Seize the moments: missed opportunities to immunize at the family practice level

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\textbf{Background.} Missed immunization opportunities (MOs) are a significant barrier to achieving high immunization coverage.

\textbf{Objective.} To describe the nature of MOs to immunize within primary care in New Zealand and their effect on immunization completeness.

\textbf{Methods.} Audit of medical records of ~10 randomly selected children <2 years old from each of 62 primary care practices in Auckland, New Zealand.

\textbf{Results.} The 616 audited children made 10,094 visits to primary care practices. MOs occurred at 97% (60) of practices, in 556 (5.5%) of visits, and 31% of the children had one or more visits that were an MO. Overall, children who had any recorded MO visit were 3.1 times more likely to be incompletely immunized than children who had no recorded MO (95% CI 1.87–5.14). Children with the greater percentage of overall visits that were MOs had up to a 9 times increased likelihood of incomplete immunization compared to those who had no MO visits. Nurse visits have less MOs than doctor (1.5% versus 6%) but are more likely to occur within well-child visits.

\textbf{Conclusions.} MOs are common in primary care practices, occurring in nearly one-third of visiting children. The risk of under-immunization increases with the increasing percentage of visits that are MOs. Overall strategies directed at reducing MOs need to focus on a range of aspects for the practitioner and the practice system.

\textbf{Keywords.} Family practice, immunization, missed opportunities, primary health care, vaccination.

\textbf{Background}

Childhood immunization is one of the most cost-effective activities in health care.\textsuperscript{1} Failure to deliver scheduled vaccines in a timely manner results in disease epidemics.\textsuperscript{2–4} Improvements in the infrastructure of immunization service delivery are key to the increase in immunization coverage.\textsuperscript{5–7}

Missed immunization opportunities (MOs) are a significant health care system factor contributing to incomplete immunization.\textsuperscript{8} MOs are defined as health care visits where children do not receive an immunization when they are age eligible for the vaccine with no contraindication present.\textsuperscript{9} MOs are estimated to occur in 20–84\% of all child health care visits\textsuperscript{10} contributing to 13–40\% of total under-vaccination.\textsuperscript{11}

\textbf{Objectives}

The study objectives were to describe the frequency and characteristics of MOs to immunize within the New Zealand primary health care setting and to estimate the contribution MOs make to incomplete immunization.

\textbf{Methods}

\textit{Design}

A patient record audit, as part of a larger project examining family practice and health professional determinants of immunization coverage.\textsuperscript{12, 13}

\textit{Setting}

Seventy-two randomly selected primary care practices from a 2005 database of 346 practices within
metropolitan Auckland, New Zealand (population ≈1.2 million).

Subjects
Ten children aged between 6 weeks and 24 months were randomly selected from the patient database of all eligible children enrolled at each study practice. Practice staff obtained written informed consent from their parents.

Outcome measures
Immunizations received by each child were determined by an electronic audit of each practice management system. Children were defined as completely immunized if they had received all New Zealand schedule immunizations due as defined by the child’s age (6 weeks, 3, 5 and 15 months).3

The definition of a true contraindication was based on the New Zealand standard definition3 which includes anaphylaxis to a prior dose or component of the vaccine, moderate or severe illness with a temperature 38°C (100°F) and specific contraindications to specific vaccines.

The medical notes of all recruited children were retrospectively audited. Recorded visits were documented. Visits that fell within a date period when an immunization event was due but not given were recorded along with the diagnosis and any contraindication, based on the clinical notes.

Data analysis
MOs and immunization completeness for each child were described. Associations of MO with immunization completeness were determined using odds ratios and 95% confidence intervals. Because children were enrolled in groups from each practice, these analyses were adjusted for clustering by practice using SAS-PC version 9.1 (SAS Institute, Cary, NC) and SAS callable SUDAAN version 9.0.1 (Research Triangle Institute, Research Triangle Park, NC).

Results
Practice recruitment is summarized in Figure 1. Sixty-two of the 72 practices enrolled (89%) consented caregivers for the audit. The remaining eight practices lacked time or available staff to undertake recruitment.

There were 661 children recruited (range 8–18 per practice), of whom 655 had complete information. The variance in number recruited per practice was due to some practices sending out >10 requests and accepting all.

Audit of these 655 children’s records identified 10 094 visits to the practice (median 15 visits per child). Of these visits, two-thirds (6797) were to the family physician and one-third (3297) to the practice nurse. Sixteen per cent (1614) were joint visits to both. Overall, 6% (556) of all visits resulted in an MO, and MOs occurred at 97% (60) of the practices.

Of the 2002 children who had MOs, 20% (400) occurred when the first, 14% (280) when the second, 27% (550) when the third and 40% (800) when the fourth immunization event was due.

Characteristics of visits where MOs occurred
Overall, 80% (447) of MOs were with acute care visits: respiratory tract illnesses, 37% (166); acute otitis media, 9% (54); non-specific viral illnesses, 5% (31); skin infections, 5% (30); gastroenteritis, 5% (28); eczema,
4% (20). Together these six conditions accounted for 65% of acute visits where MOs occurred.

