

NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE

Final appraisal document

Osimertinib for untreated EGFR mutation- positive non-small-cell lung cancer

1 Recommendations

- 1.1 Osimertinib is not recommended, within its marketing authorisation, for untreated locally advanced or metastatic epidermal growth factor receptor (EGFR) mutation-positive non-small-cell lung cancer (NSCLC) in adults.
- 1.2 This recommendation is not intended to affect treatment with osimertinib 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

Locally advanced or metastatic EGFR mutation-positive NSCLC is usually first treated with afatinib, erlotinib or gefitinib.

Evidence from a randomised controlled trial suggests that people who take osimertinib live longer than people who take erlotinib or gefitinib. They also live longer before their disease gets worse. But there is no direct evidence comparing osimertinib with afatinib, which may be more effective than erlotinib and gefitinib.

Osimertinib does not meet NICE's criteria to be considered a life-extending treatment at the end of life. The most plausible cost-

effectiveness estimates are above what NICE normally considers an acceptable use of NHS resources. So osimertinib is not recommended.

Although some of the clinical uncertainty could be addressed through collecting further data from the clinical trial, osimertinib does not meet NICE's criteria to be included in the Cancer Drugs Fund because it does not have the potential to be cost effective at the price offered.

2 Information about osimertinib

Marketing authorisation indication	Osimertinib (Tagrisso, AstraZeneca) is indicated 'for the first-line treatment of adult patients with locally advanced or metastatic non-small cell lung cancer (NSCLC) with activating epidermal growth factor receptor (EGFR) mutations'.
Dosage in the marketing authorisation	80 mg taken orally once daily until disease progression or unacceptable toxicity. EGFR mutation status in tumour or plasma specimens should be determined using a validated test method. Dosing interruption with or without dose reduction may be needed based on individual safety and tolerability. If dose reduction is necessary, then the dose should be reduced to 40 mg once daily.
Price	£5,770 for 80 mg and 40 mg osimertinib (pack of 30 tablets, excluding VAT; British national formulary online, accessed March 2019). The company has a commercial arrangement, which would have applied if the technology had been recommended.

3 Committee discussion

The appraisal committee (section 5) considered evidence submitted by AstraZeneca, a review of this submission by the evidence review group (ERG), and the technical report developed through engagement with stakeholders. See the [committee papers](#) for full details of the evidence.

The appraisal committee was aware that several issues were resolved during the technical engagement stage, and agreed that:

- The utility value of 0.678 (from the AURA 2 trial, second-line treatment with osimertinib) was more representative of people in the progressed disease state (table 3, pages 24 to 25 of the technical report).
- A combined approach to determine the appropriate resource costs for people in the progressed disease state was acceptable (table 3, pages 24 to 25 of the technical report).

It recognised that there were remaining areas of uncertainty associated with the analyses presented (table 2, pages 22 to 23 of the technical report), and took these into account in its decision making. It discussed the following issues, which were outstanding after the technical engagement stage.

Clinical need

People would welcome a new treatment option

- 3.1 The patient experts explained that people with untreated locally advanced or metastatic epidermal growth factor receptor (EGFR) mutation-positive non-small-cell lung cancer (NSCLC) are often very unwell, with many distressing symptoms. There are no curative treatments. The prognosis is generally poor despite treatments such as targeted therapies and immunotherapy. People would therefore welcome new treatments that improve their symptoms, quality of life, and increase how long they live (even if this increase is only small). Locally advanced or metastatic EGFR mutation-positive NSCLC is first treated with an EGFR tyrosine kinase inhibitor, such as [afatinib](#), [gefitinib](#) or [erlotinib](#), in line with NICE guidance. The clinical experts explained that people would usually be offered afatinib based on the clinical evidence (see section 3.4). After afatinib, gefitinib or erlotinib, people may be offered either [osimertinib](#) (through the Cancer Drugs Fund) if they have developed the T790M resistance mutation in the EGFR gene, or chemotherapy if not. People who are not well enough to have further treatment would be offered best supportive

care. After chemotherapy, people may be offered immunotherapy, docetaxel with or without nintedanib, or best supportive care. The clinical experts stated that osimertinib would be beneficial as an additional treatment option because it is better tolerated than existing treatments, with fewer side effects. Also, if osimertinib was a first-line treatment option it would remove the need for T790M mutation testing before second-line treatment. This involves a biopsy, which is invasive and can be psychologically distressing. The committee agreed that additional options would be beneficial and concluded that osimertinib would be a useful addition to first-line treatment.

