

## Original Article

# Exploring the Factors Affecting the Prevention, Control and Reporting of Enterovirus Infections in Kindergartens

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### Abstract

This study seeks to investigate what steps kindergartens have taken in preventing, controlling and reporting enterovirus infections; and whether these kindergartens have encountered any problems or difficulties during kindergarten reviews in relation to enterovirus control. Semi-structured in-depth interviews are used in this study. In Chiayi City, a private kindergarten, a public kindergarten, and a nurse who has been involved in kindergarten reviews, are selected as purposive samples. The principal or director and relative staffs of both kindergartens, as well as a school nurse who has been involved in kindergarten reviews, are interviewed. Results obtained from the investigation show that the private kindergarten would actively check children's oral conditions, rather than just passively maintaining children's personal hygiene. The public kindergarten, however, is more focused on getting children to wash hands and to disinfect the environment, and does not actively check children for possible symptoms. In promoting awareness of enterovirus, the private school teaches children about the right steps and the right time to wash hands. During outbreaks, the private school uses red notes and communication books to inform parents on how to prevent enterovirus infections. It also asks their children to put on face masks and avoid public places. The public kindergarten would inform the parents about enterovirus infections at the beginning of each semester. Information about enterovirus is posted on the school's bulletin board, and drawing competitions on health topics such as the "five correct steps to wash hands" are often held. When the private kindergarten finds symptoms such as fever, rashes, or oral ulcers on a child, they would keep the child in a sick bay to keep them away from other children. Parents would be asked to pick up a child who displays symptoms and to have them seen by a doctor. The private school would insist that sick children stay at home until they are fully recovered and free of symptoms. Teachers at the public kindergarten would contact the caregivers by phone when a child is absent and record the reason for the absence and the time the child is due to

return to the classroom. More details will be recorded for a suspended class. In disease reporting, public kindergartens are obliged to send a daily report to three local health authorities, (local health agency, health bureau, and education authority), regardless of the existence of any suspected cases. Private kindergartens only need to report to the local health bureaus when there is a suspected case within the school. It is recommended that the reporting is simplified to a single agency; that more attention is directed towards the details which are often overlooked in enterovirus prevention and control; that the cooperation between the government and local communities can be tightened; and that a community-driven partnership is encouraged to increase the awareness of healthcare information to build healthier communities.

**Keywords:** Enterovirus, prevention and control of enterovirus, Enterovirus reporting

## **Introduction**

### **1. Background**

Due to global climate change, there has been a higher occurrence rate of infectious diseases in recent years. A mutated enterovirus strain apparently appeared in Taiwan between 2009 and 2010 [1].

Enterovirus 71 (EV71) is the virus that, other than poliovirus, most likely to cause severe neurological complications. Data collected by Taiwan Centers for Disease Control (Taiwan CDC) over the years shows that young children are the most vulnerable group to the infection by EV71 virus, sometimes causes severe complications and with a fatality rate ranging from 3.8% to 25.7% [2].

A kindergarten is a public area where infectious diseases spread easily. Although "disease monitoring and controls on children" and "health protection" have not necessarily been points of major consideration in parents' choice of kindergartens [3-4], hygiene conditions and disease control inside the kindergarten still represent a major concern for parents. A study shows that kindergartens in Taiwan's southern areas generally lack unity and coordination in the planning and practice of dealing with emergency accidents and diseases, and do not have enough staff and facilities to care for young children during outbreaks. Although 72% of kindergartens are keeping a record of relevant information, less than 19.5% of them are able to take advantage of the information collected [5]. This is why only limited results can be expected from the kindergarten-run basic disease prevention courses.

Education authorities have been reviewing childcare facilities regularly. This study hopes to evaluate the information gathered by the reviews from the perspective of disease prevention, and to find out whether current assessments are able to reflect the effort of disease prevention education. Through collecting, summarizing, and analyzing the feedback from those who have been involved in the reviews, this study also hopes to offer some useful information to improve the current kindergarten review system.

## 2. Purpose

This study uses semi-structured in-depth interviews to ask those who have been involved in kindergarten assessments for their opinions and suggestions in relation to the regular hygiene checks in the assessment and the reporting system of infectious diseases.

