DAG

(Directed Acyclic Graph)

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Clinical Epidemiology Program

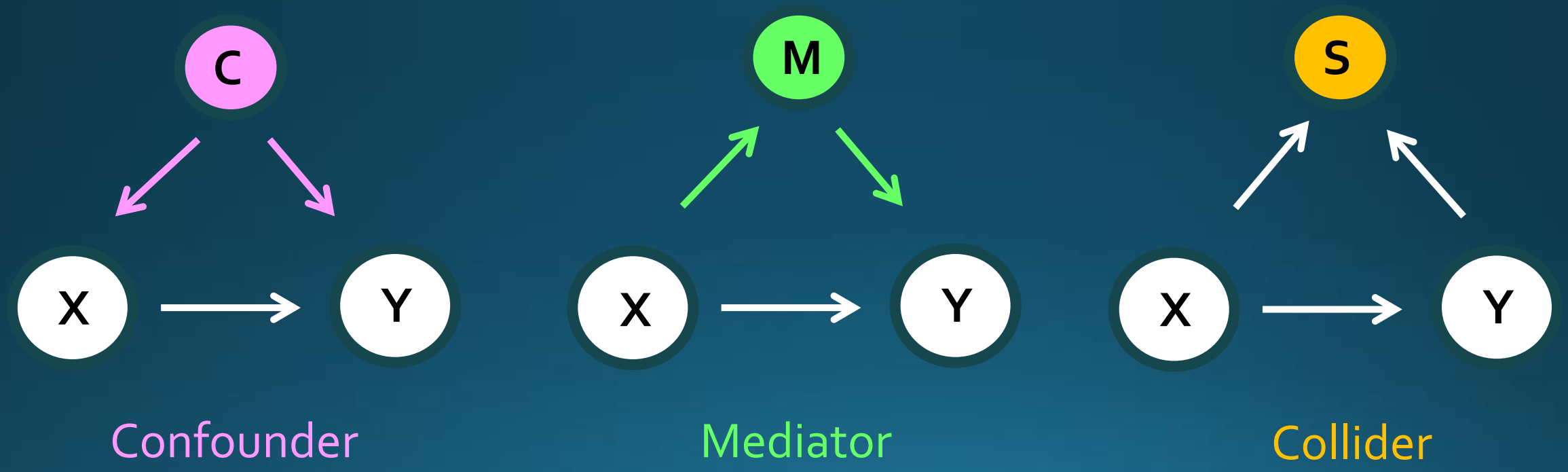
Introduction

- Use to estimate causal effect
- RCT is not practical in some area of health research
- Exploring causal effect from observational data
- Many associated / influenced factors

DAGs

- Directed Acyclic Graphs
- Diagram represent causal pathway
- Nodes, connected by unidirectional arrows (=Directed)
- Arrows, not specify positive/negative, large/small, linear/non-linear etc. “Non-parametric”
- Each node can’t connect to itself (=Acyclic)

Basic DAGs Structure

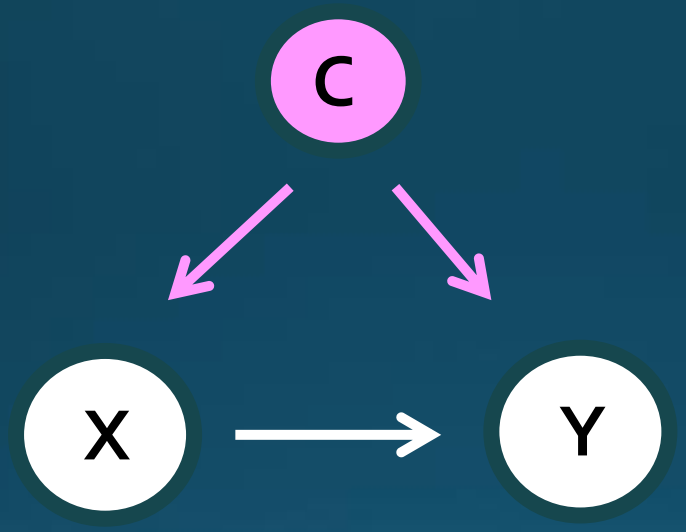


Confounder

Mediator

Collider

Confounder



- Variable influence both exposure and outcome
- (Fake) association between exposure and outcome

