PREVALENCE OF COMPLETE CHILDHOOD IMMUNIZATION AND ITS ASSOCIATED FACTORS AMONG UNDER-FIVE CHILDREN OF MILITARY PARENTS IN MILITARY CAMP, MALACCA

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ABSTRACT

Background: Immunization is one of the most important and cost effective public health interventions in preventing fatal infectious diseases among children worldwide. The prevalence of childhood immunization in the armed forces is lacking, not producible and not published in many international journals. The objective of this study was to determine the prevalence of childhood immunization under 5 years of age and its associated factors among military parents in Malacca.

Materials and Methods: A cross sectional study was carried out among 276 military parents at a military camp in Malacca. Sampling was conducted using systematic random sampling from those who had fulfilled the criteria. A pre tested self-administered questionnaire was used to collect data on socio demographic factors, family factors, parents’ knowledge on immunization, parents’ perceptions towards health care providers and influences of external factors. Data was analyzed using SPSS version 21.

Result: A total of 276 respondents were recruited for this study with a response rate of 86.3%. The mean age of the respondents was 30.2 ± 4.6 years old. Majority of the respondents were female (97.1%), Malay (70.3%) and lived outside the military camp (94.2%). The median age for the children in the study was 24 months (IQR: 25). The prevalence of childhood immunization was 91.7% for complete immunization for age status. There was significant association between complete childhood immunization and parents’ knowledge and support from the spouse. The predictor for complete childhood immunization was high score of parents’ knowledge on childhood immunization (AOR= 16.63; 95% CI: 5.08, 54.45; P< 0.001).

Conclusion: The prevalence of complete childhood immunization was high among parents in the Armed Forces. This study provides insights for future research, mainly on the influences of external factors and health care providers.

Keywords: prevalence, childhood immunization, armed forces
1.0 Introduction

Immunization is one of the most important and cost effective public health interventions in preventing fatal infectious diseases in children worldwide. The World Health Organization Expanded Programme on Immunization (EPI) was launched in 1974 to reduce morbidity and mortality in six targeted infectious diseases. This programme recommends immunization against diphtheria, pertussis, tetanus, tuberculosis, poliomyelitis and measles and aims on 85% immunization coverage. It was estimated that 2 to 3 million deaths every year was successfully prevented through global immunization programme (World Health Organization, 2013). For instance, through measles immunization, global measles mortality had shown almost 74% reduction from an estimated 535,300 deaths in 2000 to 139,300 in 2010 (World Health Organization, 2014).

The coverage of childhood immunization in Malaysia has achieved way beyond the WHO target of 90% nationally (UNICEF, 2011). In 2012, Malaysia’s immunization coverage was 97% for DTP, polio, Hepatitis B and Hib immunization (UNICEF, 2014). Among the Western Pacific countries, Malaysia is one of the countries which achieved above 95% immunization coverage in 2012 (Malaysia National Health Fact, 2013).

Malaysian Armed Forces (MAF) is known for its unique infrastructure in which the organization itself contains multidisciplinary departments such as education, health, religious, law enforcement and others. Malaysian Armed Forces Health Services (MAFHS) was established to provide health services to all military personnel and their family. The MAFHS is tri-service serving the Army, Navy and Air Force. The primary role of Health Services Support (HSS) is the conservation of the fighting strength of the MAF both in peacetime and in war. It consisted of medical and dental branches, field health services support, field clinical and health services and health services logistic support system (Army Manual, 2003).

Health care coverage for military dependents is available through the maternal and child health clinics in the camp and government health centres. Well-child and immunization services are provided free for military families if obtained from a military clinic or government health clinic, but involves out-of-pocket expense if obtained elsewhere (CPG, 2004). This study was carried out to determine the prevalence of childhood immunization under 5 years of age and its associated factors among military parents in Malacca, namely socio-demographic characteristics, family characteristics, parents’ level of knowledge on immunization, parents’ perception on health care services and external factors.

2.0 Materials and Methods

2.1 Study Design and Study Population

This study was a cross sectional study conducted among parents of children aged five years and below in a military camp, Malacca from February to August 2015. The camp was considered to be the main military territory located 20 km to the North of the state capital of Malacca. The inclusion criteria were either the father or mother was a regular military
personnel, working in the military camp in Malacca, resides in Malacca and the youngest child is aged five years and below during the study period. Based on Lemeshow, Hosmer, Klar, and Lwanga, (1990), the sample size was 350 after adjusting for 10% non-response. The list of names of the military parents were obtained from military headquarters in Malacca.

