Parents' Decision-making for Childhood Immunization and Prevention of Childhood Diseases – A Cross-Sectional Survey

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Research Article

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Abstract

Background

The childhood vaccination program (EPI) is claimed by the World Health Organization (WHO) to be the most cost-effective intervention to reduce child mortality. Therefore, in low-income countries governments and health authorities invest in vaccination programs to reach herd immunity. However, despite the resources allocated to the EPI, epidemics preventable through vaccines are still reported in these countries. In Cameroon, the Foumbot district in the West region has witnessed measles epidemics since 2010 and in 2013 a polio outbreak was reported.

Methods

The design of this study is a cross-sectional survey. A total of 160 mothers of children between the ages of 12 to 23 months were selected by simple random sampling technique. Pre-tested structured questionnaire was used for data collection. Data was analyzed using SPSS statistical software.

Results

The outcome of this survey shows that 60% of the children studied were completely vaccinated, 37.75% were partially vaccinated, and 1.25% had not received any vaccine. The logistic regression analysis shows that a poor knowledge of infectious diseases (OR=0.3) was a significant predictor of partial and no vaccination status in children.

Conclusion

Parents' decision-making for EPI was based on the information and experiences available in the community. Therefore, parents who are poorly educated on VPDs and living in a community with missing information and misinformation about vaccination will probably not complete the EPI. Public health authorities should invest in health education programs with the goal of developing skills for health-seeking behavior in individuals and communities.

Background

Prevention of children of diseases is the primary concern of pediatrics [1][3][4]. Since 1974, in order to reach herd immunity, the WHO (World Health Organization) has been motivating health authorities all around the world to invest in the EPI (Expanded Program on Immunization) to ensure vaccination of children around the world against vaccine-preventable childhood diseases (VPDs). Six vaccine-preventable diseases are recommended by the EPI: tuberculosis, polio, diphtheria, tetanus, measles, and pertussis [2]. In 2014, the herd immunity threshold in low-income countries was still below the 92-95% set

by the WHO for VPDs except the BCG vaccine [22]. In Cameroon, the proportion of children below 2 years of age who are completely vaccinated for all recommended childhood vaccines [7][27][28] is still well below the target 80% of eligible children targeted by the Cameroonian government [11]. In September 2013, many cases of paralysis were reported in Foumbot district and Malentuen district in Cameroon. The Genotyping of the viruses showed that a similar virus (Wild Poliomyelitis Virus) affected all the children [12]. Interestingly, the affected children in Cameroon had never been outside the country. The virus genotype linked to the outbreak shows a parenthood to the poliovirus observed in Chad in 2011 [23].

The Foumbot district is a place at risk because of the outbreak. The district hosts one of the largest border fresh-food markets in Cameroon where people from all parts of the country and neighboring countries of Cameroon such as Niger, Chad, Central African Republic, Congo, Gabon, Equatorial Guinea, and Nigeria interact. The risk of expansion of the poliovirus to other parts of the country and to the neighboring countries is high. The parents of the first confirmed cases were farmers and gardeners who used to visit markets in Malentuen [12]. Although vaccination programs to eradicate measles around the country had already been implemented, a proliferation of measles was reported in nine health districts including the Foumbot district, [24]. Despite the financial resources allocated to the EPI to achieve herd immunity, VPDs remain a health care concern in Cameroon. The sole provision of vaccination does not guarantee herd immunity throughout the country [7][27]. Only the BCG coverage, which is given at birth, is above 90%. The coverage of other vaccines in children is still far below 80% expected in all health districts. [7][11]. Based on actual experiences gained by vaccination practice in each region or community, it is possible to define the causes of reticence to the vaccination [14][17][18][41][29][30][31]. Therefore, programs leading to a higher prevention of infectious diseases in the population can only be defined, once the underlying reasons for the refusal and/or the interruption of the vaccination program are clearly identified. This study identifies, examines the factors affecting complete childhood vaccination in Foumbot district.

