The validity and reliability of parent's recall for routine Immunization in Cameroon: an evaluative study

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BSTRACT

Objective: The objective of this study was to determine the validity of parent's recall for immunization using the vaccination card as the reference in Yaounde-Cameroon.

Settings: This study was a communitybased study in all the 6 health districts in Yaounde, Cameroon

Participants*:* The study targeting parents of children aged 0-59months who had their children's vaccination cards. The immunization history of each child was taken based on both parent's recall and vaccination card. Using the vaccination card as a reference, the sensitivity, specificity, positive predictive value and negative predictive value of parent's recall were calculated. The degree of agreement and the kappa statistics between the two methods were calculated using R version 4.1.0 (2021-05-18).

Results*:* A total of 529 households were visited and 87 elligible parents enrolled. Approximately 55.2% of the children were girls and 53% of them were aged 12-59 months. In total, 94.25% of the participants enrolled were one of the biological parents of the children, with mothers making the majority 86.20% of participants. When combined for all vaccines, the sensitivity, specificity, positive predictive value, and negative predictive value of parent's recall were 63%, 60%, 90%, and 23% respectively. The degree of agreement between the two sources was highest for BCG(94%) and lowest with Polio2(32%). Parent's recall(94%) was most likely to correctly predict BCG vaccination status of a child than using the scars on the forarm(74%).

Conclusion: Our conclusion is that validity and reliability of parent's recall vary a lot across different vaccines and parent's recall is not very reliable for immunization status assessment in children. Parent's recall is preferred for verifying BCG immunization to scars on the forarm. In general, we recommend that parent's recall for routine immunization should be used only as a last resort or for BCG, and measles and Yellow Fever vaccines.

Keywords: vaccination-card, specificity, sensitivity, Positive-Predictive-Value, Negative-Predictive-Value, validity, reliability, parent's recall

1. INTRODUCTION

Parent's recall for immunization can be defined as the ascertaining of children immunization history based solely on the parent's/guardian's declaration without any documented proof (1). During immunization service delivery, the health provider checks the immunization history of the child and identifies vaccines that are due or missed with respect to the child's age. In the absence of any document to prove the real vaccination status of the child, the provider will have to interview the child's parents or guardians in order to determine the child's immunization status(2). In the same way, researchers equally rely on parent's recall when the vaccination card is not available to evaluate the vaccination status of a child enrolled in survey (3).

Parent's recall is frequently used to assess the immunization of children(4). In Cameroon, investigators relied on parent's recall during immunization surveys for 30%-70% of children enrolled(5–8). The case was different in other context, 3% in Tripura(*Datta et al. - 2016.*), 67% in Pakistan(8), 5% in Tanzania(10).

Though parent's recall is frequently used to assess the immunization status of children, it is kwon that data collected through parent's recall does not always match with the real immunization history of the child(11,12). In the first place, the parent/guardian accompanying the child might not be the same person who was taking care of the child in the past. This can be the case if the biological parents of the child died at some point or unable to accompany the child because of occupations or illness(13). Secondly, the parent's recall might be incorrect simple because the parent partially or fully forgot the immunization history of the child in question(14). Lastly, because

the investigator relies on parent's recall, the parent could intentionally decide to give incorrect information and there will be no way to verify(15).

A few number of studies have assessed the validity of parent's recall for immunization using vaccination card or vaccination register as the gold standard in some countries(4,13,16,17). Based on the findings from these studies, the specificity, sensitivity of parent 's recall for immunization varies across contexts and vaccines(12,13).

A systematic review on the validity of parent's recall observed that studies in the subject matter were very few in low-middle income countries(11%) where investigators rely very largely on household information for immunization history assessment(13). The study concluded that there is no enough evidence to make a definitive conclusion on the subject(13). No study has been done in Cameroon to assess the context specific situation. The objective of this study was to determine the validity of parent's recall for routine immunization in Cameroon using vaccination card as the reference.

2. MATERIALS AND METHODS

2.1. Ethical Approval and Public involvement in the study

This study was authorized by the regional ethics committee for the center region of Cameroon with the authorization reference: No: 01410/CRERSHC/2021. Verbal consent was obtained for all participants before enrollment. The public was not involved in the design conduct and dissemination of this results.

