Llywodraeth Cymru
Welsh Government

From: NR
Technical Advisory Group

Cleared by: Fliss Bennee

Date: 06/09/2020

MINISTERIAL ADVICE

For decision by: Minister for Health and Social Services

Copied to: First Minister, Minister for Finance and Trefnydd, Deputy Minister for Health and Social Services,

Subject	COVID-19 Reasonable Worst Case (RWC) scenario for Wales during autumn and winter 2020/21
100 word summary	Four different reasonable worst case (RWC) scenario models have been considered by the Technical Advisory Group (TAG) to aid planning for the impact of Covid-19 in Wales during autumn and winter 2020/21. The models have been compared with each other and evaluated against assessment criteria. The Swansea University delayed response model has been recommended by TAG (21 August 2020) as the preferred model for use in Wales. These models do not currently change NHS planning but will be used for other planning purposes.
Timing	Urgent, part of COVID-19 response This sign off is **urgent** due to the nature of the work in informing our winter planning and response.
Recommendation	The Minister for Health and Social Services is asked to agree the adoption of the Swansea University delayed response model as the Reasonable Worst Case scenario for Wales to aid planning for the impact of Covid-19 during autumn and winter 2020/21.

Decision report	This decision does require a Decision Report, which may be published at any point.

ADVICE

Background

1. The Technical Advisory Group (TAG) was formed in response to the standing up of a UK Scientific Advisory Group for Emergencies (SAGE), to provide scientific and technical advice to Welsh Government during the COVID-19 pandemic and the subsequent response. An operational cell (TAC) was formed in the Civil Contingencies group for emergencies, consisting of the Chief Scientific Adviser for Health and a single supporting executive.

2. TAG has grown in line with the measuring, modelling and advising responsibilities placed upon it. The growth of the core cell and the membership of the scientific group has allowed a wider spread of the workload and ensured that we can consider and respond to many more requests for advice and interpretation. The current structure and terms of reference were agreed in previous ministerial advice ("20200428 MA VG Technical Advisory Cell TOR").

3. Funding has been agreed (MA/VG/1841/20 and MA/VG/2563/20) to cover costs associated with providing timely scientific and technical advice and evidence on SARS-COV-2 and COVID-19 for the Welsh Government. A key use of this funding has been to facilitate the development of mature policy models specific to Wales to support planning and policy decisions, rather than relying on Wales outputs to be included in the England models. It has also been used to develop and monitor 'circuit breaker' metrics.

4. Two Wales-specific models are now available for use:

    - A deterministic model developed by Armakuni, working closely with Oxford University Big Data Institute, NHS England and Faculty.AI; and
    - A stochastic model developed by Swansea University academics (Prof Gravenor and Dr Dawson), based on the London School of Hygiene and Tropical Medicine model - but seeded to Wales

5. The Swansea University model has already been used to inform TAG advice, including the 5 miles travel radius, the need for testing results to be returned within 24 hours, and impacts of combining households ('bubbling').

6. A number of the UK modelling groups continue to include Wales in their outputs, enabling us to compare and contrast the results for Wales across multiple models, based on the different starting assumptions and variables used.

Developing Reasonable Worst Case Scenarios for Autumn/Winter 2020/21

7. Reasonable Worst Case models are developed to support planning to ensure that we are able to consider and respond to a range of potential outcomes. The RWC Scenarios represent a challenging manifestation of the outcome of events, whilst excluding highly implausible scenarios.

8. The RWC is intended to offer a forecast of what could happen, not a prediction of what will happen. It represents a possible version of the future, but one that we hope to avoid. Through demonstrating a pessimistic but plausible scenario, the RWC can support planning efforts to focus on the mitigations and activities than need to be undertaken to avoid this scenario becoming a reality.

9. The RWC scenario for March – September 2020 was agreed by SAGE on 31 March 2020 and adopted as the RWC scenario for the UK, and in Wales to support Welsh Government, Local Health Board and Local Authority planning during this period.

