Immunisation state and its documentation in hospital patients

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Abstract

Two prospective surveys of the immunisation state and its documentation were conducted among children under 2 years old attending a child's hospital. A survey of 111 children attending the casualty or outpatient departments showed that, according to reliable records, 106 (95%) were fully immunised for age with oral polio vaccine, 93 (84%) with triple antigen, and 26 of 33 children ≥16 months of age (79%) with measles-mumps vaccine. A survey of 204 inpatients showed that, according to verified records, significantly fewer inpatients than outpatients were fully immunised for age with oral polio vaccine (176, 86%) and with triple antigen (144, 71%). The proportion of inpatients vaccinated with measles-mumps vaccine was 81% (48 of 59). The inpatient figures are all lower than the 95% goal of current child immunisation programmes. Although parents of 98% of inpatients had a personal health record for the child, it was available at the time of admission for less than half the children. Lack of use of the personal health record by admitting medical staff was reflected in incorrect or absent documentation of the immunisation state in 17 of 49 (35%) of the records of children verified to have inadequate immunisations. Parents and health care staff need to be educated in the optimal use of the personal health record. Hospital paediatric staff need to be encouraged to verify the immunisation state of all young children, on admission, and arrange to rectify any deficiency found.

The key to a successful immunisation programme lies in ensuring a high degree of compliance in children of preschool age. During the first two years of life, the child immunisation schedule recommended in New South Wales specifies that triple antigen and Sabin oral polio vaccine should be given at 2, 4, and 6 months of age, measles-mumps vaccine at 15 months of age, and a booster of triple antigen at 18 months of age. From July 1989 measles-mumps vaccine was replaced by measles-mumps-rubella vaccine. In the United States, where school aged children are reported to have a compliance of greater than 95% with routine immunisation, appreciable numbers of cases of measles and mumps do still occur in children below school age. Many of the cases described in these reports were in children over 16 months of age who had missed being vaccinated against measles and mumps. To prevent this happening, those providing health care need to use all opportunities to ensure that their patients are appropriately immunised. 7-9 Paediatric authorities in both Great Britain and the United States have therefore strongly recommended that every hospital admission should be used as an opportunity to determine the child's immunisation state, and to correct any deficiency found.

This presupposes that each child's immunisation state is known by parent or provider, or both. The retrieval of this information accurately, however, is not without its difficulties. Parental recall is fallible, 12 so that a form of documentation is required that is acceptable to, and will be used appropriately by, both parents and health providers. Partly to solve this problem, the personal health record booklet was designed by the New South Wales Department of Health in conjunction with the Royal Australian College of General Practitioners as a health record to be held by parents. Since the beginning of 1988 mothers who have given birth in obstetric units in New South Wales and the Australian Capital Territory have received a personal health record in which their child's immunisations and other information about health should be recorded. 13 So far the value of the personal health record as an immunisation record does not seem to have been measured.

In response to calls to examine admission to hospital as an opportunity to improve immunisation uptake in young children, and prompted by the need to evaluate the personal health record as a method of recording immunisations, we conducted a prospective study among children under the age of 2 years who were attending the Prince of Wales Children's Hospital. The choice of this age group reflected concerns about compliance with the primary course of vaccination with triple antigen, oral polio vaccine, and measles-mumps and with the 18 month booster, and follows recommendations of the World Health Organisation for the assessment of compliance with immunisation. 14 The specific aims of the study were (i) to determine compliance with routine childhood immunisation of a hospital based population sample; (ii) to assess the extent of use of the personal health record as the record of immunisations held by parents; and (iii) to examine the accuracy, and thus the value, of the immunisation history of each inpatient as it was recorded in the medical notes.

