**Module 2B of the UK Covid-19 Public Inquiry**
**Request for Evidence under Rule 9 of the Inquiry Rules 2006**
**Reference for Request - M2B/AN/01**

# SUBMISSION TO THE COVID ENQUIRY BY ANDREW NELSON
# CHIEF INFORMATION OFFICER, CWM TAF MORGANNWG LOCAL HEALTH BOARD

**1) Please provide a brief overview of your qualifications, career history, professional expertise and major publications**

## GRADUATE LEVEL QUALIFICATIONS

- MSc Operational Research and Applied Statistics with Distinction, Cardiff University, 2013
- MSc Health Service Management with Distinction, Cardiff University, 2008
- BSc (Hons) Economics with Actuarial Studies, University of Southampton, 1998

## OTHER TRAINING

- 5 day NIST Practitioner course in Cyber Security
- Data Protection and GDPR refresher training – undertaken annually

## EMPLOYMENT HISTORY

**Chief Information Officer, Cwm Taf Morgannwg University Health Board,**
**September 2020 to present.**

I am answering this Request however in the capacity in which it has been sent to me, that is focussing on the Welsh Government response to the pandemic, rather than on the Health Board or NHS Wales response.

I am accountable for the delivery of operational informatics, performance reporting and coding services and the strategic development and delivery of the digital strategy of the Health Board (HB). The role incorporates accountability for the transformational programme and the digital elements of the HB's Covid-19 recovery programmes and wider objectives set out in the organisation's Integrated Medium Term Plan.

Functionally the role includes seeking opportunities for value generation through wider collaboration across Wales and management responsibility for cyber security, software development and deployment, service management, infrastructure, business intelligence, digital engagement and communication, performance and data management, analysis, improvement of digital and data literacy and practices, the professional standards of digital practitioners and the clinical coding and data quality functions.

**I am presently the Data Protection Officer for the organisation, ensuring that the organisation acts lawfully.**

Responsible for responding to the huge change in societal, organisational and governmental behaviours as the UK worked through and recovers from the Covid-19 pandemic.

As a practising Informatician with expertise in modelling and statistics I was responsible for leading the organisation's intelligence on Covid and remain **a member of the Welsh Government's policy modelling cell.** I undertake the majority of the organisation's stochastic modelling and forecasting, and major quantitative planning requirements, most recently on the successful development of the business case for a new £100m regional elective treatment and diagnostic centre.

In addition, **I chair the all Wales National Data Resource technical steering group, am a member of the Welsh Technical Standards Board and the Information Governance Management Advisory Groups. I have recently been part of the national steering group, which has supported the shaping of the NHS Wales Data strategy, owned by the NDR programme.**

I act as an advisor on Informatics matters to numerous national groups including the strategic programme for primary care, the Unscheduled Care Collaborative, the Value Based Healthcare team, the Planned Care recovery team and the National Data Resource team.

**Associate Director for Quantitative Planning, Cwm Taf Morgannwg University Health Board, September 2019 to September 2020**
Accountable for leading and developing the organisation's internal planning process to determine the configuration of acute hospital services across the CTM area with a primary focus on Emergency Medicine, Critical Care and Paediatrics. This work which culminated in the programme finally being agreed by the UHB's board seven years after the plans were first raised.

**With the onset of Covid I was directly responsible to the Chief Executive in providing the intelligence from a numerical perspective in preparing for and managing the pandemic.** This included initial adoption of the UK model and using it to support all services and other Health Boards to put in plans to cope with the anticipated consequences and progressed to providing alternative models and scenario assessments of policy interventions based on observed activity which informed local and national decisions.

In this role **I was a permanent member of the WG policy modelling cell**, developing, validating and advising on the anticipated impact of Covid and its response to alternative management strategies.

**Assistant Director for Performance and Information, Cardiff and Vale University Health Board, August 2013 to September 2019**

Accountable for the strategic development and delivery of the Digital Strategy of the Health Board and for the leadership and management (including professional, procurement and financial) of the clinical coding, data warehousing, information governance, business intelligence, analytics, data quality performance reporting, management and elements of the improvement functions of the UHB, which extended in the last 12 months into most aspects of ICT as I covered for sickness absence.

**Assistant Chief Operating Officer, Cardiff and Vale University Health Board, August 2012 – August 2013**
Responsible for the successful system wide delivery of all operational services in Cardiff and Vale, with a total expenditure budget in excess of £700m.

