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National Improvement of Waiting Times: First Results From the Dutch Head and Neck Audit

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Abstract

Objective. Timely treatment initiation in head and neck cancer (HNC) care is of great importance regarding survival, oncological, functional, and psychological outcomes. Therefore, waiting times are assessed in the Dutch Head and Neck Audit (DHNA). This audit aims to assess and improve the quality of care through feedback and benchmarking. For this study, we examined how waiting times evolved since the start of the DHNA.

Study Design. Prospective cohort study.

Setting. National multicentre study.

Methods. The DHNA was established in 2014 and reached national coverage of all patients treated for primary HNC in 2019. DHNA data on curative patients from 2015 to 2021 was extracted on national (benchmark) and hospital level. We determined 3 measures for waiting time: (1) the care pathway interval (CPI, first visit to start treatment), (2) the time to treatment interval (TTI, biopsy to start treatment), and (3) CPI-/TTI-indicators (percentage of patients starting treatment ≤30 days). The Dutch national quality norm for the CPI-indicator is 80%.

Results. The benchmark median CPI and TTI improved between 2015 and 2021 from 37 to 26 days and 37 to 33 days, respectively. Correspondingly, the CPI- and TTI-indicators, respectively, increased from 39% to 64% and 35% to 40% in 2015 to 2021. Outcomes for all hospitals improved and dispersion between hospitals declined. Four hospitals exceeded the 80% quality norm in 2021.

Conclusion. Waiting times improved gradually over time, with 4 hospitals exceeding the quality standard in 2021. On the hospital-level, process improvement plans have been initiated. Systematic registration, auditing, and feedback of data support the improvement of quality of care.

Keywords

diagnostic delay, head and neck cancer, hospital variation, quality registry, survival, therapeutic delay, time interval

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Head and neck cancer (HNC) comprises a heterogeneous group of tumors. These tumors tend to proliferate in a functionally and esthetically challenging region.[1] In addition, HNC patients often undergo multidisciplinary treatment, resulting in elaborate care pathways. As the options for diagnostic and treatment procedures increase and health care costs rise, there is a demand for value-based health care.[2] To evaluate and improve the quality of HNC care, a quality registry was established in 2014: the Dutch head and neck audit (DHNA).[3] All patients treated for primary HNC were prospectively enrolled in this database, with national coverage of all head and neck oncology centers (HNOCs) since 2019. Quality indicators were developed and categorized as structure, process, or outcome measures following the method of Donabedian.[2,4,5] This quality

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assessment method focuses initially on structure indicators, followed by process indicators and finally analysis of outcome measures. The DHNA aims to evaluate and improve quality of care by providing feedback to and benchmarking all participating centers.[3]

One process indicator has been a topic of interest for a long time; waiting times in HNC care. Timely treatment initiation is necessary regarding survival, oncological, functional, and psychological outcomes.[1,6] Between 1995 and 2005, waiting times in the Netherlands increased for various reasons. These include the introduction of fixed budgets, capacity limitations, new and more options for diagnostic procedures and treatment, and the centralization of HNC care.[7-9] In 2003, the mean time between first appointment and treatment initiation was 44 days, with only 22% of the patients starting treatment within 30 days.[10] In 2009, the Dutch national quality standard was set at 30 days or less between first consultation and treatment initiation in 80% of the patients.[10,11]

Both patients and health care professionals consider waiting times an important process indicator for quality of care. Indeed, patients expressed their desire for waiting time reduction when the DHNA was established.[12] For this reason, waiting time is one of the measures the DHNA focuses on. For this study, we aimed to evaluate the trends in waiting times since registration began in 2015.

Material and Methods

Study Design

This was a cohort study using prospectively collected DHNA data. Dutch health care is socialized and the mandatory basic health insurance covers HNC care. This care is executed in 14 Dutch hospitals, the HNOCs, 8 of which are academic hospitals. New patients are referred to the nearest HNOC and can request a second opinion in another HNOC when desired. Since 2019, all 14 HNOCs contribute to the DHNA, one of many national quality registries of the Dutch institute for Clinical Auditing.[13] This organization guarantees data quality through annual verification processes.[13,14] By Dutch law, ethical approval was not required for this study as data is fully anonymized.

