Role Of Non-pharmaceutical Interventions During COVID-19 Pandemic: A Systematic Literature Review

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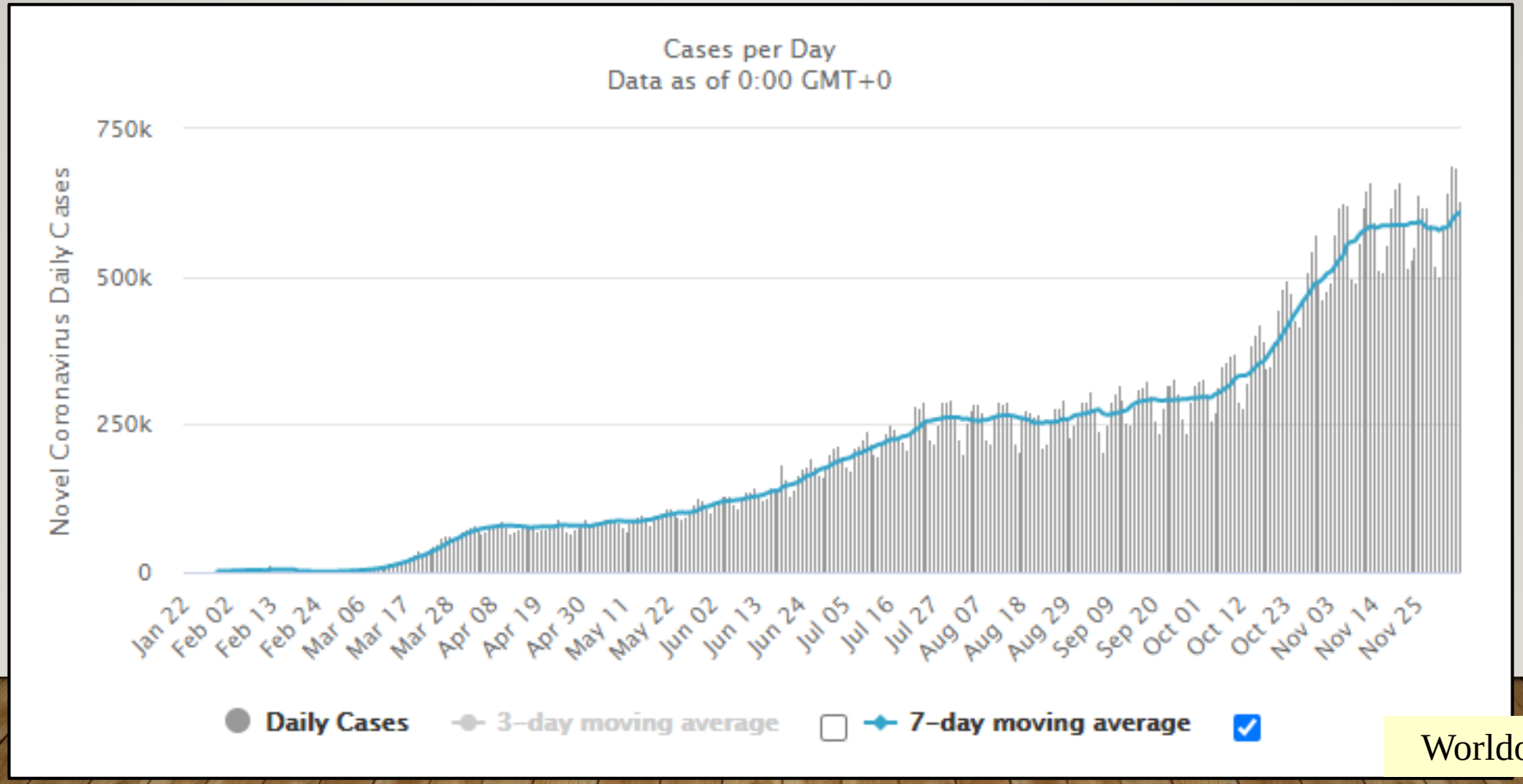
INTRODUCTION

