Prototypical Modeling and Analysis of Migration Flows in the Agadez Region of Niger Using the DHIS2 Platform

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Abstract In many countries, political, economic and social crises have led to the spread of armed conflict, terrorism and other problems. These are all evils that give rise to migration, with populations leaving their countries of origin for developed countries in search of a better life. The situation is even more dramatic and worrying, on a strategic and bloody scale, when it comes to migration from underdeveloped to economically advanced countries. This article focuses on this migratory issue, drawing up a computer model using the DHIS2 platform, followed by a statistical and prototypical analysis of migratory flows transiting from Agadez in Niger to Europe via the Mediterranean. This work has enabled a periodic assessment of migrants, and provides a reference and decision-making basis for the many players involved in the migration field, such as non-governmental organizations, state institutions, etc.

Keywords Modeling, Prototyping, Analysis, DHIS2, Migrants, Agadez.

1. Introduction

A number of scientific studies have examined the migration issue Atsu [1], political, economic and social crises. One of the consequences of these crises is the illegal migration of large numbers of African nationals to European countries. There are four classic migratory factors that continue to operate in our contemporary world: politico-religious factors, economic factors, demographic factors and compound factors [2].

Most of the results concern economic migrants, who leave their countries of origin for developed countries in search of a better life. The common image of the migrant is that of a young man from the African continent ready to do anything to reach Europe by braving the sahara desert and the Mediterranean Sea [3].

Political and media rhetoric tends to reduce the category of intermediaries in migratory movements to that of "smugglers or traffickers, inevitably described as greedy and unscrupulous" [4]. This "evil" figure remains blurred and reductive, and helps to legitimize repressive policies towards people in migration, who then take different routes and mobilize different resources, networks and strategies to circulate in spite of everything. To be content with this reading of the migration issue as a humanitarian and security issue, and in extenso a crisis to be resolved [5], inevitably obscures the diversity of contexts and experiences lived by people in migration, and of the actors involved in their circulation and settlement [6].

2. Materials and Methods

An instance of the dhis2 platform is the tool deployed to model and analyze the indicators under consideration. For some time now, the DHIS2 platform has been the tool of choice for both aggregated and non-aggregated indicator analysis. Several scientific works have been carried out using dhis2, such as those by Mantangelo et al., [7], Farnham et al., [8], Fofana and al., [9], Matin et al., [10], and Keita and Corvil. [11], etc.

3. Modeling and design

In order to analyze the indicators linked to migratory flows, a generalist modeling approach has been adopted, with a view to adapting it to any indicator. This modeling assumes that each indicator has a source, a frequency of production, a type, a sector, a domain, a sub-domain and a level of aggregation.
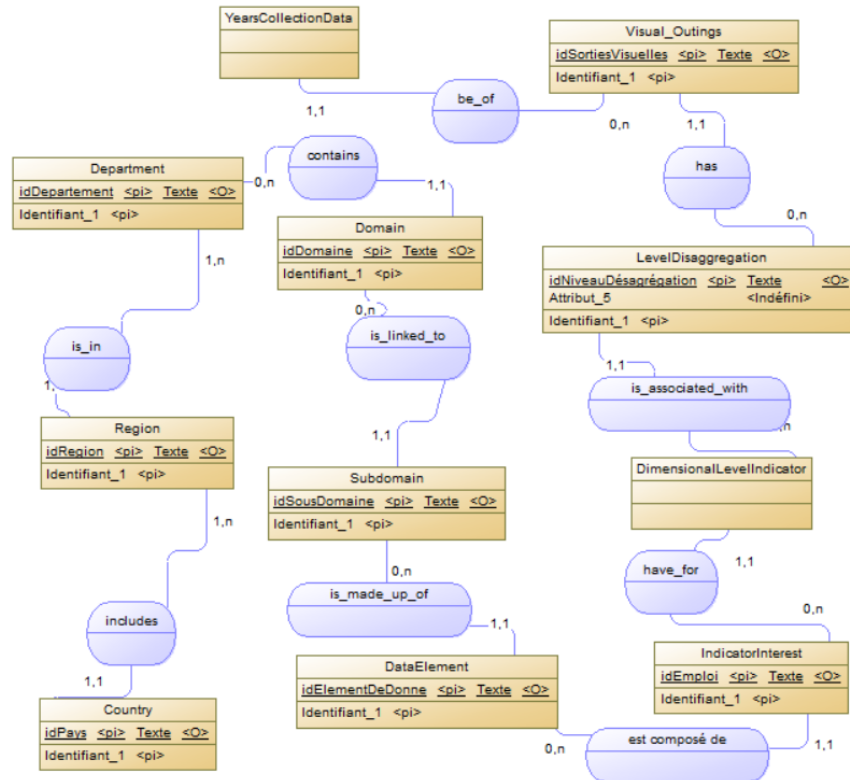

