

HIV Epidemiology, Diagnosis, Treatment and Prevention in Chad: A Systematic Review

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Abstract

Infection with the Human Immunodeficiency Virus (HIV) remains a major public health burden, with around 40 million people expected to be HIV-positive in 2023. This review provides an overview of the problem of HIV infection in Chad in recent years. The aim of this study is to provide information on the challenges of diagnosing, treating and preventing HIV infection in Chad. This was a systematic review taking into account all available publications on the issue of HIV in Chad. Of the 48 articles retrieved, 37 were selected (37/48, i.e. 77%) and full texts were obtained. Six (06) articles retrieved (6/48, i.e. 12.5%) were found cited in the bibliographic references of the articles, but the full texts were not found in the search engines. Five (05) articles excluded (5/48, i.e. 10.5%). In terms of classification of articles by theme, 7 articles dealt with the subject of prevention, awareness and communication, 6 articles addressed the topic of comprehensive care, 6 articles examined HIV co-infection with other diseases. Seven (07) articles addressed virological and therapeutic failure and resistance to ARVs, 6 articles were on the theme of prevention and 2 articles dealt with the theme of prevention of mother-to-child transmission. One (01) article was opportunistic diseases examined and one (01) article was impact of covid in the fight against HIV evaluated. One (01) article evaluated the toxicity of ARVs and no article was found on the availability of ARVs and related causes with ARV stock-outs. In Chad, the fight against HIV infection remains a major challenge and a health problem because of the difficulties involved in diagnosing and treating PLHIV, despite the efforts made by the government and its financial partners. It is important that lines of research based

on the issues addressed can be developed in order to devise control strategies that reflect the reality of the country.

Keywords

HIV, Epidemiology, Diagnosis, Treatment, Prevention, Chad, Review

1. Introduction

Infection with the Human Immunodeficiency Virus (HIV) weakens the human immune system [1]. This makes the immune system susceptible to all opportunistic diseases [2]. Worldwide, HIV remains a major public health burden, with around 40 million people expected to be HIV-positive in 2023 [3]. In Chad, the first case was reported in 1986 [4], and the current prevalence is 1.3%. Current treatment for HIV infection is based on blocking the virus with a combination of a three-drug antiretroviral (ARV) therapy. There is no effective curative treatment, but vaccine trials are underway in some developed countries [5].

According to the UNAIDS report reported by the World Health Organisation (WHO), the number of people infected worldwide since the appearance of HIV is estimated at more than 79.3 million, with 39.9 million people living with HIV, of whom more than 26 million live in Africa and 20.5 million in West and Central Africa [6]. More than 30.7 million people worldwide now have access to treatment [7]. Despite advances in treatment, the number of deaths linked to HIV/AIDS in 2023 is estimated at around 630,000, and the number of new infections is estimated at 3 million worldwide [7]. However, many infected people do not know their status, and most of them live in Africa.

Despite the tireless efforts of the authorities and partners, access to screening remains a major challenge. This makes HIV infection a major public health issue, with enormous challenges in terms of prevention, screening and comprehensive care.

In Chad, the prevalence of people living with HIV (PLHIV) is estimated at 1.3% among the general population aged 15 - 49 according to data from the EDST 2014-2015 study [4]. This prevalence is relatively low compared with other countries in the sub-region, which, according to the WHO, varies between 3% and 5%. However, the issue remains worrying, especially when there is a disparity in prevalence between provinces, as well as community circulation of the disease in the general population. Prevention strategies involving raising awareness, communication and education, collaboration between the public and private sectors, and community involvement in the fight against the disease are all needed to put an end to this epidemic.

This review provides an overview of the problem of HIV infection in Chad in recent years. The aim of this study is to provide information on the challenges of diagnosing, treating and preventing HIV infection in Chad.

2. Methodology

2.1. Inclusion Criteria

The inclusion criteria defined for this systematic review were:

- Studies conducted in Chad;
- Prospective studies, retrospective studies, cohort studies, communication reviews or poster discussions that dealt with the subject of HIV in Chad;
- Articles written in French, English or any other language;
- Articles that have been published and are available online.

2.2. Exclusion Criteria

- Articles for which the integral texts have not been found;
- Articles are not available online.

