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

Date: 3/12/21

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 3/12/21 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.

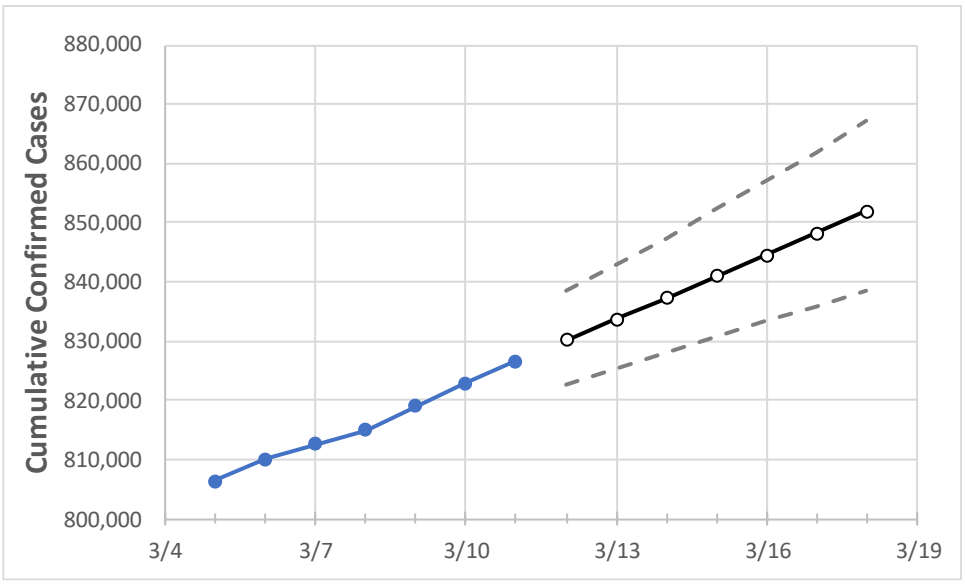
IEM's Modeling Lead

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:						
	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18
New Jersey	814,916	819,042	822,817	826,632	830,158	833,711	837,241	840,928	844,545	848,202	851,865

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:						
	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18
Bergen	80,605	81,125	81,535	82,037	82,460	82,880	83,310	83,741	84,168	84,594	85,016
Burlington	36,326	36,443	36,584	36,738	36,868	36,998	37,129	37,260	37,394	37,527	37,665
Camden	45,073	45,231	45,363	45,497	45,618	45,739	45,859	45,978	46,098	46,216	46,336
Essex	75,967	76,301	76,640	77,009	77,320	77,635	77,956	78,275	78,589	78,902	79,226
Gloucester	24,684	24,770	24,888	24,976	25,052	25,129	25,206	25,283	25,361	25,439	25,517
Hudson	71,635	71,969	72,300	72,644	72,957	73,279	73,605	73,923	74,250	74,565	74,883
Hunterdon	7,199	7,244	7,275	7,309	7,343	7,379	7,414	7,449	7,484	7,518	7,555
Mercer	28,463	28,570	28,685	28,766	28,857	28,948	29,039	29,129	29,218	29,306	29,394
Middlesex	74,783	75,169	75,461	75,779	76,070	76,366	76,664	76,967	77,267	77,566	77,869
Monmouth	59,340	59,856	60,229	60,556	60,925	61,296	61,671	62,055	62,441	62,837	63,239
Morris	39,106	39,332	39,575	39,792	40,019	40,247	40,479	40,712	40,951	41,197	41,443
Ocean	60,887	61,210	61,576	61,859	62,155	62,453	62,752	63,055	63,362	63,667	63,970
Passaic	58,484	58,725	58,987	59,205	59,439	59,677	59,920	60,168	60,416	60,668	60,929
Somerset	23,603	23,756	23,905	24,034	24,149	24,268	24,385	24,504	24,624	24,746	24,871
Sussex	9,514	9,608	9,660	9,762	9,831	9,904	9,977	10,052	10,131	10,215	10,297
Union	58,472	58,754	58,936	59,144	59,376	59,607	59,842	60,084	60,319	60,557	60,796
Warren	7,360	7,392	7,425	7,453	7,490	7,527	7,564	7,601	7,638	7,675	7,712

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:		
	3/8	3/9	3/10	3/11	3/13	3/15	3/17
Bergen	80,605	81,125	81,535	82,037	82,880 (16,576) [3,978] {1,989}	83,741 (16,748) [4,020] {2,010}	84,594 (16,919) [4,061] {2,030}
Burlington	36,326	36,443	36,584	36,738	36,998 (7,400) [1,776] {888}	37,260 (7,452) [1,788] {894}	37,527 (7,505) [1,801] {901}
Camden	45,073	45,231	45,363	45,497	45,739 (9,148) [2,195] {1,098}	45,978 (9,196) [2,207] {1,103}	46,216 (9,243) [2,218] {1,109}
Essex	75,967	76,301	76,640	77,009	77,635 (15,527) [3,726] {1,863}	78,275 (15,655) [3,757] {1,879}	78,902 (15,780) [3,787] {1,894}
Gloucester	24,684	24,770	24,888	24,976	25,129 (5,026) [1,206] {603}	25,283 (5,057) [1,214] {607}	25,439 (5,088) [1,221] {611}
Hudson	71,635	71,969	72,300	72,644	73,279 (14,656) [3,517] {1,759}	73,923 (14,785) [3,548] {1,774}	74,565 (14,913) [3,579] {1,790}
Hunterdon	7,199	7,244	7,275	7,309	7,379 (1,476) [354] {177}	7,449 (1,490) [358] {179}	7,518 (1,504) [361] {180}
Mercer	28,463	28,570	28,685	28,766	28,948 (5,790) [1,389] {695}	29,129 (5,826) [1,398] {699}	29,306 (5,861) [1,407] {703}
Middlesex	74,783	75,169	75,461	75,779	76,366 (15,273) [3,666] {1,833}	76,967 (15,393) [3,694] {1,847}	77,566 (15,513) [3,723] {1,862}
Monmouth	59,340	59,856	60,229	60,556	61,296 (12,259) [2,942] {1,471}	62,055 (12,411) [2,979] {1,489}	62,837 (12,567) [3,016] {1,508}
Morris	39,106	39,332	39,575	39,792	40,247 (8,049) [1,932] {966}	40,712 (8,142) [1,954] {977}	41,197 (8,239) [1,977] {989}
Ocean	60,887	61,210	61,576	61,859	62,453 (12,491) [2,998] {1,499}	63,055 (12,611) [3,027] {1,513}	63,667 (12,733) [3,056] {1,528}
Passaic	58,484	58,725	58,987	59,205	59,677 (11,935) [2,865] {1,432}	60,168 (12,034) [2,888] {1,444}	60,668 (12,134) [2,912] {1,456}
Somerset	23,603	23,756	23,905	24,034	24,268 (4,854) [1,165] {582}	24,504 (4,901) [1,176] {588}	24,746 (4,949) [1,188] {594}
Sussex	9,514	9,608	9,660	9,762	9,904 (1,981) [475] {238}	10,052 (2,010) [482] {241}	10,215 (2,043) [490] {245}
Union	58,472	58,754	58,936	59,144	59,607 (11,921) [2,861] {1,431}	60,084 (12,017) [2,884] {1,442}	60,557 (12,111) [2,907] {1,453}
Warren	7,360	7,392	7,425	7,453	7,527 (1,505) [361] {181}	7,601 (1,520) [365] {182}	7,675 (1,535) [368] {184}

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.