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An Assessment of the Maturity of Cancer Survival Data Used in Economic Models for the National Institute for Health and Care Excellence's Single Technology Appraisals

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ABSTRACT

Objectives: This study examines the maturity of survival data used in cancer drug appraisals by the National Institute for Health and Care Excellence (NICE) and the implications for decision making.

Methods: We assessed the maturity of survival data used in economic models within NICE single technology appraisals published between January 1, 2011 and December 31, 2023 (n = 301). We categorized these survival data according to whether they were "highly immature" (<20% of events), "immature" (20%-50%), or "mature" (>50%). We applied multinomial logistic regression analysis to assess the association of factors such as time period, the introduction of the Cancer Drugs Fund (CDF), cancer type, disease severity/stage, technology type, and trial design (single-arm or randomized controlled trial), with the maturity of the survival data. We then assessed the association of the maturity of the survival data with the subsequent recommendation of the NICE appraisal committee.

Results: After adjusting for potential confounders, the percentage of appraisals with highly immature survival data increased from 25.1% (pre-CDF) to 40.4% (post-CDF) (P = .105). Appraisals that used single-arm trials or were for early-stage cancers were more likely to use highly immature survival data. Those technologies with highly immature data were more likely to receive CDF recommendations (30.4% vs 11.5%, P = .007).

Conclusions: The trend toward more NICE single technology appraisals of cancer drugs relying on immature survival data are consistent with moves by regulatory agencies to encourage expedited approvals for innovative therapies. For Health Technology Assessment decision-making, it is essential to balance early drug access with the use of robust evidence.

Keywords: economic evaluation, health technology assessment, maturity of survival data, NICE, oncology.

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Highlights

- The use of immature survival data is one of the main uncertainties and challenges in providing reliable cost-effectiveness evidence in cancer drug appraisals by the National Institute for Health and Care Excellence. However, it is unclear how the use of immature survival data has changed over time and impacted Health Technology Assessment decision-making.
- There is a trend toward the use of more immature survival data in National Institute for Health and Care Excellence technology appraisals over time for cancer drugs. Appraisals that use immature survival data are more likely to get provisional recommendations by means of the Cancer Drugs Fund.
- The growing reliance on immature survival data may reflect a policy shift toward early access to medicine. Although managed access schemes, such as the Cancer Drugs Fund, can enable earlier access to drugs with immature evidence, this brings uncertainty into Health Technology Assessment decision-making.

Introduction

Health technology assessments (HTA) provide scientific and systematic evidence to inform decisions about which health technologies to publicly fund.[1] In England and Wales, the National Institute for Health and Care Excellence (NICE) uses cost-effectiveness assessments to decide which technologies to recommend for National Health Service (NHS) funding.[2] NICE Methodological guidance requires submissions to take time horizons that are sufficient to capture the differential impact of the alternative technologies on quality-adjusted life-years (QALYs) and cost.[3] For many technology appraisals (TAs), the accurate estimation of the long-term effect of the alternative technologies on overall survival (OS) is a crucial source of uncertainty in the cost-effectiveness evidence.[4] Although some clinical trials use complete response or progression-free survival (PFS) as the primary clinical outcome, in economic models submitted for NICE cancer TAs, the common approach is to use OS data, which may be defined as either a primary or secondary outcome in the phase 3 trial supporting the submission. A major concern is that the main evidence for the assessment of comparative effectiveness, for example, from the pivotal phase 3 clinical trial, has immature survival data. In the ensuing cost-effectiveness analyses, the survival data used in the economic model can be defined as immature when the length of follow-up in the clinical trial for the intervention in question is judged insufficient to provide accurate estimates of relative effectiveness according to survival.[5-7] If immature survival data are used in NICE appraisals, this can lead to a different recommendation compared to if evidence is available for a longer period of trial follow-up.[8]

It is possible that evidence submitted for NICE TAs has evolved over time in line with changes in methodological guidance. Also,

practice in the production and assessment of evidence may have responded to changes in drug regulatory policy,[9] which, along with the inception of the Cancer Drugs Fund (CDF) in 2016, has encouraged earlier access to cancer drugs. However, previous research has not assessed whether the proportion of NICE submissions for cancer drugs with immature survival data has changed over time, nor whether this proportion increased with the introduction of the CDF. Most of the available information comes from case studies or unstructured reviews.[10,11] This is an important gap in knowledge, as estimates of the magnitude of survival benefits are often major drivers of the cost-effectiveness assessments, which are crucial for decision making.[12,13] Hence, a systematic investigation of how the maturity of the survival data, focusing on OS from the pivotal trial used in economic models for NICE cancer appraisals, has changed over time, within the context of policy changes, can provide HTA agencies with important insights to inform their future decision making.