**Information and Quantitative Planning Lead for the South Wales Programme, December 2012 to August 2013 and November 2011 to March 2012**
Member of the South Wales Programme team responsible for considering the reconfiguration of obstetric, neonatal, emergency medicine and paediatric services across five Health Boards and the Welsh Ambulance Service. Responsibility for providing analysis and information to support the

development of feasible service models and the assessment of the six options for hospital reconfiguration.

**Assistant Director, Acute Hospital Services, Cardiff and Vale University Health Board, January 2010 to August 2012**
This post had very similar responsibilities to my subsequent Assistant Chief Operating Officer post but for only four of the eight operational divisions. In this role I was part of the UHB's financial turnaround team for four months, which with PWC consulting, sufficiently reduced the overall financial deficit faced by the UHB to that which had been agreed by the Welsh Government.

**Performance Improvement Manager, Delivery and Support Unit, April 2007 to January 2010**
Accountable for delivering performance improvement in NHS Wales' organisations that were failing to deliver targets (service and financial) within the Annual Operating Framework (AOF). I undertook 21 'programmes of support', working in every Health Board and successfully delivering a a maximum 26 week total waiting time in all cardiac services.

**Assistant General Manager, Medicine & Regional Services, Cardiff and Vale NHS Trust, Feb 2004 to Mar 2007**
Principally responsible for planning and continuous performance improvement within the Medicine & Regional Services Group, providing operational leadership in delivery of the AOF targets, bed management, pathway improvement, modelling and quantitative analysis.

**A number of Directorate Manager roles following being on the National General Management Training Scheme Sept 1999 to March 2001**

**MAIN PUBLICATIONS AND AWARDS**
-"Determining patient outcomes from patient letters: A comparison of text analysis approaches", Morgan, J. Harper P., Knight V, Artemious A, Carney, A and Nelson A , *Journal of the Operational Research Society. 2018*
-*"Simulating bed capacity: evaluating the impact of healthcare service transfers",* R. Bares, J. Griffiths, V. Knight, J. Williams, K. Baboolal, and A. Nelson, Modelling and Simulation (UKSim), 2012 14th International Conference on, Cambridge, United Kingdom, pp.358-362, March 28 2012-March 30 2012,
- *"How efficient could an Emergency Unit be? A Perfect World Model";* Kesh Baboolal[1], Jeff D Griffiths[2], Vincent A Knight[2], Andrew V Nelson[1], Cheryl Voake[2], Janet E Williams[2] –Emergency Medicine Journal, December 2011
- *Development of Primary Target Measures in Outpatients*; Carlsen C, Cochrane J, Nelson A, - Abstract accepted by Innovations in Care Conference November 2003 and published *in "A Guide to Good Practice: Outpatients, Diagnostics, Therapies and Elective Surgery"*; Welsh Assembly Government, 2003, p. 37
- Health and Care Research Wales Funding Award - Prudent elective surgery scheduling: A whole systems approach, £223,566, 5/1/2016-31/12/2017
- Times Higher Education Awards 2015 Winner - Outstanding Contribution to Innovation and Technology – "Maths Saves Lives" – Part of the Cardiff University team recognised, being co-author of seminal paper and part of improvement delivery team

**PROFESSIONAL MEMBERSHIPS**
Membership of the Operational Research Society and the Association of Professional Healthcare Analysts.

**2) A list of the groups (i.e. TAG and/or any of its subgroups) in which you have been a participant, and the relevant time periods. Please also confirm if you are or have been a participant in SAGE or other relevant groups in the relevant time periods.**

I was a member of the national modelling forum from 30/3/20. This was a group of WG and NHS modelers and clinicians providing advice and interpretation to the SAGE models in Wales.

On 29 April 2020, I became a member of the Modelling, Task and Finish Group chaired by Dr Brendan Collins, Head of Health Economics in WG, which later morphed into the TAC Policy Modelling Sub Group.

I reduced my contribution as a member of the group from February 2022 as Wales moved into the post pandemic recovery phase.

I have not been a participant in SAGE or other relevant groups in the relevant time periods.

**3) An overview of your involvement with those groups between January 2020 and May 2022, including:**
   **a) When and how you came to be a participant;**
   **b) The number of meetings you attended, and your contributions to those meetings; and**

My involvement predominantly came from me having a leadership role in the NHS analytics community in Wales, both as a CIO and as a practicing analyst.

On receipt of the initial Imperial College models, I developed analytical tools that enabled hospitals and Health Boards to infer the resource requirements (as listed in answer to 3c below) that would be needed based on the forecasts for hospital and critical care admissions and I shared these across all NHS Wales organisations. Accompanying this I set up a communication network for organisations across Wales to share findings and provide mutual support.

