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Research Article

Exploration of the Completion Quality of Routine Vaccination Cards Kept At Home in the Provincial Health Division of Équateur, Democratic Republic of the Congo

IMAMBO BOTULI Saddam[1] and Aimée LULEBO MAMPASI[2]

[1]MPH, Community Health, School of Public Health, University of Kinshasa, Democratic Republic of Congo.

[2]MPH, PhD, Department of Epidemiology and Biostatistics, University of Kinshasa, Democratic Republic of Congo.

Article Info:

Corresponding author:
IMAMBO BOTULI Saddam
MPH, Community Health,
School of Public Health,
University of Kinshasa
saddamimambo@gmail.com

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Abstract

Introduction: Vaccination cards kept at home are an important source of information for verifying children's vaccination status and for vaccination coverage surveys. However, the quality of the information recorded on them determines their usefulness as a documentary source.

Methods: A descriptive exploratory study was conducted through secondary analysis of 100 photographs of vaccination cards for children aged 6–23 months, collected during the 2022 Vaccination Coverage Survey in Équateur Province, DRC. Cards were assessed using WHO data-quality review criteria across ten predefined elements. A card was considered complete when all identification, vaccination, chronology, legibility, and documentation fields were correctly completed, with provider validation by signature or stamp assessed separately. Frequencies, percentages, and descriptive observations were used to summarize findings.

Results: Of the 100 cards examined, errors or omissions concerned the child's name in 25% of cases, the date of birth in 11%, the sex in 2%, and the name of the parent or guardian in 15%. Omissions or inconsistencies in vaccination dates were observed in 48% of the cards, and discrepancies in vaccination chronology in 59%. No card bore the vaccinator's signature or the facility's stamp. The handwriting was legible and indelible in 60% of the cards, while 29% contained erasures or annotations. Excluding validation by signature or stamp, 9% of the cards were complete and correctly filled out.

Conclusion: Review of the cards reveals documentation deficiencies, primarily concerning vaccination dates, dose sequences, validation of procedures, and completeness. Strengthening the standardization of data formats, training, supervision, and data quality control mechanisms appears necessary to improve the reliability of the information recorded on the cards.

Keywords: vaccination cards; data quality; routine immunization; Equateur; Democratic Republic of the Congo.

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I. Introduction

Vaccination is one of the most effective public health interventions for preventing infant morbidity and mortality [1]. Immunization cards play an important role in individual child monitoring, verification of vaccination status, and vaccination coverage surveys [2-4]. However, their usefulness depends on card availability and the quality of the information recorded on them.

In the Democratic Republic of Congo (DRC), vaccination coverage surveys show lower coverage levels than those sometimes suggested by administrative data. At the national level, the 2023 vaccination Coverage Survey(VCS) estimated coverage of the first dose of the pentavalent vaccine (Penta 1) at 80.5% and coverage of the third dose (Penta 3) at 57.6% among children aged 12 to 23 months [5]. In Équateur Province, the available data also demonstrate the value of comparing sources: administrative coverage for Penta 1 was considered close to the 2023 ICS estimates, while administrative data from January to September 2024 remained close to the 2023 VCS estimate for this province [5].

This comparison between sources is important because the quality of vaccination data depends, in particular, on the accuracy, completeness, and consistency of primary documents. Data quality reviews conducted in the DRC have reported problems with inconsistencies, missing values, and the reliability of information used for vaccination monitoring [6-8]. In this context, the vaccination card kept at home represents a primary document that allows verification of the doses received by the child when it is available and correctly filled out.

In the Équateur Province, geographical constraints, the diversity of health zones, and logistical difficulties create a unique context for service delivery and the documentation of vaccination activities [9]. Analysis of cards kept in households can therefore provide additional information on the quality of vaccination record-keeping and on factors that may limit their use as a data source.

The present study aimed to explore the quality of completion of routine vaccination cards kept at home for children aged 6 to 23 months in the Équateur Province, based on photographs collected during the Vaccination Coverage Survey (VCS) 2022, describing the main errors, omissions and irregularities observed.

II. Methods

Study framework

The study was conducted in the Provincial Health Division (DPS) of Équateur, located in northwestern DRC. The province is bordered by the Congo River and several other waterways. In 2025, its population was estimated at 3,291,850 inhabitants over an area of 103,902 km², resulting in a population density of 32 inhabitants/km². The DPS comprised 18 health zones, 18 central health zone offices, 18 general referral hospitals, one provincial hospital, and 284 health centers. Immunization services were offered in public health facilities as well as in licensed private clinics.

