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An Achievement Report on the Years 2001-4 Bacillary Dysentery Prevention & Control Program for Mountainous Rural Areas of Taiwan

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Abstract

By the year 2001 there were still many cases of Bacillary dysentery being reported each year in many mountainous rural areas of Taiwan. The incidence of that disease in those particular areas was often ten or even hundreds of times greater than elsewhere or in non-mountainous areas. Therefore, Bacillary dysentery was then commonly recognized as one of the major communicable diseases in the mountainous rural areas and somewhat of a social embarrassment.

The Taiwan CDC wanted to act on this problem, so it launched a comprehensive "Four-year Enhanced Bacillary Dysentery Prevention and Control Program Specially Targeted at Selected Mountainous Rural Areas," which consisted of a host of different measures including improving a health-supporting environment and proceeding with a multi-channel health education campaign, upgrading hygiene awareness of residents and cultivating healthier behaviors, reinforcing the on-the-job training with regard to prevention and control for local healthcare workers, establishing a much tighter disease surveillance system, and improving environmental sanitation and hygienic agricultural behaviors. The objective was to curb the outbreak rate of Bacillary dysentery in those prevalent areas. After four years of intensive joint efforts by all concerned, we were happy to find at the end of 2004 that the annual number of Bacillary dysenteric cases in those targeted rural areas was successfully cut down by 84% from the previous five-year cumulative case number average. At that point, the annual record of total Bacillary cases per one hundred thousand mountainous area residents over the past consecutive eight years was 31.3, 42.3, 51.5, 55.4, 325.8, 79.0, 16.9, and 15.8, which represented a positive trend that clearly indicates Bacillary dysentery in those areas may be well under control by the end of the program.
Key words: Taiwan, mountainous rural areas, Bacillary dysentery, and prevention and control program.

Introduction

Bacillary dysentery is a bacterial enteric transmittable disease caused by infection with *Bacillary dysenteriae*. Within one to three days after the infection, the affected may display symptoms like diarrhea, fever, nausea, vomiting, cramps or seizures, and tenesmus. Sometimes toxemia is also associated with shigellosis.

A typical dysentery case would have traces of blood, mucus, and pus, formed by bacterial colonies, in the stool. Some patients also suffer from watery diarrhea [1]. Similar to *Salmonella typhi*, *Bacillary dysenteriae* has no natural reservoir hosts, and the disease is transmitted from person to person (usually among children) primarily through direct contact. A person may also become infected through eating food contaminated with the causal agent. Bacillary dysentery has an extremely low infectivity dose, less than 200 organisms may cause infection, and it is, therefore, highly communicable [2]. In an early observation, it was very much emphasized that this disease could be easily transmitted through direct contact or by minute contamination transmitted by insects [3]. Another study conducted much later by Wharton, et al [4] on many cluster outbreaks concluded by deduction that a great many subsequent cases were infected by nothing more than having direct contact with bacterial carriers to a various extent, and infants, toddlers, and children often being the original infection source [5]. Therefore, to prevent and control Bacillary dysentery from frequently breaking out and becoming epidemic in the future, it is apparently necessary to work on a multi-front approach that seeks improvements in personal hygiene, drinking water quality, environment sanitation, and various living/eating habits simultaneously, to be hopefully effective.

In the past few decades, people and government agencies in Taiwan region have made all kinds of public health efforts and implemented many epidemic prevention measures. Along with continuing improvement in environmental sanitation and the general public's living standard, the incidence of many formally familiar enteric infectious diseases such as cholera, typhoid fever, paratyphoid fever, amebic dysentery, and hepatitis A has been diminishing gradually among the general public as a whole. However, hepatitis A and Bacillary dysentery still

remained quite prevalent in mountainous rural areas. In view of this, Department of Health (DOH) first launched a sustained vaccination program of hepatitis A in mountainous rural areas in June 1991. Consequently, we started to see an obvious decrease in case numbers of the disease among the residents there in 1997, and by the end of 1998 the incident rate in those mountainous rural areas decreased even further, becoming lower than that in the non-mountainous regions. But despite that good news, there were still too many Bacillary dysentery cases occurring each year in some remote mountainous rural areas, and in fact Bacillary dysentery one of the most important infectious diseases there. The incidence of Bacillary dysentery in those areas remained extremely high and was often several tens or even hundreds of times greater than that of the non-mountainous areas.

Bacillary dysentery infection has many negative effects on the local community as well as the entire country. Not only is it a serious problem affecting individual health, but also a substantial economic burden to the individual's family, community or tribe, as well as the country. As the disease manifests itself in the form of diarrhea, fever, vomiting, and other uncomfortable symptoms, the patient would not be able to work for several days, making a serious impact on the family's income. If the patient is sick enough to be hospitalized, somebody has to pay for the medical services. Besides, Bacillary dysentery can have a very significant negative effect on the business of tourism of the mountainous rural areas. If this disease is not eradicated or diminished, it will pose a potential hazard to the health of visiting tourists. Furthermore, the occurrence of Bacillary dysentery outbreaks is bad for the country's image, as the disease is globally much more common in regions where public environment hygiene facilities are less than ideal compounded by poor individual hygiene habits of the local population, notably represented by underdeveloped regions in

Southeast Asia and Africa. Taiwan is supposed to have already become a developed country with a current average annual income per capita of as much as fourteen thousand US dollars, yet the actual incidence of Bacillary dysentery was still too high a figure to match its “developed-country” status. Therefore, it was indeed somewhat of an idealistic, patriotic move of the government to protect Taiwan’s image and national pride in the international arena, in addition top the more fundamental motive, to better assure the health of our fellow citizens in the mountainous rural areas.

In view of this, the Taiwan CDC set out in 2000 to formulate a “Four-year Enhanced Bacillary Dysentery Prevention and Control Program Specially Targeted at Selected Mountainous Rural Areas,” and initiated the task in 2001 with the close collaboration of the health bureaus responsible for those mountainous rural areas, in the hope that the prevalence of Bacillary dysentery infection would eventually be diminished through the implementation of this program.

Materials and methods

Definition of a confirmed Bacillary dysentery case

Laboratory examination of stool or rectal swab specimens from the patient has resulted in positive identity of *Shigella dysenteriae*.

Analysis of previous outbreaks (1997-2000)

During the time period from 1997 to 2000, there was a total of 1632 reported cases of Bacillary dysentery in Taiwan (see Table 1). The more detailed annual incidence statistics of the disease for the two different geographic regions are summarized as follows: the annual rates of confirmed cases for the mountainous rural area for those four consecutive years were 31.3, 42.3, 51.5, and 55.4 cases,

respectively, per each one hundred thousand people, while their counterparts among the non-mountainous areas were only 1.5, 1.5, 0.4, and 0.9 cases instead per hundred thousand people. And the population living in the mountainous area was basically much the same throughout this period of four years, remaining at about one percent of the total Taiwan population. More precisely it was 0.95%, 0.96%, 0.97%, and 0.97% for the respective years. Therefore, we can appreciate that the incident rates in the mountainous area turned out to be about 21, 28, 120, and 65 times the rates of its non-mountainous counterpart in the same years. There is no doubt in anyone's mind that the disease was much more serious in the mountainous rural areas than elsewhere (see Figures 1, 2, 3, and 4).