Dr Brendan Collins approached me on the 30 March 2020 to ask if we could share materials and learning which led to me joining his Task and Finish group on that date. Following additional work, I then undertook using the decline in covid admissions to estimate R(t) and produce forecasts for Wales and locally. Brendan took a view (27/4/20) that we needed a small group of expert modelers to form to share granular level information.

Since then I attended nearly every meeting of the policy modelling sub group until March 2022.

**c. Your role in providing research, information and advice.**

My role changed over time.

Initially it was to use data available to the NHS (which was far more granular and timely than that available nationally) to:

- Provide an understanding of the resource requirements to meet the national Ferguson / Imperial models for a wide range of resources by time – including
  - Beds for Covid,
  - Clinical decision makers
  - Registered nurses

Critical Care Nurses
Auxillary Nurses
Ancillary Staff
Lab staff
Oxygen
PPE
NIV machines
Ventilator machines
Mortuary beds
Trolley
Ward beds for non Covid
Ventilated beds for no covid
Psychological support
Transport

- Advise on which scenario the various UHB's were likely following and at what stage of the epidemic curve we may be. In effect estimating the local growth rate.
- Critically appraise guidance issued by WG and advise as to how improvements could be made which reduced the error in the Reasonable Worst Case model - for this we used hospital data (admissions, critical care admissions and mortality) to calculate community prevalence rather than forecasts of community prevalence to forecast

After the first wave had peaked and guidance was issued by WG that HBs should plan on the basis of what they were experiencing as opposed to use, my role switched to

- developing stochastic and deterministic models and forecasts for both hospital resource allocation and for prevalence in the community, based on our calculation of R(t) and its continuation. In effect providing models for the expected case, as opposed to 'worst case'.
- providing quantitative advice and understanding of the data enabling parameters in other models to be tested – this included hospital acquired infections, pathway transitions (e.g. % patients who required critical care, pathway lengths of stay.
- updating the group in regards to changes in data reporting and clinical practice which would alter modelling assumptions (e.g. how CPAP was changing).
- providing surveillance reports and forecasts for the region at Lower Super Output Area level which supported the policy decision to empower Regional Partnership Boards (RPBs) to advise on the requirement for local lockdowns.
- identifying the impact of hospital acquired infections and how this was impacting in R(t) estimates.
- supporting NWIS and WG to build Business intelligence tools for wider and easier dissemination of the numerous models and assumptions being considered.

Over time input into policy changed towards:

- Testing assumptions on parameters and outputs in the model based on NHS data.
- Developing alternative models, both population based and observation based to test against Swansea University model based on alternative data sources – this incorporated in the 3rd wave estimating the impact of vaccination.
- Providing a brief input into consideration of isolation hospitals.
- Undertaking population analysis and surveillance

**4. A summary of any documents to which you contributed for the purpose of advising TAG and/or its related subgroups on the Covid-19 pandemic. Please include links to those documents where publicly available.**

- Models which identified the resources based on the Ferguson Imperial model
- Models based on the provider catchment populations of HBs as opposed to resident populations
- Models which covered the short term (next 21 days) which could be used for operational purposes based on what the UHB's were experiencing rather than SEIR models
- Document querying WG requirement (AG letter 3rd April 2020) on a constructive basis -i.e. showing flaws in calculations and reworked results
- Documents setting out our modelling assumptions (e.g. pathway transitions with length of stay in each stage)
- Documents validating assumptions e.g. Length of stay for critical care etc oxygen use per litre
- Operational planning scenarios being used by the NHS as opposed to the imperial Ferguson models (Institute for Health Metrics and Evaluation & Warwick University Pancrazi 8/4/20)
- 27/4 Updated models using changepoint detection and all Wales data to compliment UK wide papers
- Analysis showing workforce availability / sickness rates and the correlation and timing with the covid peak
- Forecasts for Community Acquired Infections and Hospital Acquired Infections admissions and resulting resource requirements (beds, critical care etc) under a range of scenarios
- Advice on early warning metrics, circuit breakers and change point detection
- Analysis of testing, infection and mortality rates by Unitary Authority in Wales
- Understanding the impact of mobile testing units on reported cases
- Population analysis of who had covid tests, got infected, was admitted to hospital and died.
- Development of the Swansea University model

**5. A summary of any articles you have written, interviews and/or evidence you have given regarding the work of the above-mentioned groups and/or the Welsh Government's response to the Covid-19 pandemic. Please include links to those documents where publicly available.**

Please refer to the document section

I produced no publications but did provide the data and some analysis for a post hoc population health insight into who was affected by covid.