2.2 Data Collection and Study Instrument

A pre-tested questionnaire was used as the instrument for the study. A pilot study was carried out for face validity, constructive validity and internal consistency of the questionnaire. The questionnaire comprised of five sections: Part I consists of socio-demographic data of the parents; Part II was information about the family characteristics; Part III addressed parents’ level of knowledge on immunization (16 items); Part IV was on parents’ perception of health care services (16 items); and Part V was on influences of external factors on immunization (12 items) which consisted of support from spouse (4 items), logistic influences (4 items), and support from military organization (4 items). Part I and II consisted of open and closed ended questions. Part III comprised of questions with ‘Yes/I don’t know/No’ answers. A Likert scale was used for Part IV and V with response options ranging from 1 (strongly disagree) to 5 (strongly agree). The children’s follow-up booklet was used to record their immunization schedule to avoid recall bias.

The results of the reliability test of the questionnaire on 36 military parents in Kuala Lumpur showed that the internal consistency was acceptable with Cronbach’s alpha of 0.75. The questionnaire was translated from English to Malay and was back translated. The Malay version was used for the respondents’ better understanding.

2.3 Data Analysis

The collected data were analyzed by using IBM Statistical Package of Social Sciences (SPSS) version 21. Descriptive analysis such as frequency, percentage, median, and interquartile range, were used to summarize and explain characteristics of independent and dependent variables. Also, inferential analysis (chi square test and simple logistic regression) were used to determine the relationship between categorical independent and dependent variables and multiple logistic regressions was used to determine the predictors for Complete Childhood Immunization. The significant level was taken as P<0.05.

3.0 Result

3.1 Response rate

The total number of respondents that was managed to be approached was 320 respondents. However, only 276 respondents consented to be involved in the study conducted. The overall response rate for this study was 86.25%. The nonresponses were mainly due to reluctance in participating when spouse was not around (22.7%) and absence of both parents (77.3%) during the conduct of the study.
3.2 Prevalence of Childhood Immunization

The prevalence of childhood immunization in the military camp in Malacca was 91.7% for complete immunization for age, 2.9% complete but delayed immunization and 5.8% incomplete immunization for age. Most of the reasons for incomplete and delayed immunization were children having fever (45.8%) on the visit for the immunization and spouse was not around (45.8%) to take the children for immunization. About one case gave reason of no vaccine available (4.2%) and another missed the immunization due to holiday (4.2%). From the 24 respondents who had delayed or incomplete immunization, about 45.8% missed DTaP/IPV/Hib booster, followed by MMR (16.7%), DTaP/IPV/Hib 3rd dose (16.7%), Hepatitis B 3rd dose (8.3%), DTaP/IPV/Hib 2nd dose (8.3%), and 4.2% missed both, DTaP/IPV/Hib 2nd dose and Hep B 3rd dose.

3.3 Characteristics of the respondents

3.3.1 Socio-demographic characteristics

Table 1: Distribution of respondents by socio-demographic characteristics, (N=276)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Father</td>
<td>8</td>
<td>2.9</td>
</tr>
<tr>
<td>Mother</td>
<td>268</td>
<td>97.1</td>
</tr>
<tr>
<td>Place of living</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the military camp</td>
<td>16</td>
<td>5.8</td>
</tr>
<tr>
<td>Outside the military camp</td>
<td>260</td>
<td>94.2</td>
</tr>
<tr>
<td>Fathers’ characteristic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 25 years old</td>
<td>19</td>
<td>6.9</td>
</tr>
<tr>
<td>26 – 35 years old</td>
<td>202</td>
<td>73.2</td>
</tr>
<tr>
<td>36 – 45 years old</td>
<td>53</td>
<td>19.2</td>
</tr>
<tr>
<td>&gt; 46 years old</td>
<td>2</td>
<td>0.7</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malay</td>
<td>194</td>
<td>70.3</td>
</tr>
<tr>
<td>Indian</td>
<td>2</td>
<td>0.7</td>
</tr>
<tr>
<td>Others</td>
<td>80</td>
<td>29.0</td>
</tr>
<tr>
<td>Religion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Islam</td>
<td>208</td>
<td>75.4</td>
</tr>
<tr>
<td>Hindu</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Christian</td>
<td>67</td>
<td>24.3</td>
</tr>
<tr>
<td>Educational level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary education</td>
<td>267</td>
<td>96.7</td>
</tr>
<tr>
<td>Tertiary education</td>
<td>9</td>
<td>3.3</td>
</tr>
<tr>
<td>Type of occupation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Army</td>
<td>272</td>
<td>98.6</td>
</tr>
<tr>
<td>Non-army</td>
<td>4</td>
<td>1.4</td>
</tr>
<tr>
<td>Position in army (n = 272)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Officer</td>
<td>4</td>
<td>1.5</td>
</tr>
<tr>
<td>Other ranks</td>
<td>268</td>
<td>98.5</td>
</tr>
</tbody>
</table>
Table 1 shows the distribution of the respondents by socio-demographic characteristics. The mean age of the respondents was 30.22 ± 4.586 years old. The respondents’ age was between 19 to 46 years old and majority of them were in the age group between 26 to 35 years old (73.2%). Majority of the respondents were mothers (97.1%). The median age for father was 32.00 (IQR: 6) while the mean age for mother was 30.17 ± 4.57 years. For ethnicity, the majority of the respondents were Malays (71.0%). A large proportion of the respondents were non-army, constituting 88.8% of the total respondents. Majority of the respondents has achieved secondary level education (87.7%), have a household income of less than RM 5000.00 per month (91.7%) and lived outside the military camp (94.2%).

