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

Date: 6/21/21

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 6/21/21 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.

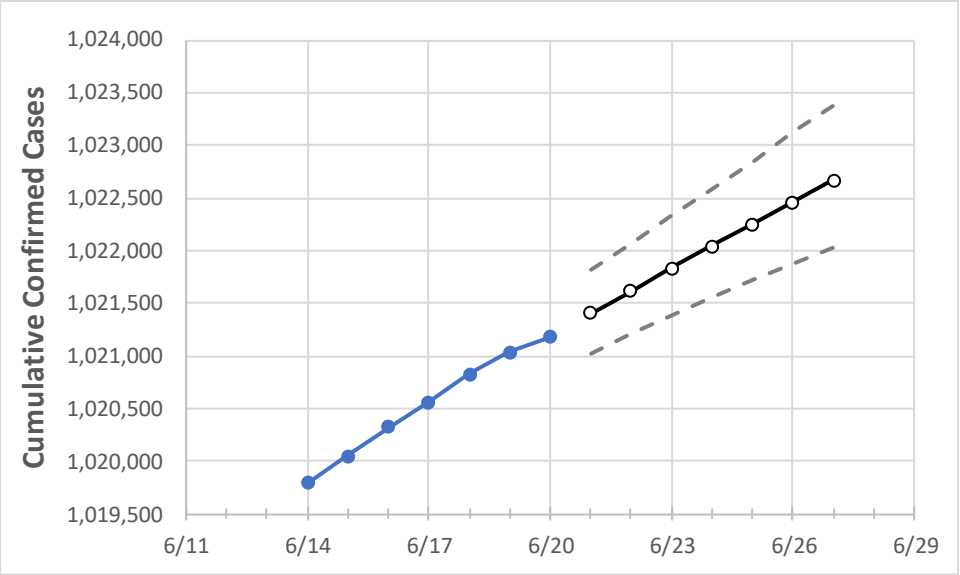
IEM's Modeling Lead

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:						
	6/17	6/18	6/19	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27
New Jersey	1,020,564	1,020,830	1,021,038	1,021,182	1,021,403	1,021,618	1,021,830	1,022,043	1,022,252	1,022,457	1,022,665

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:						
	6/17	6/18	6/19	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27
Bergen	104,653	104,680	104,694	104,711	104,732	104,754	104,775	104,796	104,817	104,837	104,857
Burlington	44,300	44,304	44,312	44,319	44,326	44,333	44,339	44,346	44,352	44,358	44,363
Camden	55,798	55,806	55,817	55,823	55,832	55,841	55,850	55,858	55,867	55,874	55,882
Essex	94,370	94,386	94,395	94,402	94,416	94,429	94,442	94,454	94,466	94,477	94,489
Gloucester	30,634	30,642	30,644	30,649	30,654	30,659	30,664	30,669	30,673	30,678	30,682
Hudson	88,264	88,271	88,291	88,303	88,324	88,344	88,365	88,386	88,407	88,428	88,449
Hunterdon	9,833	9,841	9,848	9,849	9,852	9,856	9,859	9,862	9,866	9,869	9,872
Mercer	34,122	34,128	34,134	34,136	34,141	34,147	34,152	34,157	34,162	34,167	34,172
Middlesex	92,511	92,530	92,546	92,559	92,576	92,594	92,610	92,627	92,643	92,659	92,675
Monmouth	75,701	75,739	75,769	75,795	75,823	75,852	75,882	75,911	75,942	75,974	76,006
Morris	50,268	50,280	50,291	50,293	50,302	50,311	50,319	50,328	50,336	50,344	50,353
Ocean	76,162	76,190	76,208	76,220	76,247	76,274	76,302	76,331	76,360	76,389	76,418
Passaic	73,211	73,245	73,256	73,267	73,288	73,309	73,329	73,350	73,371	73,391	73,412
Somerset	30,138	30,152	30,161	30,166	30,177	30,188	30,199	30,210	30,222	30,234	30,246
Sussex	14,050	14,061	14,069	14,072	14,077	14,082	14,087	14,093	14,098	14,103	14,109
Union	71,638	71,647	71,654	71,655	71,667	71,678	71,690	71,700	71,711	71,721	71,731
Warren	10,001	10,005	10,010	10,014	10,016	10,018	10,020	10,022	10,023	10,025	10,027