Clinical evidence

The FLAURA trial is broadly generalisable to people with untreated locally advanced or metastatic EGFR mutation-positive NSCLC in England

3.2 The clinical evidence for osimertinib came from the ongoing FLAURA randomised controlled trial. FLAURA is comparing the efficacy and safety of osimertinib with standard care (erlotinib or gefitinib) for people with locally advanced or metastatic EGFR mutation-positive NSCLC. Patients in the trial had either the exon 19 deletion (del19) or exon 21 (L858R) EGFR mutation. The clinical experts explained that these 2 mutations account for around 90% of all EGFR mutations. Also, most trials only include people with these mutations, including the trials that were carried out with other tyrosine kinase inhibitors. The committee acknowledged that although other mutations may not respond as well to osimertinib, the marketing authorisation indication is not restricted to these 2 mutations (see section 2). It therefore agreed that the EGFR mutation status of patients in FLAURA generally reflected that seen in NHS clinical practice in England. The inclusion criteria allowed people with stable brain metastases to enter the trial but limited the trial population to people with an Eastern Cooperative Oncology Group (ECOG) performance score of 0 or 1. For this reason, the committee was aware that the clinical trial population may be in better health than people with stage IIIb or IV

NSCLC in the NHS and that people with many comorbidities may not have been included in the trial. Also, it noted that afatinib was not a comparator in the standard care arm in FLAURA (see section 3.4) and that many subsequent treatments used in the trial are not routinely used in the NHS. Despite these concerns, the clinical experts explained that the evidence from FLAURA was broadly generalisable to NHS clinical practice. The committee agreed with the clinical experts.

Osimertinib extends progression-free and overall survival compared with gefitinib and erlotinib but the size of the benefit is unclear

3.3 An interim analysis of FLAURA showed that progression-free survival was statistically significantly longer with osimertinib than with erlotinib or gefitinib. At the latest data cut (12 June 2017) median progression-free survival was 18.9 months for osimertinib (95% confidence interval [CI] 15.2 to 21.4) and 10.2 months for standard care (95% CI 9.6 to 11.1). The hazard ratio was 0.46 (95% CI 0.37 to 0.57; $p < 0.001$). Overall survival data were very immature (25% of events) but the interim results showed that osimertinib extended overall survival compared with standard care. This produced a hazard ratio of 0.63 (95% CI 0.45 to 0.88; $p = 0.007$) which was not statistically significant (a p -value of less than 0.0015 was needed for the result to be significant). The committee acknowledged that the FLAURA data were very immature and that there was substantial uncertainty in overall survival because of the number of events still to be reported. It concluded that osimertinib lengthened progression-free survival, and possibly overall survival, compared with erlotinib or gefitinib but the overall survival benefit was difficult to establish because the data were very immature.

EGFR tyrosine kinase inhibitors do not all have equal efficacy

3.4 The relevant comparators for this technology appraisal are erlotinib, gefitinib and afatinib. FLAURA compared osimertinib with either gefitinib or erlotinib, but not with afatinib. The Cancer Drugs Fund clinical lead noted that afatinib is currently the most prescribed EGFR tyrosine kinase