The aim of this article is to understand which factors are associated with the use of immature survival data in appraisals of cancer drugs and the consequences of using immature data for NICE decision-making. There are three objectives: (1) to describe the level of maturity of survival data in NICE TAs over time, before and after the introduction of the CDF; (2) within these appraisals, explore factors associated with the use of immature survival data; and (3) assess how the use of immature survival data is associated with appraisal recommendations.

Methods

Overview

In addressing the first 2 objectives, we considered the extent to which the use of immature survival in economic models for NICE single TAs (STAs) increased over time, in line with movements toward early access to medicines.[14,15] Faced with submissions that have immature survival data, drug regulatory agencies such as the US Food and Drug Administration and the European Medicines Agency have become more likely to approve drugs on the basis of immature survival data for marketing authorization.[15] Similarly, the CDF was intended to provide timely access to medicines with the potential to be cost-effective, but which weakness in the available evidence (including from immature survival data) meant the expected cost-effectiveness was highly uncertain.[16] We also recognized that other characteristics of the STA might be associated with use of more immature survival data in the economic model, namely, if the trial was single-arm rather than randomized, if the cancer was early- versus late-stage, and whether or not the cancer therapy was targeted (see Covariates subsection).

In addressing the third objective, we focused on the period after the introduction of the CDF, as the NICE appraisal committee then had the option of making the provisional recommendation that the drug was available through the CDF, instead of routine commissioning.[17] Hence, we hypothesized that "a drug appraisal with more immature survival data is more likely to get conditional approval by means of the CDF."

Data Sources and Study Design

This study reviewed the maturity of the survival data from the main clinical data used in economic models for NICE STAs of cancer drugs. The data required were extracted from all STAs of oncology medicines (n = 301) published between January 1, 2011 and December 31, 2023. Appraisals exiting CDF were also included as they were subject to a separate appraisal process from their original assessments. Also, final appraisal determination (FAD) was reviewed to include any relevant information and additional evidence submitted during committee meetings and appeals. A data extraction protocol[18] was used to extract comprehensive information about the characteristics of the main clinical trial for the medicine under evaluation, including the number (and %) of death events reported from company submission in each STA.[19,20] The main clinical data refer to those from the clinical trial used in the economic model to assess the cost-effectiveness of the technology of interest. The definition of a trial included a single-arm trial as well as a randomized controlled trial (RCT). When key information was missing or redacted in the company submission, the report or article summarizing the original results of the clinical trial was reviewed to extract the information.

Measures

Explanatory variables

The explanatory variables of interest were time period (objective 1), the introduction of the CDF (objectives 1-2), and maturity of survival data (objective 3). The unit of time was the month in which the FAD of the technology under evaluation was published. "Post-CDF" was defined as appraisals issued after TA399, the first TA to discuss the CDF. The maturity of the survival data used in the economic model, also used as an outcome variable for objectives 1 and 2, was described in detail in the subsequent section (Outcome Variables).

Covariates

We adjusted for those covariates that may have had independent associations with the outcomes of interest. Specifically, we recognized increases over time in the proportion of STAs that were for early-stage cancer treatment, which used a single-arm clinical trial and assessed targeted cancer therapy. We also allowed for the disease severity of the population for the STA. Single-arm trials often rely on surrogate endpoints such as tumor response or PFS[21,22] and do not collect long-term survival data.[23-26] Marketing authorization for targeted therapies is often expedited on the basis of interim results and adaptive trial designs.[27,28] Clinical covariates, including cancer stage and use of best supportive care (BSC) as a comparator, were used within STAs to proxy disease severity, which is likely to have implications for survival data maturity. Cancer stage was particularly relevant as advanced cancers tend to have higher mortality rates and more mature survival data, and BSC was used as a proxy for advanced disease severity. The severity modifier was not applied as it is a newly introduced criterion. We also excluded the end-of-life criteria, as it is intended for terminal illnesses with a life expectancy under 24 months and captures only a narrow subset of advanced disease. We also considered cancer type as a binary variable (hematological vs solid tumors). Although most variables were available from the original dataset constructed according to the protocol, information on stage and BSC were extracted separately (see Appendix 1 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2025.07.010).

In addressing the third objective, we used a covariate to represent whether or not the clinical trial data used in the economic model came from a direct treatment comparison. We chose to define the covariate in this way rather than according to whether the clinical data were from an RCT or single-arm trial, to avoid collinearity with the covariate representing the maturity of the survival data.

