Document title: Case complexity adjustment in brief

To make comparisons as fair as possible, surgeons who undertake high risk cases should be given appropriate credit for the complexity of their work. The risk of an adverse outcome such as a surgical complication during a cataract operation, or vision loss from surgery, varies depending on the characteristics of the patient and their eye. The purpose of case complexity adjustment is to ensure, as far as possible, that surgeons undertaking the most complex surgery are not penalised for accepting challenging cases. Conversely, surgeons who accept mainly straightforward cases should not gain an advantage from adopting risk aversive strategies because such an approach may result in patients being denied access to surgery when they could potentially have gained a visual benefit. The details of case complexity adjustment are fully described in the accompanying documents on this web-page; this document provides a brief non-technical overview of the methodology.

Hundreds of thousands of cataract operations have been analysed to discover which factors are associated with adverse outcomes. The statistical risk models developed in this way allow predictions to be made of the probability of an adverse outcome arising in an individual operation based on the patient and eye risk factors present. (One of the documents on this web-page contains a spreadsheet calculator which surgeons can use to predict the likelihood of an adverse outcome for individual operations). For a series of operations e.g. those done by an individual surgeon, the likelihood of an adverse outcome is calculated for each of the cases submitted to the audit. Where full information is available on the patient and eye risk factors the prediction will be more accurate, where risk factor data are missing the prediction may underestimate the likelihood of an adverse outcome. *This is an important point to remember, if a surgeon does not record the patient and eye data fully then the risk factor(s) are assumed to be absent and no credit is received for what might have been a complex and difficult operation*. From all the operations in a surgeons' series the average of the predicted probabilities of an adverse outcome for that series is calculated. This average represents the expected adverse outcome rate for that series of operations considering how complex or straightforward they were. This expected adverse outcome rate is compared with the observed adverse outcome rate by dividing the observed by the expected rate. This ratio of observed / expected rate is multiplied by the overall benchmark value to arrive at the adjusted rate for the surgeon.

As an example, if Surgeon A has done 100 operations with an average predicted probability of PCR (=average case complexity) of 2.5%, and only 1 PCR occurred, then the adjusted rate would be the benchmark (2%) * observed rate / expected rate = 2%*1/2.5=0.8%. This surgeon would be performing better than expected after accounting for their case complexity.

Surgeon B may also have done 100 operations with the same average predicted probability of PCR of 2.5% but with 2 PCRs having occurred. Their adjusted rate would be 2%*2/2.5=1.6%, again a bit lower than the benchmark.

Surgeon C may also have done 100 operations with the same average predicted probability of PCR of 2.5% but with 3 PCRs. Their adjusted rate would be 2%*3/2.5=2.4%, this time a little higher than the benchmark because there were more complications than expected based on the surgeon's case complexity.

Surgeon D with the same average predicted probability of PCR of 2.5% but with 4 PCRs would have an adjusted rate of 2%*4/2.5=3.2%.

Surgeon E is trying to game the system by only accepting 'easy' (i.e. low risk) cases. Surgeon E has an average predicted probability of an adverse outcome of just 0.9%. With 100 operations and just 1 PCR Surgeon E has an adjusted rate of 2%*1/0.9=2.2% which is above the benchmark and demonstrates that by only accepting low risk cases Surgeon E has gained no benefit as the adjustment for their case complexity takes into account the fact that he/she is only undertaking straightforward operations. If surgeon E had had another PCR (2 in 100) their adjusted rate would have been 4.4%. Attempts at gaming thus bring no benefit and can backfire. The results for the five example surgeons are shown in the following table

Surgeon	**Number of operations**	**Number of PCR's**	**Observed PCR rate**	**Average predicted probability**	**Adjusted PCR rate**
A	100	1	1%	2.5%	0.8%
B	100	2	2%	2.5%	1.6%
C	100	3	3%	2.5%	2.4%
D	100	4	4%	2.5%	3.2%
E_1	100	1	1%	0.9%	2.2%
E_2	100	2	2%	0.9%	4.4%

Comment

These examples illustrate that case complexity adjustment not only gives ‘credit’ to those undertaking difficult cases but it also avoids rewarding risk aversive behaviour in surgeons who try to cherry pick only easy cases. *What this also means is that a failure to record accurately the complexity of the cases undertaken can result in a surgeon being ‘penalised’ due to a lack of the necessary risk factor information which is used for case complexity adjustment*. The current methodology cannot account for every risk encountered but in the interests of a more level playing field providing some credit for higher complexity operations where feasible seems inherently desirable. Some well-known risks, e.g. alpha-blocker use, are picked up and ameliorated by surgeons and therefore these do not appear in the model. This does not however imply that these ‘known risks’ should be disregarded, vigilance with all operations will help reduce risk across the board, including in regard to uncommon risks which may not be detectable using standard statistical methodology. It should be borne in mind that occasional difficult cases will be encountered for which adjustment is not made by the model. In the unlikely event of a surgeon being identified as a possible ‘outlier’ as a result of one or more exceptional cases this could be resolved through checks on these individual operations. The audit will review risk prediction models every few years in order to maintain relevance to changes in technique and surgical practice.

Approximately half the surgeons and centres are expected to have adverse outcome rates above the benchmark rate because the benchmark simply reflects an average across all operations. What is important however is to avoid being above the alert (2SD - standard deviations; 1 in 40 chance) or alarm (3SD; under 1 in 700 chance) levels above the benchmark. If confirmed, the alert level should prompt reflection and the alarm level review of practice in accordance with national outlier policies. For small numbers of cases these ‘limits of acceptable practice’ are wide reflecting the statistical uncertainty of a small sample. As illustrated by the funnel plots on this site the limits narrow as the sample size (number of cases) increases. Looking ahead, a period of > 1 year may be adopted by the audit to increase sample sizes and reduce this statistical uncertainty.

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