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HEALTH

# Pertussis Vaccine Schedules: What can serosurveillance and modelling tell us?

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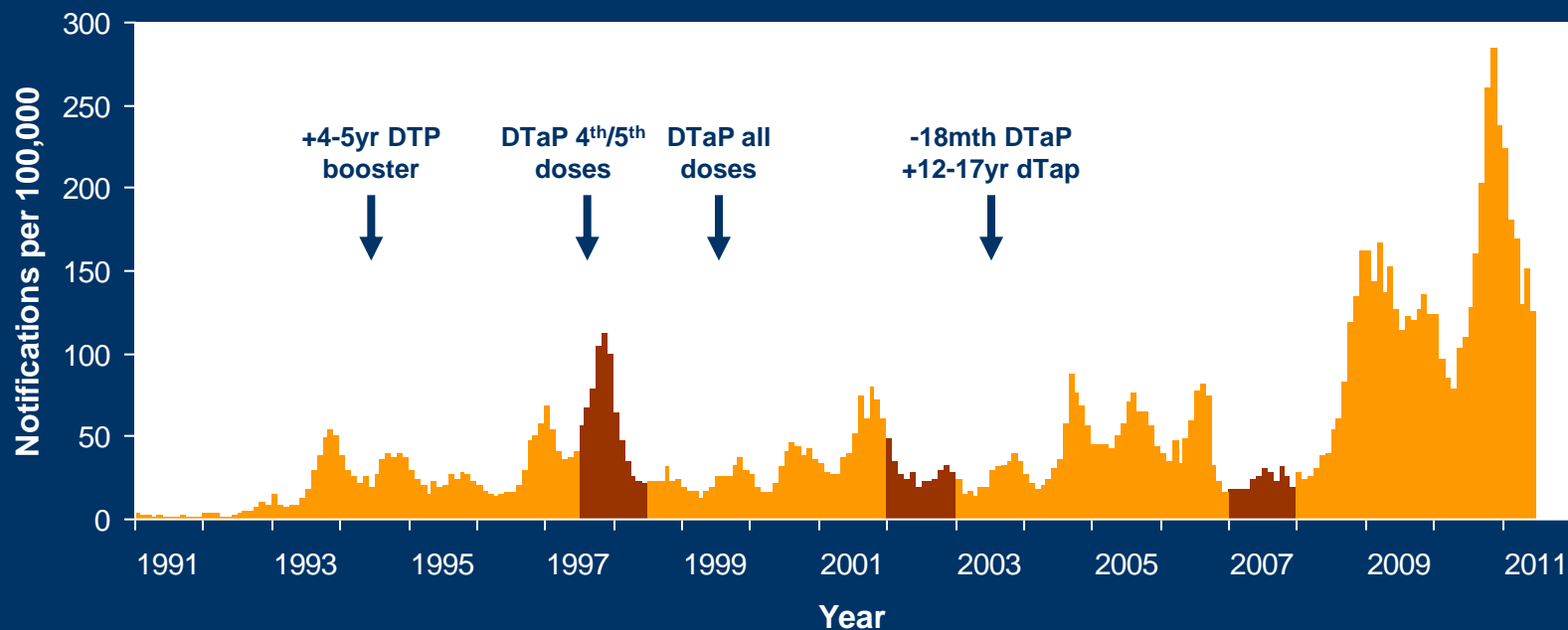
Vaccine & Immunisation Research Group, Murdoch Childrens Research Institute and Melbourne School of Population Health, The University of Melbourne  
National Pertussis Workshop, Darling Harbor, Sydney  
25-26<sup>th</sup> August 2011

