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

Date: 2/24/21

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 2/24/21 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.

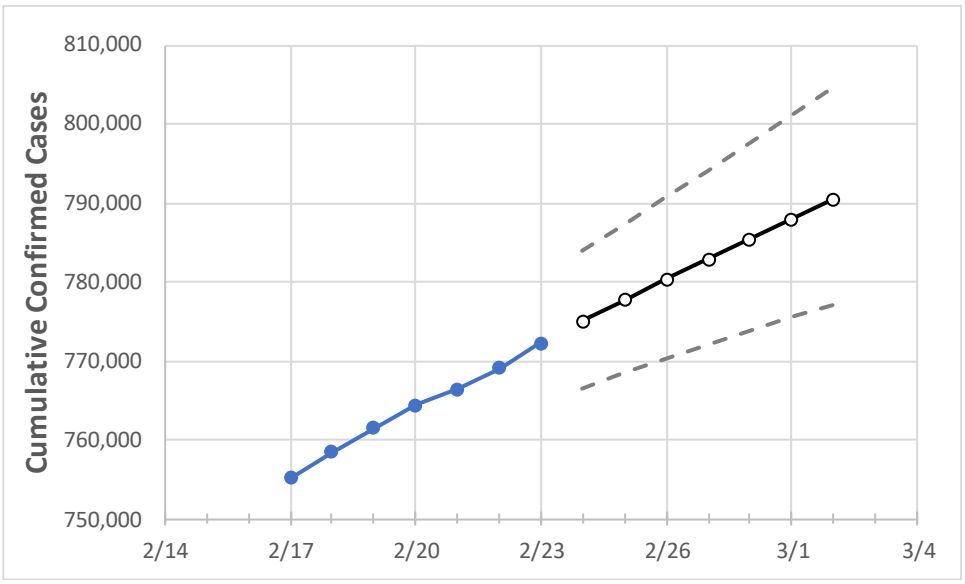
IEM's Modeling Lead

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:						
	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2
New Jersey	764,375	766,405	769,109	772,267	774,972	777,645	780,306	782,873	785,467	787,901	790,428

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:						
	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2
Bergen	74,471	74,689	75,062	75,478	75,796	76,116	76,432	76,747	77,045	77,344	77,636
Burlington	34,473	34,557	34,677	34,771	34,870	34,965	35,059	35,152	35,238	35,324	35,407
Camden	43,169	43,242	43,390	43,503	43,606	43,705	43,803	43,898	43,988	44,078	44,167
Essex	71,449	71,592	71,834	72,100	72,354	72,608	72,851	73,098	73,350	73,579	73,811
Gloucester	23,602	23,644	23,719	23,788	23,845	23,902	23,956	24,010	24,062	24,110	24,159
Hudson	66,897	67,058	67,349	67,644	67,894	68,143	68,383	68,619	68,854	69,083	69,315
Hunterdon	6,658	6,673	6,699	6,729	6,759	6,788	6,818	6,847	6,875	6,902	6,930
Mercer	27,098	27,143	27,236	27,298	27,372	27,446	27,517	27,588	27,658	27,724	27,789
Middlesex	70,503	70,672	70,874	71,184	71,425	71,663	71,894	72,119	72,343	72,550	72,759
Monmouth	54,680	54,840	55,082	55,359	55,590	55,814	56,033	56,261	56,471	56,686	56,896
Morris	36,220	36,328	36,515	36,691	36,836	36,977	37,119	37,257	37,390	37,524	37,655
Ocean	56,459	56,631	56,895	57,136	57,361	57,596	57,823	58,044	58,268	58,483	58,694
Passaic	55,529	55,633	55,755	55,949	56,115	56,282	56,442	56,605	56,761	56,918	57,073
Somerset	22,034	22,090	22,171	22,307	22,398	22,486	22,574	22,665	22,749	22,833	22,916
Sussex	8,797	8,805	8,850	8,891	8,927	8,962	8,997	9,030	9,064	9,098	9,131
Union	55,207	55,304	55,484	55,678	55,858	56,036	56,208	56,377	56,550	56,720	56,891
Warren	6,768	6,792	6,815	6,851	6,874	6,896	6,918	6,940	6,960	6,980	7,000

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:		
	2/20	2/21	2/22	2/23	2/25	2/27	3/1
Bergen	74,471	74,689	75,062	75,478	76,116 (15,223) [3,654] {1,827}	76,747 (15,349) [3,684] {1,842}	77,344 (15,469) [3,712] {1,856}
Burlington	34,473	34,557	34,677	34,771	34,965 (6,993) [1,678] {839}	35,152 (7,030) [1,687] {844}	35,324 (7,065) [1,696] {848}
Camden	43,169	43,242	43,390	43,503	43,705 (8,741) [2,098] {1,049}	43,898 (8,780) [2,107] {1,054}	44,078 (8,816) [2,116] {1,058}
Essex	71,449	71,592	71,834	72,100	72,608 (14,522) [3,485] {1,743}	73,098 (14,620) [3,509] {1,754}	73,579 (14,716) [3,532] {1,766}
Gloucester	23,602	23,644	23,719	23,788	23,902 (4,780) [1,147] {574}	24,010 (4,802) [1,152] {576}	24,110 (4,822) [1,157] {579}
Hudson	66,897	67,058	67,349	67,644	68,143 (13,629) [3,271] {1,635}	68,619 (13,724) [3,294] {1,647}	69,083 (13,817) [3,316] {1,658}
Hunterdon	6,658	6,673	6,699	6,729	6,788 (1,358) [326] {163}	6,847 (1,369) [329] {164}	6,902 (1,380) [331] {166}
Mercer	27,098	27,143	27,236	27,298	27,446 (5,489) [1,317] {659}	27,588 (5,518) [1,324] {662}	27,724 (5,545) [1,331] {665}
Middlesex	70,503	70,672	70,874	71,184	71,663 (14,333) [3,440] {1,720}	72,119 (14,424) [3,462] {1,731}	72,550 (14,510) [3,482] {1,741}
Monmouth	54,680	54,840	55,082	55,359	55,814 (11,163) [2,679] {1,340}	56,261 (11,252) [2,701] {1,350}	56,686 (11,337) [2,721] {1,360}
Morris	36,220	36,328	36,515	36,691	36,977 (7,395) [1,775] {887}	37,257 (7,451) [1,788] {894}	37,524 (7,505) [1,801] {901}
Ocean	56,459	56,631	56,895	57,136	57,596 (11,519) [2,765] {1,382}	58,044 (11,609) [2,786] {1,393}	58,483 (11,697) [2,807] {1,404}
Passaic	55,529	55,633	55,755	55,949	56,282 (11,256) [2,702] {1,351}	56,605 (11,321) [2,717] {1,359}	56,918 (11,384) [2,732] {1,366}
Somerset	22,034	22,090	22,171	22,307	22,486 (4,497) [1,079] {540}	22,665 (4,533) [1,088] {544}	22,833 (4,567) [1,096] {548}
Sussex	8,797	8,805	8,850	8,891	8,962 (1,792) [430] {215}	9,030 (1,806) [433] {217}	9,098 (1,820) [437] {218}
Union	55,207	55,304	55,484	55,678	56,036 (11,207) [2,690] {1,345}	56,377 (11,275) [2,706] {1,353}	56,720 (11,344) [2,723] {1,361}
Warren	6,768	6,792	6,815	6,851	6,896 (1,379) [331] {166}	6,940 (1,388) [333] {167}	6,980 (1,396) [335] {168}

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.