



Prognostic Factors Influencing Five-Year Survival of Colorectal Cancer Patients at the National Center for Cancer Control, Niamey (2018-2023)

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Abstract

Introduction: Colorectal cancer (CRC), due to its frequency and severity, represents a significant public health problem worldwide. It is a major cause of cancer-related death. This study aims to evaluate the five-year survival of colorectal cancer patients and identify factors associated with prognosis at the National Cancer Center of Niamey. **Materials and Methods:** This retrospective analytical study included patients with histologically confirmed colorectal cancer managed between January 1, 2018, and December 31, 2023. Overall survival was defined as the time from diagnosis to death from any cause. Patients who were alive at the end of follow-up or lost to follow-up were censored at the date of last contact. Survival was estimated using the Kaplan-Meier method and compared using the log-rank test. Prognostic factors were identified using Cox proportional hazards regression. **Results:** A total of 222 patients with colorectal cancer were included in the survival analysis. The mean age was 48.6 ± 15.4 years. The median overall survival was 13 months. The estimated survival rates at 1, 2, 3, 4, and 5 years were 58.6%, 17.9%, 6.5%, 1.6%, and very low approaching zero, respectively. In multivariate analysis, poor treatment adherence was independently associated with increased risk of death (HR = 1.59; 95% CI: 1.107 - 2.297; $p = 0.012$). **Conclusion:** Colorectal cancer in Niger is associated with poor survival, mainly due to late diagnosis and suboptimal treatment adherence. Strengthening early detection and improving access to care are essential to reduce mortality.

Subject Areas

Global Health

Keywords

Colorectal Cancer, 5-Year Survival, Epidemiology, Niger

1. Introduction

Colorectal cancer (CRC) constitutes a major public health problem worldwide due to its high frequency and severity. It ranks among the most commonly diagnosed cancers and remains a leading cause of cancer-related death in many countries [1] [2]. According to the World Health Organization, CRC ranks third among the most frequent cancers and second among the causes of cancer mortality, with more than 1.9 million new cases and approximately 930,000 deaths estimated in 2020 [3].

Several risk factors have been identified in the development of this disease. Dietary habits play a predominant role, particularly a diet rich in animal fats, red and processed meats, and low in fiber, which may account for 30% to 50% of cases. In addition to these nutritional factors, genetic, behavioral, and environmental determinants are also involved [4] [5].

In low-resource countries, including those in sub-Saharan Africa, the incidence of CRC appears to be increasing, probably in connection with the epidemiological transition, urbanization, and changes in lifestyle. In Niger, an increase in digestive cancers, particularly colorectal cancers, has been reported in recent years. Hospital data from the National Hospital of Niamey indicate that CRC represents a growing proportion of diagnosed cancers, often with late presentations and an unfavorable prognosis [6]. At the national level, estimates from the GLOBOCAN program have reported several hundred annual deaths related to colorectal cancer, highlighting its significant impact on mortality [7].

Cancer survival is an essential indicator for assessing the effectiveness of diagnostic and therapeutic strategies. Cancer registries, which allow systematic follow-up of cases within a defined population, represent a reference tool for estimating survival and analyzing prognostic factors of digestive cancers [8]. However, in Niger, the absence of a structured national system for monitoring cancer patients limits the availability of reliable long-term survival data. Many deaths occur at home or in non-interconnected health facilities, making it difficult to accurately assess patient outcomes.

In this context, the present study aims to estimate the five-year survival of patients with colorectal cancer and to identify factors associated with prognosis at the National center for cancer control of Niamey, in order to contribute to a better understanding of the evolution of this disease and to guide oncological management strategies in Niger.

2. Methods

2.1. Study Design and Setting

This was a retrospective analytical study conducted at the National Cancer Control Center (CNLC) in Niamey, Niger, which is the main referral center for cancer management in the country.

2.2. Study Period and Population

Patients with histologically confirmed colorectal cancer diagnosed and managed between January 1, 2018, and December 31, 2023 were included.

2.3. Inclusion and Exclusion Criteria

All patients with confirmed colorectal cancer and complete medical records were included. Patients with incomplete or unusable records were excluded.

2.4. Data Collection

Data were extracted from medical records. When vital status was not documented, patients or relatives were contacted by telephone to determine survival status and date of death, if applicable.

2.5. Definition of Variables

Outcome variable:

Overall survival was defined as the time from diagnosis to death from any cause.

Death = event

Alive at last contact = censored

Lost to follow-up without confirmed death = censored at last known contact date.

2.6. Statistical Analysis

Continuous variables were summarized using mean $\pm$ standard deviation. Categorical variables were expressed as frequencies and percentages.

Survival probabilities were estimated using the Kaplan-Meier method. Differences between groups were assessed using the log-rank test.

