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

Date: 2/23/21

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 2/23/21 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.

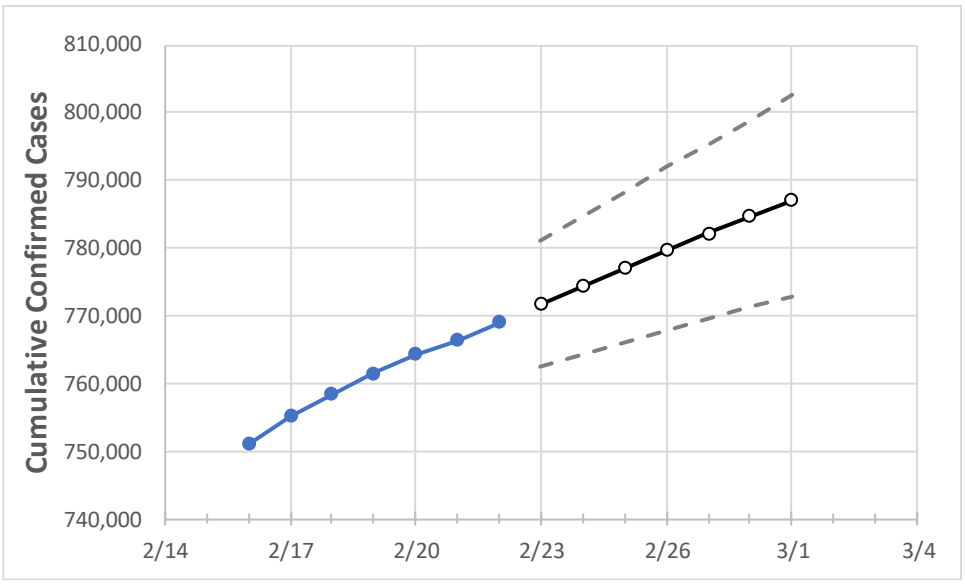
IEM's Modeling Lead

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
New Jersey	761,498	764,375	766,405	769,109	771,754	774,422	777,032	779,623	782,146	784,687	787,128

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Bergen	74,126	74,471	74,689	75,062	75,377	75,676	75,980	76,280	76,565	76,855	77,140
Burlington	34,230	34,473	34,557	34,677	34,778	34,876	34,971	35,065	35,154	35,243	35,327
Camden	43,042	43,169	43,242	43,390	43,495	43,595	43,695	43,792	43,890	43,981	44,071
Essex	71,178	71,449	71,592	71,834	72,086	72,341	72,584	72,819	73,055	73,292	73,534
Gloucester	23,511	23,602	23,644	23,719	23,776	23,832	23,886	23,940	23,992	24,043	24,089
Hudson	66,716	66,897	67,058	67,349	67,596	67,839	68,074	68,308	68,539	68,770	68,998
Hunterdon	6,615	6,658	6,673	6,699	6,731	6,762	6,792	6,823	6,853	6,882	6,910
Mercer	27,015	27,098	27,143	27,236	27,316	27,396	27,472	27,550	27,624	27,698	27,767
Middlesex	70,279	70,503	70,672	70,874	71,109	71,341	71,570	71,790	72,014	72,220	72,424
Monmouth	54,467	54,680	54,840	55,082	55,308	55,536	55,757	55,977	56,185	56,391	56,596
Morris	36,077	36,220	36,328	36,515	36,660	36,800	36,938	37,074	37,205	37,332	37,457
Ocean	56,273	56,459	56,631	56,895	57,133	57,371	57,600	57,826	58,048	58,268	58,482
Passaic	55,408	55,529	55,633	55,755	55,923	56,089	56,256	56,415	56,577	56,733	56,884
Somerset	21,937	22,034	22,090	22,171	22,255	22,336	22,415	22,494	22,574	22,652	22,725
Sussex	8,750	8,797	8,805	8,850	8,887	8,922	8,956	8,990	9,023	9,056	9,087
Union	55,029	55,207	55,304	55,484	55,660	55,839	56,012	56,178	56,347	56,511	56,672
Warren	6,736	6,768	6,792	6,815	6,837	6,858	6,879	6,899	6,918	6,937	6,956

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:		
	2/19	2/20	2/21	2/22	2/24	2/26	2/28
Bergen	74,126	74,471	74,689	75,062	75,676 (15,135) [3,632] {1,816}	76,280 (15,256) [3,661] {1,831}	76,855 (15,371) [3,689] {1,845}
Burlington	34,230	34,473	34,557	34,677	34,876 (6,975) [1,674] {837}	35,065 (7,013) [1,683] {842}	35,243 (7,049) [1,692] {846}
Camden	43,042	43,169	43,242	43,390	43,595 (8,719) [2,093] {1,046}	43,792 (8,758) [2,102] {1,051}	43,981 (8,796) [2,111] {1,056}
Essex	71,178	71,449	71,592	71,834	72,341 (14,468) [3,472] {1,736}	72,819 (14,564) [3,495] {1,748}	73,292 (14,658) [3,518] {1,759}
Gloucester	23,511	23,602	23,644	23,719	23,832 (4,766) [1,144] {572}	23,940 (4,788) [1,149] {575}	24,043 (4,809) [1,154] {577}
Hudson	66,716	66,897	67,058	67,349	67,839 (13,568) [3,256] {1,628}	68,308 (13,662) [3,279] {1,639}	68,770 (13,754) [3,301] {1,650}
Hunterdon	6,615	6,658	6,673	6,699	6,762 (1,352) [325] {162}	6,823 (1,365) [328] {164}	6,882 (1,376) [330] {165}
Mercer	27,015	27,098	27,143	27,236	27,396 (5,479) [1,315] {657}	27,550 (5,510) [1,322] {661}	27,698 (5,540) [1,329] {665}
Middlesex	70,279	70,503	70,672	70,874	71,341 (14,268) [3,424] {1,712}	71,790 (14,358) [3,446] {1,723}	72,220 (14,444) [3,467] {1,733}
Monmouth	54,467	54,680	54,840	55,082	55,536 (11,107) [2,666] {1,333}	55,977 (11,195) [2,687] {1,343}	56,391 (11,278) [2,707] {1,353}
Morris	36,077	36,220	36,328	36,515	36,800 (7,360) [1,766] {883}	37,074 (7,415) [1,780] {890}	37,332 (7,466) [1,792] {896}
Ocean	56,273	56,459	56,631	56,895	57,371 (11,474) [2,754] {1,377}	57,826 (11,565) [2,776] {1,388}	58,268 (11,654) [2,797] {1,398}
Passaic	55,408	55,529	55,633	55,755	56,089 (11,218) [2,692] {1,346}	56,415 (11,283) [2,708] {1,354}	56,733 (11,347) [2,723] {1,362}
Somerset	21,937	22,034	22,090	22,171	22,336 (4,467) [1,072] {536}	22,494 (4,499) [1,080] {540}	22,652 (4,530) [1,087] {544}
Sussex	8,750	8,797	8,805	8,850	8,922 (1,784) [428] {214}	8,990 (1,798) [432] {216}	9,056 (1,811) [435] {217}
Union	55,029	55,207	55,304	55,484	55,839 (11,168) [2,680] {1,340}	56,178 (11,236) [2,697] {1,348}	56,511 (11,302) [2,713] {1,356}
Warren	6,736	6,768	6,792	6,815	6,858 (1,372) [329] {165}	6,899 (1,380) [331] {166}	6,937 (1,387) [333] {166}

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.