Population

Patients with a tumor of the pharynx, larynx, oral cavity, salivary gland, or nasal cavity are included in the DHNA. Cervical lymph node metastasis or squamous cell cancer of an unknown primary tumor (CUP) is also included. Patients with in situ carcinoma, a second primary tumor, or recurrent malignancy of the head and neck region are excluded. Melanomas, cutaneous malignancies, thyroid carcinomas, sarcomas, neuroendocrine cancers, and hematologic malignancies are currently not included in the DHNA. Data on all records of curatively treated patients registered from January 1, 2015, to December 31, 2021, was extracted. Data from the first registration year (2014) was excluded as this comprised limited data on 3 centers. Patient characteristics (age, gender, comorbidities, performance status), tumor characteristics (location, clinical TNM [cTNM], pathological TNM [pTNM]), and primary treatment modality (surgery, radiotherapy, systemic therapy, multimodality treatment) were extracted from the DHNA database. Dates of referral, first consultation, pathological confirmation (biopsy), multidisciplinary team (MDT) meeting, and first treatment were used to calculate intervals. Patients that received their primary treatment in another hospital or that received no/unknown treatment were excluded.

Definitions

We determined the care pathway interval (CPI), time to treatment interval (TTI), and corresponding indicators to assess waiting times. The CPI was defined as the number of days from the first visit to an HNOC to curative treatment initiation. The TTI was defined as the days between histopathological biopsy and curative treatment initiation. For the indicators, the percentage of patients with a CPI or TTI of ≤30 days was calculated following the national quality standard. In the Netherlands, HNC patients are referred to an HNOC by a general practitioner, dentist, or non-HNOC hospital. Pathological confirmation is either obtained by the referring specialist or the HNOC specialist. Logically, biopsy before or after referral influences the CPI and TTI. For tumor staging, the Union for International Cancer Control TNM Classification was used, with the seventh edition for up to and including 2017 and the eighth edition from 2018 onward.[15,16] Comorbidities were scored according to the Adult Comorbidity Evaluation 27 (ACE-27) for oncological patients.[17]

Statistical Analysis

Continuous data are presented as a mean with standard deviation or median with interquartile range (IQR) based on the distribution. Categorical variables are presented as number of records with percentages. Analysis was performed using the R software system for statistical computing (version 4.2). Where appropriate, the Wilcoxon rank-sum, Fisher's exact, and Pearson's χ^2 test were used for categorical comparison. CPI and interhospital variation improvements were analyzed in a funnel plot.[13] The funnel plots of the CPI-indicator show the difference between individual hospitals and the national benchmark (weighted mean) with corresponding confidence intervals (CIs). One can say that a hospital outside of the 95% CI differs from the national benchmark with 95% certainty. As data are dichotomized for the CPI-indicator, median funnel plots were added to provide insight into hospital improvement in CPI above the 30-day limit. These median funnel plots show the difference between individual hospitals and the national benchmark (median) with corresponding control limits. For varying numbers of patients, the distribution of the median CPI was computed by repeated random sampling from all available CPIs. This distribution's 2.5 and 97.5 percentiles are presented as control limits in the funnel plot.[18] By checking if the median CPI of a particular hospital falls outside the control limits, one can test if there is significant deviation from the overall (nationwide) performance. In case of a small number of patients (N), no reliable statement about the hospital's performance can be made.

Results

Study Population

A sample of 11,266 patients curatively treated for primary HNC could be included between 2015 and 2021. (**Figure 1**) Patients were predominantly male (64.1%) with a median age of 66 years (IQR: 59-74 years). (**Table 1**) No comorbidities were present in 23.3%, with 24.0% experiencing comorbidities of ACE-27 grade 1-3. Data on comorbidity was missing in 52.7%. The World Health Organization (WHO) performance status was normal in 41.8%, but 24.5% was restricted in activity to disabled (WHO: 1-4), and data were missing in 33.8%. cTNM staging indicated local disease in 40.8% (cTNM stage 0-II) and advanced disease in 53.5% (cTNM stage III-IV). The cTNM stage was unknown in 5.8%. Tumor subsites varied, with the oral cavity (31.0%), larynx (23.6%), and oropharynx (22.2%) being the most common sites. When patients were treated with a single modality, this encompassed surgery in 27.3% and radiotherapy in 30.1%. Chemoradiation was given to 19.1% of the patients. Surgical treatment was complemented with radiotherapy in 19.6% and with chemoradiation in 3.6%. The number of registered patients per year increased up until 2018 as more centers joined the DHNA, with 2134 to 2287 records per year from 2018 onward.

Trends in Waiting Times

The benchmark median CPI/TTI declined from 37/38 days in 2015 to 26/33 days in 2021 ($P < .001$). (**Figure 2**) From 2018 on, the median CPI remained under 30 days. Correspondingly, the benchmark CPI- and TTI indicators increased from 39% and 35% in 2015 to 64% and 40% in 2021, respectively ($P < .001$), as more patients start treatment within 30 days or less (**Figure 3**). The density plot for the CPI in 2021 displays the distribution of waiting times around the benchmark, with the 90th percentile at 47 days (**Figure 4**). In 2021, waiting times were shorter for local disease (median CPI 23 days) compared to advanced disease (median CPI 27 days) (**Figure 5**). Within patients treated in 2021, those who underwent surgery as first treatment had a shorter median CPI (23 days) compared to radiotherapy, systemic therapy, or multimodality treatment (27-28 days).

