benefit the annual deworming activity performed in May and September, respectively by MOH, RMI as to further help evaluate the deworming effectiveness.

**Seven. Others**

**Prof., Chia-Kwung Fan, LL.M., Ph.D.:**

Neglected tropical diseases (NTDs) have been formally recognized as a target for global action towards the Sustainable Development Goals (SDGs) aiming to end the epidemics of HIV, tuberculosis, malaria and NTDs by 2030. Present study has established collaboration and help with Marshallese Health Ministry to establish the baseline data regarding pinworm among Marshallese schoolchildren through mutual collaboration with Public Health Department to fulfill the missions of SDGs 3 and SDGs 17. Altogether, mass screening should continue and treat infected schoolchildren and their family members all are important measures in control of pinworm infection in RMI.

**Technician, Ai-Wen Yin :**

This year, we conducted screening for pinworm infections in public and private primary school children in Majuro, the Republic of the Marshall Islands. We thanked MCH public health nurse and a nurse from Taiwan health center in Majuro, Ingrid, for their assistance, including screening instructions and translation. Including the communication with the principals of the schools in advance, and drafting the time course for the inspection, so that the screening plan can be a complete success. This is the second year of the pinworm screening. Compared with the previous results, it can be found that the positive rate of pinworm infection is significantly reduced, and the

infection rate before giving deworming drugs and the difference after giving deworming drugs can be compared due to the different deworming time of each school. It is believed that there is an important part of the parasitic epidemic prevention of the Republic of the Marshall Islands, and also can treat infected children actively. Furthermore, though the communication with parents and schools to achieve the concept of promoting health education.

### **Eight. Overall assessment**

Due to the WHO will give an ABZ to schoolchildren in RMI in March and September, respectively each year, but they do not follow up the deworming effectiveness, so the outcome in reducing the parasites infection is unclear. It just gives our team a chance to help WHO examine their deworming effectiveness. Present study finds the prevalence is still a little bit high in LES (25.0%, 29/116), MBCA (7.4%, 2/27) and SDA (9.4%, 3/32) because the drug administration has not yet accomplished before we start the screening. Therefore, the infection rate was higher than that of the drug administrated school. We also found that one of the child's thumb suspected of having pinworm ova contamination. During Prof. Fan's report to the Julia, Deputy Health Minister, she also mentioned that there are so many appendicitis cases whether appendicitis is caused by pinworm infection should be seriously evaluated since pinworm infection may lead to the possibility of appendicitis. Prof. Fan's reports indicate that 51518 appendectomy cases in a clinical study, 2308 cases were found to have pinworm infection, accounting for 4.5% of the total of 51518 appendectomy cases. Julia emphasized again that there are many patients with appendicitis, whether it is caused by pinworm infection should be further investigated.

It is recommended that in addition to treatment of the infected children, all family members should also receive medication and clean the home environment, including bed sheets, quilts, underwear, etc., because of the long sunshine time in RMI can provide the benefits in killing any contaminated pinworm ova. To expose them under the sunshine for at least 2 hours should be able to kill the pinworm ova. In addition to effectively killing the larvae of the pinworms, it can avoid repeated infections. It also has killing effects on allergens such as dust mites. This method is an affordable and effective control measure. It's simple and does not cost money. In addition, hand sanitization is also an important way to prevent infection. The public health nurse conducts a pinworm screening once a year for kindergarten and elementary school children, and the laboratory medical technicians assist in the examination of the specimen and the treatment of the infected patients by the physician, all are important ways contributing to greatly reduce the infection rate of pinworm in schoolchildren. Our achievement and prevention advice received Julia's support and thanks.

### **Nine. Acknowledgements**

Ambassador Hsiao and all of the staffs, Embassy of Republic of China (Taiwan) in Republic of the Marshall Islands

Ms Yin-Ting Wang, nurse & manager, Taiwan Public Health Center in Republic of the Marshall Islands

Ministry of Health and Welfare, Republic of China (Taiwan)

Taipei Medical University-Shuang-Ho Hospital, Republic of China

(Taiwan)

Ministry of Health, Republic of the Marshall Islands

Majuro Hospital, Ministry of Health, Republic of the Marshall Islands

Mr. Ramson, Nurse, Ministry of Health, Republic of the Marshall Islands

Taiwan Technical Mission in RMI, Republic of China (Taiwan)

