Influenza vaccine uptake among children and pregnant women

Chris Blyth

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Director, Wesfarmers Centre of Vaccines and Infectious Diseases (WCVID), TKI

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Sami Carlson

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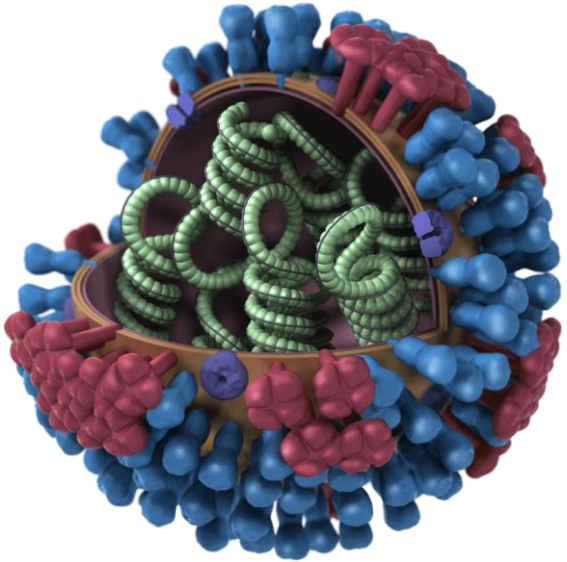
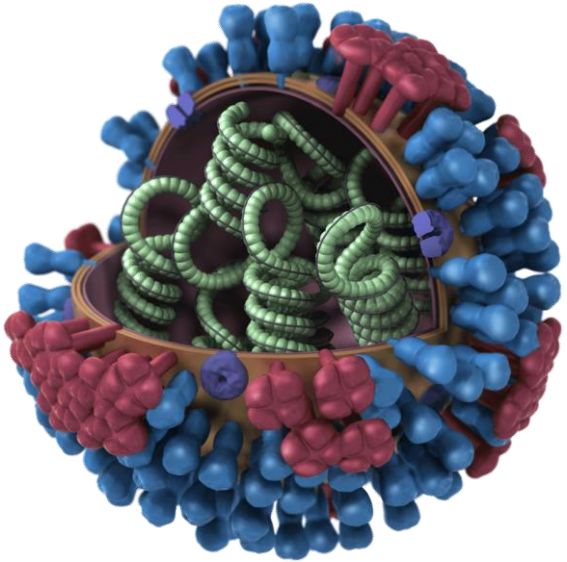
Influenza vaccination in 2024



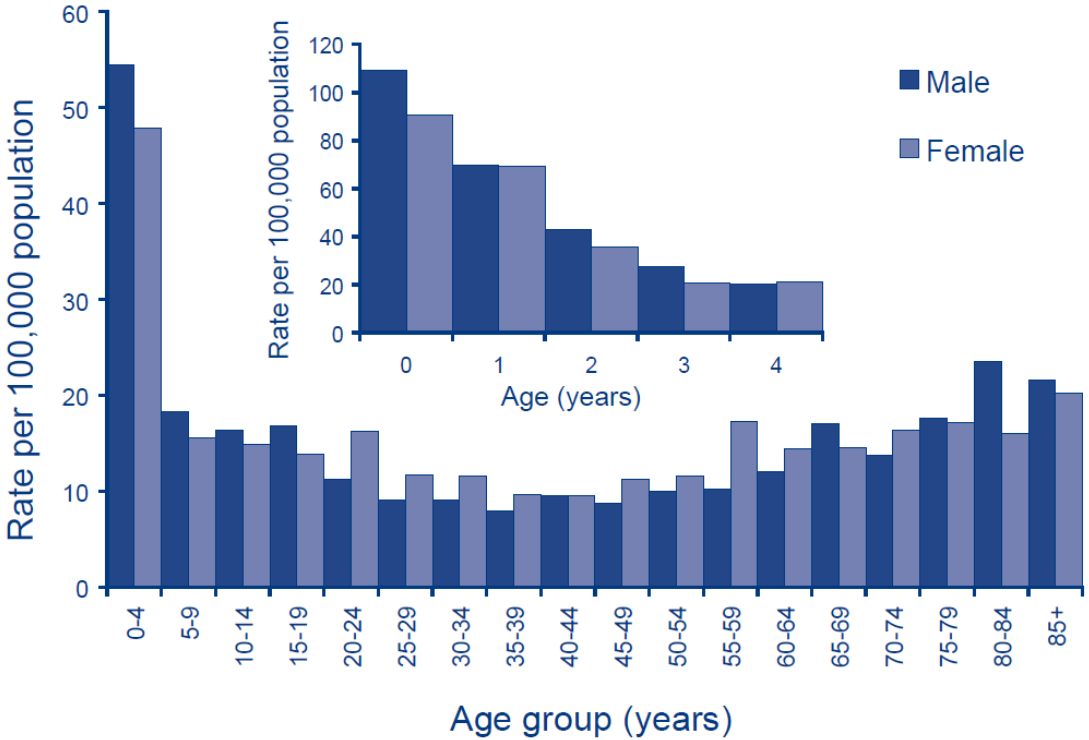
- Vaccination recommended for all from 6 month of age
- Flu vaccines can be co-administered with other vaccines (and monoclonal antibodies)
- Two doses for those <9 years and receiving flu vaccine for the first time

Influenza vaccination in 2024



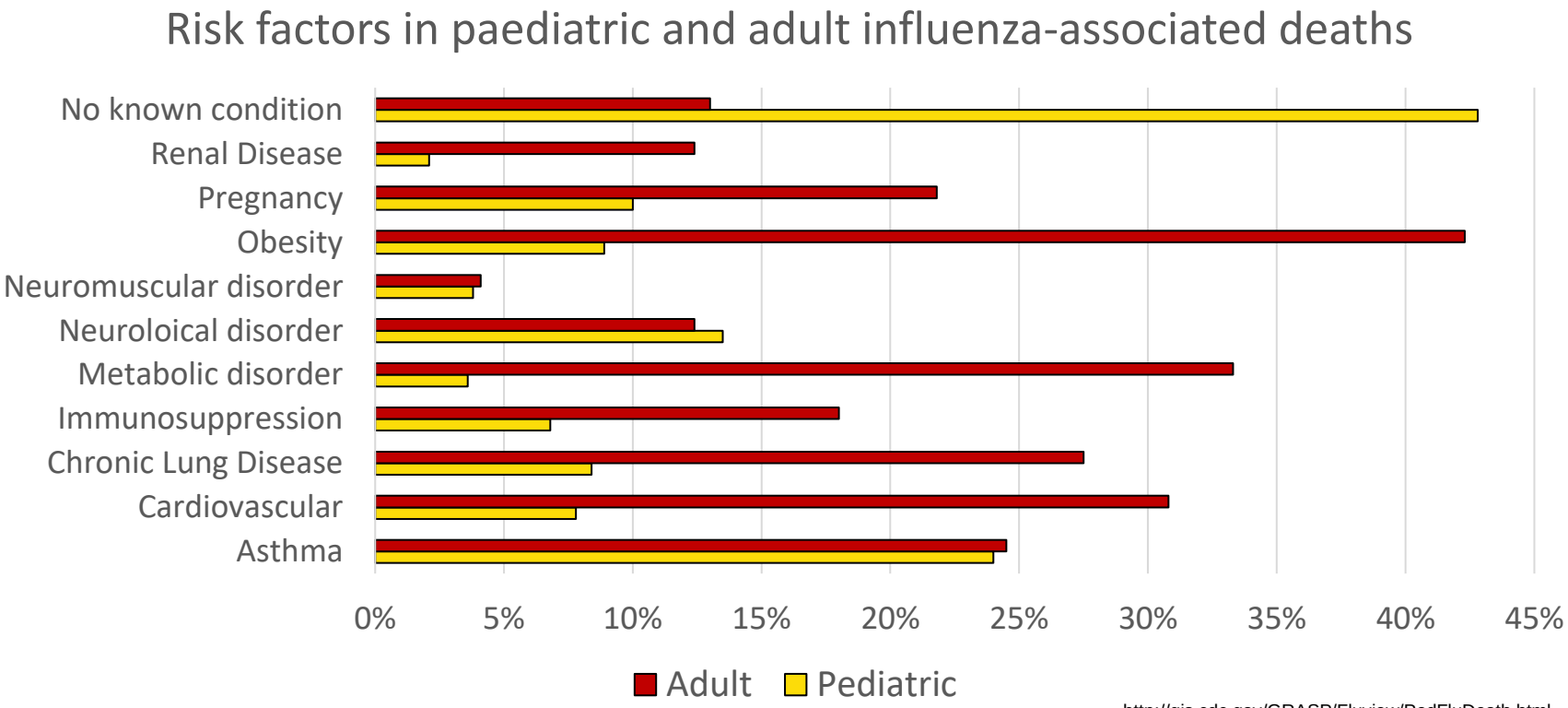
- NIP funded for:
  - All children 6m to <5y
  - All adults ≥ 65 years
  - All Aboriginal people from 6m
  - All pregnant women
  - All those with specific medical conditions
- State funded for:
  - All children 5y to year 6
  - Healthcare workers in the public system