10. The UK Government Cabinet Office commissioned SAGE and the SPI-M subgroup to produce RWC models for autumn and winter 2020/21 in July 2020.
In parallel, Welsh Government Technical Advisory Cell officials asked Armakuni and Swansea University modelling teams to develop RWC models for Wales.

11. As a result, four potential RWC scenarios have been prepared for consideration in Wales:
- UK Cabinet Office RWC Scenario (developed by SAGE)
- Swansea University RWC Scenario
- Armakuni RWC Scenario
- Academy of Medical Sciences scenario based on R=1.1 (featured in the AMS 'Preparing for a challenging winter 2020/21' report)

12. A summary of each of these RWC scenarios and corresponding models is attached at annex 2.

13. The TAG Policy Modelling Sub-group undertook an assessment to compare the models with each other and evaluated against a set of criteria to determine which might be the most suitable for Wales planning purposes.

14. A summary of each RWC scenario is provided in the table below:

	Infections	Hospital admissions[1]	Deaths[2]	Max total bed occupancy[3]	Max ICU bed occupancy[6]
Model 1: SAGE RWC	410,000	18,000	4,200	1,560	360
Model 2: AMS RWC	n/a (15,300 confirmed cases)	1,600	1,200	570	40
	636,000	18,200	6,300	1,300	190

[1] Hospital admissions refers to confirmed COVID-19 patients admitted to hospital for COVID-19.
[2] PHW deaths are used for the SAGE RWC and AMS2 RWC. The Armakuni 40/40/70 RWC refers to hospital deaths only. The Swansea Uni RWC refers to ONS deaths which are
[3] Bed occupancy (including ICU bed occupancy) refers to beds occupied by confirmed COVID-19 patients.

Model 3: Swansea University RWC					
Model 4: Armakuni 40/40/70 RWC	1,918,000 (37,300 cases)	32,400	10,400	3,850	750

15. NHS Delivery has already proposed/adopted a planning scenario for NHS organisations in Wales based on assumptions extrapolated from the situation in Wales in May 2020. The choice of official RWC scenario for Wales would not currently change the planning assumptions that NHS organisations are working towards.

16. The current NHS planning assumptions are more challenging than most of the new RWC scenarios and feature a maximum hospital bed occupancy of 5,000 beds and 350 ICU beds across Wales. This is closest to the Armakuni scenario for general beds (3,850 beds at peak) and closest to the SAGE scenario for ICU beds (360 beds at peak). The bed occupancy results depend a lot on length of stay which has been highly variable for covid patients and varies by health board. Having additional capacity in the NHS will be useful for other NHS services that are likely to increase in the winter, such as non-covid non-elective admissions and surgical procedures.

Options for RWC Scenario for Wales

17. The Minister is asked to consider the following options:

Option 1 – Agree the Swansea University delayed response RWC as the official RWC for Wales for Wales for autumn and winter 2020/21(**recommended**):

- The Swansea University model offers a flexible, dynamic model that has been specifically calibrated for Wales. The TAG Policy Modelling Sub-Group considers that the starting assumptions for the Swansea RWC Scenario are the most consistent with the conditions in Wales. There is particular concern that the Cabinet Office RWC scenario agreed by SAGE is based on July figures for Covid-19 cases in Wales that were distorted by the outbreaks in meat processing plants that were quickly brought under control – this meant for instance that in the SAGE RWC Wales (population 3.2million) had a higher peak of cases than Scotland (population 5.4million).
- The Swansea University model is already being used to support development of advice on the impact of other policy formulations, and therefore there is a logic to have internal consistency between our primary model used to support policy and the RWC model.
- Alongside the TAG Policy Modelling Sub-Group, the Swansea University RWC scenario has received external scrutiny via an extraordinary SPI-M meeting, where no issues or concerns were raised about the model.
- Scotland and Northern Ireland have chosen their own RWC scenarios, so there is no strong drive to unify behind a single RWC for the UK.
- The Swansea University baseline model contains further sensitivity analyses; the rapid response where circuit breakers are reacted to within 15

days, a delayed response where it takes 45 days to react (recommended scenario), and a shielding scenario where shielding is taken into account.
- Because the Swansea model is flexible and dynamic this means that it can be recalibrated if the situation changes. For example, if we see a continued uptick in cases in September and October that is much higher than the model predicts, the model can be recalibrated to produce a new scenario. Whereas if we use the SAGE scenario, we are reliant on SAGE to produce a new model scenario for Wales.

