Factors Associated with Incomplete Childhood Immunization among Residents in St Mary, Jamaica

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ABSTRACT

Aim: *To investigate factors associated with caregiver failure to complete immunizations for their children in the parish of St Mary, Jamaica.*

Methods: *A case-control study was conducted with 50 cases defined as caregivers who failed to immunize their children and 179 controls defined as caregivers of children who were properly immunized. The cases were caregivers of children who were randomly selected from clinic records of children who failed to complete their immunization within the study period. Controls were caregivers of children who were identified to have completed their immunization from a similar list. Cases and controls were visited at home and interviewed using a validated questionnaire. Cases and controls were compared in terms of socio-demographic, economic and other variables.*

Results: *Participants with less than secondary school education were more likely to be non-compliant (odds ratio [OR], 2.51, 95% confidence interval [CI], 1.06 − 5.97), while participants who were aware of legislation against non-compliance with immunization (OR, 0.35; 95% CI, 0.17, 0.69) were less likely to fail to immunize their children.*

Conclusion: *Policy-makers and programme managers need to use established educational and communication channels to increase awareness of childhood immunization especially among families with lower educational levels in the parish.*

Keywords: Defaulting, determinants, immunization, Jamaica

Factores Asociados con la Inmunización Infantil Incompleta en Residentes de Saint Mary, Jamaica

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RESUMEN

Objetivo: *Investigar los factores asociados con el fracaso de los encargados del cuidado infantil en cuanto a garantizar la completa inmunización de los niños en la Parroquia de Saint Mary, Jamaica.*

Métodos: *Se llevó a cabo un estudio de caso-control con 50 casos definidos como encargados de cuidado infantil que dejaron de hacer inmunizar a sus niños y 179 controles definidos como encargados del cuidado de niños que fueron debidamente inmunizados. Los casos eran cuidadores de niños que fueron seleccionados de forma aleatoria a partir de las historias clínicas de niños que no completaron su inmunización dentro del periodo de estudio. Por el contrario, en el caso de los controles se trataba de encargados del cuidado de niños identificados por haber completado su inmunización a partir de una lista similar. Tanto los casos como los controles recibieron una visita en sus casas, y fueron entrevistados usando una encuesta validada. Ambos – casos y controles – fueron comparados en términos de sus aspectos socio-demográficos y económicos, así como otras variables.*

Resultados: *Los participantes con un nivel de escolaridad por debajo de la enseñanza secundaria presentaron una mayor probabilidad de ser incumplidores (odds ratio [OR], 2.51, 95% intervalo de confianza [IC], 1.06 − 5.97), mientras que los participantes que sabían de la legislación contra el*

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incumplimiento de la inmunización (OR, 0.35; 95% CI, 0.17 − 0.69) presentaron una menor probabilidad de dejar de inmunizar a sus niños. .

Conclusión: *Los encargados de trazar políticas y los administradores de programas necesitan usar los canales de comunicación y educación – sobre todo entre las familias con nivel educacional más bajo – con el propósito de lograr una mayor concientización en torno a la necesidad de inmunizar a todos los niños de la parroquia.*

Palabras claves: Omisión, determinantes, inmunización, Jamaica

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INTRODUCTION

Immunization against childhood diseases such as tuberculosis, poliomyelitis, measles, diphtheria, whooping cough and tetanus reduce childhood morbidity and mortality (1). Studies have shown that the cost to treat a vaccine preventable disease may be up to 30-times more than the cost of the vaccine (2). Children who contract these preventable diseases usually suffer from impaired physical growth, cognitive development, emotional development and social skills (3). Immunization in Jamaica is compulsory; it is a pre-requisite for school enrolment and defaulters can be punished under the law (4). In spite of this, the immunization coverage rates are sub-optimal. In 2007, the Ministry of Health, Jamaica, reported that only 76% of children aged 12 to 23 months of age had received all their recommended immunizations (5). These low rates of coverage create a potential for outbreak of vaccine preventable diseases. In 2001, the Ministry of Health, Jamaica, reported an outbreak of 11 cases of poliomyelitis, seven cases of rubella, one case of diphtheria, seven cases of whooping cough, 111 cases of tuberculosis and nine cases of tetanus (6). Additionally, incomplete immunizations serve as an indicator of poor access to other preventive and primary healthcare programmes (7).