Hospital Variation in CPI

The number of participating hospitals was expanded from 7 in 2015 to all 14 HNOCs from 2018 onward. For the CPI-indicator, hospital variation was assessed using funnel plots (**Figure 6**). HNOCs individual CPI-indicator rates varied from 17.0% to 81.8% in 2015. In 2018, the quality standard was met for the first time by 3 HNOCs, and by 4 in 2021. That year, CPI-indicator rates ranged from 38.4% to 94.2%. Three hospitals scored higher than the upper bound of the 95% CI in 2021, indicating that they performed better than the benchmark with 95% certainty. The 5 hospitals with percentages under the lower bound of the 95% CI performed below the benchmark with 95% certainty in that year.

Hospital variation in median CPI for 2015 and 2021 is presented using median funnel plots (**Figure 7**). In 2015, participating HNOCs had a median CPI between 21 and 48 days. Dispersion declined over the years, with the median CPI ranging from 17 to 34 days in 2021. Five centers had a median above 30 days in 2021, all of which are outside of the upper limit of the 97.5 percentile. There were 4 hospitals with a median under the 2.5 percentile.

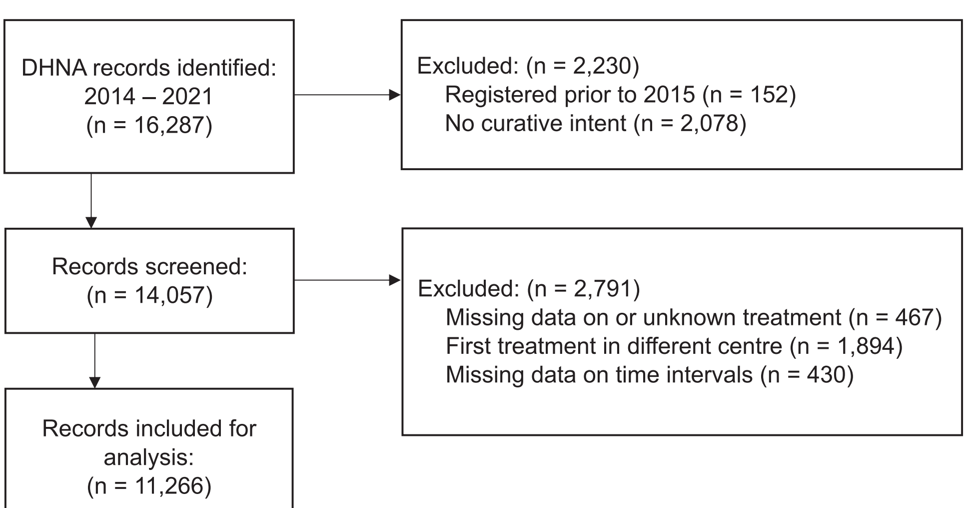

Figure 1. Flowchart for study cohort selection from the Dutch head and neck audit (DHNA).

Table 1. Demographic Characteristics of Population

Total	N = 11,266
Gender	
Male	7225 (64.1%)
Female	3549 (31.5%)
Unknown	492 (4.4%)
Age (median years, IQR)	66 (59, 74)
ACE-27 score	
No comorbidities (0)	2628 (23.3%)
Comorbidities (1-3)	2705 (24.0%)
Unknown	5933 (52.7%)
WHO performance score	
Normal activity (0)	4706 (41.8%)
Restricted activity to disabled (1-4)	2757 (24.5%)
Unknown	3803 (33.8%)
Clinical TNM stage	
Local disease (stage I-II)	4596 (40.8%)
Advanced disease (stage III-IV)	6022 (53.5%)
Unknown	648 (5.8%)
Tumor location	
Oral cavity	3490 (31.0%)
Oropharynx	2505 (22.2%)
Nasopharynx	277 (2.5%)
Hypopharynx	710 (6.3%)
Larynx	2659 (23.6%)
Nasal cavity	477 (4.2%)
Salivary glands	634 (5.6%)
SCC unknown primary	301 (2.7%)
Other	213 (1.9%)
Treatment modality	
Surgery	3079 (27.3%)
Surgery and radiotherapy	2209 (19.6%)
Surgery and chemoradiation	405 (3.6%)
Radiotherapy	3395 (30.1%)
Chemoradiation	2149 (19.1%)
Other	29 (0.3%)
Year of registration	
2015	632 (5.6%)
2016	832 (7.4%)
2017	1078 (9.6%)
2018	2134 (18.9%)
2019	2158 (19.2%)
2020	2145 (19.0%)
2021	2287 (20.3%)

Abbreviations: ACE-27, Adult Comorbidity Evaluation 27; HNOCs, Head and neck oncology centers; IQR, interquartile range; SCC, squamous cell carcinoma.

