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

Date: 3/8/22

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 3/8/22 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.

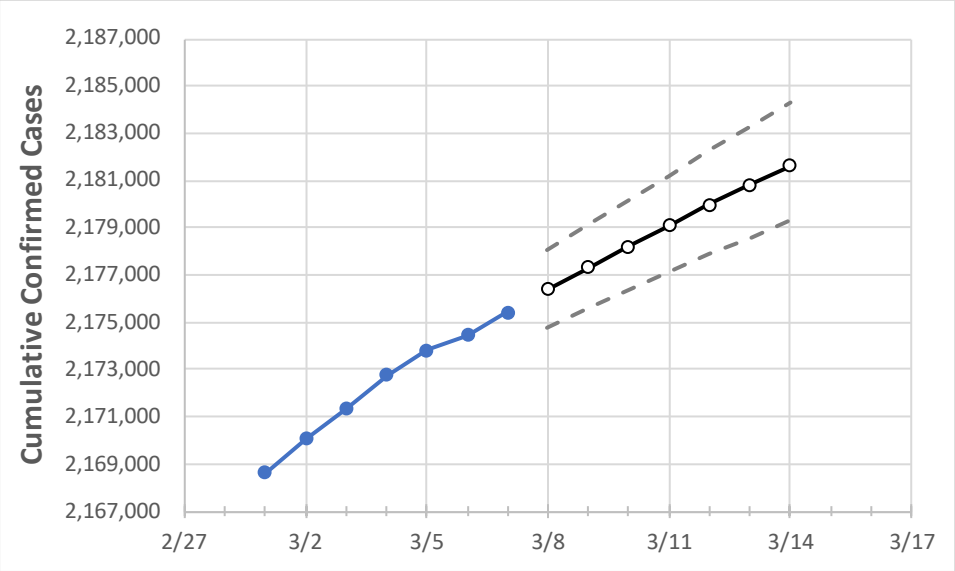
IEM's Modeling Lead

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:						
	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14
New Jersey	2,172,771	2,173,813	2,174,473	2,175,439	2,176,397	2,177,311	2,178,204	2,179,118	2,179,984	2,180,828	2,181,615

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:						
	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14
Bergen	219,036	219,161	219,245	219,360	219,470	219,583	219,690	219,794	219,903	220,008	220,104
Burlington	100,910	100,972	101,001	101,035	101,064	101,089	101,114	101,138	101,160	101,183	101,204
Camden	124,333	124,407	124,425	124,443	124,476	124,508	124,537	124,568	124,594	124,622	124,647
Essex	209,470	209,547	209,610	209,714	209,795	209,873	209,951	210,026	210,100	210,174	210,245
Gloucester	69,107	69,135	69,146	69,163	69,185	69,205	69,224	69,243	69,261	69,279	69,295
Hudson	168,413	168,508	168,564	168,748	168,853	168,964	169,064	169,167	169,266	169,371	169,471
Hunterdon	24,161	24,158	24,166	24,172	24,184	24,195	24,206	24,216	24,226	24,237	24,247
Mercer	74,741	74,794	74,820	74,848	74,878	74,908	74,937	74,966	74,995	75,021	75,048
Middlesex	189,467	189,610	189,724	189,836	189,983	190,119	190,260	190,395	190,537	190,671	190,805
Monmouth	161,644	161,691	161,716	161,754	161,806	161,857	161,902	161,949	161,994	162,039	162,080
Morris	116,516	116,573	116,618	116,649	116,696	116,742	116,786	116,828	116,871	116,912	116,953
Ocean	160,044	160,112	160,153	160,200	160,256	160,310	160,363	160,414	160,464	160,514	160,562
Passaic	142,644	142,710	142,740	142,812	142,865	142,920	142,972	143,026	143,076	143,127	143,178
Somerset	66,493	66,516	66,537	66,558	66,586	66,612	66,637	66,661	66,685	66,710	66,732
Sussex	33,476	33,488	33,498	33,517	33,532	33,547	33,562	33,576	33,589	33,603	33,617
Union	142,743	142,787	142,840	142,933	142,994	143,058	143,113	143,166	143,223	143,274	143,325
Warren	23,579	23,587	23,594	23,599	23,608	23,616	23,624	23,632	23,639	23,647	23,654