3.3.2 Family Characteristics

Table 2: Distribution of respondents by family characteristics, (N=276)
<table>
<thead>
<tr>
<th>Family characteristics</th>
<th>Frequency (f)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 and above</td>
<td>111</td>
<td>40.2</td>
</tr>
<tr>
<td><strong>Age of the youngest child</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 2 years old</td>
<td>165</td>
<td>59.8</td>
</tr>
<tr>
<td>&gt; 2 years old</td>
<td>111</td>
<td>40.2</td>
</tr>
<tr>
<td><strong>Child’s place of birth</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital</td>
<td>272</td>
<td>98.6</td>
</tr>
<tr>
<td>Clinic</td>
<td>3</td>
<td>1.1</td>
</tr>
<tr>
<td>House</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Youngest child with health problem</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>16</td>
<td>5.8</td>
</tr>
<tr>
<td>No</td>
<td>260</td>
<td>94.2</td>
</tr>
<tr>
<td><strong>Presence of immunization booklet at the time of interview</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>271</td>
<td>98.2</td>
</tr>
<tr>
<td>No</td>
<td>5</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Table 2 depicts the distribution of respondents by family characteristics. More than half of the mothers had their youngest child at the age of 26 to 35 years old (65.2%). The mean age of mother at the time of the child’s delivery was 27.97 ± 4.47 years old. About 40.2% of the respondents had more than 3 children and 98.6% of the mothers delivered at the hospital. Majority of the youngest child were two years old or less (49.3%). The median age for the children was 24 months (IQR: 25). About 16 (5.8%) of the total children had health problems at the time the study was conducted. Majority of the respondents (98.2%) showed presence of the immunization booklet at the time of the interview.

### 3.3.3 Parents’ Knowledge on Childhood Immunization

Table 3: Items measuring the parents’ knowledge on childhood immunization.

<table>
<thead>
<tr>
<th>Item</th>
<th>N (%) correct responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Immunization prevent infectious diseases</td>
<td>265 (96.0)</td>
</tr>
<tr>
<td>2  Immunization is for all ages</td>
<td>151 (54.7)</td>
</tr>
<tr>
<td>3  There are various type of childhood immunization</td>
<td>242 (87.7)</td>
</tr>
<tr>
<td>4  Immunization is beneficial for children under the age of 2</td>
<td>214 (77.5)</td>
</tr>
<tr>
<td>5  Immunization can’t be given to children with health problems</td>
<td>71 (26.1)</td>
</tr>
<tr>
<td>6  There are several type of childhood immunization can’t be given to children with certain health problems</td>
<td>164 (59.4)</td>
</tr>
<tr>
<td>7  Childhood immunization is safe</td>
<td>254 (92.0)</td>
</tr>
<tr>
<td>8  Childhood immunization is important</td>
<td>266 (96.4)</td>
</tr>
<tr>
<td>9  Immunization is given as soon as your child is born</td>
<td>257 (93.1)</td>
</tr>
<tr>
<td>10 Immunization stopped at the age of 2 years old</td>
<td>77 (27.9)</td>
</tr>
<tr>
<td>11 Childhood immunization is not important in disease prevention</td>
<td>180 (65.2)</td>
</tr>
<tr>
<td>12 Immunization is halal</td>
<td>207 (75.0)</td>
</tr>
</tbody>
</table>
Table 3 depicts the parents’ knowledge on the childhood immunization. More than 90% of the respondents answered correctly for statements on immunization prevents infectious diseases (96%), immunization is important (96%), immunization is safe (92%) and that immunization is given as soon as a child is born (93.1%). Whereas, less than 30% of the respondents answered correctly for statements on immunization can’t be given to children with health problems (26.1%), and immunization stopped at the age of 2 years old (27.9%). Majority of the respondents (88.4%) obtained a high score of 50% or more for knowledge on childhood immunization.