As to the age distribution of Bacillary dysentery patients, the largest age group, during the four-year period surveyed, which stood out among the reported cases in the mountainous area was the 0-4 year old group. In the year 1997 the actual case number of this group was 30 and this accounted for 46% of the total case number of that year. Likewise in 1998, the same age group contributed 41 cases, which accounted for also 46% of the total. In 1999, the age group had 41 cases accounting for 37%, while in 2000 there were 51 cases accounting for 43%. From a broader viewpoint, we see that about two thirds of all cases were under 14 years of age. The exact figures were as follows: in 1997, 40 reported cases were below age 14 and accounted for 62% of the total, whereas in 1998, 1999, and 2000, the under-14 age group numbered 57, 76, and 85 and they accounted for 64%, 69%, and 71%, respectively. Therefore generally speaking, most shigellosis cases in those mountainous rural areas of Taiwan were under 14 years of age (Table 2 and Figure 5).

When comparing incident rates of Bacillary dysentery patients of different sexes in the four years examined, we found that in 1997 there were 26 males and

37 females, so the male/female ratio was 1:1.4. Likewise, in the years 1998, 1999, and 2000, male versus female case numbers of the year were 33 to 52, 47 to 56, and 42 to 69, also the ratios were 1:1.6, 1:1.2, and 1:1.7, respectively. As shown in Figure 6, as long as all age groups of the afflicted in the period between 1997-2000 were considered, other than the majority age group of 0-14, the trend seemed to be that a female was more likely to be infected than a male.

When analyzed from the point of view of locality, the outcomes are shown in Table 3 as well as Figures 7 and 8. Briefly, the so-called mountainous rural area Bacillary dysentery most frequently occurred in certain mountainous rural areas under the administration jurisdiction of six counties, namely Ilan County, Taoyuan County, Hsinchu County, Nantou County, Hualien County, and Taitung County.

If we look at the number of cases which occurred in each month of the period, we find that in the year 1997, the monthly case number was above average in seven months, i.e. April, May, June, July, August, September, and November. Likewise, the months in 1998 with an above average case number were May, July, August, September, November, and December, and those months in 1999 were January, July, and October, while those in 2000 were June, September, November, and December. Therefore, in those four years, the months which appeared two times on the four above-average-case-number-month lists are May, June, August, and December, and months that appeared three times on the four lists are July, September, and November. That leaves January, February, March, April, and October being months either mentioned just once or not at all on those lists. In other words, we can see the trend that Bacillary dysentery infection was less likely to take place in the spring season.

To sum up, we understand that the incidence rate of Bacillary dysentery was

much higher in mountainous rural areas than elsewhere in Taiwan. It often broke out in mountainous rural areas in Ilan County, Taoyuan County, Hsinchu County, Nantou County, Hualien County, and Taitung County. Most victims were children under 14 years of age, but among those above 14, females are more likely to contract the disease. Although the disease incidence appeared to be low in the spring months of January to April, the remaining months of the year were more favorable for the disease to spread, but no other clear seasonal variations seemed to exist for the epidemic (Table 4 and Figure 9).

Problem analyses

According to the findings of field epidemiological investigations and results of prevention and control programs carried out by the Taiwan CDC and local health units in the previous year, though Bacillary dysentery was indeed very common in many mountainous rural areas, it was not common in all of them. The reason for those rural areas having an exceptionally high incidence is closely related to their practicing of tribal culture, basic survival environment, and economic activities.

For example:

(I) Tribal characteristics and living customs of different indigenous people: Since the disease is very highly communicable and has an extremely low infectivity dose, as low as 10 to 100 organisms may cause infection, it is very easy for the disease to be transmitted and to circulate among family members and physical contacts, should personal hygiene habits be unsatisfactory. Records show that communities with a higher incidence of Bacillary dysentery infection are those of the Thao people, in particular. The reasons behind this fact may be because the Thao people are accustomed to eating raw food and they like to

share food in outdoor settings. In addition, they use hands instead of tools like chopsticks or cutlery when they eat. All these factors may facilitate the transmission of diseases among members of the family and neighbors in the same community.

(II) Erroneous and false concepts about disease by indigenous people: Many of them do not give much thought to diarrhea, for one. Some of them even believe that children need to have diarrhea from time to time in order to grow up properly. Therefore, when they spot the signs of outbreaks of Bacillary dysentery, they think of it as a blessing from the gods and don't want to do anything about it or to see the doctor for help. That is one major reason why Bacillary dysentery spreads so easily within the family, community, and in school settings.

(III) The issue of drinking water: According to a statistics assembled in 1998, there was a great discrepancy in the availability and popularity of use of tap water facilities between the mountainous rural areas and elsewhere. Namely, the coverage was only 31.2 per cent in those rural areas, whereas that in the non-mountainous areas it averaged 90.6 per cent. Some mountainous rural areas did have the so-called "simplified" tap water setups, which unfortunately often lacked the ideal management they needed, and the quality of water provided was in fact not considered up to par. Besides, many indigenous people claimed they did not care for the smell or taste of tap water and moreover did not like the idea of having to pay extra for it, so they would rather follow the traditional way of drinking directly from "free" spring water in the mountains. This water would not be first boiled before use. Consequently, not only should the government continue to push for an increase in the availability of tap water in remote locations and improve the

management of existing tap water systems to better its quality and safety, it seems even more important that the authorities should educate the indigenous residents to get used to drinking boiled water, in order to at least avoid contracting transmittable diseases through contaminated drinking water.

(IV) Environment sanitation issue: Many residences in the affected rural areas were equipped with the most primitive type of toilets, i.e. lacking septic tanks and appropriate disposal facilities for human waste. The random disposal of untreated excrement would very easily lead to environmental pollution and water source contamination. In extreme cases, spring water pipe lines had been installed right inside ditches for drainage, and the spring water would be very easily polluted before reaching homes. In addition, there is normally no functioning public garbage disposal system to rely on and wastes would be dumped at some sites close by to residences, which become in no time the breeding grounds of flies and other disease-carrying insects. These contaminated insects might carry pathogens around freely onto exposed food around the neighborhood because few houses have screens installed on doors and windows.

(V) Agricultural economy activities: The economic crops planted in those areas are mainly high mountain grown vegetables and temperate fruits. Because chemical fertilizers are expensive, local farmers often purchase cheaper, not composted, raw chicken manure to fertilize, and this practice leads to the breeding of a great many flies that facilitates further the spread of all kinds of disease pathogens. Another negative factor is the fact that the vegetable fields or fruit orchards in the mountains are mostly situated far away from home. Although there are usually shelters nearby the work place, they are of a very primitive type and seldom have toilets and hand-washing facilities.

Therefore, farmers are obliged to empty their bowel or urinate wherever it is convenient, and that would easily result in water source pollution or pathogen spread.

(VI) Issues concerning people seeking medical attention and disease reporting: Many indigenous people have erroneous ideas about diseases and consider diarrhea not a major issue, therefore do not seek the attention of a doctor. Even if they do, the transportation in those rural areas is anything but convenient, and accessibility to medical facilities is poor to say the least; many indigenous folks choose not to have health insurance coverage at all because they cannot afford the minimal monthly premium. All these factors of course cause them be much less willing to consult a doctor when they feel ill. On the other hand, some medical workers working in the area are apathetic about reporting cases (because they see too many of them), which also has slowed down the outbreak surveillance and retarded the prevention and control efforts for this disease.

Duration of the program implementation

This prevention and control program was officially launched on January 1, 2001 and ended on December 31, 2004.

Goals set for this program

We hoped that by the end of 2004, we would be able to lower the incidence of Bacillary dysentery infection in the targeted mountainous rural areas from the previous five-year average by at least 50% and eliminate the epidemic of the disease in the said areas.

Political motivations behind this program

(I) Increasing the prevention and control of a disease of high incidence among the indigenous people.