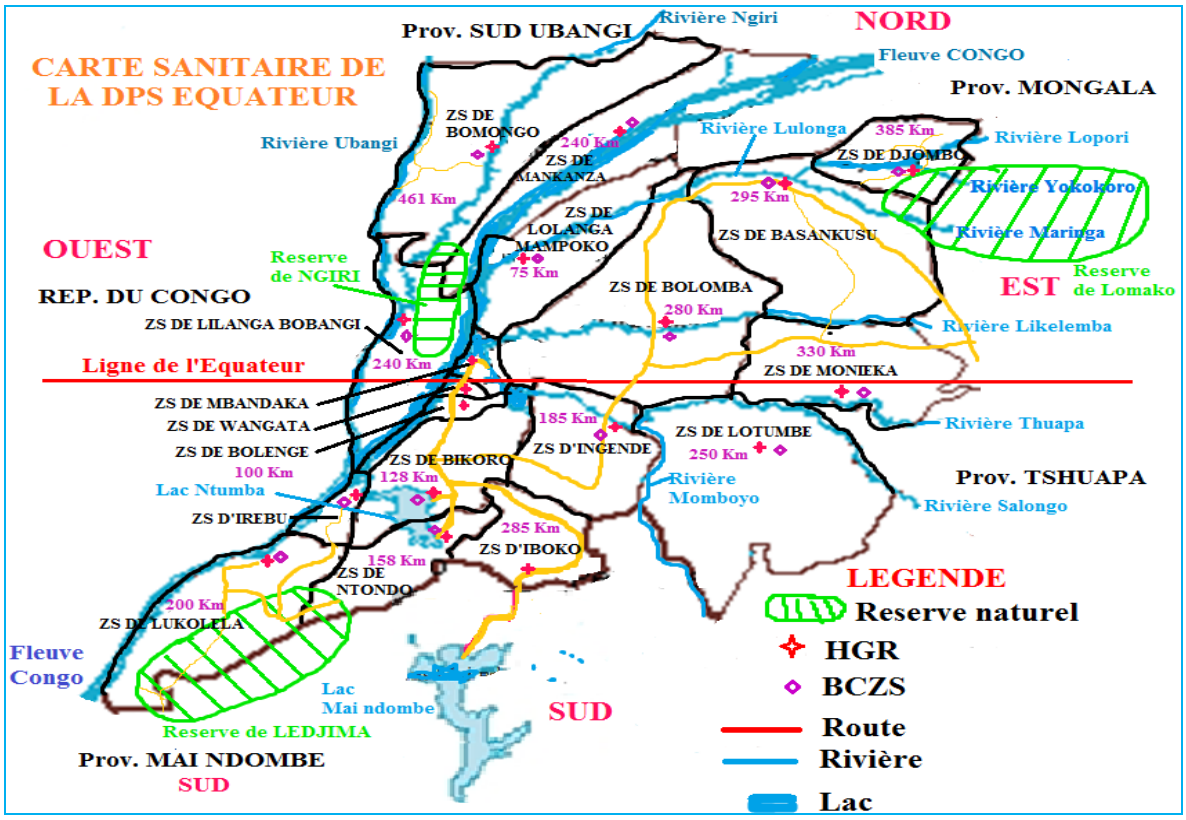


Figure 1. Postcard from DPS Equateur

Study Design and Period

A descriptive exploratory secondary analysis was conducted on photographs of vaccination cards collected during the 2022 Vaccination Coverage Survey (VCS) in Équateur Province, Democratic Republic of the Congo (DRC). The analysis focused on the completeness, accuracy, legibility, and documentation quality of the information recorded on the cards.

Study Population and Unit of Analysis

The study population consisted of photographs of vaccination cards for children aged 6–23 months included in the 2022 VCS database for Équateur Province. The photograph of an individual vaccination card constituted the unit of analysis.

Sample Size and Sampling Technique

A purposive sample of 100 vaccination-card photographs was selected for detailed examination. This sample size was chosen to support the exploratory objective of describing visible errors, omissions, and documentation deficiencies. The photographs had originally been collected from surveyed households using electronic tablets by trained interviewers after obtaining parental or guardian consent.

A purposive sample of 100 vaccination-card photographs was selected from the 2022 Vaccination Coverage Survey database for Équateur Province, Democratic Republic of the Congo. The photographs were examined to assess the completeness, accuracy, legibility, and documentation quality of the recorded information. The selection criteria and the total number of eligible photographs in the original database could not be established from the available study records. Therefore, the findings are limited to the 100 photographs examined and should not be interpreted as representative of all vaccination cards in the province.