Outcome variables

The outcome variable of interest for addressing the first 2 objectives was the level of maturity of the survival data for the

intervention used in the economic model within the manufacturer's initial submission to the NICE STA process. This variable was defined by the proportion of participants in the relevant clinical trial for whom death had been reported at the last available data cutoff. There is no consensus as to what constitutes "immature" survival data, and so we applied a criterion used previously and subjected this to sensitivity analysis. In the base case, we followed Tai et al,[8] who reviewed the maturity of survival data presented in external assessment group (EAG) reports, and defined those STAs with trials that reported under 50% of death events as using "immature survival data." Rather than adopting a single cut-point, we introduced additional cut-points to allow a more nuanced understanding of the maturity of the survival data. We defined an additional cutoff of 20% of death events to designate STAs that used "highly immature" survival data (<20% of observed death events), which is a terminology that has been used by EAG reports and the NICE appraisal committee (see, for example, TA592, TA680, TA716) (Table 1). The accompanying EAG reports were also reviewed to check the alignment of the categorization of the maturity of the survival data with the EAG's judgments.

If the number of death events were redacted in the manufacturer's submission, we checked published papers for the trials in question, but if this information was unavailable, we also reviewed EAG reports and FAD for statements that could potentially indicate immaturity, such as "survival data are immature." If information on the maturity of the survival data were unavailable or the classification unclear from these sources, in the base case, we assumed these survival data were "highly immature." In the sensitivity analyses, we excluded these STAs from the analysis, which assumed these STAs were missing the survival data "completely at random."[29]

For addressing the third objective, the outcome variable was the recommendation of the TA committee. This information was extracted from the latest FAD according to 5 categories: not recommended, recommended for routine commissioning, optimized, recommended within the CDF, and optimized within the CDF. As the recommendations of "optimized (n = 42)" and "optimized within the CDF (n = 12)" were only made for a small minority of STAs, we used the broader categories of: "recommended for routine commissioning," "recommended within the CDF," and "not recommended," respectively.

Analysis

First, across the STAs included, we reported the average proportion of trial participants with observed death events, by year, to examine changes in the maturity of survival data over time. STAs were classified by the maturity of the survival data used in the economic model (Table 1). Results were reported by cancer type, and before versus after the introduction of the CDF (objective 1). Second, we applied multinomial logistic regression models to assess how the maturity of the survival data according to the 3-way categorization described above changed over time, including after versus before the introduction of the CDF (objective 2). Third, we assessed the association between the maturity of the survival data and the NICE appraisal committee's recommendation (objective 3). For this objective, we used STAs issued after the introduction of the CDF (ie, after April 2016) to recognize the new decision options that were available after this time point.

To aid the interpretation of the results, we reported the association of time period and the introduction of the CDF, and the maturity of the survival data on NICE's decision, according to average predicted percentages rather than odds ratios, after adjusting for potential confounders.[30] All analyses were conducted using STATA 18.5 (StataCorp, College Station, Texas).

Table 1. Survival maturity classification.

Criterion for base case analysis	
Classification	**Proportion of death events (p, %)**
Highly immature	$p < 20\%$
Immature	$20\% \leq p \leq 50\%$
Mature	$p > 50\%$
Criterion for sensitivity analysis	
Classification	**Proportion of death events (p, %)**
Highly immature	$p < 30\%$
Immature	$30\% \leq p \leq 60\%$
Mature	$p > 60\%$

Sensitivity Analysis

We undertook 2 sensitivity analyses to understand the impact on the results of using different maturity criteria and excluding missing data from the analysis. First, we applied an alternative criterion of greater than 60% rather than greater than 50% to define "mature" survival data, and less than 30% rather than less than 20% to define "highly immature" survival data. Second, for those STAs without information pertaining to the maturity of the survival data, rather than assuming that the survival data were "highly immature," we excluded them and assumed that they were "missing at random."