Variables with $p < 0.20$ in bivariate analysis were entered into a multivariate Cox proportional hazards regression model to identify independent prognostic factors. Results were reported as hazard ratios (HR) with 95% confidence intervals. The proportional hazards assumption was assessed using Schoenfeld residuals.

Statistical significance was set at $p < 0.05$.

2.7. Ethical Considerations

Authorization (No. 000080/MSP/P/AS/DGSP/CNLC dated May 29, 2024) from the National Cancer Center of Niamey was obtained prior to data collection. Verbal informed consent from participants or their relatives was obtained during tel-

ephone calls. Anonymity and data confidentiality were strictly maintained.

3. Results

3.1. Sociodemographic Characteristics of Patients

A total of 433 digestive cancer cases were recorded at the National Cancer Control Center in Niamey between 2018 and 2023. Among them, 231 patients were diagnosed with colorectal cancer (CRC). After exclusion of 9 patients due to incomplete records, 222 patients were included in the final survival analysis.

The mean age of the patients was (Mean: SD) = 48.60 years $\pm$ 15.40, with a range from 17 to 89 years. The majority of patients were between 40 and 60 years old. Males were the most affected 62.2%, with a male-to-female ratio of 1.64. The Niamey region recorded the highest number of cases 53.6%, followed by the Dosso region 23%, and the Tahoua and Maradi regions 6.8% (**Table 1**).

Table 1. Distribution of colorectal cancers registered at CNLC/NY according to sociodemographic characteristics from 2018 to 2023.

	Effective	Percentage
Age (year)		
<20	05	2.3
20 - 39	69	31.1
40 - 59	90	40.5
60 - 79	56	25.2
≥ 80	02	0.9
Sex		
Male	138	62.2
Female	84	37.8
Region		
Agadez	07	3.2
Diffa	03	1.4
Dosso	51	23
Maradi	15	6.8
Niamey	119	53.6
Tahoua	15	6.8
Zinder	12	5.4
Nationality		
Nigerien	214	96.4
Other Nationality	08	3.6

3.2. Anatomopathological Characteristics

Lieberkühn adenocarcinoma was the most frequent histological type (86.48%). Rectal tumor location was the most frequent 67.10%, and 36% of patients had metastases.

TNM classification was specified in only 49 patients (22.1%), mostly from examinations performed abroad. The remaining records (77.9%) contained no TNM data or were too heterogeneous to allow reliable statistical analysis. Tumor grade was reported for 20 patients (9.9%), in various forms: Grade 1, Grade 2, or Duke's stage B/C, depending on where the pathology was performed. The vast majority of records (90.1%) did not specify the grade (**Table 2**).

Table 2. Distribution of colorectal cancer cases registered at the CNLC/NY according to radiological, and histological profile, and tumor location, from 2018 to 2023.

	Effective	Percentage
Histological type		
Lieberkühn Adenocarcinoma	192	86.48
Mucous colloid Adenocarcinoma	06	2.70
Signet Ring Adenocarcinoma	02	0.90
Mucous carcinoma	10	4.50
Not specified	12	5.40
Tumor location		
Colon	56	25.20
Rectum	149	67.10
Caecum	15	6.80
Colorectal	02	0.90
Metastases		
Yes	80	36.00
No	141	63.50
TNM classification		
TNM not specified	173	77.90
TNM-specified (heterogeneous, examinations abroad)	49	21.10
Histological grade		
Grade not specified	202	90.10
Grade-specified (heterogeneous)	20	9.90

3.3. Overall Survival

The median overall survival was 13 months. Survival rates at 1, 2, 3, 4, and 5 years were 58.6%, 17.9%, 6.5%, 1.6%, and very low approaching zero, respectively.

The Kaplan-Meier curve showed a steep decline in survival within the first two years of follow-up (**Figure 1**).