Preschool children



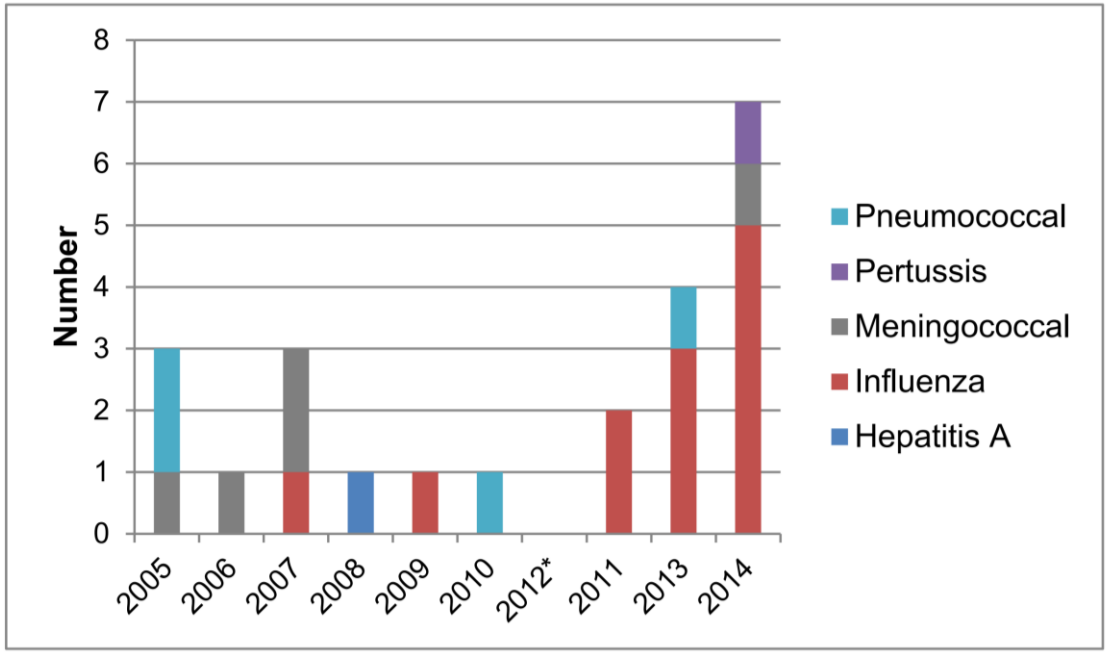
Owen R et al. CDI 2008

Preschool children



http://gis.cdc.gov/GRASP/Fluview/PedFluDeath.html

Influenza: the most common vaccine preventable cause of death



NCIRS NSW report, 2016

Influenza: the most common vaccine preventable cause of death

Flu kills three young children

PETA RULE and DEBBIE GUEST

Three children have been killed by the flu in Perth in the past few days, prompting experts to issue an urgent warning that parents should take their children to the doctor as soon as they show signs of the illness.

The three children were all under five and lived in the metropolitan area. It is understood each of them died within 24 hours of showing the first signs of the flu, which doctors say was a form of the common influenza A strain. They warned that listlessness, cough and fever were the key symptoms parents should look for and urged them to seek medical advice immediately.

"While we do not want to create unnecessary panic, it is important for parents to be aware that the disease can cause serious illness within 24 hours," Health Department director of communicable disease control Paul Van Buynder said last night.

Two of the deaths were at Princess Margaret Hospital and at least two of the children had also contracted pneumonia as a result of the virus, which could have contributed to their deaths.

Doctors across the State have been warned that they may be inundated by worried parents, prompting the Health Department to advise them of the details of the deaths.

Australian Medical Association president Geoff Dobb said influenza A strain was one of the most common during winter and that West Australians were particularly vulnerable because it had been several years since the last flu epidemic.

He said parents should not be worried if their children simply had a runny nose and headache, though they should look out for a fever above 38C.

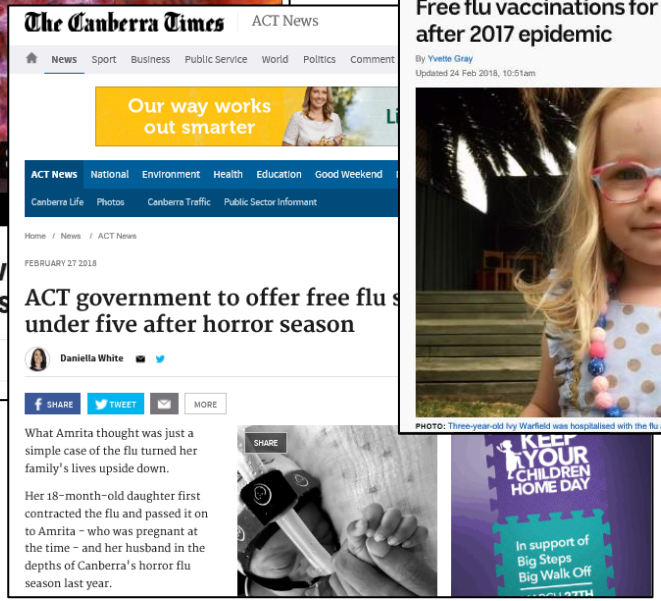
"The critical thing is the combination of a fever and a cough," he said. "What we're talking about here is not just having a runny nose and feeling unwell, often people refer to that loosely as having the flu. A true influenza will make you feel really unwell, more severe with cough fever and muscular aches and pain."

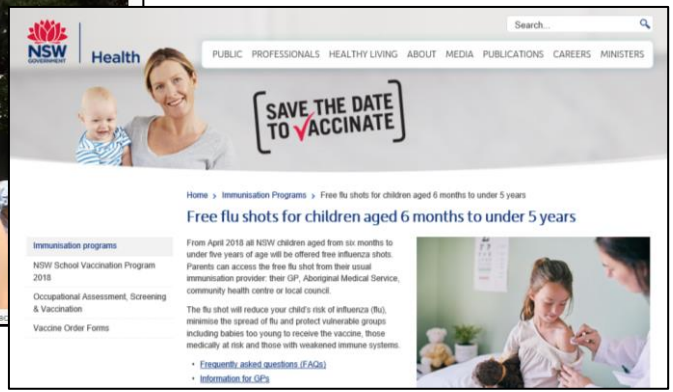
He said that unlike the flu, people with a cold may have a sore throat and runny nose, followed by a cough, but without a significant fever.

Parents can call Health Direct on 1800 020 080 for advice and locations of their nearest after-hours clinic.

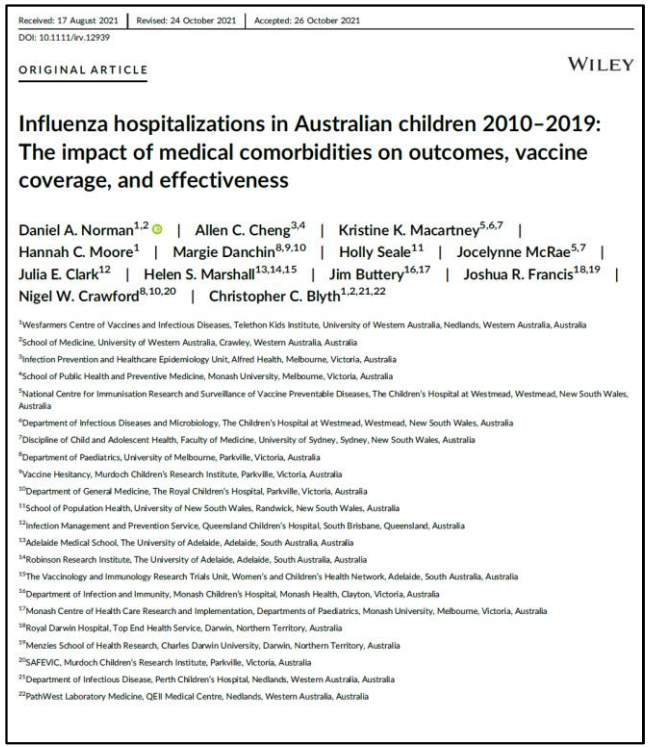
West Australian Newspaper: 7th July 2007

Influenza: the most common VP cause of death





A moderately protective vaccine



Received: 17 August 2021 | Revised: 24 October 2021 | Accepted: 26 October 2021
DOI: 10.1111/irv.12939

ORIGINAL ARTICLE

WILEY

Influenza hospitalizations in Australian children 2010–2019: The impact of medical comorbidities on outcomes, vaccine coverage, and effectiveness

