INDEMIC
Indonesia Infectious Disease
Modelling Community

oucru

Sparkle
A program supported by the Australian Government
and implemented by the Doherty Institute

Membangun Model

Hands-on Activity

Rahmat Sagara
OUCRU Indonesia

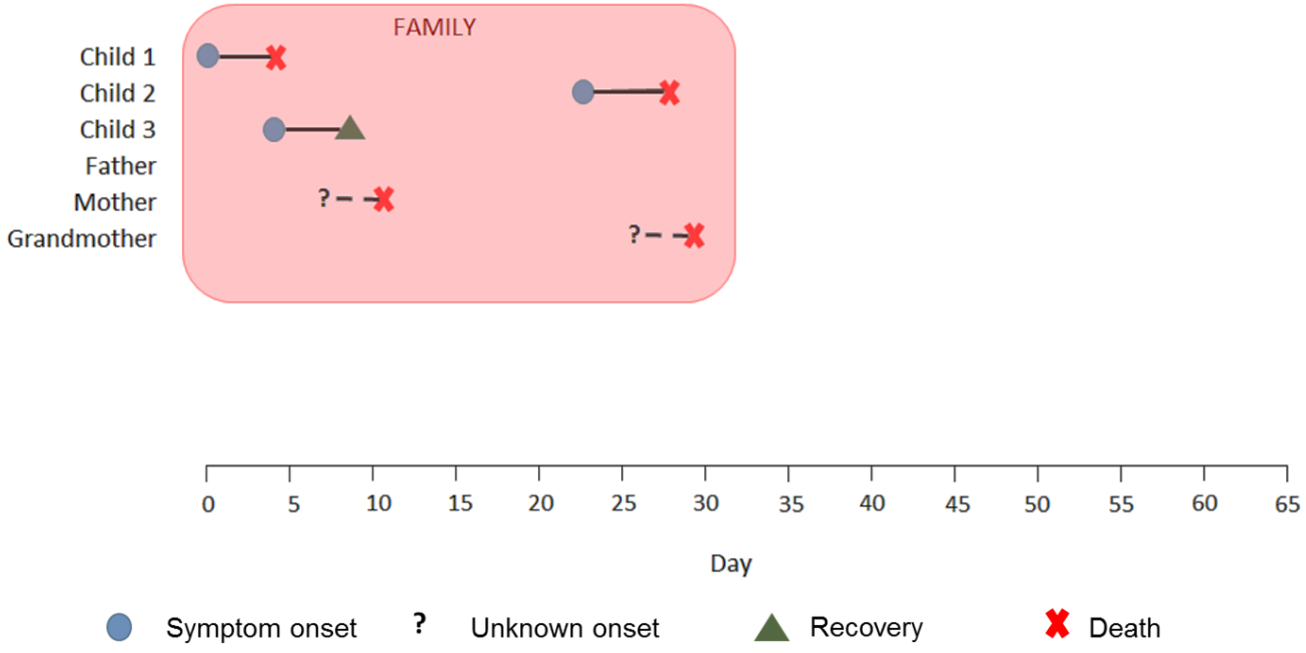
(diadaptasi dari materi presentasi Dr. Patricia Campbell)

Tujuan

- Mengidentifikasi transisi keadaan (*state transitions*) yang mungkin dialami individu terkait penyakit menular
- Menerjemahkan karakteristik penyakit yang diamati ke dalam diagram model penularan (*transmission model*)
- Memahami alasan mengapa model yang lebih rumit mungkin diperlukan