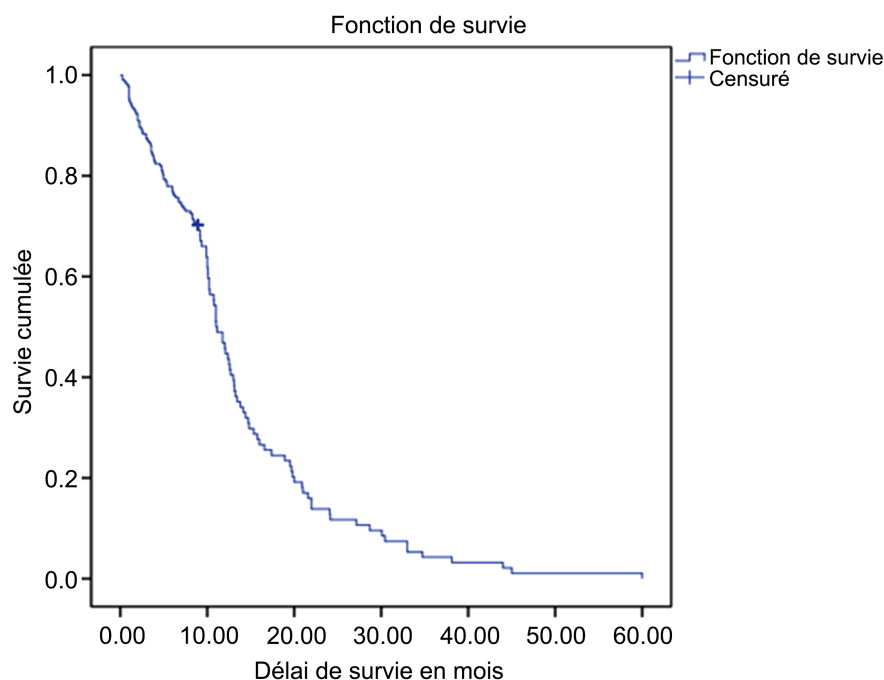


Figure 1. Kaplan-Meier curve of overall survival of colorectal cancer patients at the CNLC/NY from 2018 to 2023.

3.4. Factors Associated with Survival

Bivariate Analysis

The bivariate analysis identified several factors significantly associated with overall survival of colorectal cancer patients: age, history of CRC surgery, radiotherapy treatment, and treatment adherence.

Survival according to sociodemographic characteristics

None of the sociodemographic characteristics studied, with the exception of age, was significantly associated with patient survival. Overall patient survival at 1, 2, and 3 years was significantly higher in subjects under 60 years of age compared to those 60 years of age and older. Specifically, 63.3% at 1 year, 22.0% at 2 years, and 8.3% at 3 years versus 45.6% at 1 year, 10.5% at 2 years, and 3.5% at 3 years, respectively. $p = 0.015$ (**Figure 2**).

Survival according to prognostic factors

None of the prognostic factor studied, with the exception of a history of surgical treatment for colorectal cancer, were significantly associated with patient survival. Patients with a history of surgical treatment had significantly higher 1-, 2-, and 3-year survival rates than those without surgical treatment (**Table 3**).

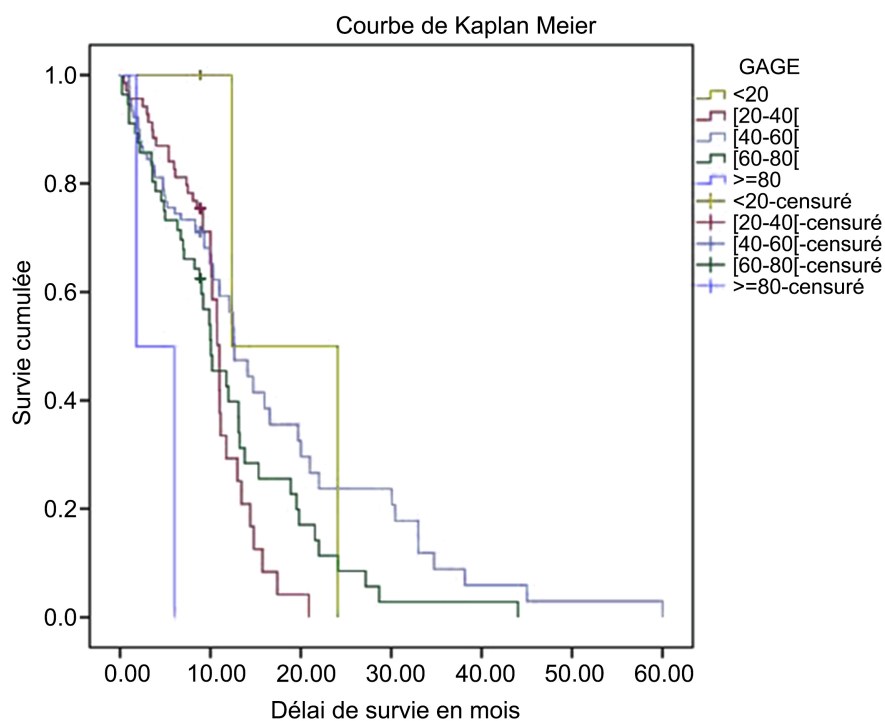


Figure 2. Kaplan Meier curve overall survival of colorectal cancer patients from 2018 to 2023 at CNLC/NY according to age groups.

Table 3. Colorectal cancer case survival from 2018 to 2023 at the CNLC/NY according to prognostic factors.