2.3. Preparing the Review

In order to structure the review properly and produce an objective meta-analysis, discussions were held with people working in the fight against HIV, researchers in the field and other stakeholders, so that the review could be classified thematically in order to capitalise on the information more effectively. Keywords have been defined to make it easier to search for articles. Search terms used was: HIV and epidemiology and Chad, HIV and cancer and Chad, HIV and coinfections and Chad, HIV and drug resistance and Chad, HIV and social and Chad, HIV and opportunist infection and Chad etc.

2.4. Data Collection

This was a systematic review taking into account all available publications on the issue of HIV in Chad. All published articles were searched (articles, oral communications, conference conclusions, etc.) in French, English or Arabic. Each full text was then obtained via the journal page or by sending a message to the corresponding author.

For articles that are paid for or inaccessible on search engines (Pubmed, Google Scholar, Scopus, Embase, etc.) an email was sent to the authors to ask if they could share their articles for a citation.

2.5. Data Entry

The review data was entered using Word 2016 and Microsoft Excel 2016.

3. Results

On the basis of the inclusion criteria, 52 articles dealing with HIV-1 in Chad were found. The diagram used to select the articles is shown in **Figure 1** below.

Of the 48 articles retrieved, 37 were selected (37/48, i.e. 77%) and full texts were obtained and nine (09) articles retrieved (9/48, i.e. 23%) were found cited in the bibliographic references of the articles, but the full texts were not found in the search engines. Fourteen (14) articles were excluded.

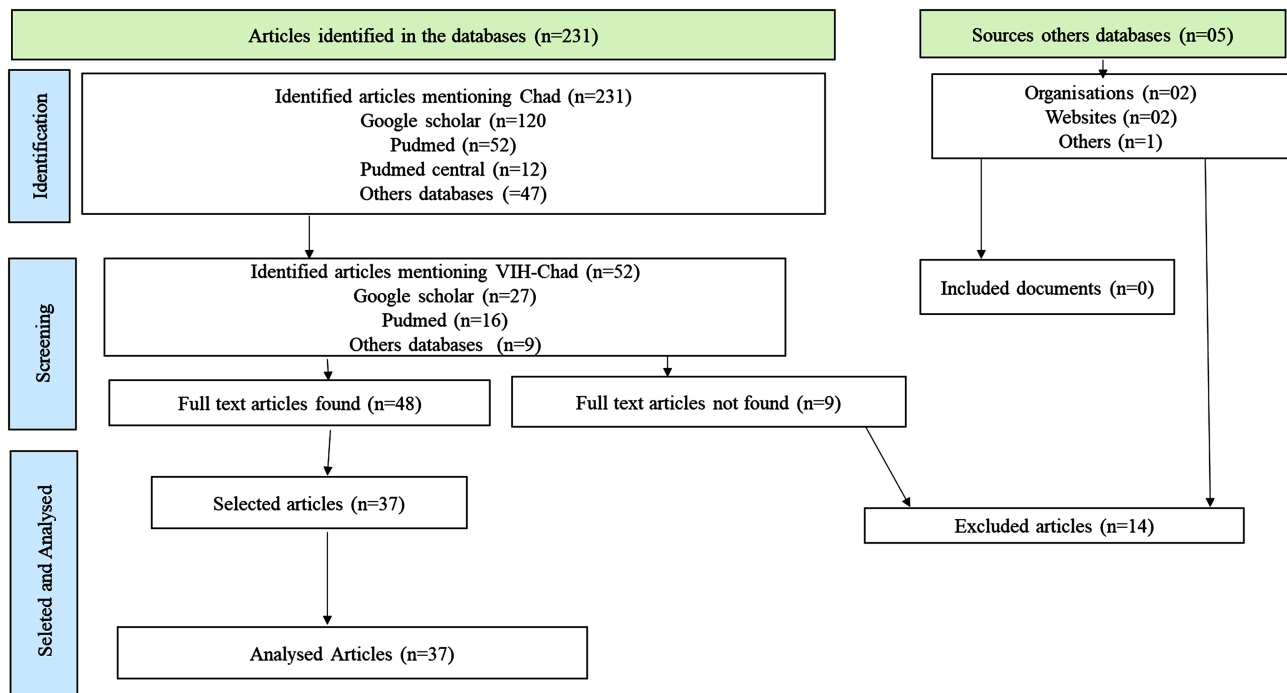


Figure 1. Article selection diagram.

