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Acceptance of Malaria, Human Papillomavirus, and Monkeypox Vaccines in the Democratic Republic of Congo: A 2024 Nationwide Vaccine Coverage Survey

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Abstract

Background

In 2024, when the Democratic Republic of Congo (DRC) decided to introduce new vaccines against three health conditions (malaria, monkeypox, and cervical cancer), this study examined vaccine acceptance at the individual level, nationwide.

Methods

A cross-sectional household survey using a multistage sampling design was conducted in September 2024 in all 26 provinces of the DRC. Individuals aged 18 years and above were surveyed face-to-face about their socioeconomic characteristics as well as behavioral and social determinants (BeSD) related to malaria, cervical cancer, and monkeypox vaccine uptake. Multivariate binary logistic regression using Stata 18 was performed to identify the factors associated with vaccine acceptance for each of the three vaccines.

Results

The results showed high vaccine acceptance for the three new vaccines: 95.6% for malaria, 81.9% for monkeypox, and 84.3% for cervical cancer, with only malaria showing high awareness. Disparities were observed across provinces and rural and urban areas. The common factors associated with vaccine acceptance for the three health conditions were vaccine confidence and peer support.

Conclusion

The high level of vaccine acceptance revealed in this study indicates the potential success of scaling up the introduction of the three vaccines in the DRC. National Immunization programs should, however, consider raising awareness of cervical cancer and the importance of the vaccine among female parents to achieve comparable vaccine uptake levels to those of malaria and monkeypox vaccines.

Introduction

Over the past five decades, immunization has been recognized as a cornerstone public health strategy and one of the most cost-effective public health interventions for reducing population morbidity and mortality (1, 2). Since 1974, the EPI has averted 154 million deaths, including 146 million among children under five years of age, accounting for 40% of the global decline in infant mortality and 52% in the African region (2, 3). However, while some diseases are being eliminated or eradicated, other health conditions or new variants of diseases that are still under control require the introduction of new vaccines to sustain the fight against preventable deaths.

Decisions regarding the introduction and scale-up of new vaccines in a national immunization schedule are critical and depend on multiple factors, including disease burden, vaccine safety,and suitability for national programs, vaccine availability and price, as well as affordability and relative cost-effectiveness (4). However, these are programmatic and structural factors that do not directly influence vaccine uptake at the individual level of analysis. Behavioral and social factors should also be considered for optimal vaccination coverage and satisfactory vaccine uptake (5). Among these factors, vaccine acceptance is the predominant behavioral factor (6). It is a psychological dimension of intent, which, in turn, is related to personal beliefs, confidence, motivation, perceived risk exposure, knowledge, vaccination awareness, and social influence/norms (5).

In 2024, the Ministry of Health of the Democratic Republic of Congo (DRC) considered three health conditions: malaria, cervical cancer, and monkeypox, as major public health problems. The DRC recorded 27.3 million malaria cases and 24,880 malaria deaths in 2022, an increase of 9.2 percent and 11.2 percent, respectively, since 2021 (7). This accounts for 54 percent of malaria cases in Central Africa, the highest in the sub-region, and represents 12.3 percent of global malaria cases and 11.6 percent of malaria-related deaths, ranking the DRC as the second-highest country with the number of malaria cases and deaths globally (7). Consequently, the country adopted the R21/Matrix-M malaria vaccine in 2024 to reduce the burden of malaria in vulnerable populations (8).

Cervical cancer remains the leading cause of cancer-related deaths among women worldwide and is the most frequent cancer in women in the Democratic Republic of Congo (DRC)(9, 10). Among the 20 countries with the highest burden of cervical cancer, 18 are in the WHO African Region. In 2022, this region accounted for 23% of the global cervical cancer mortality (11). According to the World Health Organization (WHO), every two minutes, a woman dies from cervical cancer, despite the existence of practical tools, such as vaccination against human papillomavirus (HPV), the major cause of cervical cancer, which can prevent the majority of cases and eventually eliminate this disease (12). In May 2018, the World Health Organization (WHO) Director-General initiated a call for the elimination of cervical cancer. In August 2020, the World Health Assembly endorsed the Global Strategy for Cervical Cancer Elimination, urging each country to achieve the 90-70-90 targets. According to this strategy, by 20230, 90% of girls will be fully vaccinated with the HPV vaccine by the age of 15, 70% of women will be screened at ages 35 and 45, and 90% of individuals diagnosed with cervical precancerous or cancerous lesions will receive treatment (13). To accelerate progress towards cervical cancer elimination, the DRC adopted a single-dose schedule for the human papillomavirus (HPV) vaccine, aligning with WHO recommendations (14).

