

To: Audit and Risk Committee

For meeting on: 19 February 2015

Agenda item: 10

Report by: Pam Kitsawat, Economist

Report on: Macpherson review: Quality assurance of analytical models

Purpose

1. This paper provides information on the Macpherson review, its recommendations and their implications for the quality assurance (QA) of Monitor's analytical models. The Audit and Risk Committee is asked to note the work the team has done to date, and the proposed to ensuring that Monitor meets the Macpherson recommendations on an ongoing basis.

Background

2. The Macpherson review was published in March 2013. It made eight recommendations that apply to government departments and their arm's length bodies (ALBs)¹. In general terms, the recommendations focus on improving the environment and culture within which government bodies QA their business critical analytical models². This includes a requirement for Accounting Officers to confirm within the Annual Governance Statement that an appropriate framework of QA is in place for the business critical models used within their organisations.
3. In response to the Macpherson recommendations, the Department of Health (DH) has established an Analytical Modelling Oversight Committee (AMOC) to update and review the business critical models used by DH and its ALBs each quarter. AMOC also identifies, monitors and addresses risks in relation to these models and, if required, contacts ALBs to gather information about QA processes. Membership is voluntary and currently consists of senior analysts and directors from DH, NHS England and Public Health England.

¹ The Macpherson recommendations are shown in the table on the following pages.

² The Department of Health has a working definition of a business critical model. This is set out in Annex A.

Monitor's activities to date

4. AMOC has identified a number of actions that it expects Monitor and other ALBs to take on an ongoing basis. These are to:
 - a) Ensure an overall system of QA is in place within the organisation, with a view to providing assurance to the Accounting Officer that the Macpherson recommendations have been addressed.
 - b) Engage with and respond to requests and processes by AMOC and DH's Audit and Risk Committee.
 - c) Maintain a continuous review to identify new business critical models and to decommission any that are no longer used.
 - d) Liaise with AMOC on emerging areas of risk in Monitor's QA mechanisms.
5. A number of requests from AMOC and DH's Audit and Risk Committee have been responded to over the past year. This has included identifying the business critical models used within Monitor and completing templates to describe the QA processes for each model. The templates were reviewed by AMOC in March 2014 and feedback was given to each model owner. In August 2014, Monitor engaged with DH on the first regular review to confirm its business critical models and to provide updates on the queries raised in March 2014. The next review is expected around February 2015.
6. To date, the team has identified three business critical models in use within Monitor. These are the Long Term Financial Model, the Tariff Calculation Model and the Impact Assessment (IA) Model. Annex B contains information on each model, as published in last year's Annual Governance Statement, and explains why they are considered business critical. The team is in the process of updating this information for 2014/15.
7. The table below shows an assessment of Monitor's position against each of the eight Macpherson recommendations. These recommendations are being met relating to specific models, but the assessment is that further work is now needed to ensure Monitor meets the recommendations relating to organisation-wide engagement and frameworks on an ongoing basis. This is discussed further in the next section.

Macpherson recommendations	LTFM	Tariff model	IA model	Rationale
Recommendation 1: All business critical models in government should have appropriate QA of their inputs, methodology and outputs in the context of the risks their use represents.	✓	✓	✓	Feedback received from DH's review in April 2014 indicates that the QA processes Monitor has in place for each of these models are very thorough.
Recommendation 2: All business critical models in government should be managed within a framework that ensures appropriately specialist staff are responsible for developing and using the models as well as quality assurance.	✓	✓	✓	Feedback received from DH's review in April 2014 indicates that the framework in place for managing each of these models, including the roles and responsibilities of staff, is robust.
Recommendation 3: There should be a single Senior Responsible Owner (SRO) for each model through its lifecycle, and clarity from the outset on how QA is to be managed. Key submissions using results from the model should summarise the QA that has been undertaken, including the extent of expert scrutiny and challenge.	✓	✓	✓	There is a single SRO for each of these models. - LTFM: Martin Smith. - Tariff model: Ulrich Kaltenbronn. - IA model: Zephian Trent.

