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

Date: 9/17/21

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 9/17/21 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.

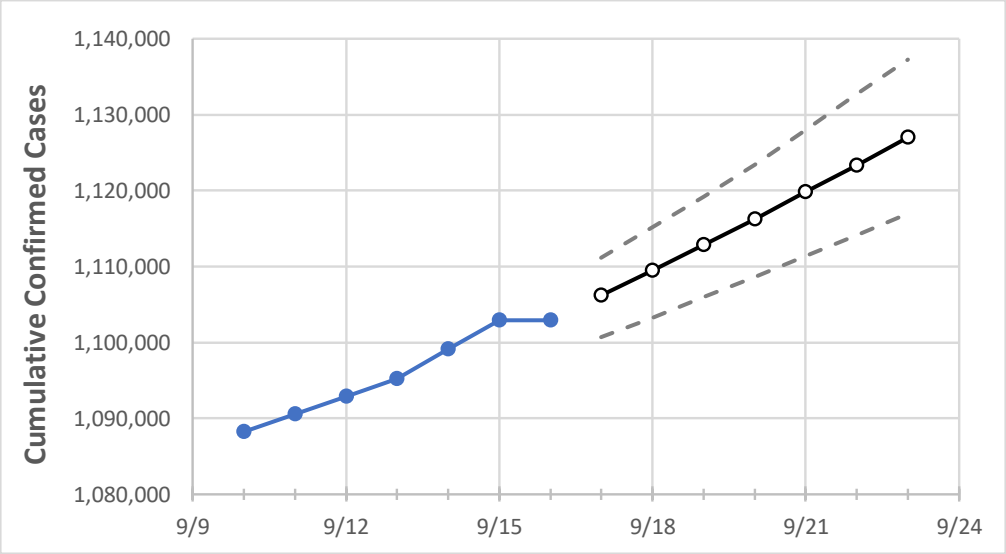
IEM's Modeling Lead

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:						
	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23
Michigan	1,095,200	1,099,079	1,102,957	1,102,957	1,106,185	1,109,489	1,112,818	1,116,268	1,119,790	1,123,372	1,127,047

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:						
	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23
Genesee	45,509	45,656	45,803	45,803	45,918	46,039	46,159	46,282	46,404	46,532	46,659
Ingham	27,259	27,348	27,437	27,437	27,527	27,619	27,715	27,814	27,917	28,023	28,131
Kent	80,737	81,083	81,428	81,428	81,705	81,983	82,269	82,569	82,873	83,183	83,488
Livingston	19,058	19,132	19,206	19,206	19,268	19,331	19,394	19,457	19,523	19,587	19,652
Macomb	108,140	108,389	108,638	108,638	108,864	109,088	109,315	109,551	109,783	110,025	110,264
Monroe	16,960	17,034	17,108	17,108	17,168	17,228	17,289	17,353	17,421	17,489	17,558
Oakland	130,259	130,593	130,926	130,926	131,221	131,528	131,831	132,145	132,454	132,772	133,092
Washtenaw	29,357	29,434	29,511	29,511	29,592	29,672	29,754	29,836	29,920	30,005	30,090
Wayne	180,217	180,635	181,053	181,053	181,429	181,814	182,198	182,590	182,988	183,391	183,796

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:		
	9/13	9/14	9/15	9/16	9/18	9/20	9/22
Genesee	45,509	45,656	45,803	45,803	46,039 (9,208) [2,210] {1,105}	46,282 (9,256) [2,222] {1,111}	46,532 (9,306) [2,234] {1,117}
Ingham	27,259	27,348	27,437	27,437	27,619 (5,524) [1,326] {663}	27,814 (5,563) [1,335] {668}	28,023 (5,605) [1,345] {673}
Kent	80,737	81,083	81,428	81,428	81,983 (16,397) [3,935] {1,968}	82,569 (16,514) [3,963] {1,982}	83,183 (16,637) [3,993] {1,996}
Livingston	19,058	19,132	19,206	19,206	19,331 (3,866) [928] {464}	19,457 (3,891) [934] {467}	19,587 (3,917) [940] {470}
Macomb	108,140	108,389	108,638	108,638	109,088 (21,818) [5,236] {2,618}	109,551 (21,910) [5,258] {2,629}	110,025 (22,005) [5,281] {2,641}
Monroe	16,960	17,034	17,108	17,108	17,228 (3,446) [827] {413}	17,353 (3,471) [833] {416}	17,489 (3,498) [839] {420}
Oakland	130,259	130,593	130,926	130,926	131,528 (26,306) [6,313] {3,157}	132,145 (26,429) [6,343] {3,171}	132,772 (26,554) [6,373] {3,187}
Washtenaw	29,357	29,434	29,511	29,511	29,672 (5,934) [1,424] {712}	29,836 (5,967) [1,432] {716}	30,005 (6,001) [1,440] {720}
Wayne	180,217	180,635	181,053	181,053	181,814 (36,363) [8,727] {4,364}	182,590 (36,518) [8,764] {4,382}	183,391 (36,678) [8,803] {4,401}

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.