Methods

Study area

The Foumbot district covers an area of about 1000 km². The district is rural and located in the Noun Division, West region of Cameroon. In 2013, the health district estimated the population to be 62,776 inhabitants (from the 2013 Census), the majority being Bamum. The predominant religion is Islam. Farming is the main occupation. The district hosts the most important fresh food market in the western region and is divided into eleven health communities, which provide EPI to the local population.

Study design

A cross-sectional survey of parents of children aged 12 to 23 months was performed from 1st July to 31st October 2014. This included a questionnaire to record the characteristics of mothers and children, and to evaluate maternal knowledge about vaccination. Only parents of the children were interviewed. Survey

participants were selected randomly according to the WHO vaccination coverage cluster survey sampling [5][6][8][10]. The vaccination coverage has been evaluated by means of the vaccination booklet and EPI register. A child was said to be completely vaccinated if he had received all of the vaccines recommended by the EPI by the time he was selected for the survey.

Sample size determination

Using the sample size calculation methodology presented in the WHO Immunization Coverage Cluster Survey Reference Manual (WHO/IVB/04.23), the sample size required was determined using the coverage of 64%

obtained in the western region, a precision of ± 10%, a type 1 error of 10% and a design effect of 1.5, in conformity with the standard WHO methodology [6][8]. Thus, the calculated minimum number of children required was 147.

Participants

During the investigation, data from 160 children and 160 parents were collected in the district randomly. The sampling process was performed according to the simple random sample (SRS) method [5][6]. The first household was randomly chosen from each selected cluster. Each household was chosen randomly, such that each household had the same probability in the cluster of being chosen during the sampling process [9]. The sampling technique applied allows the researcher to perform the evaluation with a sample that is representative. From this sample, statistical values have been generated to be extrapolated to the whole population of the Foumbot health district.

Data analysis

The data was collected by trained nurses using a French structured questionnaire. The structured questionnaire was adopted from the Demographic Health Survey of Cameroon [7]. The content of the questionnaire included: sociodemographic characteristics, questions related to parents and child health services, parents' perception about vaccination, parents' knowledge about VPDs. The vaccines received by the child were obtained from the vaccination card or through the vaccination history of the child reported by the parent. Prior to data collection, the questionnaire was pre-tested on 5% of the sample on a similar population.

The data from the interview was coded and entered into a computer database using *Microsoft Office Excel 2010*. Descriptive statistics were performed by means of *EPI info 3.5.4 statistical software program* to analyze the sample, to check the association of each independent variable with the complete vaccination. For this purpose, the odds ratios were calculated along with 95% confidence intervals (CI) and the p-value from the Fisher's exact test. The analysis of the factors associated with vaccine incompleteness was carried out by means of the statistical software program SPSS according to a multivariate logistic regression model of the "forward" type: the first was a bivariate analysis which allowed us to obtain raw odds ratios for each one. of the variables with their 95% confidence intervals

and their P values. The variables that obtained a p value <0.5 were statistical significant and were all entered into a multivariate logistic regression model to control for confounding factors and to determine which characteristics are independent predictors of the child's vaccination status [Table 3].

Ethical clearance

This study obtained the authorization of the Faculty of Medicine of the Université des Montagnes and the health authorities of the Foumbot district to be carried out. Verbal informed consent was required for each participant prior to the administration of the questionnaire.