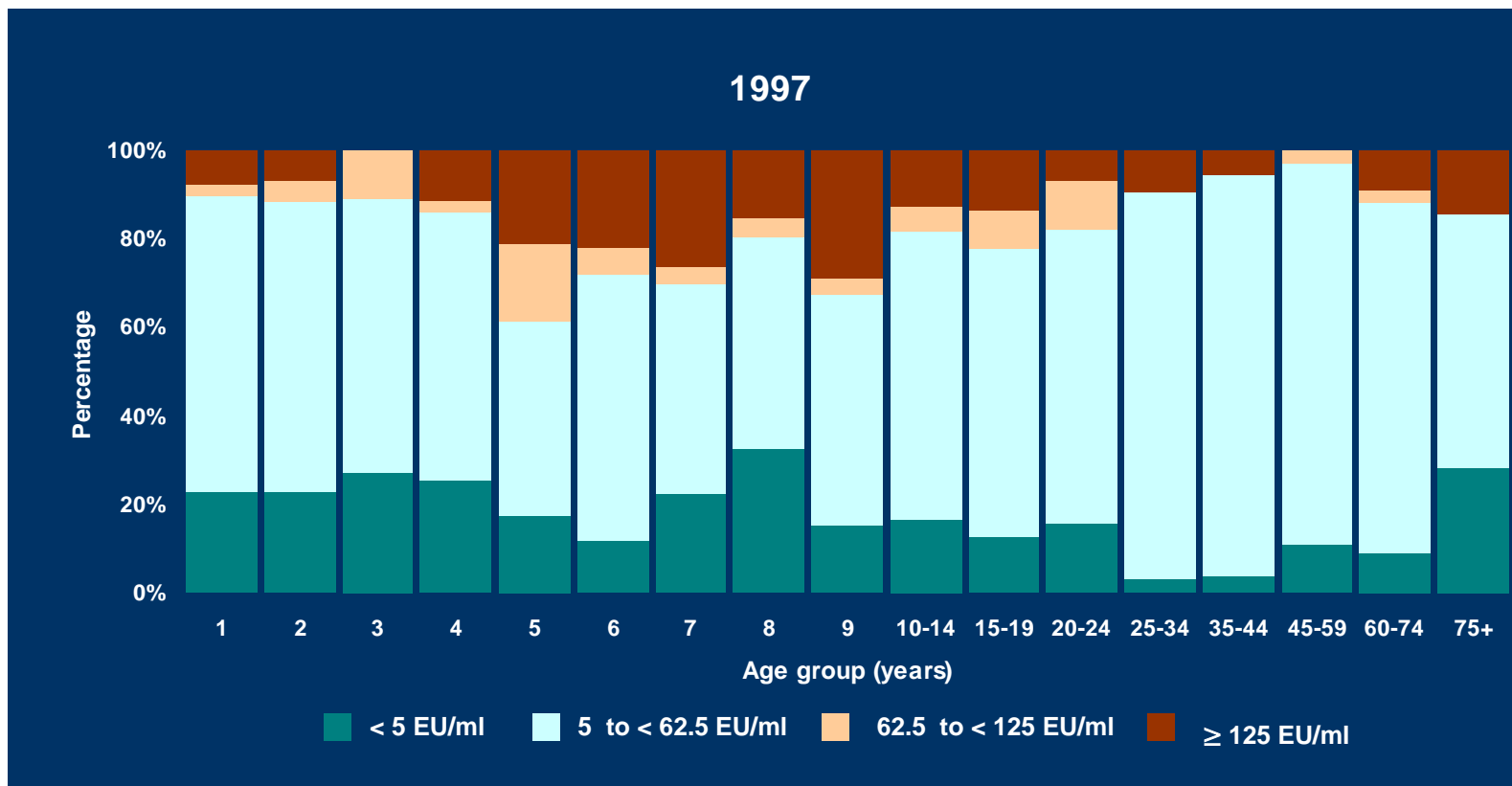
- Rationale for pertussis serosurveys
- Findings of the Australian pertussis serosurveys
- How can models help?
- What are the key features of a model to explore drivers of pertussis trends in Australia?
- Summary and conclusions