inhibitor in England for this population. He also stated that previous trials, such as LUX-Lung 7, showed that afatinib statistically significantly improved progression-free survival compared with gefitinib. The clinical experts agreed that gefitinib and erlotinib are likely to have equal efficacy. They stated that people taking afatinib had a better response rate to treatment, a longer duration of response and longer progression-free survival than with erlotinib and gefitinib. Also, they usually stayed on afatinib for longer. The company stated that LUX-Lung 7 did not show a statistically significant increase in overall survival for afatinib compared with gefitinib. It therefore assumed that afatinib was equivalent in efficacy to erlotinib and gefitinib in its economic model. However, the clinical experts explained that LUX-Lung 7 was not powered (that is, it did not have enough people in the trial) to show a difference in overall survival compared with gefitinib. The ERG did its own exploratory indirect treatment comparison that suggested osimertinib statistically significantly improved progression-free survival compared with afatinib but showed no statistically significant difference in overall survival. The committee concluded that there was evidence of improved progression-free survival with afatinib compared with gefitinib, and erlotinib and gefitinib cannot be assumed to have equal efficacy with afatinib.

Modelling of overall survival

Assuming a 6-year treatment benefit for osimertinib is optimistic

3.5 The company used a partitioned survival structure with 3 health states (progression-free, progressed disease and death) to model overall survival in FLAURA. It used a time horizon of 20 years to capture all relevant costs and benefits for people having treatment. The company initially assumed a treatment benefit for osimertinib for the full 20-year period. The committee agreed with the ERG and clinical experts that this assumption was optimistic considering the data available and would have to be adjusted to reflect a more realistic benefit from osimertinib treatment. The company therefore revised its base case assuming a 6-

year duration of treatment effect after the start of treatment (that is, applying a hazard ratio of 1 to both the osimertinib and standard care arms 6 years after starting treatment). The committee recalled that in previous appraisals for locally advanced or metastatic NSCLC, the preferred treatment-effect duration for immunotherapies was 3 to 5 years. However, it acknowledged that these appraisals involved drugs with a different mechanism of action to osimertinib and a maximum treatment duration. Therefore it was not appropriate to compare them. The clinical experts agreed that because osimertinib is associated with improved progression-free survival and duration of response, treatment effect would continue after symptomatic and radiological progression for some people. They stated that this could plausibly give about 3 months of additional benefit after stopping treatment with osimertinib compared with erlotinib and gefitinib. The clinical experts believed that because osimertinib penetrates the blood-brain barrier better than erlotinib and gefitinib, it may help improve control of brain metastases. The committee recalled that afatinib yields longer progression-free survival than erlotinib and gefitinib, but as there was no direct evidence comparing osimertinib with afatinib (see section 3.4), it could not establish how osimertinib compared with afatinib in terms of progression-free and overall survival. The ERG's preferred analyses used durations of 3 and 5 years. The ERG explained that the company's 6-year duration of treatment effect would mean that people who stopped taking osimertinib within 1 or 2 years of starting it would still benefit for the full 6 years. The ERG emphasised the limitations of modelling the duration of treatment effect with a partitioned survival model. This is because a crude approach is needed to make adjustments around the assumptions (for example, assuming equivalence at a single time point). The ERG noted that this does not fully reflect what happens in a clinical setting. The committee concluded that a 6-year duration of treatment effect for osimertinib was optimistic and that without more evidence, the ERG's analyses using a 3- or 5-year duration of treatment effect were more appropriate.

The economic model does not capture the benefits of subsequent treatments appropriately

