Nivolumab for adjuvant treatment of invasive urothelial cancer at high risk of recurrence

Technology appraisal guidance
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Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.
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1 **Recommendations**

1.1 Nivolumab is recommended as an option for the adjuvant treatment of muscle-invasive urothelial cancer that is at high risk of recurrence after radical resection in adults whose tumours express PD-L1 at a level of 1% or more. It is recommended only if:

- adjuvant treatment with platinum-based chemotherapy is unsuitable, and
- the company provides nivolumab according to the commercial arrangement.

1.2 This recommendation is not intended to affect treatment with nivolumab that was started in the NHS before this guidance was published. People having treatment outside this recommendation may continue without change to the funding arrangements in place for them before this guidance was published, until they and their NHS clinician consider it appropriate to stop.

**Why the committee made these recommendations**

Radical resection (surgery) aims to remove all traces of the cancer. Adjuvant treatment aims to reduce the risk of the cancer returning after resection. Standard care for muscle-invasive urothelial cancer that is at high risk of recurrence after radical resection is adjuvant treatment with platinum-based chemotherapy or best supportive care.

Clinical trial evidence shows that adjuvant treatment with nivolumab reduces the risk of the cancer coming back compared with placebo. However, it is uncertain whether nivolumab increases how long people live because this data is not available yet. An indirect treatment comparison of nivolumab with platinum-based chemotherapy is also highly uncertain.

The company did not provide cost-effectiveness estimates comparing nivolumab with platinum-based chemotherapy. The most likely cost-effectiveness estimates for nivolumab compared with best supportive care are uncertain. But, these estimates are within what NICE usually considers an acceptable use of NHS resources when platinum-based chemotherapy is not a suitable option. So, adjuvant treatment with nivolumab is recommended only if platinum-based adjuvant chemotherapy is not suitable.
2 Information about nivolumab

Marketing authorisation indication

2.1 Nivolumab (Opdivo, Bristol Myers Squibb) has a UK marketing authorisation 'for the adjuvant treatment of adults with muscle invasive urothelial carcinoma (MIUC) with tumour cell PD-L1 expression ≥ 1%, who are at high risk of recurrence after undergoing radical resection of MIUC'.

Dosage in the marketing authorisation

2.2 The dosage schedule is available in the summary of product characteristics for nivolumab.

Price

2.3 The list price of nivolumab is £2,633 per 240 mg per 24-ml vial (excluding VAT; BNF online, accessed May 2022). The company has a commercial arrangement. This makes nivolumab available to the NHS with a discount. The size of the discount is commercial in confidence. It is the company's responsibility to let relevant NHS organisations know details of the discount.
3 Committee discussion

The appraisal committee considered evidence submitted by Bristol Myers Squibb, a review of this submission by the evidence review group (ERG), and responses from stakeholders. See the committee papers for full details of the evidence.

New treatment option

Nivolumab is a valued adjuvant treatment option for people with resected high-risk muscle-invasive urothelial cancer

3.1 Muscle-invasive urothelial cancer can have a significant impact on people and their families and carers. Standard care after radical resection is platinum-based chemotherapy (adjuvant treatment) or best supportive care. Some people have platinum-based chemotherapy before the surgery (neoadjuvant treatment) and would not be eligible for adjuvant treatment with platinum-based chemotherapy. Despite resection, the disease can recur. High risk is defined by the MIUC pathologic staging criteria in section 5.1 of nivolumab's summary of product characteristics. The patient experts explained that there is a high unmet need in this area and a new treatment option at this part of the pathway was welcomed. They explained that for some people platinum-based chemotherapy is not suitable or tolerated, and some people are unwilling to have it. The patient experts explained that extending the duration of disease-free survival is important to patients. This is because it allows them to spend more time with their families and enjoy a good quality of life, and relieves stress on carers. The clinical and patient experts noted that nivolumab was generally well tolerated and that the short infusion time of the treatment compared with chemotherapy was an advantage. The clinical experts explained that immunotherapy at an early stage has the potential to significantly improve outcomes and increase the number of people whose cancer is cured. The committee considered that adjuvant treatment with nivolumab after radical resection may address an unmet need. The committee acknowledged that nivolumab is the first adjuvant
immunotherapy available for resected high-risk muscle-invasive urothelial cancer. It concluded that nivolumab is a valued treatment option for people with resected high-risk muscle-invasive urothelial cancer.

