IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/11/21

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 <u>not</u> 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 3/11/21 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
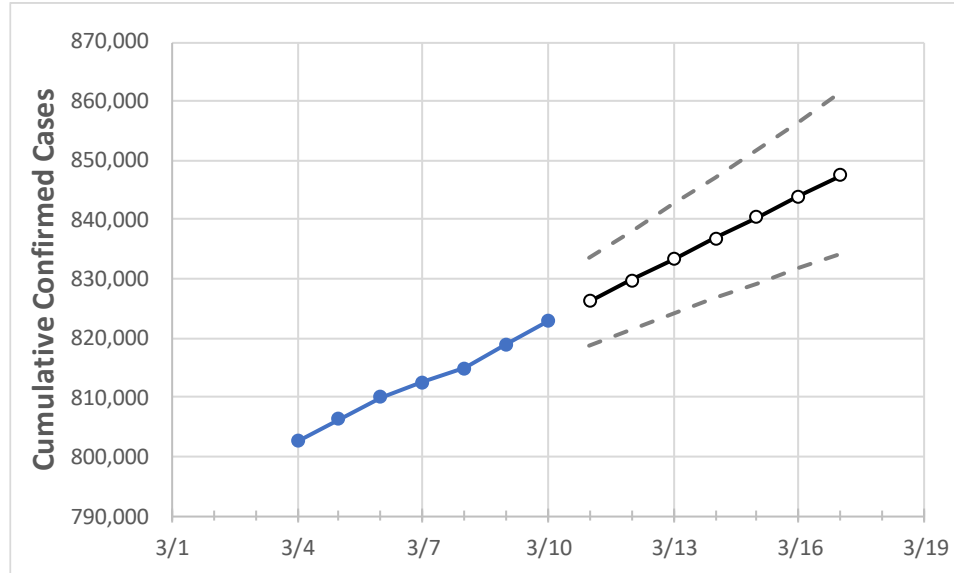
	Actual Confirmed Cases On:				Projected Cases For:						
	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17
New Jersey	812,609	814,916	819,042	822,817	826,281	829,829	833,379	836,876	840,410	843,980	847,565

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:						
	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17
Bergen	80,339	80,605	81,125	81,535	81,937	82,341	82,742	83,150	83,542	83,951	84,369
Burlington	36,206	36,326	36,443	36,584	36,709	36,834	36,959	37,087	37,213	37,341	37,469
Camden	44,972	45,073	45,231	45,363	45,485	45,605	45,722	45,842	45,959	46,076	46,196
Essex	75,772	75,967	76,301	76,640	76,935	77,229	77,520	77,811	78,101	78,392	78,686
Gloucester	24,640	24,684	24,770	24,888	24,962	25,035	25,109	25,185	25,257	25,333	25,408
Hudson	71,406	71,635	71,969	72,300	72,605	72,910	73,213	73,519	73,826	74,138	74,442
Hunterdon	7,165	7,199	7,244	7,275	7,310	7,345	7,380	7,415	7,450	7,486	7,521
Mercer	28,400	28,463	28,570	28,685	28,778	28,870	28,963	29,056	29,150	29,244	29,338
Middlesex	74,641	74,783	75,169	75,461	75,745	76,032	76,317	76,603	76,886	77,175	77,464
Monmouth	59,141	59,340	59,856	60,229	60,584	60,948	61,315	61,685	62,061	62,446	62,833
Morris	38,943	39,106	39,332	39,575	39,792	40,014	40,238	40,466	40,694	40,930	41,170
Ocean	60,663	60,887	61,210	61,576	61,883	62,184	62,493	62,801	63,113	63,421	63,725
Passaic	58,331	58,484	58,725	58,987	59,221	59,459	59,699	59,946	60,196	60,448	60,704
Somerset	23,534	23,603	23,756	23,905	24,017	24,132	24,247	24,361	24,478	24,595	24,716
Sussex	9,469	9,514	9,608	9,660	9,718	9,775	9,835	9,897	9,956	10,017	10,080
Union	58,314	58,472	58,754	58,936	59,168	59,400	59,639	59,880	60,119	60,366	60,608
Warren	7,337	7,360	7,392	7,425	7,464	7,502	7,541	7,580	7,619	7,659	7,698

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:		
	3/7	3/8	3/9	3/10	3/12	3/14	3/16
Bergen	80,339	80,605	81,125	81,535	82,341 (16,468) [3,952] {1,976}	83,150 (16,630) [3,991] {1,996}	83,951 (16,790) [4,030] {2,015}
Burlington	36,206	36,326	36,443	36,584	36,834 (7,367) [1,768] {884}	37,087 (7,417) [1,780] {890}	37,341 (7,468) [1,792] {896}
Camden	44,972	45,073	45,231	45,363	45,605 (9,121) [2,189] {1,095}	45,842 (9,168) [2,200] {1,100}	46,076 (9,215) [2,212] {1,106}
Essex	75,772	75,967	76,301	76,640	77,229 (15,446) [3,707] {1,853}	77,811 (15,562) [3,735] {1,867}	78,392 (15,678) [3,763] {1,881}
Gloucester	24,640	24,684	24,770	24,888	25,035 (5,007) [1,202] {601}	25,185 (5,037) [1,209] {604}	25,333 (5,067) [1,216] {608}
Hudson	71,406	71,635	71,969	72,300	72,910 (14,582) [3,500] {1,750}	73,519 (14,704) [3,529] {1,764}	74,138 (14,828) [3,559] {1,779}
Hunterdon	7,165	7,199	7,244	7,275	7,345 (1,469) [353] {176}	7,415 (1,483) [356] {178}	7,486 (1,497) [359] {180}
Mercer	28,400	28,463	28,570	28,685	28,870 (5,774) [1,386] {693}	29,056 (5,811) [1,395] {697}	29,244 (5,849) [1,404] {702}
Middlesex	74,641	74,783	75,169	75,461	76,032 (15,206) [3,650] {1,825}	76,603 (15,321) [3,677] {1,838}	77,175 (15,435) [3,704] {1,852}
Monmouth	59,141	59,340	59,856	60,229	60,948 (12,190) [2,925] {1,463}	61,685 (12,337) [2,961] {1,480}	62,446 (12,489) [2,997] {1,499}
Morris	38,943	39,106	39,332	39,575	40,014 (8,003) [1,921] {960}	40,466 (8,093) [1,942] {971}	40,930 (8,186) [1,965] {982}
Ocean	60,663	60,887	61,210	61,576	62,184 (12,437) [2,985] {1,492}	62,801 (12,560) [3,014] {1,507}	63,421 (12,684) [3,044] {1,522}
Passaic	58,331	58,484	58,725	58,987	59,459 (11,892) [2,854] {1,427}	59,946 (11,989) [2,877] {1,439}	60,448 (12,090) [2,901] {1,451}
Somerset	23,534	23,603	23,756	23,905	24,132 (4,826) [1,158] {579}	24,361 (4,872) [1,169] {585}	24,595 (4,919) [1,181] {590}
Sussex	9,469	9,514	9,608	9,660	9,775 (1,955) [469] {235}	9,897 (1,979) [475] {238}	10,017 (2,003) [481] {240}
Union	58,314	58,472	58,754	58,936	59,400 (11,880) [2,851] {1,426}	59,880 (11,976) [2,874] {1,437}	60,366 (12,073) [2,898] {1,449}
Warren	7,337	7,360	7,392	7,425	7,502 (1,500) [360] {180}	7,580 (1,516) [364] {182}	7,659 (1,532) [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.