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

Date: 9/24/21

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 9/24/21 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.

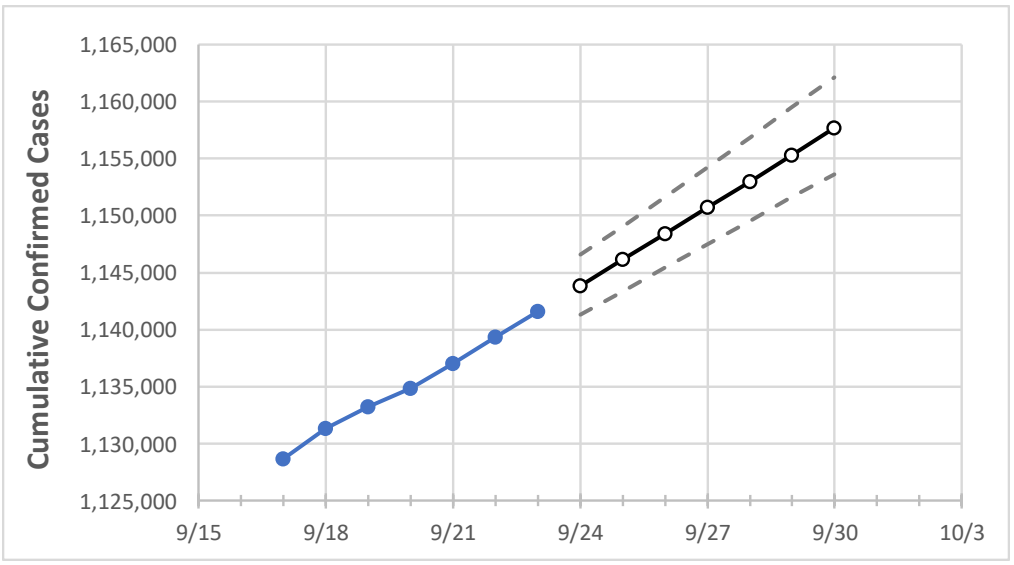
IEM's Modeling Lead

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:						
	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30
New Jersey	1,134,851	1,137,016	1,139,367	1,141,619	1,143,869	1,146,165	1,148,416	1,150,718	1,152,976	1,155,322	1,157,664

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:						
	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30
Bergen	114,724	114,862	115,071	115,270	115,448	115,633	115,815	115,998	116,182	116,367	116,551
Burlington	50,897	51,015	51,137	51,265	51,392	51,519	51,645	51,772	51,896	52,025	52,153
Camden	63,382	63,530	63,724	63,921	64,098	64,275	64,452	64,635	64,817	65,009	65,200
Essex	103,004	103,173	103,338	103,488	103,647	103,802	103,962	104,124	104,281	104,447	104,611
Gloucester	35,350	35,462	35,586	35,694	35,813	35,932	36,053	36,175	36,296	36,424	36,550
Hudson	94,832	94,924	95,035	95,139	95,256	95,369	95,484	95,600	95,717	95,834	95,950
Hunterdon	11,178	11,195	11,217	11,258	11,283	11,307	11,332	11,356	11,382	11,407	11,433
Mercer	37,542	37,612	37,688	37,755	37,826	37,898	37,970	38,041	38,116	38,189	38,262
Middlesex	101,881	102,078	102,256	102,436	102,632	102,825	103,018	103,215	103,410	103,611	103,807
Monmouth	87,251	87,421	87,609	87,806	87,990	88,173	88,354	88,539	88,719	88,901	89,086
Morris	55,318	55,401	55,483	55,553	55,643	55,729	55,818	55,905	55,992	56,079	56,168
Ocean	87,430	87,757	88,039	88,282	88,540	88,793	89,052	89,316	89,580	89,846	90,118
Passaic	78,827	78,954	79,062	79,194	79,309	79,423	79,537	79,654	79,772	79,893	80,008
Somerset	33,409	33,469	33,547	33,602	33,666	33,729	33,792	33,857	33,922	33,986	34,051
Sussex	15,711	15,754	15,799	15,846	15,892	15,939	15,986	16,033	16,083	16,133	16,184
Union	77,603	77,708	77,833	77,932	78,047	78,158	78,272	78,385	78,504	78,620	78,734
Warren	11,216	11,236	11,264	11,304	11,332	11,360	11,388	11,416	11,444	11,472	11,501