**6. Your views as to whether the work of the above-mentioned groups in responding to the Covid-19 pandemic (or Wales's response more generally) succeeded in its aims.**

The primary aim was to inform policy making and the WG TAG on matters relating to the prevalence and impact of covid and of the likely effect of the various options for responding.

To this extent I would consider that the group succeeded in its aims, providing policy advice based on reasonably accurate predictions and interpretations, always in the requisite timeframes required.

The group was well co-ordinated and chaired, with information being shared bi-directionally with the Technical Advisory Group and SAGE, WG, the NHS and other stakeholders. Membership was inclusive,

with people invited to join where they were able to contribute value, and was neither too small nor too large.

All members of the group were open and had access to sensitive data. People collaborated and were encouraged to articulate alternative opinions, facts and findings. There was kindness and acceptance of the diversity of the group, both in terms of expertise and interests. However input from subject matter experts in epidemiology was limited to clinicians rather than modellers until WG commissioned Swansea University to provide a Welsh model.

The group did examine the impact on equity and indirect harm of covid in moderation, but lacked resources to get into great detail on this and as a result insufficient consideration was given to this as a matter. The same can be said for economic considerations, despite the best endeavours of the group's chairman to do so.

In terms of preparedness for future pandemics, the group exposed the significant deficits that exist in the quantitative analytics fields of epidemiology, Operational Research and Health Economics in Wales.

The ability to capture new sources of data was limited to establishing a call centre for TTP, which did not apply any data standards, and to mortality reporting. A common data set which would have provided far greater in sight and allowed for far more in depth understanding and better decision making, never got off the ground, presumably because of the very closed architecture within the digital systems that exists in NHS Wales. As a result the availability of data has not improved and we are not in a strong position to improve the modelling for any future pandemic

In the first wave of the pandemic, the absence of such a group, resulted in sub-optimal decision making, largely as a result of the decision makers having insufficient understanding within WG as to how to interpret the models in the early phase. The outcome of their mis-understanding was the requirement for NHS Wales to put in place capacity well in excess of that required to meet the reasonable worst case models. (letter from AG 3/4/20)

Where it could have been better:

There were insufficient people with modelling and analytical skills available to do the doing. With hindsight local cells of analysts collaborating on developing models , based on local data that they were observing, which could then be fitted together to produce an aggregated model, would have been far more useful than the dogmatic utilisation of the Imperial model & the central UK models. One of the main reasons for this is we found that the national model could never be an accurate tool for local resource and planning as the dynamics of Covid and the variances in observed prevalency rates in North Wales were different to those of West Wales and South East Wales.

Clinical advice was purely epidemiological, we had to use our wider network to understand changes in clinical treatment patterns, admission practices, infection control measures. This was managed and the group worked well together acquiring and disseminating information and knowledge.

There was no established process within WG for the commissioning and adoption of models. This relates both to there being no process for WG to agree or sign off 'the formal latest model of the group'. This often resulted in there being a delay in models being made available to those who relied upon them to provide a response.

Similarly there was no process for new methodologies to be considered. This resulted on many occasions in lengthy time delay between models being produced and being commented on by the group. Again with hindsight, the group should have been able to review early outputs to critique prior to sign off. But it happened the other way around, meaning that any concerns were balanced against the 'time delay incurred already' and further delaying dissemination. Additionally, the 'narrow' network of dissemination meant that some organisations who were dependent on the models for their operations received projections quickly, whilst others did not.

Models that were built up from the various regions of Wales, rather than a single Welsh model, were lacking and resulted in the advice to Ministers being based on a forecast for Wales which in being an aggregate of the North Wales, West Wales and South East Wales was prone to far greater error. As a lesson to be learnt I would propose that distinctions need to be drawn between

1) models and guidance used and made by policy decision makers when determining national population wide measures and decisions and
2) models and guidance used and made by policy decision makers when instructing or supporting service organisations (such as the police, NHS etc).

**7. Your views as to any lessons that can be learned from the Welsh Government's response to the Covid-19 pandemic, in particular relating to the work of the above-mentioned groups. Please describe any changes that have already been made, and set out any recommendations for further changes that you think the Inquiry should consider making.**

Data literacy and Data experts with a knowledge of epidemiology and health care would appear to be scarce, both within WG and the NHS. I would suggest the Enquiry considers why this was and remains the case.