3.1. Breakdown of Studies in the Journal

In terms of classification of articles by theme, 7 articles dealt with the subject of prevention, awareness and communication, 6 articles addressed the topic of comprehensive care, 6 articles examined HIV co-infection with other diseases. Seven (07) articles addressed virological and therapeutic failure and resistance to ARVs, 6 articles were on the theme of prevention and 2 articles dealt with the theme of prevention of mother-to-child transmission. One (01) article were opportunists diseases examined and one (01) article was impact of covid in the fight against HIV evaluated. One (01) article evaluated the toxicity of ARVs and no articles were found on the availability of ARVs and related causes with ARV stock-outs.

The table below (**Table 1**) summarises the various articles found, the journal and year of publication, and the topics covered.

Table 1. Articles selected and analysed.

Authors and Year publication	Titles	Journal	Subject covered
Proth. 2014 [8]	Supporting HIV treatment in Chad: A sociologist among clinicians	Journal des anthropologues 138 (139), 183-203	Awareness/Communication
Nodjiadjim <i>et al.</i> , 2006 [9]	Socio-cultural communication as a tool for the prevention of sexually transmitted diseases and HIV among adolescents in Chad	Vertigo-la revue électronique en sciences de l'environnement	Communication and prevention
Bessimbaye <i>et al.</i> , 2014 [10]	Seroprevalence of HBs Ag and of anti-HCV antibodies among HIV infected people in N'Djamena, Chad	Bulletin de la Société de pathologie exotique 107, 327-331	Coinfection VIH/AgHbs/HCV
Mortier <i>et al.</i> , 2016 [11]	Feasibility of cervico-uterine smear testing in HIV-positive women living in Chad	Soc Pathol..., 2016 - pathexo.societe-mtsi.fr	Prevention

Continued

Adawaye, 2014 [12]	New genotypic approaches for monitoring HIV resistance to antiretroviral drugs in resource-limited countries. The case of Chad	Adawaye - 2014 - orbi.uliege.be	Resistance
Hamat <i>et al.</i> , 2018 [13]	Insuffisance rénale du sujet VIH sous ARV: A propos de 29 cas à l'Hôpital Général de Référence nationale de N'Djamena (Tchad)	Int. J. Bio. Chem. Sci	Support
Djimadoum <i>et al.</i> , 2022 [14]	Evaluation of the performance of five rapid diagnostic tests for the detection of the Human Immunodeficiency Virus (HIV 1 & 2) in Chad	http://www.journalijisr.com SJIF Impact Factor 4.95Vol. 04, Issue, 08, pp.3173-3174, August 2022	Prevention
Naorgué <i>et al.</i> , 2013 [15]	Prevalence of HIV/AIDS in schools in Sarh: secondary school pupils screened at the Maïngara Health Centre	Revue Scientifique du TCHAD, 2013	Prevention
Hota <i>et al.</i> , 2019 [16]	Prévalence et transmission du Virus de l'Immunodéficience Humaine de la mère à l'enfant à N'Djamena	International Journal of..., 2019 - ajol.info	Prevalence of HIV among pregnant women
