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Investigations of Immunization Coverage Rates of Infants and Children in Five Cities and Counties in Taiwan

1. Introduction

With the improvement in nutrition and environmental sanitation, the promotion of immunization and the availability of medical care, infant mortality in the recent years has dropped sharply from 44.71 per 1,000 live births in 1952 to only 5.05 in 1991. This achievement though is remarkable, unless a high immunization coverage rate of various vaccines in due time is maintained, the sources of infection will increase, and once the pathogens attack, outbreaks could result[1]. The poliomyelitis outbreak in 1982 ending in 1,043 cases and 98 deaths, and the measles outbreaks every two to three years are some examples. In 1988 alone, there were still some several thousand reported cases of measles[2]. These facts indicate the importance of immunization in the prevention of infectious diseases.

Statistics of the World Health Organization (WHO) shows that each year there are three million deaths and 350,000 disables of infants and children[3]. These numbers could have been reduced sharply through effective immunization. Communicable diseases such as tuberculosis, diphtheria, pertussis, tetanus, poliomyelitis and measles though are major threats to the lives of infants and children, they are vaccine-preventable. The World health Organization, in its Expanded Programme on Immunization (EPI), has made the prevention of these six communicable diseases as its goal. Recently, WHO has also recommended immunization againt hepatitis B. Taiwan's immunization program includes the seven recommended by WHO and mumps, Japanese encephalitis and rubella as well, with a hope to eliminate poliomyelitis, neo-natal tetanus and congenital rubella syndrome by 1995 and to effectively control measles by the year 2000.

Five criteria have to be met in order to effectively control these 10 communicable diseases:

1. effective vaccines,
2. high immunization rate,
3. effective control of susceptible groups,
4. reliable and swift reporting systems of diseases, and
5. effective management of outbreaks.

Survey findings of the Department of Health show that between 1986 and 1989, the immunization complete rates of these 10 vaccines for children aged 12 to 23 months had been around 55 to 88%[4]. These rates require further improvement.

Surveys of immunization coverage rates have been conducted in 18 cities and counties in the Taiwan area, while the remaining Taipei Municipality, Hsinchu City, Taitung County, Keelung City and Penghu County have not been surveyed yet. To establish baseline data for the entire 23 cities and counties, this study has been conducted. The purposes are:

1. to conduct surveys of immunization rates in these five cities and counties,
2. to understand reasons for failure in completing the required immunization and to make recommendations for improvement, and
3. to develop sampling survey methods for use in Taiwan.

II. Materials and Methods

1. Target Groups

Of the cities and counties under survey, Taipei Municipality has 12 districts, Hsinchu City 3 districts, Keelung City 8 districts, and Taitung and Penghu counties 22 townships. Each township has several villages, lins and households.

The cluster sampling method described below was applied. The survey was conducted between October 1991 and May 1992. Public health nurses were trained in interview techniques, and after some pretesting, were asked to undertake the actual interviewing.

Targets for survey were infants and children aged 12 to 23 months as indicated on the household registration records. All children residing in the sampled areas, registered or otherwise, were to be interviewed as to the dates of their immunization of various vaccines and reasons for failure. Persons interviewed or members of families were asked to present the immunization cards. Dates of immunization were then recorded on the questionnaire by interviewers. If the cards were not available, persons who spent most time caring for the children were asked to give the dates by memory which were then recorded on the questionnaire by interviewers. These dates were checked against the records of health stations or hospitals. When they failed to match, these immunizations would not be accepted as completed.

2. Sampling Method

Following the survey method of the Expanded Programme on Immunization of WHO, the cluster sampling method was applied[5]. In all survey areas, the populations of districts were added together. Within a county or city, there were highly urbanized, less urbanized, remote and coastal areas[6], and the number of neighborhoods and households also varied. Every 80 to 120 households were then organized as one cluster and numbered so that each cluster would have more or less the same number of

households for random sampling. This was a modification of the WHO method which used the population of a district as a basic unit for sampling. For each city or county, 30 clusters were systematically sampled, and all children in the age groups of 12-23 months in these sampled clusters were interviewed. When seven eligible children were interviewed in one cluster, the interview was considered complete[7]. Results thus obtained were within the 95% ± 10% confidence intervals.

The household registration system in Taiwan is relatively well-established. Families are organized into households, lins, li's (villages), townships, cities, districts, and counties (municipalities). The cluster sampling method described above can be easily applied.

3 Procedures

Pre-testings:

1) Public health nurses visited local household registration offices to copy down names and addresses of existing households in a township or district; moved-out or empty households were excluded.

2) All lins in the neighboring li's were arranged in order; the number of households in each lin was given.

3) All townships, cities or districts of a municipality or county were arranged randomly and recorded.

4) All lins were clustered into 80 to 120 households per cluster. Taipei Municipality had 6,733 clusters, Hsinchu City 178, Keelung City 918, Taitung County 613 and Penghu County 249 clusters.