Survival	1 year	2 year	3 year	4 year	5 year	P
Time to consultation						0.366
<3 Month	78.60%	0.00%	0.00%	0.00%	0.00%	
3 - 6 Month	52.50%	0.00%	0.00%	0.00%	0.00%	
1 - 2 year	71.40%	0.00%	0.00%	0.00%	0.00%	
>2 year	60.30%	17.70%	3.50%	0.00%	0.00%	
Family history of CRC						0.661
Yes	61.50%	20.50%	0.00%	0.00%	0.00%	
No	58.20%	17.60%	5.30%	1.80%	0.00%	
History of surgical treatment for CRC						0.034
Yes	80.00%	48.00%	16.00%	0.00%	0.00%	
No	57.00%	14.70%	5.50%	1.80%	0.00%	
Number of Risk Factors						0.54
0	57.50%	19.20%	8.50%	2.10%	0.00%	
>=1	59.00%	22.00%	10.00%	3.50%	1.00%	

Survival according to treatment characteristics

None of the treatment characteristics studied, with the exception of radiotherapy and treatment adherence, were significantly associated with patient survival. Patients who received radiotherapy had significantly higher 1- and 2-year overall survival than those who did not (**Table 4**).

Table 4. Colorectal cancer case survival from 2018 to 2023 at the CNLC/NY according to treatment type.

Survival	1 year	2 year	3 year	4 year	5 year	P
Chemotherapy						0.353
Yes	60.60%	17.00%	5.70%	1.90%	0.00%	
No	48.60%	24.30%	12.10%	0.00%	0.00%	
Radiotherapy						0.001
Yes	89.30%	44.60%	0.00%	0.00%	0.00%	
No	54.00%	15.90%	6.40%	1.60%	0.00%	
Surgery						0.227
Yes	62.90%	18.00%	2.20%	0.00%	0.00%	
No	50.00%	18.80%	0.00%	0.00%	0.00%	
Treatment adherence						<0.001
Good	74.30%	21.12%	8.90%	0.00%	0.00%	
Poor	44.70%	14.90%	3.50%	3.00%	0.00%	

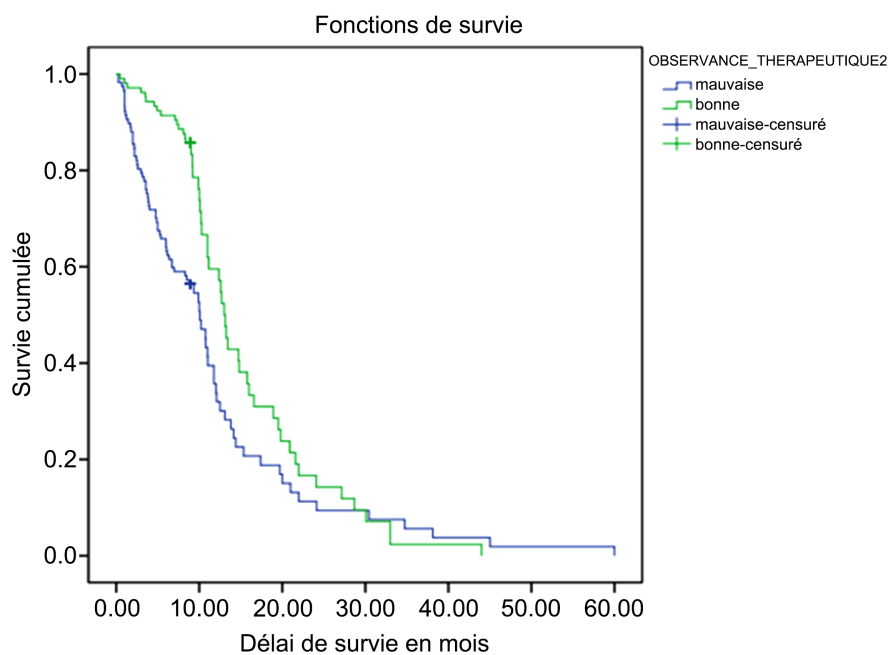


Figure 3. Overall survival of colorectal cancer patients from 2018 to 2023 at the CNLC/NY according to treatment adherence.

Patients with good treatment adherence had significantly higher 1-, 2-, and 3-year overall survival than those with poor adherence. Respectively: 74.30% 21.12% 8.90% vs. 44.70% 14.90% 3.50% ($P = 0.000$) (**Figure 3**).

3.5. Multivariate Analysis

After adjustment for potential confounders, only treatment adherence remained an independent prognostic factor for survival.

Poor treatment adherence was associated with increased risk of death (HR = 1.59; 95% CI: 1.107 - 2.297; $p = 0.012$).

Other factors such as age, surgery, and radiotherapy, lost statistical significance in multivariate analysis (**Table 5**).