Subjects and methods

CASUALTY AND OUTPATIENT SURVEY

Parents of children aged from 3 to 25 months who were attending the children's outpatients
department or the paediatric casualty depart-
ment were asked to complete a brief question-
naire in which they were asked to give the
child’s sex, date of birth, and the suburb where
they lived. Other details requested concerned
routine immunisations in the first two years of
dife— that is, number of doses of triple antigen,
combined diphtheria-tetanus, and oral polio
vaccine given in the first year, whether measles-
mumps or measles-mumps-rubella vaccine was
received, whether the 18 month booster was
received, and if so, whether it was triple antigen
or combined diphtheria-tetanus. A contact tele-
phone number was sought, and an attempt was
made later to contact all parents of children for
whom a Sydney telephone number was recorded.
The interviewer then asked the
parents to verify the responses to the survey by
referring to any immunisation records held at
home. In some cases, parents asked the inter-
viewer to contact the provider of the immunisa-
tion for validation.

INPATIENT SURVEY
The survey questionnaire was given to mothers
of children aged between 3 and 25 months who
were inpatients of the Prince of Wales Chil-
dren’s Hospital during the last six months of
1989. Those with haematological or oncological
disorders were excluded. In addition to the
questions included in the outpatient survey, the
interviewer asked the source(s) of the child’s
immunisations, and whether the parents held a
personal health record or other immunisation
record for the child. The interviewer then asked
to see the child’s personal health record. If it
could not be seen during that admission, per-
mission was sought to either contact the parents
later or telephone the immunisation provider(s)
to verify the information about immunisations
that had been provided by the mother. Finally,
the hospital record was examined to see whether
the child had been admitted urgently or elec-
tively and how accurately the immunisations
had been recorded by admitting medical staff.
For each inpatient, the medical record of
immunisations was compared with the records
held by parents or providers and classified as:
(a) correct-details (numbers and types of doses
recorded fully and correctly), (b) correct-
abbreviated (intelligible and correct, but medi-
cal paraphrasing used or ages but not types of
vaccine recorded), (c) incorrect, and (d)
undocumented (immunisations either not men-
tioned, or in so shortened a form as to be mean-
ingless).

ANALYTICAL METHODS
For the purposes of analysis, children were con-
sidered to have incomplete immunisations for
age if they had not received a scheduled dose at
the time of the survey, and it was more than one
month overdue.15 For example, children were
held to have missed measles-mumps vaccinations
if they were at least 16 months of age at the time
of the survey, and to have missed the 18 month
booster if they were at least 19 months of age.
Statistical comparisons between groups were
made with the χ² test, with the Yates’s correc-
tion for continuity when required.

Results
CASUALTY AND OUTPATIENT SURVEY
Of 154 survey forms on which a Sydney tele-
phone number had been recorded, it was possi-
bile to contact the parents of 111 children. Of
the remainder, 30 children (19%) were no
longer living at the address given, or the tele-
phone number was unobtainable, and the
parents of eight children kept no records and
could not name the providers; parents of five
were uncooperative. Verified data were avail-
able for all 111 children. There were 48 (43%)
girls and 63 boys, mean age 11Æ2 months. Based
on documented immunisation data, 101 (9%) had
received all required first year doses of tri-
ple antigen, and of 21 children old enough to
have also received the 18 month booster injec-
tion, 13 had received this dose as triple antigen,
and two as combined diphtheria-tetanus vac-
cine. In accordance with the recommended
schedule (which specifies four doses of triple
antigen in the first two years) 93 (84%) of the
111 children were appropriately immunised for
age with triple antigen, and a further seven (6%) had
received some doses as combined diphtheria-tetanus. One hundred and six chil-
dren (95%) had received the correct number of
doses of oral polio vaccine for age, and 26 (79%)
of the 33 children aged 16 months or older had
been vaccinated with measles-mumps/measles-
mumps-rubella.