Option 2 – Agree the use of another RWC model as the official model for Wales:
- The Cabinet Office RWC scenario was agreed by SAGE on 30th July 2020. Choosing this RWC model would ensure Wales is consistent with the SAGE recommendation. However, WG officials and TAG have concerns that the starting assumptions used for this model do not accurately reflect the reality of local conditions in Wales.
- The Armakuni RWC model is calibrated to Wales. The current figures are significantly more pessimistic than other models considered. This is due to not taking circuit breakers into account leading to a continuous rise in infections. It is likely that action would be taken to reduce rising infection levels making this a less plausible model to use for the RWC. We have more confidence in the Swansea model which has had more academic scrutiny.
- The AMS RWC model fits in with the circuit breakers in that R does not rise above 1.1. However, it does not take any anticipated future events into account such as schools returning and a colder winter period. It is a simple growth rate model based on the R rate remaining stable at 1.1 from September 2020 onwards.

Option 3 – Do not sign off on any RWC model for Wales for the autumn and winter of 2020/21.
- This may lead to many different models being adopted by different health boards, local authorities, Strategic Coordination Group's and other organisations, leading to uncertainty and inconsistencies.

Financial implications

18. There are no direct financial implications of this advice at present. However the modelling has required investment from Welsh Government of around £100,000 for the Swansea University model and continued spend on work from Armakuni. Consideration may need to be given to offering research credits, recognition or continued funding if this approach is favoured in the long run.

19. The agreement of an official RWC scenario will be used as the basis for planning decisions across Welsh Government and other organisations, with resource implications. However, the resource implications have not been factored in to the assessment or recommendation of the most suitable RWC scenario for Wales. The RWC scenario represents the challenging but plausible scenario that we may encounter, and not a scenario based on what is 'affordable'. These resource decisions would still need to be made in the absence of any model.

Novel or Contentious issues

20. No Novel issues. There will be significant scrutiny on all of the technical and scientific evidence and advice provided to the Welsh Government. The data and models used by TAG to provide advice on COVID-19 harms and lockdown need to be of the highest quality. There is already a degree of second guessing from the public and wider scientific communities and the media, and this will only increase.

Legal issues

21. The RWC model will inform the advice provided to the Welsh Ministers on the Covid-19 response and necessity of restrictions being in place for Wales, as well as informing the overall UK response.

22. Paragraph 13 of Schedule 1 to the NHS (Wales) Act 2006 provides the Welsh Ministers with the power to conduct research, or assist any person to conduct research in to any matters relating to the causation, prevention, diagnosis or treatment of illness and any such other matters connected with any service provide under the NHS (Wales) Act 2006. The assistance provided may be given by grant or otherwise.

23. Additionally, Section 60 of the Government of Wales Act 2006 enables the Welsh Ministers to do anything which they consider appropriate to achieve any one or more of the following objects–
    a. the promotion or improvement of the economic well-being of Wales,
    b. the promotion or improvement of the social well-being of Wales, and
    c. the promotion or improvement of the environmental well-being of Wales.

24. This power may be exercised in relation to or for the benefit of the whole or any part of Wales, or all or any persons resident or present in Wales and includes power to do anything in relation to or for the benefit of any area outside Wales, or all or any persons resident or present anywhere outside Wales, if the Welsh Ministers consider that it is likely to achieve one or more of the objects in that subsection.

25. The power also includes the power–
    a. to enter into arrangements or agreements with any person,
    b. to co-operate with, or facilitate or co-ordinate the activities of, any person,
    c. to exercise on behalf of any person any functions of that person, and
    d. to provide staff, goods, services or accommodation to any person.