Results

Description of Survival Data Maturity Used by Economic Models in NICE STAs

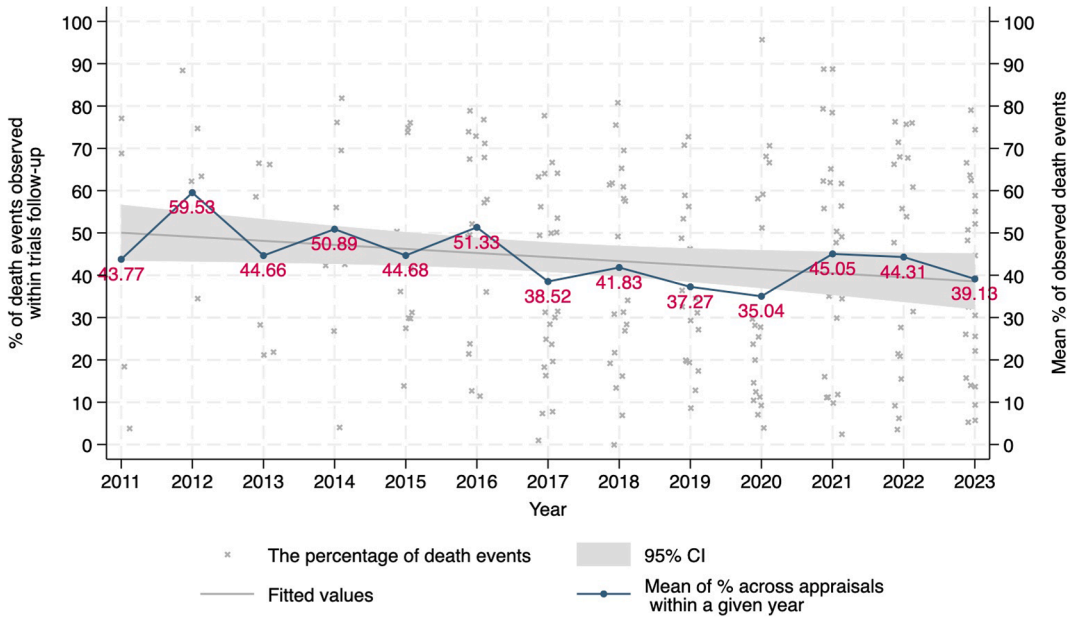
Figure 1 plots the percentage of death events observed in the main clinical evidence used by the economic models reported in STAs. The figure illustrates that the average percentage of death events observed within STAs declined over time. Of the 301 STAs included, 116 (38.5%) used highly immature survival data, 97 (32.2%) were based on immature data, and 88 (29.2%) used mature survival data. The proportion of missing OS data and the categorised maturity of survival data are reported separately (see Appendix 2 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2025.07.010) More than half of blood and bone marrow cancer appraisals (60.2%) and skin cancer appraisals (58.3%) used highly immature survival data in the economic models (see Appendix 3 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2025.07.010). Mature survival data were more likely to be used in economic models for bladder cancer appraisals (70.0%).

Figure 2 illustrates that the proportion of appraisals that used highly immature data increased after the introduction of the CDF (16.0% vs 43.0%). The number of death events in pre- and post-CDF period are reported separately (see Appendix 4 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2025.07.010)

Factors Associated With the Use of Immature Survival Data

Figure 3 presents that, after covariate adjustment, the average predicted percentage of STAs that used highly immature survival in economic models increased over time from 36.2% (95% confidence interval [CI] 18.2%-54.3%) in 2011 to 41.4% (95% CI 31.1%-51.8%) in 2023. There is a corresponding decrease in the average

Figure 1. Summary of the percentage of death events in appraisals from 2011 to 2023.

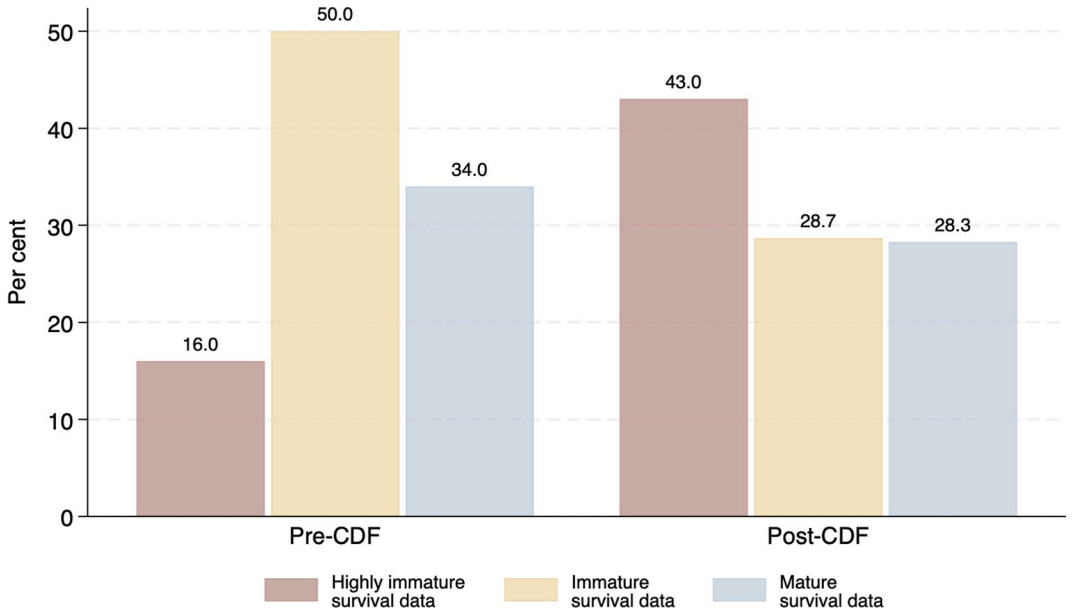


CI indicates confidence interval.

percentage using mature survival data from 31.4% (95% CI 16.6%-46.2%) in 2011 to 26.1% (95% CI 16.3%-35.9%) in 2022, although the differences over time between the proportions in each maturity category were not statistically significant (X^2 = 1.55, P = .460). The percentage of appraisals with highly immature survival data increased from 25.1% (pre-CDF) to 40.4% (post-CDF) (P = .105), whereas immature survival data decreased from 54.1% (pre-CDF) to 28.0% (post-CDF) (P = .015) (Fig. 4).