Berita Terkini

Wabah Penyakit



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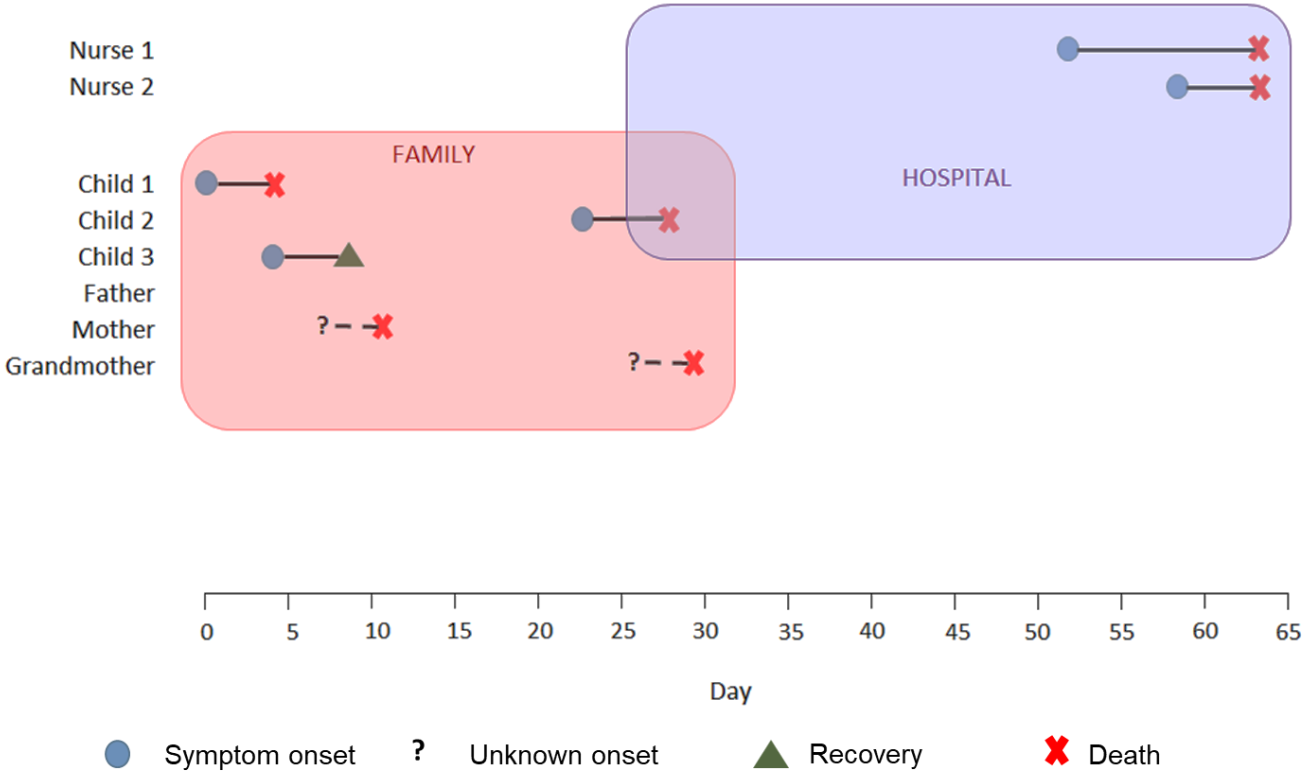