Additionally, the DRC accounted for approximately 90% of all monkeypox cases in Africa, with over 30,000 suspected or confirmed cases and nearly 990 deaths reported (15). The surge in cases, emergence of a novel strain of clade I monkeypox virus, and observed human-to-human transmission driven by

sexual transmission in the eastern part of the country have prompted a new strategic response (16). In October 2024, the DRC launched a mpox vaccination campaign using the MVA-BN vaccine, prioritizing health workers, contacts of confirmed cases, and other high-risk groups (17).

At the time the present research was conducted, little was known about the behavioral factors that could influence the uptake of these newly introduced vaccines. Since the decision to accept a new vaccine is complex and depends on social and behavioral determinants at the individual level, this study aimed to assess the levels of vaccine acceptance for malaria, HPV, and mpox in the DRC and to identify the BeSD factors associated with vaccine acceptance.

Material and methods

Study design and settings

The Kinshasa School of Public Health (KSPH) conducted a cross-sectional household survey in September 2024 covering all 26 provinces of the DRC.

Population

All individuals aged 18 years or older who were present in the selected household on the survey day were approached for consent to be interviewed.

Sampling size

The survey was representative at the provincial level. In each province, the minimum number of households to be surveyed was estimated by considering a proportion of 50% of people who would have accepted vaccination, accounting for maximum variance, the 95% confidence coefficient (1.96), a precision level of 5%, a design effect (DEFF) of 2, and a non-response rate of 10%, using the following formula:

$$n \geq \frac{Z_{.}^{2}.p.q}{d^{2}} xDEFF$$

in which: z = 1.96. This resulted in a minimum desired sample size of 900 adults per province.

Sampling technique

We used a multistage stratified cluster sampling technique following the health pyramid in the DRC. All 26 provinces were included in this study. (1) In the first stage, we randomly selected six health zones (HZ) within a province according to the size of the urban and rural strata of the HZ. In each stratum, the HZ were selected using simple random sampling with a random number generator. (2) In each selected HZ, we randomly selected five health areas (HA). (3) Each HA was divided into sixteen approximately equal segments. Segmentation was used to control for the pocket effect that could result from a simple random selection. The 2nd, $7^{th,}$ and 14th were selected every time; (5) In each of these three segments, households were enumerated, and five households were selected by systematic sampling. In each selected household, all adults present during the visit provided consent to be interviewed by the researcher. Sampling probabilities and weights were estimated to adjust for the prevalence. Figure 1 shows the spatial distribution of selected health zones

Data collection and variable management

Data were collected using a structured questionnaire developed by the Kinshasa School of Public Health. The questionnaire was constructed in XML format and administered digitally via the Survey CTO application. The questionnaire included sections on household socioeconomic characteristics and Behavioral and Social Drivers (BeSD) for each of the three vaccines. The coordination team trained the provincial supervisors in Kinshasa, who, in turn, recruited and trained the data collectors in the provinces following the same methodology. The training lasted six days, including one day of pre-testing the methods and tools used. The survey was conducted over one month, with a single visit to each selected household.

Sociodemographic data included age, sex, marital status, profession, and education level. The wealth index variable was computed using principal component analysis, which reduced 17 household ownership characteristics to a single score variable before categorizing them into quintiles. Behavioral and social drivers' variables included the following domains: Intent, Opinions and feelings (risks and benefits perceived), Social processes (support from family and religious leaders, as well as recommendations from healthcare workers)

Outcome definition

Vaccine acceptance was defined as the intent to receive the monkeypox vaccine for adults (18 + years old), the intent to vaccinate children under 5 years of age with the malaria vaccine, or the intent to vaccinate daughters aged 15 years or older with the HPV vaccine.