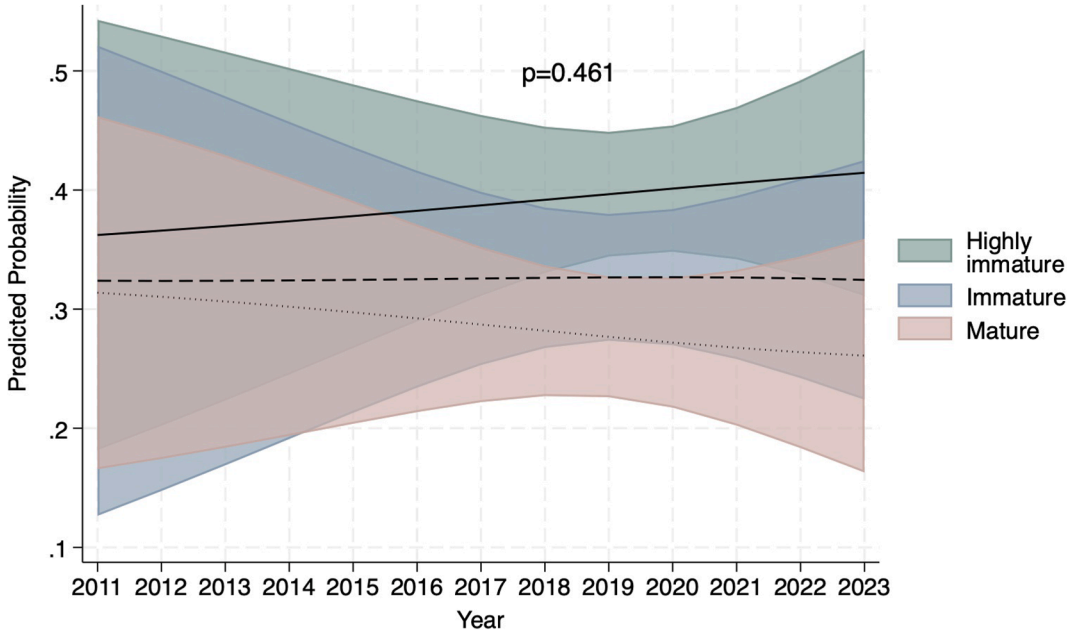
We found that the adjusted predicted percentages of STAs that used highly immature survival data were higher with appraisals that used single-arm trials (61.2%, 95% CI 48.5%-73.9%) versus RCTs (33.4%, 95% CI 27.8%-39.0%) (P = .000). Additionally, a higher percentage of TAs for early-stage cancer (64.4%, 95% CI 53.0%-75.7%) used highly immature survival data than for metastatic cancer (24.1%, 95% CI 14.5%-33.8%) (P = .000). For appraisals of targeted therapies, the adjusted percentage of using immature survival data was 43.9 % (95% CI 34.5%-53.2%) versus 24.5% (95% CI 18.5%-30.5%) for nontargeted therapies (P = .001) (see Appendix 5 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2025.07.010).

Figure 2. Maturity of survival data before and after CDF.



CDF indicates Cancer Drugs Fund.

Figure 3. Adjusted predicted percentages of using maturity of survival data (categorized) over time.