Patients With and Without 30-Day CPI

In 2021, 833 patients (71.5%) had a CPI of ≤30 days (**Table 2**). Compared to patients with a CPI of >30 days, more patients were treated with surgery only (58.9% vs 48.2%, P =.005). More patients with local disease were in the CPI ≤ 30 group, based both on the clinical and pTNM stage (cTNM 59.4% vs 47.6%, P =.001/pTNM 52.3% vs 43.1%, P =.003). Upstaging and downstaging rates were comparable between groups (P = 0.5).

CPIs in 2021

In 2021, 1384 patients (61,0%) were referred to an HNOC with pathological conformation of the tumor (**Figure 8**). The other 39,0% underwent their first biopsy in the HNOC. Compared to biopsy in the HNOC, patients referred with pathological tumor confirmation had a shorter median CPI (22 vs 26 days) and longer median TTI (33 vs 26 days). Comparable intervals were observed between referral and the first HNOC appointment (5 vs 5 days) and between MDT meeting and treatment initiation (16 vs 17 days).

Discussion

Since the start of the DHNA, we have observed a decline in waiting times for curative treatment initiation in HNC care. On a national level, the percentage of patients starting treatment within 30 days or less has increased. The national quality standard of 80% of the patients having a CPI of ≤30 days was met by 3 hospitals from 2018 onward and 4 in 2021. Dispersion between hospitals declined for the median CPI and CPI-indicator.

Literature on the impact of prolonged waiting times and treatment delay in HNC is widely available yet inconsistent. In a systematic review by Graboyes et al on the association between TTI and survival, 9/13 studies indicated that delay leads to worse survival.[6] However, TTI definitions varied significantly, as did the thresholds for delay (20-120 days). The authors recommend CPI/TTI thresholds of 30 days, in line with our Dutch quality standard. Study heterogeneity was also a problem in the systematic review of Schutte et al, describing 51 studies on waiting times for diagnosis or treatment concerning oncological, functional, and psychological outcomes.[1] Though pooled analysis was not possible, the adverse effects of treatment delay were indisputable. Determinants of delay have been described by a systematic review of Schoonbeek et al, grouping 52 studies for quantitative analysis.[19] In line with our results, their study recognized advanced disease and radiotherapy as factors contributing to delay. In addition, academic facilities, ethnicity, and insurance type were associated with prolonged waiting times.

Apart from patient and tumor characteristics, organizational factors and planning are of influence. In 1976, Denmark established a national prospective HNC database for guideline development, clinical studies, and quality assurance.[20] Here, the annual incidence for HNC is approximately 1400 and care is centralized in 5 dedicated HNC hospitals. They successfully introduced a fast-track program from 2012 to 2015, where 94.5% of the patients started treatment within 28/32 days (surgery/chemoradiation respectively) from referral.[21] Considering this, a 30-day limit is not unreasonable. One HNOC has introduced a multidisciplinary first-day consultation in