Macpherson recommendations	LTFM	Tariff model	IA model	Rationale
Recommendation 4: The Accounting Officer's governance statement within the annual report should include confirmation that an appropriate QA framework is in place and is used for all business critical models. As part of this process, and to provide effective risk management, the Accounting Officer may wish to confirm that there is an up-to-date list of business critical models and that this is publicly available.		Partially met		Monitor's Annual Report and Accounts 2013/14 contained a list of our business critical models and described the QA processes in place for each one. However, we do not currently have a framework in place for refreshing the list of business critical models beyond the yearly process feeding into the annual report.
Recommendation 5: All departments and their Arm's Length Bodies should have in place, by the end of June 2013, a plan for how they will create the right environment for QA, including how they will address the issues of culture, capacity and capability, and control.		Partially met		We have engaged with the DH's programme of work to ensure that it and its ALBs have the right environment and frameworks in place. However, Monitor does not currently have an agreed internal plan for how we will create the right environment for QA.
Recommendation 6: All departments and their Arm's Length Bodies should have in place, by the end of June 2013, a plan for how they will ensure they have effective processes – including guidance and model documentation – to underpin appropriate QA across their organisation.		Partially met		We have engaged with the DH's programme of work to ensure that each organisation has effective processes to underpin QA. However Monitor does not currently have an agreed plan for how we will ensure effective processes to underpin QA internally.
Recommendation 7: To support the implementation of these recommendations, the review recommends the establishment of an expert departmental working group to continue to share best practice experience and to help embed this across government.		✓		DH has established an Analytical Modelling Oversight Committee to embed the Macpherson recommendations and share best practice experience within itself and its ALBs.
Recommendation 8: Organisations' progress against these recommendations should be assessed 12 months after this review is published. HMT will organise the assessment, possibly with support from another department.		✓		DH conducted an assessment of all business critical models used within the department and its ALBs in April 2014. This included completing a structured assessment template for each model. AMOC reviewed each template and gave feedback to each model owner.

Ongoing work against the Macpherson recommendations

8. In line with the Macpherson recommendations, model owners are accountable for implementing appropriate QA procedures for their analytical models. In addition, work is required to ensure Monitor has an appropriate framework in place for reviewing and reporting on the models within the organisation. This would involve acting as a point of contact for AMOC and liaising with directorates to identify new business critical models and decommission old ones.
9. Guidance from AMOC suggests that each organisation should think about the process that works best for itself to ensure that all business critical models are identified. Monitor's Economics team has met with the Chief Information Officer, the Risk and Performance Director and the Board Secretary to discuss options for this work. It has identified the following improvements to Monitor's processes:
 - a) *Identifying and monitoring Monitor's business critical models (recommendation 4):* To ensure a streamlined process, well aligned to Monitor's normal business cycle and embedded in its risk and performance conversations, the Risk and Performance team will coordinate the Macpherson process within Monitor as part of its regular liaison with directorates. The Macpherson process will be incorporated into the quarterly performance and risk reporting process. This would help to identify gaps and

overlaps between the risks facing the organisation. Moreover, some of the processes and frameworks in place for Monitor's business critical models are likely to form mitigations or controls on several of the risks within its corporate risk register.

- b) *Assessing models and advising on QA processes (recommendations 5 and 6):* The role of the Risk and Performance team will be to ensure that directorates are aware of the Macpherson requirements and to identify new models as they arise. In relation to the peer review of specific models, the Risk and Performance team will be able to call on an existing group of analysts from across Monitor. At present this is called the modelling and statistical tools working group³. This group has the capacity to assess and advise on the QA procedures for analytical models and can interact directly with model owners as required. It can also act as an additional advisory group to help identify models. To date the group has been relatively informal but the Economics and KIM teams are working to establish a Chair and terms of reference for the group. Part of the group's remit will be to advise on best practice QA in line with the Macpherson recommendations⁴. Further, the Risk and Performance Team will liaise with the Chair of this group as part of the quarterly reporting process to identify risk and assurance issues relating to the business critical models,
10. On top of this, AMOC will continue to assess Monitor's business critical models via its regular review and will provide feedback and advice where needed. AMOC has requested that Monitor continues to notify it of any new business critical models as they arise.