Tosi <i>et al.</i> , 2002 [17]	Study of HIV seroprevalence in patients with pulmonary tuberculosis with pulmonary tuberculosis in 1999 in Chad	https://www.semanticscholar.org/paper	Coinfection VIH/TB
Dounebaine et Winskell. 2021 [18]	Social behaviors and HIV risk factors among men in Chad and Cameroon	Pan Afr Med J. 2021. PMID: 34285754 Article PMC gratuit.	Prevention
Keita <i>et al.</i> , 2021 [19]	Virological response, HIV-1 drug resistance mutations and genetic diversity among patients on first-line antiretroviral therapy in N'Djamena, Chad: findings from a cross-sectional study	Eur J Clin Microbiol Infect Dis. 2021. PMID: 33237460	Resistance
Adawaye <i>et al.</i> , 2017 [20]	Virological response, HIV-1 drug resistance mutations and genetic diversity among patients on first-line antiretroviral therapy in N'Djamena, Chad: findings from a cross-sectional study	BMC. 2017. PMID: 29126456 Article PMC gratuit.	Support/résistance
Donato <i>et al.</i> , 2013 [21]	Field evaluation in Chad of community usage of CD4 T lymphocyte counting by alternative single-platform flow cytometry	BMC Health Serv Res. 2013. PMID: 24083615 Article PMC gratuit.	Support/assessment of immune system restoration
Azetsop et Diop. 2013 [22]	Access to antiretroviral treatment, issues of well-being and public health governance in Chad: what justifies the limited success of the universal access policy?	Philos Ethique Humanit Med. 2013. PMID: 23902732 Article PMC gratuit.	Access to healthcare
Djarma <i>et al.</i> , 2014 [23]	Continuous free access to HAART could be one of the potential factors impacting on loss to follow-up in HAART-eligible patients living in a resource-limited setting: N'djamena, Chad	Trans R Soc Trop Med Hyg. 2014. PMID: 25163753	Care: patient follow-up
Abderrazzack <i>et al.</i> , 2016 [24]	Correlation between Asymptomatic Bacteriuria and HIV-1 Viral Load Level and CD4 Count in Pregnant Women on Antiretroviral Therapy in N'djamena (Chad)	World Journal of AIDS Vol.5 No.4, December 8, 2015	Support
Abderrazzack <i>et al.</i> , 2015 [25]	HIV-1 Viral Load and CD4 Assessment in HIV-1 Infected Pregnant Women Supported as Part of PMTCT in N'Djamena, Chad	World Journal of AIDS Vol.5 No.3, September 25, 2015. DOI: 10.4236/wja.2015.53027	Support
Yandai <i>et al.</i> , 2023 [26]	HIV and Seroconversion among Pregnant Women at the University Hospital of Mother and Child in Chad	Journal of biosciences and médecins	Prevention of mother-to-child transmission
Djimera <i>et al.</i> , 2021 [27]	HIV RNA Load and Antiretroviral Drug Resistance of HIV-1 Strains in Chad on Dried Blood Spots: A Pilot Study	Journal of AIDS and HIV Treatment Volume 3 Issue 1.DOI: https://doi.org/10.33696/AIDS.3.014	Resistance
Vidal <i>et al.</i> , 2003 [28]	High Genetic Diversity of HIV-1 Strains in Chad, West Central Africa Vidal, Nicole*	J Acquir Immune Defic Syndr. 2003 Jun 1; 33(2):239-46. doi: 10.1097/00126334-200306010-00020. PMID: 12794561.	Genetic diversity of HIV strains