Daniel A. Norman[1,2] | Allen C. Cheng[3,4] | Kristine K. Macartney[5,6,7] | Hannah C. Moore[1] | Margie Danchin[8,9,10] | Holly Seale[11] | Jocelynne McRae[5,7] | Julia E. Clark[12] | Helen S. Marshall[13,14,15] | Jim Buttery[16,17] | Joshua R. Francis[18,19] | Nigel W. Crawford[8,10,20] | Christopher C. Blyth[1,2,21,22]

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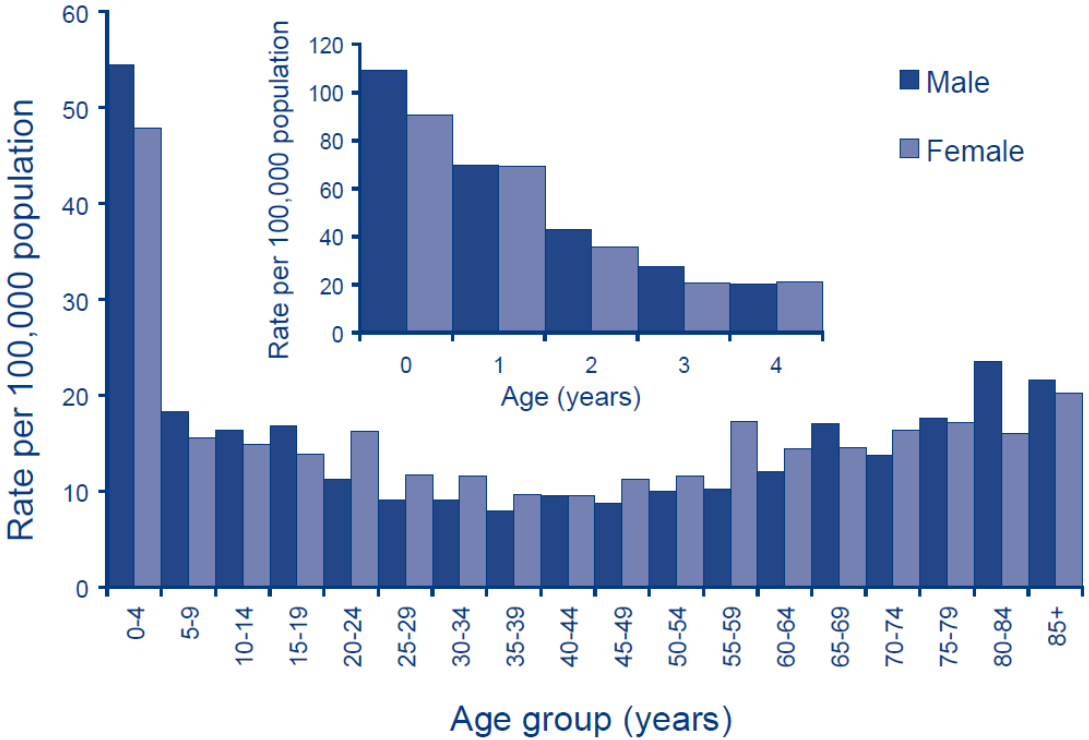
Variable	Vaccine effectiveness (95% CI)
Influenza strains	
Influenza A	57% (49, 64%)
Influenza B	56% (44, 65%)
Age	
<23 months	53% (34; 67%)
24-59 months	61% (49, 71%)
≥ 5 years	60% (47, 70%)
Risk factors	
Aboriginal	51% (2, 76%)
Cardiac condition	75% (50, 87%)
Respiratory condition	64% (49, 74%)
Neurological condition	64% (44, 77%)
Genetic condition	62% (29, 80%)

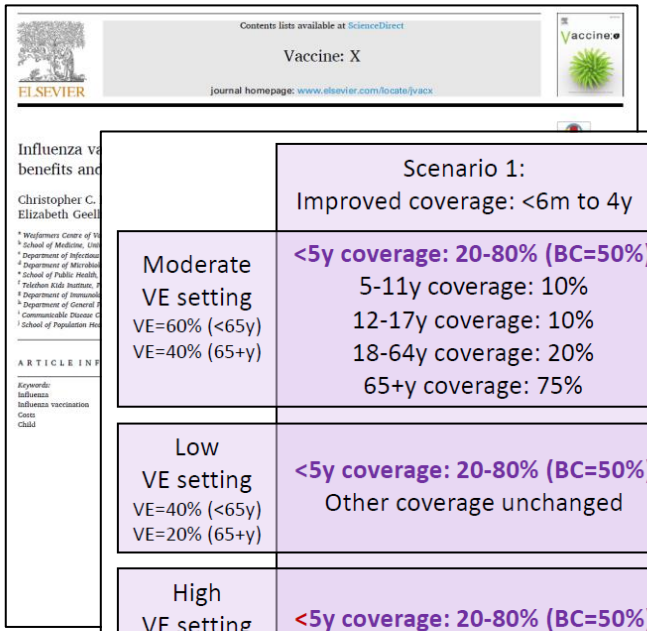
Norman DA, IoRV 2021

What about primary school children?



Owen R et al. CDI 2008

What about primary school children?

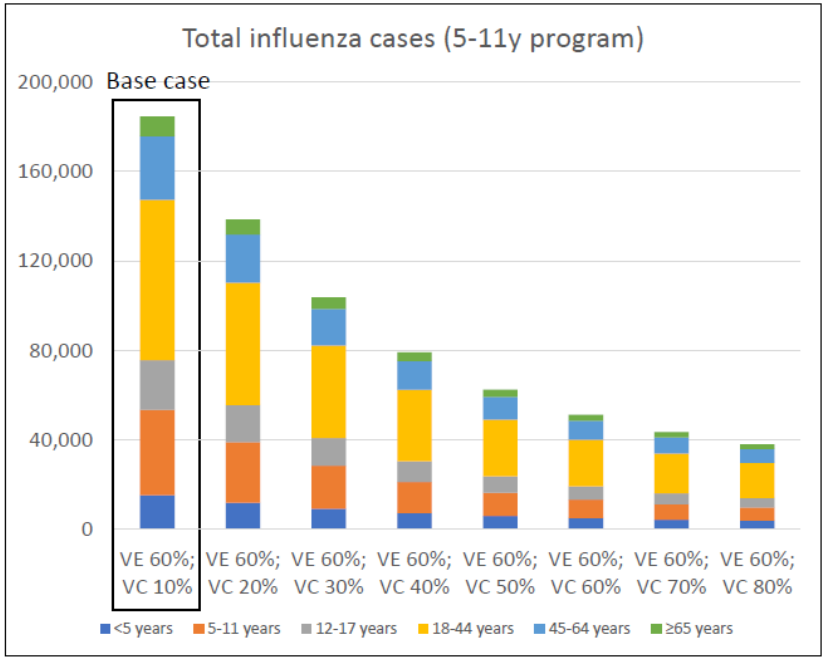


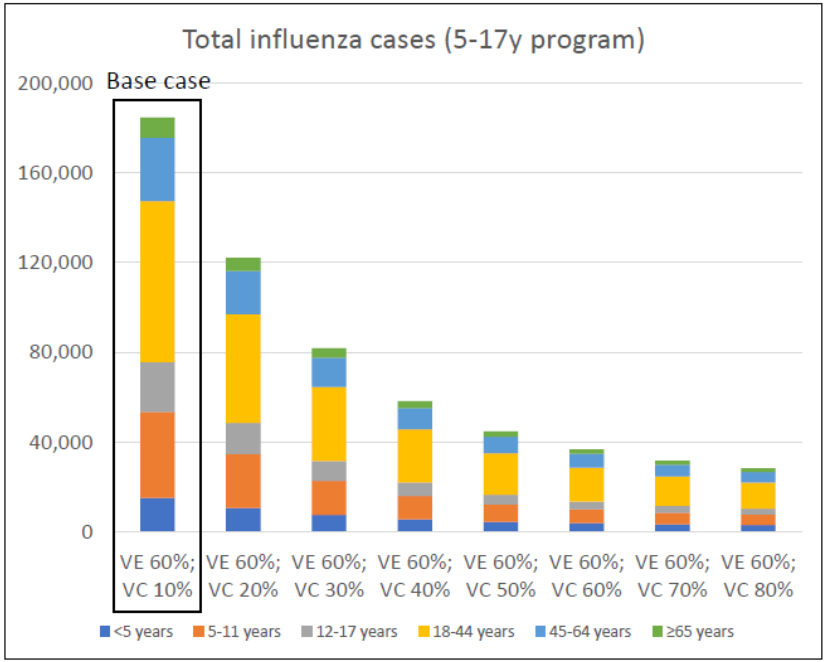
Published deterministic compartmental SEIR transmission model

