| Epoch	Phase*	Rules for Special causes to mark the END of the phase	Reasons for Rules and Notes	Number of points used in fitting for limits & rule for freezing limits [KL: have to look at code to confirm]	Reasons for Points used and guidance and Notes
1	1.1	One point above c-chart limit; eight points above c-chart midline	Standard rules for signal, sensitive to shift to Epoch 2 (this is what we really want to know).	At least eight deaths and five records. The logic in the code now says if there is no signal, we update the limits 'forever' [no freeze]	We are willing to allow a very short series in order to allow us to detect Epoch 2 quickly. Usually, the series in Phase 1.1 does not go very long before there is a signal that requires a new phase but in principle, it could take a VERY long time to see eight deaths. Some locations show this.
	1.2, 1.3, etc.	Two consecutive points above or below the c-chart control chart limit OR eight consecutive values on one side of center line (this is what IHI evidently implemented)	Require two consec pts to dampen changes to phase. It may be partly an accident that IHIdecided to use the 'two consec pts' rule for phases 1.2, etc,	At least eight deaths and five records. The logic is we go to as many as 21 records and then freeze limits [e.g. Alabama] but if there is a signal **before** 21 points, we end the phase, which will agree with IHI approach. (that is, the logic adds one point at a time to the phase data and checks for signal).	I could argue that the rules for Phase 1.k, k > 1, should be the same as 1.1: we want to detect change to exponential growth. But IHI code seems to distinguish 1.1 from 1.k.

2	2.1	Two consecutive points above or below control chart limits OR eight consecutive values on one side of center line.	This is IHI's modification.	At least five records and up to 21 records. Fix the limits after 21 records. (We will only use less than 21 records if Phase 2.1 is the 'current' phase, where we are adding a new point to the fit with each update of the record. See schematic, phase z.n is the current phase, where we may be adding new data.)	If phase 2.1 is 'the current phase' where new days are being added (e.g. we just entered phase 2.1 a few days ago and we are still observing new data), we are fitting the exponential with as few as five records and as many as 21. It is possible that the series does NOT have a significant log10 slope after 21 points but did have a significant log10 slope after 15 points. We will just live with this problem.
	2.2	Two consecutive points above or below control chart limits OR eight consecutive values on one side of center line.		At least five records and up to 21 records. Fix the limits after 21 records. (same as 2.1)	
3	3.k	Two consecutive points above or below control chart limits OR eight consecutive values on one side of center line. END and TRANSITION TO EPOCH 4: • The lower limit for the phase 3.k is < 2 deaths	Note that Epoch 3 derives the midline and limits on the log10 scale and then exponentiates (so limits are never symmetric about the midline). Question on transition to end of Phase 3.k to Phase 4.1: do we want to continue IHI's rule of TWO points consecutive below	At least five records and up to 21 records. Fix the limits after 21 records. (We will only use less than 21 records if Phase 2.1 is the 'current' phase, where we are adding a new point with each update of the record. See schematic, phase z.n is the current phase,	For consistency with Epoch 2, use the same number of points and fix limits after 21 points. The only difference between Epoch 2 and 3 is the judgment of the slope of the log10 deaths regression.

		• There are consecutive special cause signals (8 consecutive days below the CL or a point below the lower limit of phase 3.k)	the lower limit or just use ONE point below the lower limit. Implemented: two consecutive points below limit.	where we may be adding new data.	
4	4.1	Same Rule as Epoch 1		Same Rule as Epoch 1	
	4.k	Same as 1.k		Same as 1.k	

Schematic of Phases.   The blue phases are 'in the past' and fixed. The orange phase is open to adding new values.

| Phase 1.1 | → | Phase x.k | → | Phase y.m | → | Phase z.n |
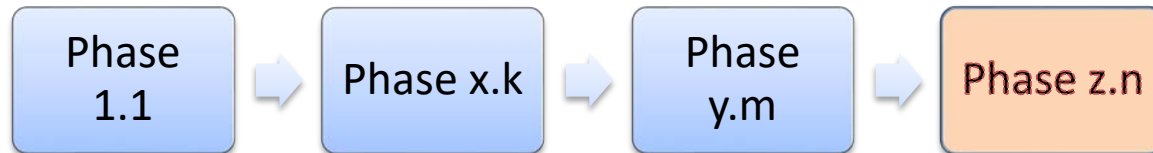
Phase z.n is the 'current phase', we get a new observation each day that we can add to the phase calculations.

Discussion of Epoch 4: Not implemented in summer IHI code, a natural extension implemented in R

1. This epoch begins only when there has been a descent phase. It uses a C-chart, as in epoch 1. The start of Epoch 4 is indicated by two requirements:

·   The lower limit for the descent phase becomes < 2

·   There are consecutive special cause signals (8 consecutive days below the CL or two points below the lower limit)

2.   After both of these criteria are met, we plot data without limits until 8 events (e.g. eight deaths, not eight date records) have occurred (including points associated with special causes).

3. After at least 8 total events have occurred, calculate the center line (CL) as the average of daily counts and the upper limit (UL): CL + 3* sqrt(CL)] using data from all days since the initial special cause event that marks the start of Epoch 4.

4.   Phase(s) in Epoch 4 should have the same rules as phases Epoch 1: we are sensitive to an outbreak of exponential growth so the first phase in Epoch 4 should have the same rule as Epoch 1 Phase 1.   Then we will have have subsequent phases in Epoch 4 follow the same rules as other phases in Epoch 1.