Findings And Childhood Vaccination Status

Childhood Vaccination Coverage

Vaccine	Case Present study (n=160)	Percentage Present study (n=160) %	DHS (2011)		WHO (2014)	
			West Region, Cameroon (n=2265) %	Woldwide Cameroon (n=272) %	Africa %	%
BCG	158	98.8	87.1	95.9	91	84
Polio 0	158	98.8	71.7	84.4		
DPT 1	144	90	85.5	94.4		
DPT 2	134	83.8	78.3	87		
DPT 3	125	78.1	68.4	75.5	86	77
OPV 1	143	89.4	93.3	92.5		
OPV 2	134	83.8	85.5	87.5		
OPV 3	124	77.5	69.8	76.6	86	77
VAA (Yellow Fever)	101	63.1	69.3	77.7		
VAR (Measles)	101	63.1	70.6	79.8	56	11
Not vaccinated	2	1.25	4.5	2.3		
Completely vaccinated	96	60	52.1	62.9		

Table 1: Vaccination coverage from Foumbot district for each antigen compared to latest data for Cameroon from WHO and Sociodemographic Health Survey (DHS)

Health facilities	Number of professional in charge of the vaccination
CSI Kwen Baigom	3
Hôpital EEC Baigom	1
CSI Mbanjou	2
CSI Mbantou	3
CSP St blaise	1
Hôpital district foumbot	4

Table 2: Vaccination staff in the Foumbot district, 2014

The vaccination status of the child was established by the records in the vaccination booklet, the records in the EPI registration or by the presence of scar in the case of BCG. In the 5 clusters, a total of 160 households were surveyed. It was found that 96 (60%) children had received complete vaccination by the age of two. On the other hand, 62 (38.75%) had received partial vaccination and 2 (1.25%) had not received any vaccine. The dropout rate between the initial vaccine BCG or OPV 0 and the final vaccine measles is quite high with 36%; that means, over one third of the children were unable to complete the vaccination program [Table 1].

Factors	Categorical variables / characteristics of the mother and child		Complete Vaccination			Binary logistic	
			Yes	No	Total	OR (95% CI)	P. Value
			N=96 (%)	N=64 (%)	N=160 (%)		
Maternal Age	<25	Yes	53 (60.9)	34 (39.1)	87 (54.4)	1.09 (0.57 - 2.05)	0.461
		No	43 (58.9)	30 (41.1)	73 (45.6)		
	25 to 34	Yes	33 (60)	22 (40)	55 (34.4)	1 (0.51 - 1.94)	0.566
		No	63 (60)	42 (40)	105 (65.6)		
	> 34	Yes	10 (55.6)	8 (44.4)	18 (11.3)	0.81 (0.30 - 2.18)	0.434
		No	86 (60.6)	56 (39.4)	142 (88.8)		
Education	No school	Yes	0 (0)	2 (100)	2 (1.3)	0	0.158
		No	96 (60.8)	62 (39.2)	158 (98.8)		
	Primary	Yes	37 (54.4)	31 (45.6)	68 (42.5)	0.67 (0.35 - 1.26)	0.141
		No	59 (64.1)	33 (35.9)	92 (57.5)		
	Secondary	Yes	57 (64.8)	31 (35.2)	88 (55)	1.55 (0.82 - 2.94)	0.115
		No	39 (54.2)	33 (45.8)	72 (45)		
	University	Yes	2 (100)	0	2(1.3)		0.36
		No	94 (59.5)	64 (40.5)	15 (98.8)		
Child Birth order	1st	Yes	27 (67.5)	13 (32.5)	40 (25)	1.53 (0.72 - 3.26)	0.176
		No	69 (57.5)	51 (42.5)	120 (75)		
	2nd	Yes	32 (68.1)	15 (31.9)	47 (29.4)	1.63 (0.79 - 3.34)	0.121
		No	64 (56.6)	49 (43.4)	113 (70.6)		
	3rd	Yes	14 (50)	14 (50)	28 (17.5)	0.61 (0.26 - 1.38)	0.164
		No	82 (62.1)	50 (37.9)	132 (82.5)		
	>3	Yes	23 (51.1)	22 (48.9)	45 (28.1)	0.6 (0.29 - 1.20)	0.105
		No	73 (63.5)	42 (36.5)	115 (71.9)		
Marital Status	Single	*Yes*	*17 (81)*	*4 (19)*	*21 (13.1)*	*3.23 (1.03 - 10.09)*	*0.028*
		No	79(56.8)	60 (43.2)	139 (86.9)		