	Scenario 1: Improved coverage: <6m to 4y	Scenario 2: Improved coverage: 5 to 11y	Scenario 3: Improved coverage: 5 to 17y
Moderate VE setting VE=60% (<65y) VE=40% (65+y)	**<5y coverage: 20-80% (BC=50%)** 5-11y coverage: 10% 12-17y coverage: 10% 18-64y coverage: 20% 65+y coverage: 75%	<5y coverage: 50% **5-11y coverage: 10-80% (BC=10%)** 12-17y coverage: 10% 18-64y coverage: 20% 65+y coverage: 75%	<5y coverage: 50% **5-11y coverage: 10-80% (BC=10%)** **12-17y coverage: 10-80% (BC=10%)** 18-64y coverage: 20% 65+y coverage: 75%
Low VE setting VE=40% (<65y) VE=20% (65+y)	**<5y coverage: 20-80% (BC=50%)** Other coverage unchanged	**5-11y coverage: 10-80% (BC=50%)** Other coverage unchanged	**5-11y coverage: 10-80% (BC=50%)** **12-17y coverage: 10-80% (BC=10%)** Other coverage unchanged
High VE setting VE=80% (<65y) VE=60% (65+y)	**<5y coverage: 20-80% (BC=50%)** Other coverage unchanged	**5-11y coverage: 10-80% (BC=50%)** Other coverage unchanged	**5-11y coverage: 10-80% (BC=50%)** **12-17y coverage: 10-80% (BC=10%)** Other coverage unchanged

Blyth CC et al, Vaccine X, 2023

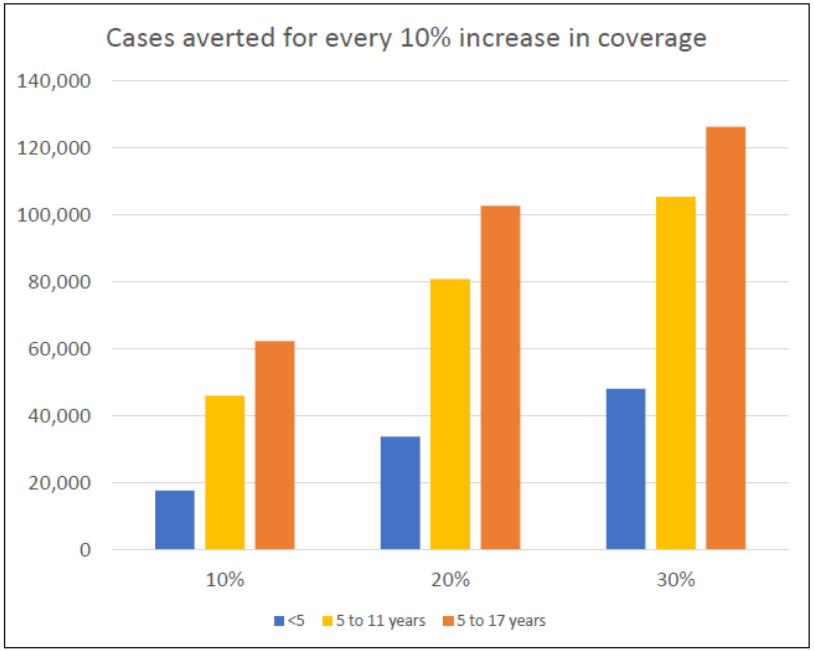
What about primary school children?

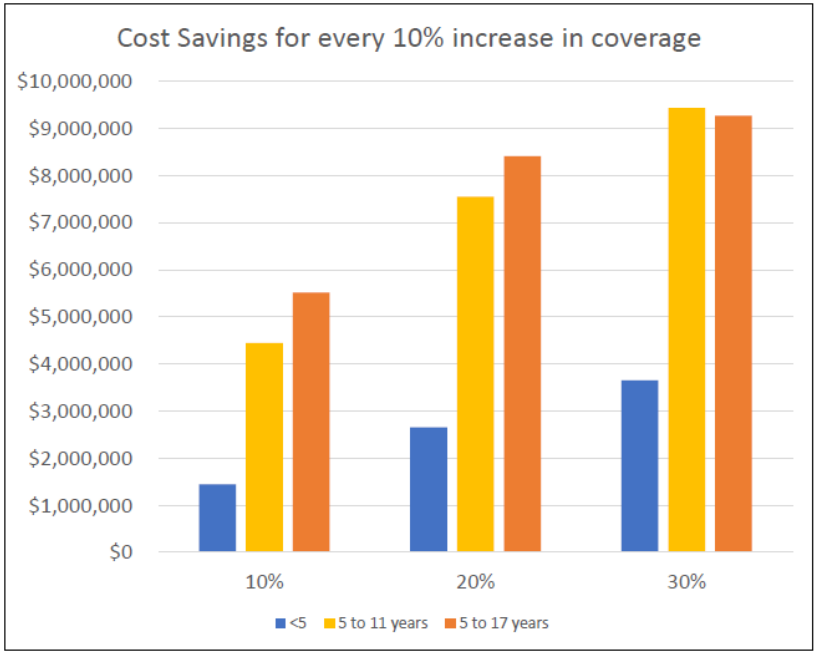




Blyth CC et al, Vaccine X, 2023

What about primary school children?





Blyth CC et al, Vaccine X, 2023

What about primary school children?

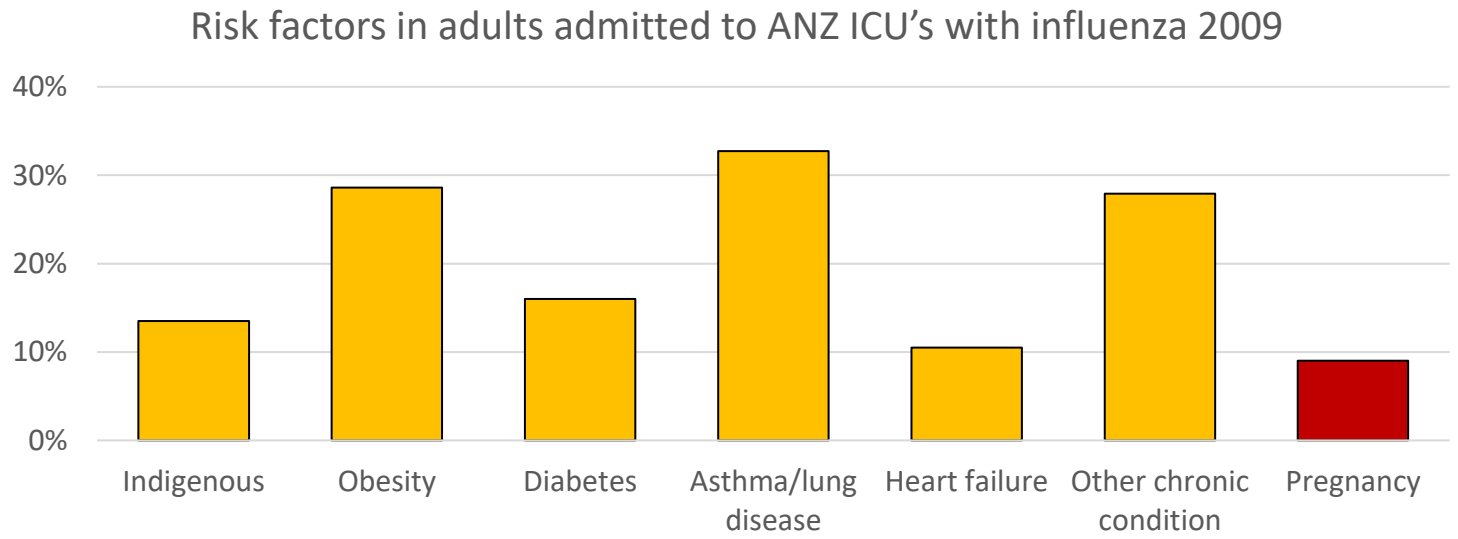
Vaccinate the Vectors

Protect the grandparents

Blyth CC et al, Vaccine X, 2023

What about pregnant women?

- Pregnancy is an independent risk factor for severe influenza (hospitalisation, ICU admission and death)

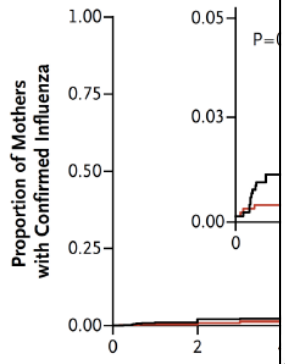


ANZIC Investigators, NEJM 2009

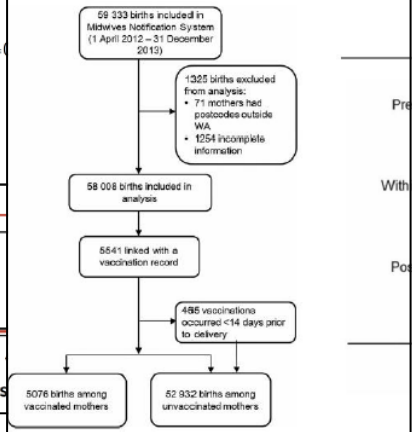
What about pregnant women?