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:		
	9/20	9/21	9/22	9/23	9/25	9/27	9/29
Bergen	114,724	114,862	115,071	115,270	115,633 (23,127) [5,550] {2,775}	115,998 (23,200) [5,568] {2,784}	116,367 (23,273) [5,586] {2,793}
Burlington	50,897	51,015	51,137	51,265	51,519 (10,304) [2,473] {1,236}	51,772 (10,354) [2,485] {1,243}	52,025 (10,405) [2,497] {1,249}
Camden	63,382	63,530	63,724	63,921	64,275 (12,855) [3,085] {1,543}	64,635 (12,927) [3,102] {1,551}	65,009 (13,002) [3,120] {1,560}
Essex	103,004	103,173	103,338	103,488	103,802 (20,760) [4,982] {2,491}	104,124 (20,825) [4,998] {2,499}	104,447 (20,889) [5,013] {2,507}
Gloucester	35,350	35,462	35,586	35,694	35,932 (7,186) [1,725] {862}	36,175 (7,235) [1,736] {868}	36,424 (7,285) [1,748] {874}
Hudson	94,832	94,924	95,035	95,139	95,369 (19,074) [4,578] {2,289}	95,600 (19,120) [4,589] {2,294}	95,834 (19,167) [4,600] {2,300}
Hunterdon	11,178	11,195	11,217	11,258	11,307 (2,261) [543] {271}	11,356 (2,271) [545] {273}	11,407 (2,281) [548] {274}
Mercer	37,542	37,612	37,688	37,755	37,898 (7,580) [1,819] {910}	38,041 (7,608) [1,826] {913}	38,189 (7,638) [1,833] {917}
Middlesex	101,881	102,078	102,256	102,436	102,825 (20,565) [4,936] {2,468}	103,215 (20,643) [4,954] {2,477}	103,611 (20,722) [4,973] {2,487}
Monmouth	87,251	87,421	87,609	87,806	88,173 (17,635) [4,232] {2,116}	88,539 (17,708) [4,250] {2,125}	88,901 (17,780) [4,267] {2,134}
Morris	55,318	55,401	55,483	55,553	55,729 (11,146) [2,675] {1,337}	55,905 (11,181) [2,683] {1,342}	56,079 (11,216) [2,692] {1,346}
Ocean	87,430	87,757	88,039	88,282	88,793 (17,759) [4,262] {2,131}	89,316 (17,863) [4,287] {2,144}	89,846 (17,969) [4,313] {2,156}
Passaic	78,827	78,954	79,062	79,194	79,423 (15,885) [3,812] {1,906}	79,654 (15,931) [3,823] {1,912}	79,893 (15,979) [3,835] {1,917}
Somerset	33,409	33,469	33,547	33,602	33,729 (6,746) [1,619] {810}	33,857 (6,771) [1,625] {813}	33,986 (6,797) [1,631] {816}
Sussex	15,711	15,754	15,799	15,846	15,939 (3,188) [765] {383}	16,033 (3,207) [770] {385}	16,133 (3,227) [774] {387}
Union	77,603	77,708	77,833	77,932	78,158 (15,632) [3,752] {1,876}	78,385 (15,677) [3,762] {1,881}	78,620 (15,724) [3,774] {1,887}
Warren	11,216	11,236	11,264	11,304	11,360 (2,272) [545] {273}	11,416 (2,283) [548] {274}	11,472 (2,294) [551] {275}

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.