Network analysis of England's single parent household COVID-19 control policies: a proof-of-concept study

Dr Natalie Edelman (BSMS, UoB)

Prof Jackie Cassell (BSMS)

Prof Istvan Kiss (UoS)

University of Brighton

brighton and sussex medical school

University of Sussex

INTRODUCTION

Policy 1: Children of single parent households (SPHs) were permitted to move between parental homes.

Policy 2: SPHs permitted to form a support bubble with another SPH/other household.

Related work:

Network analyses of social and support bubbles look only at bubble impact and assumed exclusivity – no additional actors entering or leaving homes.

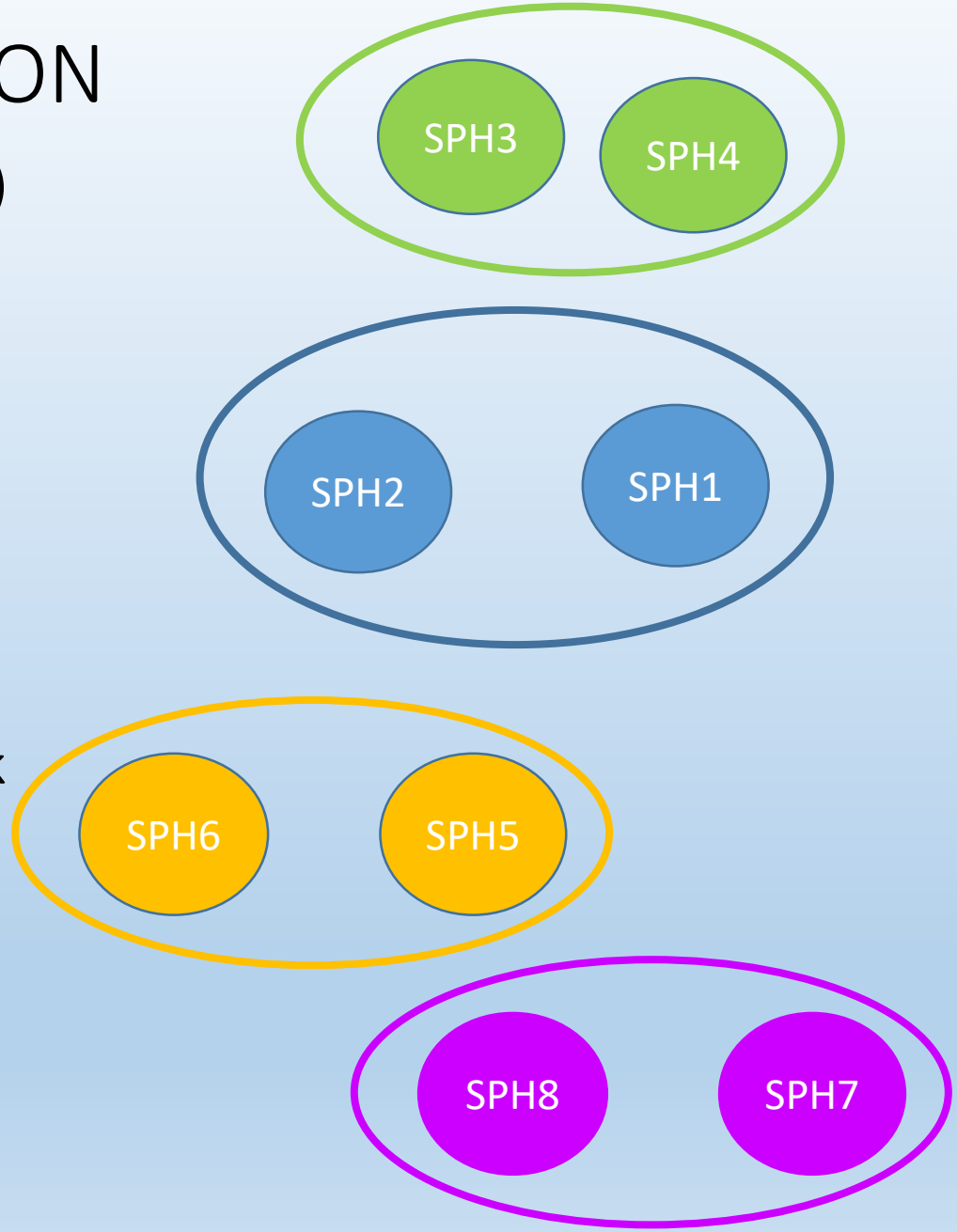
INTRODUCTION

Policy 1: Children of single parent households (SPHs) were permitted to move between parental homes.

Policy 2: SPHs permitted to form a support bubble with another SPH/other household.

Related work:

Network analyses of social and support bubbles look only at bubble impact and assumed exclusivity – no additional actors entering or leaving homes.