- Pregnancy is an independent risk factor for severe influenza

- Vaccination in pregnan
  - Trial and observationa
    similar to other popul

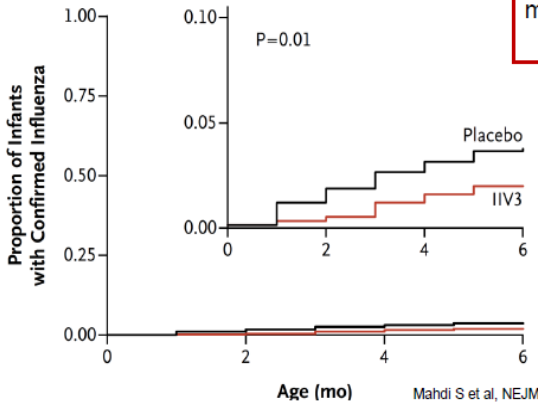


- Vaccination in preg
  - Similar reduction i



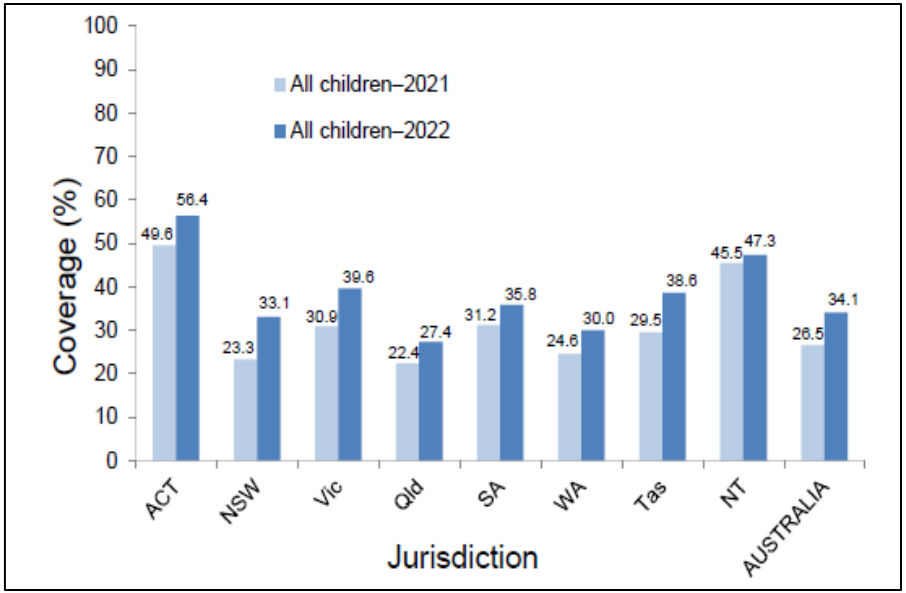
- Vaccination in pregnancy protects the infant
  - Trial and observational data suggests VE is similar to other populations

VE against maternal infection: 48% (11-70%)

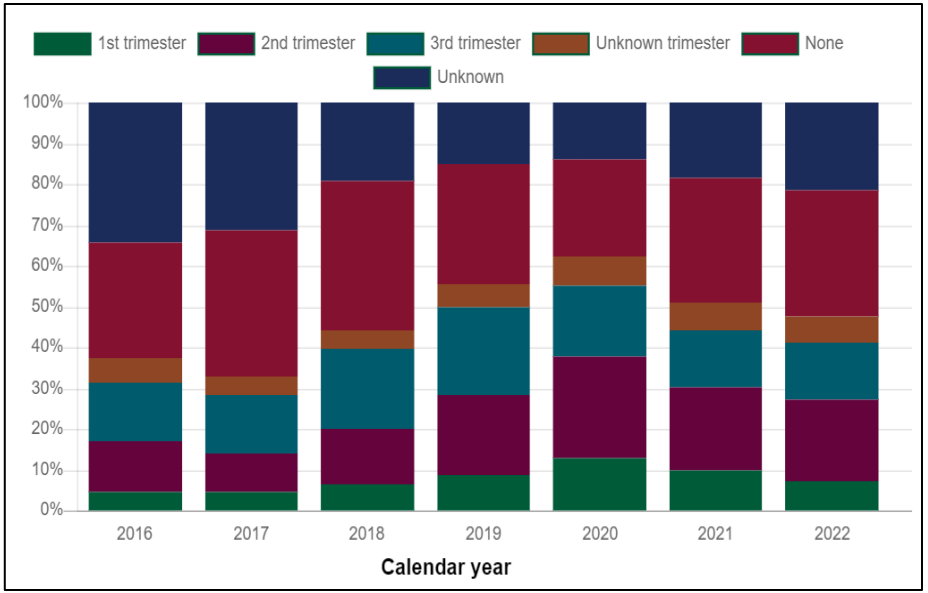


Mahdi S et al, NEJM 2014

The biggest challenge



Preschool children – 2021 and 2022 (nationally)



Pregnancy women – 2016-2022 (WA)

NCIRS report; WA Health

Improving influenza vaccine uptake

Dr Samantha Carlson
Senior Research Officer
Vaccine Social Scientist
Infectious Diseases Epidemiology Team
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Children

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What prevents uptake?

Parents may:

- be unaware
- believe it’s unnecessary
- have concerns about side effects
- feel children receive too many needles
- feel others also aren’t vaccinating
- not have established annual behaviour
- not have received a HCW recommendation
- find it difficult to get an appointment, get to an appointment, or remember to make appointment
- be busy

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What prevents uptake?

HCWs may:

- have competing demands = not enough time to recommend
- not have skills or knowledge to communicate effectively
- believe it's another HCWs responsibility to recommend
- forget to recommend
- be concerned about upsetting children by giving too many injections
- not be sending reminders

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What facilitates uptake?

Parents may:

- trust that vaccine is safe and effective
- know how serious influenza can be
- know that the vaccine is free
- have a trusted, friendly HCW
- have received a HCW recommendation
- have established an annual behaviour

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What facilitates uptake?

HCWs may:

- be recommending
- be providing a holistic, family-based and opportunistic approach
- work in setting where leaders (e.g., hospital executive) endorses vaccination

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Pregnant women

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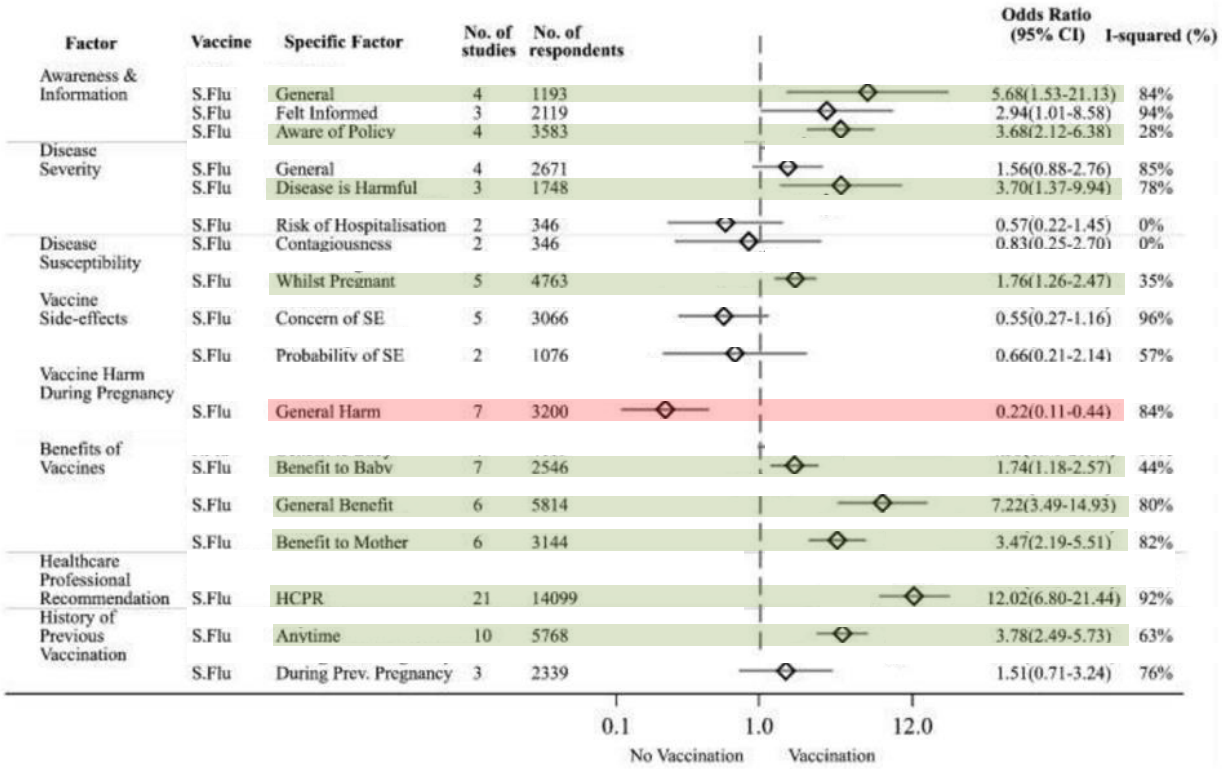

Fig 2. Factors associated with maternal vaccine uptake—A summary forest plot. Abbreviations. HCPR—healthcare professional recommendation, General—generally, P. Flu—pandemic influenza vaccine, SE—side effects, S. Flu—seasonal influenza vaccine.

https://doi.org/10.1371/journal.pone.0234827.g002

HUMAN VACCINES & IMMUNOTHERAPEUTICS
2022, VOL. 18, NO. 7, e2156229 (11 pages)
https://doi.org/10.1080/21645515.2022.2156229

Taylor & Francis
Taylor & Francis Group

REVIEW

Protecting pregnant people & infants against influenza: A landscape review of influenza vaccine hesitancy during pregnancy and strategies for vaccine promotion

Annette K. Regan [a,b] and Alice Fiddian-Green [a]

Table 1. Summary of strategies for increasing influenza vaccine acceptance during pregnancy[40,83].