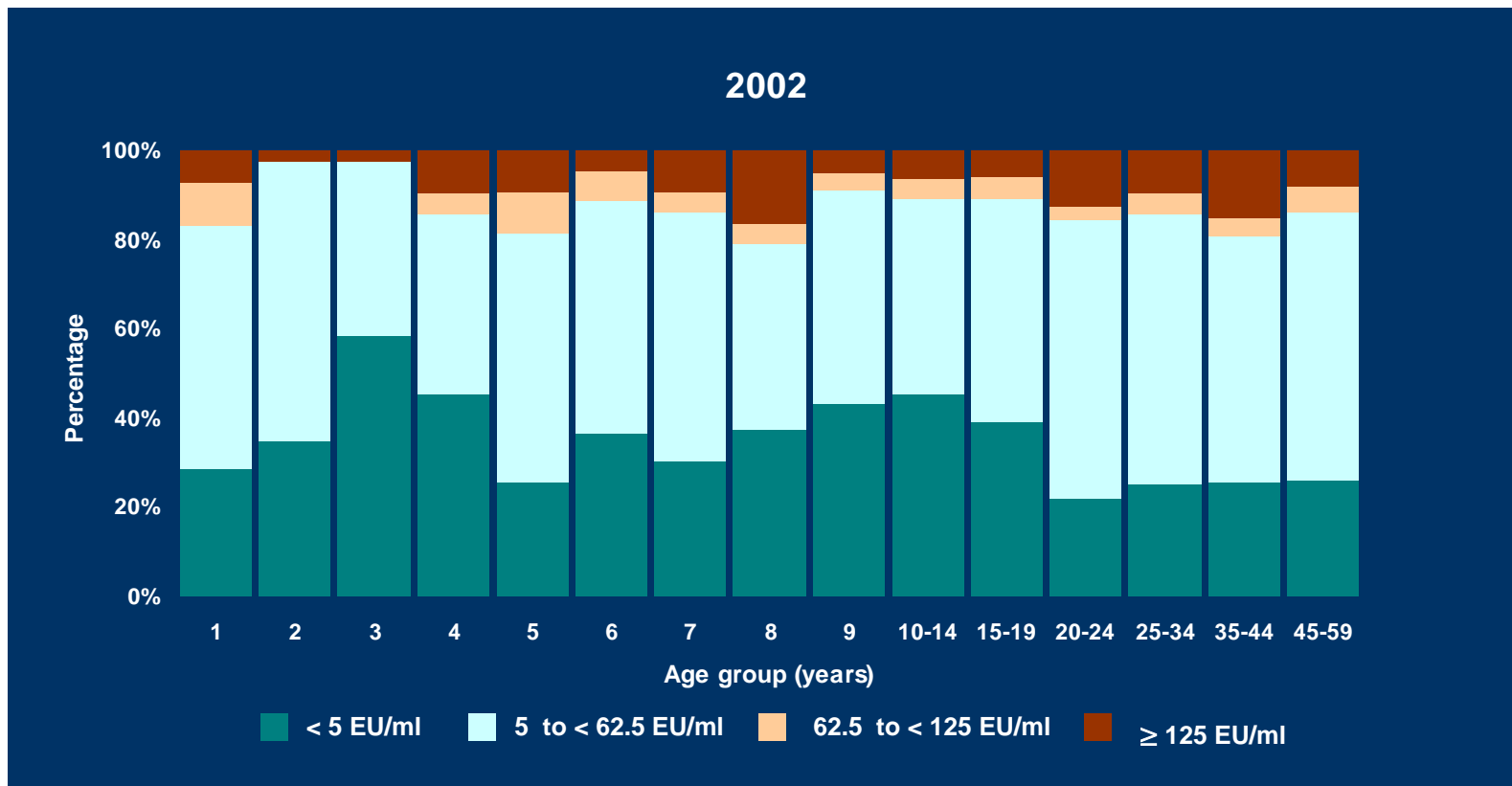
- Clinical case finding subject to multiple sources of bias
- Objective assessment of recent exposure
- Antibody concentration thresholds deemed as evidence of recent exposure from studies of natural infection
- While correlates of protection may be complex, do undetectable antibody levels correlate with population susceptibility?

