Area, and data entry and analysis were conducted centrally.

For primary analysis, an immunisation was accepted to have been given if a provider or parent stated that it had occurred. 'Fully immunised' for the purposes of our study meant that a child had received all the immunisations that the ACIR flagged as 90 days overdue on 17 June 1997 at time of survey. Where a fully immunised child was incorrectly flagged (misclassified) as 90 days overdue, a single reason for this was attributed by a trained data-entry clerk under direction of the principal researcher (SC). Categories of misclassification were determined post survey.

Results

Sample characteristics

There were 27,195 children born after 1 January 1996, resident in NSW, flagged by the ACIR as at least 90 days overdue for any vaccine at 17 June 1997 and eligible for inclusion in the study. The eldest children in the study were born at the beginning of 1996 and were 17 months of age, the youngest children in the study were born in the first two weeks of 1997 and were five months of age. The estimated total number of children in NSW between these ages was 89,129.[8] The median age of children in the sample was 12 months. The estimated proportion of the five to 17-month-old childhood population recorded as ACIR-overdue varied from 20.2% in the Hunter to 40.5% in Western Sydney.

The 850 children in the sample were reportedly overdue for 5,325 vaccines – a mean of six per child. More than half the children (57.2%) were recorded by the ACIR as having received at least one vaccine in the primary course, but a significant minority had reportedly received no vaccines at all (30.4%), or only their first hepatitis B vaccine (12.5%), which is usually given in hospital. Overall, general practitioners accounted for 63.2% of all last providers listed.

Validation survey results

There were 393 interviews with the last providers, 230 parent interviews and 112 interviews with a provider identified by the parent. Overall information on every ACIR-overdue immunisation, whether given or not given, was obtained for 526 or 61.9% of children. For 57 of these children this was from parental report alone. Of these 526, 452 (86.6%) were fully immunised according to either a provider or parent. Between Health Areas the proportion of children successfully followed-up varied from 48% to 80%, and the percentage of these fully immunised varied from 74% to 97%. After simple weighting by Health Area population, the overall proportion of NSW children identified by ACIR as 90-days-overdue for immunisation who were fully immunised at the time of survey was an estimated 85% (95% CI 82.6%-87.4%).

For 427 (94.5%) of the 452 fully immunised children, dates of administration were obtained for all immunisations, and 354 (82.9%) of these children received all ACIR-90-day-overdue immunisations within 90 days of them being due. Most (59.7%) received all immunisations within 30 days of them being due (see Figure 1).

Of the 452 fully immunised children, a sufficient reason for the child being flagged wrongly as overdue by ACIR could be attributed for only 248 (55%) of children. The majority (141) of these cases we attributed to provider errors, but 104 we attributed to 'system errors' (see Table 1).

Discussion

This study had several limitations. First, full information was not obtained from approximately one-third (38.6%) of the children in the study, and so their immunisation status was not able to be determined. For the most part this is probably because parents moved, but additional possibilities included the creation of duplicate records for a child under different names. It is probably correct to assume that the group we were unable to contact were more likely to be unimmunised. This is significant in itself and shows the difficulty of using this ACIR data to reach this group of possibly unimmunised children.