2.2. Research design

This was an evaluative study targeting parents of children aged 0-59months who had their children's routine vaccination cards. The immunization status of each child was recorded based on parent's recall and compared with the information from the vaccination card(reference sources) to estimate sensitivity, specificity, positive predictive value and negative predictive value of parent's recall. Data were collected through a household survey in which participants were interviewed and vaccination cards verified. The reliability of parent's recall was

80 estimated using Kappa statistics and degree of agreement between the two sources of information. Data were
81 analysed with R version 4.1.0 (2021-05-18).

82 ***2.3. Research area***

83 This study was done in six(6) health districts in Cameroon: Biyem assi, Cite verte, Djoungolo, Efoulan,
84 Nkolbisson, and Nkolndongo. The study area was Yaoundé Cameroon.

85 ***2.4. Study population***

86 This study targeted parents (or guardians) of children under five years, living in Yaounde that were in possession
87 of their vaccination cards. All potential participants who could not present the vaccination card of their children
88 were excluded from the study.

89 ***2.5. Sample size calculation***

90 Sample size needed for this study was calculated using the formula for sensitivity study(18). The parameters
91 used for the sample size estimation included the following: expected sensitivity of 94.6%(10), $Z_{\alpha/2}$ at 95%
92 confidence interval 1.96, expected vaccination coverage of 42%(19), and the desired precision of 5%. We obtained
93 a sample size of 163 participants. When we considered the vaccination card retention in Cameroon (57%), average
94 household size(4.9), and proportion of children under five years in the population(19), we estimated to interview
95 529 households in order to obtain the desired sample size.

96 ***2.6. Sampling Methods***

97 Household selection in the field was done using a 2-stage cluster sampling. A total of 30 clusters constituting
98 of 24 households each were assessed. Clusters were selected with probability proportionate to size (PPS) and
99 households within cluster selected by restricted sampling. The restricted sampling here refers to a modified form
100 of systematic sampling in which instead of using sampling interval in a systematic way, we randomly selected one
101 household within successive sampling interval. This method was preferred to give more room for chance factor
102 in household selection.

2.7. Data collection

The data collection tool used in this survey was the questionnaire used by demographic health survey in Cameroon in 2018 for immunization coverage(19). However, unlike DHS in which parent's recall was used in the absence of vaccination card, we used both sources at the same time for all participants. Data collection tool was designed in KoBo toolbox and deployed in tablets for electronic data collection. Prior to data collection, data collectors were trained and tools pretested.

2.8. Data management and data analysis

Data analysis was done with R version 4.1.0 (2021-05-18). Using vaccination card as our reference source, we calculated sensitivity(se), specificity(se), positive predictive values (PPV) and negative predictive values (NPV) of parent's recall with their corresponding 95% confidence interval (CI). These values were calculated per vaccine dose and for the all vaccine combined. Besides, we calculated the degree of agreement between the 2 methods and the reliability of the test estimated using Kappa statistics. These values were also calculated per vaccine dose and for the all vaccine combined.

3. Results and Discussions

3.1. Sample description

A total of 529 households were assessed and 87 children aged 0-59 months identified having vaccination cards and their parents(guarduians) enrolled. Table1 presents the age and sex distribution of the children whose parents were enrolled into the study. Approximately 55.2% of the children were girls and 47% of them were aged 0-11 months. In total, 82(94.25%) of the participants enrolled were one of the biological parents of the children with mothers making the majority 75(86.20%) of participants.

***Table 1**: age and sex distribution of children whose parents were enrolled for parent's recall study in Yaounde*

	0-11months	12-23months	23-59months	Total

	n(%)	n(%)	n(%)	n(%)
Boys	23(56.1)	9(36.0)	7(33.3)	39(44.8)
Girls	18(43.9)	16(64.0)	14(66.7)	48(55.2)
Total	41(100.0)	25(100.0)	21(100.0)	87(100.0)

3.2. validity of parent's recall

When combined for all vaccine doses assessed, the sensitivity and specificity of parent's recall were 63% and 60% respectively. Also, the positive predictive value and negative predictive value were 90% and 23% respectively. However, the kappa test of agreement shows that parent's recall is not very reliable. Table 2 shows the number of times parent's recall was either in agreement or disagreement with the information from the vaccination cards. Note that though only 87 participants were enrolled, depending on the age of the child, one parent could answer up to 15 times on one child, corresponding to the different vaccine doses. This gives rise to the data in table 2 and hence table 3 which presents the validity and reliability parameters of parent's recall for all vaccines.