(II) Looking after disadvantaged indigenous ethnic groups in our society by protecting their rights to enjoy good health.

(III) Putting emphasis on the prevention stage of disease control, thus hopefully reducing the cost of medical treatment, and avoiding the tremendous overall social costs by hindering the disease from turning into one of epidemic proportions.

(IV) Improving the environmental conditions by assisting indigenous tribes in their current efforts to develop the business of local tourism in a broader sense and increasing their average economic productivity more practically by reducing their sick leaves.

Preset targets to be reached each year:

1. At the end of 2001, our goal is that the Bacillary dysentery annual case number in those thirteen targeted rural areas has been successfully reduced to less than 75% of the previous five-year cumulative case number average.
2. At the end of 2002, our goal is that the Bacillary dysentery annual case number in those thirteen targeted rural areas has been successfully reduced to less than 65% of the previous five-year cumulative case number average.
3. At the end of 2003, our goal is that the Bacillary dysentery annual case number in those thirteen targeted rural areas has been successfully reduced to less than 55% of the previous five-year cumulative case number average.
4. At the end of 2004, our goal is that the Bacillary dysentery annual case number in those thirteen targeted rural areas has been successfully reduced to less than

50% of the previous five-year cumulative case number average.

Strategies employed by this program

1. In order to efficiently reach the above preset goals of this program, Taiwan CDC formulated the following prevention and control strategies:

2. In 2001, based on the actual outbreak records of Bacillary dysentery cases occurring in recent years in all mountainous rural areas of Taiwan, we chose thirteen rural areas in six counties with the worst affliction records as the targeted principal rural areas for staging this program. The chosen rural areas include Nanao and Datong in Ilan County, Fuhsin in Taoyuan County, Chanshih and Wufeng in Hsinchu County, Renai and Hsinyi in Nantou County, Hsiulin, Chaohsi and Wanjung in Hualien County, and Haituan, Dajen and Lanyu in Taitung County. Later in 2002, we also expanded the program coverage to add some rural areas in Chiayi County, Kaohsiung County, and Pingtung County, which had sporadic cases before, as the “enhanced prevention and control” region.

3. We arranged for those six targeted county health authorities to get together and organized a so-called “Promotion Taskforce for Prevention and Control of Mountainous Rural Area Bacillary Dysentery,” and asked them to pitch in and share the workload and responsibilities of carrying out the program to their maximum capabilities.

4. In accordance with the need for an ongoing tribal health-improving project, we trained and motivated local volunteers in mountainous communities to take part in a sanitation and health educational campaign.

5. We also recruited concerned community groups to participate in the sanitation and health educational campaign.

6. We held related activities such as household sanitation contests and

community model home exhibits to enhance the awareness of the villagers to actively clean up their own environmental conditions and always keep them clean and tidy.

7. We initiated seminars about Bacillary dysenteric prevention and control and drinking water sanitation at local institutions and organizations (including schools and long-term care institutions) and disease prevention personnel at local health stations to increase their knowledge about this particular disease.

8. We made an effort to reinforce the health education provided for the local healthcare workers, so that we would be able to, as a team, keep alert, maintain and control the overall situation, miss no case reporting if disease occurred, and react by initiating the prevention and control procedures as early as possible.

9. We put emphasis on the efficiency and effectiveness of health education offered to local students and common villagers. The purpose in so doing was to change the unhygienic living habits in order to avoid contracting diseases derived from those habits.

10. We established a much improved surveillance system and put it to work by closely monitoring the communicable diseases in those targeted areas to better handle outbreaks, avoid reporting blunders, proceed to effective prevention and treatment, and eventually fulfill the goals of disease control and eradication.

11. We set up a laboratory testing support system for those targeted rural areas so that we could detect and track cases of the disease as well as asymptomatic bacteria carriers to prevent secondary infections and epidemic spreads from occurring.

12. Every season of the year, there would be a regular review meeting on mountainous rural area Bacillary dysentery held to discuss progress made and problems which emerged up in the past three months.

13. At the end of each year, there would be an annual evaluation session focusing on what has been accomplished and what failed to keep those six counties alert. This session would also reveal difficulties and problems each county encountered, offer encouragement to the counties performing well, and provide chances for less successful performers to learn from others.

Detailed tasks to be carried out in 2001-2004:

1. A special subsidiary fund would be distributed in those targeted rural areas to help with the construction of basic sanitation facilities, such as upgrading drinking water piping, water drainage or disposal facilities, household hygiene improvements, and adding hand-washing facilities.
2. Each involved county in the program would establish a mission-oriented county prevention workgroup that should routinely hold annual and seasonal review meetings within their own jurisdictions.
3. The Taiwan CDC would hold countrywide regular yearend and end of season review meetings of the mountainous rural area Bacillary dysenteric prevention and control programs.
4. Motivating local volunteers to take part in the programs: In all the aforementioned thirteen targeted mountainous rural areas, namely Nanao and Datong in Ilan County, Fuhsin in Taoyuan County, Chanshih and Wufeng in Hsinchu County, Renai and Hsinyi in Nantou County, Hsiulin, Chaohsi and Wanjung in Hualien County, and Haituan, Dajen and Lanyu in Taitung County. Later in 2002, we also expanded the program coverage to add some rural areas in Chiayi County, Kaohsiung County, and Pingtung County, and some additional other later added mountainous rural areas in Chiayi County, Kaohsiung County, and Pingtung County, volunteers would be recruited,

trained, and put in the program to assist in the efforts.

5. Holding health education campaigns by giving lectures to the public on living environment, habits of hygiene, and agricultural behaviors: Altogether during the four years of this program, we held a total of 4343 lectures of such kind in the nine counties, i.e. Ilan, Hsinchu, Taoyuan, Nantou, Chiayi, Kaoshiung, Pingtung, Taitung, and Hualien, involved in this program.
6. Increasing the frequency of lectures offered on disease reporting protocols for healthcare workers: During the four years of this program, we held a total of 458 lecture sessions in the above-mentioned nine participating counties.
7. In all targeted thirteen rural areas, a widespread propaganda campaign was mounted for program promotion through the creating and showering of the region with flags, flyers, posters, and large billboards of a health education nature.
8. Setting up laboratory supporting systems in Nantou County, Hsinchu County, and Ilan County.
9. In the three counties included later in the program, the local health bureaus held countywide painting contests on the subject of prevention and control of mountainous region Bacillary dysenteric infections, and transformed the winning paintings into large health educational billboards. In this way, the campaign was rich in the culture and character of the indigenous people, and elicited a popular response.
10. At the yearends of 2002, 2003, and 2004, the three later added counties conducted their own annual achievement evaluations and contests.

Accomplishments

This “Four-year Enhanced Bacillary Dysentery Prevention and Control

Program Specially Targeted at Mountainous Rural Areas" duly finished its course at the end of 2004. In that final year, the total number of people afflicted with Bacillary dysenteric infection in mountainous rural areas of the nine counties was 36, only about 16 per cent of the cumulative average of the prior five years, or 223 cases per year. In other words, the incidence of the disease was reduced by a remarkable 84% at the closure of the program (Table 5).

And if we counted the grand total of Bacillary dysentery cases reported in all mountainous rural areas of Taiwan, there were only 38 in 2004. Our record shows that for all mountainous rural areas alone, the yearly incidence rates of the disease in 1997-2004 were 31.3, 42.3, 51.5, 55.4, 325.8, 79.0, 16.9, and 15.8 cases per one hundred thousand people. This also indicates that Bacillary dysentery was under good control by the end of the program (Figure 10).