Statistical Analysis

Data were analyzed using Stata 18.0 (StataCorp LLC, College Station, TX, USA). Descriptive statistics were used to summarize participants' sociodemographic and economic characteristics. Sampling weights were computed accordingly, and the adjusted prevalence of the BeSD domains was reported with 95% confidence intervals. Logistic regression was performed to identify associations between vaccine acceptance and the potential

explanatory variables. All explanatory variables were forced into the regression model, and adjusted odds ratios (ORs) were reported. The significance level was set at $p < 0.05$.

Results

Recruitment

A total of 17,999 adults from 11,700 households consented to participate in this survey. All of them responded to the socio-demographic module and monkeypox vaccine BeSD questions. Among them, only 10,466 were parents of children under 5 years old and responded to the BeSD questions on the malaria vaccine, while 7,565 were parents of girls aged 15 years or older and responded to the BeSD question on cervical cancer.

Socio-demographic characteristics

Table 1 displays the distribution of the sampled population across sociodemographic characteristics. Exactly 86.4% of the participants lived in rural areas. Approximately 50% of the population was aged 25–44. More than half (55.8%) had secondary education.

Table 1
Distribution of sociodemographic characteristics, DRC, 2024.

Location	**N (17,999)**	**%**
Urban	2,455	13.6
Rural	15,544	86.4
Age group		
18–24	3,533	19.6
25–34	4,596	25.5
35–44	4,127	22.9
45–54	2,628	14.6
55–64	1,813	10.1
65+	1,292	7.2
Gender		
Male	8,262	45.9
Female	9,737	54.1
Level of education		
No school	1,834	10.2
Primary	5,160	28.8
Secondary	9,999	55.8
Higher Education	1,006	5.6
Quantiles of wealth		
Lowest	3,640	20.2
Lower	3,664	20.4
Middle	3,618	20.1
Higher	3,602	20.0
Highest	3,425	19.0

Acceptance rate and other Behavioural parameters rate

Regarding BeSD parameters, Table 2 shows high levels of vaccine acceptance nationwide for monkeypox (81.9%), malaria (95.6%), and cervical cancer (84.3%) vaccines. However, the table highlights the low awareness of cervical cancer among adults (39.9%) and moderate awareness of monkeypox (65.6%). Confidence and other social norms (recommendations) regarding the three vaccines were also high.

Table 2
Acceptance rate and other BeSD parameters rate

	Monkeypox vaccine (n = 17,999)	Malaria vaccine (n = 10,466)	HPV vaccine (n = 7,565)
Disease awareness	65.7 [61.4–69.9]	97.5 [96.7–98.1]	39.9 [35.8–44.2]
Vaccine confidence	78.8 [74.9 – 82.3]	92.7 [91.0–94.1]	78.8 [75.4–81.9]
Vaccine acceptance (Intent)	**81.9 [77.9–85.3]**	**95.6 [94.5–96.5]**	**84.3 [81.0–87.1]**
Recommendation to others	81.9 [78.1–85.2]	94.4 [93.1–95.5]	83.5 [80.3–86.2]
Recommendation from peers	73.4 [68.7–77.6]	87.4 [85.0–89.5]	73.7 [69.8–77.3]
Recommendation from the community	78.6 [74.4–82.3]	89.5 [86.9–91.7]	79.2 [75.9–82.2]

All provincial-level vaccine acceptances for Malaria, Mpox, and HPV are included in the supplementary files. The Fig. 2 below map vaccine acceptance across the province in 2024

Determinants of Vaccine Acceptance

Table 3 presents the results of the three multivariate regression models for monkeypox, malaria, and cervical cancer vaccine acceptance. From this comparative table, “vaccine confidence” and “recommendation from peers” were the main stable determinants of vaccine acceptance for the three vaccines. Additionally, the population living in rural areas had 2.76 times higher acceptance of the malaria vaccine than that of the urban population. Female parents had lower vaccine acceptance for their daughters aged 15 years and above vaccinated against cervical cancer than male parents.