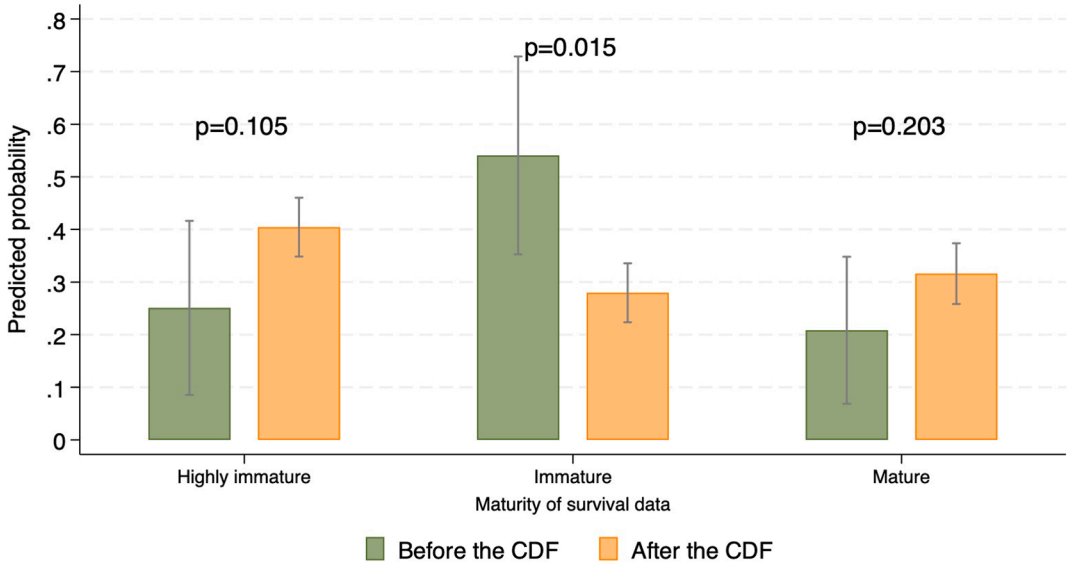
TA Recommendation by the Level of Maturity of Survival Data

After the introduction of the CDF, STAs were more likely to receive a CDF recommendation if they used immature survival data (Fig. 5). Of the STAs with highly immature survival data, 30.4% (95% CI 21.5%-39.2%) were recommended for the CDF compared to 19.4% (95% CI 11.0%-27.7%) with immature and 11.5% (95% CI 4.0%-18.9.4%) of those with mature survival data (hypothesis test on difference in decision across survival data categories, P = .007). The underlying regression results are presented in Appendix 6 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2025.07.010.

Sensitivity Analysis

The results of the sensitivity analyses were consistent with those of the base case. When alternative criteria (30, 60%) were applied to define the maturity of the survival data, the increase in the use of highly immature survival data after the introduction of

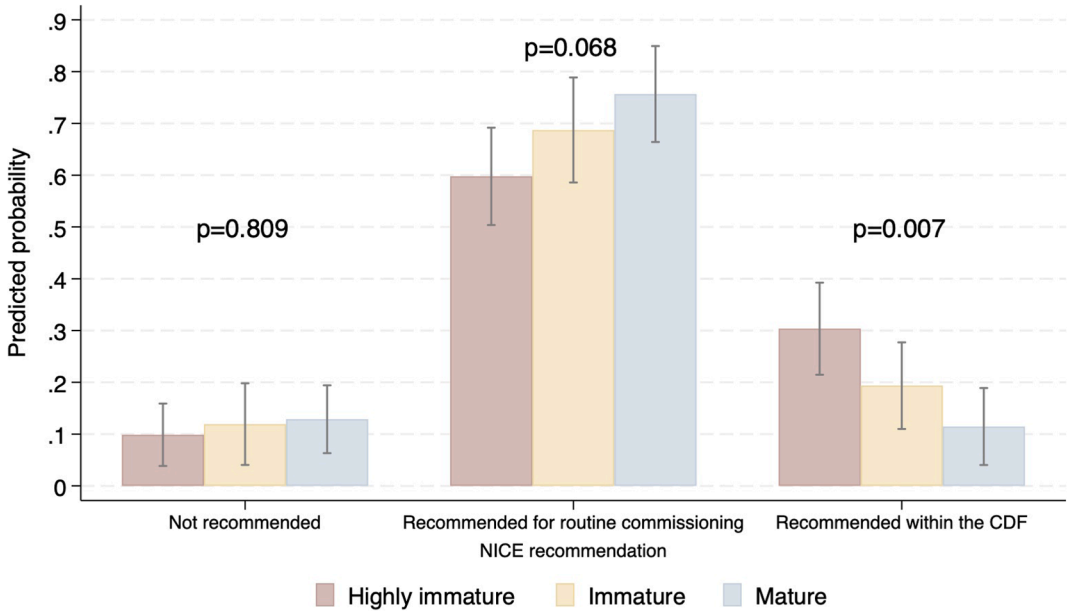
Figure 4. Adjusted predicted percentages of using maturity of survival data (categorized) before/after the introduction of the CDF.



Note: P-values indicate the statistical significance of the difference in predicted probabilities between the pre- and post-CDF within each maturity category based on interaction terms from a single fitted model.

CDF indicates Cancer Drugs Fund.

Figure 5. Adjusted predicted percentages of NICE recommendations according to the maturity of survival data.



CDF indicates Cancer Drugs Fund; NICE, National Institute for Health and Care Excellence.