3.6 The committee was aware of NICE's position statement on [handling comparators and treatment sequences in the Cancer Drugs Fund](#). This states that 'products recommended for use in the Cancer Drugs Fund after 1 April 2016 should not be considered as comparators, or appropriately included in a treatment sequence, in subsequent relevant appraisals'. But the committee accepted that it could consider the company's approach of including osimertinib as a subsequent treatment (in line with NICE's technology appraisal of [osimertinib for locally advanced or metastatic EGFR T790M mutation-positive non-small-cell lung cancer](#)) in the model in this appraisal, because this reflected that some patients in FLAURA did receive osimertinib as a subsequent treatment. People in the standard care arm in the model could have osimertinib as a second-line treatment, assumed to be 33% of people (based on clinical opinion). The committee noted that, although the costs of osimertinib as a second-line treatment were applied in the standard care arm of the model, efficacy was not fully captured given that only around 20% of people had osimertinib as a second-line treatment in the trial. The committee was aware that the subsequent treatments used in the trial may not reflect NHS practice. It noted that different subsequent therapies would mean different survival prospects and health states that cannot be captured in the modelling. The ERG explained that to overcome the limitations of the model in capturing the efficacy of subsequent treatments, and to create more flexibility to explore varying the duration of treatment benefits, additional health states would be needed. The ERG described how an individual patient simulation model would better account for these issues but it would need lots of additional data and trial data are usually immature. The committee agreed that the company's model was broadly appropriate for decision making. It acknowledged the limitations of the model and, given the immaturity of the data, concluded that the model did not fully capture the benefits of subsequent treatments appropriately.

The company's modelling of overall survival is appropriate but the immaturity of the data introduces uncertainty in estimating overall survival

3.7 At the latest data cut, median overall survival was not achieved in either the osimertinib or standard care arm. To estimate the overall survival of people in FLAURA the company used a piecewise Weibull extrapolation of the Kaplan–Meier curve which was based on observed data up to 7.9 months in the trial. This estimated that mean overall survival was 66.96 months with osimertinib and 44.39 months with standard care, assuming a 20-year time horizon in the model. The committee was aware that this extrapolation resulted in the most conservative piecewise survival estimates of those presented and fitted the data well. It understood that the FLAURA data were immature (only 25% of events occurring), which introduced uncertainty into the survival estimates, and that further data collection is planned. It concluded that, although the company's and ERG's preferred choice of distribution for modelling overall survival was appropriate, the immaturity of the data introduces uncertainty in estimating the results.

Cost-effectiveness estimate

The most plausible ICER for osimertinib is higher than what NICE normally considers a cost-effective use of NHS resources

3.8 The committee recalled its preferred modelling assumptions:

- A treatment-effect duration (that is, from the start of treatment) of 3 to 5 years (see section 3.5).
- Weibull extrapolation of overall survival in both the osimertinib and standard care arms (see section 3.7).
- A utility value of 0.678 (see table 3, pages 24 to 25 of the technical report).

Using these assumptions, all of the pairwise incremental cost-effectiveness ratios (ICERs; including all relevant confidential commercial arrangements) for osimertinib, compared with erlotinib, gefitinib and

afatinib were greater than £30,000 per quality-adjusted life year (QALY) gained. When a fully incremental analysis is done (that is the calculation of incremental QALY gains and costs along a list of treatment options ranked by ascending cost) the ICER compared with erlotinib was also above £30,000 per QALY gained. Also, the committee noted that the ICER for osimertinib compared with afatinib was based on the assumption that afatinib has equal efficacy to gefitinib and erlotinib. The committee acknowledged that given the available evidence from LUX-Lung 7 and clinical expert opinion, it is possible that afatinib has better efficacy than gefitinib and erlotinib. If so, this could affect the pairwise ICER for osimertinib compared with afatinib. At consultation, the company submitted subgroup analyses for 3 individual patient characteristics from FLAURA (see section 3.11). The committee noted that it could not determine how these affected the ICER because no new cost-effectiveness analyses were presented. Therefore, it concluded that the most plausible ICER for osimertinib is higher than what is considered an acceptable use of NHS resources.

End of life

Osimertinib is likely to extend life by over 3 months

3.9 The committee considered the advice about life-extending treatments for people with a short life expectancy in NICE's [guide to the methods of technology appraisal](#). It recalled that, at the most recent data cut, median overall survival had not been reached in FLAURA and that the increased survival in the osimertinib arm was not statistically significant from the standard care arm (see section 3.3). However, it also noted that the company's economic model predicted mean overall survival would be 22 months longer with osimertinib than with standard care. Based on evidence from FLAURA and predictions from the economic model (using the committee's preferred assumptions), the committee concluded that osimertinib was likely to extend life by over 3 months and therefore met the extension-to-life criterion.