Figure 1: Access and coverage indicators analysis model

The modeling carried out was integrated into dhis2 using the maintenance module, adapting it to dhis2's technical architecture as shown in the figure below:
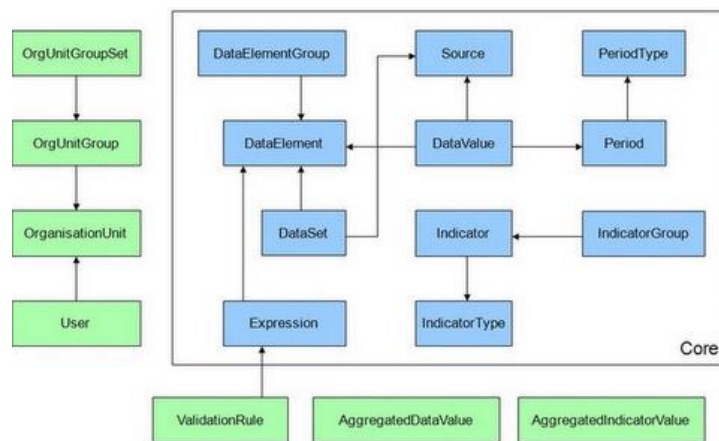

Figure 2: DHIS2 technical architecture (Documentation dhis2, 2020)

The model is based on a data element called "number of refugees and asylum seekers", which has been disaggregated into age brackets and then into gender (male or female). For the age disaggregation, it is composed of the following brackets: [0-4], [5-11], [12-17], [18-59] and [60+]. Finally, a data set was retained, consisting of the data element, number of refugees and asylum seekers.

Data was entered using a form that summarizes the level of disaggregation of the data to be analyzed. Figure 3 illustrates this data form.

Par sexe et age	0-4		5-11		12-17		18-59		60+	
	female	male	female	male	female	male	female	male	female	male
Number of refugees and asylum seekers										

Figure 3: Agadez migration data entry form

4. Results and discussion

To analyze migrant flows through Agadez, official data from the International Organization for Migration (IOM) and the National Institute of Statistics (INS) were used. Monthly data from 2018 to 2024 were used. Figures 4 to 9 illustrate the interpretations made.

Table 1 summarizes the number of migrants transiting Agadez from 2018 to 2024. These numbers have been presented by age group and gender.

Table 1: Migrants transiting through Agadez from 2018 to 2024

Agadez										
Number of refugees and asylum seekers										
	0-4		**5-11**		**12-17**		**18-59**		**60+**	
	female	**male**	**female**	**male**	**female**	**male**	**female**	**male**	**female**	**male**
2018	412	398	141	1398	969	7610	343	344	28	30
2019	796	715	255	1688	1547	13190	549	610	16	32
2020	498	508	98	464	976	8892	298	353	805	2
2021	562	556	84	1132	1249	10525	456	492	4	3
2022	1368	1357	492	2840	2865	17082	1427	1376	12	56
2023	1487	1419	585	2257	3179	20431	1458	1466	13	51
2024	503	444	253	583	1128	7282	501	492	12	37