26. Under section 135 of the Government of Wales Act 2006 the Auditor General may carry out examinations into the economy, efficiency and effectiveness with which the Welsh Ministers have used their resources in discharging their functions, although the Auditor General may not question the merits of the policy objectives of the proposal.

Communications and media handling

27. Risk communication is particularly important, and outlining the role of the RWC scenario will need a clear explanation to minimise the risk of it being misinterpreted

28. TAC Officials will produce/has prepared a short public facing summary document to give an overview of the RWC model and its results. This is attached at annex 3.

Annex 1: ASSURANCE AND COPY RECIPIENTS

CLEARANCE TRACKING

Aspect	Tracking	Yes	No	N/A	Clearance no.
Finance	Financial implications over £50,000?	☐	☐	☒	
	Cleared by Group Finance?	☐	☐	☒	
	Cleared by Strategic Budgeting?	☐	☐	☒	
	Cleared by Local Government Finance?	☐	☐	☒	
Legal	Legal issues?	☐	☒	☐	
	Cleared by relevant lawyers?	☐	☒	☐	
Governance	Novel and contentious issues?	☐	☒	☐	
	Cleared by Corporate Governance Centre of Excellence?	☐	☐	☒	

DEPUTY DIRECTOR, STATEMENT OF ASSURANCE

In clearing this MA, I confirm that I, Fliss Bennee have quality assured this advice, ensuring it is provided on the basis of evidence, accurately presents the options and facts and I am accountable for the recommendations made

I am satisfied that the recommended decision or action, if agreed, would be lawful, affordable and comply with all relevant statutory obligations. Welsh Government policy priorities and cross portfolio implications have been fully considered in line with delivery of the government objectives.

I have fully considered the statement of assurance contained in the MA guidance to ensure all relevant considerations have been taken into account and that the actions and decisions take account of regularity, propriety and value for money.

COPY LIST

All mandatory copy recipients (as indicated in the guidance).

Additional copy recipients specifically interested in this advice:

- Shan Morgan
- Andrew Goodall
- Alan Brace
- Frank Atherton
- Reg Kilpatrick
- Glyn Jones
- Stephanie Howarth
- Jane Runeckles
- NR
- Ifan Evans
- Neil Buffin
- Jean White
- NR
- NR
- Rob Orford
- Fliss Bennee
- Andrew Sallows
- Albert Heaney

Annex 2

UK Cabinet Office RWC

On 30th July 2020, SAGE agreed the following RWC Scenario: increasing incidence, based on agreed doubling times, from the end of July to the end of November 2020, reflecting a difficult autumn followed by a large winter peak. After this point, measures are implemented that reduce non-household contacts to 50% of normal, pre-lockdown levels (though all school contacts are maintained) and kept in place until March 2021. This will be modelled for the UK, the four nations, and regions of England.

The commission for this RWCS was designed to consider the whole UK. As policy responses to the epidemic are likely to differ between the devolved nations, it would be expected that each of Scotland, Wales, and Northern Ireland would have different trajectories over time; devolved administrations will want to take this into account. There is potentially significant variability in the devolved nations due to very low case numbers currently, and so these scenarios for Scotland, Wales, and Northern Ireland are likely highly uncertain.

The following bullets describe the way the SAGE RWC model develops over time:

- Incidence continues as per current trends until the end of July 2020 with all non-household contact assumed to be approximately 70% of "normal" pre-lockdown levels
- Incidence doubles once by the end of August 2020
- Incidence doubles during the first two weeks of September, after which policy measures reduce R to around 1, until the end of October.
- A two-week doubling time for incidence returns throughout November
- At the end of November, policy measures are put in place which:
  - SCENARIO A: All non-household contacts are reduced to 25% of their normal (pre-lockdown) levels
  - SCENARIO B: All non-household contacts are reduced to 35% of their normal (pre-lockdown) levels
  - SCENARIO C1: All non-household contacts (including school contacts) are reduced to 50% of their normal (pre-lockdown) levels
  - **SCENARIO C2: All non-household contacts are reduced to 50% of their normal (pre-lockdown) levels; all school contacts are maintained. Scenario C2 is chosen as the RWC Scenario.**
- These measures are sustained until the end of March 2021
- An improved standard of care during this period with generalised use of dexamethasone is also assumed.

