

Hywel Dda University Health Board

Digital Modelling (EDAPT)

Final Internal Audit Report

April 2021

Private and Confidential

NHS Wales Shared Services Partnership

Audit and Assurance Services



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Management Action Plan
Assurance Opinion and Action Plan Risk Rating

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1. Introduction and Background

In line with the revised 2020/21 Internal Audit Plan for Hywel Dda University Health Board (the Health Board) a review of the local management of the data modelling toolkit developed by the Health Board during the COVID-19 Pandemic to support forecasting and decision making was undertaken.

NHS Wales organisations such as Hywel Dda University Health Board have had to work quickly, and flexibly under extraordinary pressure to meet the needs of its workforce and the public during the pandemic.

As one of many initiatives undertaken by the Health Board, a modelling toolkit for prediction of demand and capacity was developed. This toolkit, known as the "Empirical Demand and Planning Toolkit" which draws on similar nationally distributed models, further refining them to allow for other variables specific to the Hywel Dda Health Board area such as rurality etc.

The relevant lead for the assignment is the Director of Finance.

2. Scope and Objectives

The objective of the audit was to confirm the modelling toolkit developed is consistent with the real-world position and produces reliable forecasting information in order to allow stakeholders to rely on the model's results with confidence.

The areas reviewed during the audit were:

- **Development** – the development of the toolkit ensured appropriate models were used and appropriate adjustments made, with the key problem(s) clarified and testing undertaken;
- **Processing** – inputs to the toolkit are complete and only used once, the logic behind the processing is understood, and appropriate data validation is undertaken;
- **Outputs** - Users understand the output and its basis, the output matches real world situations and users can adjust parameters to fit needs; and
- **Security** - Security is maintained over the data used within the toolkit.

3. Associated Risks

The potential risk considered in the review are as follows:

- Poor oversight and governance in relation to modelling tool developed under COVID-19.
- The solution deployed to model COVID-19 demand does not deliver the anticipated benefits.

- Users make decisions based on information from the toolkit which is unreliable or poorly understood.


OPINION AND KEY FINDINGS

4. Overall Assurance Opinion

We are required to provide an opinion as to the adequacy and effectiveness of the system of internal control under review. The opinion is based on the work performed as set out in the scope and objectives within this report. An overall assurance rating is provided describing the effectiveness of the system of internal control in place to manage the identified risks associated with the objectives covered in this review.

The overall level of assurance that can be assigned to a review is dependent on the severity of the findings as applied against the specific review objectives and should therefore be considered in that context.

The level of assurance given as to the effectiveness of the system of internal control in place to manage the risks associated with the data modelling toolkit is **Substantial Assurance**.





RATING	INDICATOR	DEFINITION
Substantial Assurance		The Board can take substantial assurance that arrangements to secure governance, risk management and internal control, within those areas under review, are suitably designed and applied effectively. Few matters require attention and are compliance or advisory in nature with low impact on residual risk exposure.

Overall the controls in place to manage the risks associated with toolkit tested within this review are of a substantial standard. The development of the toolkit ensured appropriate models were used and appropriate adjustments made, with the key problems clarified and testing undertaken. Controls for input and output of the toolkit have been incorporated in its design and security is maintained over the data used within the toolkit.

No high priority findings were identified by our review, noting only one medium and three low priority weaknesses which present some opportunities to enhance effectiveness of controls. These weaknesses related to clarification of Intellectual property, knowledge sharing and fine tuning of the toolkit's dashboards.

5. Assurance Summary

The summary of assurance given against the individual objectives is described in the table below:

Audit Risk		Assurance Summary*			
					
1	Development – the development of the toolkit ensured appropriate models were used and appropriate adjustments made, with the key problem(s) clarified and testing undertaken				✓
2	Processing – inputs to the toolkit are complete and only used once, the logic behind the processing is understood, and appropriate data validation is undertaken				✓
3	Outputs - Users understand the output and its basis, the output matches real world situations and users can adjust parameters to fit needs				✓
4	Security - Security is maintained over the data used within the toolkit				✓

* The above ratings are not necessarily given equal weighting when generating the audit opinion.

