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

Date: 3/26/21

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 3/26/21 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.

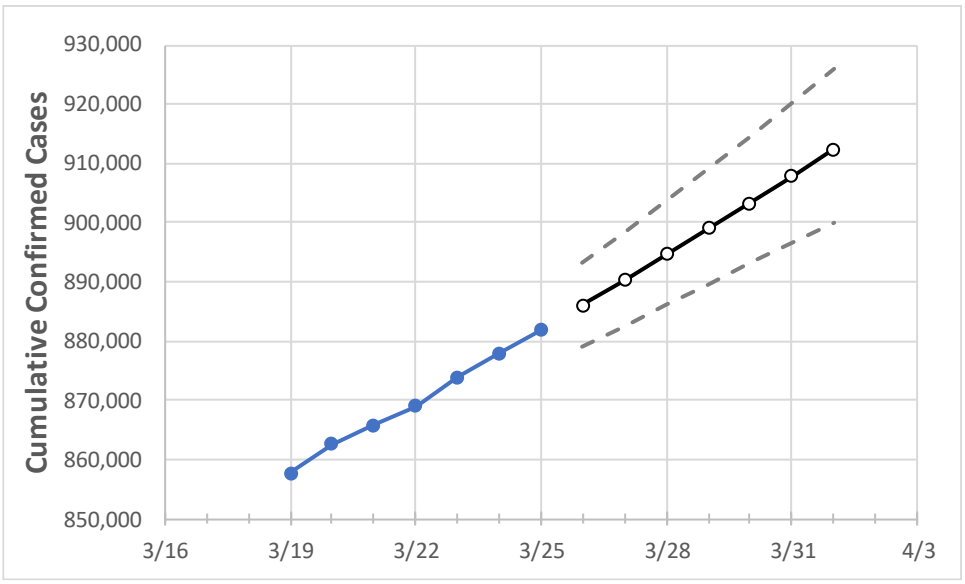
IEM's Modeling Lead

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:						
	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1
New Jersey	869,037	873,840	877,936	881,882	886,117	890,331	894,655	898,996	903,359	907,805	912,381

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:						
	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1
Bergen	86,830	87,348	87,799	88,162	88,615	89,065	89,530	89,994	90,462	90,923	91,394
Burlington	38,258	38,441	38,595	38,780	38,944	39,109	39,277	39,450	39,625	39,803	39,978
Camden	47,161	47,320	47,502	47,701	47,879	48,060	48,244	48,437	48,628	48,823	49,024
Essex	80,999	81,432	81,875	82,264	82,682	83,106	83,531	83,963	84,404	84,851	85,304
Gloucester	25,911	26,038	26,133	26,259	26,369	26,479	26,591	26,705	26,822	26,941	27,061
Hudson	76,296	76,769	77,073	77,390	77,741	78,099	78,459	78,816	79,173	79,533	79,898
Hunterdon	7,783	7,840	7,895	7,929	7,975	8,022	8,068	8,114	8,161	8,208	8,256
Mercer	29,814	29,946	30,042	30,152	30,256	30,361	30,466	30,572	30,678	30,786	30,894
Middlesex	79,710	80,214	80,537	80,900	81,300	81,704	82,113	82,519	82,929	83,345	83,772
Monmouth	64,489	64,966	65,307	65,718	66,115	66,517	66,913	67,314	67,729	68,149	68,573
Morris	42,784	43,032	43,251	43,480	43,761	44,050	44,334	44,626	44,927	45,220	45,516
Ocean	65,308	65,619	66,013	66,291	66,618	66,949	67,281	67,615	67,954	68,291	68,626
Passaic	61,795	62,064	62,328	62,571	62,821	63,075	63,324	63,584	63,836	64,089	64,354
Somerset	25,373	25,560	25,699	25,789	25,925	26,062	26,201	26,342	26,487	26,634	26,782
Sussex	10,565	10,644	10,767	10,882	10,984	11,091	11,200	11,315	11,431	11,552	11,677
Union	61,790	62,044	62,285	62,496	62,738	62,978	63,219	63,464	63,713	63,960	64,205
Warren	7,994	8,061	8,103	8,157	8,214	8,270	8,328	8,388	8,448	8,510	8,572

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:		
	3/22	3/23	3/24	3/25	3/27	3/29	3/31
Bergen	86,830	87,348	87,799	88,162	89,065 (17,813) [4,275] {2,138}	89,994 (17,999) [4,320] {2,160}	90,923 (18,185) [4,364] {2,182}
Burlington	38,258	38,441	38,595	38,780	39,109 (7,822) [1,877] {939}	39,450 (7,890) [1,894] {947}	39,803 (7,961) [1,911] {955}
Camden	47,161	47,320	47,502	47,701	48,060 (9,612) [2,307] {1,153}	48,437 (9,687) [2,325] {1,162}	48,823 (9,765) [2,343] {1,172}
Essex	80,999	81,432	81,875	82,264	83,106 (16,621) [3,989] {1,995}	83,963 (16,793) [4,030] {2,015}	84,851 (16,970) [4,073] {2,036}
Gloucester	25,911	26,038	26,133	26,259	26,479 (5,296) [1,271] {635}	26,705 (5,341) [1,282] {641}	26,941 (5,388) [1,293] {647}
Hudson	76,296	76,769	77,073	77,390	78,099 (15,620) [3,749] {1,874}	78,816 (15,763) [3,783] {1,892}	79,533 (15,907) [3,818] {1,909}
Hunterdon	7,783	7,840	7,895	7,929	8,022 (1,604) [385] {193}	8,114 (1,623) [389] {195}	8,208 (1,642) [394] {197}
Mercer	29,814	29,946	30,042	30,152	30,361 (6,072) [1,457] {729}	30,572 (6,114) [1,467] {734}	30,786 (6,157) [1,478] {739}
Middlesex	79,710	80,214	80,537	80,900	81,704 (16,341) [3,922] {1,961}	82,519 (16,504) [3,961] {1,980}	83,345 (16,669) [4,001] {2,000}
Monmouth	64,489	64,966	65,307	65,718	66,517 (13,303) [3,193] {1,596}	67,314 (13,463) [3,231] {1,616}	68,149 (13,630) [3,271] {1,636}
Morris	42,784	43,032	43,251	43,480	44,050 (8,810) [2,114] {1,057}	44,626 (8,925) [2,142] {1,071}	45,220 (9,044) [2,171] {1,085}
Ocean	65,308	65,619	66,013	66,291	66,949 (13,390) [3,214] {1,607}	67,615 (13,523) [3,246] {1,623}	68,291 (13,658) [3,278] {1,639}
Passaic	61,795	62,064	62,328	62,571	63,075 (12,615) [3,028] {1,514}	63,584 (12,717) [3,052] {1,526}	64,089 (12,818) [3,076] {1,538}
Somerset	25,373	25,560	25,699	25,789	26,062 (5,212) [1,251] {625}	26,342 (5,268) [1,264] {632}	26,634 (5,327) [1,278] {639}
Sussex	10,565	10,644	10,767	10,882	11,091 (2,218) [532] {266}	11,315 (2,263) [543] {272}	11,552 (2,310) [555] {277}
Union	61,790	62,044	62,285	62,496	62,978 (12,596) [3,023] {1,511}	63,464 (12,693) [3,046] {1,523}	63,960 (12,792) [3,070] {1,535}
Warren	7,994	8,061	8,103	8,157	8,270 (1,654) [397] {198}	8,388 (1,678) [403] {201}	8,510 (1,702) [408] {204}

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.