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

Date: 3/17/21

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 3/17/21 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.

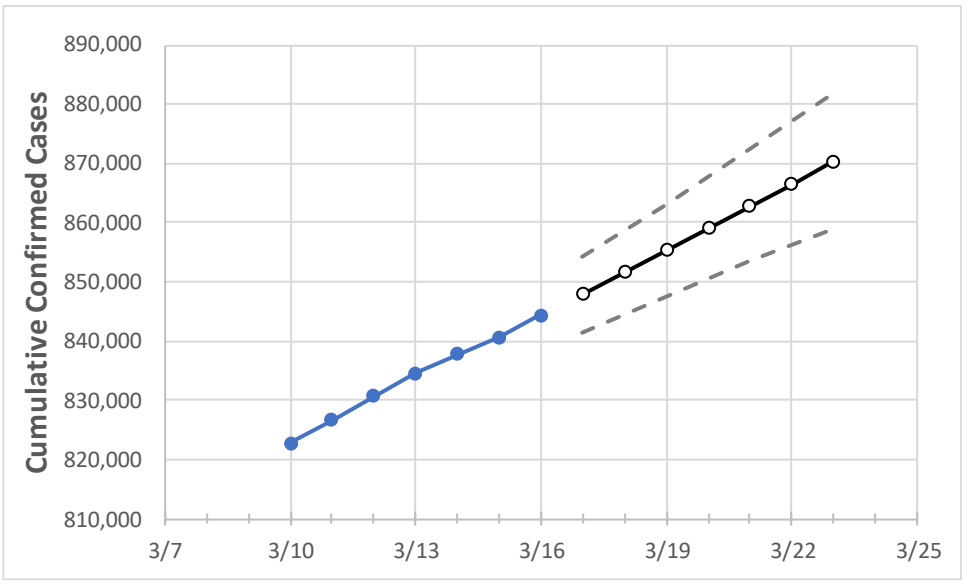
IEM's Modeling Lead

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:						
	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23
New Jersey	834,547	837,861	840,685	844,398	847,998	851,630	855,353	859,062	862,801	866,575	870,366

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:						
	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23
Bergen	82,880	83,263	83,594	84,076	84,491	84,908	85,331	85,753	86,177	86,600	87,032
Burlington	37,000	37,136	37,226	37,336	37,460	37,584	37,708	37,832	37,953	38,077	38,200
Camden	45,760	45,899	45,994	46,111	46,234	46,355	46,478	46,600	46,722	46,844	46,966
Essex	77,780	78,065	78,308	78,676	79,005	79,336	79,678	80,011	80,350	80,691	81,036
Gloucester	25,130	25,206	25,243	25,318	25,389	25,461	25,533	25,602	25,673	25,745	25,817
Hudson	73,292	73,595	73,816	74,064	74,357	74,649	74,936	75,225	75,518	75,808	76,091
Hunterdon	7,401	7,454	7,490	7,523	7,562	7,602	7,642	7,682	7,724	7,766	7,808
Mercer	28,946	29,057	29,126	29,195	29,282	29,366	29,451	29,536	29,622	29,707	29,790
Middlesex	76,532	76,797	77,082	77,485	77,818	78,150	78,490	78,828	79,174	79,519	79,865
Monmouth	61,340	61,647	61,940	62,277	62,645	63,023	63,404	63,792	64,174	64,568	64,954
Morris	40,593	40,821	40,975	41,199	41,466	41,740	42,020	42,300	42,593	42,885	43,194
Ocean	62,540	62,815	63,049	63,358	63,665	63,973	64,281	64,592	64,897	65,199	65,509
Passaic	59,715	59,896	60,111	60,392	60,637	60,889	61,144	61,403	61,667	61,932	62,210
Somerset	24,299	24,411	24,495	24,618	24,737	24,857	24,977	25,102	25,226	25,353	25,480
Sussex	9,919	9,968	10,011	10,061	10,129	10,198	10,269	10,340	10,413	10,485	10,560
Union	59,605	59,826	60,047	60,286	60,518	60,750	60,983	61,220	61,452	61,687	61,925
Warren	7,550	7,592	7,624	7,658	7,697	7,736	7,775	7,815	7,856	7,896	7,937

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:		
	3/13	3/14	3/15	3/16	3/18	3/20	3/22
Bergen	82,880	83,263	83,594	84,076	84,908 (16,982) [4,076] {2,038}	85,753 (17,151) [4,116] {2,058}	86,600 (17,320) [4,157] {2,078}
Burlington	37,000	37,136	37,226	37,336	37,584 (7,517) [1,804] {902}	37,832 (7,566) [1,816] {908}	38,077 (7,615) [1,828] {914}
Camden	45,760	45,899	45,994	46,111	46,355 (9,271) [2,225] {1,113}	46,600 (9,320) [2,237] {1,118}	46,844 (9,369) [2,249] {1,124}
Essex	77,780	78,065	78,308	78,676	79,336 (15,867) [3,808] {1,904}	80,011 (16,002) [3,841] {1,920}	80,691 (16,138) [3,873] {1,937}
Gloucester	25,130	25,206	25,243	25,318	25,461 (5,092) [1,222] {611}	25,602 (5,120) [1,229] {614}	25,745 (5,149) [1,236] {618}
Hudson	73,292	73,595	73,816	74,064	74,649 (14,930) [3,583] {1,792}	75,225 (15,045) [3,611] {1,805}	75,808 (15,162) [3,639] {1,819}
Hunterdon	7,401	7,454	7,490	7,523	7,602 (1,520) [365] {182}	7,682 (1,536) [369] {184}	7,766 (1,553) [373] {186}
Mercer	28,946	29,057	29,126	29,195	29,366 (5,873) [1,410] {705}	29,536 (5,907) [1,418] {709}	29,707 (5,941) [1,426] {713}
Middlesex	76,532	76,797	77,082	77,485	78,150 (15,630) [3,751] {1,876}	78,828 (15,766) [3,784] {1,892}	79,519 (15,904) [3,817] {1,908}
Monmouth	61,340	61,647	61,940	62,277	63,023 (12,605) [3,025] {1,513}	63,792 (12,758) [3,062] {1,531}	64,568 (12,914) [3,099] {1,550}
Morris	40,593	40,821	40,975	41,199	41,740 (8,348) [2,003] {1,002}	42,300 (8,460) [2,030] {1,015}	42,885 (8,577) [2,058] {1,029}
Ocean	62,540	62,815	63,049	63,358	63,973 (12,795) [3,071] {1,535}	64,592 (12,918) [3,100] {1,550}	65,199 (13,040) [3,130] {1,565}
Passaic	59,715	59,896	60,111	60,392	60,889 (12,178) [2,923] {1,461}	61,403 (12,281) [2,947] {1,474}	61,932 (12,386) [2,973] {1,486}
Somerset	24,299	24,411	24,495	24,618	24,857 (4,971) [1,193] {597}	25,102 (5,020) [1,205] {602}	25,353 (5,071) [1,217] {608}
Sussex	9,919	9,968	10,011	10,061	10,198 (2,040) [490] {245}	10,340 (2,068) [496] {248}	10,485 (2,097) [503] {252}
Union	59,605	59,826	60,047	60,286	60,750 (12,150) [2,916] {1,458}	61,220 (12,244) [2,939] {1,469}	61,687 (12,337) [2,961] {1,480}
Warren	7,550	7,592	7,624	7,658	7,736 (1,547) [371] {186}	7,815 (1,563) [375] {188}	7,896 (1,579) [379] {190}

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.