3.4 External factors

From the study conducted, it was found that only 31.5% of the parents were able to carry out the responsibility of taking the child for immunization when they spouse were not around and considered long distance of travelling was not a barrier for the immunization (79.3%). Fifty seven percent of the respondents also reported that the absence of their spouses was not a hindrance to bring their children for immunization.

3.5 Associated Factors

3.4.1 Association between socio-demographic factors and status of childhood immunization

Table 4: Association between socio-demographic factors and childhood immunization (N=276)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Complete Immunization n(%)</th>
<th>Incomplete Immunization n(%)</th>
<th>Test Statistics</th>
<th>df</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malay</td>
<td>184 (94.8)</td>
<td>10 (5.2)</td>
<td>0.494&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1</td>
<td>0.574</td>
</tr>
<tr>
<td>Non Malay</td>
<td>76 (92.7)</td>
<td>6 (7.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education level Father</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary education</td>
<td>251 (94.0)</td>
<td>16 (6.0)</td>
<td>0.573&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1</td>
<td>1.000</td>
</tr>
<tr>
<td>Tertiary education</td>
<td>9 (100)</td>
<td>0 (0.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable</td>
<td>Complete Immunization n(%)</td>
<td>Incomplete Immunization n(%)</td>
<td>Test Statistics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------------------</td>
<td>-----------------------------</td>
<td>-----------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>( \chi^2 ) / Fisher’s Exact</td>
<td>df</td>
<td>P value</td>
</tr>
<tr>
<td><strong>Mother</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary education</td>
<td>227 (93.8)</td>
<td>15 (6.2)</td>
<td>0.579(^a)</td>
<td>1</td>
<td>0.702</td>
</tr>
<tr>
<td>Tertiary education</td>
<td>33 (97.1)</td>
<td>1 (2.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Place of living</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the camp</td>
<td>14 (87.5)</td>
<td>2 (12.5)</td>
<td>1.397(^a)</td>
<td>1</td>
<td>0.235</td>
</tr>
<tr>
<td>Outside the camp</td>
<td>246 (94.6)</td>
<td>14 (5.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Type of occupation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Father</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Army</td>
<td>256 (94.1)</td>
<td>16 (5.9)</td>
<td>0.250(^a)</td>
<td>1</td>
<td>1.000</td>
</tr>
<tr>
<td>Non-Army</td>
<td>4 (100)</td>
<td>0 (0.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Army</td>
<td>22 (95.7)</td>
<td>1 (4.3)</td>
<td>0.097(^a)</td>
<td>1</td>
<td>1.000</td>
</tr>
<tr>
<td>Non-Army</td>
<td>238 (94.1)</td>
<td>15 (5.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Household income</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; RM 5000.00</td>
<td>232 (94.3)</td>
<td>14 (5.7)</td>
<td>0.047(^a)</td>
<td>1</td>
<td>0.688</td>
</tr>
<tr>
<td>≥ RM 5000.00</td>
<td>28 (93.3)</td>
<td>2 (6.7)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: \( \chi^2 \) test, level of significant, P<0.05, \(^a\)= Fisher’s Exact Test

Table 4 shows the association between the socio-demographic factors and the status of childhood immunization. There was no significant association observed between all the factors and childhood immunization (P >0.05).