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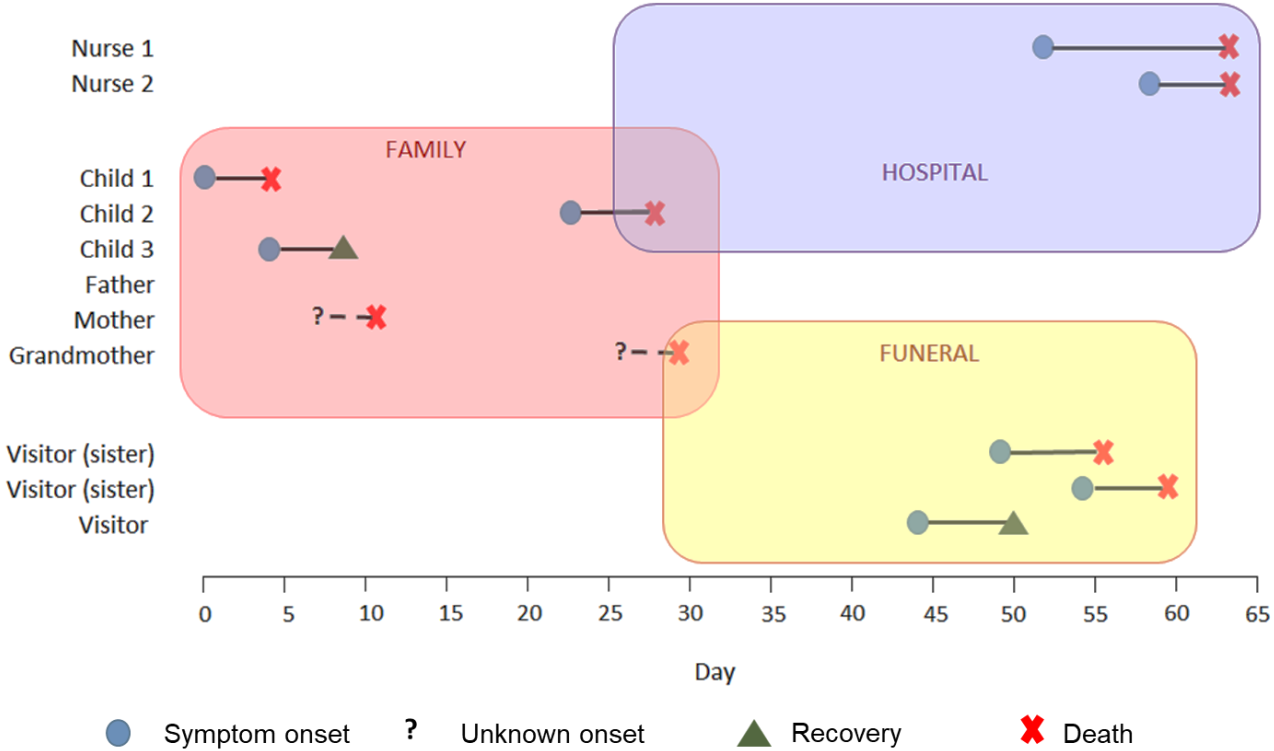

Data Wabah Penyakit

Case No.	Age (years)	Date of symtom onset	Date of recovery	Date of death	Comments	
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Data Wabah Penyakit

Case no.	Age (yrs)	Sex	Symptom onset	Date of recovery	Date of death	Comments	
1	2	M	02/12/2013		06/12/2013	Child 1	
2	10	F	06/12/2013	11/12/2013		Child 3	
3	3	F	25/12/2013		29/12/2013	Child 2; hospitalised 27/12	
4	31	F			13/12/2013	Mother	
5	55	F			01/01/2014	Grandmother	
6	39	M	25/01/2014		02/02/2014	Nurse 1; at hospital of case 3	
7	25	F	29/01/2014		02/02/2014	Nurse 2; at hospital of case 3	
8	42	M	15/01/2014	21/01/2014		Visitor; attended funeral	
9	57	F	20/01/2014		26/01/2014	Visitor; attended funeral	
10	52	F	25/01/2014		30/01/2014	Visitor; attended funeral	

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Data Wabah Penyakit

Case no.	Age (yrs)	Sex	Symptom onset	Date of recovery	Date of death	Comments	Symptom duration
1	2	M	02/12/2013		06/12/2013	Child 1	5 days
2	10	F	06/12/2013	11/12/2013		Child 3	
3	3	F	25/12/2013		29/12/2013	Child 2; hospitalised 27/12	
4	31	F			13/12/2013	Mother	
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						Average duration of symptoms	6.25 days

Tugas 1: Mendiskusikan ciri-ciri wabah

Dengan memperhatikan diagram dan tabel:

- Apakah ada individu yang tidak lengkap informasinya?
- Apa saja penjelasan yang mungkin untuk kesenjangan yang besar antara awal gejala yang diamati pada setiap individu?
- Untuk tujuan pengembangan model penularan, apakah penting informasi bahwa seseorang sembuh atau meninggal?
- Apakah ada hal lain yang mungkin penting?