Example

Small eyes
(Yes/No)

p-sig*

Chopstick Skill
(High/Low)

- Small eyes associate with high chopstick skill

Example

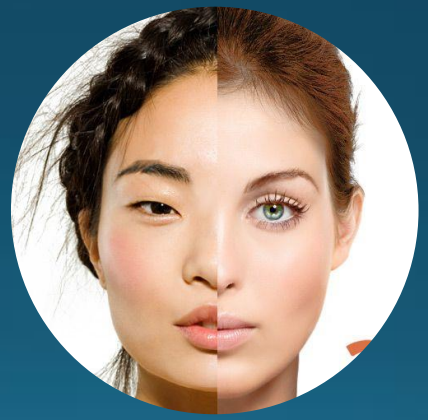
p-not sig

Small eyes
(Yes/No)

p-sig*

p-sig*

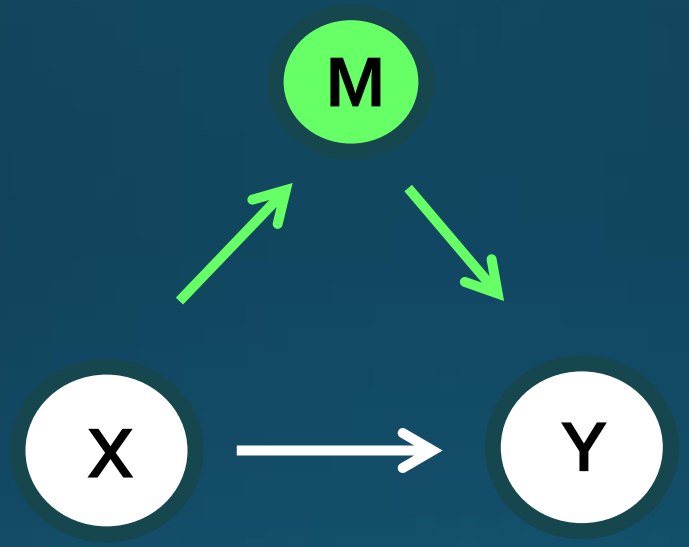
Chopstick Skill
(High/Low)



Chinese
(Yes/No)

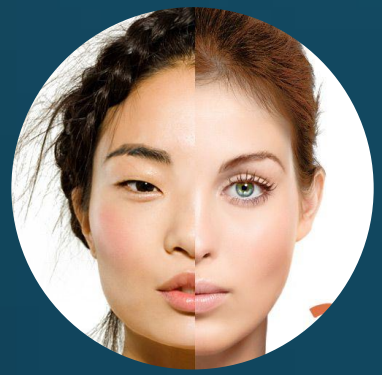
- ~~Small eyes associate with high chopstick skill~~
- Chinese associate with high chopstick skill

Mediator



- Variable caused by exposure, and then it causes outcome
- fall on causal path between X and Y

Example



Chinese

(Yes/No)

p-not sig

Chopsticks Skill

(High/Low)

p-sig*

Mother teach to use chopsticks (Yes/No)

- Chinese is not associated with chopsticks skill

Example

Mother teach to use chopsticks (Yes/No)

Chinese (Yes/No)

p-sig*

p-sig*

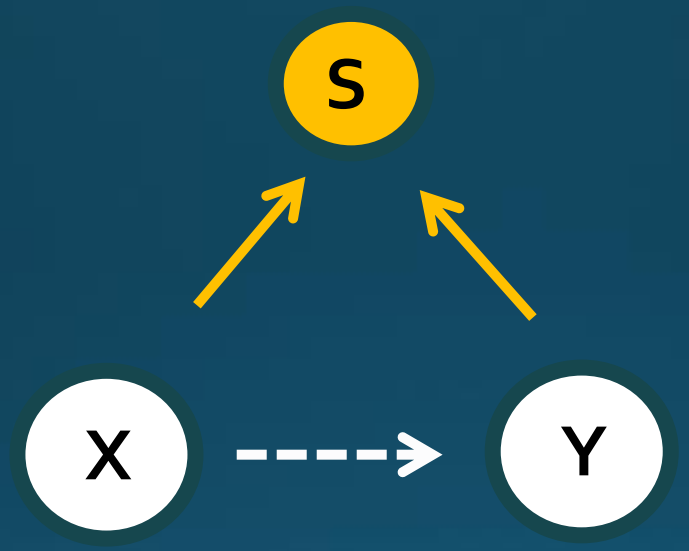
p-not sig

Chopstick Skill (High/Low)

