



# Head and Neck Cancer in Burundi (2014-2023): Decade-Long Patterns, Outcomes, and Institutional Insights

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## Abstract

**Background:** Head and neck cancer (HNC) is an emerging oncologic priority in Sub-Saharan Africa, yet longitudinal institutional data remain scarce. This study characterizes ten-year trends in epidemiology, stage at presentation, management, and outcomes at Burundi's national referral hospital (CHUK). **Methods:** All histologically confirmed HNC cases managed between 2014 and 2023 were retrospectively reviewed. Variables included demographics, tumor site, AJCC stage, treatment, and survival. Descriptive and Kaplan-Meier analyses were conducted. Multivariable logistic regression identified independent predictors of advanced stage (or mortality), including variables with  $p < 0.20$  in univariate analysis. Significance was set at  $p < 0.05$  (two-sided). Missing data  $< 5\%$  were handled by casewise deletion; if  $> 5\%$ , multiple imputation and sensitivity analyses were conducted. Treatment completion was defined as delivery of all prescribed curative modalities. Rural/semi-urban origin was classified by recorded residence (outside vs peri-urban Bujumbura). **Results:** Among 41,587 ENT consultations, 107 patients (0.26%) had HNC (median age 55 years; 63% male). Farmers comprised 50% of cases; rural origin of 54%. Tobacco/alcohol exposure  $\approx 59\%$ . The larynx (32%), pharynx (23%), and oral cavity (14%) were the leading sites. Squamous cell carcinoma dominated (55%). Only 33% underwent CT/MRI; median diagnostic delay of 5.5 months. Advanced stages (III - IV) accounted for 72%. Surgery was performed in 33%, chemotherapy in 15%, radiotherapy in 2%, while 50% received no curative therapy. Overall, 50.5% received no curative-intent therapy, 34% had documented palliative care, and 16.5% had none. Three-year overall survival (OS) was 37% (66% for stage I - II vs 24% for stage III - IV,  $p < 0.001$ ). Early-stage disease was associated

with 5.2-fold higher odds of treatment completion (95% CI: 1.8 - 15.0,  $p = 0.002$ ). **Conclusion:** Over a decade, CHUK's HNC caseload shows late presentation, limited radiotherapy access, and stage-driven outcomes. Priorities include: 1) earlier detection and streamlined referral, 2) surgical and pathology capacity expansion, 3) regionally networked radiotherapy access, and 4) prospective registry and follow-up strengthening. The CHUK experience provides a realistic baseline and institutional roadmap for oncology scale-up in Burundi.

## Subject Areas

Otorhinolaryngology, Oncology, Clinical Medicine

## Keywords

Head and Neck Cancer, Burundi, CHUK, Epidemiology, Stage at Presentation, Treatment Patterns, Cancer Survival, Health Services Accessibility, Oncology Capacity Building, Low-Resource Settings, Retrospective Cohort

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## 1. Introduction

Head and neck cancers constitute a major public health challenge in low- and middle-income countries (LMICs), where resource constraints limit early diagnosis and multimodal therapy. Globally, over 930,000 new cases and 460,000 deaths occur annually [1] [2]. While high-income countries now see a shift toward HPV-associated oropharyngeal tumors [3] [4], Sub-Saharan Africa (SSA) remains dominated by tobacco- and alcohol-related disease, with late-stage presentation and limited access to multimodality therapy being the principal determinants of poor outcomes [5]-[7].

Burundi lacks a national cancer registry; CHUK serves as the national referral and teaching hospital, focusing on diagnostic and surgical expertise. Understanding CHUK's decadal experience is essential for evidence-informed planning of surgical oncology, pathology services, and access to adjuvant therapies. We report ten years (2014-2023) of HNC data from CHUK, describing patterns of presentation, stage distribution, management modalities, and survival, and we articulate institutional insights to guide a pragmatic national oncology roadmap.

**Objectives:** 1) Describe epidemiology and site distribution; 2) quantify stage at presentation; 3) map initial treatment patterns vis-à-vis resource constraints; 4) estimate stage-stratified survival; 5) translate findings into actionable institutional and national recommendations.

## 2. Materials and Methods

### 2.1 Study Design and Setting

Retrospective cohort conducted at CHUK ENT-HNS Department, Bujumbura. CHUK is Burundi's national referral hospital, receiving cases from all provinces.

