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Evaluation of the Effect of Implementing the "Zero-Dose" Children Identification Strategy on Vaccination Coverage in Konseguela, 2024

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Abstract:

➢ ***Introduction:***

"Zero-dose" children are those who have not received any dose of routine vaccines. These children represent a major challenge to achieving vaccination coverage goals, especially in rural areas where geographic inaccessibility, mistrust of health services, poverty, and parental ignorance contribute to their lack of vaccination. In Konséguéla, an active search strategy for zero-dose children was implemented in 2024 with the support of community health workers and local leaders. This study was conducted to assess the effect of implementing the "zero dose" child search strategy on vaccination coverage in Konséguéla, comparing the results with those of a control site (Kôkô) where the strategy was not applied.

➢ ***Methodology:***

This was a before-and-after study with a control site, retrospective and analytical, using a mixed-methods approach. A non-probability sampling method was used. Data collected were analyzed using IBM SPSS Statistics 25 and Excel 2016. The tools included a questionnaire and an interview guide to identify challenges related to the vaccination of zero-dose children.

➢ ***Results:***

The study revealed a clear increase in vaccination coverage rates in Konséguéla after the implementation of the strategy: (BCG: 61.21% → 95.06%) ;(Penta1: 84.67% → 90.12%) ; (Penta3: 86.32% → 90.43%) et (VAR1-RR1: 88.27% → 90.33%). In Kôkô, the control site, the coverage rates remained generally stable. The comparison of these averages using the Wilcoxon test showed that there was no statistically significant difference between the two periods. The main barriers identified were: low educational level of parents, difficult geographic accessibility, socio-cultural barriers, forgetfulness or refusal from fathers, lack of information, family displacement, logistical constraints, limited resources, and lack of parental motivation.

➢ ***Conclusion:***

Overall, the study shows that the zero-dose child tracing strategy implemented in Konséguéla in 2024 did not lead to a significant improvement in vaccination coverage, despite an observed increase in coverage rates after the strategy was introduced. These findings support international recommendations to integrate the identification and tracing of unvaccinated children into routine immunization programs, particularly in areas with low coverage or high dropout rates.

Keywords: *Evaluation, Effect, Implementation, Search Strategy, Zero-Dose Children, Vaccination Coverage, Konséguéla.*

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I. INTRODUCTION

Zero-dose children are those who have not received any routine vaccinations. For operational purposes, GAVI defines zero-dose children as those who have not received a first dose of the combined diphtheria, tetanus and pertussis (DTP1) vaccine[1]. This makes these children vulnerable to these preventable diseases and increases their susceptibility to sources of infection for other children.

These so-called "zero-dose" children represent a major challenge to achieving vaccination coverage targets[2].

Between 2019 and 2021, 67 million children worldwide did not receive all their vaccinations, including 48 million who received none at all[3].

In 2023, global childhood vaccination coverage stagnated according to the WHO and UNICEF, while the number of "zero-dose" children increased from 13.9 million in 2022 to 14.5 million. Zero-dose children, who have not received any doses of vaccines included in the immunisation schedules, are particularly vulnerable to preventable diseases such as measles, polio and tetanus[4,5].

Africa is the region with the highest number of unvaccinated or under-vaccinated children: 12.7 million children were under-vaccinated in 2021, of whom 8.7 million had not received any doses, also known as "zero-dose" children. The majority of these children live in poor and marginalised areas, facing challenges such as insecurity, weak health systems and geographical barriers[3].

Inequalities in access to healthcare, exacerbated by the COVID-19 pandemic, are hindering progress. These disparities highlight the need for targeted initiatives to identify and vaccinate "zero-dose" children, with a priority on rural, isolated or conflict-affected areas[6].

Mali, classified as a fragile country in 2021 by Gavi, faces a worrying situation in terms of vaccination. In 2020, approximately 136,365 Malian children, or 18%, were considered "zero dose", placing the country 7th in Africa for the number of unvaccinated children. In 2022, Mali also ranked 13th on the continent for low DTP1 vaccination coverage[7].

Although vaccination indicators have improved significantly over the last decade, disparities persist between regions and even within health districts. In some areas, particularly rural areas, geographical inaccessibility, mistrust of health services, poverty, and parental ignorance contribute to the persistence of pockets of unvaccinated children [8].