Variables and Assessment Criteria

The assessment was guided by the World Health Organization (WHO) document *Review of the Quality of Immunization Data: Module on Immunization Records and Cards* [6]. Ten predefined elements were examined: the child's full name, date of birth, sex, parent's or guardian's name, vaccination dates, adherence to the recommended vaccination chronology, presence of the vaccinator's signature or health

facility stamp, legibility and indelibility of the ink, presence of erasures or unnecessary annotations, and overall completeness of the card. Card type (standard Expanded Programme on Immunization [EPI] card or non-standard card) was also recorded as a supplementary descriptive variable.

For each element, the information was assessed for presence, completeness, legibility, and consistency with the predefined assessment criteria, as applicable. A card was considered complete in the primary descriptive assessment when all predefined identification, vaccination, chronology, legibility, and documentation fields were correctly completed. Provider validation through a vaccinator's signature or health facility stamp was assessed separately.

Accordingly, the proportion of cards meeting the completeness criteria excluding provider validation was calculated separately from the proportion satisfying all criteria, including provider validation. If provider validation is considered mandatory for full completeness under the applicable assessment standard, a card lacking both a valid signature and a facility stamp was classified as not fully complete.

Data Collection and Quality Assessment

The analysis relied on two documentary sources: photographs of vaccination cards from the 2022 VCS database and reference documents concerning vaccination-card standards and immunization data quality. Each photograph was systematically examined using a predefined assessment grid. Information was classified as present, missing, incomplete, illegible, or inconsistent, as appropriate. Visible physical and documentation defects, including erasures, unnecessary annotations, and the absence of provider validation, were also recorded.

WHO guidance and relevant EPI documents were used to inform the assessment criteria. UNICEF publications and available evaluation reports were consulted where relevant to contextualize the findings. Because this was a secondary analysis of existing photographs, no new household data collection was undertaken.

Data Management and Analysis

Data extracted from the photographs were entered into a structured analysis matrix in Microsoft Excel. Each of the 100 photographs was reviewed systematically against the predefined assessment criteria. Observations were coded according to the presence or absence of required information and the type of error or omission identified.

Categorical findings were summarized using frequencies and percentages. Overall completeness was reported separately according to whether provider validation was excluded or included in the assessment. Qualitative observations concerning visible defects were summarized descriptively to illustrate the nature of the documentation problems identified. The findings were presented narratively and in tables, where appropriate. No inferential statistical analysis was undertaken, as the study aimed primarily to describe the observed characteristics of the selected vaccination-card photographs.

Ethical Considerations

The original 2022 Vaccination Coverage Survey was approved by the Ethics Committee of the Kinshasa School of Public Health, University of Kinshasa (Approval No. ESP/CE/175/2021), and parental or guardian consent was obtained. This secondary analysis used de-identified photographs without direct participant contact. Authorization or ethical approval for the secondary analysis was obtained.

Results

Table 1. Quality of completion of vaccination cards (n = 100)

Variable	Cards with problem, n	%
Child's name	25	25
Date of birth	11	11
Sex	2	2
Parent/guardian name	15	15

Vaccination dates	48	48
Vaccination chronology	59	59
Vaccinator signature/facility stamp	100	100
Legible and indelible ink	40	40
Erasures/annotations	29	29
Complete and correctly filled, excluding validation	9	9

The analysis was based on 100 photographs of vaccination cards belonging to children aged 6–23 months, obtained from the 2022 Vaccination Coverage Survey (VCS) conducted in Équateur Province, Democratic Republic of the Congo. The assessment examined the completeness and quality of card entries across six domains: child identification, parent or guardian identification, vaccination information, healthcare provider validation, legibility and integrity of recorded information, and overall completeness. The findings revealed substantial deficiencies, particularly the absence of the vaccinator's signature or health facility stamp (100%) and problems with vaccination chronology (59%). Missing or incorrect vaccination dates (48%) and poor legibility of entries (40%) were also common. Overall, only 9% of the cards were correctly completed, excluding provider validation, highlighting important gaps in vaccination documentation practices.

1. Child identification

Of the 100 cards examined, 25% had an anomaly concerning the child's name, including an incomplete name, a reversal of the first and last name, a spelling mistake, or the absence of the last name. The date of birth was missing or incorrect on 11% of the cards, with missing dates, inconsistencies with the child's age, day/month reversals, or poor legibility. The sex was missing on 2% of the cards.

2. Identification of the parent or guardian

The name of the parent or guardian was missing, incomplete or illegible in 15% of the cards.

3. Vaccination Information

Omissions or inconsistencies regarding vaccination dates were observed in 48% of the cards. These anomalies included missing dates for one or more doses, inconsistencies with the child's age or the vaccination schedule, day and month reversals, and formatting errors. Deviations from the vaccination chronology were observed in 59% of the cards.

