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

Date: 1/15/21

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 1/15/21 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.

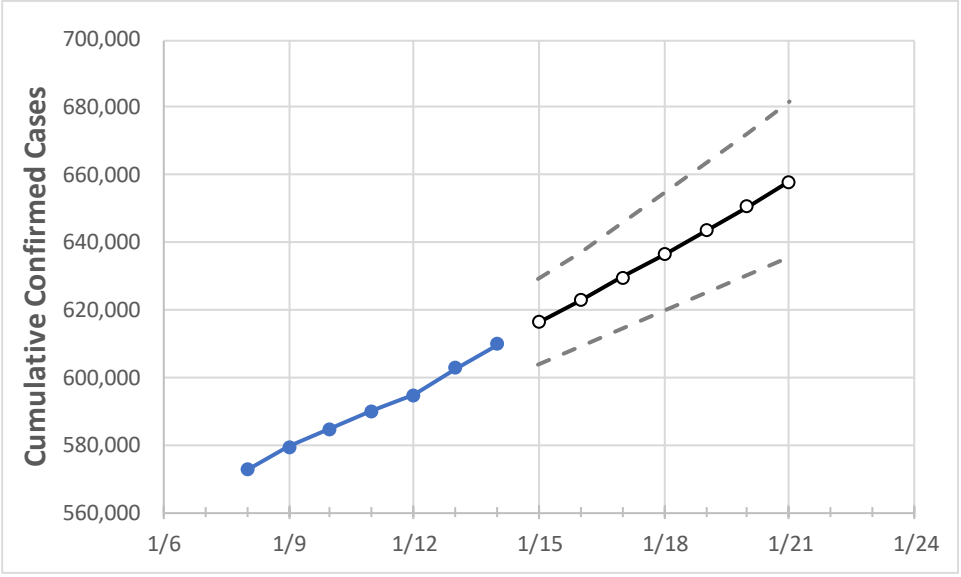
IEM's Modeling Lead

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:						
	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20	1/21
New Jersey	590,162	594,749	602,629	609,721	616,174	622,776	629,589	636,460	643,530	650,648	657,884

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:						
	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20	1/21
Bergen	57,259	57,609	58,354	59,102	59,697	60,290	60,898	61,530	62,149	62,793	63,456
Burlington	26,361	26,782	27,200	27,464	27,778	28,095	28,421	28,754	29,083	29,414	29,754
Camden	34,802	35,012	35,457	35,867	36,219	36,573	36,928	37,280	37,641	38,010	38,373
Essex	55,789	56,168	56,824	57,511	58,036	58,557	59,104	59,659	60,230	60,818	61,426
Gloucester	18,191	18,393	18,650	18,882	19,118	19,352	19,587	19,829	20,084	20,329	20,589
Hudson	52,546	52,954	53,632	54,256	54,816	55,384	55,950	56,536	57,119	57,726	58,348
Hunterdon	4,764	4,833	4,952	5,011	5,090	5,170	5,251	5,335	5,423	5,513	5,605
Mercer	21,652	21,849	22,080	22,256	22,458	22,664	22,868	23,081	23,292	23,504	23,720
Middlesex	53,852	54,224	55,035	55,710	56,291	56,884	57,494	58,108	58,718	59,334	59,966
Monmouth	40,185	40,500	41,117	41,736	42,308	42,887	43,478	44,071	44,667	45,287	45,928
Morris	26,488	26,691	27,020	27,302	27,613	27,933	28,260	28,591	28,931	29,275	29,626
Ocean	41,075	41,410	42,071	42,700	43,230	43,762	44,309	44,860	45,435	46,015	46,598
Passaic	45,892	46,104	46,517	46,888	47,181	47,479	47,765	48,058	48,353	48,661	48,967
Somerset	16,926	17,056	17,290	17,515	17,705	17,900	18,100	18,306	18,519	18,737	18,957
Sussex	6,108	6,185	6,288	6,399	6,516	6,635	6,759	6,884	7,015	7,149	7,283
Union	45,006	45,409	45,916	46,352	46,788	47,240	47,707	48,190	48,680	49,191	49,722
Warren	4,999	5,038	5,120	5,193	5,260	5,328	5,396	5,466	5,537	5,608	5,683

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:		
	1/11	1/12	1/13	1/14	1/16	1/18	1/20
Bergen	57,259	57,609	58,354	59,102	60,290 (12,058) [2,894] {1,447}	61,530 (12,306) [2,953] {1,477}	62,793 (12,559) [3,014] {1,507}
Burlington	26,361	26,782	27,200	27,464	28,095 (5,619) [1,349] {674}	28,754 (5,751) [1,380] {690}	29,414 (5,883) [1,412] {706}
Camden	34,802	35,012	35,457	35,867	36,573 (7,315) [1,756] {878}	37,280 (7,456) [1,789] {895}	38,010 (7,602) [1,824] {912}
Essex	55,789	56,168	56,824	57,511	58,557 (11,711) [2,811] {1,405}	59,659 (11,932) [2,864] {1,432}	60,818 (12,164) [2,919] {1,460}
Gloucester	18,191	18,393	18,650	18,882	19,352 (3,870) [929] {464}	19,829 (3,966) [952] {476}	20,329 (4,066) [976] {488}
Hudson	52,546	52,954	53,632	54,256	55,384 (11,077) [2,658] {1,329}	56,536 (11,307) [2,714] {1,357}	57,726 (11,545) [2,771] {1,385}
Hunterdon	4,764	4,833	4,952	5,011	5,170 (1,034) [248] {124}	5,335 (1,067) [256] {128}	5,513 (1,103) [265] {132}
Mercer	21,652	21,849	22,080	22,256	22,664 (4,533) [1,088] {544}	23,081 (4,616) [1,108] {554}	23,504 (4,701) [1,128] {564}
Middlesex	53,852	54,224	55,035	55,710	56,884 (11,377) [2,730] {1,365}	58,108 (11,622) [2,789] {1,395}	59,334 (11,867) [2,848] {1,424}
Monmouth	40,185	40,500	41,117	41,736	42,887 (8,577) [2,059] {1,029}	44,071 (8,814) [2,115] {1,058}	45,287 (9,057) [2,174] {1,087}
Morris	26,488	26,691	27,020	27,302	27,933 (5,587) [1,341] {670}	28,591 (5,718) [1,372] {686}	29,275 (5,855) [1,405] {703}
Ocean	41,075	41,410	42,071	42,700	43,762 (8,752) [2,101] {1,050}	44,860 (8,972) [2,153] {1,077}	46,015 (9,203) [2,209] {1,104}
Passaic	45,892	46,104	46,517	46,888	47,479 (9,496) [2,279] {1,140}	48,058 (9,612) [2,307] {1,153}	48,661 (9,732) [2,336] {1,168}
Somerset	16,926	17,056	17,290	17,515	17,900 (3,580) [859] {430}	18,306 (3,661) [879] {439}	18,737 (3,747) [899] {450}
Sussex	6,108	6,185	6,288	6,399	6,635 (1,327) [318] {159}	6,884 (1,377) [330] {165}	7,149 (1,430) [343] {172}
Union	45,006	45,409	45,916	46,352	47,240 (9,448) [2,268] {1,134}	48,190 (9,638) [2,313] {1,157}	49,191 (9,838) [2,361] {1,181}
Warren	4,999	5,038	5,120	5,193	5,328 (1,066) [256] {128}	5,466 (1,093) [262] {131}	5,608 (1,122) [269] {135}

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.