- (1) A school nurse from Chiayi City who has been involved with the kindergarten review program is interviewed to give feedback on the items assessed in relation to enterovirus control.
- (2) Staff members from a kindergarten that has been assessed are interviewed for their feedback on those items reviewed in relation to enterovirus control.
- (3) Both feedbacks were compared for recommendations.

## Literature Review

### 1. Introduction to Enterovirus

Enteroviruses are a group of small RNA viruses that cause bowel diseases in humans, cattle and pigs, often with asymptomatic infections. On the basis of their pathogenesis, human enteroviruses were originally divided into polioviruses, Coxsackie A viruses (CA), Coxsackie B viruses (CB), echoviruses and enteroviruses. They were later classified into four species, Human enterovirus species A, B, C and D, according to their genome sequences. The much dreaded enterovirus type 71 is a member of the Human enterovirus species A. Although it's mainly active between April and September [3], in recent years it has become more common all year round. In 2012 a new strain of CA6 which caused infectious blisters not only in the patient's mouth, but also on large areas of the patient's body [1].

Enterovirus has many strains. Being infected with one strain does not offer immunity from other strains and hence, an effective vaccine has yet to become available against these viruses. The early stage of enterovirus infection has similar symptoms to a cold, making early diagnosis difficult. These viruses can survive for up to five weeks in a patient's feces and be infectious. With no obvious symptoms, the virus can spread from the very moment of infection, and can normally be found in a patient's throat and feces a few days before the onset of the symptoms. At this stage the virus can be easily transmitted just by touching the patient's nasal or oral discharges, saliva, or food which has been eaten by the patient. EV71 often results in severe neurological complications, such as meningitis, mild encephalitis, flaccid paralysis or even death. A lack of knowledge by the general public has also made it even more challenging to prevent and control these extremely dangerous viruses [2].

Because enterovirus is transmitted by the oral-fecal route, the best way to prevent mass infection is to avoid contact with those who are potentially carrying the virus, avoid touching the nasal and oral secretions of the confirmed cases, avoid public areas during epidemic outbreaks, and wash hands thoroughly. Children of five years old or younger are at high risk of enterovirus-associated diseases [3] and kindergartens happen to be where they gather. In the 2011 academic year, close to 200,000 children spent between four and six hours a day

interacting with each other at kindergartens and it only takes one case to set off an outbreak [6]. How to ensure an effective enterovirus prevention program at kindergartens is an important challenge the government has to face.

## **2. Studies on subjects of enterovirus in kindergartens**

### **(1) Researches on enterovirus awareness**

#### **a. Awareness of symptoms of enterovirus infection and its endemic periods**

Research conducted by Su-Chin Yang et al. in 2010 found that in Taiwan's northern areas parents were more aware of the virus endemic seasons than kindergarten teachers [7]. Research by Hua-Chi Bo and Li-Chun Chang in 2007 concluded that only 53.2% of kindergarten teachers and 44.3% of parents in Tainan could correctly identify the peak season of enterovirus infections [8]. In these researches, only a third of parents and kindergarten teachers in either northern Taiwan or Tainan were able to identify basic and warning symptoms of enterovirus infection. Nearly 40% of parents and teachers in the northern areas were unable to distinguish the warning signs of hand, foot, and mouth disease (HFMD), and those of enterovirus infections. It shows that before 2009, neither the kindergarten teachers nor the parents had a clear understanding of the symptoms of enterovirus infection and the warning signs of its severe complications.

#### **b. Understand and cooperate with class suspension caused by enterovirus infections**

Su-Chin Yang et al. found that more kindergarten teachers than parents knew that infected students should stay at home for one to two weeks. Nearly half of the parents and teachers mistakenly thought anti-enterovirus drugs were available. Also, only a few couples both agreed that an infected child should stay at home for at least a week [7]. This is why the general public should be made aware that it is essential for children who are infected to be isolated until they recover.

#### **c. Access to enterovirus information**

During their research, Hua-chi Bo and Li-Chun Chang found that 80% of parents and teachers obtained their knowledge of enterovirus through TV news. Only 27.1% of teachers said that local health agencies visited their kindergartens regularly to promote information in relation to enterovirus prevention [8].