Intervention Target	Example Interventions	Amount of Evidence	Effectiveness
Individual	Patient education[84–94]	+++	Modest inconsistent increase
	Message framing[95,96]	+	No effect
	Motivational Interviewing	-	Effects not currently known in pregnancy*
Relationships	Peer support interventions (i.e., group prenatal care)[97]	+	Increase
	Community organization-led interventions	-	Effects not currently known in pregnancy*
Institutional	Staff education and training[85–88–93]	++	Modest inconsistent increase
	Provider education[85,86]	++	Increase
	Patient immunization reminders ("nudges")[87–89–98–100]	++	Modest inconsistent effect
	Provider alerts to discuss vaccination[87–93–101–104]	++	Increase
	Standing orders/midwifery-led vaccination program[103,105,106]	++	Increase
	Opt-out vs. opt-in vaccination policies[107]	+	No effect
	Institutional vaccine "champion"[85,86,106]	+	No effect
	Interventions to increase access to vaccines at clinic/health service[87,88]	+	Increase
	Workplace vaccination policies	-	Effects not currently known in pregnancy*
Community	Provision of low-cost or free vaccines to pregnant persons[108]	+	Increase
	Health policies encouraging vaccination during pregnancy[108]	+	Increase
	Health plan incentives	-	Effects not currently known in pregnancy*
Society	Mass media campaigns	-	Effects not currently known in pregnancy*
	Social marketing	-	Effects not currently known in pregnancy*

*Effects have been documented in general population, but to our knowledge, have not been evaluated among pregnant persons specifically.

Conclusion – what can you do?

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- Recommend influenza vaccination to your patients
- Consider implementing reminder systems
- Access evidence-based resources that equip you for conversations with patients:
  - https://www.health.wa.gov.au/Articles/F_I/Influenza-immunisation-program
  - https://skai.org.au/healthcare-professionals
- Share evidence-based resources with your patients:
  - https://skai.org.au/childhood/vaccinating/annual-flu-vaccination
  - https://skai.org.au/childhood/questions/why-does-my-child-need-flu-shot
  - https://skai.org.au/pregnancy-and-newborn/diseases-and-vaccines/influenza

Improving uptake of influenza vaccination in high risk children at PCH 2024

Anne Bourke

Clinical Nurse, PCH Immunisation Service

2024 Paediatric Influenza Program

- Targeted hospital wide program commencing 6th May 2024 for 14 weeks

- Education and promotion
    - Circulation of ‘Flu flyer’, advertising on digital screens, reminders sent to Heads of Departments, ‘Take 5’ flu program slides on PCH HealthPoint, flu program banners throughout hospital

2024 Paediatric Influenza Program

- PCH Inpatients
  - Opportunistic vaccination of PCH inpatients during their hospital admission
  - Treating doctor prescribes vaccine on the medication chart & ward nurse administers prior to discharge

- PCH Outpatients
  - Targeted program for medically at-risk children attending outpatient appointments to highlight eligibility for additional vaccines (25 clinics included)
    - Asplenia
    - Cochlear implants
    - Chronic lung disease including cystic fibrosis and bronchiectasis
    - Chronic renal disease
    - Trisomy 21
    - Congenital heart disease
  - Stan Perron Immunisation Centre - Walk-in clinic, no appointment required
  - Needle anxiety pathway

2024 Paediatric Influenza Program

- RN for Aboriginal Immunisation
  - An Immunisation Nurse conducts daily immunisation reviews for all Aboriginal children attending PCH outpatient appointments
  - Identifies children who are due or overdue scheduled vaccines on the WA immunisation schedule, including influenza vaccines and additional vaccines recommended for Aboriginal children
  - The Immunisation Nurse has a yarn with the families, offers opportunistic education, and facilitates vaccination through SPIC
  - Uptake of 2023 influenza vaccine significantly increased with the commencement of this role

2024 Paediatric Influenza Program

- Further information
    - Judy Mathews (CNM, PCH Immunisation Service)
    - SPIC - Phone: 6456 3721

Vaccines don’t work in fridges

Research to improve uptake

Vaccine 32 (2014) 4075–4081

Contents lists available at ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine

The impact of pandemic A(H1N1)pdm09 influenza and vaccine-associated adverse events on parental attitudes and influenza vaccine uptake in young children

Christopher C. Blyth[a,b,c,d,*,1], Peter C. Richmond[a,b,c,1], Peter Jacoby[c,1], Patrick Thornton[a,1], Annette Regan[e,h,1], Christine Robins[c,1], Heath Kelly[f,g,1], David W. Smith[d,h,1], Paul V. Effler[e,1]

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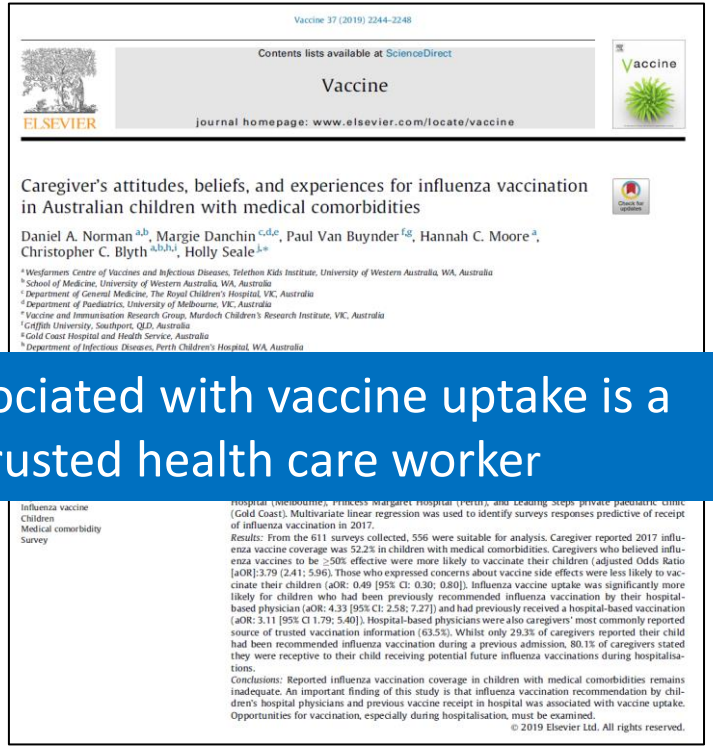
[b] Princess Margaret Hospital for Children, Subiaco, WA, Australia
[c] Wesfarmers Centre for Vaccines and Infectious Diseases, Telethon Kids Institute, Subiaco, WA, Australia

Available online 28 May 2014

Keywords:
Influenza
Vaccination
Parental attitudes
Children

pandemic A(H1N1)pdm09 and adverse-events on parental attitudes towards vaccination is uncertain.
Materials and Methods: A parental attitudes survey towards influenza illness and vaccination was conducted as part of the West Australian Influenza Vaccine Effectiveness study. Vaccination status was assessed by parental interview and confirmed by the national register and/or vaccine providers. Parental attitudes from vaccinated and unvaccinated children and attitudes in 2008–2009 and 2010–2012 were compared. Principal Component Analysis was conducted to determine core attitudes that influenced vaccine uptake.
Results: Vaccination history and parental attitude surveys were available from 2576 children. Parents of fully vaccinated children less frequently stated that influenza was a mild disease, more frequently stated that influenza vaccine was safe and were less frequently worried about vaccine side effects.
Uptake of influenza vaccine decreased significantly from 2010 onwards. From 2010, parents were less concerned about severe influenza, but more concerned about vaccine side effects and safety. Despite this significant shift in attitudes towards influenza vaccine, parental acceptance of vaccines on the national immunisation program did not change. Principal Component Analysis revealed that attitudes around vaccine safety and efficacy were the most important attitudes impacting on vaccine uptake.
Conclusions: Parental attitudes to influenza vaccine changed from 2010. Confidence in the WA preschool influenza vaccination program remains low yet appeared unchanged for other vaccines. Restoring public confidence in childhood influenza vaccination is needed before uptake can be improved.