Table 3
Associated factors to vaccines acceptance (with adjusted Odds ratio [95% CI])

	Acceptance of Monkeypox vaccine	Acceptance of Malaria vaccine	Acceptance of Cervical cancer vaccine
Status			
Urban	1	1	1
Rural	1.14 [0.70–1.88]	**2.76 [1.06–7.20] ***	0.90 [0.44–1.85]
Gender			
Male	1	1	1
Female	0.97 [0.80–1.18]	1.14 [0.63–2.08]	**0.59 [0.39–0.87] ***
Age			
18–24	1	1	1
25–34	0.87 [0.58–1.31]	1.65 [0.90–3.02]	0.73 [0.39–1.36]
35–44	0.95 [0.63–1.43]	0.99 [0.56–1.74]	0.78 [0.43–1.41]
45–54	1.23 [0.89–1.72]	1.59 [0.76–3.33]	0.79 [0.39–1.57]
55–64	0.97 [0.53–1.78]	3.29 [1.02–10.59]	0.42 [0.17–1.06]
65+	0.71 [0.42–1.19]	2.41 [0.28–20.67]	1.07 [0.18–6.45]
Attained education			
No school	1	1	1
Primary	0.93 [0.67–1.28]	1.35 [0.48–3.81]	0.73 [0.36–1.49]
Secondary	0.93 [0.67–1.29]	0.70 [0.26–1.91]	0.57 [0.30–1.09]
Higher education	0.56 [0.32–0.98]	0.31 [0.07–1.31]	0.51 [0.21–1.25]
Wealth index			
Lowest	1	1	1
Lower	0.76 [0.57–1.03]	1.04 [0.50–2.20]	0.92 [0.59–1.41]
Middle	1.07 [0.71–1.62]	1.00 [0.52–1.90]	0.74 [0.38–1.43]
Higher	0.63 [0.41–0.96]	0.92 [0.46–1.85]	1.16 [0.60–2.24]
Highest	0.58 [0.37–0.92]	2.81 [1.05–7.57]	0.79 [0.36–1.71]
Awareness of the vaccine			
No	1	1	1
Yes	1.20 [0.89–1.62]	0.90 [0.28–2.93]	1.33 [0.86–2.04]
Confidence of vaccine			
No	1	1	1
Yes	**15.22 [11.24–20.60] ***	**41.48 [22.76–75.56]***	**11.11 [6.71–18.37] ***
Recommendation from peers			
No	1	1	1
Yes	**4.28 [2.95–6.21] ***	**4.70 [1.98–11.15] ***	**5.04 [2.23–11.36] ***
Recommendation from the community			
No	1	1	1
Yes	**1.67 [1.12–2.48] ***	1.01 [0.38–2.69]	1.61 [0.75–3.43]

Discussion

The results of this study revealed an overall high acceptance of the new vaccines studied in the DRC, particularly the malaria vaccine (95.6%), followed by the HPV (84.3%) and Mpox (81.9%) vaccines. Several individual factors, summarized according to the BeSD Framework, influence this acceptance.

Malaria vaccine

This study found high acceptance (95.6%) and awareness (97.5%) of the malaria vaccine. These results contrast with the low acceptability found by Nyalundja et al. in the DRC, where 46.5% of adults reportedly agreed to be vaccinated, and 52.6% agreed to have it for their children under five years old (18). Notably, Nyalundja et al. found that only 7.26% of adults were aware of the vaccine despite its moderate acceptability. This leaves room for further research in this field. This finding raises the question of whether acceptability can be validly considered, despite a low level of knowledge. In this case, acceptability is linked to emotional factors or the habit of vaccination rather than actual knowledge of the vaccine and the disease. Other studies have found similar levels of acceptability among those with equivalent knowledge (19). These two acceptability rates in the DRC, with differing levels of knowledge, require further investigations.

