主論文の要旨

Factors associated with routine immunization coverage of children under one year old in Lao People's Democratic Republic

（ラオスにおける1歳未満児の定期予防接種率に関与する因子）

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Introduction

Routine vaccination is administered free of charge to all children under one year old in Lao People's Democratic Republic (Lao PDR) and the national goal is to achieve at least 95% coverage with all vaccines included in the national immunization program by 2025. In this study, factors related to the immunization system and characteristics of provinces and districts in Lao PDR were examined to evaluate the association with routine immunization coverage.

Methods

Coverage rates for Bacillus Calmette-Guerin (BCG), Diphtheria-Tetanus-Pertussis-Hepatitis B (DTP-HepB), DTP-HepB-Hib (*Haemophilus influenzae* type B), polio (OPV), and measles (MCV1) vaccines from 2002 to 2014 collected through regular reporting system, were used to identify the immunization coverage trends in Lao PDR. Correlation analysis was performed using immunization coverage, characteristics of provinces or districts (population, population density, and proportion of poor villages and high-risk villages), and factors related to immunization service (including the proportions of the following: villages served by health facility levels, vaccine session types, and presence of well-functioning cold chain equipment). To determine factors associated with low coverage, provinces were categorized based on 80% of DTP-HepB-Hib3 coverage (< 80% = low group; ≥ 80% = high group).

Results

1. The trend in the immunization coverage from 2002 to 2014

Table 1 shows the immunization schedule in Lao PDR. Figure 1 showed that coverage of BCG, DTP-HepB3 (DTP-HepB-Hib3), OPV3, and MCV1 vaccinations increased gradually from 2007 to a final peak of 82.2-88.3% in 2014. Among all vaccines, BCG coverage was the highest until 2008, however, by 2014, it had become the lowest. The coverage of each vaccination increased from 2002 to 2014 in most provinces (Table 3). Only Vientiane Capital showed coverage greater than 95% in all vaccinations in 2014, with BCG coverage reaching 100%. Dropout rates of DTP-HepB-Hib in provinces ranged from 0.2% to 12.7%.

2. Characteristics of provinces

The demographic characteristics of each province are shown in Table 3. Population density for children < 1-year old ranged from 0.29 (Phongsaly) to 3.10/km^2 (Vientiane Capital). The proportion of poor districts and poor villages nationwide were 20.3% and 23.1%, respectively. The characteristics related to vaccine service in each province are shown in Table 4. Most villages in all provinces were covered by health centers. The major nationwide vaccine-providing session types were outreach (40.2%) and overnight (32.1%).

The proportion of well-functioning equipment was 71.6-98.9%.

3. Correlation analysis between immunization coverage and characteristics of provinces and districts

Correlation analysis using the characteristics of provinces showed that the coverage of each vaccine was correlated with that of others (Table 5). Dropout rate was negatively correlated with the coverage of all vaccines significantly, except BCG. BCG coverage was correlated with population density of all ages and < 1-year old. Correlation analysis between immunization coverage and district characteristics showed that coverage of each vaccine in districts was correlated with the province to which the district belonged (Table 5). Coverages of all vaccines in districts were correlated with each other and the dropout rate was significantly correlated with the coverage of DTP-HepB-Hib3 and OPV3. However, there was no correlation between immunization coverage and session type or the presence of well-functioning cold chain equipment in provinces and districts.

4. Comparing two groups of provinces categorized by DTP-HepB-Hib3 coverage

We made two groups of provinces based on DTP-HepB-Hib3 coverage: lower than 80% or not (provinces with DTP-HepB-Hib3 coverage < 80% (low group) and ≥ 80% (high group)). Phongsaly, Xiengkhuang, Sekong and Saysomboune Provinces were in the low group. We compared provincial characteristics in the two groups (Table 6). The low group had lower population density of all ages and < 1-year, higher proportion of high-risk villages and more overnight than the high group. However, these differences were not significant. The proportion of poor villages was significantly higher in the low group compared with the high group (39.6% vs 19.4%, P=0.049).

Discussion

BCG coverage showed poorest improvement and the BCG coverage was also the lowest among the four vaccines in 2014. One of the reasons for the low BCG coverage might be due to the use of one vial of BCG that contains 20 doses; therefore, fixed sites provide service less often to prevent BCG vaccine wastage. Another reason might be due to the low rate of skilled birth attendance (SBA) and institutional delivery rate (IDR). Previous studies showed that HepB birth dose coverage was correlated with IDR and SBA rates, and that the lack of advice on vaccination at birth was an independent risk factor of non-vaccination status in Lao PDR. These suggest that the low SBA and IDR might have affected the low BCG coverage.

We also showed that the coverage of each vaccine correlated with others including the dropout rates in provinces and districts. These results are consistent with the results from the global data analysis indicating that OPV3 and MCV1 coverage showed similar trends

as DTP3 coverage. Therefore, BCG vaccine seems the most important target to improve routine immunization coverage since it is scheduled to be given at birth.

Further, the proportions of poor villages were significantly higher in provinces with DTP-HepB-Hib3 coverage < 80% (low group) compared with those ≥ 80% (high group). Nationwide, the two major reasons for the low coverage in poor villages were road accessibility (51.5%) and the presence of poor family (26.7%). Although routine immunization is provided free of charge, the travelling cost and the loss of one day of work are financial barriers for poor families. There might be other factors related to the poor, such as, low levels of education and the level of the knowledge of parents, which might affect people's attitudes toward health and health behavior.

Lao PDR has a high rate of tuberculosis (TB), and BCG vaccination is important as a standard TB control method in Lao PDR and a vial of one dose of BCG will be one of the solutions to low coverage. The use of mobile phones was reported to be effective in increasing of coverage of HepB birth dose and this reporting system may be effective in providing BCG vaccine at birth to more babies who are born at home.

There are some limitations to this study. First, we used a limited number of factors to determine the association with immunization coverage. The characteristics of ethnic groups are reported as associated factors of immunization coverage. However, it is difficult to analyze ethnic groups as characteristics of provinces or districts. Secondly, this study did not reveal which of the five categories (income, access to school, healthcare facility and clean water, and road accessibility) of poor villages was the most important factor for immunization coverage. Thirdly, this study used the administrative data, which, as suggested, were overestimated by 10-20% compared to the survey data. However, no systematic survey has been conducted and the administrative data could be used to determine the trend in vaccine coverage.

Conclusion

Routine immunization coverage has been improving in the last 13 years, but the national goal is not yet reached in Lao PDR. The results of this study suggest that BCG coverage and poor villages should be targeted to improve nationwide coverage.