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:		
	3/4	3/5	3/6	3/7	3/9	3/11	3/13
Bergen	219,036	219,161	219,245	219,360	219,583 (43,917) [10,540] {5,270}	219,794 (43,959) [10,550] {5,275}	220,008 (44,002) [10,560] {5,280}
Burlington	100,910	100,972	101,001	101,035	101,089 (20,218) [4,852] {2,426}	101,138 (20,228) [4,855] {2,427}	101,183 (20,237) [4,857] {2,428}
Camden	124,333	124,407	124,425	124,443	124,508 (24,902) [5,976] {2,988}	124,568 (24,914) [5,979] {2,990}	124,622 (24,924) [5,982] {2,991}
Essex	209,470	209,547	209,610	209,714	209,873 (41,975) [10,074] {5,037}	210,026 (42,005) [10,081] {5,041}	210,174 (42,035) [10,088] {5,044}
Gloucester	69,107	69,135	69,146	69,163	69,205 (13,841) [3,322] {1,661}	69,243 (13,849) [3,324] {1,662}	69,279 (13,856) [3,325] {1,663}
Hudson	168,413	168,508	168,564	168,748	168,964 (33,793) [8,110] {4,055}	169,167 (33,833) [8,120] {4,060}	169,371 (33,874) [8,130] {4,065}
Hunterdon	24,161	24,158	24,166	24,172	24,195 (4,839) [1,161] {581}	24,216 (4,843) [1,162] {581}	24,237 (4,847) [1,163] {582}
Mercer	74,741	74,794	74,820	74,848	74,908 (14,982) [3,596] {1,798}	74,966 (14,993) [3,598] {1,799}	75,021 (15,004) [3,601] {1,801}
Middlesex	189,467	189,610	189,724	189,836	190,119 (38,024) [9,126] {4,563}	190,395 (38,079) [9,139] {4,569}	190,671 (38,134) [9,152] {4,576}
Monmouth	161,644	161,691	161,716	161,754	161,857 (32,371) [7,769] {3,885}	161,949 (32,390) [7,774] {3,887}	162,039 (32,408) [7,778] {3,889}
Morris	116,516	116,573	116,618	116,649	116,742 (23,348) [5,604] {2,802}	116,828 (23,366) [5,608] {2,804}	116,912 (23,382) [5,612] {2,806}
Ocean	160,044	160,112	160,153	160,200	160,310 (32,062) [7,695] {3,847}	160,414 (32,083) [7,700] {3,850}	160,514 (32,103) [7,705] {3,852}
Passaic	142,644	142,710	142,740	142,812	142,920 (28,584) [6,860] {3,430}	143,026 (28,605) [6,865] {3,433}	143,127 (28,625) [6,870] {3,435}
Somerset	66,493	66,516	66,537	66,558	66,612 (13,322) [3,197] {1,599}	66,661 (13,332) [3,200] {1,600}	66,710 (13,342) [3,202] {1,601}
Sussex	33,476	33,488	33,498	33,517	33,547 (6,709) [1,610] {805}	33,576 (6,715) [1,612] {806}	33,603 (6,721) [1,613] {806}
Union	142,743	142,787	142,840	142,933	143,058 (28,612) [6,867] {3,433}	143,166 (28,633) [6,872] {3,436}	143,274 (28,655) [6,877] {3,439}
Warren	23,579	23,587	23,594	23,599	23,616 (4,723) [1,134] {567}	23,632 (4,726) [1,134] {567}	23,647 (4,729) [1,135] {568}

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.