- As of 4th June 2020, SARS-CoV-2 or COVID-19, has affected more than 6.56 million individuals worldwide and caused more than 387,987 deaths
- WHO has declared the pandemic as a Public Health Emergency of International Concern (PHEIC) on 30th January 2020
- Governments across the globe quickly implemented emergency lockdowns in their respective countries to help flatten the curve of infection
- With the unavailability of effective vaccines, non-pharmaceutical interventions (NPIs) have been given serious attention to prevent and curb COVID-19 transmission
- Nevertheless, until an effective vaccine or treatment intervention becomes available, COVID-19 prevention will continuously rely on NPIs, including pandemic mitigation in the community
- NPIs are important to reduce infectious disease and flatten the curve, however, data or literature on the effectiveness of NPIs is scarce
- In this review, we aim to determine the effectiveness of NPIs in the community based on previous literature.

NEW CASES WORLDWIDE

(TILL 5TH DEC 2020)



Worldometer 2020

TYPES OF NON-PHARMACEUTICAL INTERVENTIONS

Human Surveillance

- Hand Hygiene
- Disinfection
- Cough Etiquette
- Face Mask

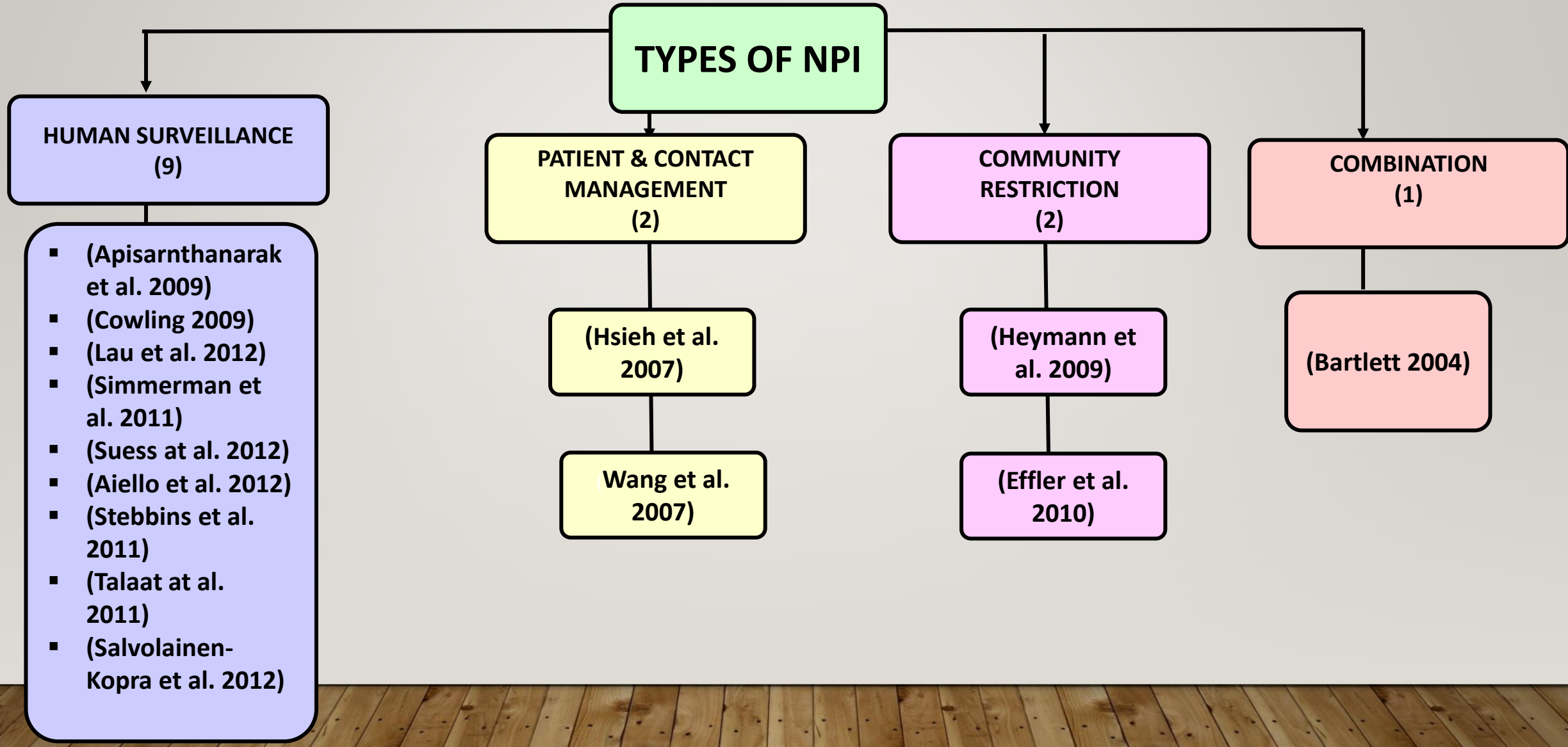
Patient & Contact Management

- Social Isolation
- Quarantine
- Contact Tracing
- Voluntary Sheltering

Community Restriction

- Closure Of Facilities
- Cancellation Of Group Events
- Travel Restrictions

TYPES OF NON-PHARMACEUTICAL INTERVENTION



COUNTRIES

No.	Country	No. of Articles
1.	Thailand	2
2.	China	2
3.	Australia	1
4.	Taiwan	2
5.	Israel	1
6.	USA	3
7.	Finland	1
8.	Egypt	1
9.	Germany	1

HUMAN SURVEILLANCE

(Apisarnthanarak et al. 2009)

-3 years Quasi-Experimental Study

-240 Thai Pre-schoolers (5 yrs old)

-Assessing (in 3 periods):
a. Hand Hygiene
b. Cough etiquette
c. Combined behaviours

-The monthly incidence of ILI:
a. period 1 (mean, 124 episodes per month) → 25.8 cases per 1,000 child-days
b. period 2 → 10.1 cases per 1,000 child-days (a reduction of 60.8% (P=0.008)
c. period 3 → 8.2 cases per 1,000 child-days (a further reduction of 19%; P=0.002).

(Cowling 2009)

-Cluster Randomized Control Trial

-45 OPD clinics in the private and public sectors in Hong Kong

-Assessing:

a. Lifestyle education (control) (134 households)
b. Hand hygiene (136 households)

c. Surgical facemasks plus hand hygiene (137 households)

-60 (8%) contacts in the 259 households had lab confirmed influenza within 7 days after intervention

-fewer infections among participants using facemasks plus hand hygiene (**adjusted odds ratio, 0.33** [95% CI, 0.13 to 0.87]).

(Lau et al. 2012)

-Cohort study

-2 Chicago Public Elementary Schools (981 students were eligible: 4-14 years old)
-Assessing: Hand hygiene

-Both the percent total absent days and percent illness-related absent days were significantly lower in the group receiving short instruction during flu season (P = 0.002, P<0.001, respectively)

- This difference peaked during the influenza season (when intervention began) and declined in the following months

-Teachers (n = 23) agreed that hand hygiene is not performed properly among students and reported time constraints as a barrier to frequent hand washing

(Simmerman et al. 2011)

- Randomized Control Trial

-1589 household member, Bangkok, Thailand

-Assessing :
a. Hand Hygiene (HW)
b. Combination of FM & HW

c. Control group

-The odds ratios (ORs) for secondary influenza infection were **not significantly different** in the HW arm (OR = 1.20; P=0.442), or the HW + FM arm (OR = 1.16;

P = 0.525)

-Influenza transmission was not reduced by interventions to promote hand washing and face mask use

(Suess at al. 2012)

-Cluster Randomized Control Trial

-84 households (30 control, 26 M and 28 MH households) with 218 households contact at Berlin, Germany (2009-2011)

-Assessing:

a. Hand hygiene

b. Face mask

-When analyzing only intervention group (implemented within 36 h after symptom onset of the index case), secondary infection in the pooled M and MH groups was **significantly lower** compared to the control group

-In a per-protocol analysis odds ratios were **significantly reduced** among participants of the M group

-NPI may be effective in preventing transmission of influenza in households

(Aiello et al. 2012)

-Randomized intervention trial

- 1,178 young adults living in 37 residence houses in 5 university residence halls (2007–2008 influenza season), Michigan University, America.