The initial response to data analysis was very centralised, with WG relying on Public Health Wales to interpret UK models. It was apparent that these organisations did not sufficiently understand acute health care delivery and wider networks of organisations with these capabilities should be established.

As at 31 March 2020 it was commented on that the lack of leadership or unwillingness to make a decision even on working assumptions within WG, whilst understandable, left a void, which clinicians and analysts did identify and concluded that if they did not fill it, it would be filled by those with a voice and not necessarily any evidence backing up their opinion.

However, senior decision makers within WG did listen to CEOs providing evidence from the HBs who did have expertise in this area and guidance issued on 1 April 2020 was:

- Short-term estimation of demand should use real-world local data on hospital and ICU admissions combined with estimates of doubling time, rather than the UK-level modelling. PHW and National Modelling Forum will support this.
- Very risk averse in regards to the reasonable worst case and a bed requirement was stipulated that was not based on the RWC at the time.

By the second wave, WG appeared to have greater confidence in a localised approach and matured towards a very data driven, evidenced based, collaborative approach to decision-making and a very delegative way of practicing. This worked well and as the focus moved over time towards the four harms and away from purely the direct harm of covid you could see it offering potential.

However, the lack of resource and capacity minimized its impact and we were never in a position to attempt to provide models that sought to demonstrate the impact of policy decisions against each of the 4 harms at anything other than a high level description.

The use of data by all parties gave confidence to clinicians on the front line as to why decisions were being made, for how long they would have to manage in certain periods of escalation (useful when making treatment decisions for non Covid urgent patients). This has been lost as we came out of covid the second time around and decisions increasingly were made by many non-subject matter experts who chose not to rely on data and evidence.

The pandemic exposed both a lack of granular data, and poor quality of the data, with minimal definitions, no data standards, and a reliance on manual returns. This applies to mortality, TTP and clinical hospital information. For example, we had no idea how many patients were on CPAP – a consequence of WG having a policy of storing data in documents as free text rather than to standards.

However, where data did exist electronically, data availability and sharing was exceptional.

Improving accuracy of the models to improve capacity requirements was very much a HB requirement.

It was concerning that throughout the first wave nearly all Public Health professionals would not believe the mathematics that a second wave would happen if lockdown or other interventions reducing R(t) were imposed and then relaxed. This may have affected WG's confidence in the maths.

Hospital acquired infections were flagged to WG and Board at the end of April 2020. When it came to modelling and predicting, Hospital acquired infections should have been treated separately from Community Acquired Infections as they are more related to outbreaks than underlying prevalence in the community, and they did not consume the same level of critical care resource, although they had longer overall length of stay. Unfortunately, the Swansea University model never got around to making this distinction and it led in my opinion to greater modelling error when applied operationally.

WG continually changed mandatory submissions, including definitions and counts in the early days of the first wave. Whilst accuracy of data is important – these changes resulted in an inability to undertake time series analysis with the data submitted to them (e.g. calculating the rate of exponential growth in prevalence). It also led to confusion as sometimes suspected would be included alongside confirmed, whilst at other times it wouldn't.

The modelling group was not a decision making group in that it was not established to agree on the model that was presented nor the advice to the minister. It provided evidence on trends and parameters, to that end, many decisions were made by those attending SAGE rather than on Welsh data. On a number of occasions, it was unclear whether any of the advice that had been put forward in the meeting would be taken on board or escalated, especially on matters of operational materiality. Our input was implied to be limited to comments on the modelling method, but it was unclear how comments around the actions, decisions and the likely impact of not making a decision were being fed up the chain. herefore, escalation was necessary through other groups that existed (e.g. Directors of Public Health).

Additional resources to support members of the modelling group contribute were nonexistent and there was no offer of additional resource. Money was however available to spend on establishing services, such as information dashboards, but not on sustaining them in the medium term.

Minimal resources were allocated to improving the timeliness of data, its accuracy or a wider understanding of the dynamics. Given how much has been spent on covid, it is a shame that the opportunity to invest in the core foundations was missed.

Whilst I have set out my constructive criticisms above in order fully to answer the question and to hopefully help the inquiry I do also want to say that by May to June 2020 the situation had much improved.

**8. A brief description of documentation relating to these matters that you hold (including soft copy material held electronically). Please retain all such material. I am not asking for you to provide us with this material at this stage, but I may request that you do so in due course.**

Email correspondence & MS Office based files.