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

Date: 11/24/20

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

The projections shown in this document are based on data pulled in as of 11/24/20 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.

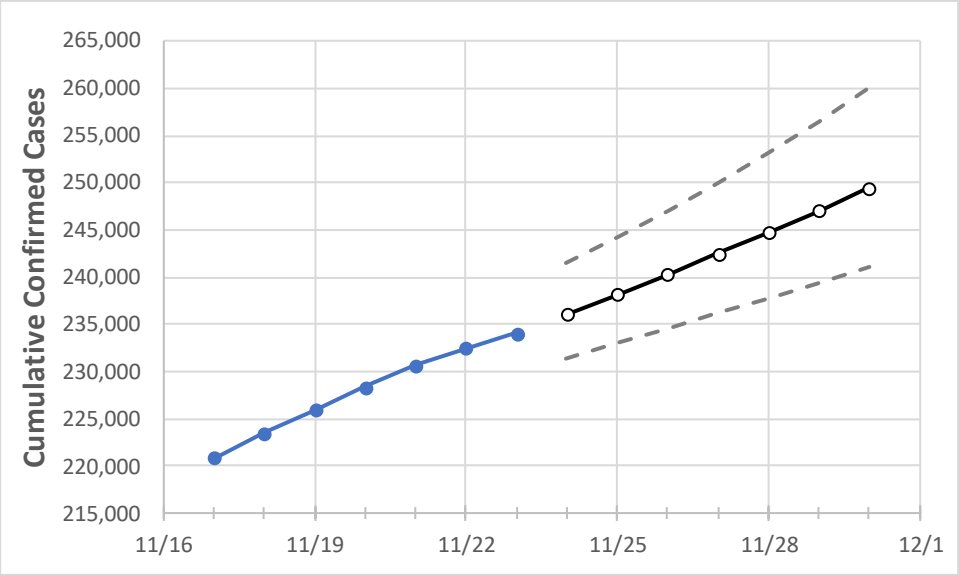
IEM's Modeling Lead

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.

Alabama State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
Alabama	228,373	230,708	232,506	234,080	236,074	238,133	240,260	242,455	244,721	247,060	249,474

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.

Alabama Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
Jefferson	29,626	30,027	30,318	30,620	30,948	31,292	31,654	32,035	32,435	32,855	33,296
Lee	7,421	7,478	7,504	7,539	7,585	7,633	7,683	7,735	7,790	7,847	7,907
Madison	11,958	12,092	12,204	12,410	12,544	12,684	12,830	12,981	13,139	13,304	13,475
Marshall	5,660	5,710	5,794	5,819	5,881	5,945	6,012	6,083	6,157	6,234	6,315
Mobile	19,090	19,189	19,260	19,306	19,402	19,501	19,603	19,709	19,818	19,931	20,047
Montgomery	11,903	11,952	12,000	12,040	12,089	12,137	12,187	12,236	12,286	12,336	12,387
Shelby	9,537	9,629	9,712	9,805	9,903	10,003	10,108	10,215	10,327	10,442	10,561
Tuscaloosa	12,274	12,356	12,446	12,501	12,592	12,686	12,782	12,881	12,982	13,085	13,191

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.*

Alabama Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	11/20	11/21	11/22	11/23	11/25	11/27	11/29
Jefferson	29,626	30,027	30,318	30,620	31,292 (6,258) [1,502] {751}	32,035 (6,407) [1,538] {769}	32,855 (6,571) [1,577] {789}
Lee	7,421	7,478	7,504	7,539	7,633 (1,527) [366] {183}	7,735 (1,547) [371] {186}	7,847 (1,569) [377] {188}
Madison	11,958	12,092	12,204	12,410	12,684 (2,537) [609] {304}	12,981 (2,596) [623] {312}	13,304 (2,661) [639] {319}
Marshall	5,660	5,710	5,794	5,819	5,945 (1,189) [285] {143}	6,083 (1,217) [292] {146}	6,234 (1,247) [299] {150}
Mobile	19,090	19,189	19,260	19,306	19,501 (3,900) [936] {468}	19,709 (3,942) [946] {473}	19,931 (3,986) [957] {478}
Montgomery	11,903	11,952	12,000	12,040	12,137 (2,427) [583] {291}	12,236 (2,447) [587] {294}	12,336 (2,467) [592] {296}
Shelby	9,537	9,629	9,712	9,805	10,003 (2,001) [480] {240}	10,215 (2,043) [490] {245}	10,442 (2,088) [501] {251}
Tuscaloosa	12,274	12,356	12,446	12,501	12,686 (2,537) [609] {304}	12,881 (2,576) [618] {309}	13,085 (2,617) [628] {314}

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.