Table 5. Multivariate analysis of determinants of survival in patients with colorectal cancer.

	HR	CI 95%	P
Treatment adherence			
Good	1		
Poor	1.59	[1.107 - 2.297]	0.012

4. Discussion

Epidemiological profile (frequency, age, and sex)

In our series, colorectal cancer accounted for 54.48% of digestive cancers managed in Niger between 2018 and 2023 (222 cases), confirming its dominant position among digestive tumors. A previous study conducted in Niger by Idrissa *et al.* (2017-2021) on 106 cases found a proportion of 32% [6], a lower figure than ours, probably related to the smaller sample size and the different study period. Regionally, Ouédraogo *et al.* in Burkina Faso observed that 39.2% [9] of patients with CRC were between 20 and 45 years old, while in Benin, Gnanngnon *et al.* reported a hospital frequency of only 1.4% [10]. Although these studies are based on heterogeneous indicators and are therefore not directly comparable, they all illustrate the growing burden of colorectal cancer in West African hospital settings, highlighting the need to strengthen screening and management programs.

The mean age at diagnosis in our cohort was 48.6 years, indicating an earlier occurrence than that described in Western countries. This early onset could be explained by the demographic structure of Niger, where more than 70% of the population is under 25 years old [11]. These observations are consistent with those reported in sub-Saharan Africa by Irabor in Nigeria, Souleymane O. in Burkina Faso, Bagnaka in Cameroon, and B. A. Odo in Côte d'Ivoire, who highlight a notable frequency of CRC among young African adults of black phenotype [9] [12]-[14].

The male predominance in our series (sex ratio = 1.64) is consistent with the international and African literature. Similar ratios were observed in Morocco by

Imad *et al.* (1.12), in Algeria by Benbekhti *et al.* (1.42), and in Mali by Dembélé *et al.* (1.5) [15]-[17]. This male overrepresentation may reflect behavioral, environmental, or hormonal factors, as well as lower utilization of healthcare services by women in certain sociocultural contexts.

Histological type: In our study, Lieberkuhnian adenocarcinoma represented the predominant histological type of colorectal cancer, in agreement with data from the World Health Organization indicating that more than 95% of colorectal cancers are adenocarcinomas [1]. This predominance is consistently observed in most regions of the world, regardless of the level of development of healthcare systems.

In Africa, although data remain limited, reported findings are similar. In Côte d'Ivoire, Odo *et al.* also identified Lieberkuhnian adenocarcinoma as the main histological subtype [14]. Likewise, in Morocco, a retrospective study conducted by Imad *et al.* reported its presence in 82% of cases [15].

Survival of patients with colorectal cancer: The results of this study highlight an extremely low survival rate among patients with CRC in Niger, with a five-year survival approaching zero. This situation mainly reflects late diagnosis and often incomplete or insufficient management.

The extremely low five-year survival observed in this study should be interpreted with caution, as many patients were enrolled late in the study period (up to 2023), and therefore had not yet completed a full five-year follow-up. In addition, appropriate censoring of patients lost to follow-up may influence survival estimates compared to studies in which such patients are incorrectly classified as deceased.

Similar results have been reported in several sub-Saharan African countries. In Senegal, Konaté *et al.* observed a five-year survival of less than 5% at the Aristide Le Dantec Hospital, in a context marked by advanced stages at diagnosis and incomplete treatment [18]. In Côte d'Ivoire, Odo *et al.* reported a median overall survival ranging between 15 and 19 months depending on age groups, mainly attributed to diagnostic delays and financial barriers [14].

A systematic review conducted by Hassen *et al.* in 2022, including 23 studies from sub-Saharan Africa, estimated the average five-year survival of CRC at 28%, with higher rates in middle-income countries (31%) than in low-income countries (20%) [21]. These data illustrate the major impact of socioeconomic development levels and healthcare system capacity on CRC prognosis.

In contrast, Maghreb countries report significantly higher survival rates. In Morocco (Imad *et al.*, 2024) reported a three-year overall survival of 60% [19]; in Algeria according to Benbekhti *et al.*, five-year overall survival is estimated at around 65% [16]; while in Tunisia, a recent study conducted in Monastir (Zemni *et al.*) in 2024 reported a survival rate of 55.1% [20]. These performances are attributed to better access to specialized care, availability of combined treatments, and a more structured care pathway organization.

In Western countries, five-year survival of CRC ranges between 60% and 65%,

according to the National Cancer Institute [24]. Data from the SEER program in the United States show a five-year survival of 64.4% for localized stages, compared with less than 15% for advanced stages [23]. In France, the National Cancer Institute reports a standardized net five-year survival of 63% (62% in men and 65% in women), linked to an organized screening strategy and rapid access to care [25].