### 3.4.2 Association between family characteristics and childhood immunization

**Table 5:** Association between family characteristics and status of childhood immunization (N=276)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Complete Immunization n(%)</th>
<th>Incomplete Immunization n(%)</th>
<th>Test Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>( \chi^2 ) / Fisher’s Exact</td>
</tr>
<tr>
<td><strong>Age mother at the time of the child’s delivery</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \leq 28 ) years old</td>
<td>140 (92.7)</td>
<td>11 (7.3)</td>
<td>1.351</td>
</tr>
<tr>
<td>&gt; 28 years old</td>
<td>120 (96.0)</td>
<td>5 (4.0)</td>
<td></td>
</tr>
<tr>
<td><strong>Place of birth</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital</td>
<td>256 (94.1)</td>
<td>16 (5.9)</td>
<td>0.250(^a)</td>
</tr>
<tr>
<td>Others</td>
<td>4 (100)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td><strong>Number of children</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \leq 2 ) children</td>
<td>155 (93.9)</td>
<td>10 (6.1)</td>
<td>0.052</td>
</tr>
<tr>
<td>&gt; 2 children</td>
<td>105 (94.6)</td>
<td>6 (5.4)</td>
<td></td>
</tr>
<tr>
<td><strong>Child’s medical problem</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Table 5 depicts the association between the family characteristics and the status of childhood immunization. There was no significant association observed between family characteristics and childhood immunization (P >0.05).

### 3.4.3 Association between parents’ knowledge and childhood immunization

Table 6: Association between parents’ knowledge and status of childhood immunization

<table>
<thead>
<tr>
<th>Variable</th>
<th>Complete Immunization n(%)</th>
<th>Incomplete Immunization n(%)</th>
<th>Test Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parents’ Knowledge</td>
<td></td>
<td></td>
<td>$\chi^2$ Fisher’s Exact</td>
</tr>
<tr>
<td>(n=276)</td>
<td></td>
<td></td>
<td>$df$ P value</td>
</tr>
<tr>
<td>Low score</td>
<td>22 (68.8)</td>
<td>10 (31.2)</td>
<td>42.941</td>
</tr>
<tr>
<td>High score</td>
<td>238 (97.5)</td>
<td>6 (2.5)</td>
<td></td>
</tr>
</tbody>
</table>

Note: $\chi^2$ test, level of significant, P<0.05

Table 6 shows that there was a significant association between status of childhood immunization and parents’ knowledge level ($\chi^2=42.941; df=1; P=0.001$). Majority of respondents with higher score (97.5%) had completed their children’s immunization for age.

### 3.4.4 Association between parents’ perception towards health care services and status of childhood immunization

Table 7: Association between parents’ perception towards health care services and status of childhood immunization

<table>
<thead>
<tr>
<th>Variable</th>
<th>Complete Immunization n(%)</th>
<th>Incomplete Immunization n(%)</th>
<th>Test Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choose military health centre for immunization</td>
<td></td>
<td></td>
<td>$\chi^2$ Fisher’s Exact</td>
</tr>
<tr>
<td>Agree</td>
<td>150 (93.2)</td>
<td>11 (6.8)</td>
<td>0.758</td>
</tr>
<tr>
<td>Not agree</td>
<td>110 (95.7)</td>
<td>5 (4.3)</td>
<td></td>
</tr>
<tr>
<td>Always choose military health centre for immunization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agree</td>
<td>139 (95.2)</td>
<td>7 (4.8)</td>
<td>0.571</td>
</tr>
<tr>
<td>Not agree</td>
<td>121 (93.1)</td>
<td>9 (6.9)</td>
<td></td>
</tr>
<tr>
<td>Variable</td>
<td>Complete Immunization n(%)</td>
<td>Incomplete Immunization n(%)</td>
<td>Test Statistics</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------</td>
<td>-----------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Choose a health centre near my house for immunization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agree</td>
<td>217 (93.9)</td>
<td>14 (6.1)</td>
<td>0.180(^a)</td>
</tr>
<tr>
<td>Not agree</td>
<td>43 (95.6)</td>
<td>2 (4.4)</td>
<td></td>
</tr>
<tr>
<td>Always choose a health centre near my house for immunization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agree</td>
<td>214 (94.3)</td>
<td>13 (5.7)</td>
<td>0.012(^a)</td>
</tr>
<tr>
<td>Not agree</td>
<td>46 (93.9)</td>
<td>3 (6.1)</td>
<td></td>
</tr>
<tr>
<td>Choosing a military health centre even though it’s far from home</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agree</td>
<td>107 (96.4)</td>
<td>4 (3.6)</td>
<td>1.636</td>
</tr>
<tr>
<td>Not agree</td>
<td>153 (92.7)</td>
<td>12 (7.3)</td>
<td></td>
</tr>
<tr>
<td>Long waiting time at the military health centre for immunization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agree</td>
<td>97 (94.2)</td>
<td>6 (5.8)</td>
<td>0.000</td>
</tr>
<tr>
<td>Not agree</td>
<td>163 (94.2)</td>
<td>10 (5.8)</td>
<td></td>
</tr>
<tr>
<td>Long waiting time make it difficult for my family</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agree</td>
<td>121 (94.5)</td>
<td>7 (5.5)</td>
<td>0.047</td>
</tr>
<tr>
<td>Not agree</td>
<td>139 (93.9)</td>
<td>9 (6.1)</td>
<td></td>
</tr>
<tr>
<td>Pay at the nearest government health centre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agree</td>
<td>36 (92.3)</td>
<td>3 (7.7)</td>
<td>0.299(^a)</td>
</tr>
<tr>
<td>Not agree</td>
<td>224 (94.5)</td>
<td>13 (5.5)</td>
<td></td>
</tr>
<tr>
<td>Affordability to pay</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agree</td>
<td>108 (95.6)</td>
<td>5 (4.4)</td>
<td>0.660</td>
</tr>
<tr>
<td>Not agree</td>
<td>152 (93.3)</td>
<td>11 (6.7)</td>
<td></td>
</tr>
<tr>
<td>Waiting time on Immunization appointment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 60 minutes</td>
<td>117 (94.4)</td>
<td>7 (5.6)</td>
<td>0.01</td>
</tr>
<tr>
<td>( \geq ) 60 minutes</td>
<td>143 (94.1)</td>
<td>9 (5.9)</td>
<td></td>
</tr>
<tr>
<td>Duration considered as a long waiting time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 60 minutes</td>
<td>42 (2.3)</td>
<td>1 (97.7)</td>
<td>1.124(^a)</td>
</tr>
<tr>
<td>( \geq ) 60 minutes</td>
<td>218 (93.6)</td>
<td>15 (6.4)</td>
<td></td>
</tr>
</tbody>
</table>