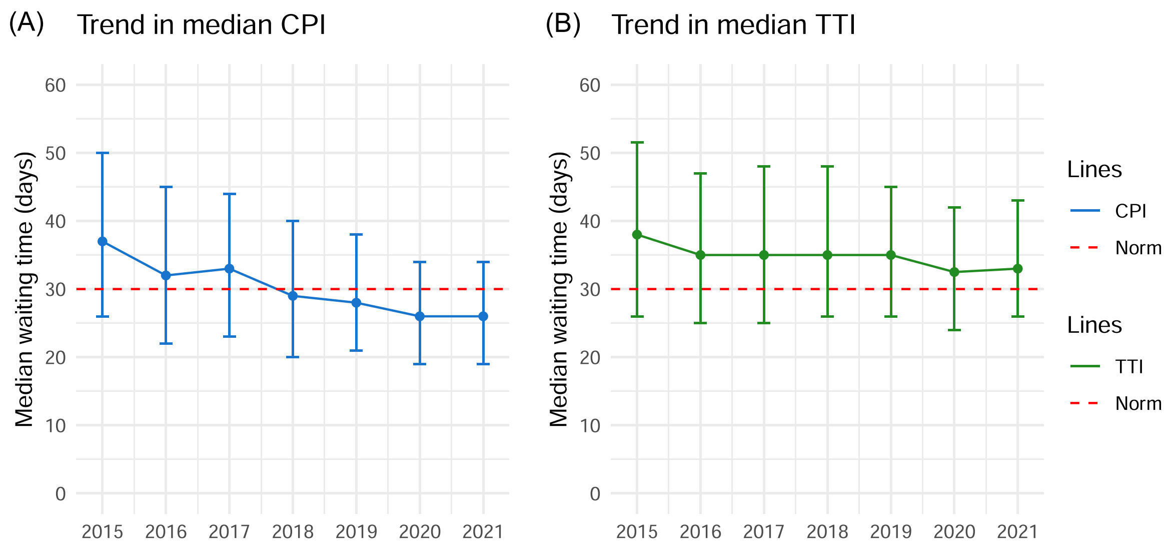

Figure 2. The care pathway interval (CPI, A) and time to treatment interval (TTI, B) declined from 2015 to 2021. Dutch national quality norm = 30 days. Data are median with interquartile ranges.

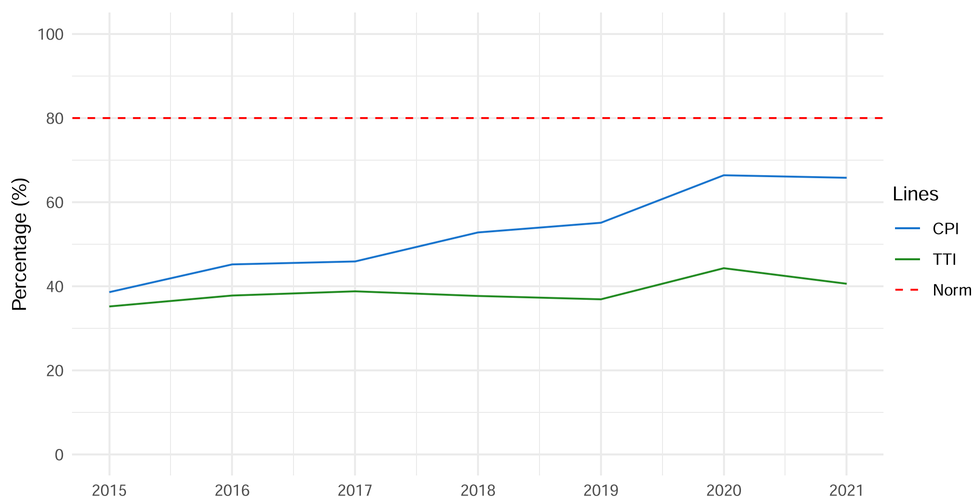

Figure 3. The care pathway interval (CPI) and time to treatment interval (TTI) quality indicators increased from 2015 to 2021. Norm = 80%.

the past. This intervention increased the CPI-indicator from 52% to 83% in 1 year and reduced the needed hospital visits for patients.[22] Though the Danish and Dutch populations are relatively small globally, programs such as this can be incorporated in other hospitals or cancer networks worldwide to improve timely HNC care. However, extrapolating these programs to a nonsocialized health care setting will expose different barriers and facilitators.

HNC incidence trends in the Netherlands indicate an increase in advanced disease, most prominently for oral cavity and oropharynx tumors.[23] More advanced tumors require intensive or multimodal treatment, both known as determinants of delay.[1,2] Changes in cohort metrics, specifically cTNM stage, tumor location, and treatment modality can, therefore, influence CPI and TTI results. Between 2018 and 2021, these cohort metrics did not significantly differ (Supplemental Information: S1, available online). Hypothetically, treatment delay can result in stage migration as tumor volume increases until treatment initiation.[24] Although locoregional tumor control can be obtained with intensified treatment, this can severely burden patients and jeopardize functional outcomes and quality of life. In our study, upstaging and downstaging did not differ based on the 30-day CPI limit. Waiting times were not negatively affected by COVID-19, as more patients were treated ≤30 days in 2020 compared to 2019.[25] During the pandemic, oncological care was prioritized and a significantly lower HNC incidence was observed.