Treatment pathway

Adjuvant platinum-based chemotherapy and best supportive care are the relevant comparators

3.2 The final NICE scope included adjuvant chemotherapy and best supportive care (active monitoring) as comparators. The CheckMate 274 trial only included a placebo (best supportive care) comparator arm. The company provided cost-effectiveness estimates for nivolumab compared with best supportive care but did not provide cost-effectiveness estimates comparing nivolumab with adjuvant chemotherapy. The company explained that this was because adjuvant chemotherapy use is low in current NHS practice. It explained that this is because of a lack of evidence of clinical benefits and people may refuse chemotherapy because of toxicity concerns. The clinical experts agreed that the use of adjuvant platinum-based chemotherapy was low for people with bladder cancer. This is because some people have neoadjuvant platinum-based chemotherapy, and some people are not fit enough to have platinum-based chemotherapy or they have toxicity concerns. The experts explained that the evidence base for adjuvant platinum-based chemotherapy was not robust for bladder cancer. The Cancer Drugs Fund clinical lead and the clinical experts explained that for people with urothelial carcinomas of the upper urinary tract, adjuvant platinum-based chemotherapy was likely to be standard of care. This was because clinical trial evidence from the POUT trial showed an increase in disease-free survival when platinum-based adjuvant chemotherapy was given within 90 days of resection (Birtle et al. 2020). In addition, neoadjuvant platinum-based chemotherapy is usually not suitable for treating urothelial carcinomas of the upper urinary tract. The committee considered that there are several reasons why adjuvant platinum-based chemotherapy may not be suitable. These reasons included:
the lack of robust randomised controlled trial evidence on adjuvant platinum-based chemotherapy for treating bladder cancer

previous neoadjuvant platinum-based chemotherapy

the toxicity profile of platinum-based chemotherapy in people who have just had major surgery

the refusal by a person to have adjuvant treatment with platinum-based chemotherapy after discussing the benefits and risks with their oncologist.

The committee considered that platinum-based chemotherapy was likely to be a suitable treatment option for people with urothelial carcinomas of the upper urinary tract. The committee concluded that adjuvant platinum-based chemotherapy, when suitable, and best supportive care are the relevant comparators.

Retreatment with immunotherapy would be offered to some people who have disease recurrence after adjuvant treatment with nivolumab

3.3 The company’s scenario analysis assumed that only people who had best supportive care after resection would have the option of immunotherapy (atezolizumab) if disease recurrence occurred. This treatment option was based on NICE’s technology appraisal guidance on atezolizumab for untreated PD-L1-positive advanced urothelial cancer when cisplatin is unsuitable. The Cancer Drugs Fund clinical lead explained that people who have nivolumab after resection may have immunotherapy again after disease recurrence if enough time has passed since nivolumab treatment had stopped (approximately 12 months). The ERG provided a scenario in which atezolizumab was a treatment option for both the nivolumab and best supportive care groups after disease recurrence. The committee concluded that retreatment with immunotherapy would be offered to some people who have disease recurrence after adjuvant treatment with nivolumab.
Clinical evidence

The clinical evidence for nivolumab is from Checkmate 274, a randomised controlled trial comparing nivolumab with placebo

CheckMate 274 is an ongoing phase 3 randomised controlled trial comparing nivolumab with placebo in people with resected muscle-invasive urothelial cancer at high risk of disease recurrence. People had nivolumab for up to 1 year. The trial included 353 people in the nivolumab arm, of whom 140 had tumours expressing PD-L1 at a level of 1% or more. The trial included 356 people in the placebo arm, of whom 142 had tumours expressing PD-L1 at a level of 1% or more. CheckMate 274 included people who were eligible to have adjuvant cisplatin (platinum-based chemotherapy). However, they were only allowed to enrol in the trial if they had documented reasons for refusing adjuvant cisplatin. Disease-free survival was the primary outcome measure. Median disease-free survival was not reached in the nivolumab arm in the currently available data (95% confidence interval [CI], 22.1 months to not estimable). Median disease-free survival in the placebo arm was 8.4 months (95% CI, 5.6 months to 20.0 months). At 6 and 12 months, 74.5% and 67.6% of people in the nivolumab arm were disease-free, respectively. This compared with 55.7% and 46.3% being disease-free in the best supportive care arm. The committee noted that in CheckMate 274, evidence for nivolumab was less encouraging for people with upper tract urothelial cancer compared with the intention-to-treat population (hazard ratios: renal pelvis tumour origin, 1.25, 95% CI 0.70 to 2.25; ureter tumour origin, 1.54, 95% CI 0.69 to 3.44). The committee concluded that the currently available data showed that nivolumab increased disease-free survival compared with placebo in people whose tumours express PD-L1 at 1% or more.