When verified data were compared with the
information initially recorded on the survey
form, 106 children were documented to have
been given three injections (triple antigen/
combined diphtheria-tetanus, or both) in the
first year, but this had been initially recalled in
only 95 children. This difference between veri-
fied and recalled data is significant (χ²=5Æ5,
p<0Æ05). When oral polio vaccine doses were
analysed in a similar fashion, 106 children were
documented to have received three doses, whereas
parents had recalled it in only 86; this
difference is highly significant (χ²=13Æ9,
p<0Æ001). To test the hypothesis that mothers
of younger children would more accurately
recall immunisations than mothers of older chil-
dren, we carried out the same comparisons for
the 69 children aged 12 months or less. In this
group, 64 were documented to have received all
required injections of triple antigen or com-
bined diphtheria-tetanus, compared with
parental recall in 62; this was not significant.
When oral polio vaccine doses were analysed,
however, a significant difference was still found
between the 64 children documented to have
received all required doses and the 54 initially
said to have received all required doses (χ²=4Æ7,
p<0Æ05). There was no difference between
documented and recalled data for the measles-
mumps/measles-mumps-rubella and 18 month
booster vaccinations.

INPATIENT SURVEY
Mothers of 204 children in hospital were inter-
viewed and immunisation data verified for all of them. There were 87 (43%) girls and 117 boys, mean age 11-7 months. Of the 204 children, 159 (78%) had received all the required first year doses of triple antigen, and of the 33 children old enough to have received the 18 month booster dose, 15 had received this dose as triple antigen, and three as combined diphtheria-tetanus. Thus 144 (71%) were appropriately immunised for age with triple antigen, and an additional 20 (9%) had received some doses of combined diphtheria-tetanus instead of triple antigen. One hundred and seventy six (86%) children had received the correct number of oral polio vaccine doses, and 48 (81%) of the 59 children aged 16 months or older had received measles-mumps/measles-mumps-rubella. Overall, only 135 of the 204 children (66%) had complied fully with the recommended schedule.

COMPARISON OF INPATIENTS WITH OUTPATIENTS
One hundred forty four of 204 inpatients (71%) had received all triple antigen doses for age compared with 93 of 111 outpatients (84%). This difference is significant ($\chi^2=6.0$, $p<0.02$). In addition, 176 inpatients (86%) had received all oral polio vaccine doses for age, compared with 106 outpatients (95%). This difference is significant ($\chi^2=5.6$, $p<0.02$). The compliance with measles-mumps immunisation in the two groups was similar ($\chi^2=0.0$, $p>0.95$).

USE OF THE PERSONAL HEALTH RECORD
When 24 of the 204 children either born outside New South Wales and the Australian Capital Territory, or before the introduction of the personal health record, were excluded from the analysis, 176 (98%) of a possible 180 children had a personal health record; in the remainder the mothers had not been given them. Many parents, however, did not bring the personal health record into hospital at the time of admission, so that the personal health record was available for only 46% of children. Of 88 children admitted urgently (the casualty department, doctor’s rooms, or interhospital transfer) only 30 (34%) had their personal health record on admission, compared with 51 of 87 children (59%) admitted electively ($\chi^2=9.6$, $p<0.01$).

ACCURACY OF MEDICAL NOTES
The adequacy of documentation of immunisations in the children’s medical notes compared with other records is shown in table 2. Overall, documentation of immunisations was correct in 155 medical records (76%), and incorrect or absent in 49 (24%). Immunisation state was incorrect or undocumented in 32 (19%) of the 155 medical notes of the children who were appropriately immunised and in 17 of 49 (35%) of those incompletely immunised.