	Married	Yes	79 (57.2)	59 (42.8)	138 (86.3)	0.393 (0.13 - 1.12)	0.06
		No	17 (77.3)	5 (22.7)	22 (13.8)		
	Widow	Yes	0	1 (100)	1 (0.6)	0	0.4
		No	96 (60.4)	63 (39.6)	159 (99.4)		
	Divorced	No	96 (60)	64 (40)	160 (100)		
Religion	Catholic	Yes	12 (75)	4 (25)	16 (10)	2.14 (0.65 - 6.96)	0.1533
		No	84 (58.3)	60 (41.7)	144 (90)		
	Protestant	*Yes*	*24 (82.8)*	*5 (17.2)*	*29 (18.1)*	*3.93 (1.41 - 10.94)*	*0.004*
		No	72 (55)	59 (45)	131 (81.9)		
	Muslim	*Yes*	*60 (52.2)*	*55 (47.8)*	*115 (71.9)*	*0.27 (0.12 - 0.61)*	*0.001*
		No	36 (80)	9 (20)	45 (28.1)		
	Animist	No	96 (60)	64 (40)	160 (100)		
Occupations	Formal sector	Yes	8 (66.7)	4 (33.3)	12 (7.5)	1.36 (0.39 - 4.73)	0.434
		No	88 (59.5)	60 (40.5)	148 (92.5)		
	Informal Sector	Yes	88 (59.5)	60 (40.5)	148 (92.5)	0.73 (0.21 - 2.54)	0.434
		No	8 (66.7)	4 (33.3)	12 (7.5)		
Reason for vaccinating	Prevent the occurrence of diseases	Yes	64 (58.7)	45 (41.3)	109 (68.1)	0.84 (0.42 - 1.67)	0.379
		No	32 (62.7)	19 (37.3)	51 (31.9)		
	Decrease the severity of diseases	Yes	1 (50)	1 (50)	2 (1.2)	0.66 (0.04 - 10.79)	0.641
		No	95 (60.1)	63 (39.9)	158 (98.8)		
	No idea	Yes	31 (63.3)	18 (36.7)	49 (30.6)	1.2 (0.61 - 2.4)	0.35
		No	65 (58.6)	46 (41.4)	111 (69.4)		
Knowledge of VDP and infectious diseases	Good knowledge	*Yes*	*88 (63.7)*	*50 (36.2)*	*138 (86.2)*	*3.08 (1.21- 7.85)*	*0.01*
		No	8 (36.3)	14 (63.6)	22 (13.8)		
	Poor knowledge	*Yes*	*8 (36.4)*	*14 (63.6)*	*22 (13.8)*	*0.32 (0.12- 0.82)*	*0.014*
		No	88 (63.8)	50 (36.2)	138 (86.3)		
Age-appropriate vaccination	At Birth	*Yes*	*83*	*46*	*129*	*2.5 (1.12 -*	*0.02*

			(64.3)	*(35.7)*	*(80.6)*	*5.55)*	
		No	13 (41.9)	18 (58.1)	31 (19.4)		
	No idea	Yes	11 (44)	14 (56)	25 (15.6)	0.4 (0.19 – 1.09)	0.06
		No	85 (63)	50 (37)	135 (84.3)		
	Other date	Yes	2 (33.3)	4 (66.6)	6 (3.7)	0.32 (0.06 – 1.79)	0.17
		No	94 (60)	60 (40)	154 (96.9)		
Mastering of the vaccination schedule	Master	***Yes***	*29 (80.6)*	*7 (19.4)*	*36 (22.5)*	*3.52 (1.43 - 8.65)*	*0.002*
		No	67 (54)	57 (46)	124 (77.5)		
Retention of the vaccination booklet	Keep	Yes	88 (62)	54 (38)	142 (88.8)	2.04 (0.76 - 5.48)	0.121
		No	8 (44.4)	10 (55.6)	18 (11.3)		