In response to this problem, new strategies have been implemented to identify and vaccinate children who have not received any doses. These include an active community search strategy, in collaboration with intermediaries, community health workers (CHWs) and local leaders, aimed at locating these children, understanding the barriers to vaccination, and integrating them into the expanded programme on immunisation (EPI). The implementation of this strategy is a promising approach.

In this context, numerous initiatives have been developed in the Koutiala health district, including in Konséguéla in 2024, such as advocacy sessions with political, administrative and religious authorities and stakeholders on the local mobilisation of resources for vaccination and malnutrition to improve the identification and vaccination coverage of 'zero-dose' children, in particular through the implementation of targeted community strategies. However, their actual effectiveness in improving vaccination coverage remains poorly documented. Therefore, the central question addressed by this study is: did the strategy of actively searching for zero-dose children implemented in Konséguéla in 2024 significantly improve vaccination coverage in this health area? Answering this question is essential for adapting public health interventions in a context of limited resources and high health challenges.

Despite the significant efforts of the Expanded Programme on Immunisation in Mali, children continue to slip through the healthcare system, particularly in rural and remote areas. These "zero-dose" children represent a major challenge to achieving immunisation targets and controlling vaccine-preventable diseases[9].

In Konséguéla, as in other health areas in the Koutiala district, the existence of pockets of unvaccinated children contributes to maintaining community vulnerability to epidemic outbreaks.

Identifying and vaccinating these children is an essential strategy for strengthening health equity and improving global vaccination coverage[10].

It is essential to evaluate the impact of this strategy on vaccination coverage in order to measure its effectiveness and consider extending it to other health areas. This study is therefore part of an operational evaluation. It aims to determine the effect of this strategy on vaccination coverage of children under 2 years of age in the Konséguéla health area.

II. METHODOLOGY

- *Study Framework:*

The study was conducted in two health areas located in the Koutiala health district.

The Koutiala health district covers the population of the former Koutiala circle. It is located in the north of the Sikasso

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region. It covers an area of 12,270 km². It has 263 villages spread across 36 rural communes and one urban commune. It is bordered to the north-west by the Bla and San districts, to the west by the Dioïla district, to the south by the Sikasso district and the Republic of Burkina Faso, and to the east by the Yorosso district.

The district has a referral health centre (CSRéf) and 48 functional health areas. In addition to these, there are 153 community health worker (ASC) sites, 106 rural maternity wards and 61 private health facilities. All of these factors work together in perfect harmony to promote the health and well-being of the population in the health district and surrounding areas.

- *Intervention Site: Konséguéla Health Area*

Located 52 km from Koutiala, in the rural commune of Konséguéla, it has a population of 48,427 inhabitants in 2024, including 10,654 children aged 0-59 months and 3,390 children aged 0-23 months. It has 22 villages, 7 ASC sites, 40 community relays and 17 GSANs.

- *Control Site: Kôkô Health Area*

Located in the commune of Koutiala, capital of the Koutiala district, it has a population of 53,326 inhabitants in 2024, including 11,732 children aged 0-59 months and 3,733 children aged 0-23 months. It has 4 villages, 2 ASC sites, 12 community relays and 46 GSANs.

The Kôkô health area was selected as a contemporary control site. Located in the same health zone, it has characteristics comparable to those of Konséguéla.