INTRODUCTION

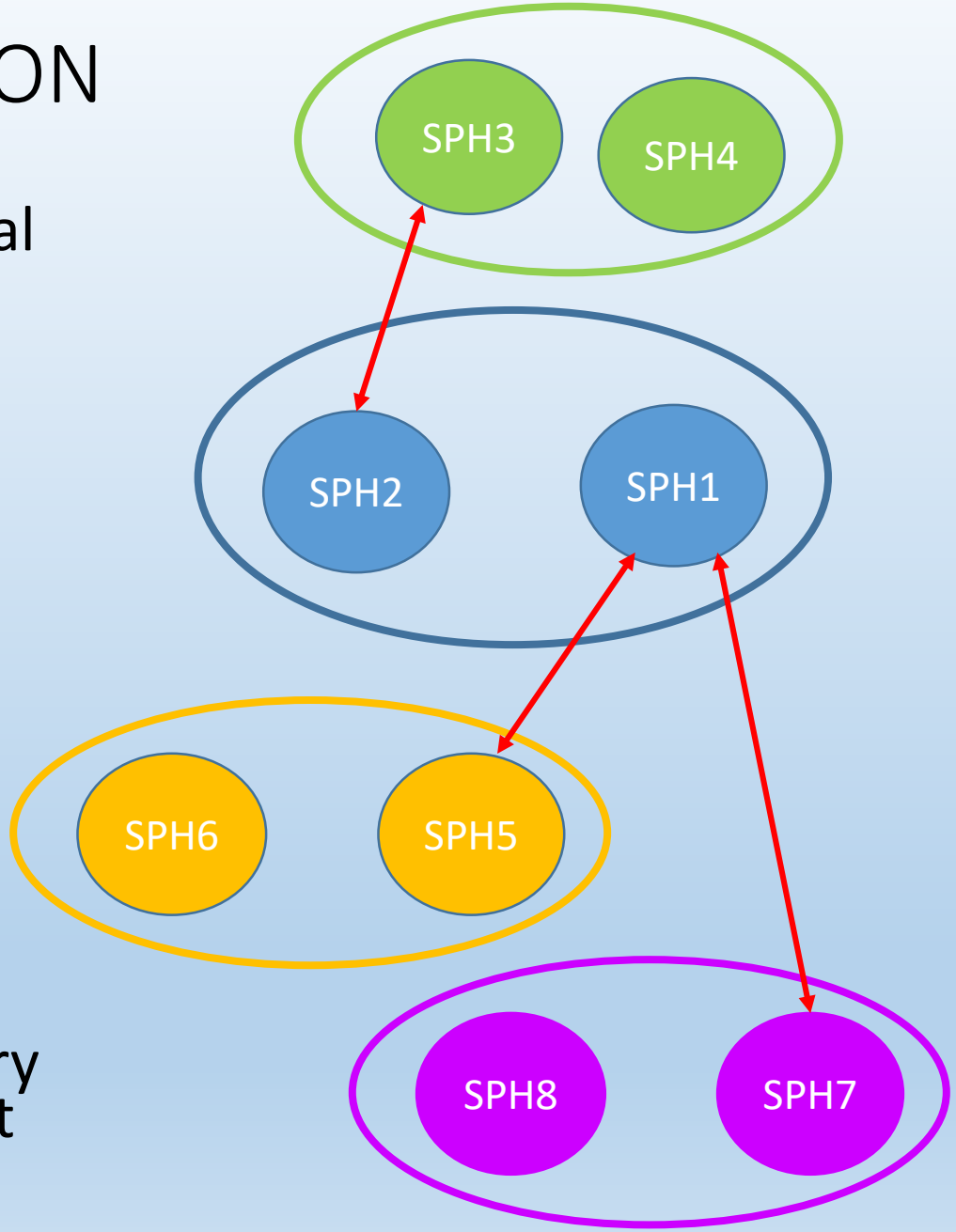
Policy 1: Children of single parent households (SPHs) were permitted to move between parental homes.

Policy 2: SPHs permitted to form a support bubble with another SPH/other household.

Related work:

Network analyses of social and support bubbles look only at bubble impact and assumed exclusivity – no additional actors entering or leaving homes.

Dynamics of COVID-19 transmission in domiciliary care and implications for prevention and support of the services.