Assumptions

The following assumptions were stated in the RWC consensus statement for SAGE on 30th July 2020:

Table 1: Severity estimates for stages of COVID-19

Risk	Proportion (range)
Proportion of infections which have symptoms	66%
Infected people hospitalised	2.4% (0.0% – 8.9%)
Hospitalised (non-ICU) patients transferring to ICU (HDU/ITU)	20.5% (1.5% – 35.2%)
All hospitalised patients dying	23.3% (1.2% – 43.3%)
Overall infection fatality rate	0.7% (0.0% – 9.7%)

Table 2: Average length of stay for COVID-19 hospitalisation phases

Period	Mean length of stay in days (range)
Hospital (non-ICU) admission to transfer to ICU (HDU/ITU)	2.0
Hospital (non-ICU) admission to death or discharge *without* an ICU (HDU/ITU) admission	8.7 (7.9 – 9.2)
ICU (HDU/ITU) stay	10.6 (8.9 – 12.1)
Hospital (non-ICU) admission to death or discharge *with* an ICU (HDU/ITU) admission†	19.0 (17.3 – 20.5)

† Includes step-down care in hospital (non-ICU) following ICU stay but prior to discharge of 6.4 days.

Academy of Medical Sciences RWC

One of the four scenarios (AMS2) detailed in the "Preparing for a challenging winter 2020/21" report was chosen as a potential RWC for Wales. This is where R rises to 1.1 from September 2020 until July 2021.

Swansea university group RWC

Summary

Colleagues at Swansea University[4] have prepared a stochastic age-structured SEIR epidemic model exploring policy scenarios in Wales, with a focus on the impact of changes in contact structures at schools, work, home, community and shielded environments. The model uses the explicit demographics for Wales, and is calibrated at the local authority level.

The initial exposure in Wales was based on an R_0 of 2.5. Three lockdown parameters are estimated. Each parameter is a % scaling of the normal contact behaviour: pre-lockdown (in the week prior to 23rd March), lockdown (the maximum reduction in contacts) and post-lockdown (a small increase in contacts to reflect increased mobility).

The model

[4] Prepared by: Dr Mark Dawson[1], Dr Ed Bennett[1], Ms Malorie Perry[2], Dr Gareth John[3], Dr Tom Connor[7], Dr Brendan Collins[4], Professor Biagio Lucini[1,5], Professor Mike Gravenor[6], Members of Technical Advisory Group.

At the UK level, SAGE and the modelling group SPI-M have provided a number of very detailed simulation models for COVID-19 analysis and forecasting. Swansea University explored a range of these models, available on the code open access repository GitHub, for use in analysing the outbreak in Wales. The analysis provided here is based on the dynamic transmission model COVID-UK, prepared and published by Davies et al at the Centre for Mathematical Modelling of Infectious Disease (CMMID, London School of Hygiene and Tropical Medicine). Full details of the model are available in Davies et al[5], and https://github.com/cmmid/covid-uk. Briefly, the COVID-UK model structure is:

