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

Date: 3/15/22

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 3/15/22 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.

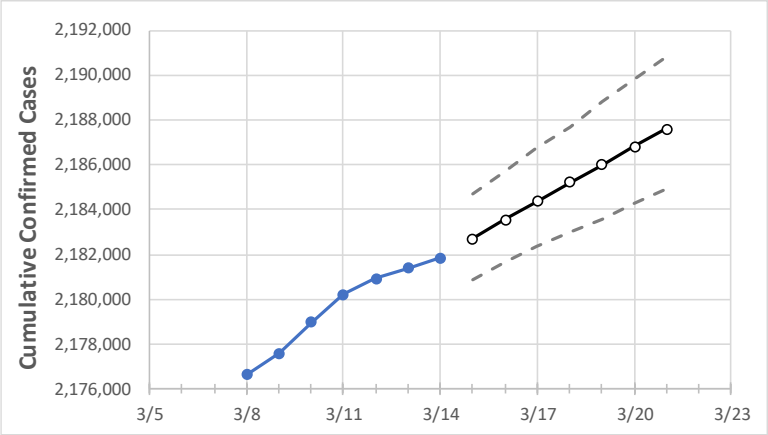
IEM's Modeling Lead

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:						
	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21
New Jersey	2,180,216	2,180,930	2,181,398	2,181,828	2,182,705	2,183,534	2,184,374	2,185,201	2,185,986	2,186,812	2,187,600

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:						
	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21
Bergen	219,942	220,070	220,146	220,183	220,296	220,415	220,529	220,640	220,755	220,867	220,973
Burlington	101,227	101,248	101,264	101,277	101,306	101,335	101,363	101,390	101,416	101,443	101,469
Camden	124,604	124,626	124,643	124,667	124,698	124,726	124,754	124,782	124,807	124,835	124,857
Essex	210,190	210,241	210,274	210,309	210,385	210,464	210,542	210,618	210,695	210,770	210,842
Gloucester	69,256	69,265	69,276	69,292	69,308	69,324	69,339	69,354	69,368	69,382	69,395
Hudson	169,267	169,302	169,327	169,369	169,471	169,566	169,667	169,759	169,856	169,956	170,048
Hunterdon	24,229	24,240	24,246	24,257	24,267	24,277	24,288	24,298	24,308	24,317	24,327
Mercer	75,032	75,073	75,114	75,143	75,184	75,226	75,267	75,309	75,349	75,390	75,433
Middlesex	190,338	190,395	190,456	190,493	190,589	190,687	190,781	190,868	190,962	191,050	191,134
Monmouth	162,045	162,088	162,118	162,155	162,204	162,255	162,301	162,352	162,398	162,448	162,495
Morris	116,937	117,009	117,044	117,073	117,126	117,179	117,230	117,278	117,331	117,380	117,428
Ocean	160,416	160,472	160,496	160,528	160,574	160,618	160,662	160,704	160,745	160,787	160,825
Passaic	143,095	143,126	143,153	143,163	143,219	143,276	143,332	143,383	143,438	143,491	143,542
Somerset	66,743	66,765	66,778	66,796	66,823	66,850	66,875	66,899	66,925	66,949	66,973
Sussex	33,561	33,568	33,574	33,575	33,584	33,593	33,603	33,611	33,619	33,627	33,635
Union	143,215	143,257	143,287	143,320	143,369	143,416	143,461	143,504	143,548	143,590	143,628
Warren	23,632	23,644	23,647	23,652	23,659	23,665	23,671	23,678	23,684	23,690	23,695

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:		
	3/11	3/12	3/13	3/14	3/16	3/18	3/20
Bergen	219,942	220,070	220,146	220,183	220,415 (44,083) [10,580] {5,290}	220,640 (44,128) [10,591] {5,295}	220,867 (44,173) [10,602] {5,301}
Burlington	101,227	101,248	101,264	101,277	101,335 (20,267) [4,864] {2,432}	101,390 (20,278) [4,867] {2,433}	101,443 (20,289) [4,869] {2,435}
Camden	124,604	124,626	124,643	124,667	124,726 (24,945) [5,987] {2,993}	124,782 (24,956) [5,990] {2,995}	124,835 (24,967) [5,992] {2,996}
Essex	210,190	210,241	210,274	210,309	210,464 (42,093) [10,102] {5,051}	210,618 (42,124) [10,110] {5,055}	210,770 (42,154) [10,117] {5,058}
Gloucester	69,256	69,265	69,276	69,292	69,324 (13,865) [3,328] {1,664}	69,354 (13,871) [3,329] {1,664}	69,382 (13,876) [3,330] {1,665}
Hudson	169,267	169,302	169,327	169,369	169,566 (33,913) [8,139] {4,070}	169,759 (33,952) [8,148] {4,074}	169,956 (33,991) [8,158] {4,079}
Hunterdon	24,229	24,240	24,246	24,257	24,277 (4,855) [1,165] {583}	24,298 (4,860) [1,166] {583}	24,317 (4,863) [1,167] {584}
Mercer	75,032	75,073	75,114	75,143	75,226 (15,045) [3,611] {1,805}	75,309 (15,062) [3,615] {1,807}	75,390 (15,078) [3,619] {1,809}
Middlesex	190,338	190,395	190,456	190,493	190,687 (38,137) [9,153] {4,576}	190,868 (38,174) [9,162] {4,581}	191,050 (38,210) [9,170] {4,585}
Monmouth	162,045	162,088	162,118	162,155	162,255 (32,451) [7,788] {3,894}	162,352 (32,470) [7,793] {3,896}	162,448 (32,490) [7,798] {3,899}
Morris	116,937	117,009	117,044	117,073	117,179 (23,436) [5,625] {2,812}	117,278 (23,456) [5,629] {2,815}	117,380 (23,476) [5,634] {2,817}
Ocean	160,416	160,472	160,496	160,528	160,618 (32,124) [7,710] {3,855}	160,704 (32,141) [7,714] {3,857}	160,787 (32,157) [7,718] {3,859}
Passaic	143,095	143,126	143,153	143,163	143,276 (28,655) [6,877] {3,439}	143,383 (28,677) [6,882] {3,441}	143,491 (28,698) [6,888] {3,444}
Somerset	66,743	66,765	66,778	66,796	66,850 (13,370) [3,209] {1,604}	66,899 (13,380) [3,211] {1,606}	66,949 (13,390) [3,214] {1,607}
Sussex	33,561	33,568	33,574	33,575	33,593 (6,719) [1,612] {806}	33,611 (6,722) [1,613] {807}	33,627 (6,725) [1,614] {807}
Union	143,215	143,257	143,287	143,320	143,416 (28,683) [6,884] {3,442}	143,504 (28,701) [6,888] {3,444}	143,590 (28,718) [6,892] {3,446}
Warren	23,632	23,644	23,647	23,652	23,665 (4,733) [1,136] {568}	23,678 (4,736) [1,137] {568}	23,690 (4,738) [1,137] {569}

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.