Tugas 2: Membuat model

Dengan mempertimbangkan diagram dan tabel:

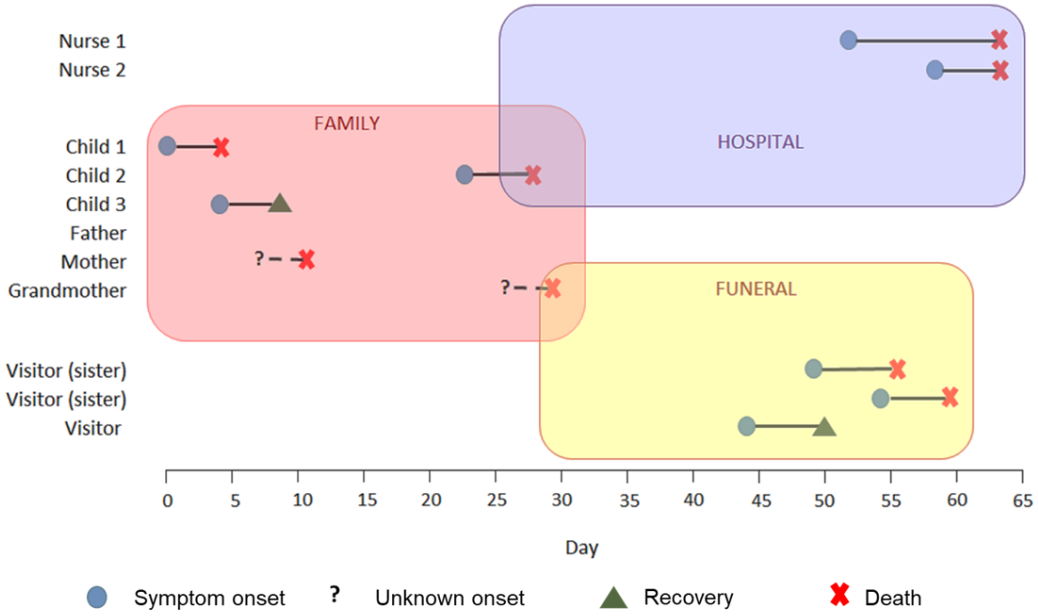
- *State* apa saja yang dibutuhkan model transmisi untuk menggambarkan populasi?
    - Mungkin akan lebih mudah jika terlebih dahulu menuliskan bagaimana *state* setiap orang berubah.
- Peristiwa (*events*) apa saja yang menyebabkan individu berubah *state*?
- Dengan menggunakan *state* dan peristiwa tersebut, cobalah menggambar model yang menangkap transisi *state* semua individu.
- Informasi apa yang dibutuhkan untuk memparameterisasi model?

Diskusi Kelompok

Hasil Diskusi Kelompok

- Sebutkan macam-macam *state* yang ada?
- Sebutkan *event* yang ada?
- Bagaimana diagram modelnya?