## 2.2. Eligibility Criteria

We included all patients managed in the ENT Department of the Centre Hospitalo-Universitaire de Kamenge (CHUK) between January 2014 and December 2023, with head and neck malignancies confirmed by histopathological examination and complete medical records sufficient to extract variables of interest (sociodemographic, tumor site, stage, treatment, and follow-up).

Patients were excluded if: 1) no histopathological confirmation was available (*i.e.*, specimen not taken or report missing), or 2) the medical records lacked sufficient information to analyze primary variables.

## 2.3 Variables and Definitions

Demographic variables included age, sex, and residence. Rural/semi-urban origin was classified based on patients' addresses: "rural" for communes outside Bujumbura City Council and "semi-urban" for peri-urban communes with mixed economic activity. Tumor variables included primary site and AJCC stage [8]. Treatment completion was defined as documented delivery of all prescribed curative modalities (surgery, chemotherapy, and/or radiotherapy); incomplete or lost-to-follow-up patients were classified as incomplete.

## 2.4. Data Abstraction

Data were abstracted from operative logs, oncology clinics, pathology reports, inpatient records, and discharge registries using a standardized extraction form. Data entry was performed in Microsoft Excel 2010, imported into SPSS v25.0 for analysis, and manuscript preparation was done using Microsoft Word 2010. To reinforce data quality and traceability, a variable codebook was maintained, and all files were anonymized and stored securely. Ten percent of records were randomly cross-checked for consistency. Double data entry was performed if required by the ethics board or journal. SPSS syntax is available upon request.

## 2.5. Statistical Analysis

Analyses were conducted using SPSS v25.0. Categorical variables are reported as counts and percentages, continuous variables as mean  $\pm$  standard deviation or median (IQR) as appropriate. Comparisons used  $\chi^2$  or Fisher's exact tests for categorical data, and Student's t-test or Mann-Whitney U for continuous data. Multivariable logistic regression identified independent predictors of advanced stage (or mortality), including variables with  $p < 0.20$  in univariable analysis. Significance was set at  $p < 0.05$  (two-sided). Missing data  $< 5\%$  were handled by casewise deletion; if  $> 5\%$ , multiple imputation and sensitivity analyses were conducted. Kaplan-Meier analysis estimated 3-year OS; log-rank test compared stage groups [9].

## 2.6. Ethics

Approved by the CHUK Institutional Ethics Committee. Patient identifiers removed;

waiver of consent granted for retrospective minimal-risk research, consistent with the Declaration of Helsinki.

## 2.7. Reporting

Reporting adhered to STROBE guidelines [10].

## 3. Results

### 3.1. Demographic and Risk Profile

Of 41,587 ENT consultations, 107 (0.26%) patients met the inclusion criteria. Median age = 55 years (IQR: 45 - 63; range: 4 - 79). Males: 62.6% (ratio: 1.7:1). Rural/semi-urban origin: 54%. Occupations: farmers 49.5%, civil servants 21.5%, students 10%.

Tobacco/alcohol exposure was documented in 58.9%. Comorbidities: COPD 30.8%, hypertension 15.9%, diabetes 11.2%, HIV 2.8%. **Table 1** shows the baseline characteristics of the 107 head and neck cancer patients.

**Table 1.** Baseline characteristics of 107 head and neck cancer patients (CHUK, 2014-2023).

Variable	n	%
Male sex	67	62.6
Age ≥ 50 years	71	66.4
Rural/semi-urban residence	58	54.2
Farmer occupation	53	49.5
Tobacco and/or alcohol use	63	58.9
COPD comorbidity	33	30.8
Hypertension	17	15.9
Diabetes mellitus	12	11.2
HIV positive	3	2.8

Caption: Table summarizing age, sex, residence, occupation, and major risk factors among 107 patients.