Design of Systems/Controls

The findings from the review have highlighted **one** issue that is classified as a weakness in the system control/design for the Digital Modelling Tool. This issue is identified in the Management Action Plan as (D).

Operation of System/Controls

The findings from the review have highlighted **three** issue that is classified as a weakness in the operation of the designed system/control for the Digital Modelling Tool. These are identified in the Management Action Plan as (O).

6. Summary of Audit Findings

In this section, we highlight areas of good practice that we identified during our review. We also summarise the findings made during our audit fieldwork. The detailed findings are reported in the Management Action Plan (Appendix A).

OBJECTIVE 1: Development – the development of the toolkit ensured appropriate models were used and appropriate adjustments made, with the key problem(s) clarified and testing undertaken

We note the following areas of good practice:

- The Empirical Demand & Activity Planning Toolkit (EDAPT) was developed by staff at the Health Board. EDAPT was further developed for use in forecasting and modelling COVID-19 demand. To do this EDAPT uses a combination of approaches to model parts of a system and combine them in a simulated wrapper, which is a vehicle for evaluating, improving and deploying suitable models;
- The EDAPT toolkit development ensured appropriate models were used by utilising existing concepts and models for forecasting demand in health care and epidemiology. The Health Board also sought advice/feedback/assurance from national groups such as Technical Advisory Cell (TAC), Technical Advisory Group (TAG) and the All Wales National Modelling Forum;
- The system is segregated with demand and activity handled differently so the changes to the code don't affect each other;
- Assumptions incorporated into the model's development were communicated to senior management within the Health Board who must also confirm and approve future adjustments, these are also communicated to Welsh government;
- Documentation produced for the early development included a functional development specification document, within this the objectives of the development were set, risks likely to affect the success of the development were identified and critical assumptions made during the specification phase recorded;
- The team has produced a document to provide a summary of the assumptions and data sources used by the Suspected, Exposed, Infected, Removed/Recovered (SEIR) models;
- Validation of the development was carried out by comparing outputs to real world data; and

- In June 2020 the Health Analytics Team set out to put together a Validation Framework to ensure the ongoing accuracy of future iterations of the modelling tool.

We note the following finding in relation to this objective:

- The arrangements for intellectual property for the model and the code which sits underneath has not been confirmed or communicated through the course of the development.

See Finding 1 at Appendix A.

OBJECTIVE 2: Processing – inputs to the toolkit are complete and only used once, the logic behind the processing is understood, and appropriate data validation is undertaken.

We note the following areas of good practice:

- Manual data input has been kept to a minimum reducing the potential for human error;
- To aid understanding of the logic behind the processing, comprehensive documentation has been produced to accompany the development, these describe the code and equations behind the tool. Additionally, the code has been written to include descriptions and annotations;
- Datasets used by the model are supplied and validated by the informatics department, therefore these have been produced in line with the Health Boards framework for Information Quality Assurance (IQA);
- The tool uses parameters as opposed to SQL code this means the parameters are predefined and used elsewhere within the organisation these link to views on the reporting server;
- Output reports and screens are only used by a select number of experienced staff therefore erroneous information can be easily identified from the output; and
- Spot checks are carried out to see if outputs remain within margins set by Welsh Government.

We note the following findings in relation to this objective:

- Initially there was a concentration of expertise in one member of staff, there have been efforts to share this knowledge and there has been

some time for protected learning within the team but there has been slippage in this with the demands placed on the staff members.

- The dashboard of the tool output screen includes a drop down that can be used to add a lag onto the displayed totals. There was an option for 1,2 or 4 days. However, this should be removed. Also, there is no description on the tool explaining what the different options would mean for the information displayed.

See Finding 2 and 3 at Appendix A.