### **(2) Obstacles to infection reporting systems in kindergartens**

The 2010 research by Guo-Ning Lin et al. found that private kindergartens worried that reporting infections would expose themselves to media coverage and affect the recruitment of students in the future [9]. Hua-Chi Bo and Li-Chun Chang found in their research that 90% of kindergarten teachers felt that most of their stress came from the parents when their students were infected with enterovirus [8]. Results from the above researches showed that kindergarten teachers and parents in Tainan did not know about the enterovirus peak season as well as their counterparts in northern Taiwan. Parents from both researches were found to be confused and unable to distinguish the symptoms and warning signs of HFMD and severe enterovirus infections. The investigation in Tainan

showed that parents did not cooperate with the requirement of suspension and would hide the truth of their child's infection; that local health authorities rarely visited kindergartens to promote disease-prevention awareness; and that teachers worried that reporting a disease would affect their business. These issues need to be addressed by the government.

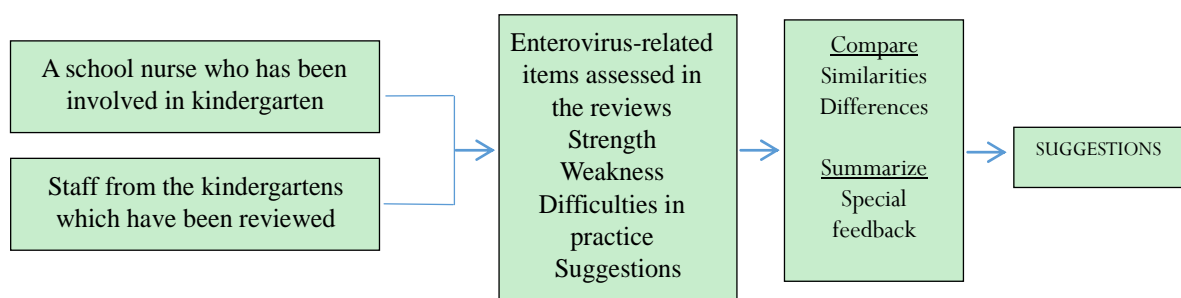
(3) Enterovirus-related items which are assessed in the kindergarten reviews [10]

- a. Environmental hygiene (24%) – toilets should be clean and well-maintained, water-tanks and drinking fountains should be washed regularly; waste collection areas should be kept clean, rubbish bins should be lidded; and classrooms must be clean and well-ventilated.
- b. Education (35%) – is enterovirus awareness promoted whenever possible? Opportunities such as parent interviews, home visits, and communication books and newsletters are all great channels to communicate with the parents about enterovirus prevention. Five children would also be randomly checked to see whether they have washed their hands correctly.
- c. Facilities (29%) – hand drying equipment should be provided or prepared by students; wash basins should be provided with clean water and cleaning products; wash basins should be at an appropriate height or provided with steps; sleeping equipment and recreational toys such as riding horses, slides and swings should be clean. Sleeping equipment should also be stored separately.
- d. Other (12%) – insect screen windows and doors should be installed in the kitchen; eating utensils, cooking equipment and stoves should be kept clean. Kitchen staff should follow hygiene procedures.

Kindergartens are not yet reviewed with particular regard to enterovirus [7]. This study hopes to find out what steps kindergartens have taken to prevent enterovirus infections, whether they have had any difficulties putting them into practice, and whether they have any suggestions in including kindergarten reviews as part of enterovirus prevention programs. It is also hoped that the feedback obtained from those who have been involved in kindergarten reviews would be useful for disease prevention authorities in achieving better results.

## Materials and Methods

### 1. Research Structure : See the figure.



**Figure. Research structure**

## 2. Research Objects

Purposive sampling is used in this research. A school nurse who has been involved in kindergarten reviews in Chiayi City has been invited to take part. Two kindergartens are selected, one private and one public, both of which have been reviewed by the authority. From each school, the director, the teacher who is managing students' health issues, and an administrator in the office, are also interviewed.

## 3. Research Method

Semi-structured in-depth interviews are used in the interviews to collect information. The goals of the interviews are to find out the self-monitoring measures taken by each kindergarten; to collect relevant reports and forms; and to understand the difficulties the school has encountered in preparing for enterovirus related items in kindergarten reviews; and their suggestions. The focus of the interview with the nurse who has been involved in reviewing those kindergartens is to identify those areas that are often overlooked by kindergartens and possible solutions.