-Assessing:

-Hand hygiene

- Face mask

show **a significant reduction** in the rate of ILI among participants face mask and hand hygiene intervention ranging from 48% to 75% when compared to the control group.

-Face masks and hand hygiene combined may reduce the rate of ILI and confirmed influenza in community settings

-These non- pharmaceutical measures should be recommended in crowded settings at the start of an influenza pandemic

(Stebbins et al. 2011)

- Randomized Control Trial

-10 elementary schools (3360 children) in Pittsburg, USA

-Assessing :
a. Hand Hygiene
b. Cough etiquette
-Total absent episodes significantly lower among the intervention group than among the control group; adjusted IRR 0.74
- reduce the cumulative incidence of influenza A by 52% (IRR: 0.48)

-NPIs (respiratory hygiene education and the regular use of hand sanitizer) did not reduce total laboratory-confirmed influenza

-However, the interventions did reduce school total absence episodes by 26% and laboratory-confirmed influenza A infections by 52%

(Talaat at al. 2011)

-Randomized Control Trial

-60 elementary schools (20,882 students) in Cairo, Egypt

-Assessing: Hand hygiene

--Compared with results for the control group, in the intervention group, overall absences caused by ILI decreased (reduced 40%, $p<0.0001$), and laboratory-confirmed influenza (reduced 50%, $p<0.0001$)

-An intensive hand hygiene campaign was effective in reducing absenteeism caused by these illnesses

(Salvolainen-Kopra et al. 2012)

-Open cluster randomized intervention trial

- total of 21 clusters (683 persons) in 6 companies, Helsinki, Finland

-Assessing: Hand hygiene

- hand hygiene with soap and water (257 persons), with alcohol-based hand rub (202 persons), or to serve as a control (224 persons).

-In the total follow-up period there was a 6.7% reduction of infection episodes (ILI) in the soap-and water arm ($p = 0.04$).

-Conclude that intensified hand hygiene using water and soap together with behavioural recommendations can reduce the occurrence of self-reported acute illnesses in common work environment.

PATIENT & CONTACT MANAGEMENT

(Hsieh et al. 2007)

- Observational study in Taiwan, during the SARS outbreak (150,000 people)
- Assessing
- 1. Level A Quarantine
- 2. Level B Quarantine
- Level A quarantine prevented approximately 461 additional SARS cases and 62 additional deaths
- Level B → around 5% reduction of cases and deaths (minor effects)

- By comparison, a perfect Level A quarantine (which aimed to quarantine all asymptomatic cases as soon as they were potentially exposed) results in more drastic reduction of cases than a perfect Level B quarantine

(Wang et al. 2007)

- Observational study in Taiwan during SARS outbreak March 18 to July 31, 2003
- 147,526 persons were placed under quarantine
- Persons under level A quarantine had a 3-times- higher rate of developing SARS than persons under level B quarantine
- Quarantining only persons with known expo- sure to people infected with severe acute respiratory syndrome could have **reduced** the number of persons quarantined by approximately 64%.

TABLE 1—Number of Persons Quarantined, Number of Laboratory-Confirmed SARS Cases, and Number of SARS Cases, by Type of Exposure: Taiwan, March to July 2003

Type of Exposure	No. Quarantined	No. of Laboratory-Confirmed SARS Cases (%)	No. of SARS Cases (%)
Level A quarantine			
Classmates or teachers	16 794	1 (0.006)	9 (0.05)
Family members or relatives	8318	14 (0.17)	27 (0.32)
Coworkers or friends	4950	1 (0.02)	3 (0.06)
Homeless persons/shelter residents	622	0 (0.00)	1 (0.16)
Public transportation	147	0 (0.00)	0 (0.00)
Unprotected health care workers	2451	7 (0.29)	20 (0.82)
Same ward or nurse unit	419	1 (0.24)	2 (0.48)
Other nosocomial SARS exposure	10 751	9 (0.08)	27 (0.25)
Unknown	7803	3 (0.04)	13 (0.17)
Total	52 255	36 (0.07)	102 (0.20)
Level B quarantine			
Travelers from SARS-affected areas	93 665	3 (0.003)[a]	52 (0.06)
Within 3 rows of a person with SARS on a flight	1606	0 (0.00)	4 (0.25)
Total	95 271	3 (0.003)	56 (0.06)