It is not certain to what extent a benefit in disease-free survival translates into a benefit in overall survival

The committee noted that because overall survival data from CheckMate 274 was event driven, the currently available data did not provide information on survival. The committee was aware that some
published evidence suggested that disease-free survival gains may not necessarily lead to overall survival gains (Sternberg et al. 2015). The clinical and patient experts emphasised the importance of disease-free survival in the adjuvant treatment setting. A clinical expert explained that the Sternberg et al. study may not be a reliable predictor of overall survival gains with nivolumab. This is because the study recruited over a long period of time, and many participants were enrolled a long time after having surgery. The Cancer Drugs Fund clinical lead highlighted that nivolumab has a different mechanism of action to platinum-based chemotherapy and therefore the extension in disease-free survival with nivolumab might translate into improved survival. The committee acknowledged these comments but considered that the lack of overall survival data was a key uncertainty in the analysis. But, it noted that it would take several years for the trial to show this data because nivolumab is positioned at a less severe part of the treatment pathway. The committee concluded that it is not certain to what extent a benefit in disease-free survival translates into a benefit in overall survival.

Indirect treatment comparison

The company's indirect treatment comparison is highly uncertain and does not include a comparison for upper tract urothelial cancer

CheckMate 274 did not compare nivolumab with platinum-based chemotherapy (see section 3.4), so the company provided an indirect treatment comparison. One comparison included people in CheckMate 274, in both the nivolumab and placebo groups, who refused cisplatin. Another comparison compared the CheckMate 274 nivolumab group with evidence from published studies of platinum-based chemotherapy. In both comparisons, the results showed that outcomes associated with nivolumab and platinum-based chemotherapy were not statistically significantly different. The exact results of the indirect treatment comparisons are considered academic in confidence and cannot be reported here. The company excluded studies that included upper tract urothelial cancer from its indirect comparison. The committee recalled that adjuvant chemotherapy was a relevant treatment option for
this group (see section 3.2). The company explained that CheckMate 274 was not powered to detect differences for upper tract disease, and that providing this indirect comparison would reduce the number of patients that would inform the analysis. The committee noted the company’s reasons but considered that an indirect treatment comparison for upper tract urothelial cancer would have been informative. The committee concluded that the company’s indirect treatment comparison is highly uncertain. It also concluded that a comparison including only upper tract urothelial cancer would have been the most relevant comparison because of the treatment pathway for upper tract disease.

Economic model

The company's economic model is appropriate for decision making but does not model disease recurrence robustly

3.7 The company’s model was a Markov model with 4 health states: disease-free survival, long-term disease-free, recurred disease and death. In the recurred disease state, the company’s base case included 1 line of treatment which was assumed to be either cisplatin or carboplatin. The ERG noted that it was assumed this treatment would be continued until death, which it did not consider to be appropriate. The committee noted that the model assumed equal efficacy in both treatment arms in the recurred disease state. This meant that increases to disease-free survival would translate to overall survival improvements. The committee recalled that the extent to which an increase in disease-free survival translated to an increased overall survival was a key uncertainty (see section 3.5). The company also used a simplified approach to model survival in the recurred disease health state by applying an exponential function (assuming constant hazards) to overall survival using median values from the literature. The committee noted this did not allow survival rates to vary over time. The committee was also aware that there were further treatment lines available which the company’s model did not account for. In particular, it did not include NICE’s technology appraisal guidance on atezolizumab for treating locally advanced or metastatic urothelial carcinoma after platinum-containing chemotherapy or avelumab for maintenance treatment of locally
advanced or metastatic urothelial cancer after platinum-based chemotherapy. The company did include a scenario which included atezolizumab for untreated PD-L1-positive advanced urothelial cancer when cisplatin is unsuitable, but only for people who had not had nivolumab. The committee expressed concern that the company could have modelled post-recurrence outcomes more robustly, for example, using tunnel states to allow transition rates to vary over time. The committee also highlighted that the model did not include all treatments currently considered standard care in NHS practice, although it understood avelumab had only recently been recommended by NICE, which limited the generalisability of results. However, the committee was reassured by the ERG that the omission of these treatments was unlikely to bias the cost-effectiveness estimates in favour of nivolumab. This was because the cost-effectiveness estimates for nivolumab would likely improve if these treatments were included because nivolumab was predicted to cure a higher proportion of people than best supportive care, therefore avoiding less cost-effective treatments (see section 3.9). The committee concluded that the company's economic model is appropriate for decision making but does not model disease recurrence robustly.