Each interview lasts about 30 minutes to an hour. A summary of the interview will be typed out and repeated back to the interviewee afterwards to ensure an accurate and complete account of the interview. Furthermore, documents such as cleaning and disinfecting records, children's temperature charts, staff's health-check records, records of children's daily morning checks, and disease reporting forms etc., are also collected as corroborating evidence, and for the purpose of triangulation.

## Results and Discussions

### 1. Self-monitoring measures by kindergartens

Both the public and private kindergartens have taken initiatives to complete forms such as body temperature charts, children's morning check forms, classroom cleaning record sheets, daily health report forms to the authorities, environmental disinfection records, reporting forms of infectious disease, and educational pamphlets or brochures, in Chiayi City. Other initiatives taken by individual kindergartens are:

- (1) The private kindergarten will provide extra disinfectants in response to disease outbreaks, and will physically check children for personal hygiene and health conditions.
- (2) The public kindergarten is more focused on washing hands and environmental disinfection, but does not check children for suspected symptoms.
- (3) The private kindergarten self-monitors more frequently than the public one.
- (4) In promoting disease prevention knowledge, the private kindergarten teaches students the correct steps and times of hand washing, and uses red notes or communication books to inform the parents about preventing enterovirus infections. During endemic periods, it also requires the children to wear masks and avoid public areas. Every morning children are reminded of the correct ways to wash hands and to prevent enterovirus infections. The public kindergarten, on the other hand, sends an educational pamphlet on enterovirus

prevention to each parent at the start of each term, and requires the parents to sign the receipt. It also publicizes relevant information on the school's noticeboard. Drawing contests are often held with themes such as "five steps to wash hands", or "nutrition the body needs" etc., to encourage more awareness of personal hygiene and health protection.

- (5) In handling suspected cases, the private kindergarten will notify the parents as soon as a child is found to have fever, oral blisters or ulcers, or skin rashes, and will take the sick child to the sick bay in the office to be isolated from the other children. Parents will be asked to pick up the child and have the child seen by a doctor. The kindergarten will keep in touch with the parents by phone to monitor the child's progress. It will insist that the child rests at home for at least seven days until no symptoms are present. The public kindergarten will call the parents and record the reason for a child's absence and the content of the phone conversation. The same information and the time the child is expected to come back to class will also be recorded in the teacher's diary. If the whole class is suspended, more details will be recorded.
- (6) As for the disease reporting system, the public kindergarten needs to report daily to three local authorities – health clinic, health bureau and education authority, regardless of whether there is any illness present. The private kindergarten, on the other hand, only needs to report when there is a suspected case.

## **2. Difficulties or suggestions the kindergartens have in relation to enterovirus related items in kindergarten reviews**

Both kindergartens interviewed say that they do not find the requirements of the reviews difficult to meet. The private kindergarten believes that the government should offer solutions to accommodate parents' temporary childcare needs when classes are suspended due to enterovirus outbreaks. It is also crucial to simplify the system and establish a single window for kindergartens to report to. Careful consideration not only increases the reporting rate, but also effectively prevents further spread of infectious diseases. Parents' childcare needs are obviously the main concern of the private kindergarten, while the public kindergarten finds it troublesome having to report to three agencies at the same time.

## **3. Feedback from the school nurse who has been involved in the reviews**

The nurse points out the difficulties that kindergarten teachers have in relation to enterovirus control:

- (1) Kindergartens often overlook the heavy workload of the teachers and the amount of additional work involved.
  - (2) Teachers are often expected to act as parental figures to their students, especially during enterovirus outbreaks when teachers are expected to look after the children as if they were their own.
  - (3) Early signs and symptoms of enterovirus infections are very similar to the common cold and it is difficult to distinguish between the two. It is therefore suggested that the common
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cold should also be reported.

(4) It is also believed that kindergartens should have smaller classes for easier teaching and managing.