4. Validation of the service provider

None of the 100 cards examined bore the signature of the vaccinator or the stamp of the facility.

5. Material quality of the filling

The ink used was legible and indelible in 60% of the cards, while 40% showed blurry or erased writing. Non-standard erasures or annotations were present in 29% of the cards; 71% did not.

6. Overall completeness and additional observations

None of the 100 vaccination cards was fully complete when provider validation, defined as the vaccinator's signature or the health facility stamp, was taken into account. Excluding this validation requirement, only 9% of the cards were complete and correctly filled out, whereas 91% contained at least one missing or incorrectly recorded piece of information. Additional physical and documentary irregularities were observed, including worn cards, folded corners, tears, and liquid stains. Variations in ink color and handwriting were also noted on some cards, suggesting inconsistencies in the recording and maintenance of vaccination information.

III. Discussion

This study assessed the quality and usability of 100 photographs of vaccination cards belonging to children aged 6–23 months from the 2022 Vaccination Coverage Survey (VCS) conducted in Équateur Province, Democratic Republic of the Congo. The findings revealed deficiencies in the documentation of vaccination histories, particularly in dose chronology, vaccination dates, provider validation, and the legibility of recorded information. These observations highlight an important distinction between vaccine administration and its documentation: a dose may have been administered even when the corresponding entry is incomplete, but deficiencies in the record can make its

verification difficult. Similar challenges have been described in studies of immunization data quality in low- and middle-income countries [7,8,10–12]. The present findings should therefore be interpreted as evidence of limitations in the quality of the photographed records rather than direct evidence of deficiencies in vaccine administration.

The completeness and accuracy of vaccination dates are particularly important for determining whether documented doses meet the applicable vaccination schedule. Birth dates and vaccination dates allow health workers and survey teams to assess the child's age at vaccination, verify intervals between doses, and identify doses whose validity cannot be established from the available information. When dates are missing, illegible, or inconsistent, the vaccination history may remain uncertain even when a dose has potentially been administered correctly. In vaccination coverage surveys, this uncertainty can complicate the classification of children according to vaccination status and may affect coverage estimates, depending on the verification rules and procedures applied. It can also hinder decisions during subsequent health visits, when providers need to establish which doses have been received and which are due. WHO guidance on immunization data quality emphasizes the importance of reviewing source documents and identifying weaknesses in recording and reporting processes [6,13]. Accordingly, improving the accuracy of vaccination dates and dose chronology should be considered a priority for both reliable coverage measurement and continuity of child follow-up.

The absence of the vaccinator's signature or health facility stamp on all 100 photographed cards is another important finding. However, this absence does not demonstrate that the recorded vaccines were not administered, nor does it automatically invalidate the information entered on the cards. Rather, it indicates that the conventional provider-validation elements assessed in this study were not visible on the photographs. This limits the extent to which the cards themselves can provide documentary confirmation of the recorded entries. In coverage surveys, the implications depend on the survey protocol and the availability of alternative evidence, such as vaccination registers or other reliable records. The finding therefore points to a need for stronger adherence to documentation procedures and more consistent completion of validation fields, while avoiding the assumption that an unvalidated entry necessarily represents an unadministered dose.

Deficiencies in child and parent or guardian identification may further reduce the practical usefulness of vaccination cards. Missing or incorrect identifying details can make it more difficult to link a record to the correct child, particularly during subsequent consultations, vaccination campaigns, or reviews of immunization status. Likewise, poor legibility and physical deterioration may limit the retrieval of information over time. These issues are especially relevant when families rely on home-based records to communicate vaccination histories between health facilities. Vaccination cards serve not only as reminders for caregivers but also as a link between households and health services; their usefulness depends on the accuracy, legibility, and traceability of the information recorded [14–16]. The observed deficiencies therefore support the need to improve record completion and preservation, although the present study did not measure their actual effects on missed or delayed vaccinations.

The relationship between card quality and vaccination coverage estimates also requires careful interpretation. Administrative data and household surveys rely on different data collection and verification processes, and discrepancies between them may arise from several sources, including incomplete reporting, denominator inaccuracies, recall, and limitations in source documentation. The broader literature has documented persistent challenges in immunization data quality in low- and middle-income countries and has highlighted the importance of standardized data collection tools, staff capacity-building, supervision, and timely feedback [10–12]. WHO's Data Quality Self-assessment framework similarly recommends reviewing source documents and routine recording and reporting practices to identify

weaknesses requiring corrective action [6,13]. Nevertheless, the present study did not compare the photographed cards with facility registers or independently calculated coverage estimates. It therefore cannot determine whether the observed card deficiencies caused, or contributed to, any particular discrepancy in reported vaccination coverage. Any national or provincial coverage figures included for comparison should be clearly identified by source, survey year, population, and antigen, and should be used as contextual information rather than as evidence of a direct relationship with card quality [5].