Both the generalised gamma and Gompertz distributions are potentially appropriate for estimating disease-free survival

3.8 The economic model provided by the company uses a generalised gamma distribution to model disease-free survival for both treatment arms. This distribution was deemed appropriate by the company because it had the best fit to the data. It also allows for a better accounting of the protocol-induced features of the hazard profiles, in particular the steep decline seen at 3 months which coincided with tumour assessments. The ERG agreed that this distribution was potentially appropriate. But, it may not have a desirable fit if the patterns of events observed in the trial, which may be influenced by the timing of data collection, are not reflective of what would happen in clinical practice. Additionally, the ERG noted that the generalised gamma distribution produces a higher risk for disease-free survival events at 5 years than the general population hazard of mortality. This did not match the company's 5-year cure assumption (see section 3.9). The ERG
advised that the Gompertz distribution is also informative but results in a
cure point earlier than 5 years. But, it noted that the choice between
these 2 potentially appropriate distributions has only a minimal impact on
the cost-effectiveness estimates. The committee agreed that the choice
of distribution is unlikely to affect decision making. It concluded that both
the generalised gamma and Gompertz distributions are potentially
appropriate for estimating disease-free survival.

There is uncertainty about the company's cure assumption

3.9 The company's base-case model assumes a cure point at 5 years. This
means that there will not be a disease recurrence after 5 years in a
disease-free survival state. The company highlighted that evidence from
CheckMate 274 demonstrates that risk of death approaches that of the
general population at 5 years. Clinical and patient experts agree that
after 5 years in a disease-free state the risk of disease recurrence is low;
however, there was some evidence to show that disease recurrence can
happen after 5 years in a small number of cases. The ERG provided an
exploratory analysis using a 10-year cure point. It cited evidence from
Sternberg et al. (2015) which demonstrated an increased mortality risk
for people with resected urothelial cancer compared with the general
population, even after 5 years in a disease-free state. The committee
noted that there is uncertainty surrounding which of these points in time
is the most accurate. But, it agreed that the exploratory analyses
provided by the ERG had a minimal impact on the cost-effectiveness
results. The committee concluded that there is evidence that disease
recurrence may take place after 5 years and mortality risks remain
elevated. But, it remains uncertain at what point it is reasonable to
assume that people are cured.

Utility values in the economic model

Disease-free utility values may be overestimated in the
company's analysis

3.10 The model provided by the company assumed that people in the
disease-free survival state after radical surgery have the same health
utility as age- and sex-matched people from the general population. The company highlighted that people in CheckMate 274, who were disease-free, had higher utility values than those of the age- and sex-matched general population. Clinical and patient experts agreed that, after a period of adjustment, people with resected urothelial cancer often adapt very well to post-surgical changes and often achieve a good quality of life with a fully functional lifestyle. They accepted that quality of life for this population is likely to be impacted in the first 1 or 2 years after surgery. The clinical experts noted that while a good quality of life is likely, there is potential for reduced quality of life. This is because of the increased presence of comorbidities in this population, the potential for some persistent effects from radical surgery (such as those impacting on sexual function) and persisting adverse events of treatment. Clinical advice to the ERG also suggested that a reduced quality of life compared with the general population was to be expected. Without evidence to inform a specific disutility value in this population, the ERG applied a disutility of 0.02 to their analyses to test the impact of disutility on the cost effectiveness of nivolumab. This was up until the time at which the cure point is applied. The committee agreed that there was likely to be a health disutility for this population. But, it noted that there was not enough evidence to inform what value this disutility should be, and that the ERG's exploratory analyses had a minimal impact on the cost-effectiveness results. The committee concluded that disease-free utility values may be overestimated in the company's analysis.