Table 3: Sociodemographic characteristics and complete childhood vaccination in Foumbot district, 2014

The child was not completely vaccinated because of:		**cases**	**Percentage**
Missing Information	Ignores the necessity for vaccination	6	17%
	Ignores the necessity of the 2nd and 3rd dose	3	
	Fear of adverse effects	2	
No interest	Discouraged by the entourage	2	6.25%
	Does not trust vaccination	2	
Lack of flexibility and resource	Absence of the vaccination personal	1	76.5%
	Lack of financial means	1	
	Vaccines not available	4	
	Long waiting time	3	
	Not suitable time schedule	1	
	Impediment (travel, sickness, mourning)	33	
	Lack of time	6	
Total		64	100%

Table 4: Reasons given by parents for missing the vaccination

Parental Perception

Defaulting factors

The parents whose children had not completed the EPI mentioned missing information (17%), Lack of interest (6.2%), and lack of flexibility and resource (76.5) [**Table 4**].

The association of the sociodemographic factors with completion of child vaccination were assessed by this study. The results showed that 52% and 80% of those who are Muslim and Non-Muslim, respectively, had children with complete vaccination status, whereas 48% and 20% of those who are Muslim and non-Muslim, respectively, had children with partial vaccination status. From all the variables, religious belonging (Muslim) showed significant association with incompletion of vaccination in bivariate analysis. The likelihood of vaccination completion among parents in Muslim communities was about 27% (OR=0.27; p-value <0.05) when compared with parents in other religious communities [**Table 3**].

Furthermore, the results showed that 36% and 64% of those with poor knowledge of VPDs and good knowledge of VPDs, respectively, had their children with complete vaccination status, whereas 54% and 36% of those with poor knowledge of VPDs and good knowledge of VPDs, respectively had their children with partial vaccination status or no vaccination status. The statistics showed that there was significant association between poor knowledge of VPDs and the childhood vaccination status [OR=0.32] at p-value < 0.0 5 [**Table 3**].

Parents' decision making

Of all parents whose children had complete vaccination status, 64:3% were assigned to the group of parents who started the vaccination at birth, 63.7% were assigned to the group of parents with good knowledge of VPDs, and 80% were assigned to the group of parents who mastered the vaccination schedule. The statistics showed that starting vaccination at birth [OR=2.5], knowledge of VPDs [OR=3.08], and mastering the vaccination schedule [OR=3.52] were significantly positive associated with complete childhood vaccination. The result of the logistic regression analysis are showed in Table 5. The final model (step 3) shows the smallest value of the AIC, the BIC, and the – 2 Log Likelihood statistics [Table 5]. This model (step 3) is better suited to explain the decision of parents about childhood vaccination status. After the adjustment of all variables that were found significant, poor knowledge of VPDs was found as a significant negative predictor of the intention to complete the EPI. That is, poor knowledge of VPDs significantly predicted a lower likelihood for parents to complete the EPI.

Model	Action	Effect(s)	Model Fitting Criteria			Effect Selection Tests		
			AIC	BIC	-2Log-Likelihood	Chi-square[a]	degree of freedom	Significance
Step 0	Entered	Constant	85.70	88.78	83.70	.		
Step 1	Entered	Muslim	76.58	82.73	72.58	11.12	1	0.001
Step 2	Entered	Start at birth	67.74	76.97	61.74	10.84	1	0.001
Step 3	Entered	Poor Knowledge of VPDs	64.16	76.46	56.14	5.58	1	0.018

Stepwise Method: Forward Selection

a. The Chi-Square for entry is based on the Likelihood-Ratio-Test

Table 5: Step Summary – Information criteria

Discussion

This study examined the association and influence of sociodemographic factors, knowledge of VPDs to complete childhood vaccination.