FLAURA should be the primary data source for deciding if osimertinib meets the short life expectancy criterion

3.10 In its main submission, the company presented registry evidence from a real-world data source (National Cancer Registration and Analysis Service [NCRAS] Public Health England data between 2014 and 2016), showing that median overall survival for the population in England was less than 24 months. The committee recognised that there was potential value in real-world evidence from the NHS in England to help inform its decision making. However, it considered there were several reasons why it was not appropriate to use these as the primary data source in isolation for its decision-making on the short life expectancy criterion:

- The committee recalled its conclusion that FLAURA was generalisable to clinical practice in England (see section 3.2). In addition, it noted the Cancer Drugs Fund clinical lead and ERG statements that it was inconsistent to use the FLAURA data to determine the overall survival benefit of osimertinib, but real-world evidence to determine life expectancy for people having standard care without making some adjustments in the economic model (such as amending the efficacy estimates).
- The committee noted that afatinib (the currently preferred and most prescribed EGFR tyrosine kinase inhibitor in England for this population) was not available for most of the time the NCRAS data were collected.
- The committee recalled that after consultation on the technical report, the clinical experts stated that about 60% of people in clinical practice were alive 2 years after starting treatment with an EGFR tyrosine kinase inhibitor.
- In the standard care arm, which used FLAURA data to inform the extrapolation of overall survival, the economic model (using the committee's preferred assumptions) predicted a median overall survival of 31.54 months and a mean overall survival of 44.39 months.

- The committee was also aware that evidence from studies in similar populations, such as LUX-Lung 7 and ARCHER 1050, showed that median overall survival was more than 24 months.
- The committee noted that the registry data were difficult to compare directly with the FLAURA data because possible confounders in the real-world population (such as comorbidities) were not taken into account.

For these reasons, the committee considered it more appropriate to base its decision about estimating life expectancy on the FLAURA data which the company had used in the economic model. Therefore, at the first committee meeting, the committee concluded that osimertinib did not meet the short-life expectancy criterion of the end-of-life criteria.

Subgroup analyses from FLAURA do not show that osimertinib meets the criteria for life-extending treatment at the end of life

3.11 At consultation, the company provided new analyses to support its case for meeting the end-of-life criteria when using the committee-preferred dataset (FLAURA). The company stated that the subgroup analyses most closely reflected the cohort of NHS patients in England. However, the Cancer Drugs Fund clinical lead's nominated deputy advised caution in interpreting these registry data because the systemic anti-cancer therapy (SACT) data set is currently incomplete and that gaps in the evidence exist between the secondary uses service data and the corresponding SACT data. The 3 subgroups were:

- no subsequent treatment with an EGFR tyrosine kinase inhibitor (because the company stated that people in England would not have a second EGFR tyrosine kinase inhibitor).
- ECOG performance score of 1 (because people in England with this condition are usually less well than those in FLAURA).

- non-Asian family origin (because most people with this condition in England are of non-Asian family origin and the company stated that they have poorer survival outcomes than people of Asian family origin).

The committee noted that the subgroups in the new analyses had not been combined to calculate a value for mean or median overall survival. It agreed that this added substantial uncertainty to interpreting the results because each subgroup was linked to a single characteristic and it was not possible to determine the degree of overlap between these groups. The committee noted that the company's overall survival estimates for all 3 subgroups in the standard care arm were longer than 24 months (the modelled outputs are academic in confidence and cannot be reported). The ERG stated that because it did not have access to the FLAURA data it could not confirm any of the company's results for the new analyses. The committee heard concerns regarding the relevance of the analyses:

- The Cancer Drugs Fund clinical lead's nominated deputy commented that many people do have more than 2 subsequent therapies after progression on an EGFR tyrosine kinase inhibitor.
- The ERG noted that the overall survival for patients of non-Asian family origin may be shorter, but the results of the subgroup analysis were very similar to those of the intention-to-treat population in FLAURA and that no statistical testing of the difference was done. The committee agreed there was no conclusive evidence that ethnicity has an influence on overall survival and that other factors may be more influential. It noted that for [afatinib](#) the clinical experts stated that differences in the effectiveness of afatinib in NSCLC are more likely to be determined by EGFR mutation status than ethnicity.

