Original Article

The impact of hand, foot and mouth disease control policies in Singapore: A qualitative analysis of public perceptions

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Abstract Hand foot and mouth disease (HFMD) is a widespread pediatric disease in Asia. Most cases are relatively mild and caused by Coxsackie viruses, but in epidemics caused by Enterovirus 71, severe complications can occur. In response to the deaths of dozens of children in a 1997 outbreak (Podin in BMC Public Health 6:180,[1] Abubakar in Virus Res 61(1):1–9,[2] WHO in[3]), Singapore practices childcare centre surveillance, case-isolation, and short-term closure of centres. We conducted 44 in-depth interviews with teachers, principals, and parents at four childcare centres in Singapore to better understand experiences with current control policies. We used applied thematic analysis to identify recurrent and unique themes. Participants were conflicted by perceiving HFMD as a severe illness and reported a sense of helplessness when hygiene and social-isolation efforts failed. They perceived that severity of HFMD influenced Singapore's choice of existing policies despite a lack of evidence of their effectiveness. Documenting stakeholders' perspectives clarifies the impact of control measures and how to communicate policy changes.

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Context: Global HFMD Policies

Background

Hand, foot, and mouth disease (HFMD) is a largely self-limiting pediatric disease that is widespread in Asia. Most cases are relatively mild and caused by Coxsackie viruses, but in epidemics caused by Enterovirus 71, one in ten cases have complications including meningitis, encephalitis, and pneumonia, and the case fatality rate is one per cent.[4] Symptomatic HFMD occurs mostly among preschool-age children, but can occur in older children and adults.[5]

Estimates vary for the incubation period, reproductive number, symptomatic rate and other epidemiologic data for HFMD.[6] HFMD is diagnosed based on a case definition that includes a fever with or without mouth ulcers and a characteristic rash.[7] The papulovesicular rash typically affects the palms of the hands and/or soles of the feet, but may appear on the buttocks, knees or elbows.[7] The vast majority of reported cases occur in children; however, published estimates suggest that asymptomatic or undiagnosed cases are common in both children and adults.[6]

In response to the vanguard Sarawak outbreak in Malaysia in 1997[1–3] in which dozens of children died, Singapore strengthened its control policies to include:

- requiring preschools to notify the Ministry of Health whenever at least two cases of HFMD occur in the same ten day period;
- home isolation of children diagnosed with HFMD for up to ten days;
- publishing on a government website the names of schools with more than ten cases or an attack rate greater than 13 per cent over a period of 16 days; and
- closing preschools with more than 16 cases or an attack rate greater than 23 per cent over 24 days. (See Figure 1 for a policy triangle framework illustrating the interaction of policies and stakeholders.)

Despite the wide media coverage of school closures and other control efforts, there is little information about parental and school experiences with HFMD and associated prevention measures. Such perspectives could aid policymakers' understanding of the utility and impact of HFMD control, as well as preferences for alternate control measures.[7]

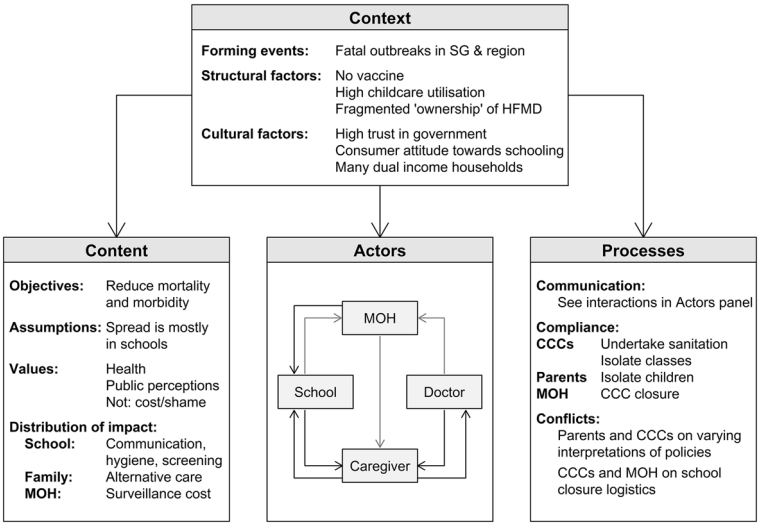

Figure 1: Policy triangle for HFMD control in Singapore.

