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

Date: 1/11/21

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 1/11/21 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.

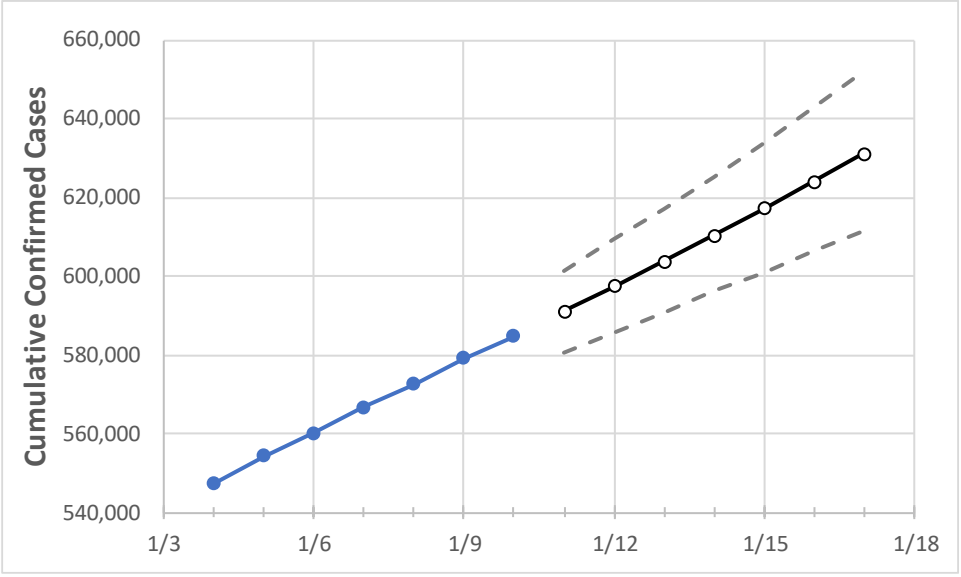
IEM's Modeling Lead

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:						
	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17
New Jersey	566,761	572,692	579,250	584,828	591,011	597,265	603,716	610,388	617,099	624,039	631,123

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:						
	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17
Bergen	55,352	55,861	56,390	56,890	57,434	57,996	58,556	59,134	59,725	60,331	60,944
Burlington	25,370	25,643	25,949	26,167	26,476	26,780	27,087	27,397	27,701	28,006	28,322
Camden	33,488	33,883	34,294	34,601	34,956	35,328	35,699	36,077	36,451	36,843	37,240
Essex	53,976	54,443	54,999	55,454	55,947	56,454	56,970	57,503	58,039	58,588	59,149
Gloucester	17,387	17,618	17,900	18,062	18,294	18,531	18,778	19,032	19,295	19,561	19,832
Hudson	50,648	51,091	51,668	52,036	52,514	52,999	53,505	53,996	54,522	55,048	55,578
Hunterdon	4,497	4,572	4,651	4,714	4,782	4,852	4,925	5,000	5,077	5,154	5,235
Mercer	20,926	21,103	21,320	21,515	21,704	21,895	22,092	22,291	22,498	22,703	22,914
Middlesex	51,429	52,004	52,627	53,218	53,782	54,363	54,945	55,530	56,154	56,757	57,361
Monmouth	37,974	38,641	39,157	39,698	40,259	40,831	41,413	42,021	42,632	43,272	43,918
Morris	25,250	25,530	25,880	26,149	26,444	26,747	27,052	27,368	27,691	28,023	28,350
Ocean	39,117	39,667	40,126	40,548	41,038	41,551	42,062	42,578	43,107	43,649	44,193
Passaic	44,942	45,148	45,386	45,642	45,888	46,136	46,389	46,630	46,882	47,128	47,379
Somerset	16,287	16,409	16,622	16,772	16,943	17,115	17,291	17,473	17,662	17,850	18,046
Sussex	5,636	5,740	5,894	6,027	6,148	6,273	6,403	6,535	6,674	6,815	6,965
Union	43,534	43,843	44,264	44,664	45,018	45,385	45,758	46,137	46,529	46,924	47,331
Warren	4,715	4,780	4,854	4,929	4,993	5,059	5,124	5,192	5,261	5,331	5,403

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:		
	1/7	1/8	1/9	1/10	1/12	1/14	1/16
Bergen	55,352	55,861	56,390	56,890	57,996 (11,599) [2,784] {1,392}	59,134 (11,827) [2,838] {1,419}	60,331 (12,066) [2,896] {1,448}
Burlington	25,370	25,643	25,949	26,167	26,780 (5,356) [1,285] {643}	27,397 (5,479) [1,315] {658}	28,006 (5,601) [1,344] {672}
Camden	33,488	33,883	34,294	34,601	35,328 (7,066) [1,696] {848}	36,077 (7,215) [1,732] {866}	36,843 (7,369) [1,768] {884}
Essex	53,976	54,443	54,999	55,454	56,454 (11,291) [2,710] {1,355}	57,503 (11,501) [2,760] {1,380}	58,588 (11,718) [2,812] {1,406}
Gloucester	17,387	17,618	17,900	18,062	18,531 (3,706) [889] {445}	19,032 (3,806) [914] {457}	19,561 (3,912) [939] {469}
Hudson	50,648	51,091	51,668	52,036	52,999 (10,600) [2,544] {1,272}	53,996 (10,799) [2,592] {1,296}	55,048 (11,010) [2,642] {1,321}
Hunterdon	4,497	4,572	4,651	4,714	4,852 (970) [233] {116}	5,000 (1,000) [240] {120}	5,154 (1,031) [247] {124}
Mercer	20,926	21,103	21,320	21,515	21,895 (4,379) [1,051] {525}	22,291 (4,458) [1,070] {535}	22,703 (4,541) [1,090] {545}
Middlesex	51,429	52,004	52,627	53,218	54,363 (10,873) [2,609] {1,305}	55,530 (11,106) [2,665] {1,333}	56,757 (11,351) [2,724] {1,362}
Monmouth	37,974	38,641	39,157	39,698	40,831 (8,166) [1,960] {980}	42,021 (8,404) [2,017] {1,009}	43,272 (8,654) [2,077] {1,039}
Morris	25,250	25,530	25,880	26,149	26,747 (5,349) [1,284] {642}	27,368 (5,474) [1,314] {657}	28,023 (5,605) [1,345] {673}
Ocean	39,117	39,667	40,126	40,548	41,551 (8,310) [1,994] {997}	42,578 (8,516) [2,044] {1,022}	43,649 (8,730) [2,095] {1,048}
Passaic	44,942	45,148	45,386	45,642	46,136 (9,227) [2,215] {1,107}	46,630 (9,326) [2,238] {1,119}	47,128 (9,426) [2,262] {1,131}
Somerset	16,287	16,409	16,622	16,772	17,115 (3,423) [821] {411}	17,473 (3,495) [839] {419}	17,850 (3,570) [857] {428}
Sussex	5,636	5,740	5,894	6,027	6,273 (1,255) [301] {151}	6,535 (1,307) [314] {157}	6,815 (1,363) [327] {164}
Union	43,534	43,843	44,264	44,664	45,385 (9,077) [2,179] {1,089}	46,137 (9,227) [2,215] {1,107}	46,924 (9,385) [2,252] {1,126}
Warren	4,715	4,780	4,854	4,929	5,059 (1,012) [243] {121}	5,192 (1,038) [249] {125}	5,331 (1,066) [256] {128}

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.