

# CAN WE DEVELOP AN EARLY WARNING SYSTEM FOR THE NEXT WAVE OF COVID-19?

*ENGAGE WITH STRATHCLYDE 9 MAY 2022*

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**THE AWARDS**  
2019

**WINNER**  
UK UNIVERSITY  
OF THE YEAR  
FOR A SECOND TIME

Times Higher Education University of the Year 2012 & 2019  
Times Higher Education Widening Participation Initiative of the Year 2019  
The University of Strathclyde is rated a QS 5-star institution

THE SUNDAY TIMES  
GOOD  
UNIVERSITY  
GUIDE  
2020  
SCOTTISH  
UNIVERSITY  
OF THE YEAR



THE QUEEN'S  
ANNIVERSARY PRIZES  
FOR HIGHER AND FURTHER EDUCATION  
2019



- Brief overview of COVID-19 bed projections
- Continuing development of COVID-19 Early Warning System (EWS)
- Some ‘surprises’
- Potential data sources for new version of the EWS
- COVID-19 scenarios for 2022 from the Scottish Government

- Integrated epidemiological model to forecast new confirmed COVID-19 cases, feeding into a Discrete Event Simulation model to predict COVID-19 bed utilisation levels in intensive care (ICU and HDU) and general wards
- *Data inputs:* (a) recent time series of new confirmed cases; (b) estimated proportions (depending on age profiles and percentage vaccinated) of infected people requiring hospital admission; (c) probability distributions of the length of stay in hospital; (d) number of beds already occupied, whether by COVID-19 patients or people admitted for unrelated conditions
- *Local knowledge:* age profiles; length of stay distributions; emergence of new variants; local clusters of cases – based on close cooperation with NHSL's Public Health team

## Projections of bed utilisations in NHS Lanarkshire for the three weeks starting 11 April 2022

	'Low' Scenario		'Mid' Scenario		'High' Scenario	
Week beginning	Max number ICU & HDU beds occupied concurrent	Max number of beds occupied concurrent (TOTAL)	Max number ICU & HDU beds occupied concurrent	Max number of beds occupied concurrent (TOTAL)	Max number ICU & HDU beds occupied concurrent	Max number of beds occupied concurrent (TOTAL)
11/04/2022	1	198*	3	261*	3	305*
18/04/2022	1	186	2	198	3	231
25/04/2022	1	119	2	138	3	222

\* The actually observed number of beds concurrently occupied on Tuesday 12/04/2022 were 4 or less ICU & HDU beds and 224 beds in total.

NHSL ICU bed utilisation numbers include both ICU and HDU beds.  
 NHSL (Hospital) bed utilisation numbers include General Ward, ICU and HDU beds.

# Structure of the EWS

Primary Question

Main Themes

Essential Questions

Primary Indicators

Secondary Indicators

Do we have a problem?  
What is the nature of the problem?  
What action do we need to take?

**Disease Situation**

**Healthcare System**

**Disease Control**

What is the level of disease burden?

How is the level of disease burden changing?

Are there any signs of resurgences in cases?

Do we have sufficient capacity to treat severe cases?

Do we have sufficient capacity to treat moderate cases?

Do we have sufficient healthcare workforce to treat cases?

Are we testing enough to detect cases?

Is the Test & Protect service sufficiently robust?

Incidence nature & spread of new cases (incl. high risk loc's)

Weekly change in incidence, nature & spread of new cases

Cumulative exceedance & syndromic data (via NHS 24)

ITU & HDU availability (% surge occupancy)

General ward bed availability (% surge occupancy)

Health (& social) care workforce absences %

% people tested positive; % positive tests

% new cases from quarantined contacts

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Number of tests performed per 100,000 people