- Stochastic, tracking up to 66.4 million people at the UK level over time steps of 6 hours, hence the output is probabilistic and a distribution of outcomes can be obtained from a fixed set of parameters.
- Age-structured into 16 age bands, with demographics provided at the local authority level.
- There are 6 Disease states: Susceptible (S), and after successful transmission Exposed (E) but not infectious. After a latent period approximately 50% of infectious individuals are asymptomatic (I_s), while the rest enter a pre-clinical, but infectious state (I_p) followed by a clinical symptomatic infectious state (I_c) followed by isolation and recovery (R). The waiting times in each state are gamma distributed[2].
- Age-specific hospitalisation rates, fatality rates, and duration of hospital stay, estimated from the early stages of the pandemic are used to monitor the impact of the epidemic and health service capacity[2].
- A detailed description of the transmission between individuals based on measured social mixing patterns provided by the POLYMOD study[6]. Contact matrices are provided for home, school, work and community, all stratified by age band.
- The force of infection at time t for an individual is then given by the product of the susceptibility to infection upon contact and the number of contacts per day (all age specific).
- Scenarios are explored by scheduling changes to the number of contacts expected in each age group, and how this varies over time, for example when schools open/close, when lockdown measures dramatically decrease contacts, and when relaxation gradually increases the contact rate.

Following modifications to allow for flexible initial conditions and flexible scheduling of combinations of interventions over long time periods, the version of the model being used is available on Swansea University's code repository (https://github.com/sa2c/covid-uk).

Armakuni (Oxford) RWC model

The below records important aspects of the model inputs, process, and significant assumptions when using it in Wales. This should be read in conjunction with the core documentation of the OpenABM model[7], which explains how the generic model is set up.

Inputs

- We are using weekly data for all UK from the CoMix study to determine multipliers on random, workplace, and quarantine interactions by age group during the lockdown period, interpolating for missing weeks in May. We have found that using 'pure' CoMix data for lockdown interactions leads to underestimation of the ongoing infection levels (and consequent hospitalisations and deaths) during the lockdown period, so are multiplying the data by a constant of 1.4 to more realistically reflect actual behaviour.

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[5] N Davies et al (2020). Effects of non-pharmaceutical interventions on COVID-19 cases, deaths, and demand for hospital services in the UK: a modelling study. *The Lancet Public Health* 5 (7) E375-E385. DOI:https://doi.org/10.1016/S2468-2667(20)30133-X

[6] Mossong et al (2008). Social contacts and mixing patterns relevant to the spread of infectious diseases. *PLoS Medicine* 5 e74.

[7] OpenABM model **version:** eu.gcr.io/wales-gov-covid-dashboard/wg-model:v0.2

- We are not using CoMix for household contacts data, as we do not have a comparable baseline for this data - we are using the original model assumption that all members of a household will mix
- For the "% of deaths in ICU" figures, we are using the defaults plus some adjustments in the oldest age groups to create internal consistency with RWCS papers, since no other authoritative source is currently available, and death location is not a key concern for Wales
- All other inputs are informed by Welsh Government views on the most reliable recent source for each.

Process

- The model was run 25 times[8] and the average and standard deviation (sd) of these runs were used as the output for a given set of inputs. At Wales scale, the standard deviation of key measures (e.g. number of daily infections) begins to stabilise for sample sizes greater than 20, and Armakuni do not see significant improvements in the stability of the mean or sd after 25.
- The model timeline is aligned by tracking cumulative hospital admissions up until the first "lockdown policy change" on 12th March. At that date there had been 551 cumulative admissions according to PHW data, so whenever running a simulation we align calendar time to model time based on when the simulation first hits that figure.
- In order to ensure the model fits as well as possible to Wales' real situation, it was calibrated by:
    - allowing the mean infectious period and infectious rate of the disease to vary using a 'grid search' until we find the best fit to Wales' real cumulative deaths and cumulative hospital admissions figures.
    - measuring fit by checking the total mean squared error between these real figures and those output by the model (both normalised, so total error is in the range 0-2), and finding values of infectious period and infectious rate that minimise the error over the March-June period
    - beginning our search for these parameter values at the initial assumptions used UK-wide. These were chosen to vary as this is the approach approved by BDI and Faculty.ai for their England implementation, and we know that these parameters can reflect underlying structural social factors such as comorbidities.