In Asia, survival rates vary by country. In Korea (Hyuk Hure *et al.*, 2018) and in Japan (Nishizaki *et al.*, 2021), five-year survival exceeds 65%, thanks to well-established mass screening programs [26] [27]. In China (Wang *et al.*), five-year survival is estimated between 56% and 62%, with strong variations according to tumor stage (up to 85% at stage I versus approximately 30% at stage IV) [28]. In Southeast Asia (Danpanichkul *et al.*) and in some middle-income countries such as Malaysia (Muhamad *et al.*) and India (Chivshankhar *et al.*), survival remains lower, often below 40%, due to insufficient screening and inequalities in access to care [29]-[31].

Therapeutic adherence and access to care: In our study, therapeutic adherence proved to be a major prognostic factor for survival (HR = 1.59; IC95 % [1.107 - 2.297]; $p = 0.012$). Patients with good adherence had significantly better survival than those who interrupted or abandoned treatment, confirming its decisive role in CRC prognosis. These results are consistent with data from the literature. A large study conducted in sub-Saharan Africa by Hämmerl *et al.* (2023), including more than 600 patients from 11 cancer registries, showed that only 3.1% of patients with stage I to III CRC received treatment in accordance with NCCN recommendations, while nearly 35% received no treatment at all. In this study, absence of treatment was associated with a significantly higher risk of death (HR = 3.49; 95% CI: 2.30 - 5.29) [22].

The low rate of optimal management is explained by several interrelated factors: lack of awareness, absence of screening programs, disease stigma (particularly related to colostomy), recourse to traditional therapies, fear of side effects, insufficient availability of specialized care, and high treatment costs [22].

Furthermore, limited access to modern diagnostic tools constitutes a major obstacle. In the study by Hämmerl *et al.*, only 17% of patients had undergone a CT scan or MRI, exposing them to a significant risk of understaging [22]. Finally, the insufficiency of radiotherapy infrastructure in sub-Saharan Africa is well documented: Beltrán *et al.* estimated the average availability at 0.115 radiotherapy machines per million inhabitants, far below actual needs [32].

Study Limitations: This study has several limitations. Its retrospective, hospital-based design introduces selection bias and limits the generalizability of the findings to the broader Nigerien population. In addition, the absence of a structured follow-up system resulted in loss to follow-up, which may have affected the accuracy of long-term survival estimates, particularly at five years.

Treatment adherence was assessed using medical records; however, the lack of precise information on voluntary treatment discontinuation made it difficult to clearly distinguish between non-adherence and loss to follow-up, potentially lead-

ing to misclassification.

Another limitation concerns tumor staging and histological grading. The unavailability of certain advanced diagnostic tests and possible tumor understaging limited their comprehensive evaluation. Moreover, TNM classification and histological grade were frequently missing or inconsistently reported (77.9% and 90.1%, respectively), reflecting a lack of standardization in pathology reports.

In addition, multiple classification systems (AJCC 7th and 8th editions, WHO, and Duke staging) were used interchangeably, sometimes within the same record, preventing the inclusion of TNM stage and grade in survival analyses. As a result, the analysis was restricted to consistently available variables such as tumor location, metastasis status, treatment modalities, and adherence.

These findings highlight the urgent need for standardized pathology reporting and the systematic adoption of a unified staging system (e.g., AJCC 8th edition) in Niger to improve data quality and enable robust international comparisons.

5. Conclusions

Colorectal cancer in Niger remains associated with very poor survival in this hospital-based study, with a five-year survival rate close to zero. This unfavorable prognosis is mainly explained by late diagnosis, limited access to specialized cancer care, and poor treatment adherence.

In this hospital-based study, age, surgical management, radiotherapy, and especially good treatment adherence were identified as factors associated with improved survival. However, the assessment of tumor stage and histological grade was significantly limited by the lack of standardization in pathology reports, the heterogeneity of TNM and grading systems, and the unavailability of certain diagnostic investigations at the national level.

These findings highlight the urgent need to strengthen early detection strategies, improve access to multimodal cancer treatments, and reinforce patient adherence to therapy. In addition, the establishment of a reliable national cancer registry and the systematic standardization of clinical and pathological data are essential to improve data quality, guide public health policies, and allow meaningful international comparisons.

Overall, improving colorectal cancer outcomes in Niger requires an integrated national cancer control strategy focused on early diagnosis, equitable access to care, and better organization of oncology data systems.

Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] American Cancer Society (2025) Annual Cancer Facts & Figures. American Cancer Society.
<https://www.cancer.org/research/cancer-facts-statistics/all-cancer-facts-figures.html>

- [2] Bray, F., Ren, J.S., Masuyer, E. and Ferlay, J. (2013) Global Estimates of Cancer Prevalence for 27 Sites in the Adult Population in 2008. *International Journal of Cancer*, **132**, 1133-1145. <https://doi.org/10.1002/ijc.27711>
- [3] World Health Organization (2023) Cancer Colorectal. <https://www.who.int/fr/news-room/fact-sheets/detail/colorectal-cancer>
- [4] Bosman, F.T., Carneiro, F., Hruban, R.H. and Theise, N.D. (2010) WHO Classification of Tumors of the Digestive System. 4th Edition, World Health Organization.
- [5] Kassab, A., Landolsi, S., Miled, A., Ben Ahmed, S. and Gharbi, O. (2013) Dietary Habits and Colorectal Cancer in Tunisia. *Immunologie Biologie Spécialisée*, **28**, 327-333.
- [6] Idrissa, N. (2021) Colorectal Cancers at the National Hospital of Niamey: Epidemiological, Diagnostic, Therapeutic and Prognostic Aspects (2017-2021). MD Thesis, University of Niamey.
- [7] Sung, H., Ferlay, J., Siegel, R.L., Laversanne, M., Soerjomataram, I., Jemal, A., *et al.* (2021) Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. *CA: A Cancer Journal for Clinicians*, **71**, 209-249. <https://doi.org/10.3322/caac.21660>
- [8] Arnold, M., Sierra, M.S., Laversanne, M., Soerjomataram, I., Jemal, A. and Bray, F. (2017) Global Patterns and Trends in Colorectal Cancer Incidence and Mortality. *Gut*, **66**, 683-691. <https://doi.org/10.1136/gutjnl-2015-310912>
- [9] Ouédraogo, S., Tapsoba, T.W., Bere, B., Ouangre, E. and Zida, M. (2019) Épidémiologie, traitement et pronostic du cancer colorectal de l'adulte jeune en milieu subsaharien. <https://sci-hub.se/downloads/2019-10-30/ca/ouedraogo2019.pdf>
- [10] Kpossou, A.R., Vignon, R.K., Hadjete, J., Sokpon, C.N.M., Gnanngnon, F.H.R., Dossou, S., Kouanou, A.A., Gbessi, D.G. and Sehonou, J. (2025) Colorectal Cancers in Two Hospitals in Cotonou (2013-2023): Epidemiological and Clinical Features. *Mali Medical*, **40**, 1-8.
- [11] World Bank (2023) Population Ages 15-64 (% of Total)—Niger. <https://data.worldbank.org/indicator/SP.POP.1564.TO.ZS?locations=NE>
- [12] Bagnaka Eloumou, S.A.F., Bekolo Nga, W.T., Kenfack, G.U., Touko, L., Malongue, A., Tzeuton, C. and Noah, D. (2020) Prognostic Factors of Colorectal Cancer in Cameroon. *Health Sciences and Disease*, **21**.
- [13] Irabor, D.O. (2017) Emergence of Colorectal Cancers in West Africa: Accepting the Inevitable. *Nigerian Medical Journal*, **58**, 87-91. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3255166/>
- [14] Odo, B.A., Kouassi, K.K.Y., Issiaka, H., *et al.* (2024) Carcinome colorectal en Côte d'Ivoire: Étude comparée des caractéristiques épidémiologiques et histopathologiques selon la tranche d'âge. https://www.santetropicale.com/manelec/fr/resume_oa.asp?id_article=3719
- [15] Imad, F.E., Drissi, H., Radallah, D., *et al.* (2016) Facteurs de risque nutritionnels des cancers colorectaux chez une population marocaine: Étude cas-témoins. *Revue d'Épidémiologie et de Santé Publique*, **64**, S150. <https://www.researchgate.net/publication/339546583>
- [16] Benbekhti Abdrebbi, S. (2022) Five-Year Survival of Colorectal Cancer in Tlemcen. https://ajhs.atriss.dz/ressources/fichiers_produits/fichier_produit_96.pdf
- [17] Dembélé, B.T., Traoré, D., Saye, J. and Bengaly, B. (n.d.) Cancers colorectaux : aspects cliniques et thérapeutiques dans le service de chirurgie B du Point G. <https://www.bibliosante.ml/bitstream/handle/123456789/4986/21M329.pdf>