CDF was not statistically significant, just as in the base case. Unlike in the base case, the statistically significant decrease in the use of immature survival data after the introduction of CDF was no longer observed (P = .227). We also found that the base case finding that STAs with more immature survival data were more likely to receive a CDF recommendation was robust to the alternative definitions of maturity (P = .002). Interestingly, we found that STAs with mature survival data were likely to receive positive recommendations (highly immature: 59.2%, immature: 73.1%, mature: 78.7%, P = .013). A similar result was observed when STAs with missing survival data were excluded (highly immature: 48.5%, immature: 67.1%, and mature: 75.2%, P = .017), although the association was attenuated in the recommended CDF (P = .134). The base case findings were robust to the exclusion of STAs without accompanying evidence on the maturity of the survival data. Full results are presented in Appendices 7 and 8 in Supplemental Materials found at https://doi.org/10.1016/j.jval.2025.07.010.

Discussion

We provide new insights about the use of immature survival data in HTA and subsequent decision making. First, we found that, of the 301 NICE STAs considered, 70% reported deaths for less than 50% of participants in the main study used to assess differences in survival between the treatment and comparators under evaluation. This use of immature survival data is likely to imply high levels of uncertainty in the resultant cost-effectiveness evidence. Second, we found weak evidence that the use of highly immature survival data increased over time, and in the period after the introduction of the CDF. Third, we found that the use of more immature survival data was associated with NICE issuing a conditional recommendation that the new drug was available through the CDF rather than as part of NICE routine commissioning. Despite the large sample size, the use of longitudinal information and the regression analyses adjusted for some of the potential confounding factors, the results are not definitive. We discuss each main finding in turn.

After allowing for potential confounders such as the cancer stage and the trial design (RCT vs single-arm), the point estimates seem to indicate that the proportion of STAs using immature survival data is increasing over time, although the estimate of the moderate association between time and use of immature survival data was not statistically significant. Despite the use of all available NICE STAs of cancer drugs (n = 301), the sample size may well have been insufficient to detect moderate differences in the proportion of STAs using immature versus mature survival data over time. The trend toward using less mature survival data, though not statistically significant, may reflect the growing emphasis on early drug approval in recent years, driven by regulatory frameworks for accelerated approval for promising new medicines.[31,32] This acceleration in regulatory processes has been a catalyst for shorter follow-ups in clinical trials and the generation of less mature survival data. Reflecting the regulatory trend of relying on interim results from limited observations, appraisals involving early-phase trials or innovative drugs were more likely to use immature survival data, which serves as the main evidence source for HTA decision-making. Although this approach may accelerate access to promising therapies, it has increased uncertainty about the magnitude of clinical benefits and cost-effectiveness for reimbursement agencies' decision making.[33]

In the NHS in England, drug provision through the CDF is an option for those cancer drugs for which there are high levels of uncertainty about comparative effectiveness and cost-effectiveness, often stemming from immature survival data.[34,35] Our descriptive analyses indicated greater use of immature survival data in economic models submitted after versus before the introduction of the CDF. Once the regression analysis had allowed for potential confounders, including the type and stage of cancer, the trial design, and disease severity, we did not find strong evidence that the introduction of the CDF modified the trend over time toward the use of less mature survival data.

This finding needs to be interpreted within the broader context pertaining to the purpose and design of many clinical trials. A clinical trial for a new drug is strictly controlled and designed to understand the safety and efficacy of the drug, with the manufacturer's primary aim to secure the approval of regulatory agencies and design the trial within a global market strategy. Therefore, it is unlikely that the introduction of a country-specific managed access fund such as the CDF would result in major changes to the design of most trials, at least within the time frames that we studied. The 2022 NICE methods guide highlights managed access schemes, such as the CDF, as mechanisms to deal with uncertainties resulting from immature evidence,[36] and this may further encourage the tendency to use less mature survival data for some STAs.

Our study found that the stage of cancer significantly influenced the maturity of survival data. Descriptive analyses revealed that appraisals for cancers with poor prognoses, such as pancreatic, head and neck, liver, and esophageal cancers, tended to use more mature survival data. Appraisals for these cancers often target later disease stages, in which shorter life expectancy leads to higher observations in death events, resulting in more mature survival data. By contrast, cancers with slower progression, such as prostate or skin cancer, frequently relied on less mature data. We included "BSC as a comparator" as a proxy for disease severity along with the stage of cancer. The QALY severity modifier used in the economic model was considered as an alternative. This information, however, was only introduced in NICE's 2023 methods.[3]

We examined the impact of using immature survival data on NICE recommendations. The findings indicate that appraisals with less mature survival data were more likely to receive recommendations for use within the CDF. This recognizes that immature survival data introduces significant uncertainty, making it challenging for committees to make immediate positive or negative recommendations. The CDF pathway allows for additional data collection to address uncertainties and subsequent reappraisal of the technology for routine use in the NHS.[35,37]

Immature survival data may reduce confidence in recommendations, complicate price negotiations, and delay reimbursement timelines. While fast-tracking early evidence can expedite regulatory approval, it does not necessarily ensure quicker patient access, as uncertainties can prolong subsequent processes.[38] For instance, drugs approved with weaker evidence may take several rounds of committee meetings and appeals and a longer price negotiation. Furthermore, a substantial proportion of drugs granted early access have failed to demonstrate long-term effectiveness,[39] underscoring the broader risks of relying on immature data in HTA decisions. These complexities necessitate careful consideration of the trade-offs between early access and decision-making certainty.