Key risks and assumptions

- Parameters on human behaviour (e.g. levels of social contact over time) are heavily based on UK-wide survey data, and are not Wales-specific.
- There are very wide error bounds on aspects of the disease, in particular the prevalence of coronavirus - that is, we cannot be sure of the difference between the number of known cases and the number of people affected, and are updating our assumptions based on the most recent scientific data.
- The model relies on assumptions about social network structures within home, work, and the wider community, which leads to emergent findings about the apparent Rt and level at which 'lack of susceptibility' arises. Changes to assumed social network structure would change these outcomes.
- The model is based on a single geographic area, and does not look at cross-border interactions or at geographic divisions within an area.

Sense checking

[8] See the Variance Jupyter Notebook - variance.ipynb) for the experiment used to arrive at this conclusion

Armakuni's latest "stable" model inputs and outputs are stored at gs://wales-gov-covid-modelling-openabm-output/20200724-fix-params/, and should be used for comparison with any proposed policies

Appendix 3. DRAFT PUBLIC REPORT: New Reasonable Worst Case Scenario for the Winter

New Reasonable Worst Case Scenario for the Winter

What is a reasonable worst case scenario?

- A 'Reasonable Worst Case' (RWC) scenario is a way of considering the most challenging outcomes that could reasonably occur as a result of COVID-19 in Wales. It is a not a forecast or a prediction of what is most likely to happen, but provides important information to help the government prepare and respond in a range of different scenarios.

'*The Reasonable Worst Case is not what will happen, it is what could happen*'

- A RWC scenario for Wales has been developed to help people in Wales and public bodies prepare for COVID-19 over the coming Winter. For example how many healthcare workers might be required to staff ICU beds, or how many COVID-19 tests might be required for social care workers.

How has the Reasonable Worst Case Scenario been developed in Wales?

- A number of RWC scenarios (or 'models') for winter 2020/21 have been considered by the UK Government scientific advisory group on emergencies (SAGE). Some of these scenarios produced information specific to Wales. The Technical Advisory Group of the Welsh Government have considered these models alongside numerous other models relevant to Wales.

- Four main models were chosen for consideration. Model 1 is the UK Government Cabinet Office RWC. Model 2 is one of the Academy of Medical Science scenarios which could be considered a 'best case scenario'. Model 3 is the RWC model developed by Swansea University and Model 4 is the RWC model developed by the data science consultancy company Armakuni who have been working with Welsh Government (based on the University of Oxford Big Data Institute model).

Which scenario has been chosen and why?

- The Swansea University RWC has been agreed to be used by Welsh Ministers. The Swansea University model was adopted for a number of reasons including:

- The projected peak is similar to the previous peak seen in Wales and could therefore reasonably be expected to be seen in a RWC scenario.

- This model uses Welsh viral genomic data to accurately consider the number of unique introductions of the virus into Wales.

- The model allows estimates of reaction times to be included in assumptions (e.g. timing between national decisions and implementation of interventions. As the RWC aims to represent the most challenging scenario, we need to consider that the signal and appropriate public health responses may not be clear, responses may be delayed and how the public respond to COVID-19 control measures may be unpredictable.

- The Swansea model considers some of the specifics of why Wales is different to other parts of the UK such as having a slightly older population on average, and having more people living in rural areas.

What does the model tell us?

- The following table shows the number of infections, hospital admissions, maximum total (and ICU) bed occupancy required, and deaths estimated to occur due to COVID-19 for the RWC models for Wales between 1st July 2020 and 31st March 2021.
- It is important to reinforce that this is a deliberately pessimistic scenario in terms of challenging public services; it is not what we think will happen. Public services, employers, communities and the public in Wales are continuing to work together to prevent spread of the virus and prevent hospital admissions and deaths while recognising that COVID-19 control measures can also cause harm.