For influenza, which affects a wider age range than HFMD, school closures of two weeks or more, including planned school holidays, can be effective in reducing spread.[8–13] Closure is most effective when initiated early in an epidemic.[10, 14] Yet, analysis suggests school closures are deemed cost-effective and justifiable only in response to high-severity epidemics.[15–17] The effectiveness of school closures as a social distancing measure was dependent on socio-economic and geographic contexts,[11, 18, 19] single versus multi-wave epidemics,[20] and compliance with limiting social interaction during school closures.[11, 17, 19]

Indirect evidence for the effect of school closure on HFMD comes from Hong Kong, where closures during SARS (2003) and pandemic influenza (2009) led to fewer consultations for HFMD than expected based on the preceding years.[4] However, in addition to school closure, the response to both epidemics included widespread hygiene, social-distancing, and mask-wearing campaigns that confounded the effect of closure.[4]

Campaigns to increase hygiene in schools and at home are supported by studies linking personal hygiene, including hand-washing by children and their caregivers, to decreased risk of contracting HFMD and critical EV71 infection.[21, 22]

There is a notable lack of qualitative evidence on the overall impact of HFMD, though research on influenza suggests that the public values

non-pharmaceutical methods, such as mask-wearing and isolation, for combating infectious diseases.[23] By examining stakeholders' perceptions of the impact of HFMD control policies, we can inform policy changes and communication of planned changes to childcare centres (CCCs) and the public.

Methods

We conducted a qualitative study consisting of in-depth interviews to understand parental and childcare centre perspectives of HFMD and the perceived benefits and disadvantages of HFMD control measures.

Sampling and recruitment

We recruited and selected principals, teachers, and parents from four CCCs in Singapore. We selected a convenience sample of CCCs among those having experienced an outbreak of HFMD in the past 12 months. We excluded some publicly funded CCCs — that included a higher proportion of families of low socioeconomic status — and private kindergartens — that included more high-socioeconomic status families — to increase transferability of the data. As a result, most children attending the included CCCs were from the middle class. Inclusion criteria were designed to ensure the transferability[24, 25] of data in an effort to represent the cultural context of Singapore, as described in the Discussion section below.

After being interviewed, principals invited four teachers to participate and sent flyers to parents. Researchers collected the returned flyers and then telephoned parents to arrange in-person interviews. We adapted the concept of saturation to determine the number of individual interviews for both teachers and parents.[26] Saturation was reached when two additional interviews with each participant type provided no new information.

Data collection

Between 26 September and 13 November 2013, we conducted semi-structured interviews in English and Mandarin with 17 parents, 4 principals, and 21 teachers. We developed in-depth interview guides in English, translated them into Mandarin, then back-translated. Interviewers revised the guides after the first CCC to ensure better flow of

conversation without notably altering content. Researchers then transcribed interviews verbatim. Interviews conducted in Mandarin were translated into English after transcription.

Data analysis

We analysed the interviews by assigning codes to meaning units — structural and emergent information, and views expressed in interviews.[27] For applied thematic analysis, codes were grouped into subthemes and themes. These themes corresponded to specific perceptions of HFMD control measures. Two researchers independently coded the data using NVivo qualitative data analysis Software.[28] Coders met regularly to ensure that new codes, consolidation of codes, and hierarchical relationships were agreed upon. Disagreement was rare and resolved through discussion.

Results

We examined key themes by participant type. A summary appears in Table 1. Most interview participants were females and ethnically Chinese Singaporean citizens. This is consistent with the population of childcare centre teachers, 99.7 per cent of whom are women.[29] The ethnicity of most of the mothers, usually the managers of children's care and schooling was Chinese.[30] The ethnicity of interview participants was slightly different than the general population with 56 per cent of CCC staff and 88 per cent of parents identifying as Chinese, while 74 per cent of Singaporean citizens[31] are counted among the Chinese ethnic majority. No demographic data were available for the population of CCC teachers. It is likely that this sample of both CCC staff and parents is representative of the general population, due to the inclusion criteria for CCCs, although the Chinese ethnic majority may be overrepresented. A review of the occupations of recruited parents suggests that, as expected, most were middle class. See Table 2 for complete participant demographics.