In summary, through the carrying out of this particular disease prevention and control program, by means of the use of a multi-channel health education campaign, the results included altering the residents' general awareness and attitude towards sanitation and health, nurturing healthier behaviors, strengthening on-the-job training of healthcare workers, establishing a more efficient disease surveillance system, improving environmental sanitation and agricultural behaviors, greatly reducing the incidence of Bacillary dysentery outbreaks in the mountainous rural areas, and savings on large medical expenditures as well as other social costs associated with the treatment and the consequences of this particular disease. Moreover, this program enabled the indigenous people to enjoy more of their "God-given" human rights of being in better health and freedom from contracting wretched diseases, minimizing their sick leaves and the resulting economic damage to their wallets, improving overall environmental sanitation of the mountainous rural areas, facilitating the

development of tourism of the local tribes, enhancing their economic activities, and bringing in more cash revenue to the indigenous people. At the same time, due to the reduced chances of *S. dysenteriae* finding "easy" hosts in Taiwan, the overall picture of our shigellosis control among the entire population will certainly benefit tremendously.

Discussions

Generally speaking, risk factors determining the susceptibility of a population towards Bacillary dysentery relate to the personal hygiene and habits of its members, environmental sanitation, the health sustaining environment, the way water is consumed, the individual's age, sex, and season of the year. Additional distinctive factors include certain inferiorities of living conditions and basic sanitary facilities experienced by residents of those targeted mountainous rural areas as compared with those elsewhere. Aside from some factors particularly related to the indigenous people such as certain traditional tribal characteristics, living customs, hygienic habits, and misconceptions about diseases, other factors influencing disease spread include the remoteness of the location, the lack of tap water and toilet facilities, which are often of lower quality, even if present, and therefore resulting in lack of popularity of usage, inferior treatment of human excrements and waste water disposal, lack of control of disease-carrying flies in the surroundings, less than ideal methods of food preservation, large scale usage of not composted raw chicken manure as fertilizer for crops, incorrect attitudes toward obtaining universal health insurance, hardship for residents when seeking medical services, less than average professionalism of local clinicians about dealing with diseases, and the less than enthusiastic disease reporting by the local doctors when outbreaks occur.

Altogether the above-stated factors make the prevention and control of Bacillary dysentery an extremely challenging task.

In order to efficiently prevent Bacillary dysentery from occurring in mountainous rural areas, the most essential measures are: establishing better health awareness among local residents, building up good personal hygienic habits, improving living environment and drinking water sanitation, and perfecting the methods of disease outbreak monitoring and reporting. Therefore, practically the program had many issues to deal with, and those issues had to be accomplished in an orderly fashion. The Taiwan CDC made a decision to focus its efforts in the first year of the program on improving basic sanitary facilities in the targeted areas, awakening the local community to the involved health issues, starting relevant health campaign trials, and combining local resources and opinions to formulate a mutually agreed-upon feasible strategy and methodology. And then the remaining three years were spent on forcefully carrying out the campaign through various channels within a framework planned in the first year. Those channels included community activities, enlisting the help of churches, schools, hospitals and clinics, volunteer recruiting, concerned social groups, and school clubs. The key was to take advantage of local humanitarian traits, geographic character, ethnic groups, and customs in designing various kinds, styles, and interfaces of health education methodology. The ultimate goal was to improve the living conditions and habits of hygiene of the local populace. At the same time, we did everything possible to strengthen the continuous on-the-job education of public health epidemic-preventing personnel to be meticulous and dependable healthcare workers at medical facilities in general, to improve outbreak monitoring resulting in quicker response in order to curb potential epidemics, and last but not the least, to enhance local medical capabilities, which

are, of course, essential for the perfection of any disease prevention task.

To deal with a program of such complexity involving as many as nine county administrations and even more numerous mountainous rural areas each at a quite different location, involving different ethnic tribes, and different cultural backgrounds, we recognized right away that administrative communication and coordination must be preeminent. In order to allow every strategic mission and task appointment from headquarters effectively reach the front line epidemic prevention personnel stationed at the local health units, and the difficulties and problems they later encountered to be reported back swiftly and in time for appropriate answers and solutions, we scheduled a routine work review meeting once every three months, in which representatives of those involved counties each gave a report on the progress of the program in areas under its jurisdiction and also presented the incidents of individual and cluster outbreaks having occurred in the past season for group discussion at the meeting. In this way we hoped that helpful ideas would emerge from the participants of the meetings to solve the problems, including altering the set rules or course of the program to make the progress more smooth and goals easier to reach.

Since this program involved different localities and different ethnic indigenous people, we had to take those differences into consideration as we formulated the game plan in the first place. As a rule of thumb we had in mind to tenaciously adhere to the goals set in the program but being flexible in the means of reaching those goals. For instance, in the health education part of the plan, we stipulated that the responsible county health bureau should go about it in a multi-channel fashion, i.e. taking advantage of all opportunities like the participation of schools, churches, community events, hospitals and clinics to reach out to the people, but as to the kind of activity and its campaign content, we

rather left that to the discretion of the local health bureaus. They were expected to adequately and effectively link up the subject of Bacillary dysentery infection prevention with their local cultural background, using special language, and folk wisdom to purposefully reduce doubts and resistant attitudes among the local residents, and eventually attract their active participation. Again, what we insisted on was getting the mission accomplished, which in this case was having folks educated about the disease.

Another challenging issue we at the Taiwan CDC had to face was how to keep on inspiring those colleagues working at the involved county health bureaus and the front line health units to carry out this four-year program wholeheartedly and without reservations. At the least we tried to minimize indifference or even defiance on their part, which would definitely harm the final results of the program. Having this in mind, we started from the second year or 2002 to hold three Bacillary dysentery prevention and control in mountainous rural areas program in process yearend review and evaluation sessions. The purpose was to look into a multitude of ongoing details including the number of health education propaganda sessions held, creativity of health education propaganda activities, achievements reflected by questionnaire results of public opinion about people health education propaganda, decreasing rate of case numbers, volunteer worker management, and control procedures following an incident of an individual case or cluster infections. For those counties having done an excellent job of disease control in the previous year, we honored them with an official trophy award in the annual national disease prevention meeting. Not only did we keep on reminding the local health bureau chiefs to take this program seriously, but also rewarded those front line disease control personnel who excelled in their performances with prizes and money. Also during the program campaign period, the related staff

members of the Taiwan CDC and its regional branches frequently visited the targeted rural areas to take part in the campaigning activities planned and executed by the local government. This gesture passed on an important message that the central government was no less concerned about the well being of the program than the local populace and determined to see that the front line prevention and control workers continue to perform at their best and show their highest combat spirit.