One of the strengths of this study is that data on the entire population could be included. This national coverage allowed us to identify trends over the years, compare groups within the cohort, and compare our data to other studies. In addition, data registration, validation, and analysis are

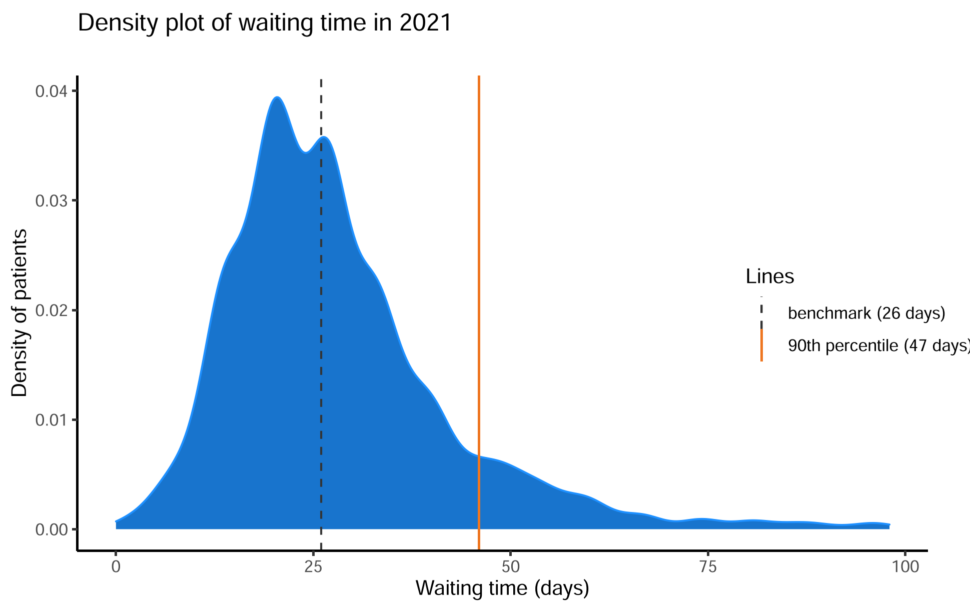

Figure 4. Density plot for the care pathway (CPI) interval in 2021 is presented. Median = 26 days. 90th percentile = 47 days (N = 2263). CPI > 100 days were excluded for visibility (N = 22, 1.0%).

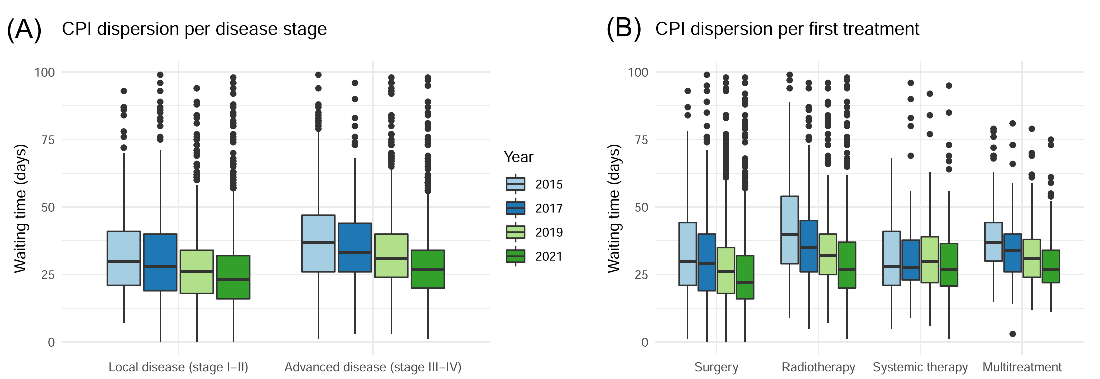

Figure 5. The care pathway interval (CPI) dispersion from 2015-2021, stratified for (A) disease stage and (B) first treatment modality. CPI > 100 days was excluded for visibility (N = 307, 2.7%).

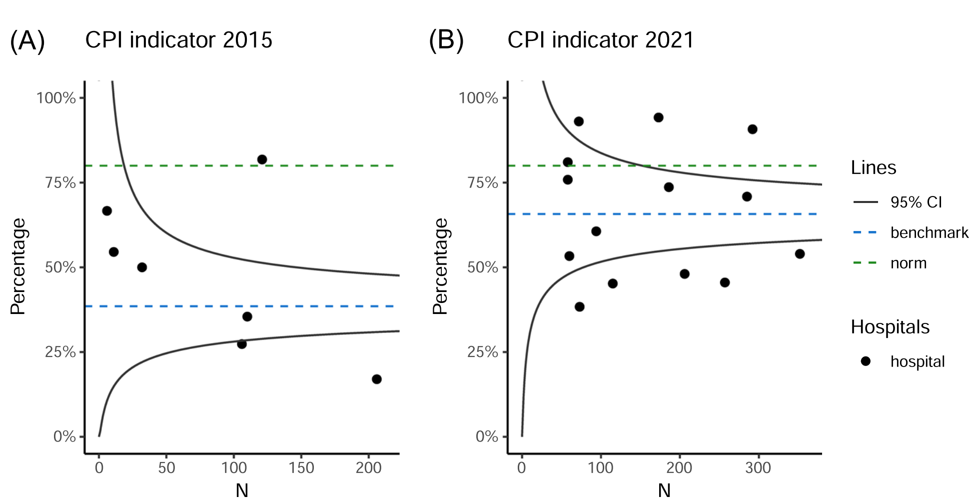

Figure 6. The funnel plots for the care pathway interval (CPI) quality indicator are presented for 2015 (A) and 2021 (B). Dutch national quality norm = 80%. CI, confidence interval.