Table 2: data on immunization history of children obtained from parent's recall and vaccination cards

		Vaccination card		
		Immunized	Unimmunized	Total
Parent's recall	Immunized	570	66	636
	Unimmunized	337	101	438
	Total	907	167	1074

Table 3 presents the sensitivity, specificity, positive predictive value and negative predictive value of parents recall with their corresponding 95% CIs calculated from the data in table 2.

Table 3: validity and reliability of parent's recall for all vaccines

Parameter	Value	95%CI
Sensitivity (Se)	0.63	[0.60, 0.66]
Specificity(Sp)	0.60	[0.53, 0.68]
Positive Predictive value(PPV)	0.90	[0.87, 0.92]
Negative Predictive Value(NPV)	0.23	[0.19, 0.27]
Degree of agreement (d.a)	0.62	[0.60, 0.65]
Kappa statistics	0.14	[0.09, 0.19]

Table 4 shows the parameters of parent's recall validity and reliability for different vaccines. The validity and reliability parameters of parent's recall vary a lot across different vaccine doses. Our findings suggest that parent's recall is more sensitive and less specific for vaccines administered at birth(BCG and OPV0) and vaccines administered at 9 months (Measles and Yellow Fever). When checking the scars on the forearm for BCG compared to vaccination card, the results showed that parent's recall(d.a=94%) is more reliable than scars(d.a=74%) were very similar to that's of the parent's recall for BCG(see table 4). On the other hand, for vaccines administered within 6 weeks-14 weeks, parent's recall turns to be more specific and less sensitive as shown on table 4.

Parent's recall is generally having a good PPVs (77% -100%) and less NPVs(11%-80%) for all EPI vaccines except for OPV1, PCV-13 1, and rota1 that presented opposite findings. However, for MR and YF vaccines, the PPVs and NPVs were similar.

In general, parent's recall was not very reliable with the kappa statistics ≤5% for all vaccines. However, parent's recall had a good degree of agreement(≥80%) for some vaccine doses such as BCG, OPV0, penta1, pcv-13 1 and YF vaccines.

Table 4*: validity and reliability of parent's recall for routine immunization of children per vaccine dose and BCG scars at the forearm using vaccination card as the gold standard.*

Vaccine	Sensitivity(PPV)	Specificity(NPV)	PPV(Sp)	NPV(Se)	d.a	Ka
BCG	0.98 (0.91, 1.00)	0.50 (0.12, 0.88)	0.96 (0.90, 0.99)	0.60 (0.15, 0.95)	0.94	0.51
Polio0	0.91 (0.83, 0.96)	0.43 (0.10, 0.82)	0.95 (0.87, 0.99)	0.30 (0.07, 0.65)	0.87	0.28
Polio1	1.00 (0.84, 1.00)	0.11 (0.04, 0.21)	0.26 (0.17, 0.37)	1.00 (0.59, 1.00)	0.32	0.05
Penta1	0.93 (0.84, 0.98)	0.62 (0.24, 0.91)	0.96 (0.87, 0.99)	0.50 (0.19, 0.81)	0.90	0.50
Pneumo1	0.46 (0.19, 0.75)	0.89 (0.79, 0.95)	0.46 (0.19, 0.75)	0.89 (0.79, 0.95)	0.82	0.35
Rota1	0.43 (0.18, 0.71)	0.83 (0.71, 0.91)	0.35 (0.14, 0.62)	0.87 (0.75, 0.94)	0.75	0.23
Polio2	0.25 (0.15, 0.38)	1.00 (0.54, 1.00)	1.00 (0.79, 1.00)	0.11 (0.04, 0.23)	0.32	0.06
Penta2	0.43 (0.30, 0.56)	1.00 (0.54, 1.00)	1.00 (0.87, 1.00)	0.14 (0.05, 0.29)	0.48	0.11
Pneumo2	0.32 (0.20, 0.45)	0.83 (0.52, 0.98)	0.90 (0.68, 0.99)	0.20 (0.10, 0.34)	0.41	0.07
Rota2	0.64 (0.50, 0.76)	0.43 (0.18, 0.71)	0.81 (0.67, 0.92)	0.23 (0.09, 0.44)	0.59	0.05
Polio3	0.28 (0.16, 0.42)	0.92 (0.62, 1.00)	0.94 (0.70, 1.00)	0.22 (0.12, 0.36)	0.39	0.09
Penta3	0.42 (0.29, 0.56)	0.73 (0.39, 0.94)	0.88 (0.70, 0.98)	0.20 (0.09, 0.36)	0.47	0.07
Pneumo3	0.40 (0.27, 0.55)	0.64 (0.35, 0.87)	0.81 (0.61, 0.93)	0.22 (0.11, 0.38)	0.45	0.03

