IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/16/21

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 <u>not</u> 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 8/16/21 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
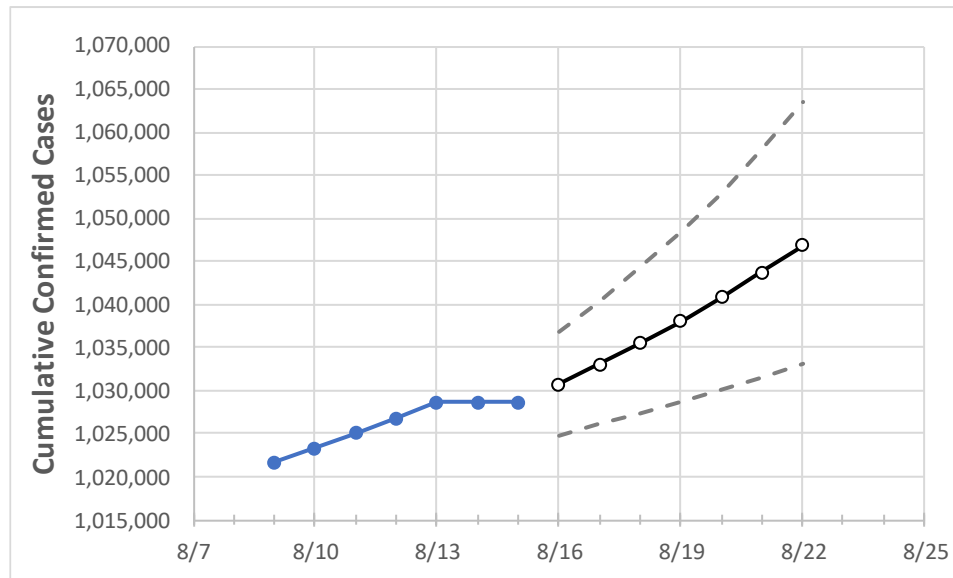
	Actual Confirmed Cases On:				Projected Cases For:						
	8/12	8/13	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22
Michigan	1,026,817	1,028,630	1,028,630	1,028,630	1,030,770	1,033,055	1,035,484	1,038,071	1,040,788	1,043,712	1,046,882

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:						
	8/12	8/13	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22
Genesee	42,671	42,738	42,738	42,738	42,831	42,932	43,041	43,160	43,289	43,428	43,577
Ingham	25,677	25,721	25,721	25,721	25,770	25,822	25,875	25,931	25,989	26,050	26,113
Kent	75,338	75,469	75,469	75,469	75,631	75,813	76,011	76,224	76,455	76,717	76,988
Livingston	17,316	17,353	17,353	17,353	17,393	17,436	17,480	17,526	17,574	17,625	17,677
Macomb	102,594	102,757	102,757	102,757	102,925	103,102	103,288	103,483	103,687	103,904	104,135
Monroe	15,846	15,877	15,877	15,877	15,908	15,941	15,977	16,014	16,054	16,096	16,139
Oakland	122,535	122,774	122,774	122,774	123,067	123,372	123,702	124,048	124,410	124,797	125,205
Washtenaw	27,335	27,407	27,407	27,407	27,472	27,543	27,617	27,694	27,777	27,864	27,957
Wayne	170,767	171,056	171,056	171,056	171,399	171,756	172,131	172,516	172,927	173,355	173,812

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:		
	8/12	8/13	8/14	8/15	8/17	8/19	8/21
Genesee	42,671	42,738	42,738	42,738	42,932 (8,586) [2,061] {1,030}	43,160 (8,632) [2,072] {1,036}	43,428 (8,686) [2,085] {1,042}
Ingham	25,677	25,721	25,721	25,721	25,822 (5,164) [1,239] {620}	25,931 (5,186) [1,245] {622}	26,050 (5,210) [1,250] {625}
Kent	75,338	75,469	75,469	75,469	75,813 (15,163) [3,639] {1,820}	76,224 (15,245) [3,659] {1,829}	76,717 (15,343) [3,682] {1,841}
Livingston	17,316	17,353	17,353	17,353	17,436 (3,487) [837] {418}	17,526 (3,505) [841] {421}	17,625 (3,525) [846] {423}
Macomb	102,594	102,757	102,757	102,757	103,102 (20,620) [4,949] {2,474}	103,483 (20,697) [4,967] {2,484}	103,904 (20,781) [4,987] {2,494}
Monroe	15,846	15,877	15,877	15,877	15,941 (3,188) [765] {383}	16,014 (3,203) [769] {384}	16,096 (3,219) [773] {386}
Oakland	122,535	122,774	122,774	122,774	123,372 (24,674) [5,922] {2,961}	124,048 (24,810) [5,954] {2,977}	124,797 (24,959) [5,990] {2,995}
Washtenaw	27,335	27,407	27,407	27,407	27,543 (5,509) [1,322] {661}	27,694 (5,539) [1,329] {665}	27,864 (5,573) [1,337] {669}
Wayne	170,767	171,056	171,056	171,056	171,756 (34,351) [8,244] {4,122}	172,516 (34,503) [8,281] {4,140}	173,355 (34,671) [8,321] {4,161}

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.