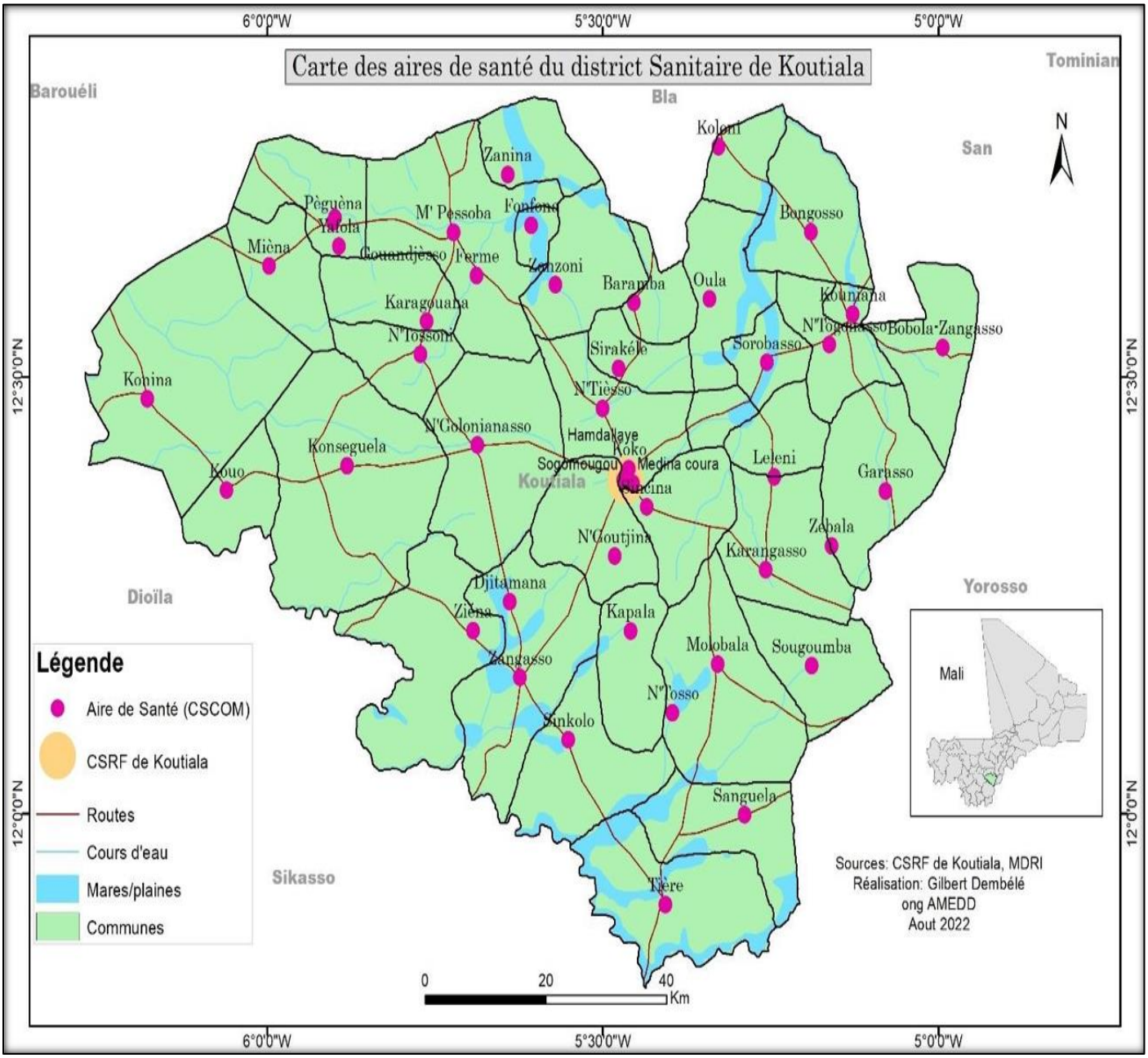

Fig 1 Map of the Koutiala Health District

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➢ *Type of Study:*

This was a retrospective, analytical, before-and-after study with a contemporary control site, designed to evaluate the effect of implementing the zero-dose child search strategy on vaccination coverage and to conduct an exploratory study to understand the difficulties hindering the implementation of zero-dose child vaccination.

➢ *Data Collection Period:*

Data collection took place from 12 to 26 June 2025 and covered data from March to August 2024 (period before implementation of the strategy) and data from September 2024 to February 2025 (period after implementation of the strategy) for the zero-dose search.

➢ *Study Population*

- Target Population: data on children aged 0 to 23 months who have not received the first dose of DTC1 according to the vaccination schedule (zero doses) living in the Konséguéla and Kôkô health areas;
- Participants: parents or guardians of "zero dose" children and vaccination personnel working in the Konséguéla and Kôkô health areas.

- *Inclusion Criteria*

Our study included the records of children aged 0 to 23 months who had not received the first dose of DTC1 according to the recommended vaccination schedule and who lived in the targeted areas;

Parents or guardians living with "zero dose" children who agreed to participate in the survey; personnel involved in vaccination in the health areas selected for the study.

- *Exclusion Criteria:*

The following were not included in our study: The records of children aged 0 to 23 months who received their first dose of DTC1 during the specified period; children with medical conditions that prevented vaccination; children over 2 years of age or living outside the Konséguéla and Kôkô area (off-target); parents or guardians who were unavailable to participate in the survey or who refused to participate; health workers or other medical professionals who did not have a direct role in vaccinating children in the areas targeted by the "zero dose" strategy.