Rantai Penularan dan Ro

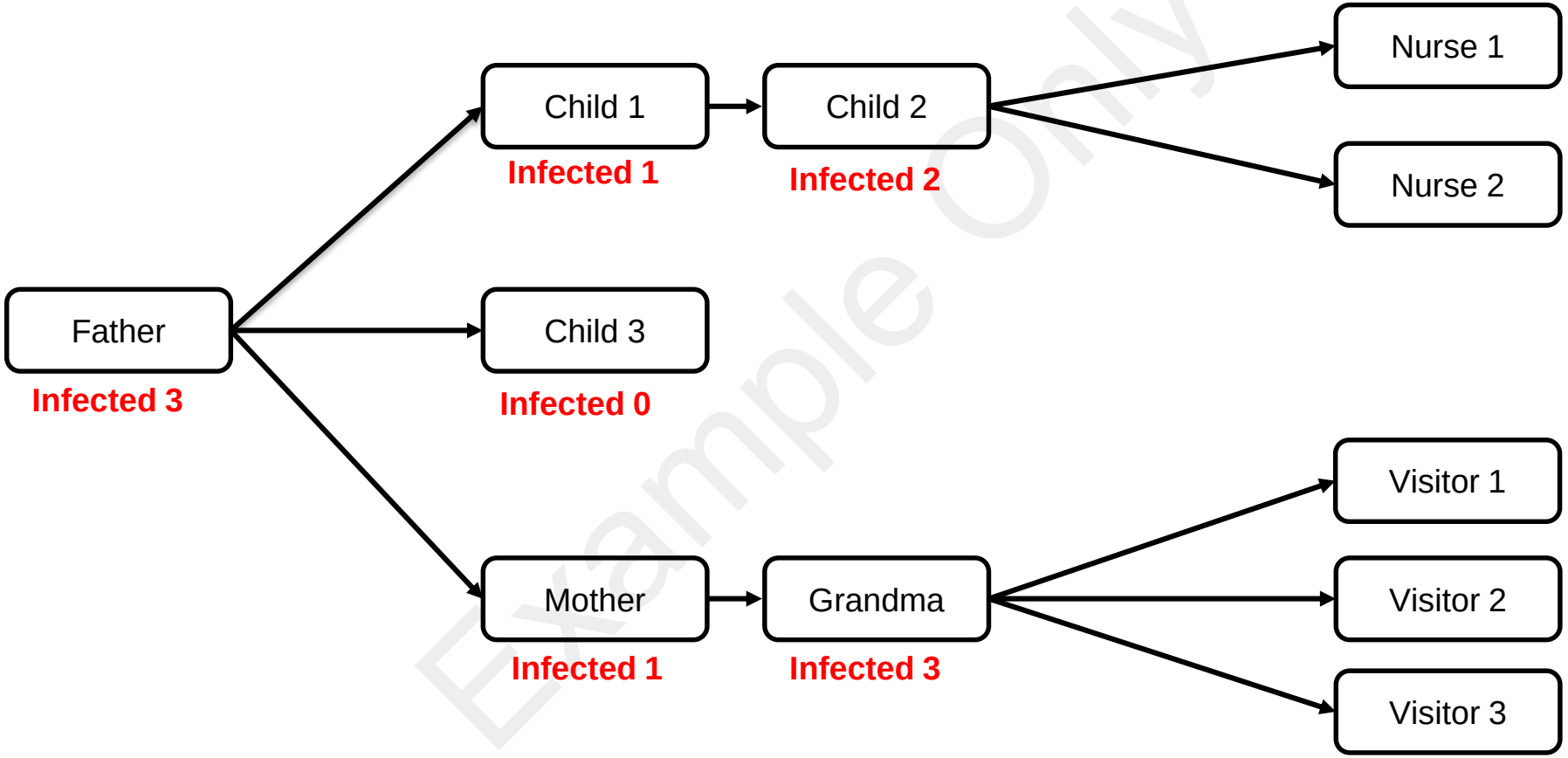


Siapa yang mendapat kasus yang pertama kali (Index case?

Untuk setiap individu yang terinfeksi, siapa yang mungkin telah menularkan penyakitnya?

Kita dapat menggunakan informasi ini untuk menggambar rantai penularan hipotetis dan memperkirakan Ro

