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

Date: 11/1/21

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 11/1/21 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.

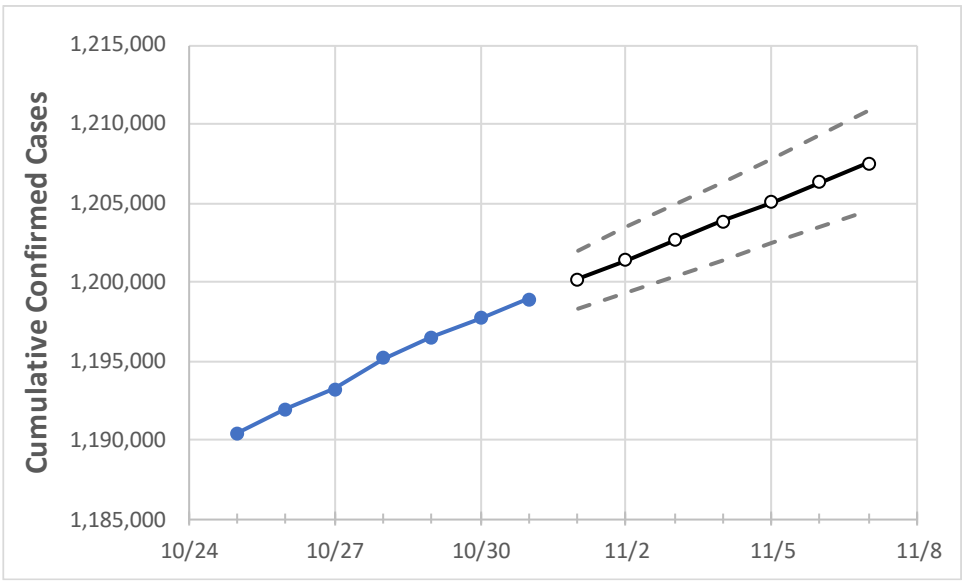
IEM's Modeling Lead

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:						
	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7
New Jersey	1,195,166	1,196,472	1,197,702	1,198,917	1,200,177	1,201,385	1,202,617	1,203,816	1,205,048	1,206,293	1,207,522

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:						
	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7
Bergen	119,767	119,911	120,023	120,092	120,192	120,291	120,389	120,490	120,587	120,688	120,787
Burlington	54,710	54,811	54,903	54,959	55,044	55,126	55,208	55,290	55,374	55,456	55,540
Camden	68,112	68,192	68,273	68,368	68,458	68,547	68,633	68,722	68,810	68,896	68,989
Essex	106,195	106,250	106,292	106,366	106,413	106,459	106,503	106,545	106,592	106,638	106,677
Gloucester	38,369	38,440	38,489	38,570	38,637	38,703	38,770	38,837	38,903	38,970	39,036
Hudson	97,409	97,456	97,517	97,586	97,640	97,693	97,745	97,800	97,854	97,909	97,958
Hunterdon	12,025	12,047	12,072	12,086	12,105	12,123	12,141	12,159	12,177	12,195	12,213
Mercer	39,493	39,556	39,590	39,636	39,687	39,736	39,785	39,836	39,885	39,936	39,984
Middlesex	106,271	106,341	106,431	106,507	106,591	106,677	106,760	106,843	106,929	107,015	107,097
Monmouth	92,322	92,442	92,576	92,695	92,813	92,933	93,049	93,170	93,288	93,408	93,528
Morris	58,013	58,074	58,122	58,187	58,245	58,299	58,356	58,411	58,468	58,524	58,580
Ocean	95,298	95,477	95,612	95,781	95,947	96,115	96,280	96,440	96,604	96,770	96,930
Passaic	81,720	81,795	81,867	81,923	81,987	82,052	82,115	82,178	82,245	82,309	82,375
Somerset	34,870	34,890	34,914	34,946	34,973	34,999	35,025	35,051	35,077	35,104	35,130
Sussex	17,338	17,382	17,406	17,435	17,475	17,513	17,548	17,588	17,624	17,662	17,697
Union	79,593	79,622	79,683	79,726	79,766	79,806	79,846	79,886	79,927	79,967	80,008
Warren	12,165	12,182	12,203	12,221	12,243	12,265	12,287	12,309	12,331	12,352	12,374

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:		
	10/28	10/29	10/30	10/31	11/2	11/4	11/6
Bergen	119,767	119,911	120,023	120,092	120,291 (24,058) [5,774] {2,887}	120,490 (24,098) [5,784] {2,892}	120,688 (24,138) [5,793] {2,897}
Burlington	54,710	54,811	54,903	54,959	55,126 (11,025) [2,646] {1,323}	55,290 (11,058) [2,654] {1,327}	55,456 (11,091) [2,662] {1,331}
Camden	68,112	68,192	68,273	68,368	68,547 (13,709) [3,290] {1,645}	68,722 (13,744) [3,299] {1,649}	68,896 (13,779) [3,307] {1,653}
Essex	106,195	106,250	106,292	106,366	106,459 (21,292) [5,110] {2,555}	106,545 (21,309) [5,114] {2,557}	106,638 (21,328) [5,119] {2,559}
Gloucester	38,369	38,440	38,489	38,570	38,703 (7,741) [1,858] {929}	38,837 (7,767) [1,864] {932}	38,970 (7,794) [1,871] {935}
Hudson	97,409	97,456	97,517	97,586	97,693 (19,539) [4,689] {2,345}	97,800 (19,560) [4,694] {2,347}	97,909 (19,582) [4,700] {2,350}
Hunterdon	12,025	12,047	12,072	12,086	12,123 (2,425) [582] {291}	12,159 (2,432) [584] {292}	12,195 (2,439) [585] {293}
Mercer	39,493	39,556	39,590	39,636	39,736 (7,947) [1,907] {954}	39,836 (7,967) [1,912] {956}	39,936 (7,987) [1,917] {958}
Middlesex	106,271	106,341	106,431	106,507	106,677 (21,335) [5,120] {2,560}	106,843 (21,369) [5,128] {2,564}	107,015 (21,403) [5,137] {2,568}
Monmouth	92,322	92,442	92,576	92,695	92,933 (18,587) [4,461] {2,230}	93,170 (18,634) [4,472] {2,236}	93,408 (18,682) [4,484] {2,242}
Morris	58,013	58,074	58,122	58,187	58,299 (11,660) [2,798] {1,399}	58,411 (11,682) [2,804] {1,402}	58,524 (11,705) [2,809] {1,405}
Ocean	95,298	95,477	95,612	95,781	96,115 (19,223) [4,614] {2,307}	96,440 (19,288) [4,629] {2,315}	96,770 (19,354) [4,645] {2,322}
Passaic	81,720	81,795	81,867	81,923	82,052 (16,410) [3,938] {1,969}	82,178 (16,436) [3,945] {1,972}	82,309 (16,462) [3,951] {1,975}
Somerset	34,870	34,890	34,914	34,946	34,999 (7,000) [1,680] {840}	35,051 (7,010) [1,682] {841}	35,104 (7,021) [1,685] {843}
Sussex	17,338	17,382	17,406	17,435	17,513 (3,503) [841] {420}	17,588 (3,518) [844] {422}	17,662 (3,532) [848] {424}
Union	79,593	79,622	79,683	79,726	79,806 (15,961) [3,831] {1,915}	79,886 (15,977) [3,835] {1,917}	79,967 (15,993) [3,838] {1,919}
Warren	12,165	12,182	12,203	12,221	12,265 (2,453) [589] {294}	12,309 (2,462) [591] {295}	12,352 (2,470) [593] {296}

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.