~~- Chinese is not associated with chopstick skill~~

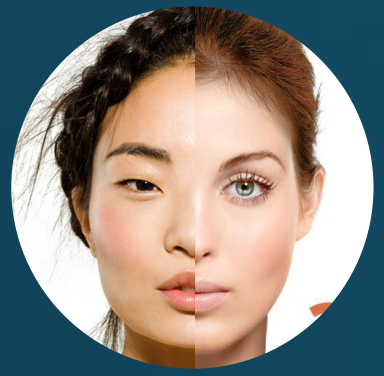
- Chinese has indirect effect to chopstick skill, by mother teaching

Collider



- Variable caused by 2 nodes
- Cause spurious association between X and Y

Example



Chinese

(Yes/No)

p-sig*

Chopstick Skill

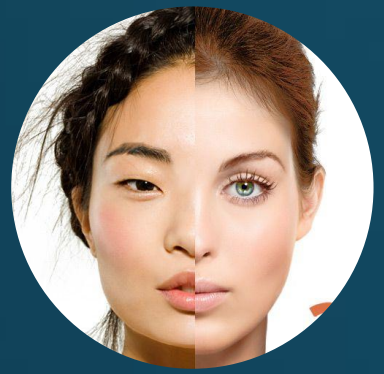
(High/Low)

Speak Chinese Fluently

(Yes/No)

- Non-Chinese use chopstick better than Chinese ???

Example



Chinese

(Yes/No)

p-sig*

Chopstick Skill

(High/Low)

