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

Date: 3/3/21

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 3/3/21 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.

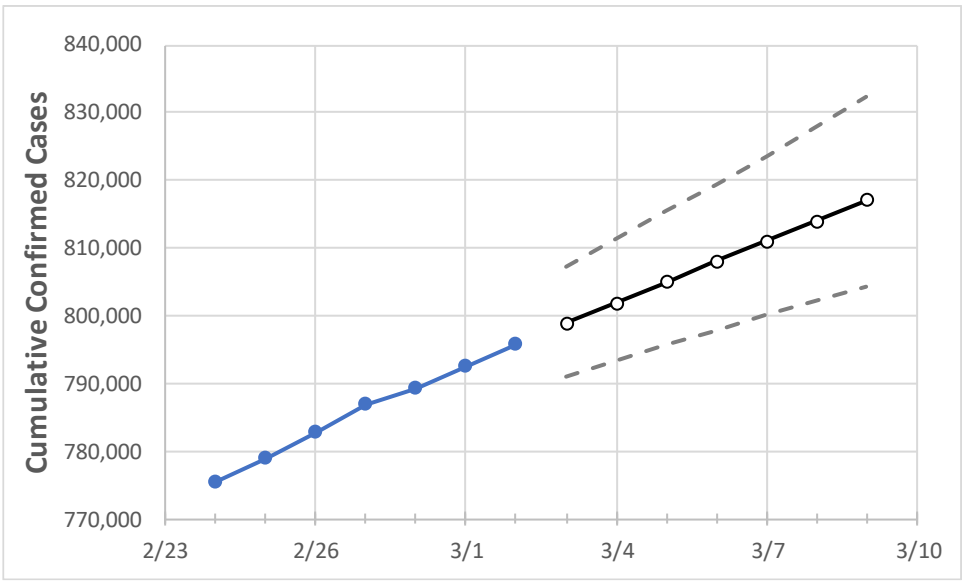
IEM's Modeling Lead

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:						
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9
New Jersey	786,967	789,356	792,496	795,785	798,843	801,852	804,905	808,023	810,995	814,034	817,031

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:						
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9
Bergen	77,290	77,537	78,040	78,445	78,840	79,234	79,625	80,024	80,425	80,829	81,245
Burlington	35,273	35,369	35,483	35,600	35,713	35,823	35,931	36,038	36,142	36,247	36,353
Camden	44,055	44,149	44,301	44,423	44,543	44,661	44,776	44,894	45,007	45,121	45,237
Essex	73,506	73,718	73,995	74,249	74,523	74,800	75,074	75,339	75,597	75,864	76,140
Gloucester	24,099	24,145	24,235	24,311	24,377	24,444	24,511	24,577	24,642	24,707	24,771
Hudson	69,078	69,277	69,600	69,940	70,244	70,547	70,855	71,164	71,475	71,791	72,098
Hunterdon	6,898	6,927	6,951	6,989	7,020	7,051	7,082	7,112	7,144	7,174	7,206
Mercer	27,702	27,790	27,881	27,976	28,055	28,134	28,211	28,289	28,366	28,444	28,518
Middlesex	72,399	72,617	72,848	73,117	73,356	73,597	73,829	74,063	74,296	74,521	74,741
Monmouth	56,659	56,878	57,157	57,460	57,735	58,011	58,283	58,556	58,822	59,091	59,362
Morris	37,408	37,542	37,727	37,892	38,046	38,201	38,352	38,501	38,647	38,793	38,940
Ocean	58,439	58,624	58,875	59,147	59,401	59,647	59,894	60,137	60,378	60,615	60,859
Passaic	56,670	56,840	56,986	57,218	57,384	57,551	57,720	57,885	58,049	58,218	58,375
Somerset	22,765	22,825	22,926	23,041	23,142	23,238	23,334	23,436	23,532	23,631	23,728
Sussex	9,102	9,127	9,173	9,219	9,258	9,296	9,335	9,375	9,413	9,451	9,487
Union	56,591	56,756	56,976	57,196	57,403	57,610	57,821	58,027	58,236	58,451	58,659
Warren	7,032	7,063	7,102	7,141	7,177	7,214	7,251	7,289	7,326	7,364	7,403

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:		
	2/27	2/28	3/1	3/2	3/4	3/6	3/8
Bergen	77,290	77,537	78,040	78,445	79,234 (15,847) [3,803] {1,902}	80,024 (16,005) [3,841] {1,921}	80,829 (16,166) [3,880] {1,940}
Burlington	35,273	35,369	35,483	35,600	35,823 (7,165) [1,720] {860}	36,038 (7,208) [1,730] {865}	36,247 (7,249) [1,740] {870}
Camden	44,055	44,149	44,301	44,423	44,661 (8,932) [2,144] {1,072}	44,894 (8,979) [2,155] {1,077}	45,121 (9,024) [2,166] {1,083}
Essex	73,506	73,718	73,995	74,249	74,800 (14,960) [3,590] {1,795}	75,339 (15,068) [3,616] {1,808}	75,864 (15,173) [3,641] {1,821}
Gloucester	24,099	24,145	24,235	24,311	24,444 (4,889) [1,173] {587}	24,577 (4,915) [1,180] {590}	24,707 (4,941) [1,186] {593}
Hudson	69,078	69,277	69,600	69,940	70,547 (14,109) [3,386] {1,693}	71,164 (14,233) [3,416] {1,708}	71,791 (14,358) [3,446] {1,723}
Hunterdon	6,898	6,927	6,951	6,989	7,051 (1,410) [338] {169}	7,112 (1,422) [341] {171}	7,174 (1,435) [344] {172}
Mercer	27,702	27,790	27,881	27,976	28,134 (5,627) [1,350] {675}	28,289 (5,658) [1,358] {679}	28,444 (5,689) [1,365] {683}
Middlesex	72,399	72,617	72,848	73,117	73,597 (14,719) [3,533] {1,766}	74,063 (14,813) [3,555] {1,778}	74,521 (14,904) [3,577] {1,789}
Monmouth	56,659	56,878	57,157	57,460	58,011 (11,602) [2,785] {1,392}	58,556 (11,711) [2,811] {1,405}	59,091 (11,818) [2,836] {1,418}
Morris	37,408	37,542	37,727	37,892	38,201 (7,640) [1,834] {917}	38,501 (7,700) [1,848] {924}	38,793 (7,759) [1,862] {931}
Ocean	58,439	58,624	58,875	59,147	59,647 (11,929) [2,863] {1,432}	60,137 (12,027) [2,887] {1,443}	60,615 (12,123) [2,910] {1,455}
Passaic	56,670	56,840	56,986	57,218	57,551 (11,510) [2,762] {1,381}	57,885 (11,577) [2,778] {1,389}	58,218 (11,644) [2,794] {1,397}
Somerset	22,765	22,825	22,926	23,041	23,238 (4,648) [1,115] {558}	23,436 (4,687) [1,125] {562}	23,631 (4,726) [1,134] {567}
Sussex	9,102	9,127	9,173	9,219	9,296 (1,859) [446] {223}	9,375 (1,875) [450] {225}	9,451 (1,890) [454] {227}
Union	56,591	56,756	56,976	57,196	57,610 (11,522) [2,765] {1,383}	58,027 (11,605) [2,785] {1,393}	58,451 (11,690) [2,806] {1,403}
Warren	7,032	7,063	7,102	7,141	7,214 (1,443) [346] {173}	7,289 (1,458) [350] {175}	7,364 (1,473) [353] {177}

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.