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Analysis of sentinel surveillance databases for malaria and its climatic factors in senegal, from 2012 to 2019.

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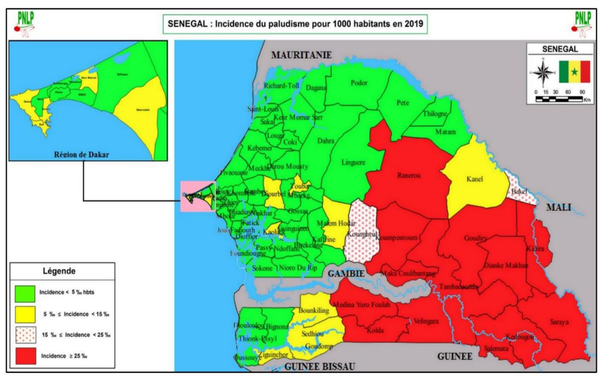
HIGHLIGHTS: (i) Malaria incidence rate follows the **trend** of its **climatic factors** while preceding them (e.g. **1**±0.5 & **2.5**±1 month for **Hygrometry** & **Rainfall** respectively) ; **(ii)** However **Wind** strength and average **Temperature** evolve in opposite directions; **(iii)** A downward trend's predicted by models between 2020-2023

1- BACKGROUND

Located in extreme west of African continent, **Senegal** is in a **malaria endemic zone** (especially south-east, as shown in **Figure 1**), which is a very **climate-sensitive vector-borne disease** however, despite effort made in malaria control (**Figure 2**) , sentinel surveillance notes a **weakness** in the malaria morbidity **data correlation** with that of climatic factors. Hence the interest in analyzing **malaria surveillance** data and its **climatic factors** on a national scale, **from 2012 to 2019**.



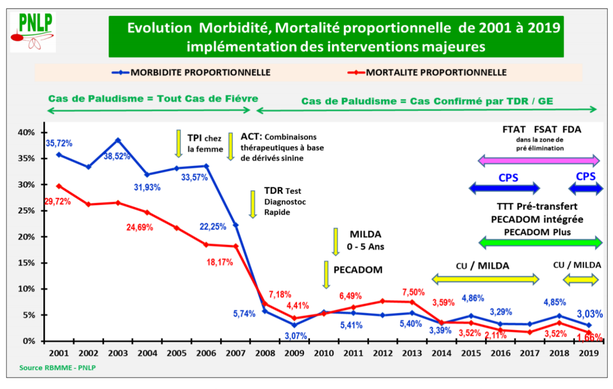


Fig 1: Malaria incidence rate Distribution, Senegal. **Fig 2:** Morbi-Mortality trend & main control strategies

2- METHODS

- **Study Type:** Observational (Cross-sectional / Retrospective / Analytical)
- **Study Period:** From January, The 1st 2012 to December, The 31st 2019
- **Study Data management:** It consisted of:
  - **Data collection and entry:** Document reviews, Malaria & Meteo Data base exploitation among 9 **Sentinel sites** & 9 **Meteo stations** pairing
  - **Data analysis:** First, a **descriptive** analysis using Excel® Software ; Then an analytical (Multi-variate/VAR(p) approach) to **autoregressive vectors** and finally a **Predictive** from 2020 to 2023 using R® Software
  - **Results presentation:** Graphics (Diagrams, Curves, Maps, and so...)
- **Ethical Considerations:** Confidentiality and Anonymity Compliance, such as *PNLP&ANACIM* Leaders Authorization was previously obtained

3- RESULTS

The **malaria incidence rate** (**MIR**) evolves **identically** from year to year such as **3** stereotypic phases:

- ✓ First almost **zero** from **January to May** as shown the **Figure 3** ;
- ✓ Then **gradually increases** with an **accentuation in August and September** ;
- ✓ Finally **decreases** progressively from **November to December**.

However incidence importance was **heterogenic** (such as, e.g. between Kedougou 12.55‰ & Louga 0.16‰)

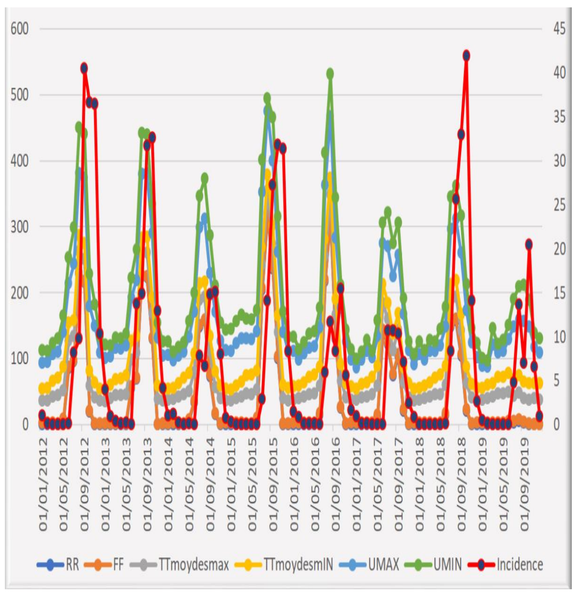


Fig 3: MIR & its climatic factors trend 2012-2019

Excepting **Wind strength** and **average Temperature**, which evolve in opposite directions, all other climatic factors follow the **same dynamics as malaria incidence**, which **precedes them** by an average duration of 2.5 ±1 month and 1 ±0.5 month for **Rainfall** and **Hygrometry** respectively, as noted in **Figure 4**