Vaccine 37 (2019) 2244–2248

Contents lists available at ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine

Caregiver's attitudes, beliefs, and experiences for influenza vaccination in Australian children with medical comorbidities

Daniel A. Norman[a,b], Margie Danchin[c,d,e], Paul Van Buynder[f,g], Hannah C. Moore[a], Christopher C. Blyth[a,b,h,i], Holly Seale[j,*]

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[g] Gold Coast Hospital and Health Service, Australia
[h] Department of Infectious Diseases, Perth Children's Hospital, WA, Australia

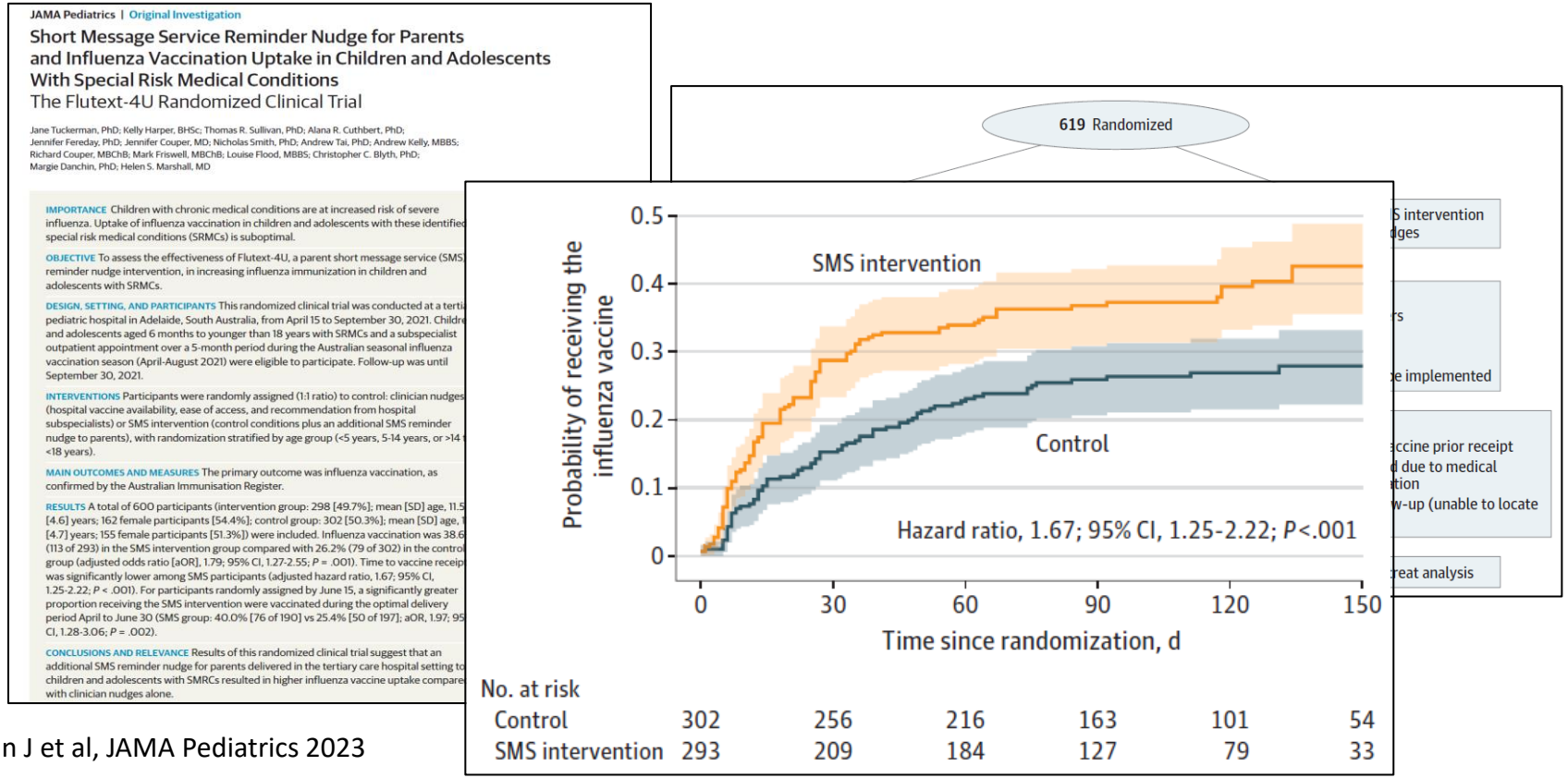
Influenza vaccine
Children
Medical comorbidity
Survey

Hospital (Melbourne), Princess Margaret Hospital (Perth), and Leading Steps private paediatric clinic (Gold Coast). Multivariate linear regression was used to identify surveys responses predictive of receipt of influenza vaccination in 2017.
Results: From the 611 surveys collected, 556 were suitable for analysis. Caregiver reported 2017 influenza vaccine coverage was 52.2% in children with medical comorbidities. Caregivers who believed influenza vaccines to be ≥50% effective were more likely to vaccinate their children (adjusted Odds Ratio [aOR]:3.79 (2.41; 5.96). Those who expressed concerns about vaccine side effects were less likely to vaccinate their children (aOR: 0.49 [95% CI: 0.30; 0.80]). Influenza vaccine uptake was significantly more likely for children who had been previously recommended influenza vaccination by their hospital-based physician (aOR: 4.33 [95% CI: 2.58; 7.27]) and had previously received a hospital-based vaccination (aOR: 3.11 [95% CI 1.79; 5.40]). Hospital-based physicians were also caregivers' most commonly reported source of trusted vaccination information (63.5%). Whilst only 29.3% of caregivers reported their child had been recommended influenza vaccination during a previous admission, 80.1% of caregivers stated they were receptive to their child receiving potential future influenza vaccinations during hospitalisations.
Conclusions: Reported influenza vaccination coverage in children with medical comorbidities remains inadequate. An important finding of this study is that influenza vaccination recommendation by children's hospital physicians and previous vaccine receipt in hospital was associated with vaccine uptake. Opportunities for vaccination, especially during hospitalisation, must be examined.

The factor most consistently associated with vaccine uptake is a recommendation from a trusted health care worker

Blyth CC et al, Vaccine 2014; Norman DA et al, Vaccine 2019

Research to improve uptake



JAMA Pediatrics | Original Investigation

Short Message Service Reminder Nudge for Parents and Influenza Vaccination Uptake in Children and Adolescents With Special Risk Medical Conditions

The Flutext-4U Randomized Clinical Trial

Jane Tuckerman, PhD; Kelly Harper, BHSc; Thomas R. Sullivan, PhD; Alana R. Cuthbert, PhD; Jennifer Fereday, PhD; Jennifer Couper, MD; Nicholas Smith, PhD; Andrew Tai, PhD; Andrew Kelly, MBBS; Richard Couper, MBChB; Mark Friswell, MBChB; Louise Flood, MBBS; Christopher C. Blyth, PhD; Margie Danchin, PhD; Helen S. Marshall, MD

IMPORTANCE Children with chronic medical conditions are at increased risk of severe influenza. Uptake of influenza vaccination in children and adolescents with these identified special risk medical conditions (SRMCs) is suboptimal.

OBJECTIVE To assess the effectiveness of Flutext-4U, a parent short message service (SMS) reminder nudge intervention, in increasing influenza immunization in children and adolescents with SRMCs.

DESIGN, SETTING, AND PARTICIPANTS This randomized clinical trial was conducted at a tertiary pediatric hospital in Adelaide, South Australia, from April 15 to September 30, 2021. Children and adolescents aged 6 months to younger than 18 years with SRMCs and a subspecialist outpatient appointment over a 5-month period during the Australian seasonal influenza vaccination season (April-August 2021) were eligible to participate. Follow-up was until September 30, 2021.

INTERVENTIONS Participants were randomly assigned (1:1 ratio) to control: clinician nudges (hospital vaccine availability, ease of access, and recommendation from hospital subspecialists) or SMS intervention (control conditions plus an additional SMS reminder nudge to parents), with randomization stratified by age group (<5 years, 5-14 years, or >14 <18 years).