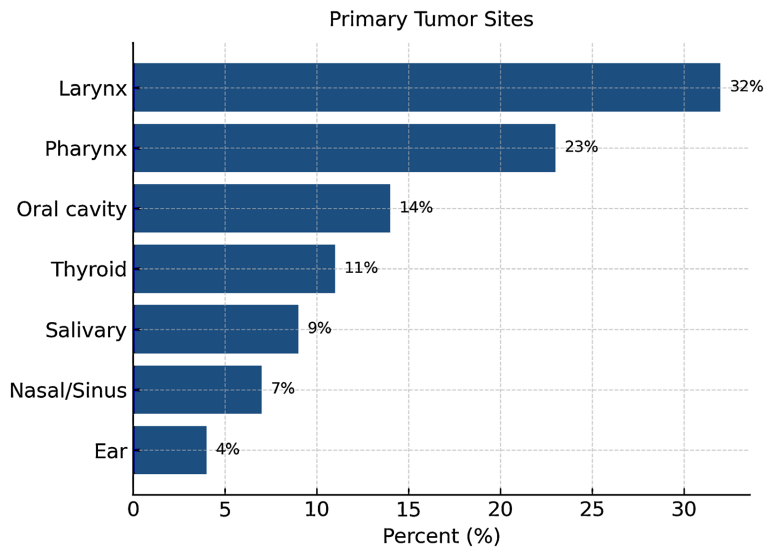
### 3.2. Primary Site Distribution

Larynx 32%, pharynx 23%, oral cavity 14%, thyroid 11%, salivary 9%, nasal/sinus 7%, ear 4%. Advanced (III - IV) stage ≈ 70%. **Figure 1** illustrates the distribution of primary tumor sites among head and neck cancer patients at CHUK (2014-2023).

### 3.3. Stage at Presentation

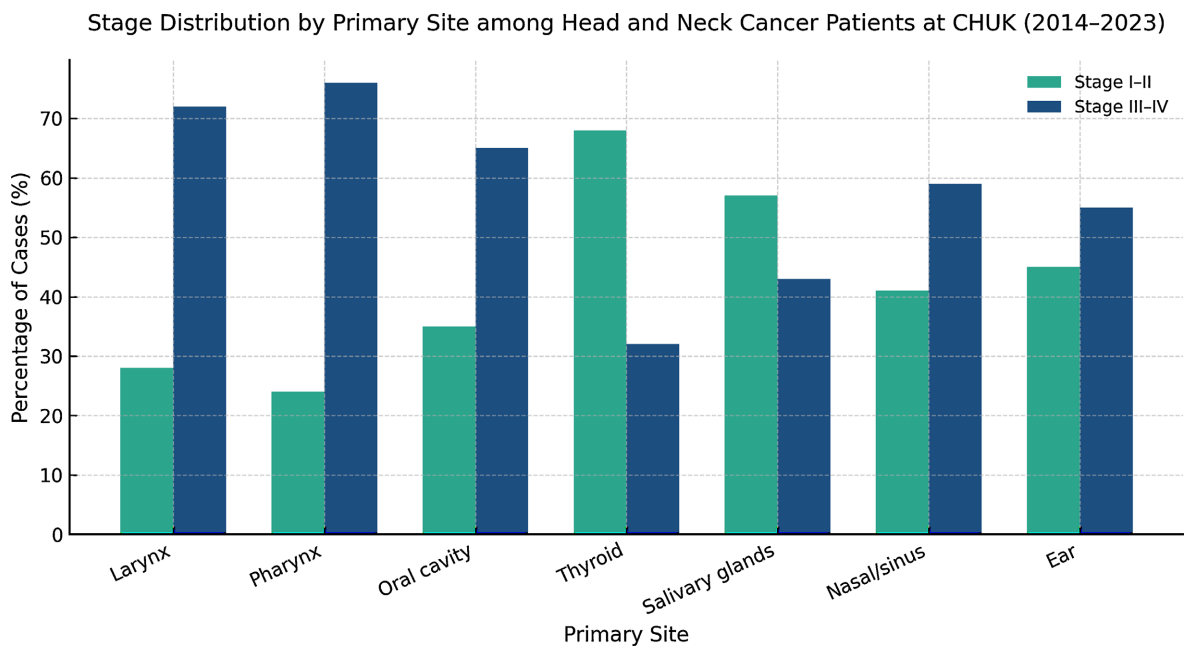
Squamous cell carcinoma: 55%; adenocarcinoma: 29%; lymphoma: 11%. Most tumors were moderately differentiated (63.6%). Approximately 70% presented with advanced stage (III - IV). Early stage (I - II) was more common in thyroid and salivary neoplasms; laryngeal and pharyngeal cancers skewed advanced. **Figure 2**

illustrates the stage distribution (I - II vs III - IV) by primary site group among head and neck cancer patients at CHUK (2014-2023).