Positive cases with no known epidemiological links

# EWS in action, Sept 2020 – April 2021

Update Tues XX Jan 2021									
Category	Key Question	Indicators		Current Figures (XX Jan 21)		Current Alert Level Date: Green/Yellow/Amber/Red	Previous Update Figures (YY Dec 20)		
Disease Situation	What is the level of disease burden?	1.1	Incidence, nature and spread of new cases, including high risk locations (Lower is Better)	170	↑	Red	120	↓	
		Case incidence (new confirmed cases/100,000 population): cumulative last 7 days							
		1.2	Incidence, nature and spread of new cases, including high risk locations (Lower is Better)	300	↑	Red	150	↓	
	Case incidence (new confirmed cases/100,000 population): cumulative last 14 days								
	1.3	Age profile of incidence: (Higher Proportion of younger age group is Better)			0.45	0.20	0.35	0.50	0.20
How is the level of disease burden changing?	2	Weekly change in incidence nature and spread of new cases (Lower is Better)	1.6	↑	Red	0.9	↓		
	Estimated Dissemination Ratio (EDR) = Incidence last 7 Days / Incidence previous 7 Days (smoothed)								
	3	Syndromic data (SD) (suspected Covid case triage via NHS24)	15	↑	Yellow	13	↓		
Calls/100,000 population: 7-day MA (Lower is Better)									
Healthcare System	Do we have sufficient capacity to treat severe cases?	4	ITU Utilisation (Lower is Better)	80%-95%	→	Yellow	75%-90%	→	
	%occupancy 4 day range								
	Do we have sufficient capacity to treat moderate cases?	5	General ward bed Utilisation (Lower is Better)	96%-90%	↓	Red	90%-80%	↓	
	%occupancy range (last 4 days)								
Do we have sufficient workforce to treat cases? A.e. we protecting HC workers?	6.1	Health and social care workforce absence, COVID-19	XX-ZZ-2021				YY-KK-2020		
	1.	% of hospital HC workers absent (Lower is Better)	400				300		
2.	Total care home HC worker absent	200				150			
	6.2		XX-ZZ-2021				YY-KK-2020		
Disease Control	Are we testing enough to detect cases?	7	% people tested that are positive: 7-day MA (Lower is Better)	22.00%	↑	Red	18.00%	↓	
	% positive tests: 7-day MA NHSL (Lower is Better)								
	8		10.00%	↑	Red	7.00%	↓		
	In interviews completed on cases 'TWO' days ago (Higher is Better)								
Do we have robust contact tracing?	9		98.0%	↑	Yellow	95.0%	↑		
10	Ratio of contacts to cases Median, Max (Lower is Better)	3.....15				2.....10			

# EWS in action, May 2021 – April 2022

Update Wed XX May 2021

Category	Key Question	Indicators	Current Figures XX May 21)		Current Alert level Date: Green/Yellow/Amber/ Red	Previous Update: Figures (YY Apr 21)			
Disease Situation	What is the level of disease burden?	1.1 Incidence, nature and spread of new cases, including high risk locations (Lower is Better) Case incidence (new confirmed cases/100,000 population): cumulative last 7 days	45	↑	Green	20	↓		
		1.2 Incidence, nature and spread of new cases, including high risk locations (Lower is Better) Case incidence (new confirmed cases/100,000 population): cumulative last 14 days	70	↑	Yellow	30	↓		
		1.3 Age profile of incidence: Proportion of younger age group is Better	<45y : 45-74 : 75+ higher	0.60	0.30	0.10	0.65	0.25	0.10
		1.4 Areas in North Lanarkshire above 200 (per 100k - 7 Day)	Cliftonville, Carfin North						
	1.5 Areas in South Lanarkshire above 200 (per 100k - 7 Day)	None							
Disease Control	How is the level of disease burden changing?	2 Weekly change in incidence nature and spread of new cases (Lower is Better) Estimated Dissemination Ratio (EDR) = Incidence last 7 Days / Incidence previous 7 Days (smoothed)	1.00	↑	Yellow	0.80	↓		
	What is the prevalence of new variants in Scotland?	3.1 Percentage of Kent variant (Scotland) (HPS S-Gene Report) - B.1.1.7	27-Apr-21	80%	Red	27-Apr-21	80%		
		3.2 Total confirmed cases of South African variant (Scotland) - B.1.351	05-May-21	34		21-Apr-21	32		
		3.3 Total confirmed cases of Indian variant (Scotland) - B.1.617	05-May-21	14		21-Apr-21	5		
		3.4 Total confirmed cases of Indian variant (Scotland) - B.1.617.2	05-May-21	0					
Healthcare System	Are we testing enough to detect cases?	4 % people tested that are positive: 7-day MA (Lower is Better)	8.00%	↓	Yellow	10.00%	↓		
		5 % positive tests: 7-day MA NHSL (Lower is Better)	2.00%	↓	Green	3.00%	↓		
	Do we have robust contact tracing?	6 % Cases closed from onset in < TWO days (Higher is Better)*	95.0%	↑	Green	80.0%	↓		
		7 Ratio of contacts to cases Median, Max (Lower is Better)	3.....10		Yellow	4.....15			
		8.1 Dose 1 (percentage of population vaccinated in that age group)	40-49	57%					
8.2 Dose 2 (percentage of population vaccinated in that age group)	60-64	32%							
Healthcare System		Not considered a significant factor in the current situation							