In this study, 76.5% of the parents whose children did not complete the EPI mentioned barriers linked to flexibility and resource [Table 4]. Referring to Table 2, some health facilities had only 1 or 2 persons in charge of the vaccination. In 2015, Cameroon was still classified by the WHO as having an acute shortage of health personnel [38]. Researchers in the USA and in Vietnam observed that the advice of a healthcare professional was the major factor that changed the view of parents who had previously refused to let their children be vaccinated or had delayed vaccination [39][40]. Therefore, contact with a healthcare professional is an important factor in health decision-making. The results of this study show that starting at birth the vaccination program increased by 2.5 the likelihood to complete the EPI [OR=2.5] [**Table 3**]. A study performed in 2000 in a rural community in Edo State in Nigeria showed that early vaccination of children increases the awareness of the parents towards VPDs and vaccination [36]. Administering the first vaccine at birth is an important step for building confidence in the medical system and in raising parental awareness about VPDs and the role that the vaccination can play in promoting the child's health. However, we found that only 60% of children had completed the EPI at the age of two years, although 98% of the children had received the BCG vaccine at birth. This shows that the awareness towards VPDs has not been reached and the confidence in the medical system was not established. A poor knowledge of VPDs [OR=0.32] was identified as the predictor of failure of complete vaccination in children. Additionally, it was found that in the group of parents belonging to Islam, 47.8% of the parents failed to complete the EPI while 20% were reported in other religious groups [**Table 3**]. The failure in the vaccination programs in Muslim communities has been reported in Nigeria, Pakistan, and Afghanistan. [13][15][20][21]. In these countries, parents' decision-making was guided by the propaganda against polio vaccine by Muslim fundamentalists. Just like Muslim communities, African communities are regularly affected by negative information on vaccination programs so that medical interventions intersected with cultural perceptions [13]. Most people on the African continent and particularly in rural areas like the Foumbot district cannot identify with the vaccination [14][35][46]. Consequently, fear "makes sense" [19][35]. The perception of parents living in these communities regarding vaccination is likely to turn into refusal following stories often linked to a conspiracy theory [13][15][20][21]. Because of the slave trade and colonization, many Africans and particularly Muslims are skeptical and suspicious about any intervention from western countries and those who refuse vaccination perceive the EPI as a western propaganda to destroy Africans, Muslims and their local traditions and cultures [34]. This outcome shows that parents' perception regarding vaccination was not generated by the religious principles but by how the information available in the community is perceived and understood. Data from India, Nigeria, and the United Kingdom (UK) shows that for these countries, trust in immunization programs is more often associated with trust in health systems [37][47]. In 2003, negative information affected the vaccination program in Muslim communities in Nigeria negatively [13][19][21]. In order to regain confidence, a long-term program was put in place. This program involved different actions and key players to help build support for vaccination: grassroots involvement, change of initiatives, and public and media awareness

[20][33]. In this study, parents with good knowledge of VPDs had a higher likelihood to complete the EPI [OR= 3.08]. Therefore, vaccination coverage increases as parents' knowledge of VPDs increases. This result is similar to studies carried out in Kenya, Nigeria, Senegal, and Turkey where it was found that educating parents particularly on healthcare and on programs to improve quality of life has reduced child mortality and increased life expectancy [16][15][41][42][43]. From these results, health education programs are beneficial as they enable parents to receive knowledge of diseases, healthcare, and prevention. It is not about academic qualification, which assures only that an individual has learned the theory and, acquired knowledge but does not guarantee that the individual has developed skills to adopt and to implement the knowledge in real life. In Thailand, it was found that women who attended a community empowerment program implemented plans to fight against malaria [44]. They offered malaria education to community members, taught mosquito control actions, promoted the use of insecticide treated bed nets, and also initiated entrepreneurship to increase revenue for the family. In Papua New Guinea, a program empowered members of a community to take charge of the acquisition, distribution and effective utilization of bed nets [44]. This led to a significant reduction in the incidence of mortality linked to malaria. Health education should ensure that parents acquire the knowledge of diseases, their causes and consequences, and learn about healthcare with the goal to engage and invest in personal and community health.