Incidentally, when performing yearend reviews and evaluations we discovered something very interesting. On each and every such occasion, we would have those involved staff members of the Taiwan CDC and its regional branches gathered as a team to visit the nine rural areas of the three later added "intensifying control" counties, to conduct a questionnaire investigation for the purpose of finding out how much the local school pupils and community residents knew about Bacillary dysentery in mountainous rural areas. This event actually held other significance as well. For instance, members of the team sent out to conduct the questionnaire survey were the people working at the Taiwan CDC head office in Taipei City and its regional branches in other major cities who were assigned to this very program. Their duties were supervising and helping out those county health bureaus to perform the task. During this questionnaire investigation, however, they had the chance to be on site themselves and behold the real situation in person. This personal experience allowed them to get an intimate feeling toward the subject and inspire them to seek for hidden problems and discuss them. We believe this move was an excellent unexpected opportunity of on-the-job training, learning, and information exchange for those colleagues, and it could vastly improve their capability and competitiveness in handling and processing their responsibilities. Through this direct contact

experience, they would realize intimately that the conducting of health education campaigns was not just a bunch of numbers of variations and sessions, but the key point was that the local disease control personnel must be willing to shoulder the responsibility of effectively impressing those ideas on the minds of the targeted audience; thus it was necessary to make their best efforts all the time, both physically and mentally, to perfect each and every campaign activity. And we sincerely believe that these review and evaluation trips were one of the most important contributing factors towards the success of this program. Now, one may wonder how much the targeted public really understood about the issue anyway. We would like to show a few figures here to give some idea of this. According to the data gathered in Hualien County targeted mountainous rural areas at yearends of 2002, 2003, and 2004, such awareness of the local population turned out to be 68%, 68%, and 76%, respectively, and that of 4th-6th graders of local elementary schools was 66%, 87%, and 80%. Our interpretation is: Data shows that expanded educational execution of health campaigns did have a positive effect on the targeted audience on understanding the campaign issues more correctly.

On the other hand, the main theme of each yearend review and evaluation was a large conference, to which all involved county health bureau chiefs and their front line workers were invited; each county was expected to make a presentation with written backup reports on what it had done in the past year. The proceedings were under the close scrutiny of all parties present at the conference, which included of course, supervisory personnel from the CDC headquarters and its regional branches, but more importantly, hands-on rank and file health workers from other counties who could answer some of the most practical questions. The attendees were in a sense taking part in a competition, yet even more, the meeting

provided them with opportunities to learn, exchange opinions, for discussion, and eventually cooperation. Overall the yearend review and evaluation turned out to be a great occasion which helped boost the morale of all workers involved in the program.

Conclusion

At all events, this program was fortunate enough to have overwhelming support from all involved county health bureaus and stations, CDC regional branches, supervising Department of Prevention and Treatment, Center for Research and Diagnostics, and leading officials of the CDC, and successfully completed a mission of extremely great challenge. A lesson we learnt from this program is that in order to have such a disease prevention and control program ending with success, certainly we need a well formulated plan and implementing methods in the first place, but besides that, critical factors include the sanction and support of the leaders at all levels of health authorities and the rank and file employees as well who really “handle” the program, the smoothness of response, communication, and coordination between all involved parties at different levels, and of course reasonably sufficient funds to pay for all the planned activities. Fortunately, this program possessed all those critical, factors, and after four years of hard work the annual number of Bacillary dysenteric cases in those targeted rural areas was successfully reduced by 84% from the previous five-year cumulative case number average, better than what we hoped for.

Recommendations

We believe the only foolproof way to thoroughly prevent mountainous area Bacillary dysentery from breaking out as in the past, and keep it under control from now on, is to continue the health education efforts through various channels

and methods, with penetration deep in the community, so to further improve the sanitation know-how, attitudes and behavior as regards hygiene of the local populace, to eliminate bad habits, to improve residential environment and drinking water quality. Therefore, it is a must that the educational and campaign portions of the program should be maintained in the future.

According to past case records mountainous rural area Bacillary dysentery cases were mainly children under 14 years of age. Therefore, that age group has been the principal target of our health education campaign. And since members of this age group are mostly elementary school students or younger children attending nursery schools, daycare centers, and kindergartens, that certainly makes the health education campaigns at those schools an important task direction. If we are able to continue the work we were doing during the program along this particular channel, we would be certain that our next generation will have good sanitation knowledge, attitudes, and behaviors. And the next generation will pass on the correct health knowledge. Once this kind of positive cyclical pattern is well established, residents of mountainous rural areas of Taiwan will remain safe from the threat of contracting communicable diseases through poor sanitary behaviors.

As each mountainous rural area has its own uniqueness in geography, climate, environment, and ethnic groups, each one of them may differ from the rest in many aspects like human attributes, customs, cultural beliefs, and economic activities. Therefore, the most effective method of holding health education campaigns in any mountainous rural area should not be the same. Instead it should be flexible and match up with local individualities, and be done through multi-channels. For example, it is preferable to incorporate the campaign into religious or faith activities, community cultural activities, and

traditional customs activities, celebrations or festivals, to use the language more familiar to the local population, and to mold the campaign into something acceptable by the local people and something they are willing to be part of. Then we can expect superior results.

Other than the above-mentioned active health educational campaigns conducted by health units and improvements in people's basic living and sanitary habits, to effect good prevention and control of mountainous rural area Bacillary dysentery, also calls for a close collaboration with other departments of the government, which will provide construction of better environmental and drinking water facilities, thus modifying positively the residents' cultural customs and living habits. This is the only feasible way to effectively solve completely the problem of the transmission and spread of Bacillary dysentery. More specifically, what we can do is to increase the popularity of tap water in the neighborhood, build simple tap water supplying water tanks and public water distribution networks to improve the quality of drinking water as soon as possible, to avoid contamination and transmission of infection. Other measures include the construction of simple community garbage dumps to solve household garbage disposal problems, conversion of existing residential aqua privies into flushing toilets along with the construction of required septic tank systems to improve basic sanitary facilities and thus effective block infection and spread; advising local farmers to replace raw chicken manure with chemical fertilizers or fermented composts in their agricultural activities is necessary to effectively stop disease vectors like flies from flourishing. Therefore, it is essential to link up with the Council of Indigenous People, the Environment Protection Administration, the Council of Agriculture, Ministry of the Interior, Ministry of Education, and Ministry of Economic Affairs and their resources and strength.

With all these helps available, we believe that this mountainous rural area Bacillary dysentery and also other similar enteric infectious disease problems will eventually be successfully solved.

Acknowledgement

We would like to dedicate this article to our colleagues working at the Ilan County Health Bureau, Taoyuan County Health Bureau, Hsinchu County Health Bureau, Nantou County Health Bureau, Chaiyi County Health Bureau, Kaohsiung County Health Bureau, Pingtung County Health Bureau, Taitung County Health Bureau, Hualien County Health Bureau, and all our superior officials and work partners at Taiwan CDC, to commemorate their invaluable contributions to this program. Without their efforts, we would never have performed so splendidly

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Table 1.Number of Bacillary Dysentery Cases in Taiwan from the Year 1997 to 2000.

	Year of incidents				
	1997	1998	1999	2000	Total
Reported cases	494	487	271	380	1632
Confirmed cases (CC)	405	426	210	321	1362
Imported CC	14	14	6	13	47
CC in MRA*	65	89	110	120	384
CC in non-MRA	326	323	94	188	931

*Mountainous rural areas

Table 2. Age Distribution of Bacillary Dysentery Cases in Mountainous Rural Areas of Taiwan from the Year 1997 to 2000.