Managed access schemes, such as the CDF for cancer drugs and the Innovative Medicines Fund (IMF) for any noncancer medicine, illustrate how initial decisions can be made that use evidence from relatively immature survival data when the drug has the potential to be cost-effective, but there is considerable uncertainty pertaining to the maturity of the survival data. The initial decision to provide the technology through the CDF or IMF anticipates that there will be a subsequent review, which will be informed by updated trial results or real-world data that include more mature survival data. The NICE real-world evidence framework[40] offers complementary guidance on how to generate, use, and interpret real-world data while recognizing the potential for bias in the estimates of relative treatment effectiveness, including for survival endpoints.

Although the CDF and IMF include mechanisms for review, outside of these programs, NICE rarely revisits decisions, even as the use of immature survival data increases. This trend suggests a growing need for routine reappraisals as evidence with more mature survival data becomes available. A potential concern is to avoid circular reasoning when evaluating the impact of the CDF, but a meaningful approach would be to assess whether these schemes truly lead to more reviews and incentivize the generation and use of more mature survival data. Although all treatments provided under the CDF are scheduled for review, there is no such mechanism for re-review for those treatments that are recommended for routine use despite the reliance on evidence from highly immature survival data. This raises concerns about the consistency and robustness of the evidence review process, particularly in ensuring that value for money is achieved over the long term.

Limitations

We provided new evidence about the association of survival data maturity with subsequent recommendations but recognized that making causal inference is challenging because of the multifactorial nature of appraisals, which were not fully captured by the data. Factors such as patient unmet need, which are used in decision making, were not fully captured in the covariate data available from the STAs (disease stage, cancer type, use of BSC, cancer stage, etc). Not all STAs had the required maturity data, as relevant information was often redacted in NICE guidance under commercial or academic-in-confidence provisions.[41,42] Despite extensive efforts to extract data from appraisal documents and clinical studies, 25% of survival data were assumed to be highly immature. Although this assumption may introduce some inaccuracies, it was deemed reasonable based on EAG and committee statements regarding the immaturity of survival data. The sensitivity analysis excluded these data but produced similar results. There is no universally agreed-upon definition for the maturity of survival data. For instance, alternative definitions might incorporate the shape of the OS curves, given that, for example, even if a high proportion of death events are observed and OS curves have reached a plateau, there may still be insufficient data to provide accurate estimates of long-term effects.[4] The clinical maturity of survival data can still introduce significant economic uncertainties, such as disparities in survival curve tails that can heavily influence QALY calculations and the resultant cost-effectiveness estimates. Also, we acknowledge that concerns about data maturity are also likely to extend to survival data from external sources and surrogate endpoints, such as PFS. These nuances highlight the complexity of defining and assessing survival data maturity in both clinical and economic contexts.

Despite these limitations, this study provides a valuable snapshot of the challenges NICE faces when appraising technologies. The data were prepared in a systematic and unbiased manner following a published data extraction protocol. This study is the first to use regression models to explore trends in the maturity of survival data used in TAs and the association between TA recommendations and the maturity of survival data. This review provides a systematic and more analytical view of the maturity of survival data in NICE cancer appraisals. It also revealed face validity as the results align with expectations based on existing knowledge. Specifically, the direction of effects follows anticipated trends: early-stage cancer trials report immature survival outcomes, single-arm trials often present early survival data and innovative technologies, such as targeted cancer therapy, enter the market with preliminary evidence. These findings support the credibility of the research approach and highlight its relevance to current HTA practices. This alignment strengthens the robustness of our methodology and its ability to provide meaningful insights.

Conclusions

The trend toward more NICE STAs of cancer drugs relying on immature survival data is consistent with moves by regulatory agencies to encourage expedited approvals for innovative therapies. This reliance on incomplete evidence, however, introduces uncertainty about long-term clinical and cost-effectiveness, leading to provisional recommendations. For HTA decision-making, it is essential to balance early drug access with the use of robust evidence.

Author Disclosures

Author disclosure forms can be accessed below in the Supplemental Material section.

Supplemental Material

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.jval.2025.07.010.

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