Continued

George <i>et al.</i> , 2022 [29]	Human immunodeficiency virus (HIV) seroprevalence at the national blood transfusion center (CNTS) in N'djamena-Chad	Vol. 04, Issue, 08, pp.3173-3174, August 2022 Available online at http://www.journalijisr.com SJIF Impact Factor 4.95	Seroprevalence
Fabienne <i>et al.</i> , 2023 [30]	Early Diagnosis of HIV-1 to Newborns Born from Mothers on Antiretroviral Treatment in Chad: A Prospective Study Using Real-Time PCR in Chad	International Journal of Science and Research (IJSR) Volume 12 Issue 9, September 2023	Prevention of mother-to-child transmission
Ali <i>et al.</i> , 2024 [31]	Virological Failure among HIV Patients on the Antiretroviral Therapy (ART) in N'Djamena (Chad)	AIDS/ Vol.14 No.4, Décembre 2024	Support and virological failure
Mishra <i>et al.</i> , 2022 [32]	A systematic review evaluating HIV prevalence among conflict-affected populations, 2005-2020	AIDSRev. Author manuscript; available in PMC 2022 September 16.	Prevalence
Adawaye <i>et al.</i> , 2021 [33]	Syphilis diagnosis and serological response to Benzathine Penicillin G among patients attending HIV clinics in N'Djaména, Chad.	Int J Infect Dis IJID Off Publ Int Soc Infect Dis. juill 2021; 108:461-4.	coinfection VIH/Syphilis
Taverne <i>et al.</i> , 2022 [34]	Epidemiology and Prevalence of Oral Candidiasis in HIV Patients From Chad in the Post-HAART Era	Front Microbiol. 2022;13:844069.	Opportunists diseases
Bedingar <i>et al.</i> , 2024 [35]	Exploring the barriers and facilitators to HIV information and health services among youth in N'Djamena, Chad: a qualitative descriptive study.	BMJ Open. 21 nov 2024;14(11):e081759.	sensibilisation
Hutton <i>et al.</i> , 2003 [36]	Prioritization of prevention activities to combat the spread of HIV/AIDS in resource constrained settings: a cost-effectiveness analysis from Chad, Central Africa.	Int J Health Plann Manage. 2003; 18(2): 117-36.	Prevention
Charpentier <i>et al.</i> , 2011 [37]	Distribution of HIV-1 and HSV-2 epidemics in Chad revealing HSV-2 hot-spot in regions of high-risk HIV spread.	J Infect Dev Ctries. 1 févr 2011;5(1):64-7.	coinfection VIH-1/ HSV
Louis <i>et al.</i> , 1990 [38]	pidemiology of infections caused by HIV-1, HIV-2 and HTLV-1 in the republic of Chad].	Bull Soc Pathol Exot 1990. 1990;83(5):603-10.	sero-epidemiological
Glenet <i>et al.</i> , 2024 [39]	Impact of COVID-19 Pandemic on the Clinical Follow-Up of Patients Living with HIV in Chad: A Retrospective Monocentric Investigation.	Am J Trop Med Hyg. 7 févr 2024; 110(2): 387-90	Impact of covid in the fight against HIV
Mihimit <i>et al.</i> , 2020 [40]	HSV-2 Infection as a Potential Cofactor for HIV Disease Progression and Selection of Drug Resistance Mutations in Adults under WHO-Recommended First-Line Antiretroviral Therapy: A Multicentric, Cross-Sectional Study in Cameroon, Central African Republic, Chad, and Gabon.	Trop Med Infect Dis. 24 août 2020;5(3):136.	coinfection VIH-1/ HSV
Adawaye <i>et al.</i> , 2024 [41]	Performance characteristics of Allele-Specific PCR (ASPCR) in detecting drug resistance mutations among non-B HIV-1 Variants.	J Virol Methods. janv 2024; 323: 114856.	Resistance
Koyalta <i>et al.</i> , 2009 [42]	High frequency of antiretroviral drug resistance among HIV-infected adults receiving first-line highly active antiretroviral therapy in N'Djamena, Chad.	Clin Infect Dis Off Publ Infect Dis Soc Am. 1 juill 2009;49(1):155-9	Resistance
Wyss <i>et al.</i> , 2004 [43]	Costs attributable to AIDS at household level in Chad.	AIDS Care. oct 2004;16(7):808-16.	Impact of AIDS on the economy
Mboumba <i>et al.</i> , 2018 [44]	Usefulness of Simultaneous Screening for HIV-and Hepatitis C-Specific Antibodies and Hepatitis B Surface Antigen by Capillary-Based Multiplex Immunochromatographic Rapid Test to Strengthen Prevention Strategies and Linkage to Care in Childbearing-Aged Women Living in Resource-Limited Settings.	Open Forum Infect Dis. mai 2018;5(5):ofy069.	Coinfection VIH/Hepatitis B or C

3.2. Epidemiology of HIV Infection and Co-Infection

At national level, seroprevalence studies are carried out every ten [10] years. The first was carried out in 2004-2005, revealing a seropositivity rate of 3.3% among adults aged 15 - 49, with 4% among women and 2.6% among men [4]. The second study was carried out in 2014-2015 and found a prevalence rate of 1.3% among adults aged 15 - 49, with 2% among women and 1.6% among men. Since then, there have been no nationwide studies. The latest data from the Ministry of Public Health's statistical yearbook shows that national HIV prevalence has fallen from 3.3% in 2005 to 1.1% in 2020 [45].

However, a study conducted in 2019 by Hota *et al.* in the city of Ndjamea reported a prevalence of 5.3% based on a sample of 1818 women tested [16], and data from 2023 from UNAIDS shows a prevalence of 1.3% among women of childbearing age [7]. In a systematic review reported by Mishra of HIV prevalence among conflict-affected populations, 2005-2020 [32], a prevalence of 11.1% was reported in conflict zones in Chad. This suggests a disparity in prevalence in the general population.

In terms of co-infection, a few studies found highlighted HIV/TB co-infection [17] and HIV/hepatitis co-infection [10] [33] [40]. There are many opportunistic diseases associated with HIV [46] [47]. Tuberculosis is the main opportunistic disease cited causing death among PLHIV [48]-[50].