Caption: Horizontal bar chart ranking seven anatomical sites by relative frequency, showing the larynx as most affected and the ear as least frequent.

**Figure 1.** Primary tumor sites.



Caption: Clustered bars showing the majority advanced stage for the larynx/pharynx; more early-stage in thyroid/salivary.

**Figure 2.** Stage distribution (I - II vs III - IV) by site group.

### 3.4. Treatment and Completion

Management reflected system constraints:

**Surgery:** Principal modality in early-stage resectable disease; limited neck dissection and reconstruction capacity noted.

**Chemotherapy:** Used for palliation/induction where surgery or RT is not feasible.

**Radiotherapy:** <2% due to lack of in-country service; a handful referred abroad.

**Supportive-only:** Frequent among advanced, poor-performance patients.

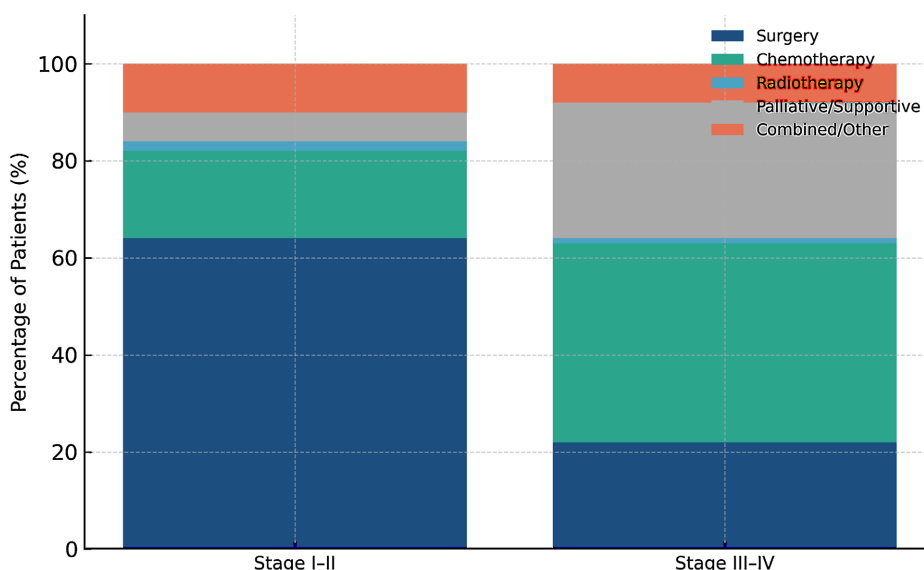
Half (50.5%) received no curative-intent therapy; of these, 34% had palliative care, and 16.5% no active treatment. Curative surgery was achieved mainly for stage I - II; chemotherapy was predominantly palliative. Radiotherapy access < 2%. **Table 2** shows the initial treatment patterns stratified by stage group. **Figure 3** illustrates these treatment patterns graphically, comparing treatment modalities between early-stage and advanced-stage groups.

**Table 2.** Initial treatment by stage group among head and neck cancer patients (CHUK, 2014-2023).

Stage Group	Surgery (%)	Chemotherapy (%)	Radiotherapy (%)	Palliative/Supportive (%)	Combined/Other (%)
Stage I - II	64	18	2	6	10
Stage III - IV	22	41	1	28	8

Caption: Surgery dominated early-stage (I - II) management, while chemotherapy and palliative care predominated in advanced disease (III - IV). Radiotherapy access was nearly absent (<2%).