Recommendation

11. It is considered that this two-stage framework, with identification and reporting of models undertaken by the Risk and Performance team, supported by advice on specific models from the modelling and statistical tools working group and AMOC, will ensure that Monitor becomes fully compliant with recommendations 4, 5 and 6 of the Macpherson review. The Audit and Risk Committee is asked to note the proposed approach.

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³ This group currently contains eleven analysts from the following teams: Provider Regulation, Monitoring, Pricing, Economics, CCD and KIM.

⁴ It will also be important to establish clear and consistent standards and approaches across Monitor to reduce risk. These can be agreed and coordinated through the working group and supported through technical tools and best practice approaches managed by KIM.

Public Sector Equality Duty:

Monitor has a duty under the Equality Act 2010 to have due regard to the need to eliminate unlawful discrimination, advance equality of opportunity and foster good relations between people from different groups. The Act protects against discrimination on grounds of age, disability, gender reassignment, marriage and civil partnership, pregnancy and maternity, race, religion and belief, gender and sexual orientation. We have thought about how the issues dealt with in this paper might affect protected groups.

We believe the paper will not have any adverse impact upon these groups and that Monitor has fulfilled its duty under the Act.

Exempt information:

None of this report is exempt from publication under the Freedom of Information Act 2000.

Annex A: DH's working definition of business critical models

What is a model (technical definition)? The real world is complicated, nuanced and difficult to predict. We use models as a way of simplifying the real world so that we can consider issues and make decisions.

The usual formulation of a model works like this:

- We start from a real world problem (for example "how much will people spend in my shop?").
- We translate this into a set of simplifying assumptions or principles ("Picture my customers as little stick men queuing up down the road. Suppose they arrive at fixed regular intervals and that their spending follows a normal distribution").
- Within this simplified version of the world, called a model, it is a lot easier to make calculations, to make mathematical manipulations and to reach conclusions. ("the net profit in my model starts high but gradually falls to zero").
- Finally we translate our conclusion back into the real world ("IF my assumptions are right, my shop is at risk of making losses after a while.").

What is a model (practical definition)? A model is a simplified view of the world. It can be a set of calculations or formulas in one spreadsheet, but it could also be a cluster or set of spreadsheets or even a set of calculations on paper. It is any block of structured analytical thinking based on an underlying set of assumptions or prejudices, used to give us a simplified view of the real world, and used to inform a business decision. A model does not even need to be numerical in nature (for example, cause and effect diagrams don't rely on numbers at all, but are a representation of the real world). For practical reasons, we do not apply this definition to simple sets of addition and subtraction, or to models that are not complete.

What is business critical? It will be for Senior Responsible Officers to consider whether their model is business critical, taking advice from appropriate analytical colleagues as required. The following is a set of general principles, adopted from cross-Government guidance to apply in a health context:

- a. Impact on patients, public and service users - If the outputs from your model were wrong, what potential impact would this have on patients or members of the public? Is there a substantive risk of dissatisfaction, or harm, or poor outcomes, prolonged illness or death?
- b. Large Economic or Financial stakes - Regardless of the degree of uncertainty, is the model allocating or handling very large sums of money? There is no absolute threshold for this, but consider items that are likely to be of interest to the Departmental Board in DH (typically, £10Ms or £100Ms as a minimum).
- c. Economic or financial impact of error - would errors in your model be likely to carry a risk of high (additional) costs to the Department or the NHS? again, consider whether there are any risks that are large enough to be of concern to the Departmental Board.

- d. Reputational impact - beyond the financial implications, are decisions likely to carry reputational risk for Department or Ministers? For example is there a risk of "major impact leading to sustained scrutiny which would significantly impede the effective development, implementation or operation of government policies"?
- e. Legal impact - will decisions arising from the model carry any risk of repercussions arising from legal precedents or legal challenge? Will any of the decisions arising from this model run the risk of being subject to judicial review?
- f. Future effects - Think beyond the current immediate use of the model: Is the model expected to be re-used frequently to support future decision-making (frequently, occasionally, once, never).

In brief, if your model carries a high degree of risk on one or more of these areas, it might be appropriate to record it as business critical.