Figure 4 below shows a comparative monthly analysis of migrant numbers over the period 2022 to 2024. The results show a clear monthly increase in migrant numbers over the period studied. These results are in line with several studies, such as Olivier et al. [6] and DE BLASIS et al. [12] which have illustrated the remarkable increase in migrant flows over time.
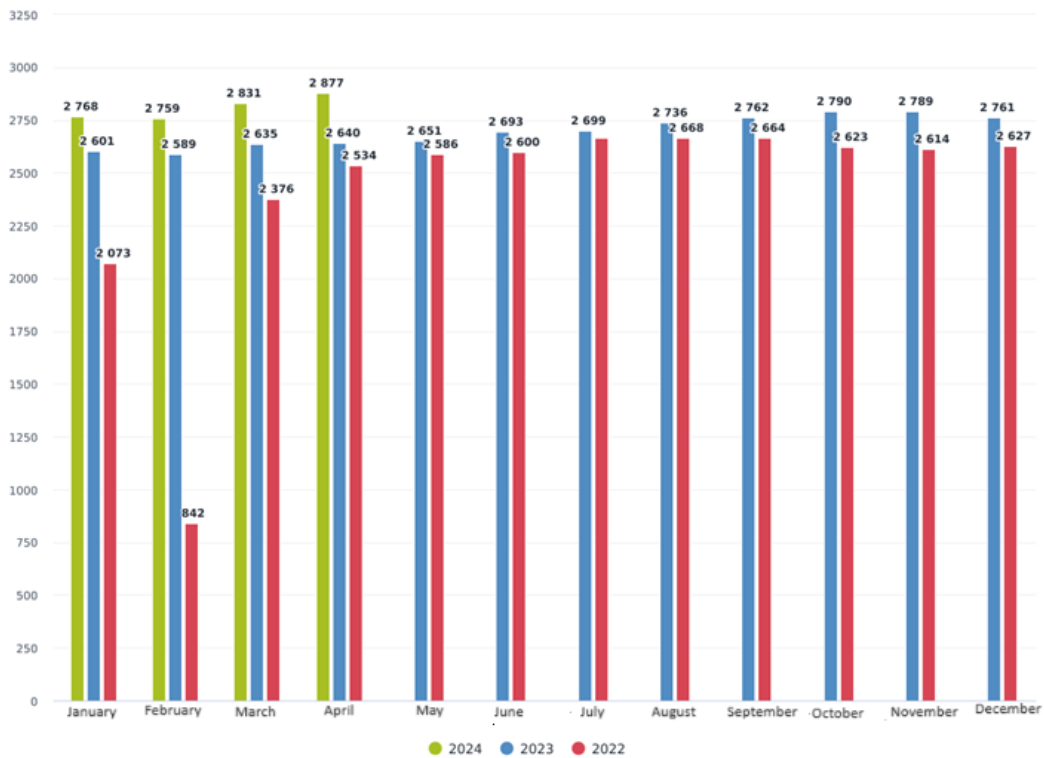