5) Eligible children were defined as children 12 to 23 months old. The survey was conducted between 25 January and 29 February 1992. Children eligible during this period were identified and surveyed.

6) All children in this age group in the sampled clusters were to be visited.

7) 12 clusters in each municipality or county were surveyed to find out on average how many households should be visited to identify one eligible child.

The survey:

1) Based on the data of villages, townships and cities already arranged randomly and recorded, 80-120 households of certain lins were combined into one cluster.

2) Names of family heads and addresses were collected from the household registration offices.

3) Each household in the sampled cluster was then visited. Data of eligible children were recorded on the questionnaire.

Quality of data collection was strongly controlled. Each interviewer, upon completion of interview, was asked to check the questionnaire once more against household record and immunization record The researchers also spot-checked the contents of some questionnaires.

III. Findings

1. At pre-testing

Clusters in the five cities and counties were randomly selected. Upon information on each household in the sampled cluster collected from the household registration office, all households of the sampled clusters were interviewed. it was found that for Taipei Municipality, Hsinchu City, Keelung City and Taitung County, on average, 6.3 to 7.2 eligible children could be located in each cluster. Of these four cities and county, some li's of Hsinchu City had already been reassigned to the industrial area though their registration records still remained in the City; most eligible children in Taitung County concentrated in Taitung City, and very few were in the townships.

Penghu County is an off-shore county and migration of population to other cities and counties is frequent. Many registered households were thus found empty. On average, only 5.1 eligible children could be located in one cluster. Of the five cities and counties, on average 6.1 eligible children could be located in one cluster.

2. The sampling

Findings of the pre-testing showed that on average only 6.1 children could be located in a cluster, so it was decided in the actual survey to increase the number of clusters to be surveyed from 30 to 35.

In Taipei Municipality, 4,123 households had been visited and 196 questionnaires collected; in Hsinchu City, 4,160 households visited and 222 questionnaires collected; in Keelung City, 3,666 households visited and 207 questionnaires collected; in Taitung County, 3,273 households visited and 162 questionnaires collected; and in Penghu County, 3,183 households visited and 157 questionnaires collected. Fewer questionnaires were collected from both Taitung and Penghu counties as more registered households in these two counties had either moved or became empty, and in some cases, they were in rather remote areas without telephones. Cases were dropped after three unsuccessful visits.

3. The survey

944 children had been located ending in 902 valid questionnaires. Of them, 62% (560 households) presented with their household registration records. In 80% of the households, either parent was present at interview. In 14% of the households, information was provided by grand-parents, and in 82% by either parent. Immunization records came in four kinds. Most had records available for verification. Of the 8 families who did not have records, some of them had the immunization either in hospitals or in other cities or counties.

4 Immunization rates

According to WHO, immunization is considered complete only when an infant

or child has accepted one dose of BCG, one dose of measles, three doses of diphtheria, tetanus and pertussis combined, and three doses of poliomyelitis vaccines. Findings of the present survey show that measles had the lowest immunization coverage rate at 88.7%-93.4% (see Table 1). The amendments of 1990 by the Department of Health require that immunization of measles is considered complete only after two doses of vaccines have been accepted. Under these criteria, the immunization rates in these cities and counties would not exceed 50% (see Table 1). In January 1991, it was amended again to one dose of measles at nine months after birth and at 15 months, MMR (mumps, measles and rubella).

The five cities and counties varied significantly in their completion rates of immunization. Penghu County had the highest of 91.3%, and Keelung City, the lowest of 79.3%.

Educational levels of either parents or caretakers were not related to immunization coverage rate. In terms of the background characteristics of either parents or caretakers, the occupation of parents, the age of father, and the age of caretaker were found not to be related to immunization coverage rates. Ages of mother though produced some difference, the difference was negligible. Either sex of children or family income was not related to immunization coverage rates.

Of those surveyed, 181 children had not completed the immunization. Either parents or caretakers of these children were asked to select from 20 likely reasons the ones that could apply (see Table 2). 162 of them said they did not take childen for immunization because children were sick at the time; some thought the immunization was already complete though in fact measles required a second dose and hepatitis B needed four vaccinations. Some mentioned being too busy or poor memory as reasons.

IV. Discussion

1. Though household registration system is relatively well established, the information needed is kept in the household registration office only, and has to be manually copied down each time. One copy of the records is kept, and when it is in use, the copying job has to be suspended. The whole process is time-consuming.

2. The number of households in a lin is not available at the household registration office. Interviewers have to check personally against the data of the Ministry of Interior. This process is time-consuming and tedious. Information as to the status of the households, either unoccupied or moved-out, is also not available.

3. Due to lack of information, some households, living together without registration or tenants, were not surveyed, and their immunization status, therefore, was not known. This could have led to higher estimate of the immunization rates in both Penghu and Taitung counties.