Annex B: Monitor's business critical models

There are three business critical models currently in use within Monitor. These are the Long Term Financial Model, the Tariff Calculation Model and the Impact Assessment Model. These models, and the QA processes in place for each one, are described below. This information was published in last year's annual governance statement. We are in the process of updating it for 2014/15.

1. Long Term Financial Model

The Long Term Financial Model (LTFM) is used by Monitor's Provider Appraisal directorate to understand the financial history, current position, and financial forecasts of foundation trust applicants. It is the tool Monitor uses to stress-test the applicant trusts' forward assumptions to assess whether the applicants are financially viable (a key criterion of authorisation); we also consider whether they are well governed and legally constituted. The model is business critical because a key government priority is the authorisation of all NHS trusts as foundation trusts. The LTFM is a key tool in assessing the financial viability of the applicant trusts.

QA processes in place

The LTFM was developed internally by a modelling expert and has been externally audited by modelling experts on a number of occasions as it has been further developed over the years.

Where minor simple fixes are required to the LTFM in-year the issue would be considered and addressed by one member of Monitor's model team and reviewed by another member before release. Where major reworks to the balance sheet calculation engine are required (such as for the introduction of International Financial Reporting Standards) we have commissioned a modelling expert from an independent accounting firm to undertake these changes, which are checked by the firm, Monitor's model team, and through piloting with applicant trusts.

Annual updates or larger changes (which require major rework of the balance sheet) to the LTFM are undertaken by members of Monitor's model team and the changes required are written up by one person (on a cell-by-cell or line-by-line basis), input by a second person, and tested by a third person. It will not be released until a senior manager and director have reviewed the changes.

The LTFM has been extensively tested. Versions of the LTFM have been used more than 200 times and the inputs and outputs scrutinised by internal and external experts.

2. Monitor Tariff Model

The Monitor Tariff Model will be used to calculate the prices and related data points Monitor sets in its national tariff document. The model is business critical because its outputs are used in the calculation of what a provider of NHS services gets paid for performing these services. It covers approximately £29 billion of expenditure.

QA processes in place

The model is based on the Payment by Results model that was produced by the Department of Health until 2013/14. All changes to this model go through a documented model change process.

The model change process requires the tariff calculation team to explain and evidence the reasons for any model change and any resulting coding changes are checked by an independent member of Monitor's Information Systems team. Furthermore, Monitor is planning to procure an external audit of the Model before publishing its outputs.

3. Impact Assessment Model

The Impact Assessment Model is primarily used to assess the expected impact of proposed changes to national prices in the National Tariff Payment system. It is used to calculate the effect on income and expenditure for providers and commissioners as a result of changes to national prices or pricing rules. The key outputs of the model set out the expected financial position of providers and commissioners, including various charts, metrics, and tables, which are included in the published national tariff impact assessment.

The model is business critical because Monitor has a statutory duty to perform impact assessment for changes to prices and pricing rules in the national tariff. This model is our principal tool for evaluating those proposals; it is used during policy development and forms an important part of our formal impact assessment of changes to prices or pricing rules in the national tariff. The policies in the national tariff govern the majority of expenditure by CCGs. In the event of a referral to the competition commission or judicial review of the national tariff this model may be reviewed by third parties. The integrity of the model is also important to our credibility and reputation as an evidenced based regulator.

QA processes in place

This documents the QA process for Version 2.0 of the Impact Assessment Model, which was used for Monitor and NHS England's proposals for the payment system in 2014/15. We are currently introducing a number of updates to the Impact Assessment Model and plan to review our QA processes for the next version, which will be used to assess our joint proposals for the payment system in 2015/16.

Version 2.0 was built in structured query language by specialist developers who were managed by business users from the pricing team under a defined project mandate. The model was subject to peer review with specific outputs reconciled against published financial statements to validate the financial data used in the model. A written audit report was produced for the model based on the tests conducted. The output of the model was shared with NHS England and the final outputs were published as part of our internal audit report. The outputs are consistent with our expectations and vary depending on changes in input variables as we expected. The model is reviewed annually to assess whether it is fit for purpose.