Perceptions

Both sets of participants perceived HFMD as more severe (seven parents and teachers), but less common than influenza (five parents and 11 teachers) despite being relatively common.

Table 1: Key themes from interviews with childcare centre staff and parents impacted by hand, foot and mouth disease

School closure	
Parents	*Childcare centre staff*
Effective at breaking cycle of transmission	
High "cost" of child care (leave, emotional/social burden)	Time to sanitize
Difficulty of arranging for child care on short notice	Difficulty of communicating with parents Cost of deploying teachers or distributing materials

Other control measures		
Case isolation	*Name publishing*	*Reporting*
CCC staff		
Ensures sick children do not spread HFMD	Purpose unclear	Necessary for MOH tracking
Inconsistent diagnosis and length of medical leave	Shameful	Unsure about whether to report 1 case or only if 2+
Parents not compliant	Raises awareness	Difficulty of coordingating with parents and doctors, who may be reluctant to report
Parents		
Effective, if inconvenient	Information not actionable	Parents were not asked about reporting
Alternate care needed/costly	May impact enrollment choices	
Lack leave and care options		

Of 16 responses to the question: "How would you feel if there were a future HFMD outbreak at your school?", 14 CCC staff noted they would feel guilty, stressed, or worried about the outbreak. One teacher: "….felt that I have the full responsibility. So, very stressful."

Prevention

Parents' most common prevention efforts among 51 mentions of this topic included increasing cleanliness at home (8) and isolating sick children (8). When discussing their family's experiences with HFMD, parents often believed their child had contracted HFMD through contact with an infected friend or family member (20).

All CCCs noted routine efforts including health checks — usually checking temperature, palms, soles of feet and mouth before allowing

Table 2: Participant demographics

Demographic	*N*	%
	CCC staff	
Role		
Principal	4	16.0
Teacher	21	84.0
Age		
<25	1	4.0
25–29	10	40.0
30–39	9	36.0
40–49	3	12.0
50+	2	8.0
Sex		
F	25	100.0
Years in role		
<1 year	7	28.0
1–2 years	11	44.0
3–5 years	3	12.0
6–9 years	2	8.0
10+ years	2	8.0
Ethnicity		
Chinese	14	56.0
Malay	5	20.0
Indian	3	12.0
Filipina	3	12.0
	Parents	
Sex		
M	4	23.5
F	13	76.5
Age		
30–34	6	35.3
35–39	6	35.3
40+	4	23.5
No response	1	5.9
Citizenship		
Singaporean	14	82.4
Other	3	17.6
Ethnicity		
Chinese	15	88.2
Other	2	11.8
Marital status		
Married	17	100.0
Occupation		
Homemaker	2	11.8
Works outside home	15	88.2
Number of children		
1	6	35.3
2	10	58.8

Table 2: *continued*

Demographic	*N*	*%*
3	1	5.9
Ages of all children		
0–47 months	21	72.4
48–59 months	7	41.2
60+ months	1	5.9

children to enter the centre — and routine hand washing — on arrival and before/after lunch. Other on-going measures included various degrees of cleaning and sanitizing. One principal noted that following a recent HFMD-related centre closure, classes would be isolated and there would be no contact between children in different classes for the foreseeable future:

> Upon discussion with our managers, I think … this age is very sensitive and disease spread very easily. So to play safe and conservative, we are not combining classes at all times now.

There were 168 mentions of outbreak responses from teachers and principals; the most common were: isolating classes from one another (22), increased cleaning (18), not allowing parents or visitors to enter (15), increasing the number of health checks (14), increased hand washing (11), and stopping outdoor play (10). Other measures ranged from requiring children to wear socks (4) to removing rugs (2) to encouraging teachers to limit children to playing alone or in groups of no more than two (2).

Case reporting policy

Teachers and principals were asked about the policy that required cases of HFMD to be reported to the Ministry of Health within 24 hours whenever at least two concurrent cases occur. Parents were not asked about the reporting policy.