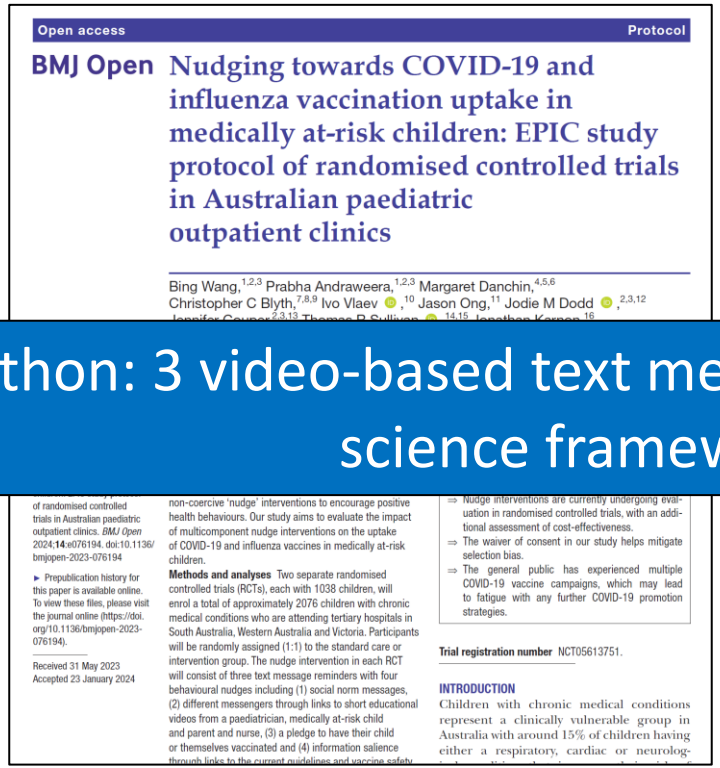
MAIN OUTCOMES AND MEASURES The primary outcome was influenza vaccination, as confirmed by the Australian Immunisation Register.

RESULTS A total of 600 participants (intervention group: 298 [49.7%]; mean [SD] age, 11.5 [4.6] years; 162 female participants [54.4%]; control group: 302 [50.3%]; mean [SD] age, 1 [4.7] years; 155 female participants [51.3%]) were included. Influenza vaccination was 38.6 (113 of 293) in the SMS intervention group compared with 26.2% (79 of 302) in the control group (adjusted odds ratio [aOR], 1.79; 95% CI, 1.27-2.55; $P = .001$). Time to vaccine receipt was significantly lower among SMS participants (adjusted hazard ratio, 1.67; 95% CI, 1.25-2.22; $P < .001$). For participants randomly assigned by June 15, a significantly greater proportion receiving the SMS intervention were vaccinated during the optimal delivery period April to June 30 (SMS group: 40.0% [76 of 190] vs 25.4% [50 of 197]; aOR, 1.97; 95 CI, 1.28-3.06; $P = .002$).

CONCLUSIONS AND RELEVANCE Results of this randomized clinical trial suggest that an additional SMS reminder nudge for parents delivered in the tertiary care hospital setting to children and adolescents with SMRCs resulted in higher influenza vaccine uptake compared with clinician nudges alone.

Tuckerman J et al, JAMA Pediatrics 2023

Research to improve uptake



Open access Protocol

BMJ Open

Nudging towards COVID-19 and influenza vaccination uptake in medically at-risk children: EPIC study protocol of randomised controlled trials in Australian paediatric outpatient clinics

Bing Wang,[1,2,3] Prabha Andraweera,[1,2,3] Margaret Danchin,[4,5,6] Christopher C Blyth,[7,8,9] Ivo Vlaev ,[10] Jason Ong,[11] Jodie M Dodd ,[2,3,12]

of randomised controlled trials in Australian paediatric outpatient clinics. *BMJ Open* 2024;**14**:e076194. doi:10.1136/bmjopen-2023-076194

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non-coercive 'nudge' interventions to encourage positive health behaviours. Our study aims to evaluate the impact of multicomponent nudge interventions on the uptake of COVID-19 and influenza vaccines in medically at-risk children.

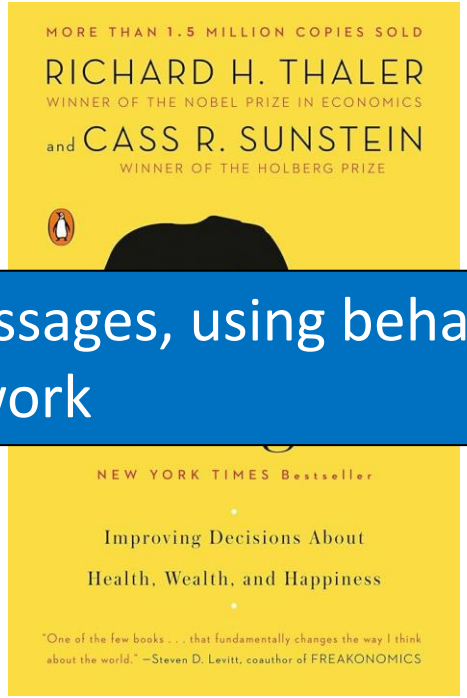
Methods and analyses Two separate randomised controlled trials (RCTs), each with 1038 children, will enrol a total of approximately 2076 children with chronic medical conditions who are attending tertiary hospitals in South Australia, Western Australia and Victoria. Participants will be randomly assigned (1:1) to the standard care or intervention group. The nudge intervention in each RCT will consist of three text message reminders with four behavioural nudges including (1) social norm messages, (2) different messengers through links to short educational videos from a paediatrician, medically at-risk child and parent and nurse, (3) a pledge to have their child or themselves vaccinated and (4) information salience through links to the current guidelines and vaccine safety

⇒ Nudge interventions are currently undergoing evaluation in randomised controlled trials, with an additional assessment of cost-effectiveness.
⇒ The waiver of consent in our study helps mitigate selection bias.
⇒ The general public has experienced multiple COVID-19 vaccine campaigns, which may lead to fatigue with any further COVID-19 promotion strategies.

Trial registration number NCT05613751.

INTRODUCTION

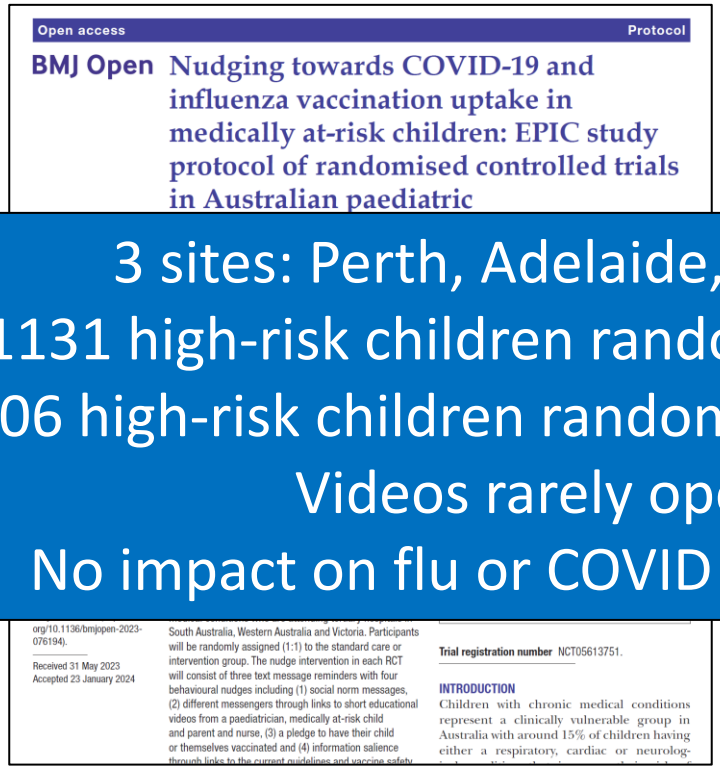
Children with chronic medical conditions represent a clinically vulnerable group in Australia with around 15% of children having either a respiratory, cardiac or neurolog-



Nudgethon: 3 video-based text messages, using behaviour science framework

Wang B et al. BMJ Open 2024

Research to improve uptake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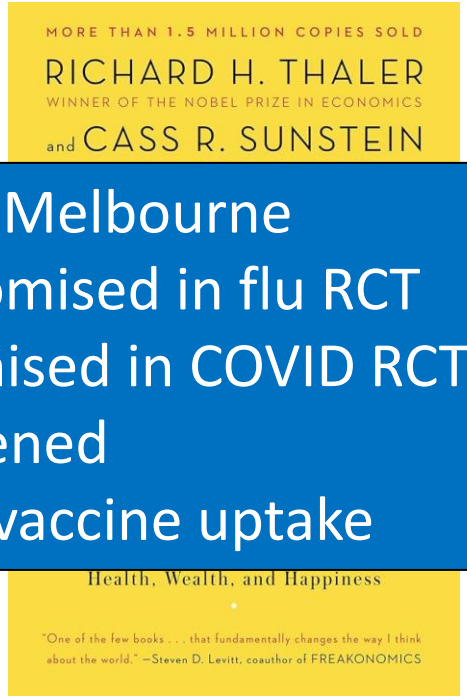
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3 sites: Perth, Adelaide, Melbourne

1131 high-risk children randomised in flu RCT

1106 high-risk children randomised in COVID RCT

Videos rarely opened

No impact on flu or COVID vaccine uptake

Wang B et al. BMJ Open 2024

Vaccines don’t work in fridges

Further research to understand barriers and enables to uptake are required.
In the meantime, recommendation is critical

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