IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/29/21

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 <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 9/29/21 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
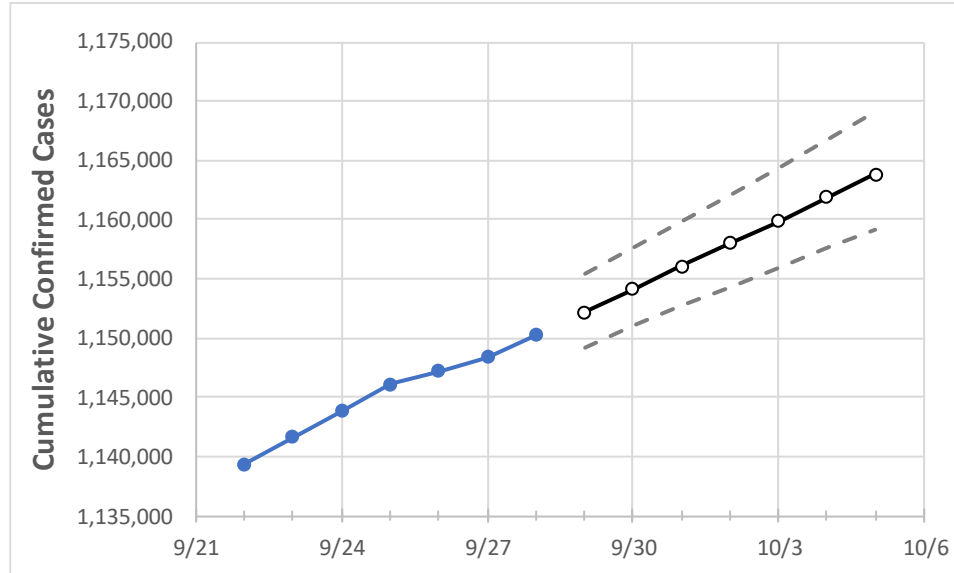
	Actual Confirmed Cases On:				Projected Cases For:						
	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5
New Jersey	1,146,089	1,147,199	1,148,358	1,150,246	1,152,214	1,154,141	1,156,105	1,157,977	1,159,901	1,161,881	1,163,796

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:						
	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5
Bergen	115,691	115,835	115,960	116,094	116,259	116,430	116,590	116,758	116,920	117,087	117,255
Burlington	51,550	51,617	51,689	51,810	51,924	52,040	52,153	52,267	52,382	52,498	52,610
Camden	64,266	64,356	64,456	64,649	64,818	64,983	65,148	65,316	65,488	65,664	65,835
Essex	103,808	103,888	103,920	104,021	104,147	104,274	104,399	104,521	104,649	104,767	104,890
Gloucester	35,894	35,931	35,978	36,131	36,238	36,346	36,451	36,556	36,670	36,778	36,888
Hudson	95,342	95,397	95,450	95,515	95,608	95,695	95,783	95,873	95,958	96,045	96,132
Hunterdon	11,303	11,313	11,324	11,340	11,360	11,381	11,402	11,423	11,443	11,464	11,484
Mercer	37,888	37,917	37,942	38,002	38,065	38,125	38,186	38,246	38,307	38,368	38,429
Middlesex	102,743	102,798	102,859	103,015	103,162	103,308	103,453	103,593	103,738	103,877	104,018
Monmouth	88,125	88,227	88,308	88,459	88,604	88,752	88,891	89,033	89,169	89,313	89,447
Morris	55,724	55,783	55,834	55,911	55,986	56,060	56,132	56,207	56,279	56,350	56,423
Ocean	88,811	88,935	89,077	89,302	89,539	89,772	90,006	90,242	90,472	90,719	90,954
Passaic	79,392	79,436	79,513	79,565	79,662	79,763	79,856	79,955	80,055	80,151	80,253
Somerset	33,722	33,745	33,777	33,826	33,882	33,934	33,988	34,041	34,096	34,149	34,203
Sussex	15,948	15,983	16,007	16,043	16,087	16,131	16,174	16,218	16,263	16,309	16,355
Union	78,195	78,212	78,259	78,358	78,460	78,560	78,662	78,759	78,864	78,964	79,062
Warren	11,355	11,372	11,387	11,417	11,441	11,463	11,485	11,509	11,532	11,555	11,577

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:		
	9/25	9/26	9/27	9/28	9/30	10/2	10/4
Bergen	115,691	115,835	115,960	116,094	116,430 (23,286) [5,589] {2,794}	116,758 (23,352) [5,604] {2,802}	117,087 (23,417) [5,620] {2,810}
Burlington	51,550	51,617	51,689	51,810	52,040 (10,408) [2,498] {1,249}	52,267 (10,453) [2,509] {1,254}	52,498 (10,500) [2,520] {1,260}
Camden	64,266	64,356	64,456	64,649	64,983 (12,997) [3,119] {1,560}	65,316 (13,063) [3,135] {1,568}	65,664 (13,133) [3,152] {1,576}
Essex	103,808	103,888	103,920	104,021	104,274 (20,855) [5,005] {2,503}	104,521 (20,904) [5,017] {2,509}	104,767 (20,953) [5,029] {2,514}
Gloucester	35,894	35,931	35,978	36,131	36,346 (7,269) [1,745] {872}	36,556 (7,311) [1,755] {877}	36,778 (7,356) [1,765] {883}
Hudson	95,342	95,397	95,450	95,515	95,695 (19,139) [4,593] {2,297}	95,873 (19,175) [4,602] {2,301}	96,045 (19,209) [4,610] {2,305}
Hunterdon	11,303	11,313	11,324	11,340	11,381 (2,276) [546] {273}	11,423 (2,285) [548] {274}	11,464 (2,293) [550] {275}
Mercer	37,888	37,917	37,942	38,002	38,125 (7,625) [1,830] {915}	38,246 (7,649) [1,836] {918}	38,368 (7,674) [1,842] {921}
Middlesex	102,743	102,798	102,859	103,015	103,308 (20,662) [4,959] {2,479}	103,593 (20,719) [4,972] {2,486}	103,877 (20,775) [4,986] {2,493}
Monmouth	88,125	88,227	88,308	88,459	88,752 (17,750) [4,260] {2,130}	89,033 (17,807) [4,274] {2,137}	89,313 (17,863) [4,287] {2,144}
Morris	55,724	55,783	55,834	55,911	56,060 (11,212) [2,691] {1,345}	56,207 (11,241) [2,698] {1,349}	56,350 (11,270) [2,705] {1,352}
Ocean	88,811	88,935	89,077	89,302	89,772 (17,954) [4,309] {2,155}	90,242 (18,048) [4,332] {2,166}	90,719 (18,144) [4,355] {2,177}
Passaic	79,392	79,436	79,513	79,565	79,763 (15,953) [3,829] {1,914}	79,955 (15,991) [3,838] {1,919}	80,151 (16,030) [3,847] {1,924}
Somerset	33,722	33,745	33,777	33,826	33,934 (6,787) [1,629] {814}	34,041 (6,808) [1,634] {817}	34,149 (6,830) [1,639] {820}
Sussex	15,948	15,983	16,007	16,043	16,131 (3,226) [774] {387}	16,218 (3,244) [778] {389}	16,309 (3,262) [783] {391}
Union	78,195	78,212	78,259	78,358	78,560 (15,712) [3,771] {1,885}	78,759 (15,752) [3,780] {1,890}	78,964 (15,793) [3,790] {1,895}
Warren	11,355	11,372	11,387	11,417	11,463 (2,293) [550] {275}	11,509 (2,302) [552] {276}	11,555 (2,311) [555] {277}

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.