Assumptions in the economic model

The company's assumption about life expectancy for people in the long-term disease-free health state is optimistic

3.11 The company's model assumed that people in the disease-free survival state for 5 years have the same life expectancy as the general population. Clinical experts agreed that the risk of disease recurrence is low after 5 years and noted that discharge from follow-up is typical at this point (see section 3.9). The ERG advised that there is some evidence of an increased risk of death, even after being disease-free for 5 years. It noted that the generalised gamma distribution used in the company
model also indicated a mortality risk greater than the general population. It therefore provided a scenario analysis in which an increased risk of mortality is applied between years 5 and 10 in the model. The committee had concerns with the modelling provided by the company but agreed that there is a lack of definitive evidence in this area. It also agreed that the ERG's analyses did not have a substantial impact on the cost-effectiveness estimates. The committee concluded that the company's assumption that people in the long-term disease-free health state have the same life expectancy as the general population is optimistic.

Cost-effectiveness estimates

The cost-effectiveness results only apply when platinum-based chemotherapy is unsuitable

3.12 The company provided an indirect comparison of nivolumab with adjuvant chemotherapy (see section 3.6). However, the company did not provide any cost-effectiveness analysis comparing nivolumab with adjuvant platinum-based chemotherapy. The company explained that this was because of the limitations of the indirect treatment comparison. The ERG considered that the cost-effectiveness results provided by the company were only relevant in circumstances in which platinum-based chemotherapy was not suitable (see section 3.2). However, the committee also recalled that for some people, particularly those with upper tract urothelial cancer, adjuvant platinum-based chemotherapy would be an appropriate treatment option (see section 3.2). This included carboplatin for people with renal impairment. The committee recalled that in CheckMate 274, the evidence for nivolumab was less encouraging for people with upper tract urothelial cancer compared with the intention-to-treat population (see section 3.4). The ERG stated that it was unlikely that nivolumab would be considered cost effective compared with adjuvant platinum-based chemotherapy, in people for whom it is suitable. This is because the indirect comparison results showed no overall statistically significant difference in treatment effect and the cost of nivolumab is higher. The committee concluded that because it had not been presented with any cost-effectiveness results...
comparing nivolumab with platinum-based chemotherapy, the cost-effectiveness results only apply when adjuvant platinum-based chemotherapy is unsuitable.

Nivolumab is cost effective only when adjuvant platinum-based chemotherapy is unsuitable

3.13 The company’s base-case incremental cost-effectiveness ratio (ICER) for nivolumab was £11,361 per quality-adjusted life year (QALY) gained compared with best supportive care. The company's base-case analysis included the following key assumptions:

- using a generalised gamma distribution to estimate disease-free survival (see section 3.8)
- the disease will not recur after 5 years in the disease-free health state (see section 3.9)
- people in the long-term disease-free health state have the same risk of death as that of the general population (see section 3.11).

The ERG provided alternative scenarios which explored:

- using a Gompertz distribution to estimate disease-free survival
- increasing the time point in the disease-free survival health state when it is assumed disease recurrence would not occur
- applying a higher mortality rate to the long-term disease-free survival health state
- including subsequent atezolizumab treatment in the recurred disease health state in both the nivolumab and best supportive care arm (see section 3.7).

The ICERs for nivolumab from the ERG’s alternative analysis ranged from £11,259 to £13,758 per QALY gained.

The ICERs reported here do not include confidential discounts for subsequent treatments, but including these discounts reduced the ICER for nivolumab. The committee noted that the analysis included the following uncertainties:
• to what extent disease-free survival translates to overall survival gains (see section 3.5)

• the company’s model applied a simplified approach to estimate outcomes in the recurred disease health state and did not include all available lines of treatment (see section 3.7).

The committee considered that the cost-effectiveness analysis was only relevant for situations when platinum-based chemotherapy was unsuitable (see section 3.2 and section 3.12). The committee concluded that, despite these uncertainties, the cost-effectiveness estimates for nivolumab were likely to be within the range that NICE normally considered a cost-effective use of NHS resources. This is when platinum-based adjuvant chemotherapy was not appropriate.