Few studies have been conducted in Jamaica to investigate why some caregivers do not avail themselves of this cost-effective means of disease prevention. One study (8) found that low income and single parenthood reduce the likelihood of children being fully immunized. Similar studies in Nigeria and Niger showed that, poor immunization was attributable to low socio-economic status and low maternal education [52%] (9). Jamaica, on the other hand, has a high female literacy rate of 92% and only 14% of the populace lives below the poverty line (10).

The present study was conducted in the Northeastern parish of St Mary, Jamaica. We hypothesized that incomplete immunizations in this parish would be associated with socio-demographic and economic factors such as maternal age, marital status, educational level, employment status of mother and family size. Findings from this study can guide programme managers on how to deploy scarce resources to efficiently improve immunization coverage and consequently reduce the incidence of vaccine preventable diseases in St Mary and probably other parishes in Jamaica with similar challenges.

SUBJECTS AND METHODS

The parish of St Mary is located in the Northeastern region of Jamaica; with an area of 610 square kilometers, this is one of the smallest of the 14 parishes. It has a population of 113 000 according to a 2001 census. Agriculture, mainly banana cultivation, is the predominant means of livelihood for residents (11). There are 29 health clinics in the parish which are manned by a mix of doctors, nurses or community health aides depending on the type of facility. The study was conducted between June and August of 2008. The Institutional Review Board (IRB) of the University of Alabama at Birmingham, the Advisory Panel of Ethics and Medico-Legal Affairs in the Jamaican Ministry of Health and the North East Regional Health Authority approved the study protocol prior to its implementation.

This was an unmatched case-control study. Recruitment of study participants involved randomly choosing children from a list of all children who did not show-up to complete their immunizations (defaulters). The full address of these caregivers were pulled-up from the records and visited by interviewers. As part of the interview, information on the immunization status of eligible children was obtained from the parents/guardians and subsequently verified from childhood immunization cards maintained by the parents/guardians. Once immunization status was verified, cases were defined as parents or guardians who reside in the Parish of St Mary but failed to have their children fully immunized in accordance with the immunization schedule of the Jamaican Ministry of Health between January 2007 and March 2008. For the purposes of this study, a parent or guardian was defined as any respondent who has been involved in the child's care and immunization activities for at least half of the study period. In defining whether a parents/guardians was a case or not, only the immunization status of the age ($\leq$ 2 years) eligible child was considered. Other children in the household who were beyond this age of eligibility were not considered irrespective of their immunization status. Controls were defined as parents or guardians who reside in the parish of St Mary but took their eligible children (aged $\leq$ 2 years) to the various clinics and completed their

scheduled immunization. The list of these controls was derived from immunization records kept by the various clinics.

Out of a total of 263 caregivers approached to participate in the study, 10 (3.6%) controls and 8 (3.0%) cases declined to participate. There were a total of 195 cases and 50 controls. While 179 (91.8%) controls were females, all cases were females. Sixteen males, who were all controls, were excluded from the analysis because their socio-economic characteristics were substantially different from the mostly female participants.

Potential study participants were given an explanation of the purpose of the study and asked if they would like to participate. They were assured of confidentiality. Upon agreement, the informed consent form was described and potential participants were asked to read the consent form. interviewers were health-workers from the parish and students trained in protocol development and questionnaire administration. Prior to taking the immunization history, interviewers were blinded to the status of the participants whether cases or controls. The questionnaire was designed and adapted from the validated Parental Knowledge and Experiences module which was used in the National Immunization Survey of July 2001 to December 2002. The questions were framed to obtain information regarding the age of the caregiver, marital status, family size, employment status and educational level attained. Other information was elicited including: the number of children in the household, the relationship of the caregiver to the child, who financially takes care of the child, if there were religious reasons pertinent in the decision to avoid immunization and if the caregiver was aware that they could be prosecuted for failure to have the child vaccinated.

Data analysis was performed using SAS software version 9.1 (SAS Institute, Cary, NC). Cases and controls were compared with respect to socio-demographic characteristics. Odds ratios (ORs) and associated 95% confidence intervals (CIs) for the association between non-completion of immunizations and sociodemographic characteristics were estimated by logistic regression. For adjusted models, a backward-selection process was performed with all demographic variables and reasons for non-completion of immunization with a *p*-value of 0.1 or less included in the final model. In the final adjusted model, the determination of which variables should be retained as confounders was based on the change-in-estimate criteria using a value of 10% (12).