Discussion
These data show that the population of young children attending a children’s hospital had a level of immunisation uptake lower than the 90–95% required for herd immunity to prevail in the general child population.16 17 The casualty and outpatient survey showed vaccine uptakes of 79% for measles-mumps, 90% for first year triple antigen, and 95% for oral polio vaccine. These data are difficult to compare with other studies because of differences in the populations surveyed and in other methods used, but a similar survey of children in casualty

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### Table 1

<table>
<thead>
<tr>
<th>Total No</th>
<th>Private doctor only</th>
<th>Local council only</th>
<th>Department of Health only</th>
<th>More than one</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sydney</td>
<td>160</td>
<td>108 (68)</td>
<td>28 (65)</td>
<td>1 (0.6)</td>
<td>1  (0.6)</td>
</tr>
<tr>
<td>Elsewhere</td>
<td>44</td>
<td>23 (52)</td>
<td>9 (20)</td>
<td>4 (9)</td>
<td>28 (5)</td>
</tr>
<tr>
<td>Total</td>
<td>204 (100)</td>
<td>136 (67)</td>
<td>12 (6)</td>
<td>22 (11)</td>
<td>29 (14)</td>
</tr>
</tbody>
</table>

### Table 2

<table>
<thead>
<tr>
<th>Accuracy of hospital medical record</th>
<th>No of patients with complete immunisations verified</th>
<th>No of patients with incomplete immunisations verified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct: detailed</td>
<td>58</td>
<td>26</td>
</tr>
<tr>
<td>Correct: abbreviated</td>
<td>65</td>
<td>6</td>
</tr>
<tr>
<td>Incorrect</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>Undocumented</td>
<td>27</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>155</td>
<td>49</td>
</tr>
</tbody>
</table>
with verification of records conducted in western Sydney in 1980 reported 94% compliance with first year triple antigen and oral polio vaccine vaccinations. The casualty survey also emphasised several difficulties found in assessing immunisation reliably in this age group. There was a high incidence of mobility: 19% of families could not be contacted six to nine months after the survey forms were first completed. Basser, in an immunisation survey conducted in the southern metropolitan region of Sydney, found that roughly 13% of families with 18 month old children moved house annually. It may be suggested that the rates of immunisation reported in the casualty survey were falsely increased because mobile families with lower compliance could not be contacted, and thus were removed from the final analysis. This selection process did not occur during the inpatient survey. In the same study Basser found that children of mobile families had an 88% compliance with the 18 month booster vaccination, compared with 92% for children from families that had not moved house, so that this factor alone is unlikely to explain the difference in immunisation compliance between our inpatient and outpatient populations.

A further difficulty concerns the accuracy of collected data when it is based on the parents’ recollection, a problem previously pointed out by Menser et al. Analysis of the casualty survey showed that there was a significant difference between the child’s immunisation state as recalled by the mother and that documented in written records. This applied to doses received during the first year of life, and inaccuracy was particularly noted in the mothers’ recollections that fewer oral polio vaccine doses had been given than was actually so.

The inpatient survey showed inadequate compliance with all scheduled immunisations among children in hospital. Of this population, 86% were appropriately immunised for age with oral polio vaccine, 81% with measles-mumps, and 71% with triple antigen. Only 66% were fully immunised for age in accordance with the schedule. These results are in direct contrast to those of recent population based studies of children of similar age. Two year old children born in the Penrith and Hawkesbury areas had uptakes of triple antigen and oral polio vaccine of 94%, and of measles-mumps vaccine of 95%, and 92% of children aged 8–11 months born in Camden were fully immunised with triple antigen and oral polio vaccine. In neither of these studies, however, were data verified against reliable records. On the other hand, the present study may be compared with a report from a children’s hospital in the United States, in which inpatient medical records were examined retrospectively to determine the immunisation state of children in hospital as recorded by the junior medical staff. Of the 85 records in which it was noted, 66 (78%) reported that the children were fully immunised for age.

