IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/8/21

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 3/8/21 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
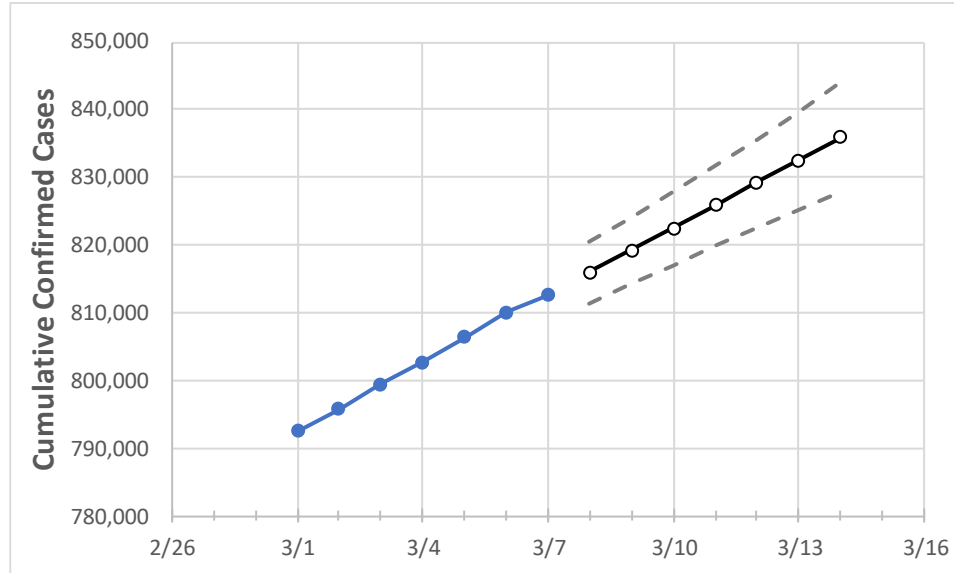
	Actual Confirmed Cases On:				Projected Cases For:						
	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14
New Jersey	802,669	806,370	810,090	812,609	815,946	819,233	822,531	825,844	829,210	832,555	835,873

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:						
	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14
Bergen	79,332	79,796	80,008	80,339	80,729	81,110	81,490	81,876	82,261	82,637	83,012
Burlington	35,842	35,975	36,125	36,206	36,319	36,432	36,547	36,659	36,772	36,884	36,999
Camden	44,633	44,769	44,915	44,972	45,086	45,198	45,309	45,417	45,522	45,631	45,736
Essex	74,861	75,189	75,544	75,772	76,064	76,356	76,647	76,933	77,219	77,507	77,797
Gloucester	24,442	24,513	24,587	24,640	24,707	24,771	24,838	24,902	24,965	25,029	25,093
Hudson	70,465	70,791	71,174	71,406	71,708	72,020	72,332	72,640	72,956	73,262	73,569
Hunterdon	7,079	7,117	7,151	7,165	7,198	7,230	7,263	7,295	7,327	7,359	7,391
Mercer	28,155	28,246	28,335	28,400	28,484	28,570	28,655	28,739	28,823	28,907	28,990
Middlesex	73,743	74,044	74,383	74,641	74,920	75,198	75,474	75,757	76,037	76,315	76,593
Monmouth	58,113	58,515	58,923	59,141	59,458	59,778	60,098	60,420	60,740	61,067	61,395
Morris	38,209	38,529	38,787	38,943	39,128	39,313	39,498	39,693	39,883	40,074	40,263
Ocean	59,803	60,087	60,469	60,663	60,938	61,207	61,484	61,757	62,022	62,292	62,556
Passaic	57,708	57,929	58,146	58,331	58,544	58,760	58,980	59,204	59,429	59,657	59,894
Somerset	23,239	23,321	23,449	23,534	23,634	23,734	23,830	23,929	24,028	24,129	24,227
Sussex	9,303	9,357	9,419	9,469	9,517	9,565	9,614	9,662	9,711	9,760	9,810
Union	57,632	57,833	58,121	58,314	58,537	58,760	58,984	59,208	59,436	59,668	59,905
Warren	7,211	7,254	7,296	7,337	7,378	7,419	7,461	7,504	7,547	7,590	7,634

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](link)) 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: | | |
	3/4	3/5	3/6	3/7	3/9	3/11	3/13
Bergen	79,332	79,796	80,008	80,339	81,110 (16,222) [3,893] {1,947}	81,876 (16,375) [3,930] {1,965}	82,637 (16,527) [3,967] {1,983}
Burlington	35,842	35,975	36,125	36,206	36,432 (7,286) [1,749] {874}	36,659 (7,332) [1,760] {880}	36,884 (7,377) [1,770] {885}
Camden	44,633	44,769	44,915	44,972	45,198 (9,040) [2,170] {1,085}	45,417 (9,083) [2,180] {1,090}	45,631 (9,126) [2,190] {1,095}
Essex	74,861	75,189	75,544	75,772	76,356 (15,271) [3,665] {1,833}	76,933 (15,387) [3,693] {1,846}	77,507 (15,501) [3,720] {1,860}
Gloucester	24,442	24,513	24,587	24,640	24,771 (4,954) [1,189] {595}	24,902 (4,980) [1,195] {598}	25,029 (5,006) [1,201] {601}
Hudson	70,465	70,791	71,174	71,406	72,020 (14,404) [3,457] {1,728}	72,640 (14,528) [3,487] {1,743}	73,262 (14,652) [3,517] {1,758}
Hunterdon	7,079	7,117	7,151	7,165	7,230 (1,446) [347] {174}	7,295 (1,459) [350] {175}	7,359 (1,472) [353] {177}
Mercer	28,155	28,246	28,335	28,400	28,570 (5,714) [1,371] {686}	28,739 (5,748) [1,379] {690}	28,907 (5,781) [1,388] {694}
Middlesex	73,743	74,044	74,383	74,641	75,198 (15,040) [3,610] {1,805}	75,757 (15,151) [3,636] {1,818}	76,315 (15,263) [3,663] {1,832}
Monmouth	58,113	58,515	58,923	59,141	59,778 (11,956) [2,869] {1,435}	60,420 (12,084) [2,900] {1,450}	61,067 (12,213) [2,931] {1,466}
Morris	38,209	38,529	38,787	38,943	39,313 (7,863) [1,887] {944}	39,693 (7,939) [1,905] {953}	40,074 (8,015) [1,924] {962}
Ocean	59,803	60,087	60,469	60,663	61,207 (12,241) [2,938] {1,469}	61,757 (12,351) [2,964] {1,482}	62,292 (12,458) [2,990] {1,495}
Passaic	57,708	57,929	58,146	58,331	58,760 (11,752) [2,820] {1,410}	59,204 (11,841) [2,842] {1,421}	59,657 (11,931) [2,864] {1,432}
Somerset	23,239	23,321	23,449	23,534	23,734 (4,747) [1,139] {570}	23,929 (4,786) [1,149] {574}	24,129 (4,826) [1,158] {579}
Sussex	9,303	9,357	9,419	9,469	9,565 (1,913) [459] {230}	9,662 (1,932) [464] {232}	9,760 (1,952) [468] {234}
Union	57,632	57,833	58,121	58,314	58,760 (11,752) [2,820] {1,410}	59,208 (11,842) [2,842] {1,421}	59,668 (11,934) [2,864] {1,432}
Warren	7,211	7,254	7,296	7,337	7,419 (1,484) [356] {178}	7,504 (1,501) [360] {180}	7,590 (1,518) [364] {182}

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.