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

Date: 2/23/22

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 2/23/22 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.

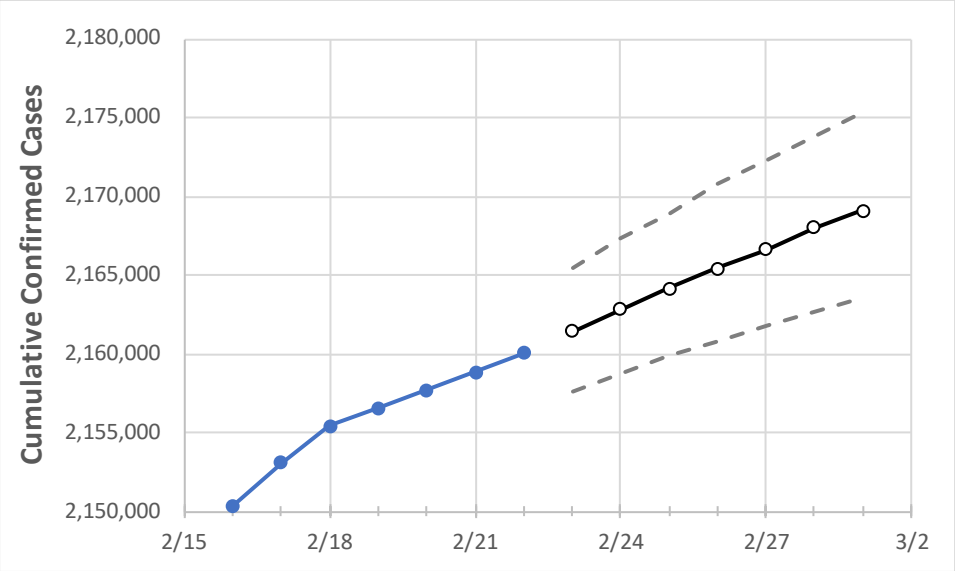
IEM's Modeling Lead

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
New Jersey	2,156,556	2,157,712	2,158,867	2,160,023	2,161,440	2,162,849	2,164,146	2,165,410	2,166,632	2,167,988	2,169,073

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Bergen	217,251	217,377	217,504	217,630	217,780	217,916	218,055	218,183	218,316	218,444	218,563
Burlington	100,344	100,395	100,446	100,497	100,582	100,654	100,735	100,808	100,875	100,943	101,007
Camden	123,666	123,723	123,780	123,837	123,908	123,973	124,038	124,099	124,160	124,215	124,271
Essex	208,163	208,260	208,358	208,455	208,567	208,674	208,775	208,880	208,980	209,087	209,177
Gloucester	68,673	68,710	68,748	68,785	68,824	68,860	68,894	68,928	68,959	68,992	69,019
Hudson	166,905	167,014	167,124	167,233	167,347	167,458	167,560	167,668	167,777	167,882	167,977
Hunterdon	23,965	23,975	23,986	23,996	24,011	24,024	24,038	24,051	24,063	24,076	24,086
Mercer	74,234	74,272	74,309	74,347	74,400	74,449	74,500	74,546	74,592	74,637	74,681
Middlesex	187,396	187,523	187,649	187,775	187,913	188,047	188,179	188,310	188,437	188,557	188,673
Monmouth	160,683	160,751	160,818	160,886	160,967	161,042	161,112	161,183	161,250	161,315	161,376
Morris	115,681	115,746	115,811	115,876	115,952	116,023	116,091	116,164	116,228	116,298	116,363
Ocean	159,086	159,159	159,231	159,304	159,378	159,452	159,518	159,582	159,646	159,708	159,764
Passaic	141,824	141,866	141,908	141,950	142,014	142,079	142,136	142,191	142,247	142,303	142,356
Somerset	65,974	66,023	66,071	66,119	66,164	66,206	66,248	66,289	66,329	66,369	66,407
Sussex	33,216	33,234	33,251	33,269	33,289	33,309	33,328	33,346	33,363	33,381	33,397
Union	141,469	141,552	141,636	141,719	141,937	142,168	142,383	142,592	142,841	143,043	143,275
Warren	23,413	23,425	23,438	23,450	23,464	23,478	23,491	23,504	23,517	23,529	23,541