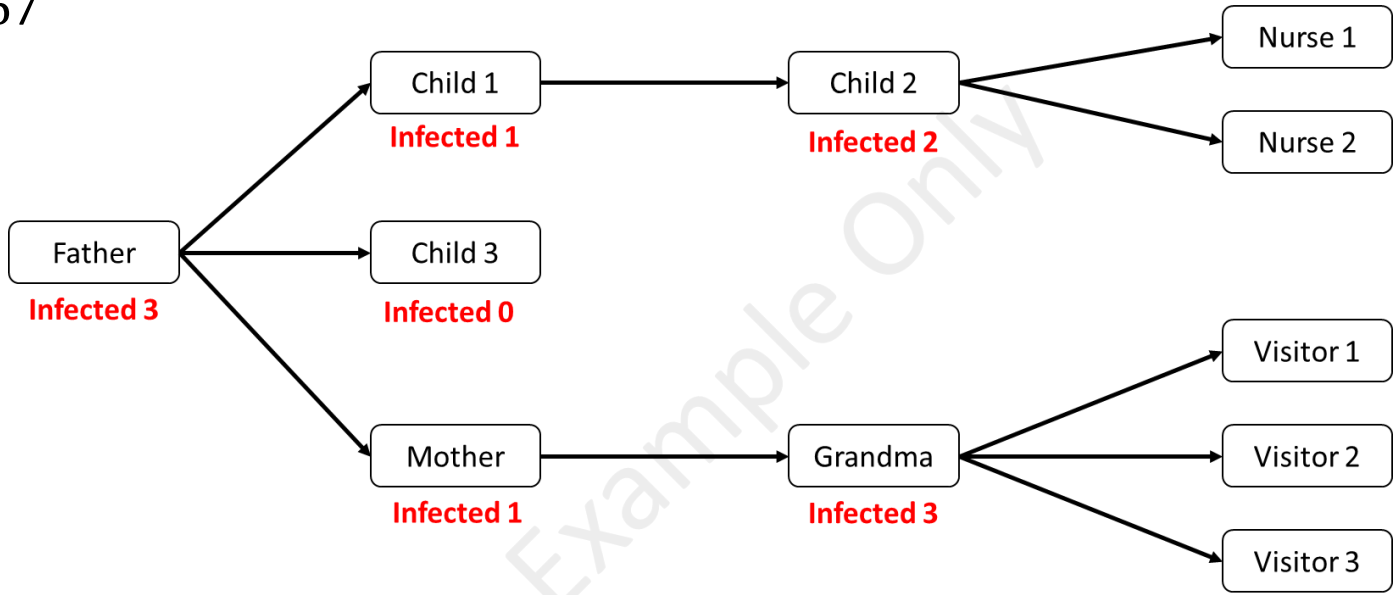
Rantai Penularan dan Ro



Rantai Penularan dan R0

$$R_0 = \frac{Jumlah\ dari\ banyaknya\ yang\ tertular\ oleh\ setiap\ penular}{banyaknya\ penular} \approx \frac{(3+1+0+1+2+3)}{6} = \frac{10}{6}$$

$$\approx 1.67$$



Berita Terkini

https://www.flickr.com/photos/121483302@N02/14632566347
https://www.flickr.com/photos/cdcglobal/15030242570

Adaptasi Model

Informasi tambahan

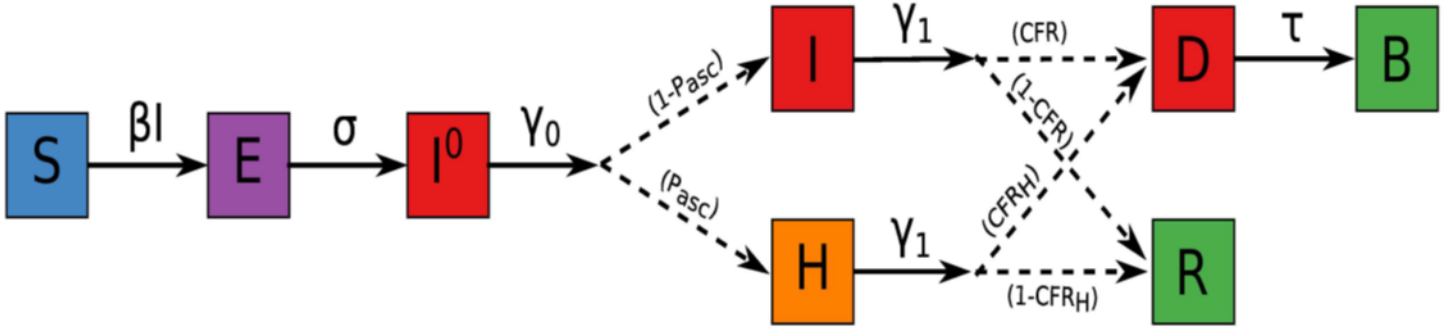
- Jumlah mayat sama dengan jumlah kasus penularan
- Setelah dikubur, mayat tidak lagi menularkan penyakit
- Rawat inap sepenuhnya mencegah penularan dan mengurangi risiko kematian

State apa yang perlu kita tambahkan ke model?

Event apa saja yang menyebabkan individu berubah *state*?

Informasi tambahan apa yang dibutuhkan?