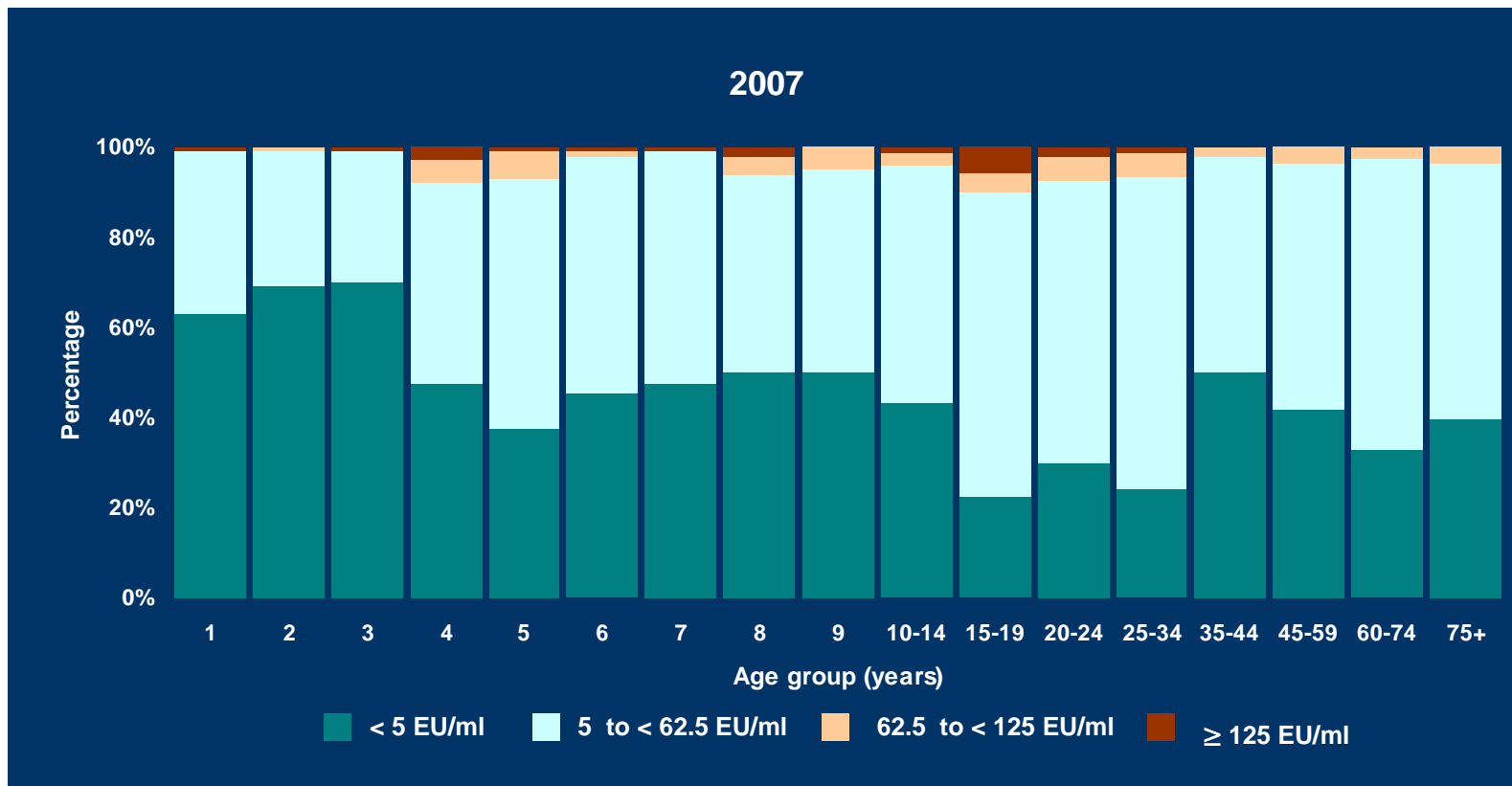
- Specimens collected through national serosurveillance program
- Residual diagnostic sera from nationally representative laboratories
- Immunosuppression (incl HIV), transfusion excluded
- Identifiers: sex, age, location, unique ID
- Anti PT IgG ELISA – 1997/8 Italy (ESEN), 2002, 2007 Australia (CIDM)