Chinese -> Good Chopstick skill

-> Bad Chopstick skill

Non Chinese -> Good Chopstick skill

-> Bad Chopstick skill

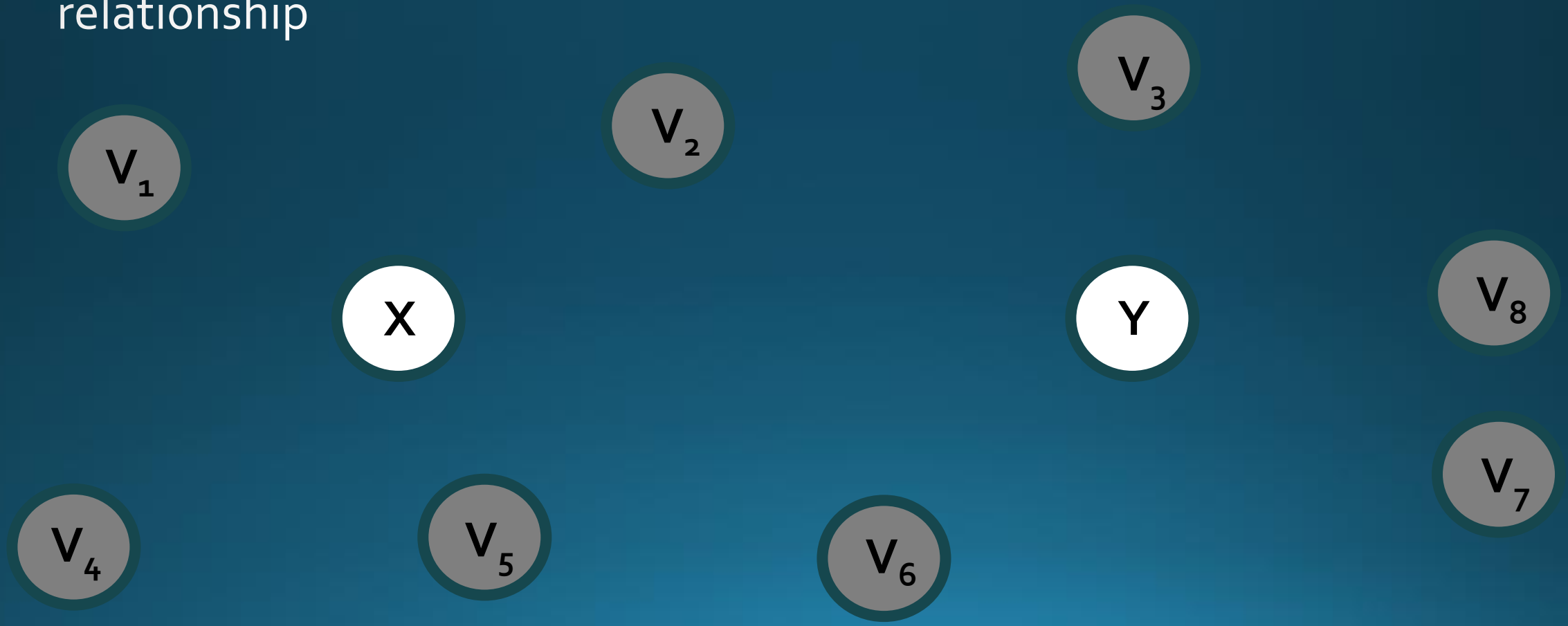
Speak Chinese Fluently

(Yes/No)

= Interested in Chinese Tradition

How DAGs helps in health research?

- There are several factors associated with Exposure and Outcome
- DAGs can help to organize the causal pathway in complex relationship



How DAGs helps in health research?