Table 1: Selected characteristics of the 229 study participants, St Mary, Jamaica

Characteristic	Cases n = 50 No.	(%)	Controls n = 179 No.	(%)
Gender				
Female	50	100	179	100
Mean age (years) ±SD	28 ± 9.8		29 ± 10.3	
Age group (years)				
< 20	6	12.0	17	9.5
20–24	13	26.0	49	27.4
25–29	16	32.0	49	27.4
30–34	6	12.0	21	11.7
35–39	5	10.0	17	9.5
40 and over	4	8.0	26	14.5
Educational level				
Some primary or completed primary	13	26.0	22	12.3
Some secondary, some vocational or completed vocational	22	44.0	99	55.3
Completed secondary	13	26.0	40	22.4
Some college or completed college	2	4.0	18	10.0
Marital Status				
Single	22	44.0	78	43.8
Visiting, divorced or widowed	4	8.0	25	14.0
Living together	17	34.0	46	25.8
Married	7	14.0	29	16.3
Employment type				
Unemployed	34	68.0	122	69.3
Employed	16	32.0	54	30.7
Aware of liability to prosecution				
Yes	14	28	95	53.1
No	36	72	84	46.9
Religion				
Have religious affiliation*	22	44.0	108	60.3
Have no religious affiliation	28	56.0	71	39.7

Key: *= Participants who profess a religious affiliation categorized into Catholicism, Apostolicism, Baptist, Anglican, Pentecostal, 7-day Adventist, and Methodist. The 7-day Adventist group who tend to reject immunization constituted 8.7% of the cases (not shown).

RESULTS

There was no significant difference between the mean age for the cases and that of the controls (Table 1). The distribution of participants across age groups was similar with most participants aged between 20 and 29 years. For both groups, caregivers were mostly unemployed and this did not differ between the groups. Most participants reported they had either attended some secondary school or vocational training; though a greater percentage of cases had less education than the controls. Cases were also more likely to report being single, unemployed and having no religious affiliation.

Older caregivers (OR, 0.44; 95% CI, 0.11, 1.78) and those living with a partner (OR, 0.57; 95% CI, 0.18, 1.80) were less likely to fail to immunize their children though neither of these associations were statistically significant (Table 2). It was also observed that having some college education or completing college education was associated with a reduced odds of defaulting compared to respondents

Table 2: Association between some independent variables with failure to immunize eligible children in St Mary Parish, Jamaica

Variable	Crude OR (95% CI)	Adjusted OR (95% CI)$^{\alpha}$	Adjusted OR (95% CI)$^{\beta}$
Age group (years)			
< 20	Ref	Ref	–
20–24	0.75 (0.25–2.29)	0.81 (0.26–2.57)	
25–29	0.93 (0.31–2.75)	0.31 (0.37–3.50)	
30–34	0.81 (0.22–2.97)	0.99 (0.25–3.86)	
35–39	0.83 (0.21–3.26)	0.95 (0.23–3.98)	
≥ 40	0.44 (0.11–1.78)	0.60 (0.14–2.62)	
Marital status			
Single	Ref	Ref	–
Visiting, divorced or widowed	0.86 (0.59–5.90)	1.08 (0.38–3.03)	
Living together	0.57 (0.18–1.804)	0.66 (0.19–2.19)	
Married	1.31 (0.63–2.72)	1.24 (0.58–2.68)	
Employment type			
Unemployed	Ref	Ref	
Employed	1.06 (0.54–2.09)	1.14 (0.56–2.32)	
Educational level			
Completed secondary	Ref	Ref	Ref
Some primary or completed primary	**2.66 (1.16–6.08)**	**2.76 (1.14–6.72)**	**2.51 (1.06–5.97)**
Some secondary, some vocational or completed vocational	1.46 (0.67–3.18)	1.51 (0.68-3.35)	1.42 (0.64–3.17)
Some college or completed college	0.50 (0.11–2.31)	0.60 (0.13–2.86)	0.58 (0.12–2.78)
Family size			
< 3	Ref	Ref	–
3–5	0.96 (0.33–2.79)	1.01 (0.33–3.11)	
≥ 6 1.89	(0.64–5.66)	2.17 (0.69–6.89)	
Aware of liability to prosecution			
Yes vs. No	**0.34 (0.17–0.68)**	**0.34 (0.17–0.67)**	**0.35 (0.17–0.69)**
Have religious affiliation			
Yes vs. No	**0.52 (0.27–0.97)**	0.56 (0.29–1.06)	0.62 (0.32–1.21)

Key: OR = Odds ratio; **CI** = Confidence interval, **Ref** = Reference group, **α** = Full model with employment type, marital status, educational status, family size and religious affiliation, **β** = Model with variables where $p \leq 0.1$, Figures in bold are significant.