OBJECTIVE 3: Outputs - Users understand the output and its basis, the output matches real world situations and users can adjust parameters to fit needs

We note the following areas of good practice:

- Output reports and screens are only accessed by a select number of users who have a great deal of insight and understanding of the information being presented;
- Before the outputs from the tool are communicated to wider audience they are analysed, and a narrative is produced to accompany the information represented in the forecast charts;
- The information produced by the modelling tool has been validated using a combination of peer review, matching to historical figures and ward counts;
- Adjustment to parameters is possible but would have to be considered acceptable by national groups and also approved by Health Board senior management before they are built into the tool; and
- Changes to parameters would be recorded as assumptions within the documentation for the tool. Some examples on future changes will be an option to include re-infection rates, future firebreaks and adjuster "r" rates for vaccinated population percentages. So, while changes to parameters to fit needs is possible the process is controlled and requires prior authorisation and any changes are documented.

No findings were noted under this objective heading.

OBJECTIVE 4: Security - Security is maintained over the data used within the toolkit

We note the following areas of good practice:

- Security is maintained over the data used within the toolkit through using anonymised datasets. These datasets in the form of SQL database

views are updated automatically and read only so cannot be corrupted by the modelling tool;

- Data is stored on a server so is covered by the Health Board continuity and backup policies; and
- The information input to the tool is for the most part anonymised, so are any outputs.

We note the following finding in relation to this objective:

- While the use of the tool was approved by senior management at the Health board, the demands on services during the pandemic and the requirement to deliver at pace meant it wasn't possible to receive advice from the Information Governance Team on the modelling tool. Under normal circumstances this would have been in the form of a Data Protection Impact Assessment (DPIA) and to establish if there is a requirement under the General Data Protection Regulation (GDPR) for the modelling tool to appear as an information asset on the Health Board information asset register.

See Finding 4 at Appendix A.

7. Summary of Recommendations

The audit findings and recommendations are detailed in Appendix A together with the management action plan and implementation timetable.

A summary of these recommendations by priority is outlined below.

Priority	H	M	L	Total
Number of recommendations	0	1	3	4

<p>Finding 1 – Intellectual property (D)</p>	<p>Risk</p>
<p>The arrangements for intellectual property for the model and the code which sits underneath has not been confirmed or communicated through the course of the development.</p>	<p>Poor oversight and governance in relation to modelling tool developed under COVID-19.</p>
<p>Recommendation 1</p>	<p>Priority level</p>
<p>Ownership of the modelling tool and its code should be established and communicated to stakeholders.</p>	<p>Low</p>
<p>Management Response</p>	<p>Responsible Officer/ Deadline</p>
<p>Agree – Further investigations will be undertaken to establish how to commence the assignment of intellectual property of the model to Hywel Dda Health Board.</p>	<p>Responsible Officer – Assistant Director of Digital Services Timeframe – July 2021</p>


<p>Finding 2 – Knowledge sharing (O)</p>	<p>Risk</p>
<p>Initially there was a concentration of expertise in one member of staff, there have been efforts to share this knowledge and there has been some time for protected learning within the team but there has been slippage in this with the demands placed on the staff members.</p>	<p>Poor oversight and governance in relation to modelling tool developed under COVID-19.</p>
<p>Recommendation 2</p>	<p>Priority level</p>
<p>The organisation should consider options to share the knowledge necessary for the upkeep of the tool, they should ensure that staff have time to share expertise with colleagues and consider developing a knowledge repository such as GitHub to document any future changes (GitHub is a code hosting platform for collaboration and version control of software developments).</p>	<p>Medium</p>
<p>Management Response</p>	<p>Management Response</p>
<p>Agree – the storage of programme / SQL code is an area which needs further discussion. A number of wiki sites have been created with the use of Microsoft 365, however this does not provide version control. The Digital Team will examine GitHub to ascertain whether it is suitable for the on-going development of programme coding.</p>	<p>Responsible Officer – Assistant Director of Digital Services Timeframe – September 2021</p>