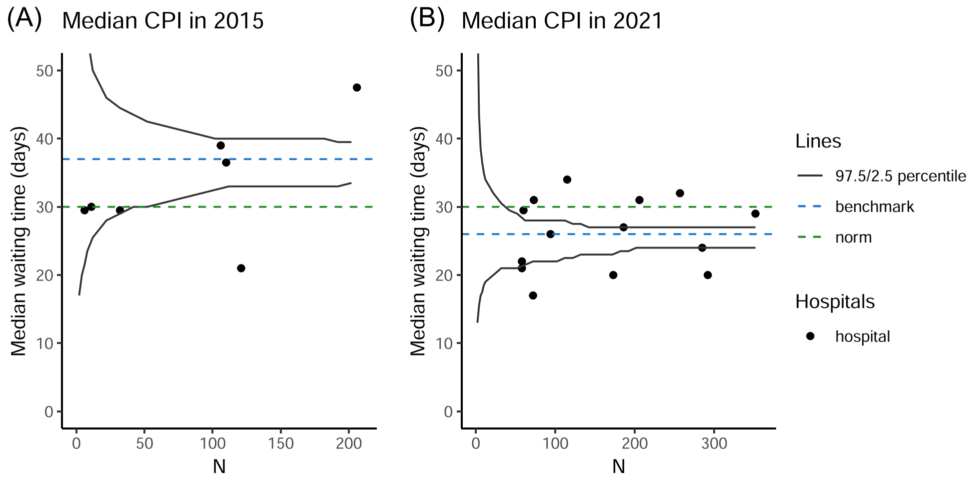

Figure 7. The funnel plots for the median care pathway interval (CPI) in 2015 (A) and 2021 (B) are presented. Dutch national quality norm = 30 days.

Table 2. Surgically Treated Patients in 2021 Starting Treatment Within 30 Days or Not

Total	CPI ≤ 30 days N = 833	CPI > 30 days N = 332	*P* value[a]
Median waiting time (IQR)	19 (14, 24)	40 (34, 52)	<.001
Treatment modality			
Surgery	491 (58.9%)	160 (48.2%)	.005
Surgery and radiotherapy	289 (34.7%)	147 (44.3%)	
Surgery and chemoradiation	51 (6.1%)	25 (7.5%)	
Other	2 (0.2%)	0 (0.0%)	
cTNM stage			
Local disease (stage 0-II)	495 (59.4%)	158 (47.6%)	.001
Advanced disease (stage III-IV)	296 (35.5%)	150 (45.2%)	
Unknown	42 (5.0%)	24 (7.2%)	
pTNM stage[b]			
Local disease (stage 0-II)	436 (52.3%)	143 (43.1%)	.003
Advanced disease (stage III-IV)	334 (40.1%)	147 (44.3%)	
Unknown	63 (7.6%)	42 (12.7%)	
cTNM versus pTNM			
Total	N = 736	N = 271	
Same stage	477 (64.8%)	183 (67.5%)	.5
Upstage	188 (25.5%)	68 (25.1%)	
Downstage	71 (9.6%)	20 (7.4%)	

Abbreviations: CPI, care pathway interval; cTNM, clinical TNM; IQR, interquartile range; pTNM, pathological TNM.
[a]Wilcoxon rank-sum test; Fisher's exact test; Pearson's χ^2 test.
[b]Only applicable for surgically treated patients with available pathology reports.

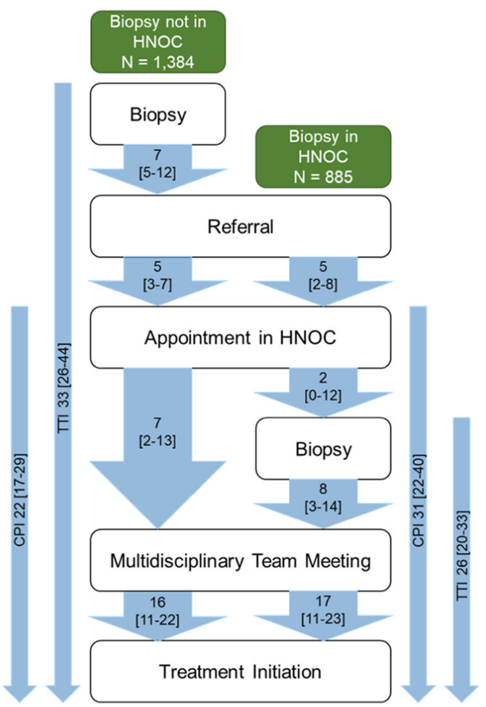

Figure 8. Care pathway time intervals in 2021 are displayed in median days with interquartile ranges. CPI, care pathway interval; HNOC, head and neck oncology center; TTI, time to treatment interval.