Tomorrow Medical Foundation

## **Ten · Appendix**

### **1. Explanatory meeting of pinworm screening project for parents**







2. Perianal specimen collected by adhesive scotch tape method and the thumbs inspected by using cellophane tape method to detect any ova contamination and questionnaire interview



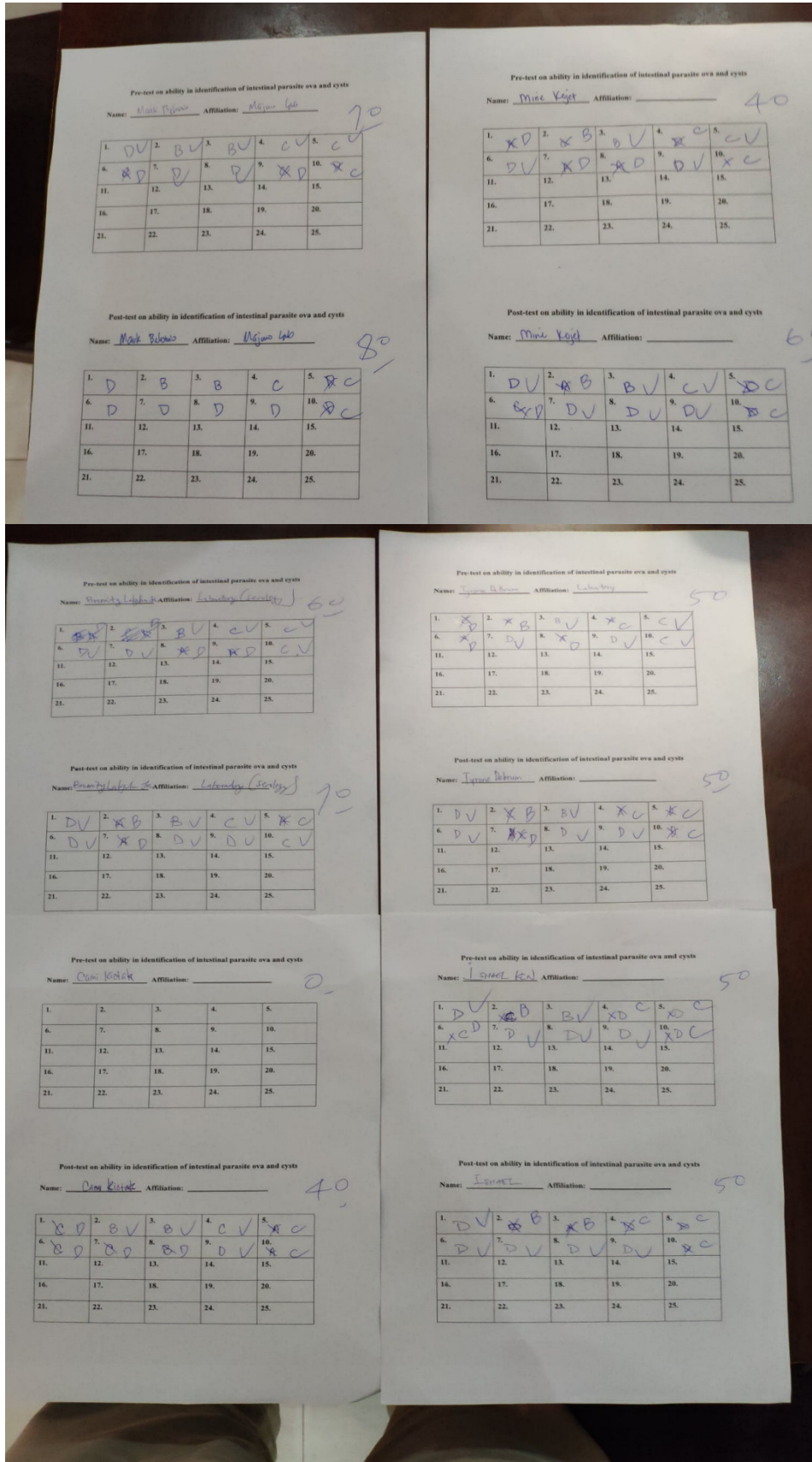




**3. Training course of diagnostic skill on pinworm infection for medical technicians and participation certificate awarding**



#### 4. Scores of pre- and post test from participant technicians during the training course





**5. Prof. Fan reported to Julia, Deputy Health Minister, RMI**



**6. Prof. Fan reported to Ambassador Hsiao, Embassy of Republic of China (Taiwan) in Republic of the Marshall Islands**