MR	0.92 (0.78, 0.98)	0.41 (0.18, 0.67)	0.77 (0.62, 0.89)	0.70 (0.35, 0.93)	0.76	0.37
YF	0.95 (0.82, 0.99)	0.47 (0.23, 0.72)	0.80 (0.65, 0.90)	0.80 (0.44, 0.97)	0.80	0.47
BCG Scars	0.77 (0.66, 0.85)	0.33 (0.04, 0.78)	0.94 (0.85, 0.98)	0.10 (0.01, 0.30)	0.74	0.05

PPV= positive predictive value, *NPV*= Negative predictive value, *d.a* = Proportion of agreement between the two methods and *ka* = Kappa constant for reliability.

A few number of studies have assessed the validity of parent's recall for immunization using vaccination card or vaccination register as the gold standard in a limited number of countries(4,13,16,17). Based on the findings from this studies, it can be observed that the specificity, sensitivity of parent 's recall for immunization various across vaccines(13). This is similar with our findings as we observed that validity changes with vaccine.

A systematic review on the validity of parent's recall suggested that we do not yet have enough evidence to make a definitive conclusion on the subject(13). On the other hand, another study in Tanzania suggested that sensitivity of parent's recall was very good(>93%) and more stable across different vaccines while specificity varies very widely across vaccines between 16%-95%(10). However, this particular study in Tanzania included only children borne within 12 months to the survey meanwhile our study targeted children 0- 59 months. It could be explained by the fact that more than 50% of our participants were children aged 12-59 months giving more chance for the parents to have forgotten the vaccines received. In another study, it was observed that parents mostly report correctly the immunization status of children less than 6 months than older children(12). We therefore expect our study to have more recall bias compared to this study in Tanzania. Several other studies have reported that parent's recall is not reliable for evaluating immunization status of children(12,20). However, studies have not attempted to describe the variability of this across vaccines. Because of recall's bias, relying on parent's recall, during routine service delivery exposes the child to the risk of missing some vaccines or being re-vaccinated unnecessarily(12,13).

Currently, parent's recall sometimes is the last resort and there is no other way to assess the vaccination status of the child especially in low income countries where the health information system is very weak(15,21). There is therefore the need to improve the immunization information system in Cameroon. This is to reduce how much we rely on parent's recall which is less reliable.

CONCLUSIONS

The sensitivity, specificity, positive predictive value, and negative predictive value of parent's recall for routine immunization in Cameroon are respectively 63%, 60%, 90%, and 23%. Parent's recall varies from one vaccine to another and it is more sensitive and less specific for vaccines administered at birth(BCG and OPV0) and vaccines administered at 9 months (MR and YF).

When compared to checking the scars on the forearm for BCG, parent's recall was more reliable in evaluation BCG immunization in children with a recall bias of 6% against 27% for scars. Generally, parent's recall is not very reliable for assessing a child's immunization status. Based on this findings, we propose the following recommendations:

- Parent's recall for routine immunization should be used only in the absence of vaccination card. However, it could be used with less risk of recall bias if we have to assess only the immunization coverage in BCG, Measles, and Yellow Fever vaccines.

- To verify BCG immunization status of the child when the vaccination card is not available, we recommend to use parent's recall instead of scars on the forarm.

ACKNOWLEDGEMENTS

We are thankful to the following people or group of people:

- Members of data collection team: Miss DOUANLA KOUTIO Ingrid Marcelle, Miss TCHENGO MASSOM THÉRÈSE ZITA, Miss Christelle Bertyl TCHANA MBETBEUM, and Miss Ngueni Letegnou Nancy.

- Professor Djuidje Marceline, providing training venue for data collectors training.

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