The current study showed a high degree of inaccuracy in the medical documentation of immunisation in the notes of children in hospital. In 24% of all records the immunisations were either wrongly recorded, or not recorded at all. Moreover, this figure rose to 35% when only the records of children known to have incomplete immunisations were considered. Thus in the population studied it would not have been possible for medical staff to attempt to correct immunisation defects in one third of children, as this portion of the group would have remained unidentified. In comparison, the retrospective study from the United States found that in 19% of medical notes there was no record of immunisation. Ideally, the admission to hospital of a young child should give an opportunity to medical staff to determine accurately the child’s immunisations, and to make a plan to correct any inadequacies, as most of these children are unlikely to have specific medical contraindications to immunisation. Such a plan might take the form of immunisation in hospital before discharge, referral to an immunisation clinic, or an admission to a special unit in hospital. Health providers in the community must be strongly encouraged to make an entry in the personal health record at each of the child’s visits. Finally, hospital staff looking after the child need to be educated to ask to see the personal health record at the time of the child’s admission, and, if the personal health record indicates a need, to make a plan for the child’s further immunisation. Only in this way can admission to hospital be used to detect and improve the current, poor immunisation records of young children in hospital.

I thank Dr M Gibbons for his assistance in the design and conduct of the casualty and outpatients survey, and the clerical staff of the outpatients and casualty departments of The Prince of Wales Children’s Hospital who distributed the questionnaires to the parents. I particularly wish to acknowledge the help of Mrs D Christe, who carried out many of the telephone interviews of parents and immunisation providers.

Forty years ago

Giardia lamblia infestation
A study of the incidence of Giardia lamblia infestation was carried out at a residential nursery with accommodation for 30 mothers and 156 children under the age of 3 years. On admission cysts of giardia were found in 27% of the children over the age of 1 year and the incidence was higher in those who had previously been in a nursery than in those who had not. Stools were loose in 8% of children on admission, but of those who had been resident for three months or more 25% had loose stools and 80% were positive for giardia. Only 4% of the mothers and nurses were positive.

Children with giardia who were treated with mepacrine showed a marked decrease in the incidence of loose stools and a greater gain in weight than untreated controls. Giardia cysts were completely eliminated from the stools after a few days of treatment. In a sample of 14 infants with giardia the faecal fat excretion on a normal fat intake was not above normal.

Tonsillectomy
In the immediate postwar years some 200 000 tonsillectomies a year were being performed in this country. In many hospitals this operation was the commonest reason for the admission of children to hospital.

In England and Wales in the three years preceding the war 16% of children in state schools had had their tonsils removed by the age of 13, compared with 83% of boys of that age entering Eton. In Kent County Council schools the overall incidence of tonsillectomy was 16% but in the local districts it ranged from 1% in Deal to 42% in Tunbridge Wells.

The indications for tonsillectomy listed in textbooks at the time included every possible symptom arising from the upper respiratory tract as well as some more remote conditions such as rheumatic fever, asthma, glomerulonephritis, anorexia, and sleep disorders. Are we finally agreed on the indications for tonsillectomy 40 years later?

Studies in neonates
Part 4 of Drillien’s series of studies of prematurity in babies born at the Simpson Memorial Pavilion, Edinburgh in the 1940s included reports on breast feeding and neonatal infection.

Of 100 premature babies 44% were fully breast fed for more than one month and 36% for more than three months. For mature control babies the comparable figures were 67% and 48%. Some 24% of the premature babies weighed under 2000 g at birth and three quarters of these were never breast fed.

In the first 10 days of life the commonest infections were skin and eye infections due to Staphylococcus aureus, thrush, and gastroenteritis. The infection rate in relation to birth weight was: 31% under 3·5 lb (1600 g), 14% between 3·5 lb (1600g) and 4·5 lb (2000 g), 10% between 4·5 lb (2000 g) and 5·5 lb (2500 g), and 6% in those over 5·5 lb (2500 g).

In a maternity hospital in Belfast, where the average stay for mothers and babies in 1946 was 10·3 days, over 80% of neonatal infections were due to S aureus.

At the Queen Elizabeth Hospital for Children, London, cultures from 11 of 15 neonates admitted with septicaemia in 1946 grew S aureus. One baby had septic arthritis and two had osteomyelitis of the maxilla; seven died.


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