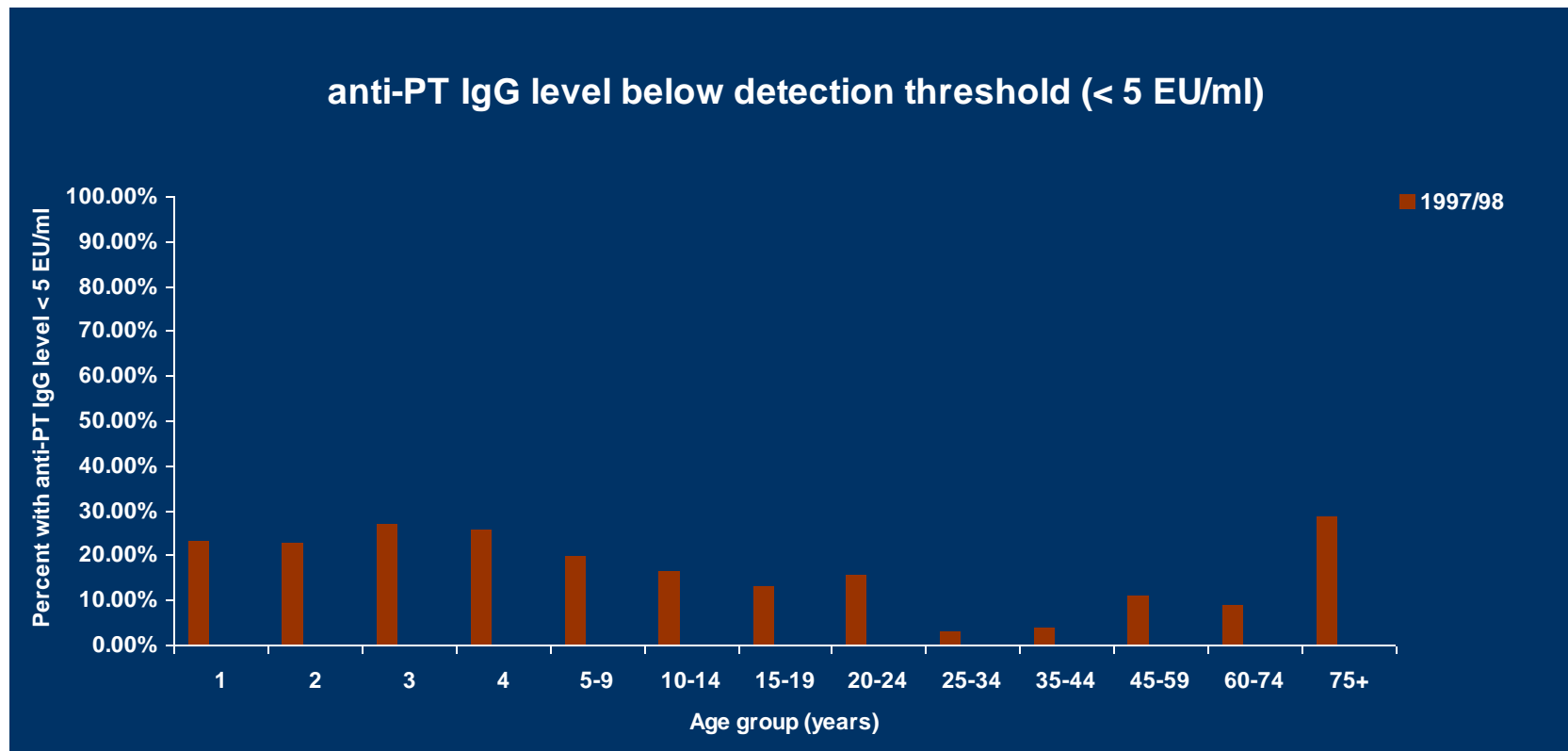
## Notification rate for pertussis in Australia 1991-2011