	Year of incidents			
Age group	1997	1998	1999	2000
0~4	30 (46%)	41 (46%)	41 (37%)	51 (43%)
5~9	6 (9%)	12 (13%)	24 (22%)	28 (23%)
10~14	4 (6%)	4 (4%)	11 (10%)	6 (5%)
15~19	3 (5%)	0 (0%)	5 (5%)	2 (2%)
20~24	3 (5%)	2 (2%)	2 (2%)	3 (3%)
25~29	2 (3%)	4 (4%)	2 (2%)	1 (1%)
30~34	1 (2%)	1 (1%)	5 (5%)	2 (2%)
35~39	0 (0%)	0 (0%)	0 (0%)	3 (3%)
40~44	3 (5%)	3 (3%)	1 (1%)	1 (1%)
45~49	1 (2%)	3 (3%)	0 (0%)	0 (0%)
50~54	0 (0%)	1 (1%)	3 (3%)	2 (2%)
55~59	1 (2%)	5 (6%)	2 (2%)	3 (3%)
60~64	2 (3%)	4 (4%)	2 (2%)	3 (3%)
65~69	2 (3%)	6 (7%)	4 (4%)	6 (5%)
70~74	2 (3%)	0 (0%)	4 (4%)	1 (1%)
75~79	5 (8%)	1 (1%)	1 (1%)	4 (3%)
80~	0 (0%)	2 (2%)	3 (3%)	3 (3%)
Total	65 (100%)	89 (100%)	110 (100%)	120 (100%)

Table 3. Geographic Distribution of Bacillary Dysentery Cases in Mountainous Rural Areas of Taiwan from the Years 1997 to 2000

.		Year of incidents			
County	Rural Area	1997	1998	1999	2000
Kaohsiung	Taoyuan	1 (2%)	0 (0%)	0 (0%)	0 (0%)
Subtotal		1 (2%)	0 (0%)	0 (0%)	0 (0%)
Taichung	Hoping	2 (3%)	1 (1%)	0 (0%)	0 (0%)
Subtotal		2 (3%)	1 (1%)	0 (0%)	0 (0%)
Taoyuan	Fuhsin	0 (0%)	6 (7%)	0 (0%)	0 (0%)
Subtotal		0 (0%)	6 (7%)	0 (0%)	0 (0%)
Taitung	Yenping	1 (2%)	0 (0%)	0 (0%)	5 (4%)
	Jinfeng	1 (2%)	0 (0%)	0 (0%))	0 (0%)
	Haituan	1 (2%)	0 (0%)	1 (1%)	4 (3%)
	Dajen	1 (2%)	0 (0%)	1 (1%)	0 (0%)
	Lanyu	1 (2%)	2 (2%)	0 (0%)	1 (1%)
Subtotal		5 (8%)	2 (2%)	2 (2%)	10 (8%)
Hsinchu	Wufeng	0 (0%)	0 (0%)	4 (4%)	0 (0%)
	Chanshih	1 (2%)	10 (11%)	10 (9%)	1 (1%)
Subtotal		1 (2%)	10 (11%)	14 (13%)	1 (1%)
Ilan	Datong	3 (5%)	8 (9%)	35 (32%)	17 (14%)
	Nanau	1 (2%)	2 (2%)	7 (6%)	8 (7%)
Subtotal		4 (6%)	10 (11%)	42 (%)	254 (21%)
Nantou	Renai	35 (54%)	30 (34%)	25 (23%)	11 (9%)
	Hsinyi	4 (6%)	1 (1%)	6 (5%)	6 (5%)
Subtotal		39 (60%)	31 (35%)	31 (28%)	17 (14%)
Hualien	Hsiulin	12 (18%)	11 (12%)	18 (16%)	49 (41%)
	Chaohsi	0 (0%)	6 (7%)	3 (3%)	9 (8%)
	Wanjung	1 (2%)	12 (13%)	0 (0%)	9 (8%)
Subtotal		13 (20%)	29 (30%)	21 (19%)	67 (56%)
Total		65 (100%)	89 (100%)	110 (100%)	120 (100%)

Table 4. Monthly Incidence of Bacillary Dysentery in Taiwan Compared to Its Average of the Year from the Years 1997 to 2000.

	Year of incidents					
Month	1997	1998	1999	2000	Subtotal	Percentage
January	0	0	1	0	1	25%
February	0	0	0	0	0	0%
Match	0	0	0	0	0	0%
April	1	0	0	0	1	25%
May	1	1	0	0	2	50%
June	1	0	0	1	2	50%
July	1	1	1	0	3	75%
August	1	1	0	0	2	50%
September	1	1	0	1	3	75%
October	0	0	1	0	1	25%
November	1	1	0	1	3	75%
December	0	1	0	1	2	50%

Remarks

“1” represents the case number in that month is larger than the average of the year.

“0” represents the case number in that month is smaller than the average of the year.

The subtotal column figure means how many times in the four-year period that particular month had more cases than the average of the respective year.

The percentage column figure came from the formula: (Subtotal÷4)×100.

Table 5. Numbers of Bacillary Dysentery Cases in Targeted Mountainous Rural Areas of Nine Counties in Taiwan from the Years 1999 to 2004.

		Year of incidents							
County	MRA	1999	2000	2001	2002	2003	2004	Total	Average
Kaohsiung	Taoyuan	0	0	0	1	3	0	4	1
Taitung	Haituan	1	4	1	1	0	0	7	1
	Dajen	1	0	0	0	0	0	1	0
	Lanyu	0	1	0	0	0	0	1	0
Chiayi	Alishan	0	0	25	0	0	0	25	5
Taoyuan	Fuhsin	0	0	32	3	0	0	35	7
Hsinchu	Wufeng	4	0	2	1	0	0	7	1
	Chanshih	10	1	42	10	15	2	80	16
Hualien	Hsiulin	18	49	131	19	2	3	222	44
	Chaohsi	3	9	13	5	4	17	51	7
	Wanjung	0	9	9	4	0	2	24	4
Nantou	Renai	25	11	88	73	11	0	208	42
	Hsinyi	6	6	72	21	1	1	107	21
Ilan	Datong	35	17	212	22	1	10	297	57
	Nanau	7	8	64	1	0	1	81	16
Total		110	115	691	151	37	36	1150	223

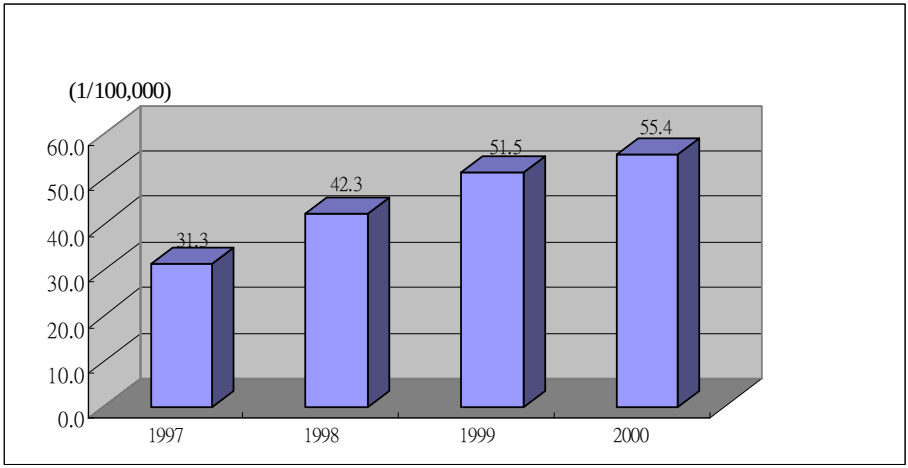

Figure 1. Incident Rate of Bacillary Dysentery in Mountainous Rural Areas of Taiwan in the Years 1997-2000