➢ *Information Collection Tools:*

The information collection tools were:

- Routine vaccination records (vaccination registers, vaccination booklets)
- Monthly vaccination reports compiled in DHIS2;
- The database of "zero dose" children;
- Community survey reports or monitoring forms used by community relays;
- Interview guides for personnel involved in implementing the strategy for identifying and vaccinating "zero dose" children;
- Interview guides for mothers or guardians of "zero dose" children.

➢ *Sampling*

- *Sampling Methods and Techniques*

The non-probabilistic sampling method with the reasoned choice technique for each case was used in this study:

✓ Data on children who received no doses: using exhaustive selection methods, we collected data in the selected health areas:
✓ Mothers of children: to comply with the principle of non-saturation and avoid redundancy in qualitative studies, we selected 12 mothers of children who were interviewed after giving their consent.
✓ Staff involved in vaccination: using a reasoned selection technique, six people with experience in implementing the strategy and involved in vaccination were selected for the study.

- *Data Collection Process*

We collected data six months before and six months after the strategy was implemented in the Konséguéla and Kôkô health area by using registers, summary reports and DHIS2 data from 2024 to 2025.

The questions in the interview guide were tested before the actual field survey began.

The topics addressed to mothers or guardians of children focused on access to and availability of services; knowledge and perceptions of vaccination; barriers to vaccination; and suggestions for improvement.

The topics for health workers, community relays and ASACO members focused on the context and role; identifying zero-dose children; obstacles encountered; resources and capacities; suggestions and needs.

➢ *Data Processing and Analysis:*

- Quantitative Data: The data collected was analysed using Excel 2016 and IBM SPSS 25, with Zotero used for bibliographic references.

Vaccination coverage was compared over the six-month period before and after the implementation of the strategy in the Konséguéla and Kôkô health areas using the non-parametric Wilcoxon test for paired samples, which is recommended when the sample size is small (with a significance threshold of $p < 0.05$).

- Qualitative Data: An analysis of the content of the interviewees' statements, interview by interview and theme by theme, using a manual content analysis grid and NVIVO software, according to the following procedure: coding of themes and speakers, transcription of responses, coding of responses by theme, grouping of similar ideas

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into sub-themes. Once this was done, we created a word cloud.

➢ *Ethical Considerations:*

The ethical aspects of the evaluation focused on:

- Informed consent: verbal informed consent from participants after informing them about the objectives, risks and benefits of the study and explaining their freedom to withdraw their consent at any time during the survey.
- Confidentiality and anonymity: anonymity and confidentiality were guaranteed throughout the survey period by protecting participants' personal information and restricting access to data.
- Protection of vulnerable groups: specific measures were taken to protect children and participants with low literacy levels.
- Risk minimisation: risks were reduced so that the participation of interviewees did not compromise their healthcare.

III. RESULTS

This study aimed to evaluate the effect of implementing the "zero dose" child search strategy on vaccination coverage among children aged 0 to 23 months in the Konséguéla health area. It generated useful data for optimising vaccination strategies and decision-making. It focuses on the conditions that facilitate or hinder the reaching of unvaccinated children and on changes in vaccination coverage (Fig. 2).