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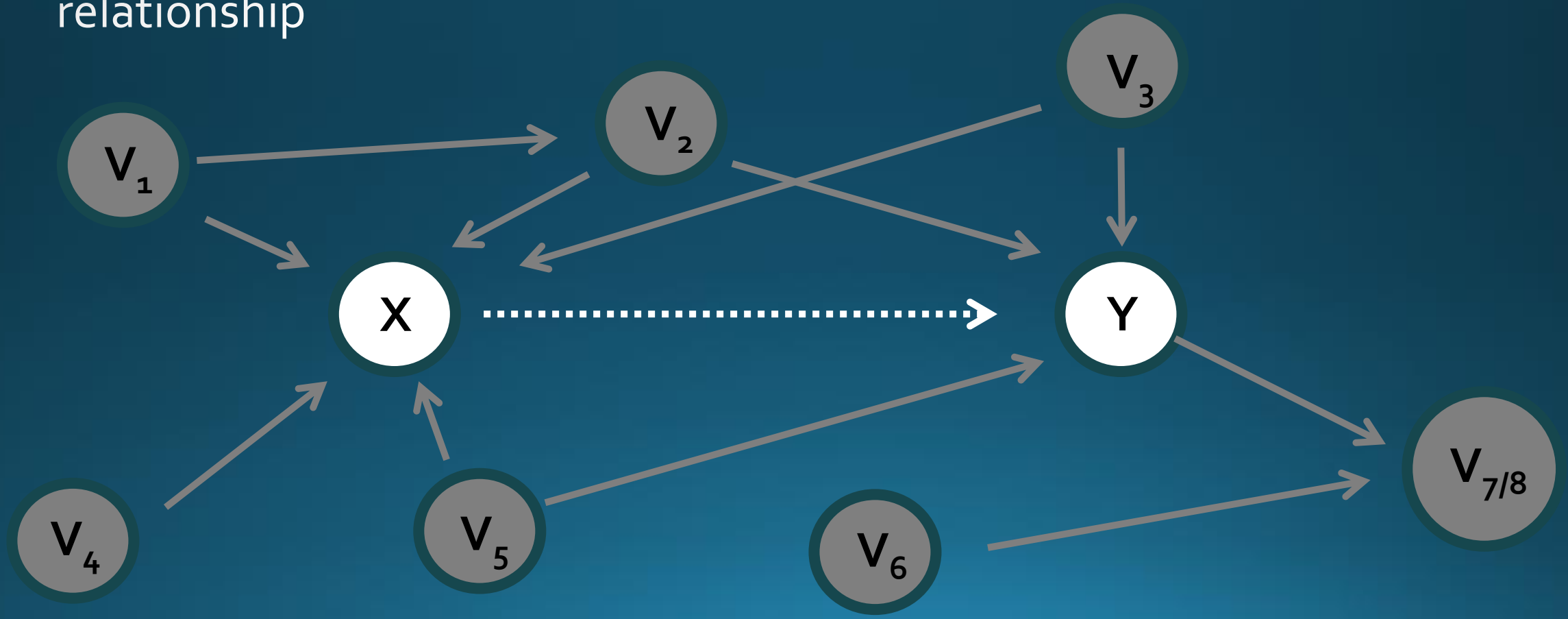
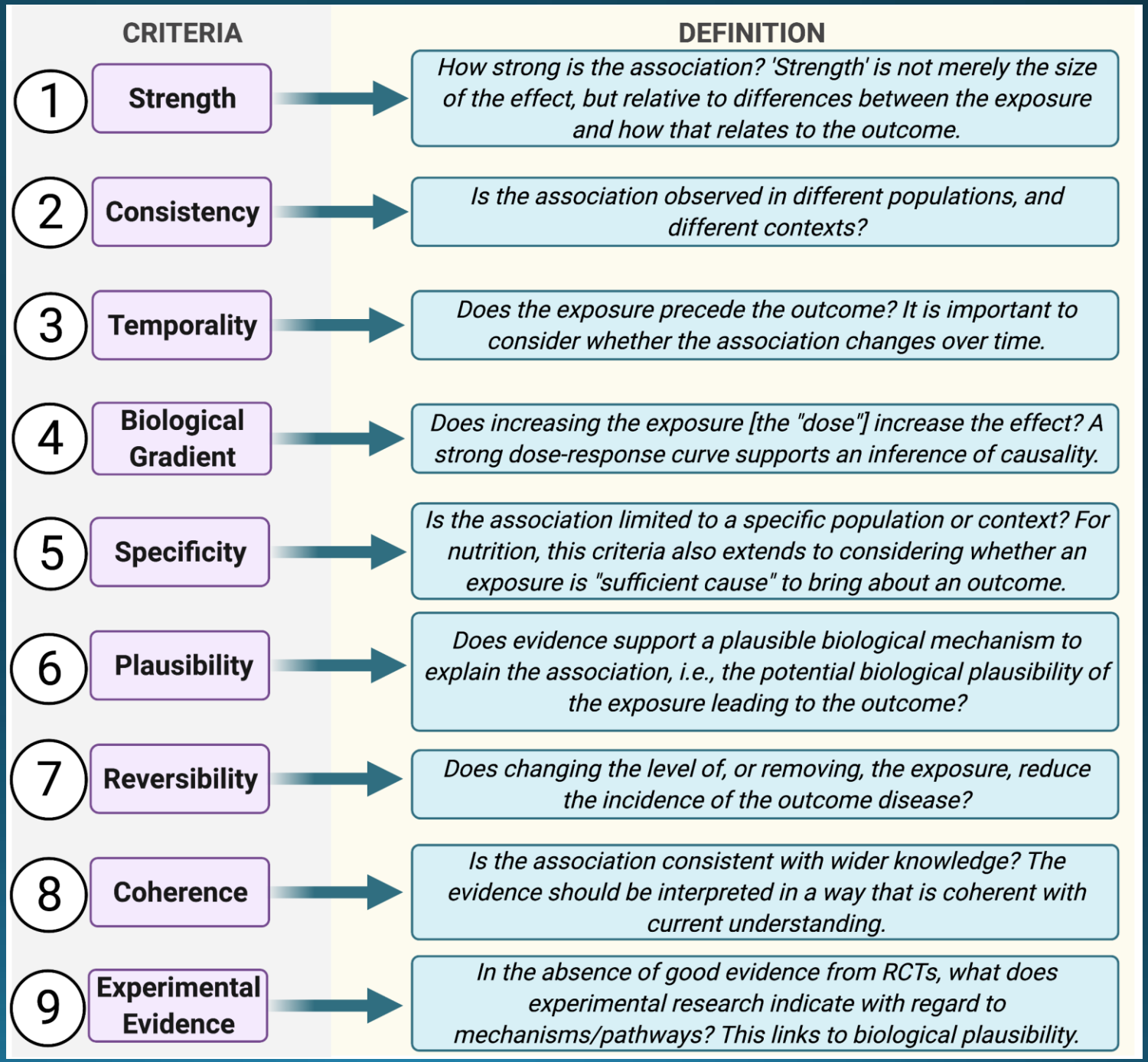