The committee concluded the subgroup analyses presented in response to consultation did not show that osimertinib meets the short life expectancy criterion. It noted that the short life expectancy criterion in the methods guide states 'normally less than 24 months' and discussed whether any flexibilities should be applied. The committee concluded that

there were no exceptional circumstances that demanded additional flexibility in applying the end-of-life criteria (such as to ensure continued access to a highly effective treatment option that was perceived by patients and clinicians to be standard of care, in circumstances where access had been enabled years ahead of NICE publishing any guidance on the technology). The committee also concluded that although the company's economic model suggests that the overall survival gain may potentially be high (see section 3.8), the immaturity of the trial data means there is considerable uncertainty about the magnitude of the benefit.

Innovation

Osimertinib may be innovative

3.12 The Cancer Drugs Fund clinical lead highlighted that follow up in FLAURA is short so the economic model was unlikely to fully capture osimertinib's beneficial effect in the brain. He also stated that osimertinib is better tolerated than other EGFR tyrosine kinase inhibitors with respect to chronic grade 1 and grade 2 skin-related toxicities and this benefit was not captured in the economic model. The committee also understood that having osimertinib for untreated EGFR mutation-positive NSCLC will reduce the need for repeat bronchoscopic biopsies in people to identify those eligible for osimertinib after an EGFR tyrosine kinase inhibitor (this is currently available via the Cancer Drugs Fund). Although there may be potential benefits that are not captured by the cost-effectiveness analyses, the committee was unable to determine the potential effect of these factors on the ICER. It concluded that osimertinib may be innovative.

Routine NHS use

Osimertinib is not recommended for routine use in the NHS

3.13 The committee considered all of the available evidence for osimertinib in this appraisal. It concluded that the most plausible ICER is above £30,000 per QALY gained. Also, osimertinib does not meet NICE's end-of-life

criteria. Because of this, the committee concluded that osimertinib could not be recommended for routine use based on what is normally considered an acceptable use of NHS resources, even when considering the potential impact of any further benefits that had not been included in the cost-effectiveness analyses.

Cancer Drugs Fund

Osimertinib is not recommended for use in the Cancer Drugs Fund

3.14 Having concluded that osimertinib could not be recommended for routine use, the committee then considered if it could be recommended for untreated locally advanced or metastatic EGFR mutation-positive NSCLC within the Cancer Drugs Fund. The committee discussed the arrangements for the Cancer Drugs Fund agreed by NICE and NHS England in 2016, noting NICE's [Cancer Drugs Fund methods guide \(addendum\)](#). The company had expressed an interest in the technology being considered for funding through the Cancer Drugs Fund. The committee acknowledged that some of the clinical uncertainty could be addressed through collecting further data from FLAURA and that final data from the trial will be available soon. But at the current price, osimertinib does not have plausible potential for cost effectiveness. The most plausible ICER, which is highly uncertain because of the immaturity of the data from FLAURA, is above £30,000 per QALY gained when the commercial arrangements are taken into account. The committee concluded that osimertinib did not meet the criteria to be considered for inclusion in the Cancer Drugs Fund, so did not recommend it for use within the Cancer Drugs Fund.

Other factors

3.15 No equality or social value judgement issues were identified.

4 Review of guidance

- 4.1 The guidance on this technology will be considered for review 3 years after publication. The guidance executive will decide whether the technology should be reviewed based on information gathered by NICE, and in consultation with consultees and commentators.

Professor Gary McVeigh
Chair, appraisal committee
June 2019

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.

Stephen Robinson

Technical lead

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