➢ *Quantitative Results*

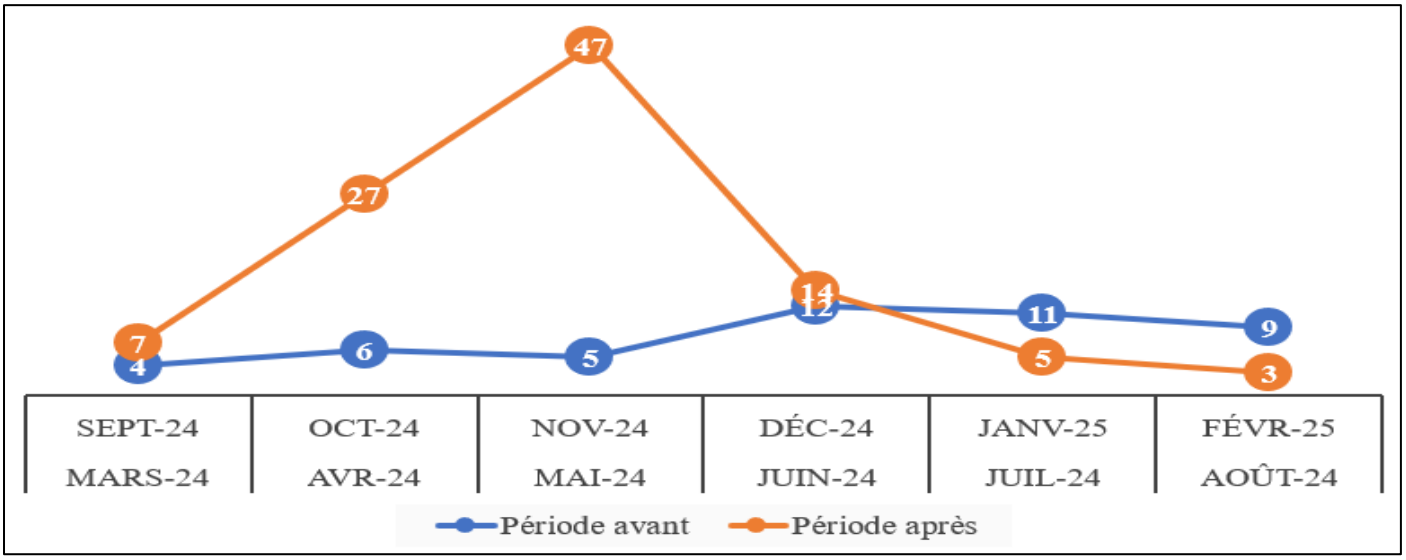

Fig 2 Number of Zero-Dose Children Caught up before and after the Implementation of the Active Search Strategy in Konséguéla

This figure shows the monthly evolution of the number of zero-dose children caught up in Konséguéla before and after the implementation of the zero-dose child search strategy.

We analysed vaccination coverage in Kôkô, the contemporary control site (Fig. 3).

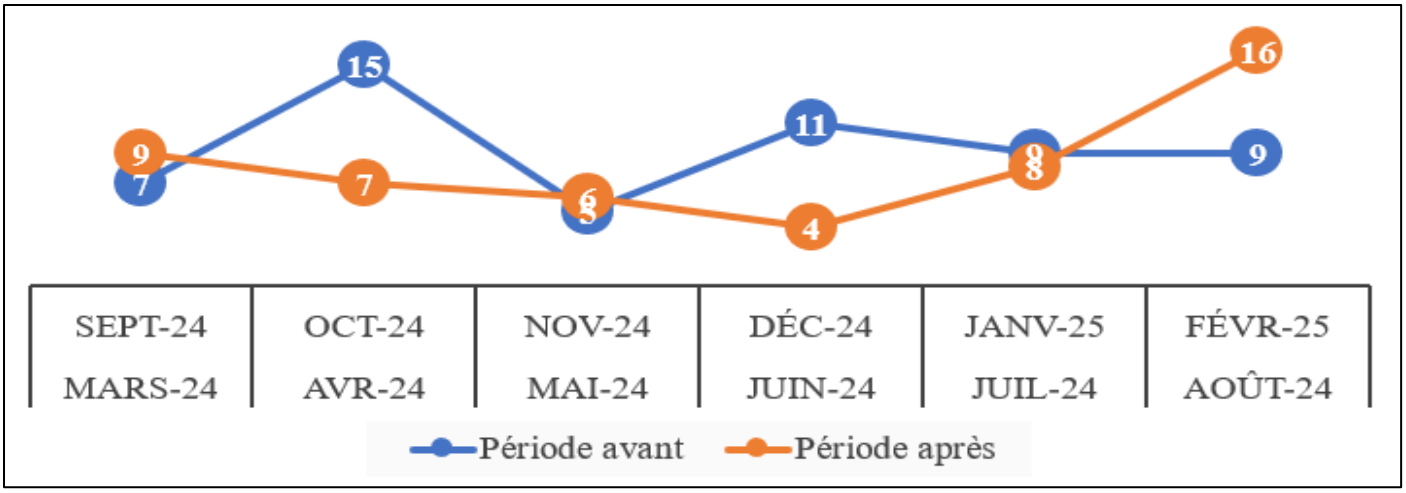

Fig 3 Number of Zero-Dose Children in Kôkô before and after the Strategy.

