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

Date: 3/2/21

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 3/2/21 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.

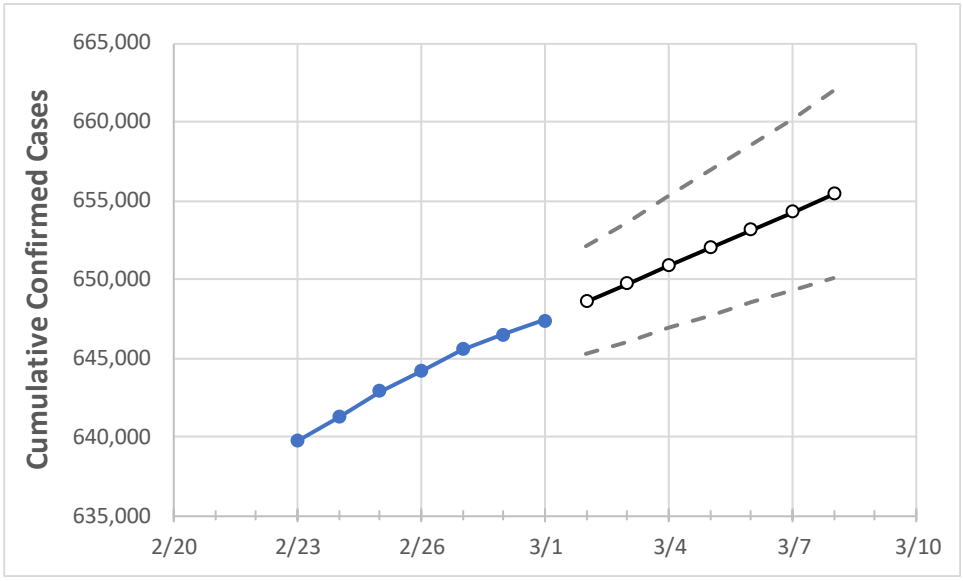
IEM's Modeling Lead

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:						
	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8
Michigan	644,125	645,550	646,483	647,415	648,571	649,704	650,849	651,983	653,139	654,275	655,444

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:						
	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8
Genesee	25,487	25,546	25,601	25,656	25,715	25,776	25,838	25,903	25,967	26,036	26,105
Ingham	16,334	16,387	16,413	16,439	16,470	16,501	16,530	16,557	16,585	16,611	16,640
Kent	51,656	51,718	51,782	51,846	51,918	51,988	52,058	52,128	52,197	52,263	52,330
Livingston	10,263	10,290	10,313	10,336	10,358	10,381	10,403	10,426	10,449	10,472	10,495
Macomb	58,758	58,935	59,027	59,119	59,244	59,369	59,498	59,630	59,763	59,900	60,039
Monroe	9,733	9,772	9,789	9,806	9,827	9,848	9,869	9,890	9,911	9,932	9,953
Oakland	74,607	74,754	74,864	74,973	75,101	75,231	75,361	75,487	75,614	75,737	75,862
Washtenaw	18,624	18,684	18,716	18,748	18,794	18,836	18,877	18,918	18,957	18,996	19,035
Wayne	101,504	101,777	101,950	102,122	102,314	102,508	102,706	102,903	103,105	103,307	103,510

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:		
	2/26	2/27	2/28	3/1	3/3	3/5	3/7
Genesee	25,487	25,546	25,601	25,656	25,776 (5,155) [1,237] {619}	25,903 (5,181) [1,243] {622}	26,036 (5,207) [1,250] {625}
Ingham	16,334	16,387	16,413	16,439	16,501 (3,300) [792] {396}	16,557 (3,311) [795] {397}	16,611 (3,322) [797] {399}
Kent	51,656	51,718	51,782	51,846	51,988 (10,398) [2,495] {1,248}	52,128 (10,426) [2,502] {1,251}	52,263 (10,453) [2,509] {1,254}
Livingston	10,263	10,290	10,313	10,336	10,381 (2,076) [498] {249}	10,426 (2,085) [500] {250}	10,472 (2,094) [503] {251}
Macomb	58,758	58,935	59,027	59,119	59,369 (11,874) [2,850] {1,425}	59,630 (11,926) [2,862] {1,431}	59,900 (11,980) [2,875] {1,438}
Monroe	9,733	9,772	9,789	9,806	9,848 (1,970) [473] {236}	9,890 (1,978) [475] {237}	9,932 (1,986) [477] {238}
Oakland	74,607	74,754	74,864	74,973	75,231 (15,046) [3,611] {1,806}	75,487 (15,097) [3,623] {1,812}	75,737 (15,147) [3,635] {1,818}
Washtenaw	18,624	18,684	18,716	18,748	18,836 (3,767) [904] {452}	18,918 (3,784) [908] {454}	18,996 (3,799) [912] {456}
Wayne	101,504	101,777	101,950	102,122	102,508 (20,502) [4,920] {2,460}	102,903 (20,581) [4,939] {2,470}	103,307 (20,661) [4,959] {2,479}

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.