Attitudes

In general, teachers and principals felt that the reporting of cases was good, necessary and important for MOH tracking of HFMD.

Experiences

CCC staff noted that parents do not always immediately inform them of an HFMD diagnosis. This has led to discrepancies between the school and MOH records of the onset of an outbreak. One principal explained:

> Sometimes when the MOH officer comes down and he shows me his list and he compares it with my list, I have encountered like discrepancies … I would see things like the parents went to see the doctor on the 8th … but the mum still bought him to school on the 8th.

Others noted that some parents would either refuse to confirm a diagnosis or to take their child to a doctor. One principal suggested that some doctors are reluctant to diagnose HFMD:

> …the doctor refuse to diagnose the child with HFMD … because it was very obvious the child had fever, the child had ulcers, a LOT of it in the throat, but doctor kept on saying doesn't, he doesn't even wanna say it's a suspected case. But he issue that child nine days of MC [medical certificate].

Medical certificates specify the number of days the physician has required the patient (a child or adult) to remain out of childcare/school/work and are used both to excuse absences and demonstrate that a person is fit to return to childcare/school/work after an illness.

Isolation policy

Parents and CCC staff were asked about the impact of requiring children diagnosed with HFMD to be isolated at home until a physician determines they are healthy enough to return to school. Preschool staff were also asked about the logistics of enforcing this policy.

Attitudes

Most CCC staff felt the policy is key to preventing the spread of HFMD and that requiring a medical certificate prevents children from returning to school before they are fully healed. While parents were

generally less positive about this policy, many felt it to be an effective means of preventing the spread of HFMD.

Experiences
Nearly all CCC staff noted that children must have a doctor's letter to return to school. A few teachers noted that some parents were not compliant and/or would refuse to see a doctor. One noted:

> For example, yesterday we have photo taking. The child is suspected to have hand, foot, and mouth but doctor refused to give the parents letter to let the child back because the doctor say actually the child has to rest one more day. But because of the photo shooting the parents insist to let the child back to school.

Parents focused on the logistical complications of keeping a child at home. For example:

> …the parents may not have sufficient leave to cover for that … if we can get grandparents to help or if we have domestic helpers. Okay, problem can be consider as solved. Okay, but most of the time when we place our child in a childcare it means like we may not have alternate help. …we may need to resort to you know go and see a doctor to get a medical certificate so that we stay at home and to look after the kids. But doesn't mean we [the parents] are sick!

Recommendations
The most common suggestions from teachers were to educate parents and to standardize the length of isolation. While parents agreed that the length of isolation varies, their recommendations focused on increasing the amount of childcare leave or offering leeway to employees who have exhausted their leave before a child is diagnosed. Others suggested that an alternate space (at home, at the CCC, or in a hospital) could provide childcare.

Naming policy

All interviewees were asked about a Ministry of Health webpage that lists the names of CCCs experiencing sizeable outbreaks. Both groups

felt the purpose of the website was unclear. Parents noted that the information was not useful in any practical sense, while CCC staff found it demoralizing and stress-inducing.

School closure policy

We asked parents and CCC staff about the impact of HFMD-related school closure. Of the four centres, one had not experienced a closure and responses from these staff and parents were hypothetical only.

Attitudes

Many parents and teachers felt that school closures were effective at breaking the cycle of HFMD transmission. CCC staff also noted that closure offered the time and space needed to clean thoroughly. One teacher noted:

> I actually welcome it. Because I was hoping they close so that the cycle would be break.

Parents explained that taking leave and identifying alternate child-care were the biggest challenges of this policy. One parent shared:

> So, for me I exhausted about ten days … for caring of them when they are sick and when I come back, a few days later, the school announce that they are close. …I'm not saying I'm very important, but some part of service will be ceased.

CCC staff focused on the unhappiness of parents and the need to devote time and effort to creating activities for children to complete at home, cleaning the centre, and communicating with parents.

Experiences

One mother was hospitalized for a medical procedure [unrelated to HFMD] during the closure and was disappointed by the lack of alternate care for her child, who spent the closure period in her mother's hospital room:

> I did ask them like for my own case I was hospitalized, my girl shut down, I ask them I got no alternate help. …So does it mean

my girl has to come stay with me in the hospital every day? You know, my husband has to work.

