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

Date: 10/15/21

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 10/15/21 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.

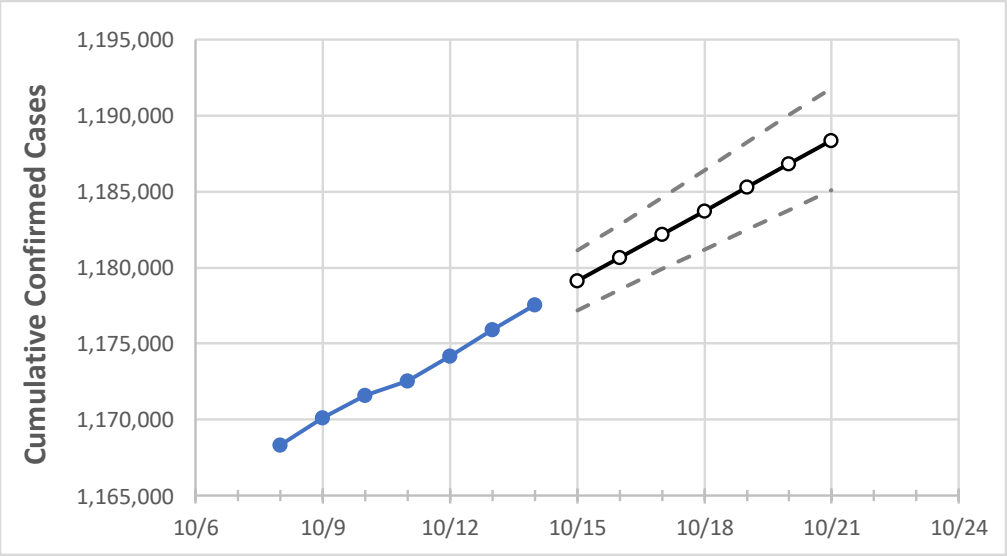
IEM's Modeling Lead

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:						
	10/11	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21
New Jersey	1,172,527	1,174,169	1,175,915	1,177,553	1,179,142	1,180,678	1,182,208	1,183,714	1,185,272	1,186,837	1,188,332

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:						
	10/11	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21
Bergen	117,928	118,050	118,198	118,337	118,452	118,567	118,680	118,792	118,903	119,015	119,124
Burlington	53,231	53,317	53,387	53,485	53,580	53,677	53,771	53,867	53,964	54,056	54,150
Camden	66,435	66,515	66,665	66,787	66,902	67,014	67,125	67,233	67,341	67,449	67,557
Essex	105,270	105,367	105,492	105,583	105,672	105,760	105,845	105,936	106,021	106,107	106,194
Gloucester	37,321	37,379	37,470	37,552	37,629	37,709	37,788	37,863	37,940	38,018	38,092
Hudson	96,423	96,470	96,548	96,646	96,713	96,781	96,847	96,911	96,979	97,044	97,111
Hunterdon	11,649	11,674	11,705	11,742	11,770	11,800	11,829	11,859	11,891	11,922	11,954
Mercer	38,648	38,699	38,745	38,802	38,847	38,892	38,936	38,981	39,026	39,070	39,112
Middlesex	104,546	104,680	104,824	104,947	105,060	105,172	105,281	105,392	105,499	105,610	105,721
Monmouth	90,262	90,397	90,533	90,666	90,784	90,901	91,012	91,131	91,242	91,355	91,464
Morris	56,934	57,005	57,077	57,150	57,223	57,297	57,369	57,442	57,514	57,589	57,661
Ocean	92,102	92,352	92,625	92,830	93,059	93,293	93,522	93,756	93,989	94,228	94,465
Passaic	80,579	80,654	80,735	80,807	80,882	80,959	81,033	81,110	81,184	81,263	81,337
Somerset	34,371	34,412	34,440	34,476	34,506	34,536	34,564	34,594	34,624	34,651	34,678
Sussex	16,618	16,669	16,714	16,759	16,805	16,851	16,897	16,943	16,991	17,039	17,086
Union	79,201	79,283	79,332	79,380	79,433	79,485	79,533	79,583	79,632	79,680	79,729
Warren	11,748	11,770	11,790	11,825	11,851	11,876	11,902	11,926	11,953	11,978	12,005

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:		
	10/11	10/12	10/13	10/14	10/16	10/18	10/20
Bergen	117,928	118,050	118,198	118,337	118,567 (23,713) [5,691] {2,846}	118,792 (23,758) [5,702] {2,851}	119,015 (23,803) [5,713] {2,856}
Burlington	53,231	53,317	53,387	53,485	53,677 (10,735) [2,577] {1,288}	53,867 (10,773) [2,586] {1,293}	54,056 (10,811) [2,595] {1,297}
Camden	66,435	66,515	66,665	66,787	67,014 (13,403) [3,217] {1,608}	67,233 (13,447) [3,227] {1,614}	67,449 (13,490) [3,238] {1,619}
Essex	105,270	105,367	105,492	105,583	105,760 (21,152) [5,076] {2,538}	105,936 (21,187) [5,085] {2,542}	106,107 (21,221) [5,093] {2,547}
Gloucester	37,321	37,379	37,470	37,552	37,709 (7,542) [1,810] {905}	37,863 (7,573) [1,817] {909}	38,018 (7,604) [1,825] {912}
Hudson	96,423	96,470	96,548	96,646	96,781 (19,356) [4,645] {2,323}	96,911 (19,382) [4,652] {2,326}	97,044 (19,409) [4,658] {2,329}
Hunterdon	11,649	11,674	11,705	11,742	11,800 (2,360) [566] {283}	11,859 (2,372) [569] {285}	11,922 (2,384) [572] {286}
Mercer	38,648	38,699	38,745	38,802	38,892 (7,778) [1,867] {933}	38,981 (7,796) [1,871] {936}	39,070 (7,814) [1,875] {938}
Middlesex	104,546	104,680	104,824	104,947	105,172 (21,034) [5,048] {2,524}	105,392 (21,078) [5,059] {2,529}	105,610 (21,122) [5,069] {2,535}
Monmouth	90,262	90,397	90,533	90,666	90,901 (18,180) [4,363] {2,182}	91,131 (18,226) [4,374] {2,187}	91,355 (18,271) [4,385] {2,193}
Morris	56,934	57,005	57,077	57,150	57,297 (11,459) [2,750] {1,375}	57,442 (11,488) [2,757] {1,379}	57,589 (11,518) [2,764] {1,382}
Ocean	92,102	92,352	92,625	92,830	93,293 (18,659) [4,478] {2,239}	93,756 (18,751) [4,500] {2,250}	94,228 (18,846) [4,523] {2,261}
Passaic	80,579	80,654	80,735	80,807	80,959 (16,192) [3,886] {1,943}	81,110 (16,222) [3,893] {1,947}	81,263 (16,253) [3,901] {1,950}
Somerset	34,371	34,412	34,440	34,476	34,536 (6,907) [1,658] {829}	34,594 (6,919) [1,661] {830}	34,651 (6,930) [1,663] {832}
Sussex	16,618	16,669	16,714	16,759	16,851 (3,370) [809] {404}	16,943 (3,389) [813] {407}	17,039 (3,408) [818] {409}
Union	79,201	79,283	79,332	79,380	79,485 (15,897) [3,815] {1,908}	79,583 (15,917) [3,820] {1,910}	79,680 (15,936) [3,825] {1,912}
Warren	11,748	11,770	11,790	11,825	11,876 (2,375) [570] {285}	11,926 (2,385) [572] {286}	11,978 (2,396) [575] {287}

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.