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

Date: 3/29/21

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 3/29/21 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.

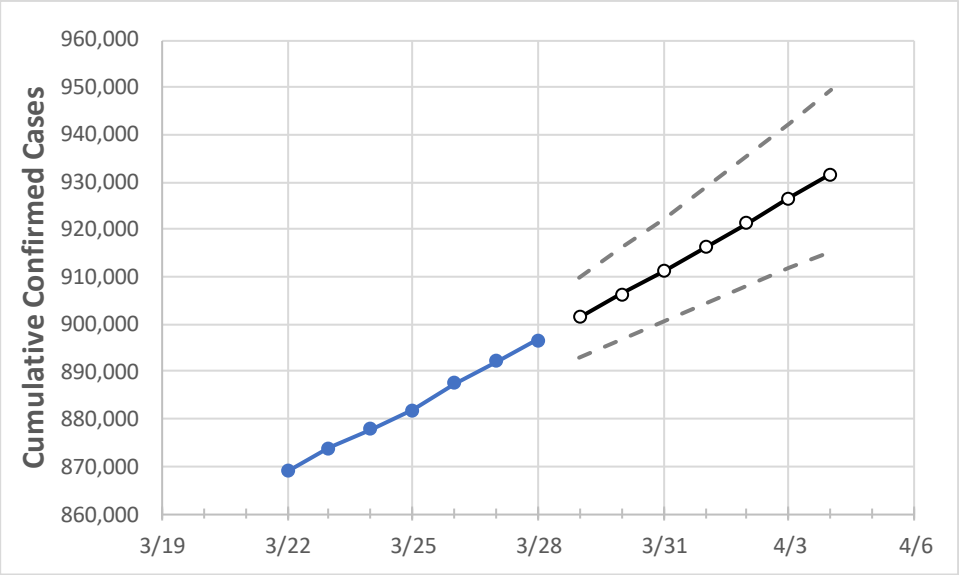
IEM's Modeling Lead

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:						
	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4
New Jersey	881,882	887,481	892,143	896,652	901,452	906,339	911,211	916,311	921,393	926,559	931,754

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:						
	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4
Bergen	88,162	88,904	89,471	90,006	90,566	91,131	91,700	92,286	92,882	93,484	94,100
Burlington	38,780	38,946	39,143	39,319	39,507	39,701	39,901	40,107	40,314	40,529	40,747
Camden	47,701	47,853	48,045	48,234	48,433	48,633	48,841	49,058	49,274	49,496	49,720
Essex	82,264	82,836	83,318	83,745	84,229	84,711	85,207	85,722	86,243	86,784	87,331
Gloucester	26,259	26,384	26,482	26,555	26,669	26,784	26,903	27,024	27,148	27,279	27,410
Hudson	77,390	77,898	78,431	78,758	79,190	79,634	80,085	80,550	81,011	81,489	81,978
Hunterdon	7,929	8,008	8,096	8,148	8,210	8,272	8,336	8,403	8,472	8,542	8,615
Mercer	30,152	30,283	30,422	30,525	30,646	30,770	30,895	31,023	31,153	31,284	31,417
Middlesex	80,900	81,447	81,865	82,325	82,781	83,242	83,718	84,196	84,694	85,195	85,706
Monmouth	65,718	66,172	66,583	66,940	67,345	67,763	68,179	68,605	69,025	69,461	69,901
Morris	43,480	43,806	43,969	44,216	44,457	44,693	44,930	45,168	45,407	45,649	45,886
Ocean	66,291	66,741	67,110	67,473	67,841	68,213	68,594	68,983	69,371	69,770	70,178
Passaic	62,571	62,933	63,225	63,547	63,832	64,126	64,418	64,721	65,013	65,317	65,626
Somerset	25,789	25,990	26,133	26,325	26,489	26,658	26,829	27,009	27,190	27,377	27,568
Sussex	10,882	11,044	11,163	11,264	11,393	11,526	11,668	11,814	11,967	12,129	12,296
Union	62,496	62,820	63,096	63,418	63,700	63,986	64,278	64,570	64,868	65,162	65,470
Warren	8,157	8,199	8,224	8,281	8,335	8,389	8,445	8,501	8,558	8,614	8,672

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:		
	3/25	3/26	3/27	3/28	3/30	4/1	4/3
Bergen	88,162	88,904	89,471	90,006	91,131 (18,226) [4,374] {2,187}	92,286 (18,457) [4,430] {2,215}	93,484 (18,697) [4,487] {2,244}
Burlington	38,780	38,946	39,143	39,319	39,701 (7,940) [1,906] {953}	40,107 (8,021) [1,925] {963}	40,529 (8,106) [1,945] {973}
Camden	47,701	47,853	48,045	48,234	48,633 (9,727) [2,334] {1,167}	49,058 (9,812) [2,355] {1,177}	49,496 (9,899) [2,376] {1,188}
Essex	82,264	82,836	83,318	83,745	84,711 (16,942) [4,066] {2,033}	85,722 (17,144) [4,115] {2,057}	86,784 (17,357) [4,166] {2,083}
Gloucester	26,259	26,384	26,482	26,555	26,784 (5,357) [1,286] {643}	27,024 (5,405) [1,297] {649}	27,279 (5,456) [1,309] {655}
Hudson	77,390	77,898	78,431	78,758	79,634 (15,927) [3,822] {1,911}	80,550 (16,110) [3,866] {1,933}	81,489 (16,298) [3,911] {1,956}
Hunterdon	7,929	8,008	8,096	8,148	8,272 (1,654) [397] {199}	8,403 (1,681) [403] {202}	8,542 (1,708) [410] {205}
Mercer	30,152	30,283	30,422	30,525	30,770 (6,154) [1,477] {738}	31,023 (6,205) [1,489] {745}	31,284 (6,257) [1,502] {751}
Middlesex	80,900	81,447	81,865	82,325	83,242 (16,648) [3,996] {1,998}	84,196 (16,839) [4,041] {2,021}	85,195 (17,039) [4,089] {2,045}
Monmouth	65,718	66,172	66,583	66,940	67,763 (13,553) [3,253] {1,626}	68,605 (13,721) [3,293] {1,647}	69,461 (13,892) [3,334] {1,667}
Morris	43,480	43,806	43,969	44,216	44,693 (8,939) [2,145] {1,073}	45,168 (9,034) [2,168] {1,084}	45,649 (9,130) [2,191] {1,096}
Ocean	66,291	66,741	67,110	67,473	68,213 (13,643) [3,274] {1,637}	68,983 (13,797) [3,311] {1,656}	69,770 (13,954) [3,349] {1,674}
Passaic	62,571	62,933	63,225	63,547	64,126 (12,825) [3,078] {1,539}	64,721 (12,944) [3,107] {1,553}	65,317 (13,063) [3,135] {1,568}
Somerset	25,789	25,990	26,133	26,325	26,658 (5,332) [1,280] {640}	27,009 (5,402) [1,296] {648}	27,377 (5,475) [1,314] {657}
Sussex	10,882	11,044	11,163	11,264	11,526 (2,305) [553] {277}	11,814 (2,363) [567] {284}	12,129 (2,426) [582] {291}
Union	62,496	62,820	63,096	63,418	63,986 (12,797) [3,071] {1,536}	64,570 (12,914) [3,099] {1,550}	65,162 (13,032) [3,128] {1,564}
Warren	8,157	8,199	8,224	8,281	8,389 (1,678) [403] {201}	8,501 (1,700) [408] {204}	8,614 (1,723) [413] {207}

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.