In another family, the mother was forced to take unpaid leave for the closure period because her husband was on a business trip at the time and the closure came towards the end of the year, when her leave was exhausted.

These anecdotal examples of the socio-economic costs of closure were echoed to a lesser degree by parents who were able to arrange for family members to care for the child, but found the period stressful and also used leave.

Recommendations

Parents focused on the need for alternate childcare options for healthy children and found the calculation of the closure threshold confusing. Their suggestions included: a shorter closure period, closing only affected classes or spaces, and closer oversight of school sanitation efforts.

CCC staff noted that more guidance from the MOH and/or monetary support for either sanitation or finding alternate care for children could be helpful.

Discussion

Singapore's high rate of preschool enrolment and of families with two working parents provides a unique context for examining the impact of social distancing measures among preschool-age children. Many families have either live-in domestic help or close relatives available to provide emergency childcare. These cultural norms influence the views expressed by both parents and teachers, offering special insight into infectious disease control policies. Despite the high rate of back up childcare support, our findings suggest that isolation and school closure measures are burdensome both socially and economically, perhaps due to the young age group. Parents have been found to be more likely to take leave to care for young children than for elementary school-age children.[32] Parents voluntarily keeping at home children who had not been diagnosed with HFMD during outbreaks was an unforeseen cost of preschool closure policy. Some parents noted children missing a

month or more of preschool in efforts to avoid being diagnosed with HFMD and subsequently increasing the count towards school closure.

The data here suggest that the social and economic costs of isolating children diagnosed with HFMD and closing preschools with large outbreaks, though high, would be acceptable to parents if proven effective. Overall, both parents and teachers were conflicted by a perception of HFMD as a severe illness and a sense of helplessness when hygiene and social-isolation efforts were not effective. The perceived severity of HFMD has influenced existing policies and the need for a public response to HFMD, even when outbreaks are relatively mild. These perceptions may be of particular interest in other geographic areas where underlying cultural norms may predispose parents to view isolation differently.

As noted above, evidence of the effectiveness of school closure is inconclusive and depends on the length of closure, epidemiology of the disease, and of social mixing patterns in the location. Studies vary in their estimates of the prevalence of asymptomatic HFMD, the incubation period and other characteristics of HFMD that would clarify the effectiveness of preschool closures.[6] While there have been no rigorous studies of individual preschool closures, the authors of a paper on the epidemiology of HFMD in Singapore from 2001 to 2007[33] conclude that the decline in cases among children aged 0–4 and the relatively low attack rate of institutional outbreaks during this period imply that preschool closures are moderating HFMD outbreaks. Yet, the authors also note that the incidence of HFMD and total number of outbreaks increased during this period. In addition, evidence of a link between preschool attendance and HFMD transmission is weak [6, 33–36].

Positive analyses of the effectiveness of influenza-related school closures may not be relevant to HFMD or to preschool-age children. While studies have suggested that older children mix with more peers at activities designed to occupy them during school closure, preschool age children are more likely to be kept home.[32] Because HFMD is most commonly symptomatic among young children, there is less concern about increasing the disease burden when children stay home and mix with older relatives or the wider community. So, while interviewees were accepting of the burden of preschool closures, it is unlikely to be an effective control measure. The combination of concern and use of burdensome policy will necessitate that communication of policy changes be deftly managed.

Other control policies may be more effective. For instance, CCCs and parents might be encouraged to increase personal hygiene behaviours, as this is supported by evidence of a link between increased hand-washing and reduced HFMD transmission.[7, 21] The public naming policy through which MOH publishes the names of preschools with HFMD outbreaks heightens awareness of hygiene measures, but may have the reverse effect, causing both parents and schools to be reluctant to comply with case reporting policies.

Recommendations and Conclusion

A clearer understanding of the epidemiology of HFMD, including reproductive number, incubation period, and prevalence of asymptomatic cases would inform policy decisions. In the future, Singapore may choose to amend existing guidelines for control of early childhood disease to reduce the burdens of voluntary isolation of healthy children and preschool closures by limiting closures to outbreaks of EV71 or by choosing to focus on clinical guidelines, parent education, and reducing public transmission.[6]

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