**Nurse versus doctor visits**

Practice nurses had a significantly smaller proportion of MOs per overall visits than family physicians. Fifty of 3297 nurse visits (1.5%) resulted in MOs, compared with 399 (6%) of physician visits (chi-square = 176, \( P < 0.001 \)).

Well-child visits resulted in 35 (70%) of MOs for nurses compared to only 18 (5%) of physicians, whereas 365 (91%) of the doctor MOs were related to acute illness or injury presentations (chi-square = 183, \( P < 0.001 \)).

**Presence of contraindications at MO visits**

True contraindications were present at 5% (28) of visits occurring within the time window of an MO, with possible contraindications in a further 4%. Most true contraindications (89%, 25 cases) were fever (temperature >100°F).

**Associations between MOs and immunization completeness**

Overall, children who had any recorded MO visit were 3.1 times more likely to be incompletely immunized than children with no recorded MO (1.87–5.14). Children for whom >20% of all their visits were MOs had 9.11 (4.35–19.38) times increased risk of being incompletely immunized compared with children who had no recorded MO visits (Table 1).

**Conclusions**

MOs to vaccinate children occur in most practices, for nearly a third of children visiting a primary care practitioner and are strongly associated with incomplete immunization.

Consistent with other studies, MO visits are more common with acute illness visits. The main focus of an acute illness visit will be on the presenting complaint and both parents and physicians may not wish to vaccinate an acutely unwell child regardless of the lack of contraindication. However, follow-up visits are scheduled after many acute care consultations and provide opportunities to consider and offer immunizations.

The different pattern seen between doctors and nurses has not been noted in other literature and is likely to be due to the different nature of the visits rather than differences in knowledge, with physician visits more likely to be due to acute illnesses. New Zealand family physicians and practice nurses have demonstrated similar knowledge gaps particularly in relation to identifying contraindications.

Greater barriers to MOs may be related to issues at the encounter rather than poor provider knowledge; such as the priority of the acute presentation taking precedence, the concerns over lack of certainty about how the acute illness will evolve and practice system issues, in particular failure to raise the attention of all staff at all encounters to the overdue immunization.

Vigilance by all staff to MOs, education around false contraindications and an effective organizational approach in general practice are the key elements to reducing MOs. A well-organized practice has an electronic practice management system to flag to all members of the practice team, at all encounters, that a child is due/overdue an immunization event. With a systematic approach and good teamwork, at each encounter the provider can offer brief advice and immediate referral of the child for vaccination at the time if desired.

Children with high rates of incomplete immunization are frequently called ‘hard to reach’. However, these children are accessible in that they are frequently attending the primary care provider. Improving focus on opportunistic immunization with visits at the provider level may have greater gains than relying on a multiple stepped recall system.

Potential gains from reducing MOs are considerable. In the USA, it has been estimated that elimination of MOs would decrease total under-vaccination by 50% and increase coverage levels up to 30%. Overall strategies directed at reducing MOs need to focus on a range of aspects for the practitioner and the practice system. These include practice systems to raise the profile of overdue immunizations at every level of the practice team. Vigilance by all staff to MOs, education around false contraindications and an effective organizational approach in general practice are the key elements to reducing MOs. A well-organized practice has an electronic practice management system to flag to all members of the practice team, at all encounters, that a child is due/overdue an immunization event. With a systematic approach and good teamwork, at each encounter the provider can offer brief advice and immediate referral of the child for vaccination at the time if desired.

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<table>
<thead>
<tr>
<th>Age group</th>
<th>Children with any MO visit recorded</th>
<th>Children with no recorded MO visit</th>
<th>Odds ratio (95% CI) of a child with any MO having incomplete immunization compared to a child with no MO</th>
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<tbody>
<tr>
<td>6 weeks to &lt;3 months</td>
<td>1 (8) 12.5%</td>
<td>1 (5) 4%</td>
<td>3.29 (1.4–7.69)</td>
</tr>
<tr>
<td>3 months to &lt;5 months</td>
<td>4 (10) 40%</td>
<td>5 (37) 13.5%</td>
<td>4.27 (0.52–35.25)</td>
</tr>
<tr>
<td>5 months to &lt;15 months</td>
<td>5 (41) 12%</td>
<td>10 (171) 6%</td>
<td>2.24 (0.72–6.96)</td>
</tr>
<tr>
<td>15 months to 2 years</td>
<td>36 (93) 39%</td>
<td>24 (115) 21%</td>
<td>2.46 (1.39–4.36)</td>
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<td>All age groups combined</td>
<td>46 (153) 30%</td>
<td>40 (328) 12%</td>
<td>3.1 (1.87–5.14)</td>
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*An incomplete immunization is one not received by the due date of the New Zealand schedule: 6 weeks, 3, 5 and 15 months of age.
encounter with staff and further attention to both provider education and motivational factors. Reducing MOs should be implemented as a quality measure at the practice level.

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Declaration

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Conflicts of interest: none.

References