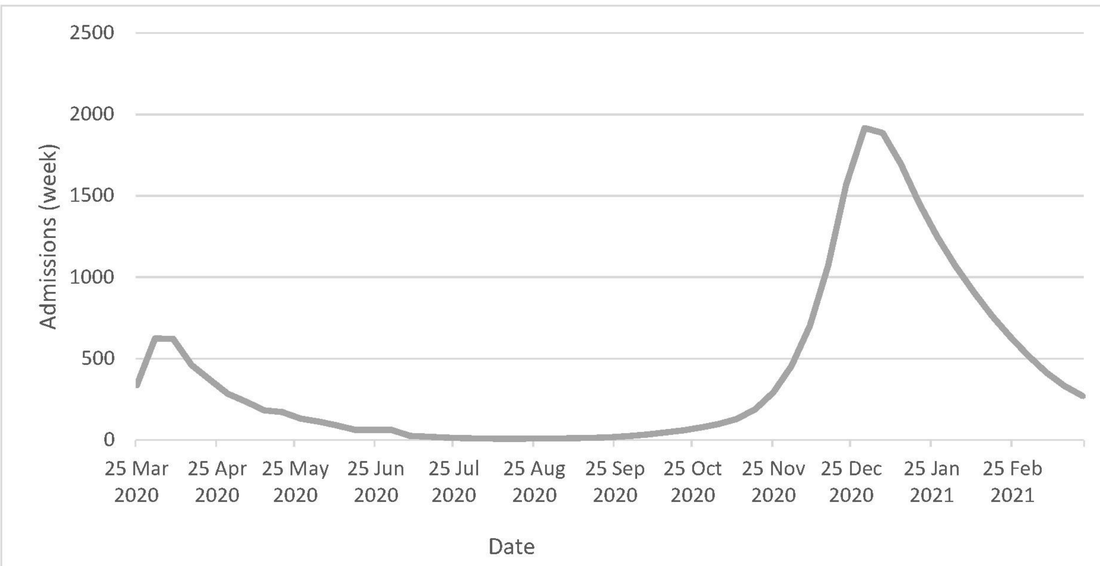
Headline figures for RWC:

	Infections	Hospital admissions[9]	Deaths[10]	Max total bed occupancy[11]	Max ICU bed occupancy[6]
Model 3: Swansea University RWC	636,000	18,200	6,300	1,300	190

Number of covid-19 hospital admissions per week

- As shown in the following graph, the Swansea model shows the next peak to occur between December 2020 and January 2021. This graph shows hospital admissions but other outcomes will show a similar shaped curve.

Confirmed COVID-19 Admissions (per week)



What will also be considered when we apply the scenario?

- Based on the emerging evidence alongside local and national discussions, the following points have been agreed and included in the model:
  - There is likely to be an increasing number of younger people with COVID-19, due to their different behaviours and activities. Younger people are more likely to have mild symptoms or no symptoms and therefore may be less likely to be tested. This may lead to an increase in cases in other groups of people.

[9] Hospital admissions refers to confirmed COVID-19 patients admitted to hospital for COVID-19.
[10] ONS deaths.
[11] Bed occupancy (including ICU bed occupancy) refers to beds occupied by confirmed COVID-19 patients.

- A higher proportion of infections may be in harder to reach groups, such as people from Black, Asian and Minority Ethnic (BAME) communities.

- At first, there will be a slow increase in the number of new cases, but the number of infections will increase more quickly over time. However, the change in infection numbers is not expected be as high, thanks to the steps taken to reduce infection risk, natural caution amongst the population, and increased testing.

- As we move into Winter, infected people may be more likely to assume their symptoms are caused by another illness, such as the flu. This means they may be less likely to report symptoms and there may be diagnostic uncertainty and additional pressures on the health system.

What's next?

- We are looking at additional scenarios within the Swansea model which include increased length of stay in hospital and intensive care, which would produce a higher level of peak occupancy.

- We are producing results at more local levels, whilst acknowledging that the virus will not follow the same path across different localities.

- We are looking at additional scenarios with different policy responses to potential increases in the number of COVID-19 cases.

- We are discussing potential additional scenarios such as an Autumn peak, best case scenarios, and the most likely scenario.

- Planning for Winter is underway and this information can be used help to inform this further. As new evidence or data emerges, the modelling can be updated.