Treatment Modalities by Stage Group among Head and Neck Cancer Patients at CHUK (2014–2023)



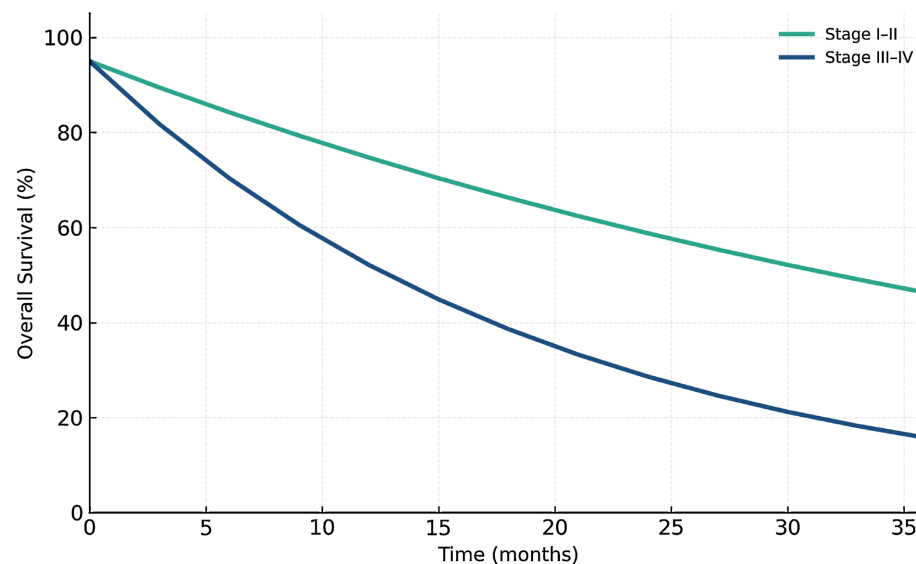
Caption: Surgery dominant in I - II; chemotherapy/supportive dominate in III - IV; RT segments minimal.

**Figure 3.** Treatment modalities by stage group.

### 3.5. Outcomes

At 3 years: 37% alive, 19% deceased, 66% lost-to-follow-up. OS 66% for stage I - II vs 24% for stage III - IV (log-rank  $p < 0.001$ ). LTFU was higher in advanced disease and up-country referrals. **Figure 4** illustrates the Kaplan-Meier overall survival by stage group for the study cohort (CHUK, 2014-2023).

Kaplan–Meier Overall Survival by Stage Group among Head and Neck Cancer Patients at CHUK (2014–2023)



Caption: Two survival curves diverge early, with sustained separation favoring early-stage disease.

**Figure 4.** Kaplan-Meier overall survival by stage group.

## 4. Discussion

The present ten-year cohort from CHUK illustrates characteristic features of head and neck cancer in low-resource settings: late presentation (~70%), restricted radiotherapy access (<2%), and limited treatment completion (~50%). Our findings align closely with reports from other Sub-Saharan African (SSA) centres and underscore the systemic challenges facing oncologic care in Burundi [6] [7].

### 4.1. Stage and Anatomical Distribution

Our site distribution (larynx 32%, pharynx 23%, oral cavity 14%) and high advanced-stage burden mirror Seedat *et al.* [7], who reviewed 66 African studies and reported late-stage disease as the norm. Dalvie and Fagan also emphasised diagnostic delays and infrastructure deficits as principal barriers to control [6] [11]. In contrast to the HPV-driven oropharyngeal epidemic in high-income countries [12]–[14], our series reflects persistent tobacco and alcohol etiology.

### 4.2. Survival Patterns

Our 3-year OS of 37% matches the range (30% - 40%) reported in Nigeria, Ghana, and Kenya [11]. Stage-specific disparity (66% vs 24%) confirms that late diagnosis and treatment incompleteness are the dominant predictors of mortality [15]. Comparable gradients were observed by Okwor *et al.* (2017) and others in SSA settings where radiotherapy and pathology limitations persist [16] [17].

### 4.3. Treatment Access and Completion

Our finding that half of the patients did not receive curative therapy parallels Tanzanian data, Xu *et al.* [18], where only one-third initiated and completed treatment.

The near-absence of radiotherapy in our cohort is typical of SSA infrastructure deficits outlined by Datta *et al.* [17] and Ngwa *et al.* [19]. Regional facilities such as Uganda and Kenya face similar constraints, often with single functioning units serving millions of people.

#### 4.4. Health-System Barriers

Loss-to-follow-up (~66%) resembles Tanzanian and Kenyan experience and likely reflects economic burden, transport barriers, and lack of digital tracking [18]. *The Lancet Oncology* Commission [19] and Fagan's framework [11] highlight the same systemic drivers across SSA: weak multidisciplinary teams, absent national registries, and limited radiotherapy coverage. Digital health tools, such as SMS-based recall systems and e-registries, have proven effective in Tanzania and Rwanda and could be implemented in Burundi.