Note: \( \chi^2 \) test, level of significant, \( P<0.05 \), \( a= \) Fisher’s Exact Test

Table 7 shows that there was a higher prevalence of complete childhood immunization among respondents who always chose military health centre, and chose it even though it’s far from the house. However, this association was not statistically significant (\( P>0.05 \)). Respondents with complete immunization were also seen higher in agreement of affordability to pay for the immunization but it was also not statistically significant (\( P>0.05 \)). Overall, there was no
significant association between the perception of parents towards health care services and the status of childhood immunization.

### 3.4.5 Association between influence of the external factors and status of childhood immunization

Table 8: Association between influence of external factors and status of childhood immunization

<table>
<thead>
<tr>
<th>Variable</th>
<th>Crude Odds Ratio</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lower</td>
<td>Upper</td>
</tr>
<tr>
<td>Support from spouse*</td>
<td>1.202</td>
<td>1.017</td>
<td>1.420</td>
</tr>
<tr>
<td>Transportation problems*</td>
<td>1.134</td>
<td>0.931</td>
<td>1.381</td>
</tr>
<tr>
<td>Support from external factors*</td>
<td>0.958</td>
<td>0.828</td>
<td>1.108</td>
</tr>
</tbody>
</table>

Note: * Significant at P<0.05

Variables were used in the model as continuous variables

Table 9: Association between duration of travelling to military health care provider and government health care provider, and childhood immunization

<table>
<thead>
<tr>
<th>Variable</th>
<th>Complete Immunization</th>
<th>Incomplete Immunization</th>
<th>Test Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n(%)</td>
<td>n(%)</td>
<td>χ²/Fisher’s Exact</td>
</tr>
<tr>
<td>Duration from house to military health centre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 15 minutes</td>
<td>158 (92.4)</td>
<td>13 (7.6)</td>
<td>2.682</td>
</tr>
<tr>
<td>&gt; 15 minutes</td>
<td>102 (97.1)</td>
<td>3 (2.9)</td>
<td></td>
</tr>
<tr>
<td>Duration from house to government health centre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 15 minutes</td>
<td>250 (94.0)</td>
<td>16 (6.0)</td>
<td>0.639*</td>
</tr>
<tr>
<td>&gt; 15 minutes</td>
<td>10 (100.0)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
</tbody>
</table>

Note: χ² test, level of significant, P<0.05, a= Fisher’s Exact Test

Table 8 provides the association between the influences of external factors, which are support from spouse, support from others, and transportation and costs of travelling. Simple logistic regression was used to determine the association with childhood immunization status. Support from spouse was found to be statistically significant (COR=1.202, 95%CI: 1.017-1.420). Table 9 shows no significant association between the duration of travelling with the status of childhood immunization.
3.6 Predictor Variables of Complete Childhood Immunization