Table 2. Causal factors, causal domains, and potential causal mechanisms of malnutrition

S. No.	Causal factors	Causal domain	Number of studies reporting the factor	Potential causal mechanisms
1.	Poverty	Socioeconomic	211	Less availability of food and housing; poor sanitation; maternal malnutrition
2.	Mother's education	Parental	155	A less educated mother is likely to be unemployed and have high-risk fertility behavior; likely to be less aware of care during pregnancy and child-rearing practices; might lack autonomy in family decisions.
3.	High-risk fertility behavior	Parental	153	Very young or elderly mothers or those with less birth spacing can be malnourished, and all these can lead to low birth weight, lactation failure, and poor infant feeding.
4.	Maternal malnutrition	Parental	89	This can lead to pregnancy complications, low birth weight, and lactation failure.
5.	Household security and hygiene	Socioeconomic	88	Lack of housing, safe water, and sanitation will lead to social insecurity, less availability of food, and recurrent infection; similar to poverty.
6.	Awareness of mothers regarding antenatal and child care	Parental	45	Lack of awareness might lead to high-risk fertility behavior and malnutrition in mother; low birth weight infant, suboptimal feeding and immunization.

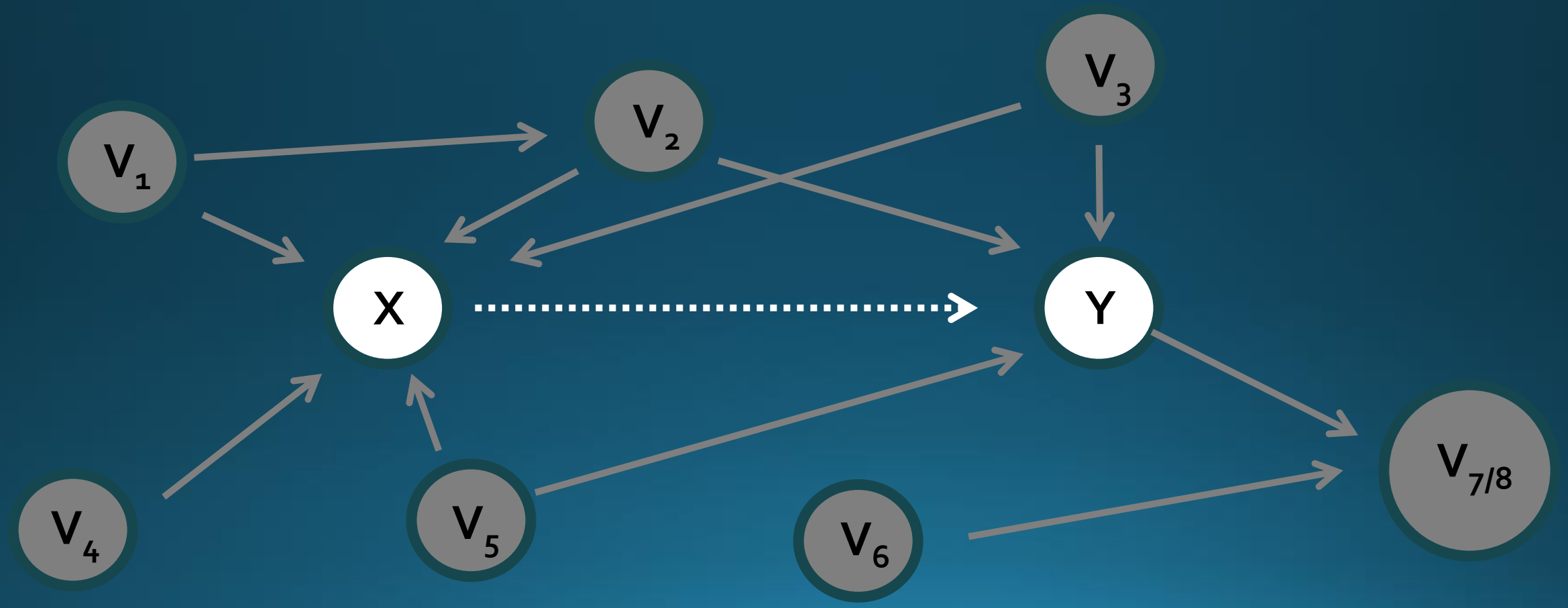
- Review literature → Construct relationship and direction between each node
- Combined node = Super node (Migration + Disaster + Marginalised)