Both the studies conducted by Hua-chi Bo and Li-Chun Chang in 2007, and by Su-Chin Yang et al. in 2010, pointed out that neither parents nor kindergarten teachers were able to clearly identify symptoms of enterovirus and other serious illnesses. Only 30 to 40% of parents and teachers were able to distinguish the differences between these symptoms [7-8]. Although the responsibility of disease diagnosis ultimately lies with medical workers, it will help early diagnosis and reporting if the general public knows more about the differences between those symptoms. Also the government should consider whether to include the symptoms of common cold as one of the reportable diseases. Active reporting should reduce the chance of outbreaks occurring.

Mei-Kuei Lu's research in 2004 pointed out that kindergarten reviews are crucial in establishing the "benchmark kindergarten". A good kindergarten not only offers children opportunities to explore, but also provides children with a safe, hygienic, and healthy environment [11]. However, those items assessed by current kindergarten reviews do not seem broad enough to cover the many details required to prevent infectious diseases.

## **Conclusions and Suggestions**

### **1. Conclusions**

(1) This study finds that the private kindergarten takes more initiatives regarding self-monitoring than the public kindergarten.

Judging by their records of environmental disinfection, the private kindergarten clearly records what has been done to keep the classroom disinfected. For example, the floor and mattress children nap on are cleaned with bleach and dried under the sun every week.

(2) Although happy with what has been assessed during the reviews, the private kindergarten has different concerns from the public one in regard to disease control and prevention.

The private kindergarten is more worried that any news of disease outbreaks will affect its roll and is more willing to comply with government policy regarding enterovirus control, and to take relevant actions. The public kindergarten, on the other hand, is more worried about having to report to different agencies and the subsequent burden on its administration.

(3) The nurse who has been involved in reviewing kindergartens offers many details that are easily missed in disease prevention activities. However, none of the kindergartens interviewed are able to offer related information. This gap in disease prevention could also happen in other kindergartens.

### **2. Suggestions**

(1) In areas of disease prevention in kindergartens: it is recommended that the central government set guidelines for disease control and prevention, but allows local



governments to adjust the details in practice. This will make it easier for kindergartens to follow clear guidelines in the disease prevention programs.

- (2) In areas of education and promotion: it is recommended that the education of enterovirus in kindergartens be carried out in accordance with existing community health education practices. However, local government must work together with the communities in sending the healthcare information to focus groups for best effect. From the interview, it was found that the public kindergarten takes more initiatives in sending out pamphlets and posting news on its notice board. Local government should encourage kindergartens to take on a more active role in educating and involving the local communities for better disease prevention.
- (3) In the area of disease reporting systems: it is recommended that local government simplify the reporting to a single agency, in order to reduce kindergartens' administrative workload, and to increase the efficiency and efficacy of reporting.
- (4) Solutions to deal with cases during disease outbreaks and class suspensions: problems caused by class suspensions need to be addressed by government agencies. Dual income families are not always able to obtain leave to care for their children. Inability to contain virus carriers will increase the scale of outbreaks.
- (5) Finally, it is recommended that the government acknowledges and awards kindergartens with good results so as to set excellent standards and to encourage others to follow suit.

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## Outbreak Investigation Express

### Outbreak Investigation on the First Two Imported Cases of Measles In 2013

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#### Abstract

Measles is a highly contagious viral respiratory disease and is classified as a category II notifiable disease in Taiwan. It is spread through air or droplets, or contact with nasopharyngeal mucus from an infected person. The number of indigenous measles cases in Taiwan has decreased year by year. However, due to frequent international interaction and neighboring to measles endemic areas include mainland China and countries in Southeast Asia, the spreading risk by imported cases persists. In Early 2013, two confirmed imported measles cases were detected in two infants who were ineligible for MMR vaccination by age. During their visiting trip with parents to mainland China, they had searched for medical assistance several times for treating upper respiratory symptoms at local hospitals in Hunan Province. After returning to Taiwan, they developed fever and rashes and were reported as measles cases. The outbreak

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investigation and management, e.g., contact assessment and relevant control measures, were launched based on "The Standard Operating Manual of Measles Prevention and Control" and "The Management Guidelines for Suspected Measles Case in Hospitals". Except the two cases, no further case of measles has been reported as of 21 February. This event can be a reference for both public health and medical workers in dealing with similar outbreaks in the future.

**Keywords:** measles, imported, MMR vaccine, contact

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