Limitations Of The Study

In this study, some limitations were expected because this is a cross-sectional study, and the sampling method is susceptible to selection bias. Only the participants that were present in the district at the time of the interview and that met the survey inclusion criteria were considered in the sample.

Conclusions

"It is often not just what is offered that makes bait out, but how it is perceived by the recipient matters" Simmi Oberoi et al. 2016

This study identified predictors of childhood vaccination hesitancy and suggestions were made to support parents' decision-making for childhood immunization and prevention of childhood diseases.

The factors "poor knowledge of VPDs and infectious diseases" and "belonging to Islam" were found to be statistically significant and associated with the failure in childhood vaccination [Table 3]. Although Islam itself is not against the vaccination, it was noticed that negative information about vaccination is frequently spread around in Muslim communities [13][21]. The shortage of health personnel in the Foumbot district [Table 2] and in Cameroon in general also limits the populations' access to health information and the trust in the medical system. When parents have poor knowledge of VPDs and the confidence in the medical system is not established, they are expected not to trust in the vaccination and in turn to refuse or interrupt the EPI. On the other hand, the factors "good knowledge of VPDs and infectious diseases" and starting vaccination "at birth" were found to be statistically significant and

positively associated with complete childhood vaccination [Table 3]. These two factors were advantageous to establish trust in the EPI and therefore generate in parents the perceptions “demand” or “acceptance” of the childhood vaccination. In the literature “Patterns of vaccination acceptance”, Streefland et al [32] declared that the perceptions demand, acceptance and refusal may or may not be based on a knowledgeable comprehension of the vaccination but are based on the experience people or communities have with it. Following this declaration, this study has found that decision-making by parents regarding vaccination may or may not be based directly on sociodemographic factors but are based on the experience and the interpretation by the local value system of the existing information available in the community [Figure 1]. The findings of this study suggest investing in health education programs targeted at parents who are poorly educated on infectious diseases. These programs should not be limited to how to avoid illness or how to cope with diseases. It should also focus on the understanding of peoples’ local health beliefs and practices and consider these beliefs and practices in developing health education programs with the purpose of developing skills in health-seeking behavior in individuals and communities. Based on the outcomes of this study, a community-related framework [Figure 1] has been developed using the conceptual framework of Sturm et al and in accordance with the Health Belief Model (HBM) [25][26]. Future research should investigate possibilities in understanding the dynamics of communities regarding health issues, while tailoring immunization programs to the local context.

List Of Abbreviations

AIC	Akaike's Information Criterion
AIDS	Acquired Immune Deficiency Syndrome
AUC	Area Under the Curve
BCG	Bacillus Calmatte Guiren
BIC	Bayesian Information Criterion
CI	Confidence Interval
CIA	Central Intelligence Agency
CMYP	Comprehensive Multiyear Plan
df	Degree of freedom
DPT	Diphtheria, Pertussis, Tetanus
EBM	Evidence Based Medicine
ECDC	European Centre for Disease Prevention and Control
EPI	Expanded Program on Immunization
EXP	Exponential
GPEI	Global Polio Eradication Initiative
GVAP	Global Vaccine Action Plan
HBM	Health-Belief-Model
Hib	Haemophilus influenza type b
HIV	Human Immunodeficiency Virus
MCV	Measles-Containing vaccine
MDO	Millennium Development Objectives
MMR	Measles, Mumps and Rubella vaccine
NGO	Non-government Organization
NID	National Immunization Day
OPV	Oral Polio Vaccine
OR	Odds Ratio
PCV	Pneumococcal Conjugate Vaccine
Polio	Poliomyelitis
REF	Reference

ROC	Receiver Operating Characteristic
S.E.	Standard Error
Sig.	Significance
SRS	Simple random sample
TT	Tetanus Toxoid
UN	United Nations
UNICEF	United Nations Children's Fund
USA	United States of America
VAA	Vaccin Anti Amaril (yellow fever vaccine)
VAR	Vaccin Anti Rougeoleux (measles vaccine)
WHA	World Health Assembly
VPD	vaccine preventable disease
WHO	World Health Organization
WPV	Wild Poliomyelitis Virus

Declarations

- **Ethics approval and consent to participate**

The ethical approval *Autorisation N° 2014/036/UdM/PR/CAB/CIE* was obtained on the 30th June 2014 from the Institutional Ethic Committee of the Université des Montagnes. Before data collection, written consent was obtained from the respondents. No participant was below the age of 16 at the time of the study.