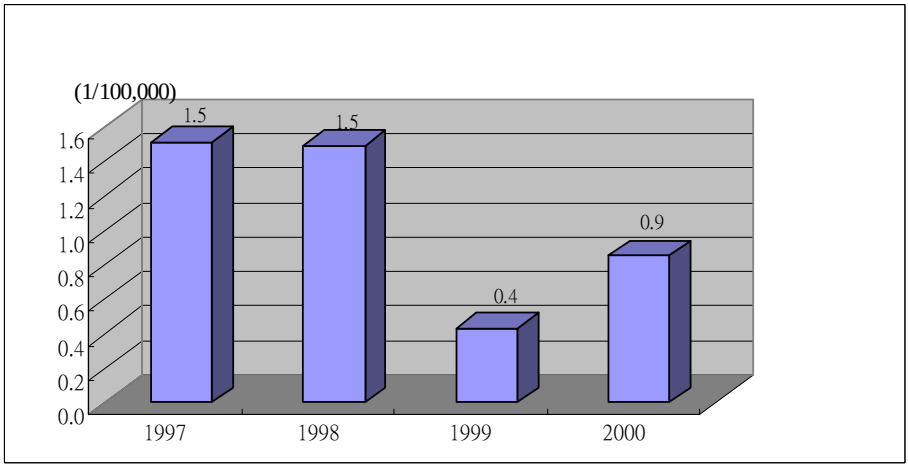

Figure 2. Incident Rate of Bacillary Dysentery in Non-mountainous Rural Areas of Taiwan in the Years 1997-2000

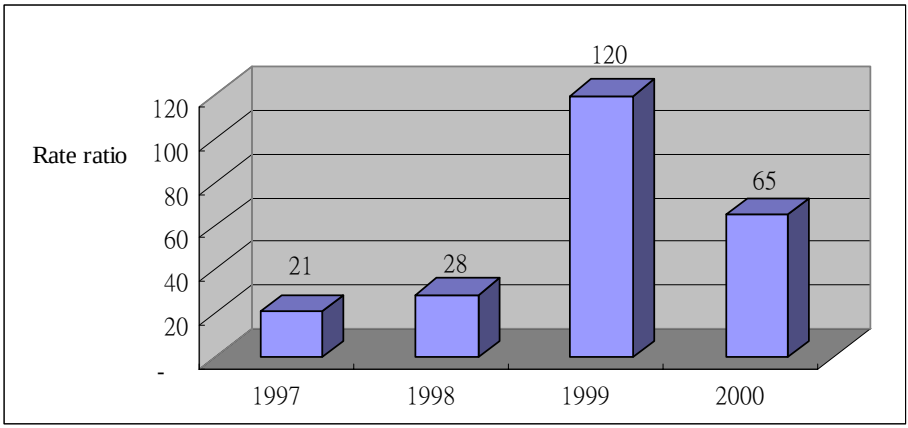

Figure 3. Comparison of Incident Rates of Bacillary Dysentery in Mountainous Rural Areas versus Those in Non-mountainous areas of Taiwan in the Years 1997-2000

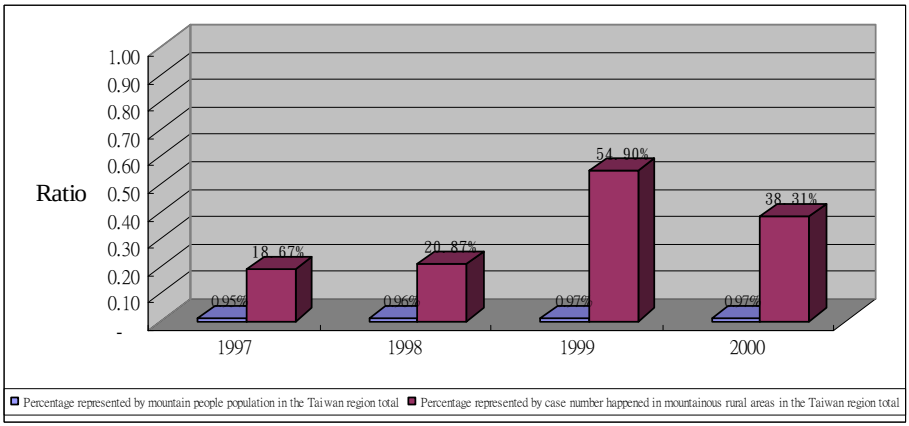

Figure 4. Comparison of Case Numbers of Bacillary Dysentery in Mountainous Rural Areas versus Those in Non-mountainous areas of Taiwan in the Years 1997-2000

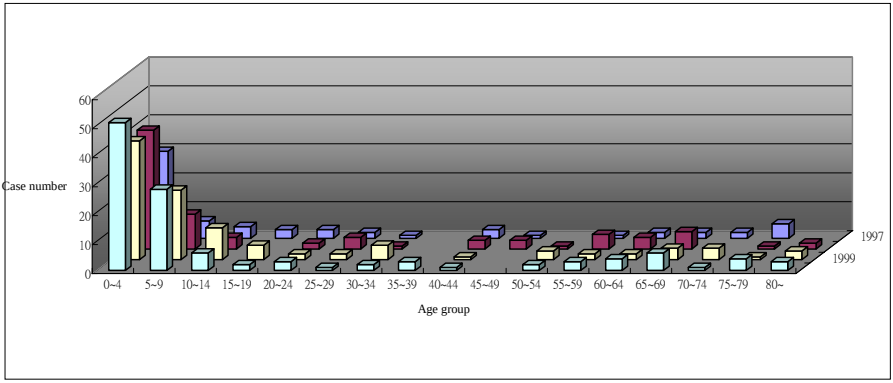

Figure 5. Age Distribution of Bacillary Dysentery Occurring in Taiwan from the Years 1997 to 2000

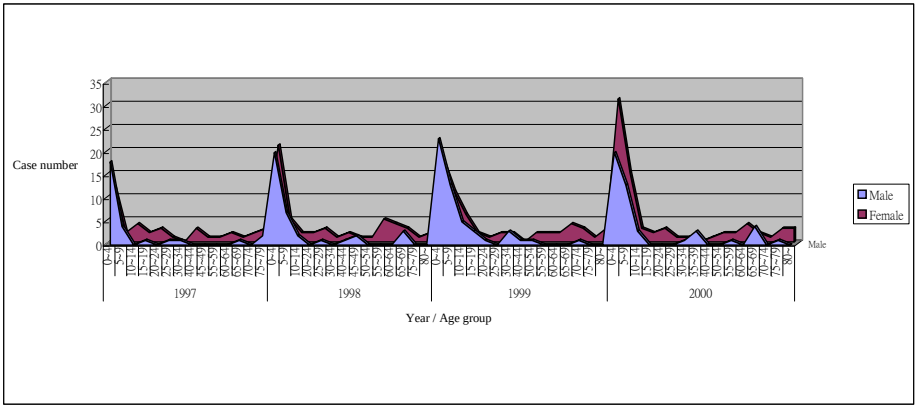

Figure 6. Age and Sex Distribution of Bacillary Dysentery Occurring in Mountainous Rural Areas of Taiwan from the Years 1997 to 2000

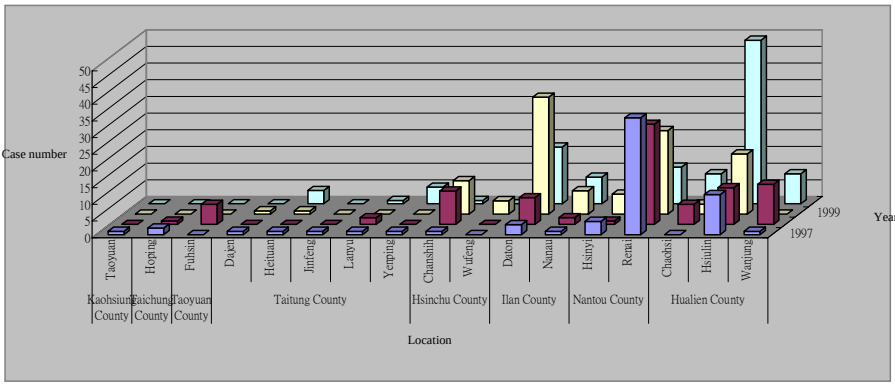

Figure 7. Administration Jurisdiction Distribution of Bacillary Dysentery Annual Case Numbers in Mountainous Rural Areas of Taiwan from the Years 1997 to 2000

