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

Date: 9/29/21

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 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 9/29/21 9 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.

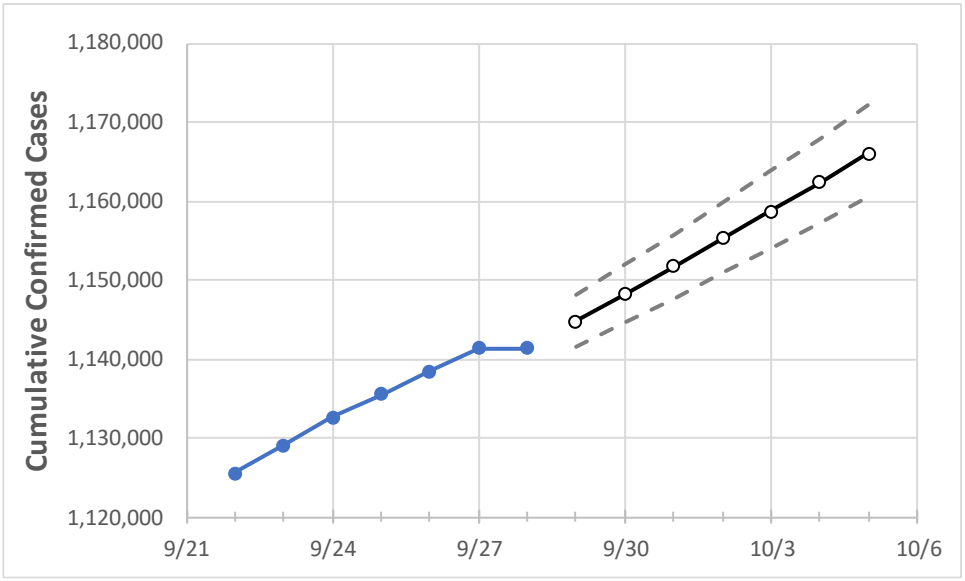
IEM's Modeling Lead

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.

Michigan State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5
Michigan	1,135,557	1,138,464	1,141,370	1,141,370	1,144,804	1,148,224	1,151,758	1,155,259	1,158,725	1,162,392	1,165,989

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 10%, and are often within 5%, of actual confirmed cases.

Michigan Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5
Genesee	46,832	46,913	46,993	46,993	47,087	47,179	47,272	47,366	47,455	47,550	47,643
Ingham	28,206	28,272	28,338	28,338	28,421	28,504	28,586	28,671	28,756	28,844	28,931
Kent	83,956	84,182	84,409	84,409	84,673	84,939	85,207	85,473	85,748	86,024	86,301
Livingston	19,880	19,956	20,033	20,033	20,113	20,195	20,278	20,363	20,448	20,535	20,625
Macomb	111,162	111,419	111,676	111,676	111,952	112,236	112,517	112,806	113,098	113,396	113,696
Monroe	17,748	17,822	17,897	17,897	17,979	18,063	18,150	18,237	18,327	18,421	18,516
Oakland	134,020	134,315	134,611	134,611	134,942	135,274	135,609	135,946	136,287	136,646	136,987
Washtenaw	30,300	30,362	30,425	30,425	30,500	30,577	30,652	30,728	30,802	30,878	30,954
Wayne	184,571	184,899	185,226	185,226	185,590	185,955	186,316	186,691	187,054	187,427	187,809

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.*

Michigan Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	9/25	9/26	9/27	9/28	9/30	10/2	10/4
Genesee	46,832	46,913	46,993	46,993	47,179 (9,436) [2,265] {1,132}	47,366 (9,473) [2,274] {1,137}	47,550 (9,510) [2,282] {1,141}
Ingham	28,206	28,272	28,338	28,338	28,504 (5,701) [1,368] {684}	28,671 (5,734) [1,376] {688}	28,844 (5,769) [1,385] {692}
Kent	83,956	84,182	84,409	84,409	84,939 (16,988) [4,077] {2,039}	85,473 (17,095) [4,103] {2,051}	86,024 (17,205) [4,129] {2,065}
Livingston	19,880	19,956	20,033	20,033	20,195 (4,039) [969] {485}	20,363 (4,073) [977] {489}	20,535 (4,107) [986] {493}
Macomb	111,162	111,419	111,676	111,676	112,236 (22,447) [5,387] {2,694}	112,806 (22,561) [5,415] {2,707}	113,396 (22,679) [5,443] {2,721}
Monroe	17,748	17,822	17,897	17,897	18,063 (3,613) [867] {434}	18,237 (3,647) [875] {438}	18,421 (3,684) [884] {442}
Oakland	134,020	134,315	134,611	134,611	135,274 (27,055) [6,493] {3,247}	135,946 (27,189) [6,525] {3,263}	136,646 (27,329) [6,559] {3,280}
Washtenaw	30,300	30,362	30,425	30,425	30,577 (6,115) [1,468] {734}	30,728 (6,146) [1,475] {737}	30,878 (6,176) [1,482] {741}
Wayne	184,571	184,899	185,226	185,226	185,955 (37,191) [8,926] {4,463}	186,691 (37,338) [8,961] {4,481}	187,427 (37,485) [8,996] {4,498}

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.