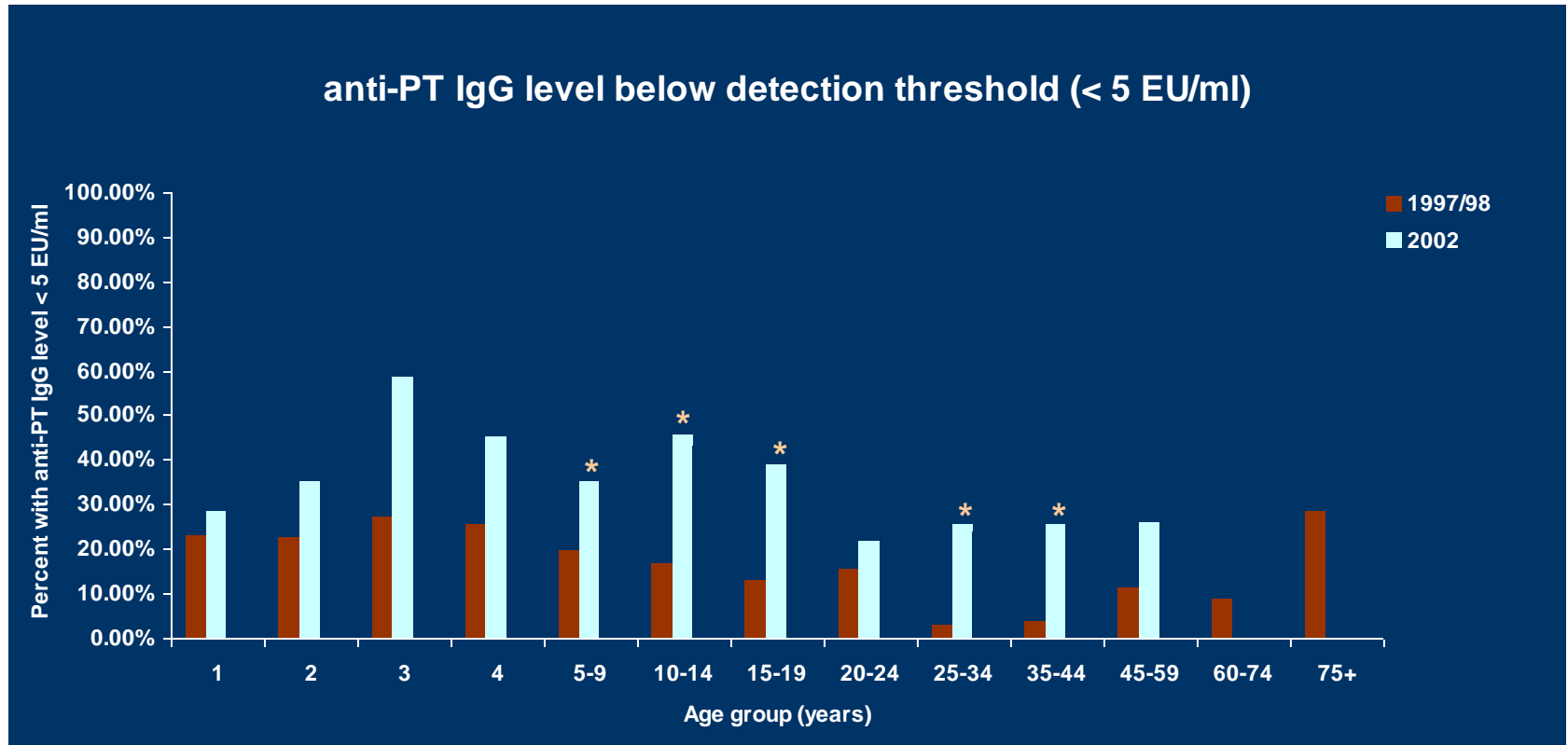




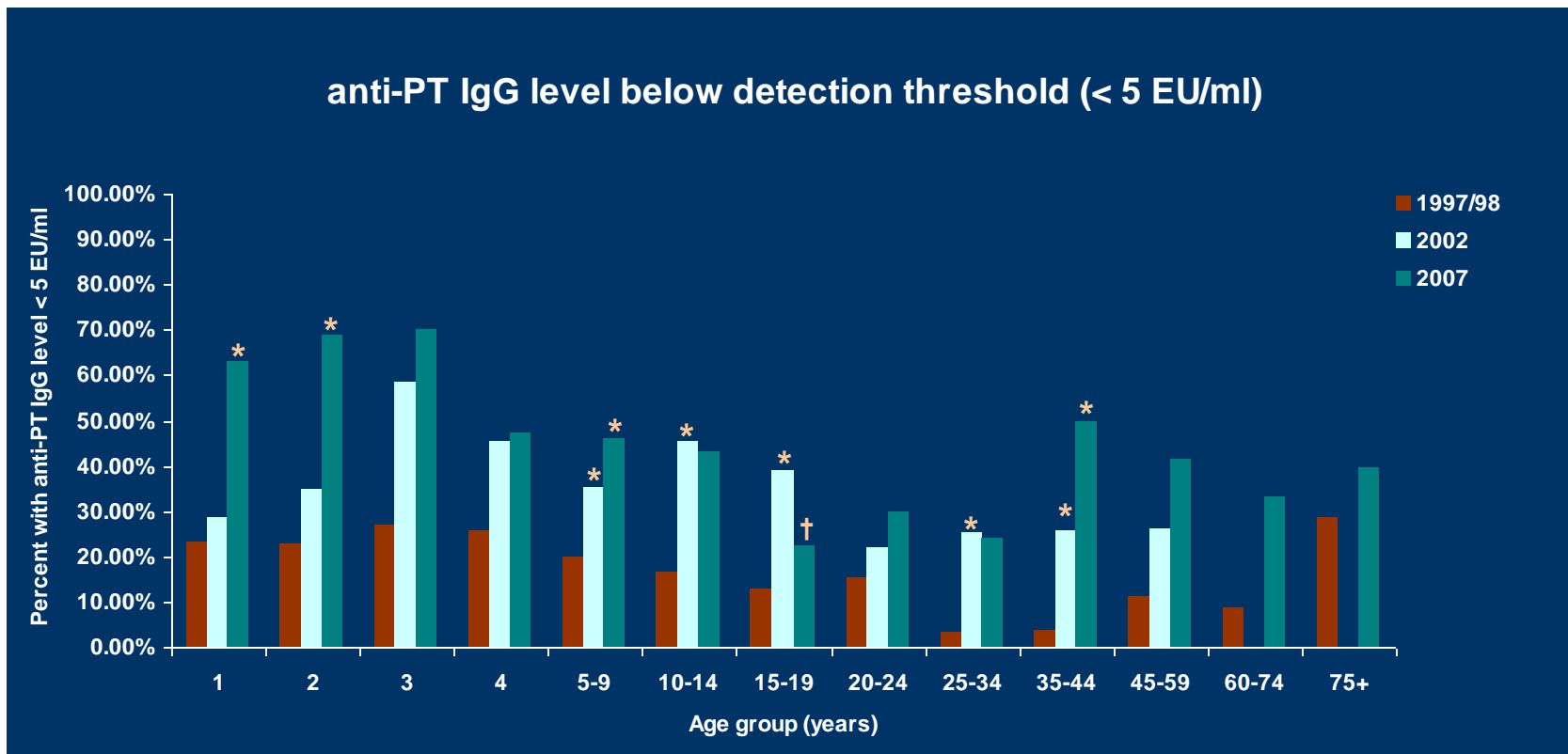






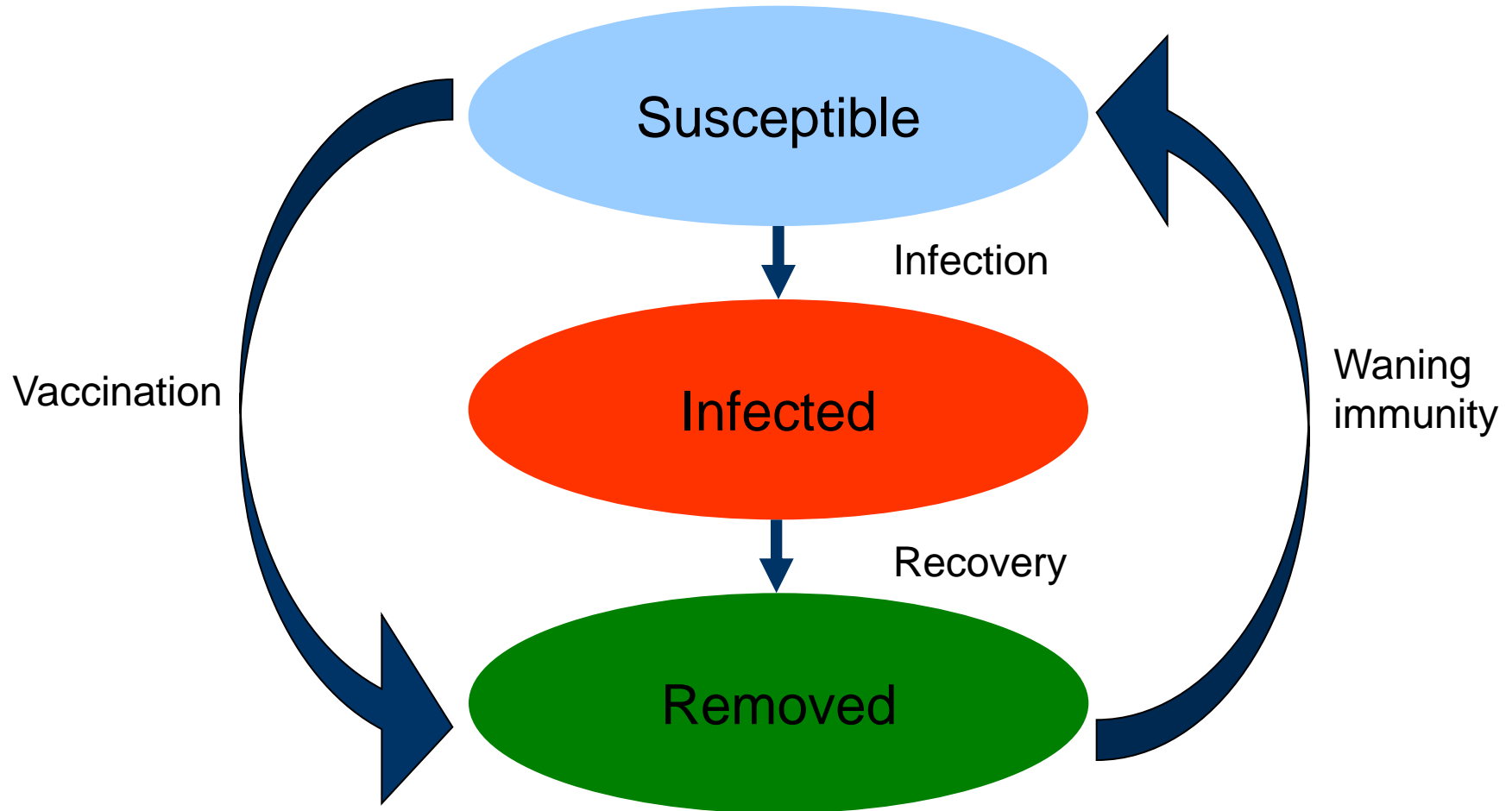


\* Significantly higher than previous collection



\* Significantly higher than previous collection  
† Significantly lower than previous collection

- Using mathematical transmission models, we can:
  - Simulate how pertussis spreads through populations under different assumptions
  - Isolate the effect of previous changes on observed disease experience, such as vaccination schedule changes
  - Simulate situations where exact information is not readily obtained, such as duration of immunity, to determine most likely values
  - Introduce different interventions to compare the likely outcomes
- We hypothesize that pertussis toxin antibodies correlate with protection and this forms the basis for our model



- How have changes to the vaccine schedule impacted on protection?
  - Age at administration
  - Vaccine formulations
- How have changes in pathogen circulation impacted on duration of protection?
- Has widespread immunisation selected for vaccine-escape mutants?



- There have been marked shifts in immunity to pertussis in Australia in recent decades
- The ‘epidemic signature’ dominates over vaccine derived immunity
- Non-linear dynamic models can be used to analyse multiple data sources, and test alternative hypotheses regarding causal pathways
- Data-driven predictive models may provide helpful insights for decision support by comparing likely relative benefits of alternative interventions

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