COMMUNITY RESTRICTION

(Heymann et al. 2009)

-Observational study in Israel (nationwide elementary schools : 6-12 yrs old, household members aged >12 years presumed to be living with these children and all other Maccabi members aged >12 years)

-Assessing: school closure

-The changes in the weekly ratio of influenza-like diagnoses to non-respiratory diagnoses were statistically significant (P=0.0074) for school children for the strike year compared to other years

-The Chanukah holiday had a negative impact on the ratio for school-aged children in 1998, 1999 and 2001 (P=0.008, 0.006 and 0.045, respectively) and was statistically significant for both adult groups in 1999 and for adults with no school-aged children in 2001

-**School closure should be considered part of the containment strategy in an influenza pandemic**

(Effler et al. 2010)

-Observational study in Perth, Australia (5-13 yrs old)

-Surveys were distributed by schools on June 22, 2009 (10 days after school closure ended) and collected on July 3, 2009

-Assessing: school closure

-Respiratory illness developed in 14 (10%) of 143 contacts and 5 (6%) of 78 peers; 6 of the 19 illnesses met the case definition for ILI, but the remaining URIs were mostly afebrile

-90% of parents reported that the school closure caused minimal or no anxiety for their child, but 55% reported that school closure caused moderate or severe disruption to family routines. 45% indicated that they were well prepared for school closure

-Of the 233 responses, 12 (5%) were from households with case-patients in the initial cluster of pandemic (H1N1) 2009 infections that led to the recommendation for school closure; 143 (61%) of the responses were from households with contacts of case-patients, and 78 (34%) were from households with peers

-Of 221 contacts and peers, 19 (9%) reported onset of respiratory symptoms during the week of school closure 14 were contacts and 5 were peers

-Illness in 6 of the symptomatic students (3 contacts and 3 peers) met the criteria for ILI; the remaining illnesses were URIs

COMBINATION

(Bartlett 2004)

- Observational study during SARS outbreak (2521 probable cases) and their close contacts in 5 districts in Beijing between March 5-29, 2003 (0-80 years old)

- Assessing:

1. Quarantine

2. Closure of facilities

3. Transit site surveillance

- 2195 quarantined close contacts; attack rate was 6.3% with a range of 15.4% among spouses to 0.36% among work and school contacts.

-the attack rate among quarantined household members increased with age from 5.0% in children < 10 years to 27.6% in adults aged 60 to 69 years.

- Among almost 14 million people screened for fever at the airport, train stations, and roadside checkpoints, only 12 were found to have probable SARS

-All public elementary, middle, and high schools (n=2610) were closed on April 24, not reopening again in some cases until early July

-The multiple control measures implemented in Beijing likely led to the rapid resolution of the SARS outbreak

-Improvements in infection control practices, use of PPE, grouping of patients with SARS in the hospital, establishment of designated fever clinics, quarantine of high-risk close contacts, and improved public information and awareness of SARS likely played important roles in controlling the outbreak.

RECOMMENDATIONS & CONCLUSION

RECOMMENDATIONS & CONCLUSION

- NPIs plays an important role in COVID-19 pandemic management and prevention
- Many studies that were carried out contribute to the growing body of knowledge on community behaviour during such outbreaks
- The results of our systematic review may be helpful to public health and education officials considering NPIs as means to control influenza outbreak i.e. COVID-19, SARS MERSCOV
- These studies may help estimate the effect of NPIs during infectious disease outbreaks as a disease mitigation measure and underscores the need for further research
- NPIs with the aid of effective vaccination programs and research on antivirals are equally important to combat pandemics

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THANK YOU