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:		
	2/19	2/20	2/21	2/22	2/24	2/26	2/28
Bergen	217,251	217,377	217,504	217,630	217,916 (43,583) [10,460] {5,230}	218,183 (43,637) [10,473] {5,236}	218,444 (43,689) [10,485] {5,243}
Burlington	100,344	100,395	100,446	100,497	100,654 (20,131) [4,831] {2,416}	100,808 (20,162) [4,839] {2,419}	100,943 (20,189) [4,845] {2,423}
Camden	123,666	123,723	123,780	123,837	123,973 (24,795) [5,951] {2,975}	124,099 (24,820) [5,957] {2,978}	124,215 (24,843) [5,962] {2,981}
Essex	208,163	208,260	208,358	208,455	208,674 (41,735) [10,016] {5,008}	208,880 (41,776) [10,026] {5,013}	209,087 (41,817) [10,036] {5,018}
Gloucester	68,673	68,710	68,748	68,785	68,860 (13,772) [3,305] {1,653}	68,928 (13,786) [3,309] {1,654}	68,992 (13,798) [3,312] {1,656}
Hudson	166,905	167,014	167,124	167,233	167,458 (33,492) [8,038] {4,019}	167,668 (33,534) [8,048] {4,024}	167,882 (33,576) [8,058] {4,029}
Hunterdon	23,965	23,975	23,986	23,996	24,024 (4,805) [1,153] {577}	24,051 (4,810) [1,154] {577}	24,076 (4,815) [1,156] {578}
Mercer	74,234	74,272	74,309	74,347	74,449 (14,890) [3,574] {1,787}	74,546 (14,909) [3,578] {1,789}	74,637 (14,927) [3,583] {1,791}
Middlesex	187,396	187,523	187,649	187,775	188,047 (37,609) [9,026] {4,513}	188,310 (37,662) [9,039] {4,519}	188,557 (37,711) [9,051] {4,525}
Monmouth	160,683	160,751	160,818	160,886	161,042 (32,208) [7,730] {3,865}	161,183 (32,237) [7,737] {3,868}	161,315 (32,263) [7,743] {3,872}
Morris	115,681	115,746	115,811	115,876	116,023 (23,205) [5,569] {2,785}	116,164 (23,233) [5,576] {2,788}	116,298 (23,260) [5,582] {2,791}
Ocean	159,086	159,159	159,231	159,304	159,452 (31,890) [7,654] {3,827}	159,582 (31,916) [7,660] {3,830}	159,708 (31,942) [7,666] {3,833}
Passaic	141,824	141,866	141,908	141,950	142,079 (28,416) [6,820] {3,410}	142,191 (28,438) [6,825] {3,413}	142,303 (28,461) [6,831] {3,415}
Somerset	65,974	66,023	66,071	66,119	66,206 (13,241) [3,178] {1,589}	66,289 (13,258) [3,182] {1,591}	66,369 (13,274) [3,186] {1,593}
Sussex	33,216	33,234	33,251	33,269	33,309 (6,662) [1,599] {799}	33,346 (6,669) [1,601] {800}	33,381 (6,676) [1,602] {801}
Union	141,469	141,552	141,636	141,719	142,168 (28,434) [6,824] {3,412}	142,592 (28,518) [6,844] {3,422}	143,043 (28,609) [6,866] {3,433}
Warren	23,413	23,425	23,438	23,450	23,478 (4,696) [1,127] {563}	23,504 (4,701) [1,128] {564}	23,529 (4,706) [1,129] {565}

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.