Other factors

3.14 A patient submission suggested that urothelial cancer is more likely to be diagnosed at a later timepoint in women than men and that women have a lower expected survival rate. The committee considered that the recommendations would be applied to everyone with the condition and was satisfied that no additional considerations were needed in relation to this issue.

3.15 NICE’s advice about life-extending treatments for people with a short life expectancy did not apply.

3.16 The committee considered that nivolumab was an innovative treatment in the adjuvant setting. The committee noted that all relevant health benefits for people with the condition had been captured in the economic model. But, it noted that the impact on caregiver quality of life had not been captured and no data on caregiver quality of life had been presented.

Conclusion

Nivolumab is recommended when platinum-based chemotherapy...
The committee considered that nivolumab is a promising new adjuvant treatment for people with muscle-invasive urothelial cancer at high risk of recurrence after radical resection and whose tumours express PD-L1 at a level of 1% or more. However, there are uncertainties in the extent that improved disease-free survival translates into overall survival gains. The committee was not presented with any cost-effectiveness analyses comparing nivolumab with platinum-based chemotherapy. It therefore considered that the cost-effectiveness results were only relevant to situations when platinum-based chemotherapy was not suitable. These situations included: the lack of evidence of effect in people with bladder cancer in the adjuvant treatment setting; use of neoadjuvant platinum-based chemotherapy; when platinum-based chemotherapy is not suitable for the person or will not be tolerated; or if the person refuses platinum-based chemotherapy after discussing the benefits and risks with their oncologist. The committee considered that platinum-based chemotherapy was likely to be an appropriate treatment option for people with urothelial carcinomas of the upper urinary tract, given the POUT trial evidence available. Compared with best supportive care, the ICERs for nivolumab were considered a cost-effective use of NHS resources when platinum-based chemotherapy is not suitable. Therefore, the committee recommended nivolumab for routine commissioning, but only if platinum-based chemotherapy is unsuitable.
4 Implementation

4.1 Section 7 of the National Institute for Health and Care Excellence (Constitution and Functions) and the Health and Social Care Information Centre (Functions) Regulations 2013 requires clinical commissioning groups, NHS England and, with respect to their public health functions, local authorities to comply with the recommendations in this appraisal within 3 months of its date of publication.

4.2 Chapter 2 of Appraisal and funding of cancer drugs from July 2016 (including the new Cancer Drugs Fund) – A new deal for patients, taxpayers and industry states that for those drugs with a draft recommendation for routine commissioning, interim funding will be available (from the overall Cancer Drugs Fund budget) from the point of marketing authorisation, or from release of positive draft guidance, whichever is later. Interim funding will end 90 days after positive final guidance is published, at which point funding will switch to routine commissioning budgets. The NHS England and NHS Improvement Cancer Drugs Fund list provides up-to-date information on all cancer treatments recommended by NICE since 2016. This includes whether they have received a marketing authorisation and been launched in the UK.

4.3 The Welsh ministers have issued directions to the NHS in Wales on implementing NICE technology appraisal guidance. When a NICE technology appraisal recommends the use of a drug or treatment, or other technology, the NHS in Wales must usually provide funding and resources for it within 2 months of the first publication of the final appraisal document.

4.4 When NICE recommends a treatment ‘as an option’, the NHS must make sure it is available within the period set out in the paragraphs above. This means that, if a patient has resected muscle-invasive urothelial cancer at high risk of recurrence after radical resection and their tumour expresses PD-L1 at a level of 1% or more and the doctor responsible for their care thinks that nivolumab is the right treatment, it should be available for use, in line with NICE’s recommendations.
5 Appraisal committee members and NICE project team

Appraisal committee members

The 4 technology appraisal committees are standing advisory committees of NICE. This topic was considered by committee D.

Committee members are asked to declare any interests in the technology to be appraised. If it is considered there is a conflict of interest, the member is excluded from participating further in that appraisal.

The minutes of each appraisal committee meeting, which include the names of the members who attended and their declarations of interests, are posted on the NICE website.

NICE project team

Each technology appraisal is assigned to a team consisting of 1 or more health technology analysts (who act as technical leads for the appraisal), a technical adviser and a project manager.

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