Several organizational factors could potentially contribute to deficiencies in vaccination documentation. Previous studies have identified limitations in health worker capacity, data management processes, the availability of appropriate recording tools, supervision, and feedback as challenges affecting immunization data quality in low- and middle-income settings [10–12]. These factors are plausible explanations for the findings in Équateur Province, but they were not directly investigated in this study and cannot be established as causes. Practical interventions could nevertheless address these potential weaknesses through regular training on the correct completion of vaccination cards, clear instructions for recording dates and dose sequences, reliable availability of standardized materials, and routine supportive supervision. Periodic reviews of completed cards, followed by specific feedback to health workers, could help identify recurrent errors and monitor improvements over time. Such measures would complement vaccine-delivery activities by strengthening the documentation needed to verify vaccination histories and support program monitoring [6,13].

Finally, the physical deterioration of some cards and the observed variations in card appearance, ink, and handwriting raise questions about the preservation and consistency of home-based records. Damaged or poorly legible records may become less useful as children move between health facilities or return for later doses. Standardized card formats, appropriate storage by caregivers, and consistent recording practices could help preserve the information required for follow-up. Digital immunization registries may provide an additional means of retrieving vaccination histories when paper records are lost or damaged; however, digital systems cannot automatically correct incomplete or inaccurate information entered at the point of vaccination. Their contribution would depend on reliable initial data entry, appropriate infrastructure, staff training, and routine data quality checks [17]. Where feasible, digital records should therefore complement rather than replace efforts to improve paper-based documentation.

Overall, this study identifies weaknesses in the completeness, legibility, chronology, and provider validation of the information visible on vaccination-card photographs from Équateur Province. Only 9% of cards were complete and correctly filled out when provider validation was excluded; none met all the assessment criteria when provider validation was required. These results demonstrate limitations in the documentary completeness of the records, but they do not establish that vaccines were not administered or quantify the effect of card quality on vaccination coverage. Strengthening standardized recording practices, provider validation, supportive supervision, and routine verification of source documents may improve the reliability and usability of vaccination records and support more consistent follow-up of children.

This study has several limitations. First, the analysis was based on photographs of vaccination cards collected during a previous survey, which limited the assessment to information visible in the images and prevented systematic verification of the recorded entries with parents or guardians, healthcare providers, or facility registers. Second, the physical condition of some cards, including photocopies, tears, and liquid stains, may have affected the legibility of certain entries and the assessment of documentation quality. Finally, the exploratory sample of 100 card photographs does not allow the findings to be generalized to all vaccination cards in Équateur Province or the prevalence of documentation anomalies to be estimated at the provincial level. Nevertheless, this analysis provides an initial assessment of the

completeness and legibility of home-based vaccination records and identifies areas for improvement in vaccination documentation practices.

Conclusion

Analysis of 100 vaccination card photographs from Équateur Province revealed deficiencies in identification, vaccination dates, dose chronology, and information completeness. The absence of provider signatures or facility stamps further limited documentary validation. These findings highlight the need for standardized documentation, healthcare provider training, supportive supervision, and routine quality checks to improve the completeness, consistency, and reliability of vaccination records and support effective child follow-up.

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Disclaimer

The opinions expressed in this manuscript are those of the authors and do not necessarily reflect the views of their affiliated academic or health institutions.

Ethical Statement

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Data Availability

The data used in this study are available from the corresponding author, IMAMBO BOTULI Saddam, upon reasonable request. Access is subject to applicable ethical requirements and confidentiality protections.

Author Contributions

- **IMAMBO BOTULI Saddam:** Conceptualization, study design, data analysis and interpretation, and manuscript drafting and revision.
- **Aimée LULEBO MAMPASI:** Methodological guidance, critical review of the manuscript, and supervision.

Both authors reviewed and approved the final version of the manuscript.

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Competing Interests

The authors declare that they have no competing financial or non-financial interests that could have influenced the work reported in this manuscript.

Declaration of AI-Assisted Writing

The authors used an AI-assisted language tool, to assist with language editing and manuscript preparation. The authors reviewed and revised the content and take full responsibility for the accuracy, originality, and integrity of the manuscript. The AI tool was not considered an author, and the authors remain responsible for all claims, interpretations, references, and conclusions presented in the article.

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