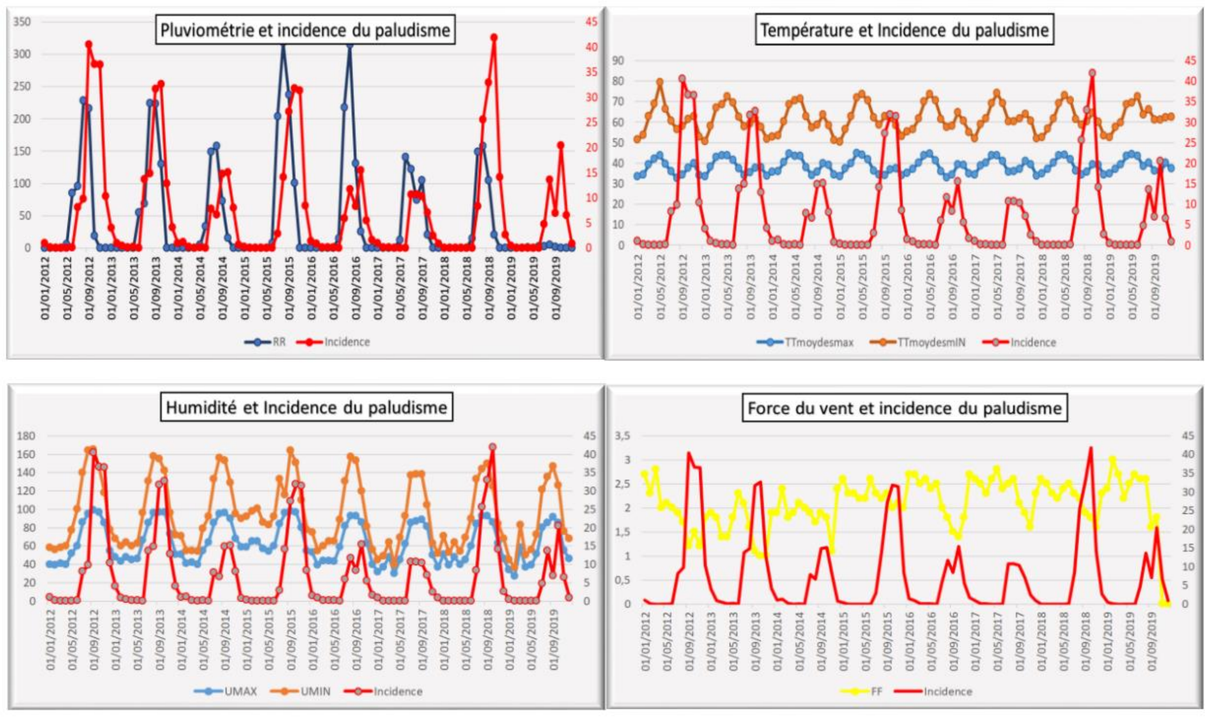


Fig 4: Evolution analysis of the MIR and its climatic factors in Bakel (Senegal) between 2012 and 2019.

Causal links found between **MIR** and **Rainfall** are **decreasing** in: Dakar ($p=4.18x10^{-6}$), Ziguinchor ($p=0.0007957$), Diourbel ($p=0.001917$), Kedougou ($p=0.004038$) and Bakel ($p=0.0332$). Other links are also observed in Bakel between **MIR** and **Temperatures**, both **minimum** ($p=0.005873$) and **maximum** ($p=0.01216$). Thus predictive modeling shows a **downward trend** in **MIR** between **2020 and 2023**. This is with the **exception** of the sites of **Dakar**, **Diourbel**, **Podor** and **Ziguinchor** where an **increase is forecast**. However, climatic factors do not follow the same trend overall (**Figures 5** & **6**).

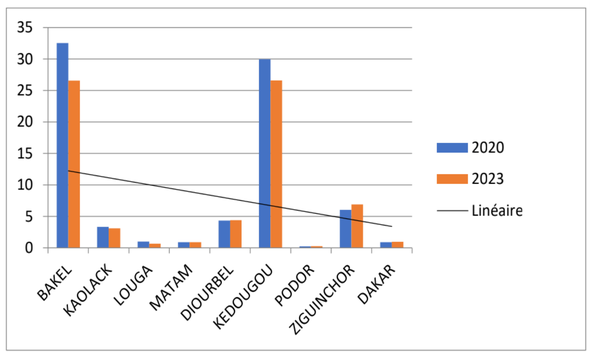


Fig 5: MIR predictions from 2020 to 2023 by region

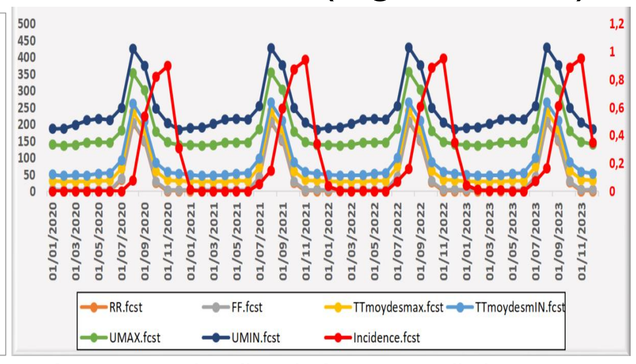


Fig 6: MIR & its climatic factors predictions 20-23

4- CONCLUSION

This work has shown the **close link** between **MIR** & **climatic factors**

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