Bradford Hill's criteria of temporality



Minimally Sufficient Adjustment Set

- Sufficient, minimal conditioning sets for regression analysis



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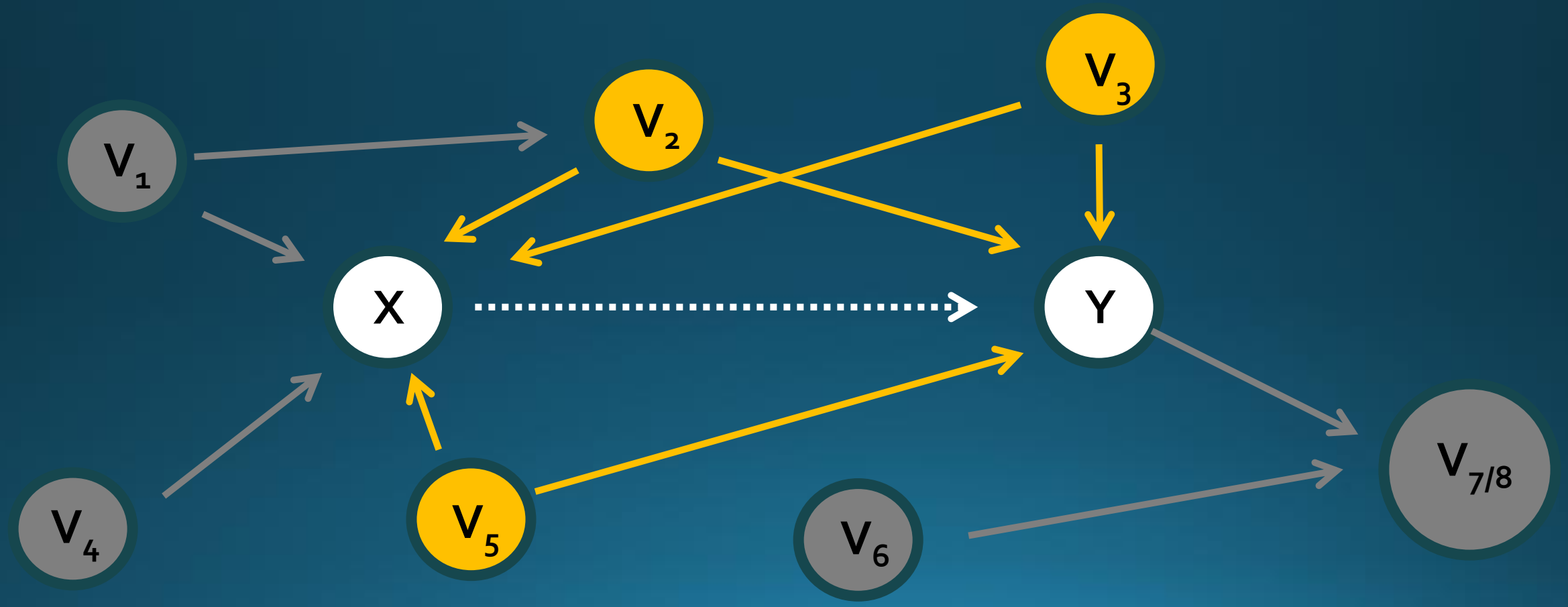