Table 10: Logistic regression model of the predictors of having complete childhood immunization

<table>
<thead>
<tr>
<th>Variable</th>
<th>B-coefficient</th>
<th>SE</th>
<th>Adjusted Odds Ratio</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Place of living</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the camp</td>
<td>0.767</td>
<td>1.010</td>
<td>2.153</td>
<td>0.298</td>
<td>15.582</td>
</tr>
<tr>
<td>Outside the camp</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Age of mother at the time of the child’s delivery</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 28 yrs old</td>
<td>-2.95</td>
<td>0.644</td>
<td>0.745</td>
<td>0.211</td>
<td>2.631</td>
</tr>
<tr>
<td>&gt; 28 yrs old</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Parents’ Knowledge</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low score</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High score</td>
<td>2.811</td>
<td>0.605</td>
<td>16.626</td>
<td>5.076</td>
<td>54.454</td>
</tr>
<tr>
<td><strong>Choosing a military health centre even though it’s far from home</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agree</td>
<td>1.001</td>
<td>0.704</td>
<td>2.722</td>
<td>0.684</td>
<td>10.829</td>
</tr>
<tr>
<td>Disagree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Support from spouse</strong></td>
<td>0.176</td>
<td>0.111</td>
<td>1.192</td>
<td>0.959</td>
<td>1.483</td>
</tr>
<tr>
<td><strong>Transportation</strong></td>
<td>0.138</td>
<td>0.127</td>
<td>1.148</td>
<td>0.895</td>
<td>1.472</td>
</tr>
<tr>
<td><strong>Duration from house to military health centre</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 15 minutes</td>
<td>-1.141</td>
<td>0.744</td>
<td>0.320</td>
<td>0.074</td>
<td>1.373</td>
</tr>
<tr>
<td>&gt; 15 minutes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: * Significant at P< 0.05
# Variables were used in the model as continuous variables
I Reference

Table 10 shows multivariate analysis, logistic regression, to determine the predictors of having complete childhood immunization. All independent variables were analyzed using the ‘Forward LR’ and ‘Backward LR’ methods. Both methods produced one variable that was significantly associated with having complete childhood immunization. The variable was parents’ knowledge on childhood immunization (OR=16.626, 95% CI: 5.076-54.454). The logistic regression model was statistically significant and fits the sample as shown by Hosmer and Lemeshow good of fit test ($\chi^2 = 9.657, df=8, P=0.290$). The Negelkerke R2 showed that about 33% of the variation of complete childhood immunization was explained by the predictor variables entered into the regression model.

The final predictive model derived from this logistic regression analysis is as below:
Log (Probability of having complete childhood immunization) = 3.241 + 2.811 (parents’ knowledge score).
4.0 Discussion

In this study, the prevalence of complete childhood immunization for age was 91.7%. This prevalence is similar to the immunization coverage reported by WHO (2013) which stated that Malaysia has achieved 90-95% immunization coverage. This reflects that the coverage for under-five childhood immunization in the Armed Forces is as good as other health care providers under the Ministry of Health of Malaysia. Reasons for delayed and missed immunization were attributed to child, family and health care provider factors.

There were three main variables which were not significant: sociodemographic, family and parents’ perception on health care. This could be because most of the characteristics related to the children who had complete immunization for age reflected the general characteristics of the respondents. For instance majority of those with children who had complete immunization for age were of secondary educational level, income of less than RM5000 and place of birth was hospital. The homogeneity of the occupation of either the respondents or their spouses, i.e. being a military officer, probably explains the insignificant findings of this study. In addition, the general population in the military camp in Malacca consisted mainly of mothers in the reproductive age group. Hence, maternal factors were not a significant contributor to childhood immunization. The Armed Forces, just as the facilities provided by the Ministry of Health Malaysia, also provide tertiary birth centres within or close to military camps and residential areas. This is very convenient for the military couples particularly when the spouses are not around (Armed Forces Medical Administration and Technical Instruction, 2011).

