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

Date: 10/11/21

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 10/11/21 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.

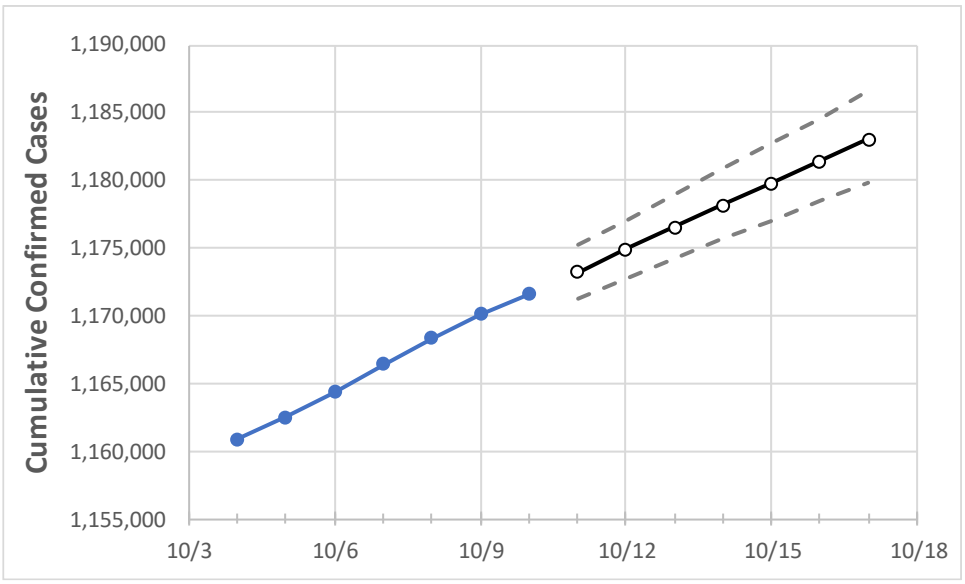
IEM's Modeling Lead

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.

New Jersey State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	10/17
New Jersey	1,166,443	1,168,312	1,170,140	1,171,573	1,173,231	1,174,897	1,176,535	1,178,179	1,179,795	1,181,441	1,183,052

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.

New Jersey Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	10/17
Bergen	117,476	117,607	117,750	117,873	118,011	118,150	118,285	118,418	118,552	118,689	118,821
Burlington	52,797	52,917	53,047	53,147	53,257	53,363	53,472	53,581	53,689	53,801	53,906
Camden	65,942	66,103	66,237	66,355	66,492	66,631	66,764	66,901	67,037	67,169	67,308
Essex	104,968	105,060	105,157	105,235	105,326	105,412	105,497	105,581	105,668	105,752	105,836
Gloucester	37,023	37,124	37,210	37,277	37,370	37,461	37,552	37,643	37,735	37,830	37,917
Hudson	96,145	96,223	96,304	96,377	96,441	96,507	96,570	96,632	96,696	96,760	96,820
Hunterdon	11,548	11,594	11,621	11,634	11,658	11,681	11,706	11,729	11,754	11,780	11,803
Mercer	38,479	38,522	38,578	38,624	38,672	38,718	38,765	38,812	38,858	38,905	38,948
Middlesex	104,138	104,271	104,389	104,473	104,580	104,684	104,790	104,894	104,996	105,099	105,198
Monmouth	89,812	89,965	90,100	90,201	90,330	90,460	90,591	90,718	90,849	90,980	91,102
Morris	56,651	56,737	56,826	56,893	56,973	57,053	57,133	57,214	57,295	57,374	57,457
Ocean	91,259	91,502	91,762	91,931	92,150	92,362	92,581	92,792	93,012	93,230	93,445
Passaic	80,278	80,358	80,440	80,537	80,615	80,692	80,767	80,843	80,919	80,996	81,071
Somerset	34,265	34,292	34,329	34,360	34,399	34,439	34,476	34,516	34,553	34,592	34,628
Sussex	16,449	16,500	16,566	16,596	16,643	16,690	16,737	16,785	16,834	16,883	16,932
Union	79,000	79,056	79,136	79,184	79,248	79,306	79,369	79,429	79,487	79,547	79,604
Warren	11,641	11,684	11,710	11,738	11,766	11,793	11,821	11,848	11,876	11,905	11,934

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.*

New Jersey Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	10/7	10/8	10/9	10/10	10/12	10/14	10/16
Bergen	117,476	117,607	117,750	117,873	118,150 (23,630) [5,671] {2,836}	118,418 (23,684) [5,684] {2,842}	118,689 (23,738) [5,697] {2,849}
Burlington	52,797	52,917	53,047	53,147	53,363 (10,673) [2,561] {1,281}	53,581 (10,716) [2,572] {1,286}	53,801 (10,760) [2,582] {1,291}
Camden	65,942	66,103	66,237	66,355	66,631 (13,326) [3,198] {1,599}	66,901 (13,380) [3,211] {1,606}	67,169 (13,434) [3,224] {1,612}
Essex	104,968	105,060	105,157	105,235	105,412 (21,082) [5,060] {2,530}	105,581 (21,116) [5,068] {2,534}	105,752 (21,150) [5,076] {2,538}
Gloucester	37,023	37,124	37,210	37,277	37,461 (7,492) [1,798] {899}	37,643 (7,529) [1,807] {903}	37,830 (7,566) [1,816] {908}
Hudson	96,145	96,223	96,304	96,377	96,507 (19,301) [4,632] {2,316}	96,632 (19,326) [4,638] {2,319}	96,760 (19,352) [4,644] {2,322}
Hunterdon	11,548	11,594	11,621	11,634	11,681 (2,336) [561] {280}	11,729 (2,346) [563] {282}	11,780 (2,356) [565] {283}
Mercer	38,479	38,522	38,578	38,624	38,718 (7,744) [1,858] {929}	38,812 (7,762) [1,863] {931}	38,905 (7,781) [1,867] {934}
Middlesex	104,138	104,271	104,389	104,473	104,684 (20,937) [5,025] {2,512}	104,894 (20,979) [5,035] {2,517}	105,099 (21,020) [5,045] {2,522}
Monmouth	89,812	89,965	90,100	90,201	90,460 (18,092) [4,342] {2,171}	90,718 (18,144) [4,354] {2,177}	90,980 (18,196) [4,367] {2,184}
Morris	56,651	56,737	56,826	56,893	57,053 (11,411) [2,739] {1,369}	57,214 (11,443) [2,746] {1,373}	57,374 (11,475) [2,754] {1,377}
Ocean	91,259	91,502	91,762	91,931	92,362 (18,472) [4,433] {2,217}	92,792 (18,558) [4,454] {2,227}	93,230 (18,646) [4,475] {2,238}
Passaic	80,278	80,358	80,440	80,537	80,692 (16,138) [3,873] {1,937}	80,843 (16,169) [3,880] {1,940}	80,996 (16,199) [3,888] {1,944}
Somerset	34,265	34,292	34,329	34,360	34,439 (6,888) [1,653] {827}	34,516 (6,903) [1,657] {828}	34,592 (6,918) [1,660] {830}
Sussex	16,449	16,500	16,566	16,596	16,690 (3,338) [801] {401}	16,785 (3,357) [806] {403}	16,883 (3,377) [810] {405}
Union	79,000	79,056	79,136	79,184	79,306 (15,861) [3,807] {1,903}	79,429 (15,886) [3,813] {1,906}	79,547 (15,909) [3,818] {1,909}
Warren	11,641	11,684	11,710	11,738	11,793 (2,359) [566] {283}	11,848 (2,370) [569] {284}	11,905 (2,381) [571] {286}

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.