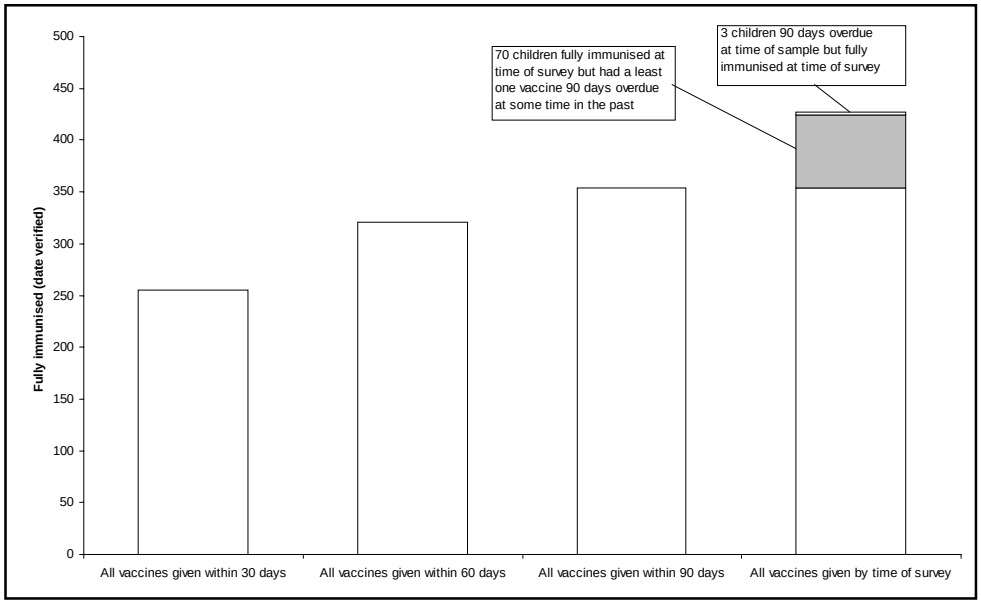

Figure 1: Timeliness of immunisation: when children identified by the ACIR as 90 days overdue became fully immunised (n=427 fully immunised at time of survey and all dates of immunisation known).

Table 1: Fully immunised children (n=452) at time of survey who were flagged as 90 days overdue by ACIR at June 17, 1997: reason for being flagged as overdue.

Reason overdue	Number	%
Unknown	**204**	**45.1%**
Provider errors	**141**	**31.2%**
No encounter form submitted[a]	53	11.7%
Probably no encounter form submitted[b]	88	19.5%
System errors	**104**	**23.0%**
Unknown ACIR problem[c]	34	7.5%
Wrong name[d]	33	7.3%
Transcription error[e]	28	6.2%
Failure of electronic data transmission[f]	4	0.9%
Wrong date of birth[g]	1	0.2%
Immunised overseas	4	0.9%
Non-errors	**3**	**0.7%**
Late immunisation[h]	3	0.7%
	452	**100%**

Notes:
(a) Provider admitted that they did not send in an encounter form.
(b) Indirect evidence that provider did not return encounter form (usually statements to the effect that encounter forms were often not returned).
(c) Provider evidence that an encounter form had been appropriately submitted (usually carbon copy).
(d) Spelling or other name error resulting in duplicate identity.
(e) Omission of a single vaccine from an immunisation encounter where other vaccines were administered and there was other evidence (usually parental) that they had been administered.
(f) General practitioner failed when attempting to submit encounter electronically.
(g) Date of birth error resulting in incorrect classification as overdue.
(h) 90 days overdue at time of sample but immunised by time of survey.

Second, we accepted at face value parent statements that their child was immunised. The validity of parent recall of immunisation has been questioned,[9] and it may be that accepting parent statements inflated our estimate of the total number immunised. However, this inflation is likely to be small given that we were able to obtain dates for all immunisations for 94.5% of the children whom we classified as fully immunised.

Third, we were unable to attribute a reason for fully immunised children being flagged by ACIR as 90 days overdue for a large minority (45%) of these children. In our opinion this is result of weakness in our method of survey (telephone) and survey instrument. If we had the resources to more intensively pursue this question using surgery visits, or examining actual copies of submitted encounter forms, we probably would have had more success in determining the reasons.

Despite these limitations, our main finding is difficult to dispute: in mid-1997 the majority of children flagged by the ACIR as 90-days-overdue were not overdue and were never overdue. Of those children who could be located, 85% were fully immunised. Even if we assume that all children who we were not able to contact were genuinely unimmunised, and were appropriately flagged by ACIR as overdue, 53% (452/850) of the sample were still fully immunised at survey and inappropriately flagged as 90-days-overdue. These results are higher than those reported by Bond, Nolan and Lester who, using this same ACIR-90-day-overdue data, found approximately 60% of children were up-to-date.[10]

Additionally, although we were not able to attribute a reason for a significant minority of those fully immunised children being incorrectly flagged as overdue it seems that the most important reason for a properly immunised child being flagged as overdue is failure on the part of the provider to return the encounter form. Non-provider errors were, however, not unimportant.

Although reflecting the situation in mid-1997, this study underlines a simple point: the ACIR relies on the accurate formation of the register and the active participation of immunisation providers to return information; otherwise, children are classified as unimmunised. The latter remains a key area of vulnerability of the ACIR. For immunisation coordinators, the practical consequence of inaccurate information is that individual follow-up is made inefficient and impracticable. The hopes that 90-day-overdue data would provide a precise tool for appropriately targeted follow-up were not realised by the end of 1997. So, attention must continue to be focused on efforts to enlist the co-operation of providers properly completing and returning encounter forms. Financial incentives for general practitioners introduced by the Commonwealth from 1 July 1998 may have by now improved the quality of the data through increased return of encounter forms, and this should be further investigated.

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