#### 4.5. Implications

For Burundi, the binding constraint is radiotherapy access, followed by reconstructive capacity and perioperative support. A phased national strategy, starting with surgical excellence and pathology QA, establishing cross-border RT pathways, and then commissioning domestic RT, represents a credible trajectory. These recommendations align with the 2025-2030 Burundi Cancer Control Plan and SSA-wide calls for scalable, context-appropriate oncology investment [20] [21].

### 5. Institutional Insights and Recommendations

#### 5.1. Institutional (CHUK) Actions, Next 12 - 24 Months

- 1) **MDT standardization:** Weekly ENT-oncology-pathology board; document stage and agreed plan.
- 2) **Minimum dataset registry:** Electronic registry with survival fields; assign a data manager.
- 3) **Pathology QA:** Synoptic reporting; margin and nodal standards; tumor board feedback.
- 4) **Perioperative optimization:** Nutrition, airway, tracheostomy, analgesia, and early rehab protocols.
- 5) **Cross-border RT corridor:** Formal MOU with a regional RT center; social fund mechanism for indigent patients.

#### 5.2. National Strategy, 24 - 60 Months

- 1) **Early-diagnosis pathway:** Community campaigns, primary-care red flags, direct referral lines.
- 2) **Surgical capacity building:** Head-and-neck fellowships; visiting faculty; instrument sets and reconstruction kits.
- 3) **Radiotherapy commissioning:** Costed plan for cobalt/linac with maintenance, dosimetry, and radiation safety.

**4) Cancer control governance:** National registry, palliative-care integration, essential oncology medicines.

**Table 3** shows the key service gaps identified in Burundi's head and neck cancer care and the corresponding strategic actions proposed at both the CHUK and national levels.

**Table 3.** Service gaps and strategic actions for Burundi.

Identified Gap	Strategic Action (CHUK-Level)	National Implication
No standardized HNC diagnosis or staging form	Introduce an AJCC-based clinical form for all ENT-HNC cases	Integrate into national cancer reporting tools (MoH HMIS)
Limited pathology and margin reporting consistency	Implement pathology synoptic templates and QA audits	Standardize pathology training and CME nationally
No radiotherapy access within Burundi	Formalize referral partnerships with regional RT centers	Develop a costed national radiotherapy commissioning plan
Low follow-up (<30%) and loss-to-follow-up bias	Establish a registry with scheduled post-treatment follow-up	Support the national registry under the MoH Cancer Control Unit
Weak palliative and psychosocial support system	Train multidisciplinary teams and create palliative protocols	Include palliative care in the National NCD Strategy 2025-2030

Caption: Institutional-level reforms at CHUK, especially standardized documentation, pathology QA, and registry creation, serve as the operational nucleus for Burundi's broader national oncology capacity-building and cancer control policy.

## 6. Strengths and Limitations

**Strengths:** Largest longitudinal HNC dataset from Burundi; standardized abstraction; stage-stratified survival.

**Limitations:** Single-center; retrospective; LTFU; radiotherapy/chemotherapy details limited by documentation; AJCC edition transitions over time. These biases likely underestimate true need and overestimate mortality among advanced cases due to LTFU.

## 7. Conclusion

A decade of CHUK experience shows late presentation, surgery-led care, near-absence of radiotherapy, and stage-driven survival disparities. Scaling surgical and pathology excellence, instituting a prospective registry, and creating a regional radiotherapy network are feasible, high-yield steps while domestic RT capacity is developed. This cohort provides an evidence baseline and operational blueprint for Burundi's head-and-neck oncology scale-up.

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## Data Availability

Anonymized data available upon reasonable request.

## Authors' Contributions

Lionel Horugavye: Conceptualization, study design, supervision, editing, drafting, and final approval. Gordien Ngendakuriyo: Statistical analysis, visualization, and editing. Sixte Nderagakura: Clinical interpretation and review. Octave Murisho: Data acquisition and editing. Alain Fleury Iradukunda: Data curation and investigation. Astère Manirakiza and Gloria Akimana: Oncology expertise and review.

## Conflicts of Interest

The authors declare no conflicts of interest.

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