who had completed secondary education (OR, 0.50; 95% CI, 0.11, 2.31). On the contrary, caregivers who attained an educational qualification equivalent to some primary or completed primary education had almost three-fold odds of defaulting on immunization (OR, 2.6; 95% CI, 1.16, 6.08) compared to those who completed secondary education. The odds of defaulting were higher with a family size of at least six members (OR, 1.89; 95% CI, 0.64, 5.66). Participants who did not take their children for immunizations were 66% less likely to be aware that failure to take children for immunization was against the law and liable to prosecution (OR, 0.34; 95% CI, 0.17, 0.68). It is also noteworthy that, there was a protective association against non-compliance among those who professed a religious affiliation (OR, 0.52; 95% CI, 0.27, 0.97).

In the full model, the association between having some primary/completing primary education and knowledge about liability to prosecution retained their statistical significance after adjusting for other variables.

In the final model, only having some primary/completing primary education (OR, 2.51; 95% CI, 1.06, 5.97) and awareness about liability to prosecution (OR, 0.35; CI, 0.17, 0.69) were significantly associated with compliance with the immunization schedule.

DISCUSSION

The results of this study indicate that completing secondary school, or knowing that it is against the law to default on immunization, were significantly associated with better compliance with immunization schedules.

While it is expected that having higher education may confer greater awareness about the risks of childhood diseases, the high literacy rate among Jamaican women may indicate that cases may not have had the same type of access

to information on immunization as the controls even if they lived in the same neighbourhood. Few studies to date have shown that having more than secondary education predicts completion of immunization. Even so, the association was moderate [OR, 1.5] (8). Those that have less education may therefore benefit from any programmes (*eg* information, education and communication strategies) directed at increasing their knowledge about immunization services and consequently disabuse their minds of any negative feelings that may exist about immunization.

Knowledge that prosecution may result from failure to immunize children appears to be a deterrent against being a defaulter. This stands to reason and makes a case for providing further information on the statutory provisions on immunization to residents of St Mary. To our knowledge, this is the first study which has demonstrated an association between mandatory legislation on immunization and completion of immunization schedule for children. However, it is also possible that caregivers became aware of the legislation only after attending the clinics to immunize their children. This scenario is plausible given that health education talks shared in the clinic may emphasize the need for immunizations and the repercussions of non-compliance. Non-statistically significant associations which reduced the odds of non-compliance with immunization were observed with smaller family size, having a religious affiliation, caregivers who were at least 40 years old and couples who live together. It is well documented that larger family size is associated with dilution of resources and hence children are not availed of the necessary healthcare including access to immunization services (8).

Some religious bodies are known to discourage their members from accepting immunization, while experiences with adverse side effects have been known to promote refusal of immunizations by certain groups (13, 14). Belonging to a religious denomination or expressing religious affiliation was found to be protective against non-compliance with immunization. Though not statistically significant in our study after adjusting for covariates, this finding is in consonance with studies in other parts of the world where religion was significantly associated with the reduced risk of non-immunization (15). Differences in results obtained by different investigators who looked at the influence of religion on immunization may be due to differences in socio-cultural antecedents and theological persuasions between populations involved in the studies.

The inability to detect some significant associations that have been reported in similar studies could be attributed to the relatively small sample size. Consequently, these results must be interpreted in light of several potential limitations, the most apparent of which is the study's small sample size. This provided limited statistical power to detect associations that were small and moderate in magnitude and yielded estimates that lacked precision.

Other potential limitations are that, not all eligible cases or controls took part in the study. Out of a total of 263 parents approached to enroll in the study, 10 (3.8%) controls and 8 (3.0%) cases declined to take part in the study. There were no differences with respect to age, gender or race of those that opted not to enroll in the study which suggests that selection bias is an unlikely explanation for the observed results. All sixteen males were excluded from the study. Results of analysis with and without this group were not meaningfully different. However, the observed results should only be taken to refer to females.

To default in immunization is a civil offense in Jamaica. In order to circumvent misleading information or socially desirable answers provided by caregivers (16), we ensured the accuracy of immunization status of the children by cross-checking their immunization cards.

In conclusion, the results of this study provide an opportunity for policy-makers in St Mary to evaluate ongoing programmes, identify gaps and step up awareness campaigns using known and effective communication channels to convey messages to communities with a large number of at-risk families. The apparent deterrent effect of the law against immunization can be explored to promote compliance among delinquent caregivers. This could go a long way in protecting unimmunized children from contracting infectious diseases or becoming a nidus from which an epidemic flourishes.

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