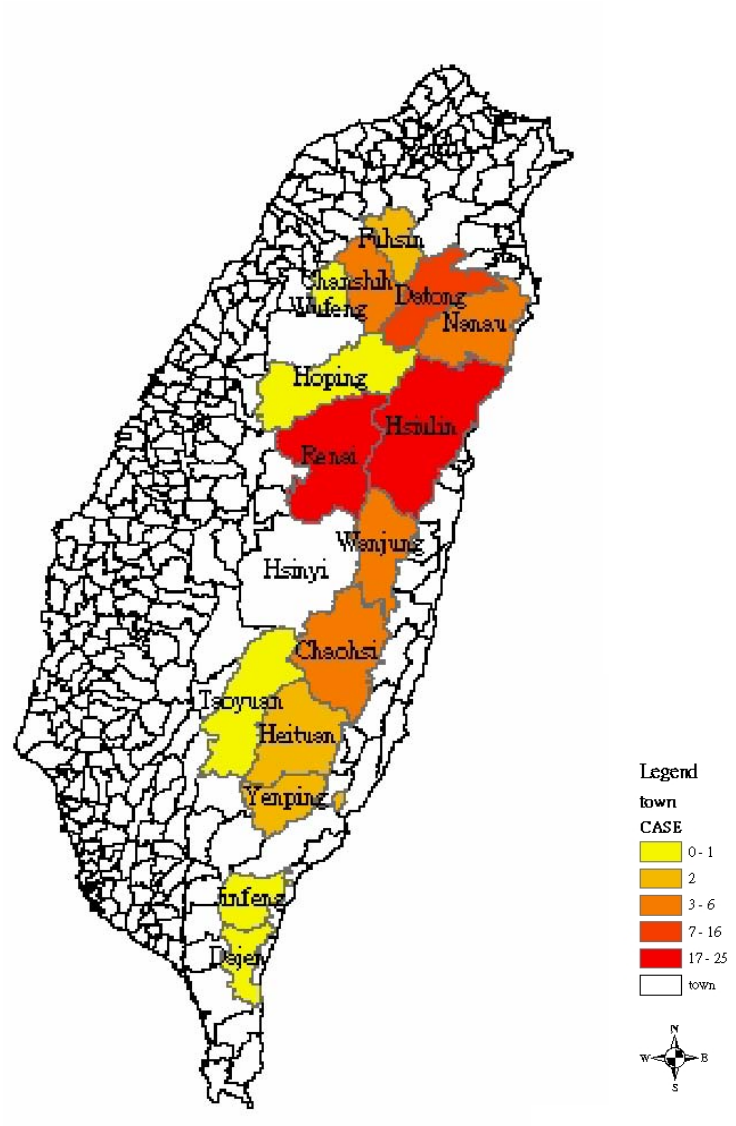

Figure 8. Geographic Distribution of Bacillary Dysentery Annual Case Number Averages

in Mountainous Rural Areas of Taiwan from the Years 1997 to 2000

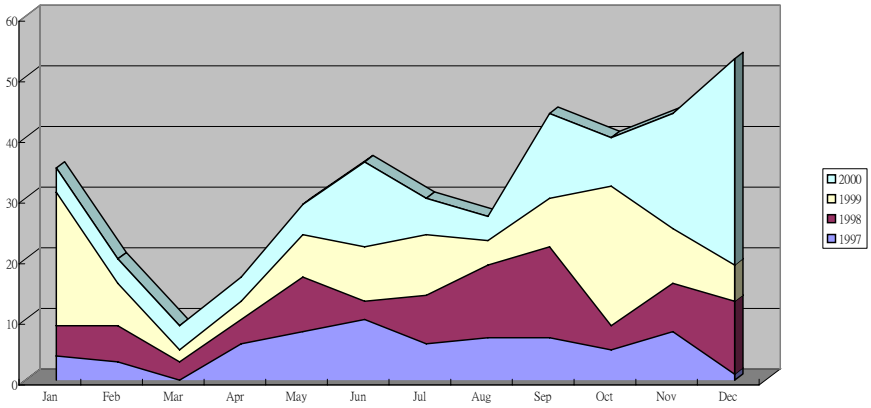

Figure 9. Monthly Distribution of Dysentery Case Numbers in Mountainous Rural Areas of Taiwan from the Years 1997 to 2000

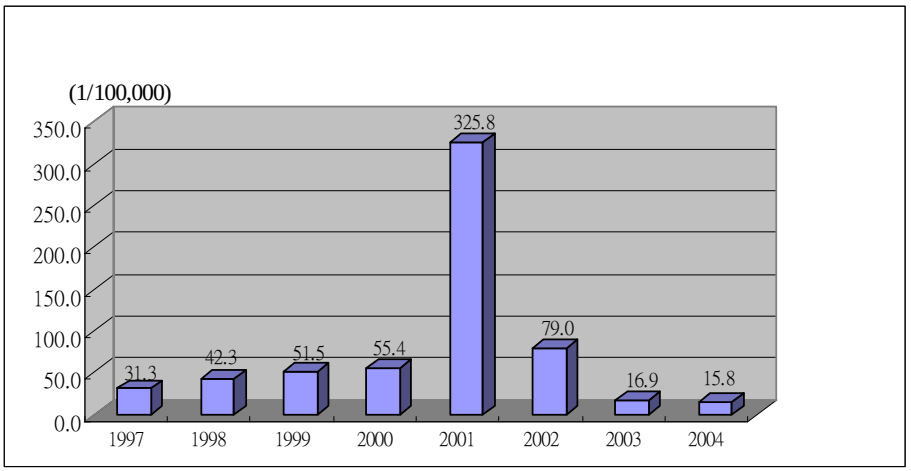

Figure 10. Comparison of Incidences of Bacillary Dysentery in Mountainous Rural Areas of Taiwan from the Years 1997 to 2004

Cases of Notifiable Diseases, I, Taiwan, R.O.C. 32th-35h Week 2005（31 July - 27 August）

※Cholera：There was no confirmed case in Taiwan in 2003. There was two confirmed cases in January and July 2004.

※Plague：There was no confirmed case in Taiwan after 1948.

※Yellow Fever：Never find any case in Taiwan.

※Rabies：There was no confirmed case in Taiwan after 1959. There was an imported case from China in July 2002.

※Ebola Hemorrhagic Fever：Never find any case in Taiwan.

※Anthrax：There was no confirmed case in Taiwan after 1972.

※Severe acute respiratory syndrome (SARS)：There was one laboratory infected case in December 2003.

Cases of Notifiable Diseases, II, Taiwan, R.O.C. 32th-35h Week 2005（31 July - 27 August）

※Typhus Fever：There was no confirmed case in Taiwan after 1949.

※Diphtheria：There was no confirmed case in Taiwan after 1988.

※Poliomyelitis：There was no confirmed case in Taiwan after 1984.

※Malaria：There was no confirmed case in Taiwan after 1966.

※Hanta virus haemorrhagic renal syndrome：The disease was reported since December 2001. 2 cases were confirmed in June 2004.

※Hanta virus pulmonary syndrome：The disease was reported since December 2001. Up to 8/27 in 2005, there was no case in Taiwan.