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This figure shows the monthly change in the number of zero-dose children caught up in Kôkô before and after the implementation of the zero-dose child search strategy.

The hypothesis test comparing the average coverage of the antigens selected at the Konséguéla site is presented in the table below (Table 1).

Table 1 Hypothesis Test of Average Coverage of the Antigens Selected at the Konséguéla Site

Antigen selected	Health area	Average coverage		Test	P-value
		Before implementation of EZD	After implementation of EZD		
BCG	Konséguéla	61,21	95,06	Wilcoxon signed-rank test for paired samples	0,249
Penta 1	Konséguéla	84,67	90,12		0,345
Penta 3	Konséguéla	86,32	90,43		0,249
VAR1- RR1	Konséguéla	88,27	90,33		0,674

Analysis of this table using the Wilcoxon signed-rank test shows us that, overall, there is no statistically significant difference (all p-values > 0.05) between the average antigen coverage for the two periods. Although there was an overall increase, it was more pronounced for BCG.

The second table presents the hypothesis test comparing the average coverage of the antigens selected at the Kôkô site (Table 2).

Table 2 Hypothesis Test of Average Coverage of Antigens Selected at the Kôkô Site

Antigen selected	Health area	Average coverage		Test	P-value
		Before implementation of EZD	After implementation of EZD		
BCG	Kôkô	96,16	93,63	Wilcoxon signed-rank test for paired samples	0,463
Penta 1	Kôkô	92,32	93,54		0,463
Penta 3	Kôkô	81,09	90,64		0,463
VAR1- RR1	Kôkô	82,11	81,65		0,753

Analysis of this table using the Wilcoxon signed-rank test shows that, overall, there is no statistically significant difference (all p-values > 0.05) between the average antigen coverage for the two periods. The results remain broadly stable for all Penta1 and Penta3 antigens and have decreased for BCG and VAR1-RR1 antigens.

The socio-demographic characteristics of the staff interviewed who were involved in vaccination are shown in the table below (Table 3).

Table 3 Socio-Demographic Characteristics of Staff Interviewed who were Involved in Vaccination

Category	Frequency	Percentage
Gender		
Male	5	83%
Female	1	17%
Position		
Vaccination officer	1	17%
Midwife	1	17%
ASACO member	2	33%
Community liaison officer	2	33%
Seniority		
Less than 5 years	1	17%
5-10 years	3	50%
10-15 years	1	17%
16-20 years	0	0%
21 years and over	1	17%
Role in the vaccination process		
Support for vaccination	4	67%
Support for vaccination officer	1	17%
Direct role in vaccination	1	17%

Analysis of the socio-demographic characteristics of the staff interviewed shows that the majority are men (83%) compared to women (17%). Approximately 83% of those interviewed have more than five years' seniority, suggesting a relatively experienced team.

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➢ *Qualitative Results*

For staff, two types of coding were carried out:

- Code T: four codes were assigned to the themes (marked T)
- Code PERS: six codes were assigned to the staff interviewed who were involved in vaccination (marked PERS).

- *The Themes Discussed are:*

✓ T1: Identification of zero-dose children
✓ T2: Obstacles encountered
✓ T3: Availability of resources and capacities
✓ T4: Suggestions and needs

The content analysis of the opinions expressed by the staff interviewed who are involved in vaccination enabled the word cloud to be summarised (Fig. 4).

