Vaccination of children against Flu and COVID-19: who benefits?

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Global burden of respiratory infections associated with seasonal influenza in children < 5 years

- 109.5 million episodes of influenza
- 10.1 million influenza-associated lower respiratory infections
- 870,000 hospitalizations
- 34,800 deaths
- 82% of in-hospital deaths in low-income and lower-middle-income countries

157 studies around the world

Some of the influenza slides are based on the presentation by Prof. Terho Heikkinen at 9th ESWI Influenza Conference in Valencia 9/2023

Wang et al. Lancet Glob Health 2020
Incidence of influenza-associated hospitalizations in children < 16 years of age (n=69,068)

16-year retrospective study
July 1988–June 2004
In Finland

Silvennoinen et al.
Pediatr Infect Dis J 2011
Incidence of influenza-associated hospitalizations in children < 16 years of age (n=69,068)

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Silvennoinen et al.
Pediatr Infect Dis J 2011

Any influenza

USA hospitalizations < 6 mo:
375/100,000

USA in-hospital mortality < 6 mo:
0.73/100,000

Kamidani et al.
Clin Infect Dis 2022

Silvennoinen et al.
Pediatr Infect Dis J 2011
Incidence of influenza-associated hospitalizations in children < 16 years of age (n=69,068)

Silvennoinen et al.
Pediatr Infect Dis J 2011
Influenza in infants

• 408 newborn infants followed for 10 months
• Attack rate of influenza: 13.5%
• Infants with influenza:
  • Acute otitis media 46%
  • Antibiotic treatment 42%
  • Hospitalization 2%

Mattila et al. Influenza Other Resp Viruses 2020
Effectiveness of inactivated influenza vaccine in children 9 months to 3 years of age

Heinonen et al. Lancet Infect Dis 2011
Efficacy of live attenuated influenza vaccine against acute otitis media

Block et al. Pediatr Infect Dis J 2011
Vaccine effectiveness in Finland in 2022–2023
Children 6 months–6 years of age
LAIV and IIV combined

Table 3: Effectiveness of Fluenz Tetra and Vaxigrip Tetra in 0.5–6-year-olds, 14+ days after full vaccination

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Cohort size</th>
<th>Cases*</th>
<th>Person-years at risk*</th>
<th>Cumulative risk*</th>
<th>Vaccine effectiveness**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza A</td>
<td>304310</td>
<td>1007; 82</td>
<td>131850; 26894</td>
<td>0.451%; 0.141%</td>
<td>67.6% (59.4%; 74.2%)</td>
</tr>
<tr>
<td>Influenza B</td>
<td>304310</td>
<td>96; 7</td>
<td>131850; 26894</td>
<td>0.045%; 0.018%</td>
<td>78.0% (52.6%; 89.8%)</td>
</tr>
<tr>
<td>Any influenza</td>
<td>304310</td>
<td>1102; 89</td>
<td>131850; 26894</td>
<td>0.495%; 0.159%</td>
<td><strong>68.7% (61.0%; 74.8%)</strong></td>
</tr>
<tr>
<td>Hospitalisation due to influenza</td>
<td>304310</td>
<td>129; 10</td>
<td>131850; 26894</td>
<td>0.058%; 0.022%</td>
<td>67.6% (37.9%; 83.1%)</td>
</tr>
</tbody>
</table>

* Not vaccinated; Vaccinated
† Adjusted for year of birth

WHO recommendation for seasonal influenza vaccination

• Highest priority:
  • Health-care workers
  • Older adults (>65 years of age)

• Priority:
  • Pregnant women
  • Individuals with specific chronic medical conditions
  • Children aged 6-59 months
Why children are important in transmitting influenza

• Attack rates are highest in children
• Viral shedding is prolonged in children
• Viral loads are higher
Why children are important in transmitting influenza

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Benefits of vaccinating children:
- For the children themselves
Why children are important in transmitting influenza

• Attack rates are highest in children
• Viral shedding is prolonged in children
• Viral loads are higher

Benefits of vaccinating children:
- For the children themselves
- For the community by reducing transmission
We only see the top of the iceberg
SARS-CoV-2 in children

• Symptoms in children are usually mild
• Some children are asymptomatic
• < 2% require hospitalization
COVID-19 death rate in children

A COVID-19 death rate in the US: August 1, 2021, to July 31, 2022

B Monthly COVID-19 deaths in the US of children and young people aged 0 to 19 years

Flaxman et al. JAMA Netw Open 2023
Respiratory tract infections leading to hospitalization in 2022–2023

76 centers in Germany

Cases/day/hospital

Doenhardt et al. Infection 2023
Respiratory tract infections leading to hospitalization in 2022–2023

ICU admissions

Doenhardt et al. Infection 2023
Effectiveness of two doses of mRNA vaccine in children 5–11 years of age (n=1 368 721)

October 2021–January 2023
mRNA-1273 and BNT162b2

60% effectiveness at 1 mo
34% at 4 mo
15% at 10 mo

Lin et al. Lancet Infect Dis. 2023
Effectiveness of two doses of mRNA vaccine in children 5–11 years of age (n=1 368 721)

October 2021–January 2023
mRNA-1273 and BNT162b2

Monovalent booster:
24% effectiveness

Bivalent booster:
77% effectiveness

Omicron infection:
80% effectiveness

Lin et al. Lancet Infect Dis. 2023
Vaccinating children against COVID-19

Benefits in preventing the harms of the disease

Known or potential risks associated with vaccination
Factors to consider in relation to COVID-19 vaccination of children

**For**
- Protection against COVID-19
- Protection against severe COVID-19
- Impact of new variants uncertain
- Protection against PIMS-TS
- Protection against long COVID
- Contribution to reducing community transmission
- Avoidance of isolation, quarantine, school closures and other indirect harms of lockdowns
- Faster return to pre-pandemic activity and economic stability

**Against**
- COVID-19 is generally mild in children
- Risk of adverse effects
- Long-term safety unknown
- Efficacy against PIMS-TS unknown
- Efficacy against long COVID unknown
- Impact on transmission uncertain
- Large proportion already immune
- Limited vaccine supply
- Impact on routine immunisations
- Cost

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Zimmermann et al.
Arch Dis Child 2022
WHO recommendation for COVID-19 vaccination

• High priority
  • Children ≥ 6 mo with immunocompromising conditions (HIV, transplant, cancer treatment)
  • Boosters every 6–12 months

• Medium priority
  • Children and adolescents with comorbidities
    • Obesity, diabetes, chronic lung diseases, heart, liver and kidney diseases
  • Primary series and first booster dose

• Low priority
  • Healthy children and adolescents aged 6 months – 17 years
  • Vaccines are safe and effective, but the burden of disease is low
  • Countries should base their decisions on contextual factors
    • Disease burden, cost-effectiveness, etc.

who.int
Accessed 29.11.2023
Should children get COVID-19 vaccine?

“The risks and benefits need continual re-evaluation with the emergence of new variants of concern and new data on effectiveness and adverse effects.”

Zimmermann et al. 
Arch Dis Child 2022
Take home messages

• Influenza causes a significant burden especially for young children

• Influenza vaccines are effective in preventing symptomatic disease, complications and hospitalizations. By vaccinating children we can also reduce the viral transmission in the community.

• COVID-19 is usually a mild disease in children. This is why COVID-19 vaccination is recommended primarily for children at increased risk of severe disease (immunocompromised, comorbidities)