

IEM's AI Modeling: Short-term COVID-19 Projections

Date: 7/7/20

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 7/7/20 11 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

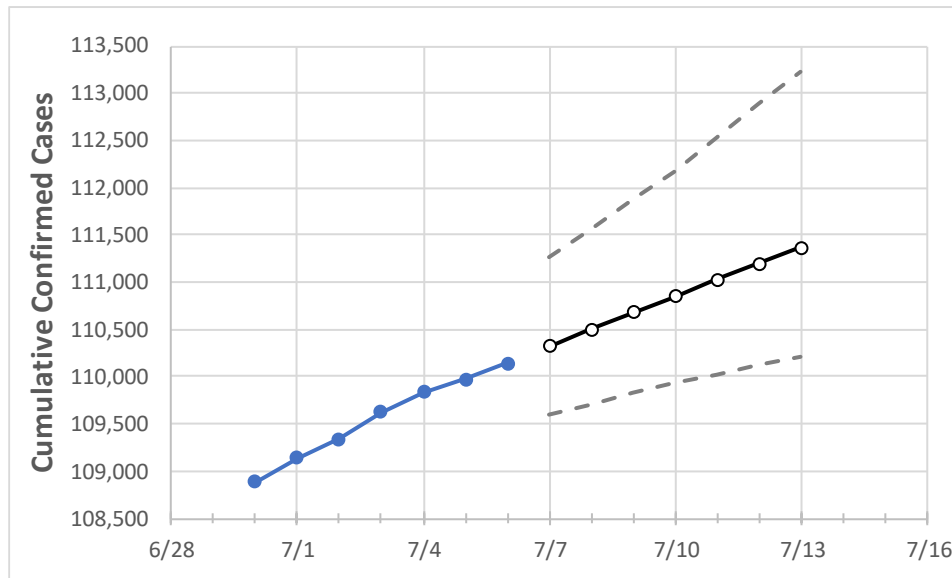
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

Massachusetts State Projections



Actual Confirmed Cases On:					Projected Cases For:						
7/3	7/4	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	
Massachusetts	109,628	109,838	109,974	110,137	110,319	110,499	110,677	110,853	111,027	111,199	111,370

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 20%, and are often within 10%, of actual confirmed cases.

Massachusetts Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	7/3	7/4	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13
Barnstable	1,553	1,555	1,557	1,561	1,564	1,567	1,569	1,572	1,575	1,577	1,580
Berkshire	602	603	603	604	605	606	607	608	609	610	612
Bristol	8,295	8,311	8,321	8,331	8,347	8,362	8,377	8,392	8,407	8,422	8,437
Essex	16,210	16,235	16,254	16,283	16,309	16,336	16,361	16,387	16,412	16,437	16,461
Franklin	373	373	373	373	374	375	377	378	379	380	382
Hampden	6,834	6,861	6,870	6,883	6,900	6,917	6,933	6,950	6,967	6,983	7,000
Hampshire	976	982	985	985	989	993	997	1,002	1,007	1,011	1,017
Middlesex	24,083	24,115	24,153	24,193	24,227	24,261	24,294	24,327	24,359	24,390	24,421
Norfolk	9,242	9,260	9,273	9,284	9,299	9,313	9,327	9,341	9,355	9,369	9,382
Plymouth	8,722	8,734	8,740	8,748	8,757	8,767	8,776	8,785	8,794	8,802	8,811
Suffolk	19,936	19,972	19,985	20,014	20,040	20,065	20,090	20,114	20,138	20,162	20,186
Worcester	12,443	12,481	12,499	12,515	12,538	12,562	12,586	12,610	12,634	12,658	12,682

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- **Beds:** For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report ([MMWR, March 18, 2020](#)) and state reports of COVID-19 cases.
- **ICU:** The CDC report found that 24% of hospitalized cases require ICU care.
- **Ventilators:** Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.

Massachusetts Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:							
	7/3	7/4	7/5	7/6	7/8		7/10		7/12			
Barnstable	1,553	1,555	1,557	1,561	1,567	(313) [75] {38}	1,572	(314) [75] {38}	1,577	(315) [76] {38}		
Berkshire	602	603	603	604	606	(121) [29] {15}	608	(122) [29] {15}	610	(122) [29] {15}		
Bristol	8,295	8,311	8,321	8,331	8,362	(1,672) [401] {201}	8,392	(1,678) [403] {201}	8,422	(1,684) [404] {202}		
Essex	16,210	16,235	16,254	16,283	16,336	(3,267) [784] {392}	16,387	(3,277) [787] {393}	16,437	(3,287) [789] {394}		
Franklin	373	373	373	373	375	(75) [18] {9}	378	(76) [18] {9}	380	(76) [18] {9}		
Hampden	6,834	6,861	6,870	6,883	6,917	(1,383) [332] {166}	6,950	(1,390) [334] {167}	6,983	(1,397) [335] {168}		
Hampshire	976	982	985	985	993	(199) [48] {24}	1,002	(200) [48] {24}	1,011	(202) [49] {24}		
Middlesex	24,083	24,115	24,153	24,193	24,261	(4,852) [1,165] {582}	24,327	(4,865) [1,168] {584}	24,390	(4,878) [1,171] {585}		
Norfolk	9,242	9,260	9,273	9,284	9,313	(1,863) [447] {224}	9,341	(1,868) [448] {224}	9,369	(1,874) [450] {225}		
Plymouth	8,722	8,734	8,740	8,748	8,767	(1,753) [421] {210}	8,785	(1,757) [422] {211}	8,802	(1,760) [423] {211}		
Suffolk	19,936	19,972	19,985	20,014	20,065	(4,013) [963] {482}	20,114	(4,023) [965] {483}	20,162	(4,032) [968] {484}		
Worcester	12,443	12,481	12,499	12,515	12,562	(2,512) [603] {301}	12,610	(2,522) [605] {303}	12,658	(2,532) [608] {304}		

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.