Finding 3 – Output displays (O)	Risk
<p>The dashboard of the tool output screen includes a drop down that can be used to add a lag onto the displayed totals. There was an option for 1,2 or 4 days. However, this should be removed. Also, there is no description on the tool explaining what the different options would mean for the information displayed.</p> <p>While the display of the dashboard shows different models and outdated models are removed there is no default, this should be set. Also, there is no description on the tool explaining what the different options would mean for the information displayed.</p>	<p>Users make decisions based on information from the toolkit which is unreliable or poorly understood.</p>
Recommendation 3	Priority level
<p>The above changes should be agreed with management and actioned to remove any potential confusion or ambiguity on the dashboards.</p>	<p>Low</p>
Management Response	Responsible Officer/ Deadline
<p>Agree – plans are advanced in making the changes noted above.</p>	<p>Responsible Officer – Assistant Director of Digital Services</p> <p>Timeframe – June 2021</p>


Finding 4 – Information Governance Team input (O)	Risk
<p>While the use of the tool was approved by senior management at the Health board, the demands on services during the pandemic and the requirement to deliver at pace meant it wasn't possible to receive advice from the Information Governance Team on the modelling tool. Under normal circumstances this would have been in the form of a Data Protection Impact Assessment (DPIA) and to establish if there is a requirement under the General Data Protection Regulation (GDPR) for the modelling tool to appear as an information asset on the Health Board information asset register.</p>	<p>Poor oversight and governance in relation to modelling tool developed under COVID-19.</p>
Recommendation 4	Priority level
<p>As business as usual returns, for added assurance the Health Analytics Team should request assistance from the Information Governance Team to perform a retrospective Data Protection Impact Assessment (DPIA).</p> <p>Consideration should also be given to establish if there is a requirement under the General Data Protection Regulation (GDPR) for the modelling tool to appear as an information asset on the health boards information asset register and an appropriate owner and administrator assigned.</p>	<p>Low</p>
Management Response	Responsible Officer/ Deadline
<p>Agree – The Health Analytics Team will work with the Information Governance Team to undertake a retrospective Data Protection Impact Assessment (DPIA) to be presented to the Information Governance Sub-Committee (IGSC).</p>	<p>Responsible Officer – Assistant Director of Digital Services</p> <p>Timeframe – August 2021</p>


Appendix B - Assurance opinion and action plan risk rating

2020/21 Audit Assurance Ratings

 **Substantial Assurance** - The Board can take **substantial assurance** that arrangements to secure governance, risk management and internal control, within those areas under review, are suitably designed and applied effectively. Few matters require attention and are compliance or advisory in nature with **low impact on residual risk** exposure.

 **Reasonable Assurance** - The Board can take **reasonable assurance** that arrangements to secure governance, risk management and internal control, within those areas under review, are suitably designed and applied effectively. Some matters require management attention in control design or compliance with **low to moderate impact on residual risk** exposure until resolved.

 **Limited Assurance** - The Board can take **limited assurance** that arrangements to secure governance, risk management and internal control, within those areas under review, are suitably designed and applied effectively. More significant matters require management attention with **moderate impact on residual risk** exposure until resolved.

 **No Assurance** - The Board has **no assurance** arrangements in place to secure governance, risk management and internal control, within those areas under review, which are suitably designed and applied effectively. Action is required to address the whole control framework in this area with **high impact on residual risk** exposure until resolved.

Prioritisation of Recommendations

In order to assist management in using our reports, we categorise our recommendations according to their level of priority as follows.

Priority Level	Explanation	Management action
High	Poor key control design OR widespread non-compliance with key controls. PLUS Significant risk to achievement of a system objective OR evidence present of material loss, error or misstatement.	Immediate*
Medium	Minor weakness in control design OR limited non-compliance with established controls. PLUS Some risk to achievement of a system objective.	Within One Month*
Low	Potential to enhance system design to improve efficiency or effectiveness of controls. These are generally issues of good practice for management consideration.	Within Three Months*

* Unless a more appropriate timescale is identified/agreed at the assignment.



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