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:		
	6/17	6/18	6/19	6/20	6/22	6/24	6/26
Bergen	104,653	104,680	104,694	104,711	104,754 (20,951) [5,028] {2,514}	104,796 (20,959) [5,030] {2,515}	104,837 (20,967) [5,032] {2,516}
Burlington	44,300	44,304	44,312	44,319	44,333 (8,867) [2,128] {1,064}	44,346 (8,869) [2,129] {1,064}	44,358 (8,872) [2,129] {1,065}
Camden	55,798	55,806	55,817	55,823	55,841 (11,168) [2,680] {1,340}	55,858 (11,172) [2,681] {1,341}	55,874 (11,175) [2,682] {1,341}
Essex	94,370	94,386	94,395	94,402	94,429 (18,886) [4,533] {2,266}	94,454 (18,891) [4,534] {2,267}	94,477 (18,895) [4,535] {2,267}
Gloucester	30,634	30,642	30,644	30,649	30,659 (6,132) [1,472] {736}	30,669 (6,134) [1,472] {736}	30,678 (6,136) [1,473] {736}
Hudson	88,264	88,271	88,291	88,303	88,344 (17,669) [4,241] {2,120}	88,386 (17,677) [4,243] {2,121}	88,428 (17,686) [4,245] {2,122}
Hunterdon	9,833	9,841	9,848	9,849	9,856 (1,971) [473] {237}	9,862 (1,972) [473] {237}	9,869 (1,974) [474] {237}
Mercer	34,122	34,128	34,134	34,136	34,147 (6,829) [1,639] {820}	34,157 (6,831) [1,640] {820}	34,167 (6,833) [1,640] {820}
Middlesex	92,511	92,530	92,546	92,559	92,594 (18,519) [4,444] {2,222}	92,627 (18,525) [4,446] {2,223}	92,659 (18,532) [4,448] {2,224}
Monmouth	75,701	75,739	75,769	75,795	75,852 (15,170) [3,641] {1,820}	75,911 (15,182) [3,644] {1,822}	75,974 (15,195) [3,647] {1,823}
Morris	50,268	50,280	50,291	50,293	50,311 (10,062) [2,415] {1,207}	50,328 (10,066) [2,416] {1,208}	50,344 (10,069) [2,417] {1,208}
Ocean	76,162	76,190	76,208	76,220	76,274 (15,255) [3,661] {1,831}	76,331 (15,266) [3,664] {1,832}	76,389 (15,278) [3,667] {1,833}
Passaic	73,211	73,245	73,256	73,267	73,309 (14,662) [3,519] {1,759}	73,350 (14,670) [3,521] {1,760}	73,391 (14,678) [3,523] {1,761}
Somerset	30,138	30,152	30,161	30,166	30,188 (6,038) [1,449] {725}	30,210 (6,042) [1,450] {725}	30,234 (6,047) [1,451] {726}
Sussex	14,050	14,061	14,069	14,072	14,082 (2,816) [676] {338}	14,093 (2,819) [676] {338}	14,103 (2,821) [677] {338}
Union	71,638	71,647	71,654	71,655	71,678 (14,336) [3,441] {1,720}	71,700 (14,340) [3,442] {1,721}	71,721 (14,344) [3,443] {1,721}
Warren	10,001	10,005	10,010	10,014	10,018 (2,004) [481] {240}	10,022 (2,004) [481] {241}	10,025 (2,005) [481] {241}

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.