- [18] Konaté, I., *et al.* (n.d.) Étude descriptive des cancers colorectaux à la clinique chirurgicale du CHU Aristide Le Dantec de Dakar.
<https://www.researchgate.net/profile/Papa-Ba-2/publication/257788343>
- [19] Imad El Badisy, Z.B., Khalis, M., Elansari, S., ElHitmi, Y., Abbass, F., Mellas, N. and El Rhazi, K. (2024) Risk Factors Affecting Patients' Survival with Colorectal Cancer in Morocco: Survival Analysis Using an Interpretable Machine Learning Approach. Preprint. <https://pubmed.ncbi.nlm.nih.gov/38346963/>
- [20] Zemni, I., Maatouk, A., Bennisrallah, C., *et al.* (2024) Five-Year Cancer Survival Rates in Monastir, Tunisia. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC11516191/>
- [21] Hassen, H.Y., Hussien, F.M., Hassen, A.M., Dewau, R., Amsalu, E.T., Limenih, M.A., *et al.* (2022) Survival Pattern of Colorectal Cancer in Sub-Saharan Africa: A Systematic Review and Meta-Analysis. *Cancer Epidemiology*, **81**, 102276.
<https://doi.org/10.1016/j.canep.2022.102276>
- [22] Hämmerl, L., Mezger, N.C.S., Seraphin, T.P., Joko-Fru, W.Y., Griesel, M., Feuchtner, J., *et al.* (2023) Treatment and Survival among Patients with Colorectal Cancer in Sub-Saharan Africa: A Multicentric Population-Based Follow-Up Study. *Journal of the National Comprehensive Cancer Network*, **21**, 924-933.e7.
<https://doi.org/10.6004/jnccn.2023.7041>
- [23] National Cancer Institute. (n.d.) Cancer Stat Facts: Colorectal Cancer.
<https://seer.cancer.gov/statfacts/html/colorect.html>
- [24] Myhre, J. and Sifris, D. (2023) Colon Cancer Survival Rates by Stage and Types and the Effect of Factors Like Age, Race, and Health. Very well Health.
<https://www.verywellhealth.com/colon-cancer-prognosis-survival-rate-life-expectancy-5093897>
- [25] Institut National du Cancer (2022) Les cancers en France - Édition 2022: Cancer Colorectal.
<https://www.cancer.fr/professionnels-de-sante/statistiques-et-chiffres-sur-les-cancers/epidemiologie-des-cancers/cancer-colorectal>
- [26] Nishizaki, D., Hida, K., Sumii, A., Okamura, R., Sakai, Y., Konishi, T., *et al.* (2022) Laparoscopic versus Open Surgery for Locally Advanced Rectal Cancer: Five-Year Survival Outcomes in a Large, Multicenter, Propensity Score-Matched Cohort Study. *Diseases of the Colon & Rectum*, **65**, 1005-1014.
<https://doi.org/10.1097/dcr.0000000000002196>
- [27] Hur, H., Oh, C., Won, Y., Oh, J.H. and Kim, N.K. (2018) Characteristics and Survival of Korean Patients with Colorectal Cancer Based on Data from the Korea Central Cancer Registry Data. *Annals of Coloproctology*, **34**, 212-221.
<https://doi.org/10.3393/ac.2018.08.02.1>
- [28] Wang, R., Lian, J., Wang, X., Pang, X., Xu, B., Tang, S., *et al.* (2023) Survival Rate of Colorectal Cancer in China: A Systematic Review and Meta-Analysis. *Frontiers in Oncology*, **13**. <https://doi.org/10.3389/fonc.2023.1033154>
- [29] Danpanichkul, P., Moolkaew, P., Kanjanakot, Y., Polpichai, N., Jaroenlapnopparat, A., Kim, D., *et al.* (2023) Rising Incidence and Impact of Early - onset Colorectal Cancer in the Asia-Pacific with Higher Mortality in Females from Southeast Asia: A Global Burden Analysis from 2010 to 2019. *Journal of Gastroenterology and Hepatology*, **38**, 2053-2060. <https://doi.org/10.1111/jgh.16331>
- [30] Muhamad, N.A., Ma'amor, N.H., Rosli, I.A., Leman, F.N., Abdul Mutalip, M.H., Chan, H., *et al.* (2023) Colorectal Cancer Survival among Malaysia Population: Data from the Malaysian National Cancer Registry. *Frontiers in Oncology*, **13**.

<https://doi.org/10.3389/fonc.2023.1132417>

- [31] Shivshankar, S., Patil, P.S., Deodhar, K. and Budukh, A.M. (2025) Epidemiology of Colorectal Cancer: A Review with Special Emphasis on India. *Indian Journal of Gastroenterology*, 44, 142-153. <https://doi.org/10.1007/s12664-024-01726-8>
- [32] Beltrán Ponce, S. E., Abunike, S. A., Bikomeye, J. C., *et al.* (2023) Access to Radiation Therapy and Related Clinical Outcomes in Patients with Cervical and Breast Cancer across Sub-Saharan Africa: A Systematic Review. *JCO Global Oncology*, 9, e2200218. <https://pubmed.ncbi.nlm.nih.gov/36795990/>