Figure 4: Monthly migrant numbers from 2022 to 2024

Figure 5 shows a gender analysis of migrant numbers over the period 2022 to 2024. The results show that men outnumber women in migration from the Agadez area. In fact, the difference is most noticeable in 2024.
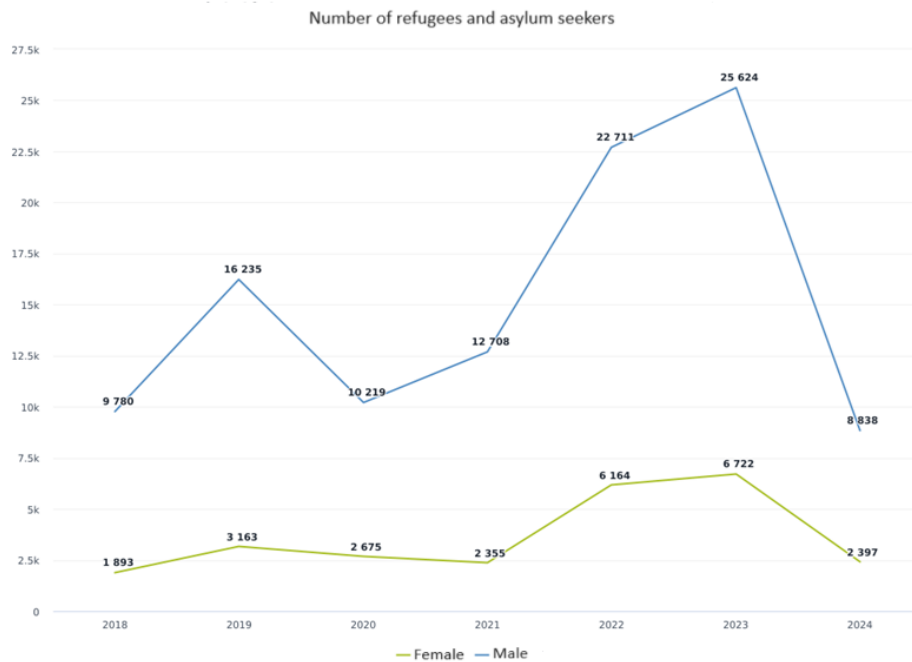

Figure 5: Comparative study of migrant numbers by gender from 2018 to 2024

To highlight the most dominant age bracket, Figure 6 has been produced. It shows the number of migrants by age group during the period under consideration. The results show that the 18 to 59 age group is the most dominant. These results are similar to the findings of works such as Becucci [13], Simonneau [14], FROWD Philippe et al. [15] and the assertion that the majority of migrants are between 18 and 60 years of age.
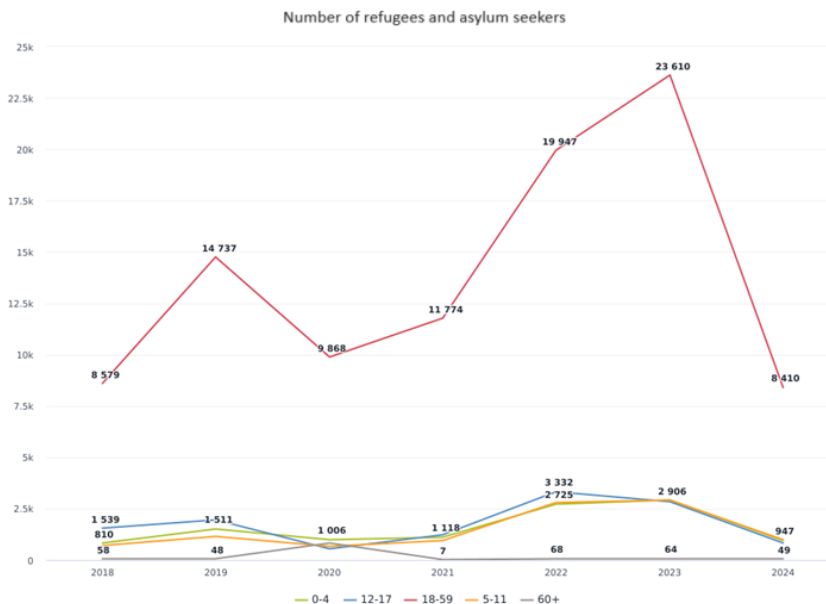

Figure 6: Headcount analysis by age group

5. Conclusion

The DHIS2 platform is nowadays a tool of choice in all fields for the analysis of indications. In this article, a model was developed for monitoring migrants in the Agadez region. A prototype based on the proposed

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modeling was also implemented in a DHIS2 instance. Using the dhis2 data viewer application, several analyses were carried out, notably on the monthly evolution of migrant numbers and their disaggregation by sex and age. The analyses carried out show that male migrants outnumber female migrants, and that their ages range from 18 to 59.

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