Distance of health care centres was not a significant factor for complete immunization for age. Availability of the military health centre or nearest health centre around two to five km from their houses and free access to the immunization benefited the parents and outweighed the risks of defaulting immunization. For those who are living outside the camp, the distance of the house is not far to the nearest health centre which was around 2 km and the distance of the house to the military health centre which was around 5 km were considered as another factor influencing the childhood immunization among the military parents. This convenience of distance between residence and health facility and also free immunization services might also be the possible explanation for the insignificant association between parents’ perception on health care services and immunization status.

Other plausible explanation for the insignificant results in this study is that it is the national policy that childhood immunization is provided free by government health care facilities to all Malaysian children and without any socioeconomic disparities allowing all children from different background to receive the immunization according to the National Immunization Schedule. Hence, cost and waiting time were not significant associations of complete immunization.

These findings was in contrast with previous studies which showed significant associations for socio-demographic variables. For instance, for place of living, a study conducted previously which reflected that rural children were 1.8 times higher risk of incomplete immunization compared to those from the urban area (OR=1.8, 95% CI 1.52-2.14) (Bugvi et al., 2014). Urban area normally associated with good health care system, better transportation system and high knowledge in immunization acceptance. Education level was found to be significantly associated with uptake of childhood immunization (P<0.001) (Al-lela et al.,...
Fernandez (2011) showed significant association between immunization and income in Indonesia (P<0.001). In Pakistan; types of employment played a role in determining the immunization uptake of the childhood immunization (P=0.001) (Bugvi et al., 2014). As for choice of health care for immunization, a study by Morrow et al., (1998) found that majority of the population chose private centres (34%) as the preferred place for the childhood immunization due to the short waiting time.

In the study conducted, there was a significant relationship between childhood immunization and parents’ knowledge (P<0.001). Higher score of knowledge was associated with higher prevalence of complete immunization. The finding is consistent with a study by Nadia et al., (2014) which found that knowledge was significantly associated with childhood immunization (P<0.001). Significant association (P<0.0005) was also found in a research done in United Arab Emirates by Bernsen et al., (2011). In a study by Maekawa et al., (2007), the odds of having complete childhood immunization among parents with good knowledge was three times higher than those with poor knowledge (OR=3.35, 95% CI 1.46-7.69). It is well known that knowledge increases with education, whereby parents who are well educated are normally more knowledgeable in childhood immunization and infectious diseases. Increase literacy at the community level, in addition to the access to higher education is seen as effective factors for children’s complete immunization status (Maekawa et al., 2007). Nonetheless, reasons for delayed and incomplete immunization in the current study were absence of the spouse and presence of minor child illnesses rather than ignorance about childhood immunization.

For the influence of external factors, the study looked into support from spouse, support from others, transportation and costs of travelling. This was much later explained by the simple logistic regression done showed support from spouse played an important role in ensuring complete childhood immunization (OR=1.202, 95% CI 1.017-1.42). The result of this study was consistent with previous qualitative study in Hawaii where lack of support and motivation for the mothers especially from the spouses played a role in delayed immunization, (Niederhauser & Markowitz, 2007).

Other external factors showed no significant association with complete childhood immunization. Nevertheless, the armed forces administration and BAKAT provide assistance to couples and families when needed to ease access to health care. Furthermore, since the military population settlements are more dispersed nowadays, whereby some of them are staying outside the camp due to overpopulated camps, they tend to seek help from the neighbours or relatives closer to them. Further research in looking at the involvement of BAKAT in improving the childhood immunization is much needed.

4.0 Conclusion and recommendation

The prevalence of the complete childhood immunization was high among children with parents in the armed forces. Parents’ knowledge was seen as the predictor for complete childhood immunization in the Armed Forces. It is recommended that further research to be undertaken such as the perceptions of parent towards health care provider especially the military health care centre and the influences of external factors, including the role of BAKAT and assistance provided by the armed forces.
Acknowledgement

This study was approved by the Ethical Committee for Research involving Human Subjects of the Universiti Putra Malaysia. We would like to thank the Commander of Malaysian Army for his permission to do this study. We fully acknowledge all people who participated and supported to complete this study.

Declaration

The authors declare that:

i. The article mentioned above has not been published or submitted for publication in any other journal.

ii. We also declare that the authorship of this article will not be contested by anyone whose name is not listed here.

iii. We have contributed significantly towards the research study ie, conception, design, analysis and interpretation of data and to drafting of the article or revising it critically for important intellectual content.

iv. There is no conflict of interest on this article

Authors’ contribution

The 1st author carried out the research, analysed the data and prepared draft of manuscript, while the 2nd and 3rd author supervised the research, corrected the data analysis and edited the manuscript.

References


