

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

Date: 8/6/20

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 8/6/20 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.

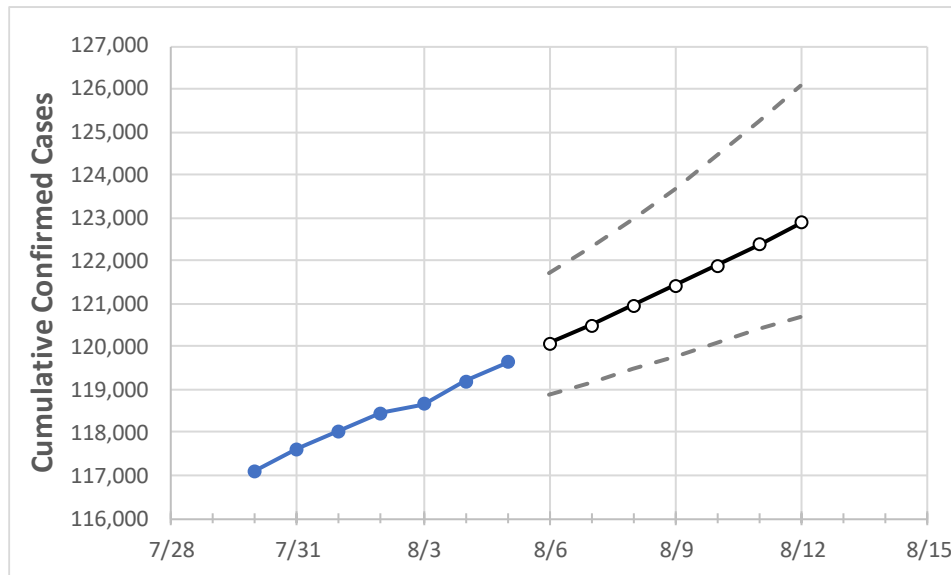
IEM's Modeling Lead

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:						
8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	
Massachusetts	118,458	118,657	119,203	119,643	120,068	120,506	120,955	121,417	121,891	122,379	122,881

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:						
	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12
Barnstable	1,757	1,764	1,770	1,778	1,785	1,792	1,800	1,807	1,815	1,823	1,831
Berkshire	657	659	661	664	666	669	671	674	677	679	682
Bristol	9,124	9,153	9,224	9,255	9,288	9,322	9,356	9,392	9,428	9,464	9,502
Essex	17,386	17,422	17,494	17,571	17,632	17,696	17,763	17,832	17,904	17,979	18,057
Franklin	405	406	406	407	408	409	410	410	411	412	413
Hampden	7,467	7,477	7,499	7,518	7,540	7,563	7,587	7,611	7,635	7,660	7,686
Hampshire	1,136	1,139	1,145	1,150	1,156	1,161	1,167	1,173	1,179	1,185	1,192
Middlesex	25,894	25,932	26,027	26,109	26,186	26,265	26,346	26,429	26,514	26,600	26,689
Norfolk	10,343	10,361	10,447	10,488	10,537	10,588	10,641	10,695	10,751	10,808	10,867
Plymouth	9,115	9,126	9,163	9,185	9,206	9,227	9,249	9,273	9,297	9,322	9,349
Suffolk	21,355	21,378	21,481	21,579	21,646	21,716	21,787	21,862	21,938	22,017	22,099
Worcester	13,415	13,442	13,469	13,497	13,538	13,580	13,623	13,668	13,713	13,759	13,806

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:							
	8/2	8/3	8/4	8/5	8/7		8/9		8/11			
Barnstable	1,757	1,764	1,770	1,778	1,792	(358) [86] {43}	1,807	(361) [87] {43}	1,823	(365) [87] {44}		
Berkshire	657	659	661	664	669	(134) [32] {16}	674	(135) [32] {16}	679	(136) [33] {16}		
Bristol	9,124	9,153	9,224	9,255	9,322	(1,864) [447] {224}	9,392	(1,878) [451] {225}	9,464	(1,893) [454] {227}		
Essex	17,386	17,422	17,494	17,571	17,696	(3,539) [849] {425}	17,832	(3,566) [856] {428}	17,979	(3,596) [863] {432}		
Franklin	405	406	406	407	409	(82) [20] {10}	410	(82) [20] {10}	412	(82) [20] {10}		
Hampden	7,467	7,477	7,499	7,518	7,563	(1,513) [363] {182}	7,611	(1,522) [365] {183}	7,660	(1,532) [368] {184}		
Hampshire	1,136	1,139	1,145	1,150	1,161	(232) [56] {28}	1,173	(235) [56] {28}	1,185	(237) [57] {28}		
Middlesex	25,894	25,932	26,027	26,109	26,265	(5,253) [1,261] {630}	26,429	(5,286) [1,269] {634}	26,600	(5,320) [1,277] {638}		
Norfolk	10,343	10,361	10,447	10,488	10,588	(2,118) [508] {254}	10,695	(2,139) [513] {257}	10,808	(2,162) [519] {259}		
Plymouth	9,115	9,126	9,163	9,185	9,227	(1,845) [443] {221}	9,273	(1,855) [445] {223}	9,322	(1,864) [447] {224}		
Suffolk	21,355	21,378	21,481	21,579	21,716	(4,343) [1,042] {521}	21,862	(4,372) [1,049] {525}	22,017	(4,403) [1,057] {528}		
Worcester	13,415	13,442	13,469	13,497	13,580	(2,716) [652] {326}	13,668	(2,734) [656] {328}	13,759	(2,752) [660] {330}		

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.