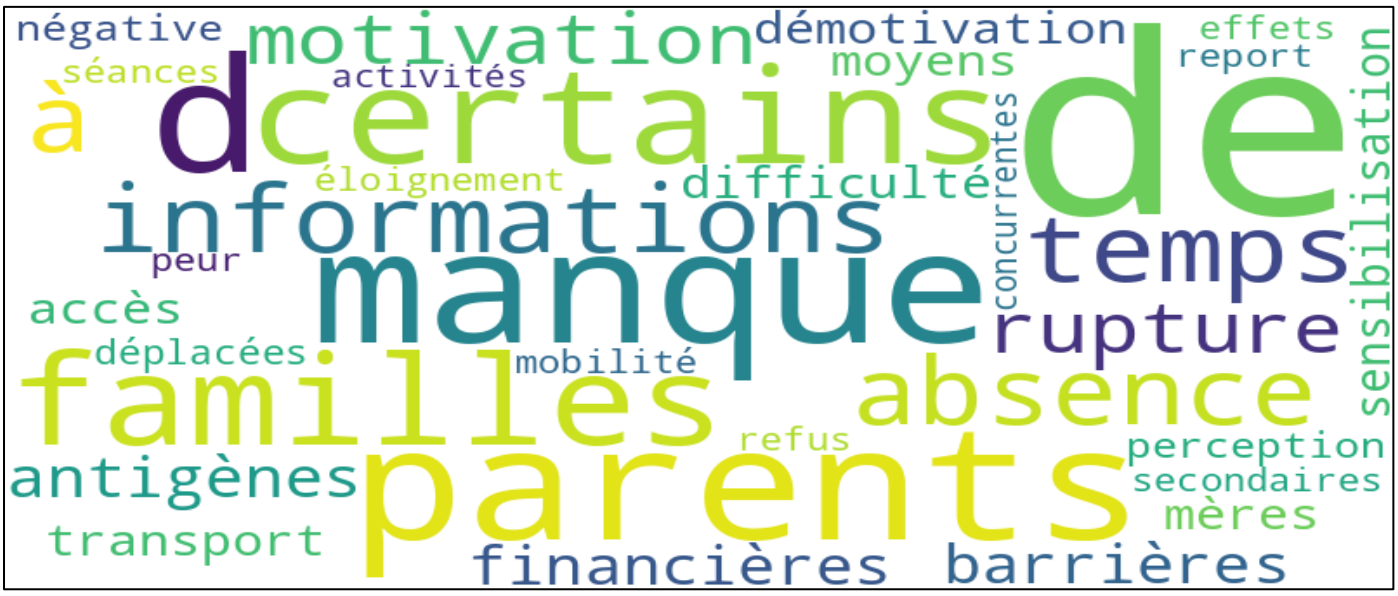

Fig 4 Word Cloud of Staff Involved in Vaccination Interviewed

Our word cloud highlights the words lack, information, parents, and demotivation, emphasising the lack of timely information, the demotivation of some parents, and antigen shortages as the main difficulties hindering the implementation of vaccination for zero-dose children.

For mothers, two types of coding were carried out: T and MEZD for mothers of zero-dose children interviewed.

- *The Themes Selected are:*

✓ T1: Accessibility to vaccination services
✓ T2: Knowledge and perception of vaccination
✓ T3: Barriers to vaccination
✓ T4: Suggestions for improvement

Content analysis of the verbatim statements of the MEZD mothers interviewed enabled the following word cloud to be summarised:

Fig 5 Word Cloud of Mothers of Zero-Dose Children Interviewed

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The word cloud allows us to see the words most frequently used in the interviews with mothers of zero-dose children. Our word cloud highlights the words "difficult" and "distance", emphasising that access and geographical distance are the main obstacles to vaccinating zero-dose children.

IV. DISCUSSION

Assessing the effect of this strategy was relevant in order to measure its real impact, document good practices, and propose improvements or extensions to other similar areas. Reaching zero-dose children in Mali is essential not only to improve vaccination coverage but also to prevent epidemics and promote equity in public health.

The overall objective of our study was to evaluate the effect of implementing the strategy to identify zero-dose children on vaccination coverage among children aged 0 to 23 months in the Konséguéla health area. A mixed methodological approach was used, which enabled us to compare the average coverage rates for the selected antigens before and after the implementation of active search for zero-dose children.

At the end of our study, we found that there was an overall increase in the average coverage rates for the selected antigens after the intervention in Konséguéla and that coverage rates were generally not far from the national targets. By comparing these average rates with those of the control site (Kôkô), where results remained almost stable between the two periods, we were able to isolate the specific effect of the intervention and confirm that this improvement was not due to chance. However, analysis of average coverage using the Wilcoxon signed-rank test for paired samples shows us that, overall, there is no statistically significant difference between the average antigen coverage rates for the two periods.

Subsequently, the opinion survey of mothers of zero-dose children and staff involved in the vaccination process also provided an in-depth understanding of the difficulties hindering the implementation of vaccination for zero-dose children, in addition to comparing vaccination data before and during the implementation of the active search strategy.

Our study reveals an overall increase in vaccination coverage for BCG, Penta1, Penta3 and VAR1 antigens between the two periods analysed, following the implementation of the active search strategy for zero-dose children (EZD) in Konséguéla.