Our study found the following factors to be associated with malaria vaccination: confidence in the vaccine (OR = 41.48) and recommendations from peers (OR = 4.70). Several studies have assessed the factors associated with vaccine hesitancy, which is defined as a lack of confidence in vaccines (20).

These results align with certain studies that have demonstrated the importance of relationship support. A study conducted in Sweden showed that peer training for parents of children expected to be vaccinated significantly improved vaccination coverage (21) (21). Another study conducted in the USA showed better COVID-19 vaccination coverage among individuals with social support (22).

Mpox vaccine

This study found an acceptability rate of 81.9%, which was higher than the global average of 59.7% reported in a systematic review by Sulaiman et al. (23). This value is also higher than that found in a study conducted in the DRC by Petrichko et al., who found an acceptability rate of 61% (24).

In our study, vaccine confidence (OR = 15), peer recommendations (OR = 4.28), and community recommendations (OR = 1.67) were significantly associated with vaccine acceptability, reinforcing the role of community. Petrichko also found that residents of Mpox-affected areas had higher vaccine acceptability (24). This suggests that the more a population is exposed to a disease, the higher its vaccine acceptance tends to be (19, 24).

HPV vaccine

Regarding HPV, our study found an acceptance rate of 84.3%, despite a low knowledge rate of 39.9%. This highlights the fact that individuals can be willing to take a vaccine despite being insufficiently informed about it and its associated diseases. Factors associated with acceptance were confidence in the vaccine (OR = 11.1) and peer recommendations (OR = 5.04). These results corroborate the findings of Kutz et al. and Wilson in their respective studies. They highlighted the following barriers to vaccination in African countries: inadequate information, fertility and promiscuity issues (lack of trust), social stigma (lack of community support), and negative experiences with vaccination (25, 26). Omayo et al., in their systematic review, listed the most frequently cited factors influencing HPV vaccine hesitancy: concerns about side effects. effects and infertility (lack of confidence), limited knowledge of the vaccine, lack of awareness of vaccination opportunities, lack of trust in healthcare professionals and new vaccines, influence of caregivers and peers, as shown with the two previous vaccines, community members, and religious and cultural factors (27). Other factors included accessibility issues (poor road conditions and transport costs), adolescent absenteeism on vaccination days, and school dropout (27). The same factors we found to be associated with accessibility in our study may not have been considered in other countries, leading to higher vaccine hesitancy.

Strengths and Limitations

The strength of this study lies in its national scope, which considers regional differences in the data. These findings can be generalized to the entire population of the country because of their breadth.

The main limitation of this study was its cross-sectional design, which limited our ability to establish a causal link. Therefore, we will only be able to demonstrate a potential association between these variables. Furthermore, the results were based on verbal responses, which limited the validity of the responses and findings.

Despite these limitations, our results are significant. They provide an overview of community awareness and acceptance of new vaccines and can guide policymakers in the right direction.

Conclusion

While community readiness to accept new vaccines is complex, this study showed that confidence and peer support can help increase the uptake of malaria, monkeypox, and cervical cancer vaccines. The National EPI program and other healthcare institutions must develop and implement a strong communication plan to enhance community trust in these new vaccines as they consider mass scaling. Urban areas for malaria vaccines and female parents for cervical cancer vaccines are also key factors for success.

Declarations

Ethics approval and consent to participate

This study was approved by the Kinshasa School of Public Health Institutional Review Board (IRB) and registered under the number ESP/CE/121/2024. It was conducted in accordance with the principles of the Declaration of Helsinki. All study methods were performed in accordance with the relevant ethical principles. Informed consent was obtained from all the participants in the study.

Consent for publication

All authors consented for the publication

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Author Contribution

JL prepared the first draft; MN, EM, and PL, BM reviewed and validated the manuscript; JL and BM performed the analysis; BM supervised the manuscript preparation; all authors reviewed and approved the final version of the manuscript.