- **Consent for publication**

Not applicable

- **Availability of data and materials**

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

- **Competing interests**

The authors declare that they have no competing interests.

- **Funding**

Not applicable

- **Authors' contributions**

JK was involved in the conception, design, analysis and interpretation of data, and report writing.

AL has been involved in the conception, design, analysis of the data and critically reviewed the manuscript.

TO has assisted with the conception and designing the study and critically reviewed the manuscript

VK was involved in the interview process and the collect of the data.

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Figures

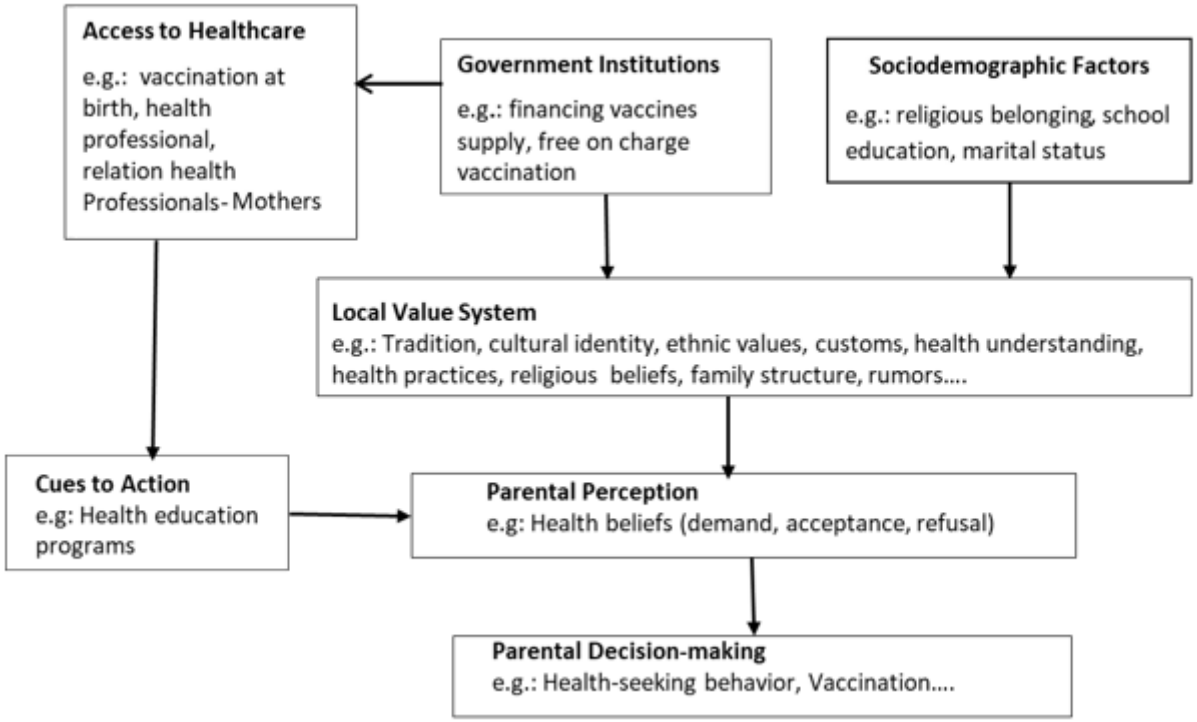

Figure 1

Community-related conceptual framework of parental decision-making

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