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

Date: 10/18/21

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 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 10/18/21 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.

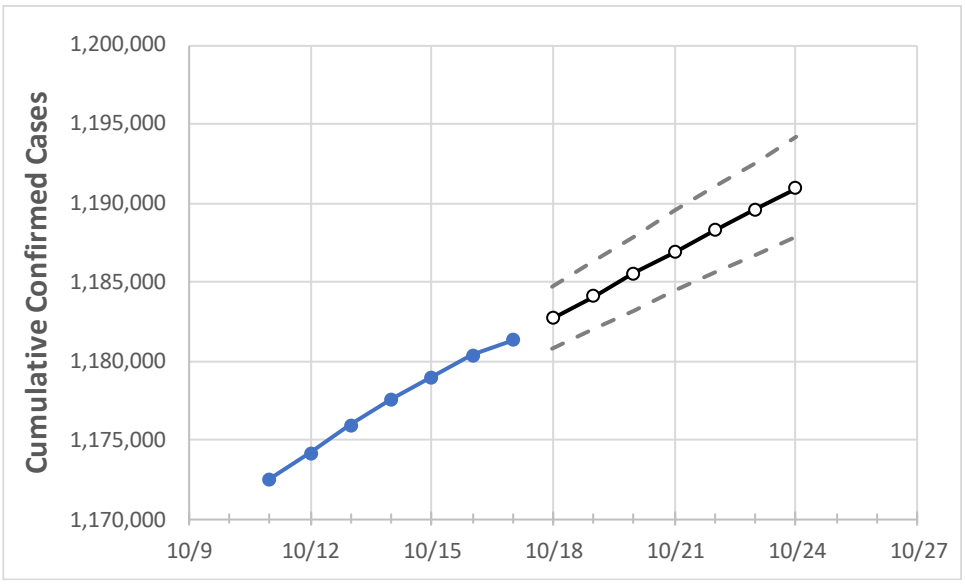
IEM's Modeling Lead

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:						
	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24
New Jersey	1,177,553	1,178,936	1,180,388	1,181,284	1,182,714	1,184,107	1,185,520	1,186,891	1,188,251	1,189,630	1,190,960

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:						
	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24
Bergen	118,337	118,458	118,621	118,678	118,789	118,902	119,010	119,120	119,230	119,338	119,445
Burlington	53,485	53,597	53,689	53,754	53,848	53,941	54,033	54,125	54,215	54,308	54,398
Camden	66,787	66,883	66,980	67,018	67,116	67,216	67,310	67,406	67,501	67,594	67,682
Essex	105,583	105,613	105,665	105,678	105,752	105,822	105,889	105,956	106,022	106,089	106,153
Gloucester	37,552	37,610	37,652	37,665	37,733	37,799	37,866	37,926	37,992	38,056	38,118
Hudson	96,646	96,694	96,781	96,822	96,886	96,950	97,010	97,074	97,137	97,200	97,263
Hunterdon	11,742	11,768	11,795	11,824	11,854	11,885	11,915	11,947	11,978	12,011	12,043
Mercer	38,802	38,865	38,907	38,944	38,990	39,034	39,080	39,125	39,170	39,216	39,260
Middlesex	104,947	105,057	105,174	105,243	105,349	105,454	105,557	105,660	105,763	105,869	105,968
Monmouth	90,666	90,799	90,926	91,039	91,156	91,272	91,387	91,502	91,617	91,730	91,841
Morris	57,150	57,229	57,318	57,367	57,440	57,512	57,583	57,654	57,726	57,797	57,869
Ocean	92,830	93,062	93,253	93,403	93,616	93,835	94,046	94,264	94,480	94,698	94,915
Passaic	80,807	80,864	80,939	80,984	81,053	81,122	81,191	81,258	81,325	81,394	81,463
Somerset	34,476	34,504	34,526	34,546	34,573	34,599	34,624	34,650	34,675	34,699	34,722
Sussex	16,759	16,803	16,862	16,896	16,943	16,990	17,036	17,083	17,132	17,180	17,228
Union	79,380	79,363	79,372	79,353	79,398	79,443	79,484	79,526	79,567	79,608	79,647
Warren	11,825	11,850	11,880	11,899	11,924	11,949	11,975	12,000	12,026	12,051	12,076

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:		
	10/14	10/15	10/16	10/17	10/19	10/21	10/23
Bergen	118,337	118,458	118,621	118,678	118,902 (23,780) [5,707] {2,854}	119,120 (23,824) [5,718] {2,859}	119,338 (23,868) [5,728] {2,864}
Burlington	53,485	53,597	53,689	53,754	53,941 (10,788) [2,589] {1,295}	54,125 (10,825) [2,598] {1,299}	54,308 (10,862) [2,607] {1,303}
Camden	66,787	66,883	66,980	67,018	67,216 (13,443) [3,226] {1,613}	67,406 (13,481) [3,236] {1,618}	67,594 (13,519) [3,245] {1,622}
Essex	105,583	105,613	105,665	105,678	105,822 (21,164) [5,079] {2,540}	105,956 (21,191) [5,086] {2,543}	106,089 (21,218) [5,092] {2,546}
Gloucester	37,552	37,610	37,652	37,665	37,799 (7,560) [1,814] {907}	37,926 (7,585) [1,820] {910}	38,056 (7,611) [1,827] {913}
Hudson	96,646	96,694	96,781	96,822	96,950 (19,390) [4,654] {2,327}	97,074 (19,415) [4,660] {2,330}	97,200 (19,440) [4,666] {2,333}
Hunterdon	11,742	11,768	11,795	11,824	11,885 (2,377) [570] {285}	11,947 (2,389) [573] {287}	12,011 (2,402) [577] {288}
Mercer	38,802	38,865	38,907	38,944	39,034 (7,807) [1,874] {937}	39,125 (7,825) [1,878] {939}	39,216 (7,843) [1,882] {941}
Middlesex	104,947	105,057	105,174	105,243	105,454 (21,091) [5,062] {2,531}	105,660 (21,132) [5,072] {2,536}	105,869 (21,174) [5,082] {2,541}
Monmouth	90,666	90,799	90,926	91,039	91,272 (18,254) [4,381] {2,191}	91,502 (18,300) [4,392] {2,196}	91,730 (18,346) [4,403] {2,202}
Morris	57,150	57,229	57,318	57,367	57,512 (11,502) [2,761] {1,380}	57,654 (11,531) [2,767] {1,384}	57,797 (11,559) [2,774] {1,387}
Ocean	92,830	93,062	93,253	93,403	93,835 (18,767) [4,504] {2,252}	94,264 (18,853) [4,525] {2,262}	94,698 (18,940) [4,546] {2,273}
Passaic	80,807	80,864	80,939	80,984	81,122 (16,224) [3,894] {1,947}	81,258 (16,252) [3,900] {1,950}	81,394 (16,279) [3,907] {1,953}
Somerset	34,476	34,504	34,526	34,546	34,599 (6,920) [1,661] {830}	34,650 (6,930) [1,663] {832}	34,699 (6,940) [1,666] {833}
Sussex	16,759	16,803	16,862	16,896	16,990 (3,398) [816] {408}	17,083 (3,417) [820] {410}	17,180 (3,436) [825] {412}
Union	79,380	79,363	79,372	79,353	79,443 (15,889) [3,813] {1,907}	79,526 (15,905) [3,817] {1,909}	79,608 (15,922) [3,821] {1,911}
Warren	11,825	11,850	11,880	11,899	11,949 (2,390) [574] {287}	12,000 (2,400) [576] {288}	12,051 (2,410) [578] {289}

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.