executed through standardized transparent processes, which empowers the reliability of our results.[13] A limitation is that data was primarily collected for quality evaluation instead of scientific purposes. Only patients presenting with primary HNC are included, so hospital numbers do not reflect the entire patient load centers treated annually. The DHNA coverage increase introduces bias in patient and tumor characteristic distribution from 2015 to 2018. Though DHNA data quality has improved over the years, our cohort demonstrated high percentages of missing data on patient characteristics. Therefore, outcomes and funnel plots could not be presented with case-mix correction.

This nationwide study describes the waiting times for curative treatment initiation of HNC patients in the Netherlands over 7 years. Multiple factors have contributed to the decline in waiting times. First, all clinicians were mandated to contribute to improve in their center because the CPI-indicator was declared a national quality standard. The results of this indicator are openly published every year since 2019, providing insight to caregivers, insurance companies, and most importantly patients.[26] Also, continuous feedback is provided by dashboarding, where every center can investigate its data and compare itself to the benchmark. Second, one of the hospitals performing above the 95% CI of the CPI-indicator implemented a fast-track program from 2010 to 2013, optimizing the multidisciplinary integrated care workflow.[27] After implementation, the CPI improved from 34 to 21 days, with comparable diagnostic costs, higher patient satisfaction, and a lower risk of death 3 years thereafter. Their increased use of flexible endoscopic biopsies reduced the time needed for diagnostics.[28] Because these local changes were successful, other DHNA facilities successfully incorporated the improvement plans of the best practice. In 2021, these hospitals performed above the 95% CI of the CPI-indicator as well.

However, both logistic and practical obstacles complicate this process. Diagnostic procedures, such as biopsies under general anesthesia, can be time-consuming. We demonstrated that both TTI and CPI are, understandably, influenced by the fact that patients can undergo biopsy before or after referral to an HNOC in the Netherlands. Biopsy before referral saves time in the CPI-pathway, but as HNOCs have all facilities on site, the TTI is shorter when patients are biopsied in-house. When looking at 2021 data, the median time between MDT meeting and treatment is over 2 weeks, which could know many causes, such as exploration of incidental findings or planning issues.[29] Though at the end of the day, planning and organization of the care pathway is the one thing we can control.

Although waiting times have improved over the years, we have also demonstrated that significant hospital variation remains. Unfortunately, not all HNOCs meet the quality standard. As the DHNA has primarily focussed on the CPI, these rates have improved more than the TTI. However, delays in the care pathway before referral are just as relevant. We should focus on regional cooperation to improve timely referrals now that in-house pathways are optimized. In addition, bottlenecks in the radiotherapy pathway should be analyzed to identify areas of improvement. Outcomes are openly discussed with our clinical audit board, in which every HNOC and discipline is represented. As of 2022, biannual roundtable meetings open the discussion between HNOCs performing under or above the benchmark to exchange perspectives and experiences. With this, the DHNA strives for intensified collaboration, where HNOCs can easily exchange improvements, with quality improvement as our goal.

In conclusion, waiting times improved gradually over time, with 4 hospitals exceeding the quality standard of a 30-day CPI for 80% of the patients. On hospital-level, process improvement plans have been initiated. Systematic registration, audit, and feedback of data promote further optimization of quality of care. To further improve waiting times, the DHNA will focus on TTI-rates, hurdles in radiotherapy, and national cooperation.

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Author Contributions

Hanneke Doremiek van Oorschot, drafting of the manuscript, data extraction, statistical analysis, data review, interpretation of the results, manuscript review, approval and reading of the final manuscript; **Dominique Valérie Clarencede Jel**, data review, interpretation of the results, manuscript review, approval and reading of the final manuscript; **Jose Angelito Hardillo**, interpretation of the results, manuscript review, approval and reading of the final manuscript. **Ludi E. Smeele**, interpretation of the results, manuscript review, approval and reading of the final manuscript. **Robert Jan Baatenburg de Jong**, interpretation of the results, manuscript review, approval and reading of the final manuscript.

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Disclosures

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Data Availability

Data is accessible upon request at www.dica.nl.

Supplemental Material

Additional supporting information is available in the online version of the article.

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