These results are consistent with several international studies that have highlighted the positive impact of this targeted approach on reaching unvaccinated children [11].

In our study, the average coverage between the two BCG periods was (61.21% → 95.06%). The marked increase in BCG coverage demonstrates the effectiveness of early interventions, particularly in identifying and treating newborns who were not vaccinated at birth. These rates are below the national target of 99%, and the trend is consistent with results observed in rural areas of Nigeria, where similar strategies have led to an increase in BCG coverage from 66% to 92% [12].

A study conducted in Bangladesh in urban slums showed that a strengthened birth registration and home follow-up system had achieved over 90% BCG coverage [13]. In our study, the involvement of community health workers in active case finding and referral to vaccination centres likely contributed to this remarkable improvement.

Our study found that the average coverage between the two periods for Penta1 was (84.67% → 90.12%). These rates are below the national target of 95%.

Coverage for the first dose of the pentavalent vaccine was already relatively high before the intervention, which mechanically limits the extent of the improvement. However, the observed increase remains significant and indicates better identification of zero-dose children before the start of the vaccination schedule. These results corroborate those obtained by Médecins Sans Frontières in Chad, which observed an increase in Penta1 coverage from 81% to 88% after active search campaigns, confirming the impact of such strategies even when initial coverage is satisfactory [14]. The increase in our context also suggests an improvement in service accessibility and parental awareness.

The average coverage between the two periods in Penta3 in our study was (86.32% → 90.43%). These rates are below the national target of 95%. The increase in coverage of the third dose of pentavalent vaccine is a key indicator of the reduction in dropouts during the vaccination schedule. The transition from Penta1 to Penta3 is often a critical point where many children are lost to follow-up. A study conducted by PATH in the Democratic Republic of Congo showed that individualised follow-up of children identified as zero-dose improved completion of the vaccination schedule, with a 20% reduction in dropouts between Penta1 and Penta3 [15]. In our study, the increase, although moderate, suggests a strengthening of the link with families and improved vaccine adherence.

Our results show that the average coverage between the two periods in VAR1-RR1 was (88.27% → 90.33%). This rate is lower than the national target of 90% before the intervention and is roughly equal to the national target after the intervention.

Coverage of the first dose of the measles vaccine has also increased, albeit slightly. This improvement is significant, as the VAR1 antigen is administered at a later age (9 months), when the risk of dropout is higher. A study conducted in Burkina Faso confirms the effectiveness of active community approaches in increasing VAR1 coverage [16]. The results of our study confirm that early identification and follow-up of zero-dose children promotes completion of the vaccination schedule, even for late antigens such as measles and rubella.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26jan1367

During the analysis of the opinions of the mothers interviewed, we learned that the low level of education of parents, accessibility issues (difficult access areas + remote areas), the existence of socio-cultural barriers, parental forgetfulness, refusal or hesitation on the part of the father, lack of information, marriages/family relocation, and transportation issues are the main difficulties hindering the implementation of vaccination for children who have not received any doses.

The summary of the analysis of the opinions of the staff interviewed who are involved in vaccination showed us that the lack of reliable lists, difficulties related to community mobilisation, geographical remoteness, difficulty of access, logistical problems, limited resources, negative perceptions, lack of timely information, and parental demotivation also constitute difficulties in the implementation of research and vaccination of zero-dose children.

V. LIMITATIONS OF THE STUDY

One of the limitations of our study is the use of routine data, which does not include enough variables for very detailed analyses and consideration of the actual coverage of the health areas covered by the study (subtraction of children outside the areas vaccinated in these health areas).

VI. CONCLUSION

Overall, our study shows that the strategy of seeking out zero-dose children implemented in Konséguéla in 2024 did not significantly improve vaccination coverage, despite an increase in vaccination coverage rates observed after the implementation of this strategy, which was more pronounced for early antigens such as BCG, but also visible for intermediate doses (Penta1, Penta3) and late doses (VAR1). These results support international recommendations to integrate the search for unvaccinated children into routine vaccination programmes, particularly in areas with low coverage or high dropout rates.

The opinions of those interviewed highlighted the difficulties hindering the implementation of vaccination for zero-dose children in the Konséguéla health area.

In light of the results of our study, further research could be conducted to assess the reasons for the failure to meet national vaccination coverage targets.

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