3.3. Therapeutic Failure and Resistance to Antiretrovirals

Since 2020, all patients on ART in Chad have been switched to the dolutegravir-based regimen, including patients experiencing treatment failure. According to the national medical treatment protocol, the triple therapy regimen based on two (02) nucleotide reverse transcriptase inhibitors (Tenofovir (TDF) + lamivudine (3TC) and an integrase inhibitor dolutegravir (DTG) has been officially adopted as a first-line regimen.

Despite the increase in the number of people accessing antiretroviral therapy (ART), there are few data on treatment failure and related factors among HIV-positive people enrolled in HIV care in resource-poor settings [2].

The CD4 cell assay, once considered a fundamental component of care, has been discontinued since 2019. The latest studies carried out in this context date back several years [19]. Even though since 2017, WHO guidelines on starting ART for newly infected people (children, adolescents, pregnant and breastfeeding women and adults living with HIV) have changed with systematic initiation of ART regardless of clinical stage and CD4 count [51].

It should be noted that treatment failure remains the main cause of death among PLHIV, and virological failure is the source of new infections.

In addition to being a factor in the death of PLHIV, treatment failure is a double punishment for patients, because ARVs, which are highly effective drugs against HIV, can also be harmful to the body [52] [53].

Over time, this leads to patients not only suffering from immune deficiency,

but also metabolic diseases (renal failure, metabolic hepatitis, etc.). This constitutes, in the long term, the potential risk of increasing the underlying risk of conditions or diseases associated with ageing and chronic HIV infection [54].

Virological failure is defined as a plasma viral load of more than 1000 copies/ml based on two consecutive viral loads after 3 months of treatment.

In the absence of genotyping tests for HIV resistance in patients on ART in Chad, clinicians rely essentially on virological failure criteria to switch patients from one line to another according to the national protocol.

We really need to develop approaches for implementing global strategies adapted to the country's context and reality in our programmes.

3.4. Prevention of HIV Infection

According to our research, there is very little research on HIV awareness, information and communication in Chad, which are the pillars of prevention. The few studies found in this review concern socio-cultural communication as a tool for preventing sexually transmitted diseases and HIV [9] and the role of a sociologist in caring for HIV-positive people [8].

In terms of awareness-raising, good practices such as radio broadcasts, giant posters and awareness-raising sketches have long since disappeared. Today, awareness-raising has almost been abandoned in favour of systematic screening of children and adolescents, because the demands of the technical and financial partners who support Chad in the fight against HIV have directed the focus towards a target population. However, the issue of HIV in Chad is more global, as the disease affects not only the target populations, but also vulnerable populations, farmers and illiterate people who are unaware of the scope and scale of this pandemic. This leaves the door open to the spread of this disease in the general population, and the spiral of new transmission is only just beginning.

In terms of information, the Voluntary Screening Centres (VSCs) located in health facilities and youth centres provide information on HIV to young people and adults. Psycho-Social Counsellors (CPS) in health facilities are also information relays.

Studies need to be carried out to adapt awareness and information strategies to the Chadian context.

4. Discussion

This review provides an understanding of the epidemiology of HIV disease, prevention methods, diagnosis and treatment.

The global HIV-1 trend in 2023 reported by UNAIDS shows a worldwide prevalence of 1.0% among adults aged 15 to 49, with 1.3% among women and 0.7% among adults aged 25 to 49 among men [3]. New infections are estimated at 1.3 million, and there are approximately 5.4 million people living with the disease who did not know they were living with HIV in 2023 (UNAIDS 2024). Around 44% (over 210,000) of new HIV infections in 2023 are reported among women,

girls and adolescents aged 15 to 24. However, there has been a considerable decrease of 62% in new HIV infections among children. On average, more than 4,000 adolescent girls and young women aged between 15 and 24 contract HIV every week.

Given these prevalences, the goal of eliminating AIDS by 2030 will be far from realistic.

The number of adults and children living with HIV was estimated at 110,000, with over 81,000 living with the disease and unaware of their status. The number of people on ART is 69,000, with 4500 new infections and 3500 deaths per year.

In terms of prevention, the old strategies have been abandoned. Today, new prevention strategies are not well documented.

