IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/13/21

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 1/13/21 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.

Alabama State Projections
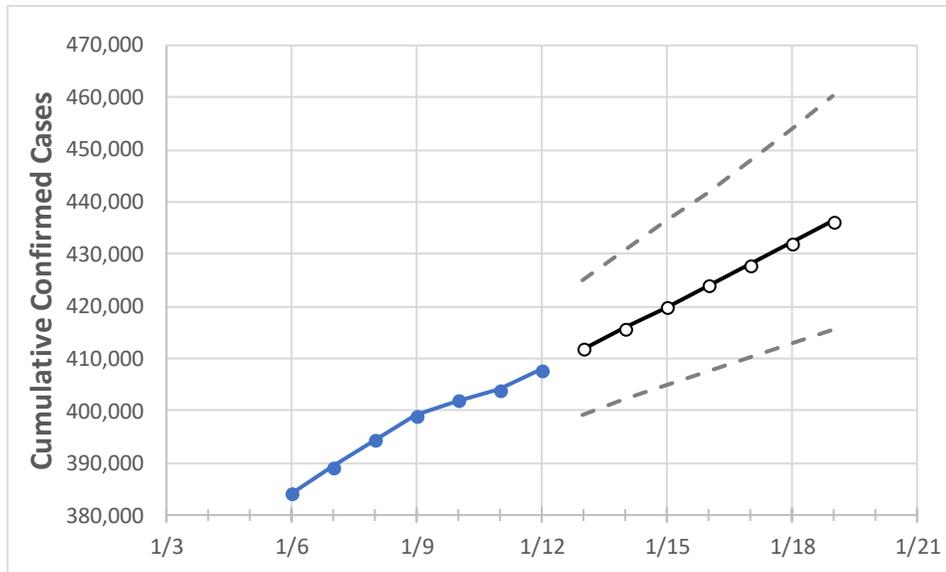
Actual Confirmed Cases On:				Projected Cases For:						
1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19
Alabama 399,150	401,900	404,000	407,848	411,781	415,771	419,836	423,900	428,058	432,213	436,426

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.

Alabama Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19
Jefferson	58,394	58,896	59,248	59,867	60,494	61,103	61,721	62,338	62,954	63,562	64,196
Lee	11,498	11,565	11,626	11,812	11,955	12,098	12,250	12,403	12,559	12,715	12,879
Madison	25,219	25,463	25,643	26,012	26,321	26,635	26,952	27,271	27,590	27,904	28,234
Marshall	9,819	9,854	9,863	9,907	9,964	10,021	10,079	10,136	10,191	10,248	10,307
Mobile	28,266	28,584	28,793	29,011	29,281	29,555	29,834	30,113	30,395	30,681	30,964
Montgomery	17,916	18,064	18,176	18,315	18,520	18,728	18,945	19,168	19,393	19,624	19,850
Shelby	17,449	17,562	17,690	17,837	18,015	18,192	18,368	18,548	18,722	18,899	19,071
Tuscaloosa	20,062	20,142	20,211	20,320	20,461	20,597	20,731	20,864	20,999	21,132	21,263

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:		
	1/9	1/10	1/11	1/12	1/14	1/16	1/18
Jefferson	58,394	58,896	59,248	59,867	61,103 (12,221) [2,933] {1,466}	62,338 (12,468) [2,992] {1,496}	63,562 (12,712) [3,051] {1,525}
Lee	11,498	11,565	11,626	11,812	12,098 (2,420) [581] {290}	12,403 (2,481) [595] {298}	12,715 (2,543) [610] {305}
Madison	25,219	25,463	25,643	26,012	26,635 (5,327) [1,278] {639}	27,271 (5,454) [1,309] {655}	27,904 (5,581) [1,339] {670}
Marshall	9,819	9,854	9,863	9,907	10,021 (2,004) [481] {240}	10,136 (2,027) [487] {243}	10,248 (2,050) [492] {246}
Mobile	28,266	28,584	28,793	29,011	29,555 (5,911) [1,419] {709}	30,113 (6,023) [1,445] {723}	30,681 (6,136) [1,473] {736}
Montgomery	17,916	18,064	18,176	18,315	18,728 (3,746) [899] {449}	19,168 (3,834) [920] {460}	19,624 (3,925) [942] {471}
Shelby	17,449	17,562	17,690	17,837	18,192 (3,638) [873] {437}	18,548 (3,710) [890] {445}	18,899 (3,780) [907] {454}
Tuscaloosa	20,062	20,142	20,211	20,320	20,597 (4,119) [989] {494}	20,864 (4,173) [1,001] {501}	21,132 (4,226) [1,014] {507}

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.