# Some 'surprises'

- Sudden emergence of local 'super-spreading events'
  - little or no warning
  - *Lanarkshire*: October 2020
- Emergence of new, more transmissible COVID-19 variants
  - some warning
  - Alpha variant (B.1.1.7), January 2021
    - Delta variant (B.1.617), summer 2021
  - Omicron variant (B.1.1.529), January 2022
    - protection through vaccination
- Emergence of highly transmissible COVID-19 sub-variants
  - little or no warning
  - *Scotland*: Omicron BA.2 sub-variant (B.1.1.529.2), March-April 2022
    - high level of re-infections
    - protection against serious disease through vaccination



- PCR confirmed cases: very limited
- LFD positives and negatives: staff testing (& absence rates)
- LFD positives and negatives: testing of patients and visitors
- *ONS COVID-19 infection survey (future funding?)*
- Wastewater derived data
- COVID-19 hospitalisation data
- Outbreaks in care homes or schools
- Calls to NHS24 for influenza-like illness (ILL)
- GP consultations rates for ILL
- Presentations at A&E for acute respiratory disease
- COVID-19 genome sequencing
- Uptake of new COVID-19 vaccines
- Global horizon scanning

1. Testing + therapeutics (low-cost antiviral pills) + vaccines
2. Rapid response plans to new variants
3. Rapid testing and use of face masks for those most of risk
4. Develop treatments for 'long Covid'

- Mukaigawara, M., Hassan, I., Fernandes, G. et al. An equitable roadmap for ending the COVID-19 pandemic. *Nat Med* (2022). <https://doi.org/10.1038/s41591-022-01787-2>

- **Immune World**

*“In this possible future vaccines and natural immunity are effective at keeping Covid-19 at low levels. New variants may emerge in Scotland but for the foreseeable future infections are based around Omicron. ... In Immune world Covid-19 in Scotland reduces below epidemic levels, becoming endemic. Cases of Covid-19 therefore spring up only as rare outbreaks which are controlled through public health measures.”*

- **Polarised World**

*“In this world, vaccines and natural immunity are effective at reducing infections. The approach followed relies on individual risk assessment and behaviours. However, society becomes polarised as some continue to take up vaccines and follow guidance while others are more reluctant. Covid-19 becomes a disease associated with those who do not or cannot get full vaccine benefit and do not or cannot adopt a risk based approach maintaining baseline measures.”*

- **Variant World – vaccine escape with same severity as Delta**

*“In this possible future a variant with vaccine escape emerges in Scotland presenting a challenge even for fully vaccinated people. This new variant leads to increased transmission, but not to increased severity compared to previous variants. In this scenario other NPIs may need to be put in place for a short time. This world is similar to what has happened in Scotland with the emergence of Omicron.”*

- **Variant World – vaccine escape with increased severity**

*“A new, more severe variant appears in Scotland (possibly as people return from their summer holidays and return to work and school). It could lead to high levels of infections leading to hospital occupancy rising well above capacity restrictions. With sustained high levels of infection we could again see increased staff absences in a number of sectors that were affected by this in the recent Omicron wave.”*



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