IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/20/20

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 7/20/20 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
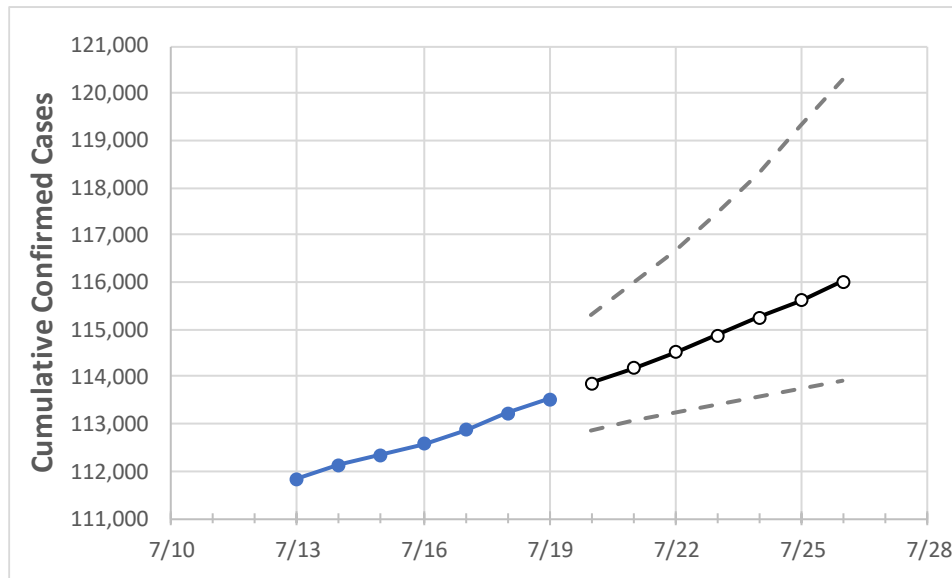
	Actual Confirmed Cases On:				Projected Cases For:						
	7/16	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26
Massachusetts	112,581	112,879	113,238	113,534	113,854	114,185	114,526	114,879	115,245	115,622	116,012

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:						
	7/16	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26
Barnstable	1,596	1,603	1,612	1,622	1,628	1,635	1,643	1,651	1,659	1,668	1,677
Berkshire	616	618	622	623	624	625	627	628	629	631	632
Bristol	8,593	8,637	8,653	8,681	8,713	8,747	8,782	8,819	8,857	8,897	8,939
Essex	16,596	16,632	16,710	16,733	16,768	16,804	16,840	16,876	16,914	16,951	16,990
Franklin	386	389	391	391	392	393	394	395	395	396	397
Hampden	7,077	7,100	7,120	7,140	7,163	7,186	7,209	7,234	7,259	7,284	7,311
Hampshire	1,015	1,026	1,033	1,039	1,044	1,049	1,054	1,060	1,066	1,073	1,080
Middlesex	24,685	24,738	24,809	24,886	24,947	25,011	25,075	25,142	25,211	25,281	25,354
Norfolk	9,588	9,612	9,658	9,699	9,739	9,781	9,825	9,871	9,920	9,971	10,026
Plymouth	8,847	8,865	8,868	8,889	8,898	8,906	8,915	8,924	8,932	8,940	8,949
Suffolk	20,445	20,499	20,555	20,601	20,652	20,704	20,758	20,813	20,871	20,930	20,991
Worcester	12,738	12,762	12,802	12,830	12,854	12,879	12,903	12,928	12,953	12,978	13,003

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:		
	7/16	7/17	7/18	7/19	7/21	7/23	7/25
Barnstable	1,596	1,603	1,612	1,622	1,635 (327) [78] {39}	1,651 (330) [79] {40}	1,668 (334) [80] {40}
Berkshire	616	618	622	623	625 (125) [30] {15}	628 (126) [30] {15}	631 (126) [30] {15}
Bristol	8,593	8,637	8,653	8,681	8,747 (1,749) [420] {210}	8,819 (1,764) [423] {212}	8,897 (1,779) [427] {214}
Essex	16,596	16,632	16,710	16,733	16,804 (3,361) [807] {403}	16,876 (3,375) [810] {405}	16,951 (3,390) [814] {407}
Franklin	386	389	391	391	393 (79) [19] {9}	395 (79) [19] {9}	396 (79) [19] {10}
Hampden	7,077	7,100	7,120	7,140	7,186 (1,437) [345] {172}	7,234 (1,447) [347] {174}	7,284 (1,457) [350] {175}
Hampshire	1,015	1,026	1,033	1,039	1,049 (210) [50] {25}	1,060 (212) [51] {25}	1,073 (215) [51] {26}
Middlesex	24,685	24,738	24,809	24,886	25,011 (5,002) [1,201] {600}	25,142 (5,028) [1,207] {603}	25,281 (5,056) [1,214] {607}
Norfolk	9,588	9,612	9,658	9,699	9,781 (1,956) [469] {235}	9,871 (1,974) [474] {237}	9,971 (1,994) [479] {239}
Plymouth	8,847	8,865	8,868	8,889	8,906 (1,781) [428] {214}	8,924 (1,785) [428] {214}	8,940 (1,788) [429] {215}
Suffolk	20,445	20,499	20,555	20,601	20,704 (4,141) [994] {497}	20,813 (4,163) [999] {500}	20,930 (4,186) [1,005] {502}
Worcester	12,738	12,762	12,802	12,830	12,879 (2,576) [618] {309}	12,928 (2,586) [621] {310}	12,978 (2,596) [623] {311}

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.