

# Emerging Evidence on COVID-19

## Evidence Brief of De-escalation of Social Bubbles

### Introduction

*What evidence is available on the de-escalation of "household bubbles", is there suggestions for how we can decrease the network segmentation of communities to larger networks?*

This review will examine the evidence on the concept of network segmentation. This has been implemented within the general public as "social bubbles". This concept refers to limitations on individual interactions with people outside of their closed network (e.g. immediate family). As we move to different phases of the epidemic, it is of interest to understand what impact increasing the social bubble size or segmented networks may have on the epidemic. This evidence brief includes literature up to June 15, 2020.

### Key Points

- This evidence brief consists of four predictive models, three of which are recent preprints and have not undergone the peer-review process.
- One preprint was identified that directly models social bubbles and real world options using the UK as the case study. The study reports that single family bubbles are estimated to have reduced the number of cases by 17%. In their model they explore relaxing the single household bubble to different scenarios of multiple households using three different secondary attack rates and  $R_0$  as the outcome.  $R_0$  is shown to increase as restrictions are relaxed, but some of the limited options appear to have minimal increase in risk.
- Three social network models also provide some evidence to support that larger, but still closed and segmented networks offer a protective effect against introduction of SARS-CoV-2. The larger a segmented network and the more contacts outside of that network, the higher the risk of virus introduction.
- There are many studies that look at the impact of social distancing more generally and in combination with other interventions. They have not been summarized in this evidence brief, but are available upon request as they are collected within the Public Health Intervention evergreen review.
- One protocol for a systematic review on physical distancing interventions was also identified, but it will not be conducted until October 2020.

### Overview of the Evidence

The concept of reducing transmission of SARS-CoV-2 by restricting close interactions to a very strict, small network (i.e.: a single family) is an effective intervention. Increasing the size of the network or de-escalation of the intervention is important to do carefully and not too quickly so control over the epidemic is maintained while slowly lifting restrictions. As there are few observations in the literature, the evidence is largely

contained in a few recent preprints that report on predictive models. These models are based on scenarios and are parameterized using observational data from the outbreak; caution should be exercised in using these findings, as the extent to which the results can be generalized to the local context is variable.

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## SOCIAL BUBBLES

Four predictive models explored concepts of social bubbles using agent-based models and other network models to demonstrate the protective impact of having closed and limited contact networks during the COVID-19 epidemic (Block et al., 2020; Leng et al., 2020; Sneppen & Simonsen, 2020; St-Onge, Thibeault, Allard, Dube, & Hebert-Dufresne, 2020). One model directly explores a range of relaxing options for contact restrictions and explores the implications using  $R_0$  (Leng et al., 2020). These models explore and explain the concept of small-segmented community networks providing increased resistance to an introduction of the virus event into smaller networks. They also explore the activities that degrade the protection of a segmented network. This occurs when an individual from a closed network interacts with other networks and is particularly higher risk when the interaction is within a random gathering event where unknown people mix e.g. public transportation, commuting to a workplace outside of the segmented network, social places such as bars and restaurants, or sporting events. However, the extent that these estimates can be used is unknown as they were based on the epidemic dynamics in a specific place.

**Table 1: Modelling studies on social bubbles or restricted social networks**

Reference	Study Description	Relevant Outcomes
(Leng et al., 2020) <i>Preprint</i>	Individual-based model: Using the UK as a case study, a mathematical model was used to assess the effectiveness of various social bubble strategies as part of a gradual lockdown exit strategy. Using a base case where non-essential shops and schools are closed, the household attack rate is 20%, and $R_0=0.8$ , a number of social bubble strategies are simulated. Results demonstrate that in this base case scenario, social bubbles reduced cases and fatalities by 17% compared to an unclustered increase of contacts.	Keeping the secondary attack rate = 20% constant. The base scenario is single family bubbles $R_0 = 0.8$ The following scenarios show how $R_0$ would be expected to change with moderate relaxing of contact restrictions: <ol style="list-style-type: none"> <li>1. Allowing all households with primary school age children to pair up <math>R_0= 0.85</math></li> <li>2. Allowing all households with children of any age to pair up = 0.90</li> <li>3. All single occupancy households to link up with other single occupancy households 0.85</li> <li>4. All single occupancy households to</li> </ol>

	Clustering contacts outside the household into exclusive social bubbles is an effective strategy of increasing contacts while limiting some of the associated increase in epidemic risk.	link up with any other household Ro=1.00 5. Scenarios 1 and 3 Ro=0.90 6. All households pair up Ro=1.11
(Block et al., 2020)	Stochastic Model: Adopting a social network approach, we evaluate the effectiveness of three distancing strategies designed to keep the curve flat and aid compliance in a post-lockdown world. We demonstrate that a strategic social network-based reduction of contact strongly enhances the effectiveness of social distancing measures while keeping risks lower.	3 scenarios for social distancing- "strengthening community and seeking similarity strategies". - Individuals choose their contact partners based on similarity of a predetermined individual characteristic. This facilitates forming small groups e.g. neighbourhood/ small organization. - Individuals consider who their contact partners interact and do not see people outside of a defined contact network. Build bubbles through repeat contacts. Individuals decide who they want to interact with. This can be used with work units as well. It is difficult for the virus to penetrate these micro-communities.
(St-Onge et al., 2020) <i>Preprint</i>	Canadian authors (Laval University) SIS/SIR models using a network science framework to look at the impact of having structures aka gatherings (groups/ classrooms/ sports teams etc.).	- They demonstrate that localized epidemics can collapse if the group or gathering size remains below a threshold. - The threshold for the mesoscopic localization regime, with a transmission rate $\beta = 0.07$ was 23 people and below.
(Sneppen & Simonsen, 2020) <i>Preprint</i>	This agent-based model explored the impact of super-spreading events. In the base model super-spreading events had little effect on the epidemic, however under various intervention strategies, limiting diffuse social contacts – random gathering events - in settings such as bars, transportation, restaurants, parties, concerts and lecture halls is far more effective than limiting the same amount of contact events in the home and work setting.	- Limiting random gathering events had a large impact on the risk of super spreading events in this model under scenarios where various intervention strategies are implemented.

## ON-GOING RESEARCH PROTOCOL

One systematic review protocol was identified that will summarize the evidence on isolation, quarantine, and social distancing strategies.

**Table 2: Research protocols**

Reference	Study Description	
(Regmi & Lwin, 2020)	What has been the impact of social distancing measures for preventing coronavirus disease 2019 [COVID-19]?	Studies will be targeted from July to October 2020 and will be restricted to peer-reviewed articles in English.

### Methods:

A daily scan of the literature (published and pre-published) is conducted by the Emerging Sciences Group, PHAC. The scan has compiled COVID-19 literature since the beginning of the outbreak and is updated daily. Searches to retrieve relevant COVID-19 literature are conducted in Pubmed, Scopus, BioRxiv, MedRxiv, ArXiv, SSRN, Research Square and cross-referenced with the literature on the WHO COVID literature list, and COVID-19 information centers run by Lancet, BMJ, Elsevier and Wiley. The daily summary and full scan results are maintained in a Refworks database and an excel list that can be searched. Targeted keyword searching is conducted within these databases to identify relevant citations on COVID-19 and SARS-CoV-2. Search terms used included: social AND (bubble or bubbles or network). Results were crosschecked with the evergreen review on Public Health Interventions. This review contains research published up to June 15, 2020. Each potentially relevant reference was examined to confirm it had relevant data and relevant data is extracted into the review.

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