4. Findings of the present study are significantly higher than findings of previous surveys either by individual vaccines or by completion rates. Previous researchers recommended that persons not registered in a locality could also visit local health stations for immunization and that they should not be refused the services. This factor, therefore, did not appear any longer among reasons for failure. This practice could have improved the immunization rate.

5. Parents or caretakers were requested to produce immunization records (forms prepared by DOH, health stations or hospitals). More families (98.7%) in the present survey than the previous surveys in 15 cities and counties carried the records, and most records were the ones prepared either by DOH or health stations. That the records were kept and valued might have been related to the policy of the DOH to check the records at the time of entering schools.

6. The present study also found that most infants or children were cared either by parents or grand-parents, and only a few were cared for 24 hours by someone else, and that the status of the caretakers was not related to the immunization coverage rate. It is possible that parents often remind themselves or caretakers to have the babies immunized.

7. The immunization coverage rates vary by cities and counties, with Keelung City the lowest. Some districts of Keelung are relatively away from health stations and in poorer transportation conditions. Their sources of information may also have been limited.

8. Reasons for failure identified in the present study are similar to those of the Taipei County study in 1989: children being sick at the time (89.5%) and immunization thought to be complete (61.9%). These reasons imply that parents are ignorant of the number of doses required for immunization to be effective; and, when missed, can immunization be made up, and if so, when? Parents should also be reminded of the next appointment. They are often too busy and they sometimes forget about it. More should be done to improve their knowledge of immunization.

V. Recommendations

1. More efforts should be made to educate the public on the importance of completing immunization according to schedule.

2. Failure in immuniation is mainly due to children being sick and parent negligence. In health education, parents should be made the target.

3. Health stations should establish records of those who fail to appear for immunization on time for follow-up and to remind either parents or caretakers children.

4. Health education programs should also aim at the high risk groups (younger

or busy mothers) to remind them the importance of immunization to the health of their children.

5. The sampling method adopted in the present study is the modification of the WHO-EPI method. To avoid unnecessary wastes in time, money and manpower, computerization of household registration is recommended.

6. Some parents complained about the format and the size of the immunization card. It is hoped to prepare a booklet, instead of a card, so that it would be easier to keep records and to be checked when children are entering schools.

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Table 1. Immunization Coverage Rates in 5 Cities/Counties, 1992

	Taipei %	Hsinchu %	Keelung %	Taitung %	Penghu %
BCG	97.3	96.6	89.8	97.1	97.8
DPT 1	100.0	100.0	98.7	98.6	100.0
DPT 2	99.5	100.0	97.4	97.2	100.0
DPT 3	98.0	98.6	93.0	94.7	98.6
Polio 1	98.3	99.0	98.1	97.6	100.0
Polio 2	97.8	99.0	97.5	96.2	100.0
Polio 3	97.3	96.8	93.0	94.7	98.6
Measles 1	88.7	93.1	88.7	90.9	93.4
Comp rate (1)	85.4	90.3	79.3	86.5	91.3
Measles 2	41.1	50.0	38.9	38.2	51.5
Comp rate (2)	38.9	47.2	37.7	33.8	49.6
HBV 1	100.0	100.0	97.5	99.0	100.0
HBV 2	99.5	100.0	95.6	99.0	100.0
HBV 3	99.5	100.0	93.7	99.0	99.3
HBV 4	83.8	90.3	80.3	86.4	85.5
HBV comp rate	83.8	90.3	80.3	86.4	85.5

$p < 0.05$

Notes: comp rate (1) — completion of one BCG, three DPT, three Polio and one measles; measles 2 — completion of two doses of measles; comp rate (2) — completion of one BCG, three DPT, three polio and two measles.

Table 2. Reasons for Failure to Accept Immunization (of 181 cases not completed immunization)

Reasons	No. Persons replied	%
1. Time for immunization arranged by health station not adequate	10	6
2. Health station far away	5	3
3. No vaccine available	2	1
4. Child sick, decided not to immunize	162	89.5
5. Child sick, health station staff recommended to postpone immunization	51	28.2
6. Natural infection of measles better, immunization not wanted	2	1
7. Serious side effects with fever	13	7
8. Parents busy	33	18
9. Grandparents (caretakers) illiterate, parents forgot to remind	19	10
10. Went abroad	3	1
11. No appointment, not known when to immunize	10	6
12. Vaccine being outdated as reported by media	1	1
13. Forgotten	17	7
14. Thought immunization completed	112	61.9
15. Vaccinated but not recorded or forgotten	9	5
16. Postponed this immunization for the Japanese encephalitis immunization	15	8
17. Not known immunization required	7	4
18. Present residence far away from original places of registration, so failed to return in time for immunization	7	4
19. Off-shore island, no one around for giving immunization	3	1
20. To be immunized at teaching hospital due to child physical condition, as advised by physician	1	1