Oxford COVID-19 Government Response Tracker

Calculation and presentation of the Stringency Index 4.0

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Check for most recent version here: www.bsg.ox.ac.uk/covidtracker

Calculation

The stringency index is calculated using only the policy indicators C1 – C8 and H1. The value of the index on any given day is the average of nine sub-indices pertaining to the individual policy indicators, each taking a value between 0 and 100:

$$I = \frac{1}{9}\sum_{j=1}^{9} I_j$$

Indicators C1 to C7 and H1 have an additional flag corresponding to whether the policy has been applied locally, in specific areas/circumstances, or generally, nationwide. We define G_j to be 0 if the policy is targeted and 1 if general. Note that a policy can only be general if it has a non-zero value, since a zero value corresponds to no measures being taken.

Because different indicators *j* have different maximum values N_j in their ordinal scales, we weight the additional contribution of a general policy by the average number of ordinal points across the eight indicators that have the targeted/general qualification. This ensures that general policies are not "over-contributing" to indicators with fewer ordinal points or "under-contributing" to indicators with more ordinal points. Specifically:

Indicator	N_j	**Targeted/General?**
C1	3 (0, 1, 2, 3)	Yes
C2	3 (0, 1, 2, 3)	Yes
C3	2 (0, 1, 2)	Yes
C4	4 (0, 1, 2, 3, 4)	Yes
C5	2 (0, 1, 2)	Yes
C6	3 (0, 1, 2, 3)	Yes
C7	2 (0, 1, 2)	Yes
C8	4 (0, 1, 2, 3, 4)	No
H1	2 (0, 1, 2)	Yes

The additional weight for a policy of general scope is defined in relation to the number of ordinal points of the eight indicators that have the targeted/general flags, that is

$$w = \frac{1}{8}\sum_{j=1}^{8} \frac{1}{(N_j + 1)} \approx 0.29$$

Then we define, for these 8 indicators the sub-indices to be

$$I_j = 100\left(C_j \frac{1-w}{N_j} + w\, G_j\right)$$

where C_j is the ordinal value of indicator Cj and its weighting here ensures that the subindex I_j varies between 0 and 100. Since C8 has no notion of general vs targeted, we just have

$$I_9 = 100\frac{C_9}{N_9}$$

The sub-indices are thus linearly proportional to the ordinal value of that policy indicator, with a standardized 'bonus point' for a generally-applied policy.

We make the conservative assumption that an absence of data corresponds to a sub-index of zero.

Here is an explicit example of the calculation:

Indicator	Value	General?	Max value	Sub Index
Variable:	Cj	Gj	Nj	Ij
C1	No data	No data	3	0
C2	1	1	3	54
C3	2	0	2	69
C4	2	0	4	34.5
C5	1	1	2	65.5
C6	2	1	3	77
C7	2	1	2	100
C8	2	NA	4	50
H1	2	1	2	100
			Overall	61.11

If fewer than six policy indicators have data on a given day, the index calculation is rejected and no value is returned.

Display

Because data are updated on twice-weekly cycles, but not every country is updated in every cycle, recent dates may be prone to missing data. To increase consistency of recent data points which are perhaps mid contribution, index values pertaining to the past seven days are rejected if they have fewer policy indicators than another day in the past seven days, i.e. if there is another recent data point with all seven indicators coded.

For example, the date at the time of writing was 24th April. The table below gives an example of which index calculations would be rejected based on the number of policy indicators with data on each data.

The API outputs two values for the stringency index – the actual index `stringency_actual` which is the calculated value, null if the index has been rejected for that date for having insufficient data, and a 'smoothed' value `stringency`.

The smoothed value is only different in the past week, and is equal to the most recent valid index (if there is one, else null). The motivation for this is to provide a stabilized value for display purposes.

Date	# Valid Cj	# Needed	Rejected?	Calculated index	Displayed
24/03/2020	3	6	YES	None	None
25/03/2020	6	6	NO	60	60
26/03/2020	4	6	YES	None	None
27/03/2020	6	6	NO	65	65
28/03/2020	3	6	YES	None	None
29/03/2020	5	6	YES	None	None
30/03/2020	2	6	YES	None	None
31/03/2020	3	7	YES	None	65
01/04/2020	7	7	NO	70	70
02/04/2020	7	7	NO	70	70
03/04/2020	6	7	YES	None	70
04/04/2020	5	7	YES	None	70
05/04/2020	6	7	YES	None	70
06/04/2020 (Today)	5	7	YES	None	70

Legacy stringency index

We also report legacy stringency index that approximates the logic of the former version of the Stringency Index, which only had seven components. This legacy indicator should only be used for continuity purposes.

The legacy indicator is calculated through the logic above, but only uses seven of the nine indicators. Specifically, it chooses between C3 and C4, and between C6 and C7, selecting whichever of those pairs provides a higher sub-index score.

$$SI_L = \frac{1}{7}(I_{C1} + I_{C2} + \text{Max}(I_3, I_4) + I_{C5} + \text{Max}(I_6, I_7) + I_{C8} + I_{H1})$$

Because C3 and C4 aim to measure the information previously measured by S3, and similarly for C6, C7, and the old S6, this method faithfully recreates the logic of the old stringency index.