STUDY AIM

Aim: To explore the putative combined impact of these policies on Covid-19 household transmission dynamics

Percolation theory

- Mathematical approach to understanding connectivity
- Examines network changes from small disconnected clusters to a ‘giant component’ likely to affect a large number of people

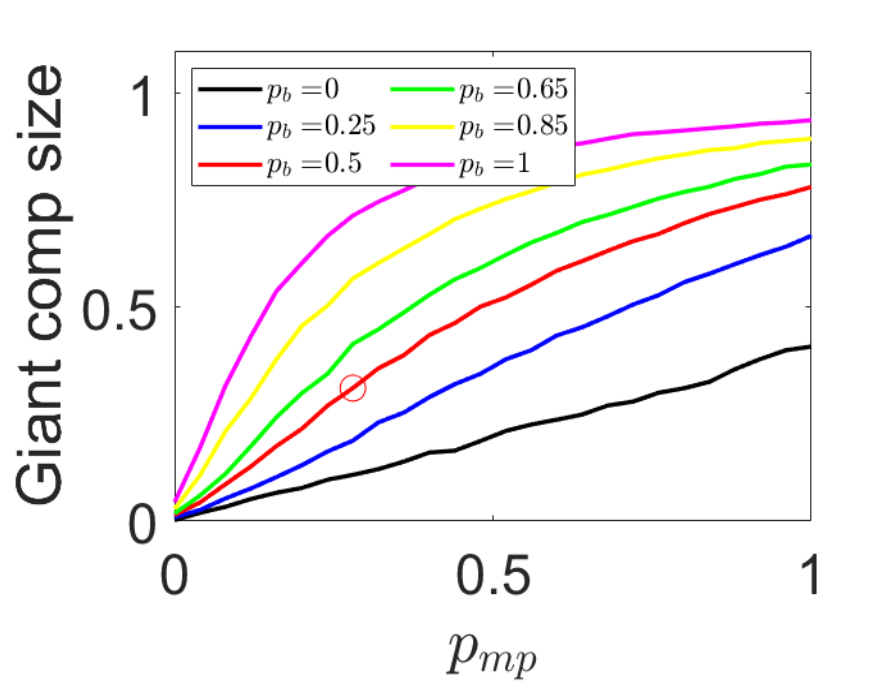
DEFINITIONS

Single parent - a primary care-giver who does not live with the other primary caregiver of their child/children, *irrespective of whether they are living with a new partner or not*

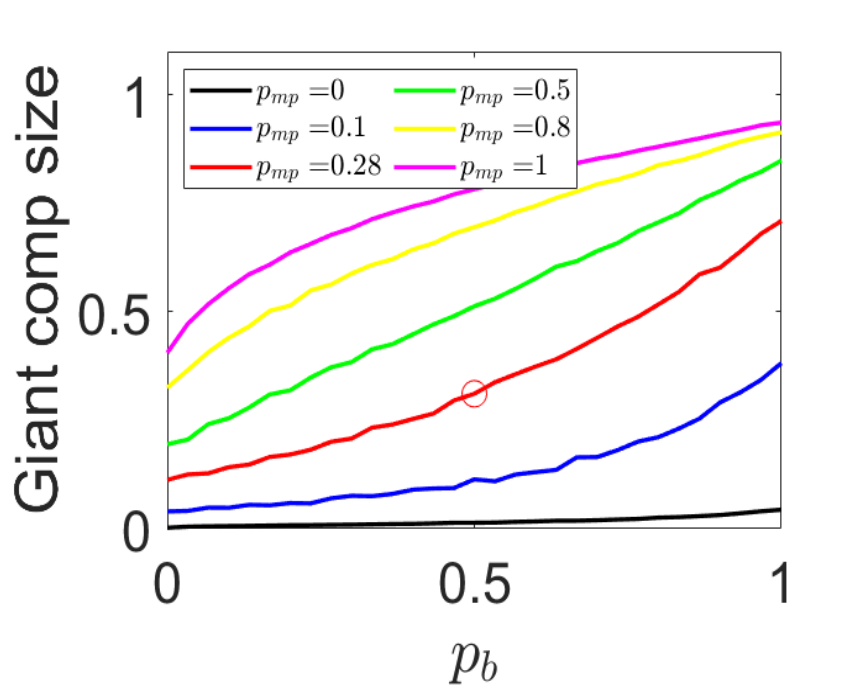
Discordant-Parentage Single Parent Household (DSPH) – a SPH that includes 2+ children who only share one parent (having different parents in other SPHs with whom they regularly stay)

VARYING EXTENT OF BUBBLING & DSPHs

Probability of SPHs of 2+ children being Discordant-Parentage SPHs (p_{mp})



Probability of SPHs forming bubbles with other SPHs (p_b)



Growth of the giant component is much slower for bubbling without DSPHs than for DSPHs without bubbling.

CONCLUSIONS

- Support bubbles between SPHs have little impact on formation of giant components that may accelerate Covid-19 transmission, even when children are moving between SPHs, *except* where one or more are DSPHs

LIMITATIONS

- Limited estimates available
- Proof-of-concept study of network connectivity *not* SARS-CoV-2 transmission
- Did not account for:
  - other types of bubble (e.g. childcare)
  - other transmission routes (e.g. school)
  - other variables impacting acquisition and transmission – e.g. age of child

DISCUSSION

Future network/epidemiological studies should consider combined effects of policies in order to:

- Understand overall impact
- Identify differential impact on sub-populations

Public health guidance should include supportive measures that mitigate the increased transmission risk afforded by support bubbling among DSPHs