Contoh Model Ebola



Moss, R., Hickson, R. I., McVernon, J., McCaw, J. M., Hort, K., Black, J., … Geard, N. (2016). Model-Informed Risk Assessment and Decision Making for an Emerging Infectious Disease in the Asia-Pacific Region. PLoS Neglected Tropical Diseases, 10(9), 1–25. https://doi.org/10.1371/journal.pntd.0005018

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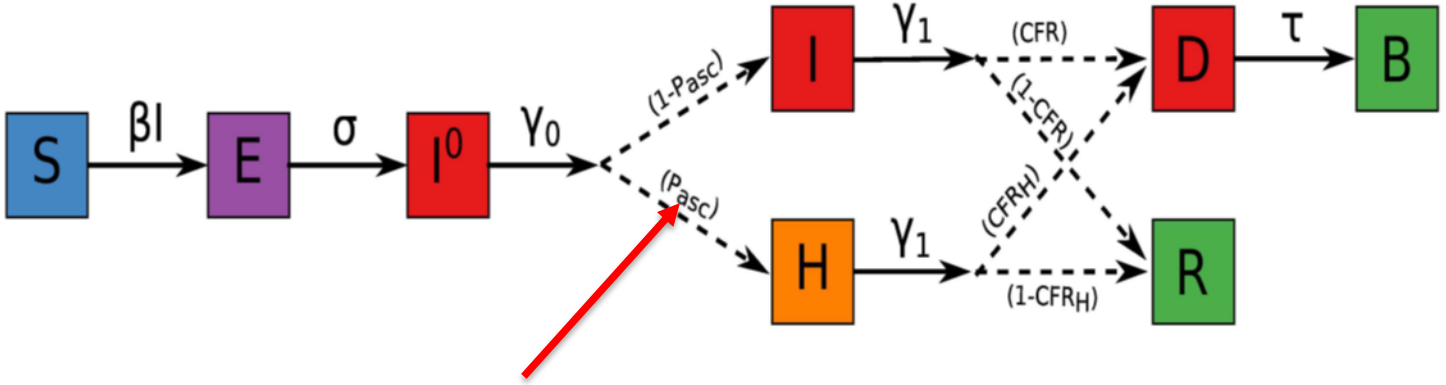

Incorporate increased surveillance by increasing P_{asc}

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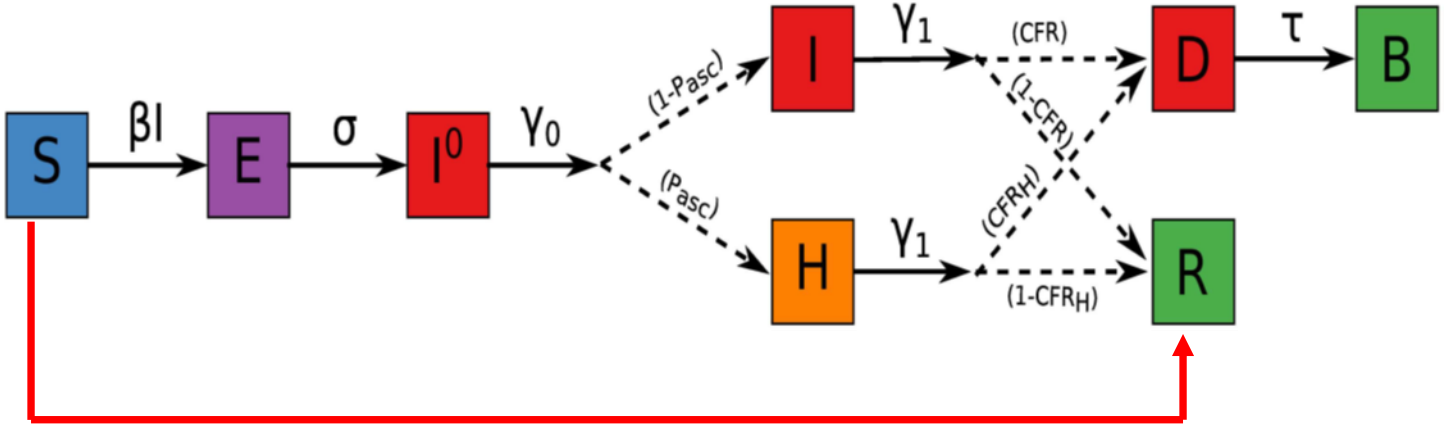

Include vaccination by moving people directly from S to R

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Pertanyaan