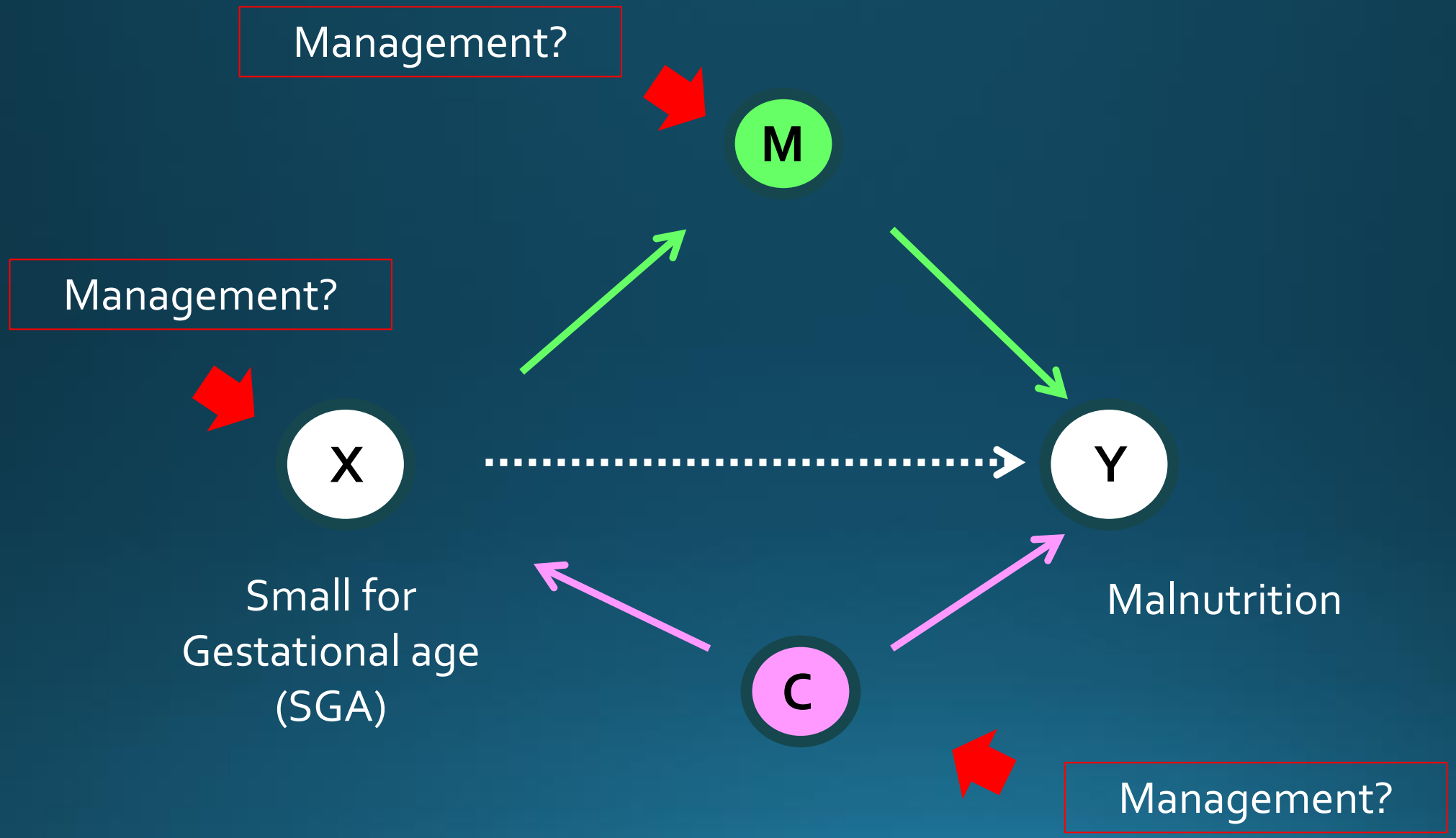
Management?
M
Management?
X
Y
Small for Gestational age (SGA)
Malnutrition
C
Management?

Thank you