In terms of treatment, many people do not have access to adequate care. In practical terms, HIV care in health facilities has been virtually abandoned by the medical profession. In most health facilities, care is provided by psychosocial counsellors (CPS). However, in some parts of Chad, an HIV-positive patient could end his or her life without being seen or consulted by qualified medical staff. However, comprehensive HIV treatment is based on an approach that combines blocking the development of the virus through a triple combination of antiretroviral drugs, boosting the immune system and regular monitoring of viremia (viral load), as well as research into and prevention of other opportunistic pathologies. Such treatment is difficult and requires qualified staff.

Access to viral load, defined as the level of virions circulating in the blood of HIV-infected people, is very poor in Chad. It is used to monitor the progression of infection, to track patients' compliance with treatment and to ensure the effectiveness of ARV treatment, defining the success or failure of ARV therapy.

Accessing a viral load test is a fundamental element of treatment, but the rate of access is very low in Chad. In 2020, according to official data, the rate of access to viral load for people on ART was estimated at 6.4% in Chad. This rate rose slightly in 2022 to around 19.2%. Despite these significant advances in terms of access to the viral load, the rate of suppression remains highly variable at around 82% [30].

The reasons for this low figure are largely due to a lack of awareness of the benefits of viral load testing among prescribers and patients themselves.

It should be noted that viral load is used to measure the efficacy of ART in patients on ART [55], and is also a key indicator for assessing the third UNAIDS performance indicator, according to which 95% of people on antiretroviral treatment should have a suppressed viral load [56]. This suppression is synonymous with non-transmission [57] and makes it possible to minimise virological failures by adapting treatment according to the levels of failure observed. According to previous studies, it varies between 14% and 53% after 6 to 24 months of initiation of treatment [58] [59]. This makes it possible to minimise new infections [60] and even eradicate the disease.

Very few studies have been carried out on the management of HIV disease in

Chad. The few studies carried out in Chad focus mainly on drug toxicity, risk factors for other diseases and patient follow-up.

In addition, there is a virtual absence of studies on compliance and acceptability of treatment, and rarely on resistance.

Researchers in Chad need to develop research projects in this area in order to deepen research into these themes.

As for the introduction of the new dolutegravir-based therapy, since 2023 the transition has been effective and all patients have been switched to the dolutegravir-based regimen, even though a few alternative molecules are still in circulation. By 2023, all patients on ART have been switched to the dolutegravir-based regimen, including patients in treatment failure. The Tenofovir/Lamivudine/Dolutegravir (TLD) triple therapy regimen was selected as a first-line regimen.

A key issue that was not taken into account when dolutegravir was introduced was the phenomenon of HIV resistance to ARVs in adults and children.

The circulation of resistant strains of the human immunodeficiency virus (HIV) and the emergence of antiretroviral-resistant strains are likely possible [61]. In Chad, most treatment centres are faced with unavailability and frequent drug stock-outs. Interruptions in ARV treatment have been reported to be a source of therapeutic failure and a major factor in the proliferation of HIV drug resistance [62] [63].

There are very few studies on HIV resistance to ARVs and no studies on HIV-1 resistance in children and pregnant women.

Essentially, it is important to take the issue of HIV resistance in pregnant women very seriously by developing the programme for monitoring and following up HIV-positive mothers who have failed virological tests. Awareness and referral strategies also need to be developed to address concerns.

The availability of ARVs varies from one part of the country to another. In some provinces, all the drug options needed to treat HIV are available. In other parts of the country, however, there are occasional or total shortages. However, very little data is available on the availability of ARVs, despite the fact that the government and its technical and financial partners, in particular the Global Fund (GF), have deployed enormous resources to purchase ARVs.

It is important to point out that no strategy or approach to HIV vaccination is yet envisaged in Chad.

5. Conclusions

In Chad, the fight against HIV infection remains a major challenge and a health problem because of the difficulties involved in diagnosing and treating PLHIV, despite the efforts made by the government and its financial partners.

The results of this study show that there is heterogeneity in HIV prevalence and very little data on the different themes addressed and analysed in this study. It is important that lines of research based on the issues addressed can be developed in order to devise control strategies that reflect the reality of the country.

Limitations of the Study

The limitations of this study lie in the availability of published articles and the heterogeneity of the methodologies used, which meant that it was not possible to carry out a meta-analysis to summarise the results statistically.

Authors' Contributions

All authors have read and approved the final manuscript.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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