IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/18/21

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 5/18/21 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
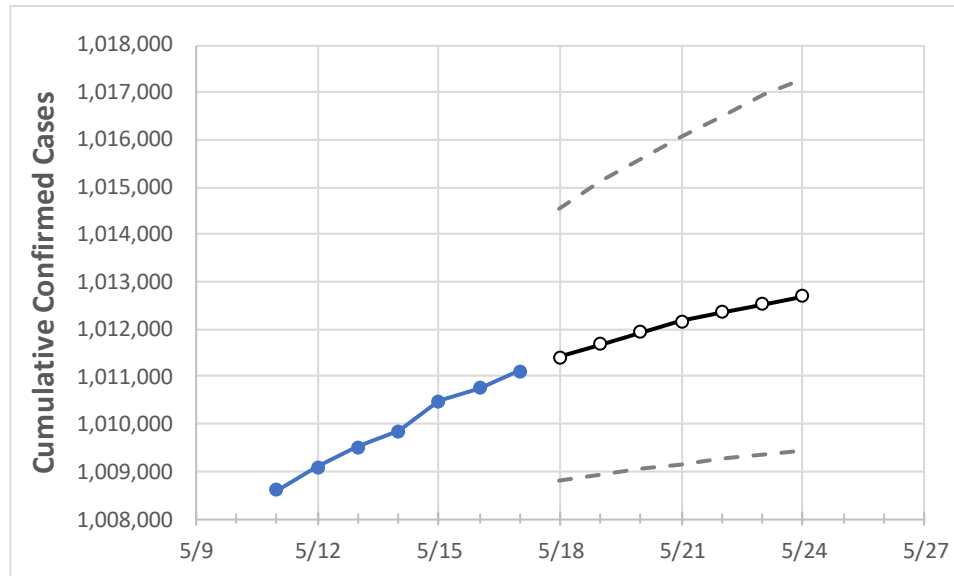
	Actual Confirmed Cases On:				Projected Cases For:						
	5/14	5/15	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24
New Jersey	1,009,844	1,010,490	1,010,759	1,011,106	1,011,411	1,011,683	1,011,939	1,012,163	1,012,354	1,012,532	1,012,694

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:						
	5/14	5/15	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24
Bergen	103,613	103,703	103,752	103,797	103,882	103,955	104,033	104,100	104,170	104,239	104,293
Burlington	44,043	44,068	44,086	44,119	44,138	44,155	44,174	44,189	44,205	44,219	44,231
Camden	54,931	54,983	55,019	55,066	55,104	55,140	55,174	55,207	55,238	55,266	55,292
Essex	93,530	93,561	93,538	93,539	93,553	93,565	93,576	93,586	93,594	93,602	93,610
Gloucester	30,238	30,261	30,254	30,276	30,293	30,310	30,325	30,340	30,354	30,366	30,378
Hudson	87,521	87,591	87,613	87,611	87,646	87,677	87,705	87,732	87,757	87,782	87,802
Hunterdon	9,687	9,691	9,701	9,704	9,711	9,716	9,722	9,727	9,732	9,737	9,741
Mercer	33,679	33,695	33,705	33,725	33,738	33,751	33,763	33,774	33,785	33,794	33,803
Middlesex	91,556	91,608	91,630	91,657	91,674	91,688	91,701	91,713	91,724	91,734	91,743
Monmouth	74,962	75,010	75,042	75,065	75,086	75,106	75,123	75,140	75,157	75,171	75,184
Morris	49,730	49,752	49,778	49,792	49,805	49,815	49,826	49,835	49,844	49,852	49,859
Ocean	75,320	75,358	75,382	75,409	75,434	75,458	75,478	75,498	75,518	75,536	75,553
Passaic	72,301	72,335	72,341	72,374	72,393	72,413	72,429	72,443	72,458	72,470	72,482
Somerset	29,831	29,855	29,861	29,863	29,874	29,884	29,893	29,901	29,908	29,915	29,921
Sussex	13,843	13,853	13,858	13,863	13,870	13,876	13,882	13,887	13,892	13,897	13,901
Union	70,986	71,036	71,042	71,049	71,068	71,084	71,100	71,113	71,126	71,137	71,149
Warren	9,857	9,866	9,867	9,868	9,874	9,880	9,886	9,891	9,896	9,901	9,905

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:		
	5/14	5/15	5/16	5/17	5/19	5/21	5/23
Bergen	103,613	103,703	103,752	103,797	103,955 (20,791) [4,990] {2,495}	104,100 (20,820) [4,997] {2,498}	104,239 (20,848) [5,003] {2,502}
Burlington	44,043	44,068	44,086	44,119	44,155 (8,831) [2,119] {1,060}	44,189 (8,838) [2,121] {1,061}	44,219 (8,844) [2,123] {1,061}
Camden	54,931	54,983	55,019	55,066	55,140 (11,028) [2,647] {1,323}	55,207 (11,041) [2,650] {1,325}	55,266 (11,053) [2,653] {1,326}
Essex	93,530	93,561	93,538	93,539	93,565 (18,713) [4,491] {2,246}	93,586 (18,717) [4,492] {2,246}	93,602 (18,720) [4,493] {2,246}
Gloucester	30,238	30,261	30,254	30,276	30,310 (6,062) [1,455] {727}	30,340 (6,068) [1,456] {728}	30,366 (6,073) [1,458] {729}
Hudson	87,521	87,591	87,613	87,611	87,677 (17,535) [4,208] {2,104}	87,732 (17,546) [4,211] {2,106}	87,782 (17,556) [4,214] {2,107}
Hunterdon	9,687	9,691	9,701	9,704	9,716 (1,943) [466] {233}	9,727 (1,945) [467] {233}	9,737 (1,947) [467] {234}
Mercer	33,679	33,695	33,705	33,725	33,751 (6,750) [1,620] {810}	33,774 (6,755) [1,621] {811}	33,794 (6,759) [1,622] {811}
Middlesex	91,556	91,608	91,630	91,657	91,688 (18,338) [4,401] {2,201}	91,713 (18,343) [4,402] {2,201}	91,734 (18,347) [4,403] {2,202}
Monmouth	74,962	75,010	75,042	75,065	75,106 (15,021) [3,605] {1,803}	75,140 (15,028) [3,607] {1,803}	75,171 (15,034) [3,608] {1,804}
Morris	49,730	49,752	49,778	49,792	49,815 (9,963) [2,391] {1,196}	49,835 (9,967) [2,392] {1,196}	49,852 (9,970) [2,393] {1,196}
Ocean	75,320	75,358	75,382	75,409	75,458 (15,092) [3,622] {1,811}	75,498 (15,100) [3,624] {1,812}	75,536 (15,107) [3,626] {1,813}
Passaic	72,301	72,335	72,341	72,374	72,413 (14,483) [3,476] {1,738}	72,443 (14,489) [3,477] {1,739}	72,470 (14,494) [3,479] {1,739}
Somerset	29,831	29,855	29,861	29,863	29,884 (5,977) [1,434] {717}	29,901 (5,980) [1,435] {718}	29,915 (5,983) [1,436] {718}
Sussex	13,843	13,853	13,858	13,863	13,876 (2,775) [666] {333}	13,887 (2,777) [667] {333}	13,897 (2,779) [667] {334}
Union	70,986	71,036	71,042	71,049	71,084 (14,217) [3,412] {1,706}	71,113 (14,223) [3,413] {1,707}	71,137 (14,227) [3,415] {1,707}
Warren	9,857	9,866	9,867	9,868	9,880 (1,976) [474] {237}	9,891 (1,978) [475] {237}	9,901 (1,980) [475] {238}

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.