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Data Availability

The data analyzed during the current study are available upon reasonable request to the corresponding author

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Figures

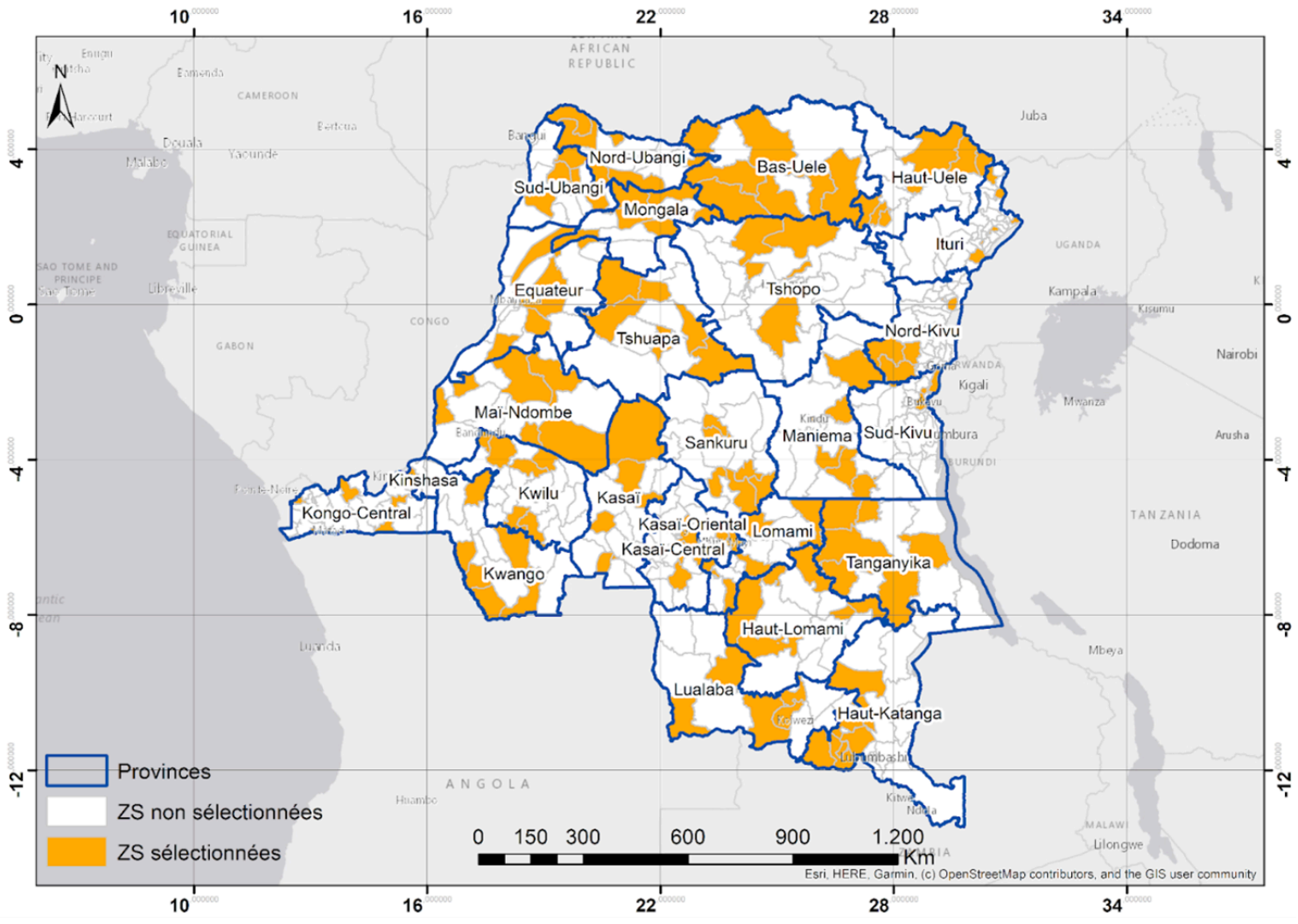


Figure 1

Spatial distribution of selected health zones

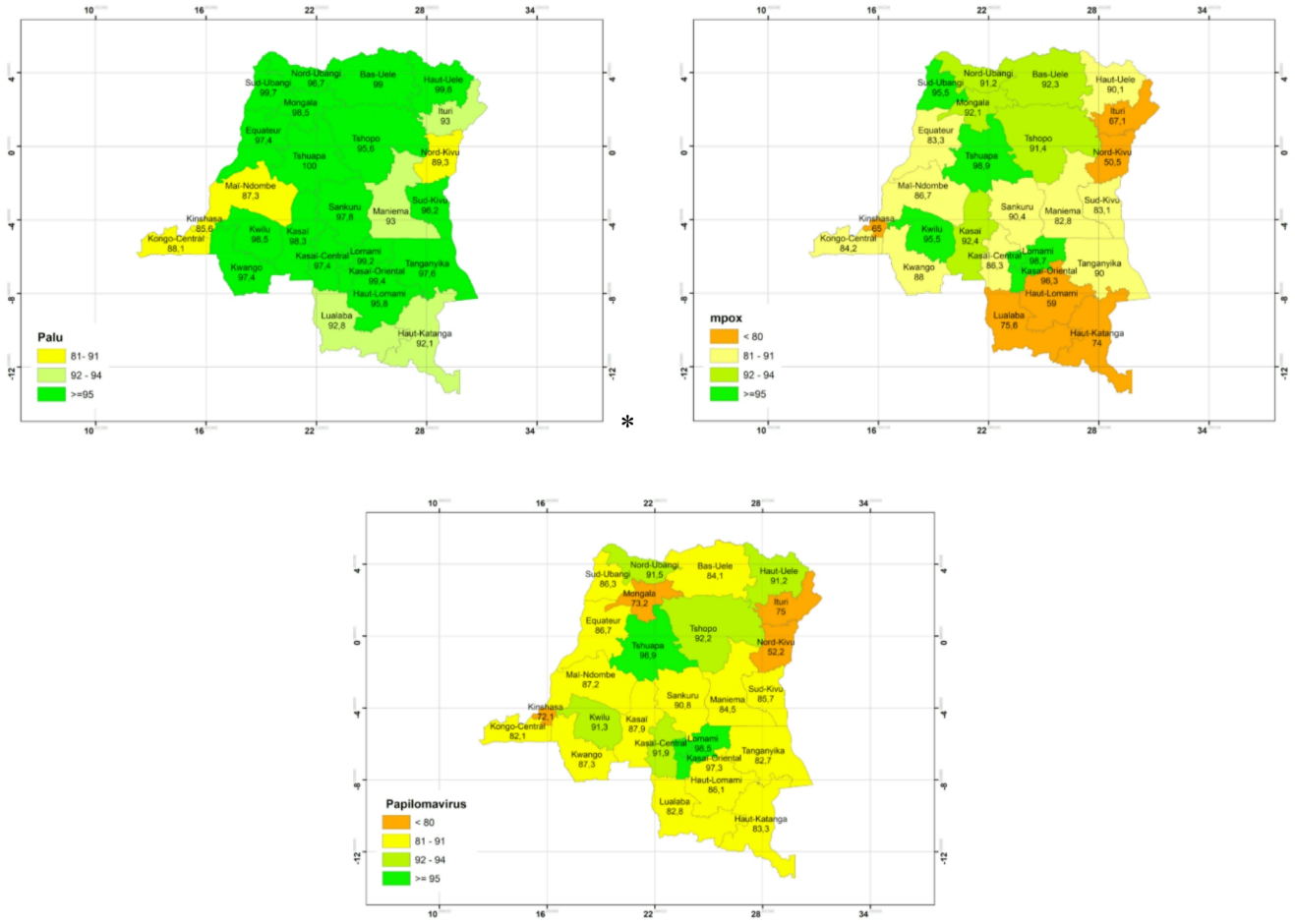


Figure 2

Vaccine acceptance Malaria, MPOX and HPV across the DRC province in 2024

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupplementaryfileprovincialcoveragePaluMPOXHPV.xlsx
- SupplementaryfileECVQuestionnaire.xlsx