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

Date: 3/18/21

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 3/18/21 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.

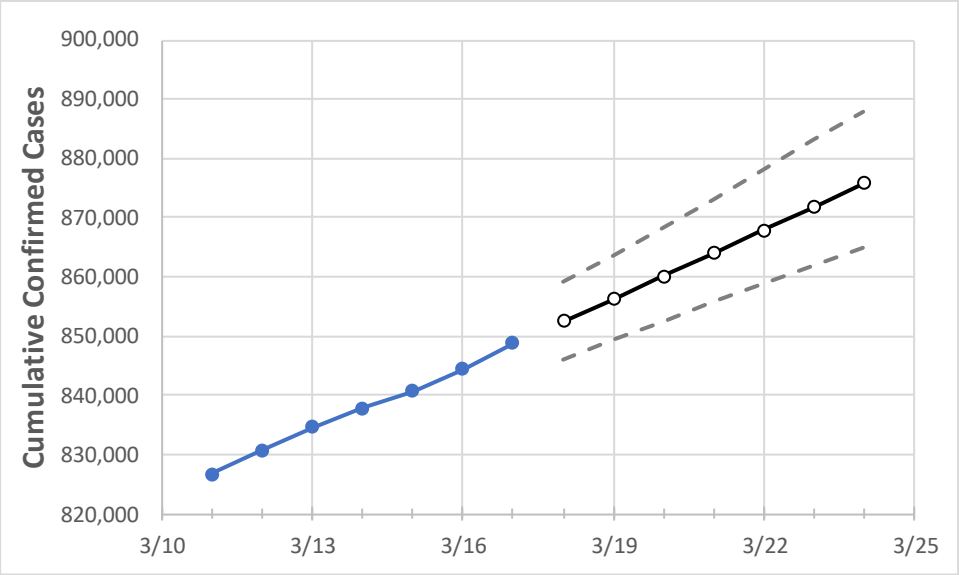
IEM's Modeling Lead

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:						
	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24
New Jersey	837,861	840,685	844,398	848,727	852,460	856,284	860,109	863,970	867,847	871,795	875,845

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:						
	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24
Bergen	83,263	83,594	84,076	84,573	85,008	85,449	85,891	86,333	86,769	87,223	87,681
Burlington	37,136	37,226	37,336	37,508	37,640	37,776	37,913	38,051	38,190	38,329	38,470
Camden	45,899	45,994	46,111	46,318	46,451	46,585	46,721	46,856	46,992	47,130	47,267
Essex	78,065	78,308	78,676	79,098	79,441	79,789	80,134	80,487	80,845	81,200	81,562
Gloucester	25,206	25,243	25,318	25,433	25,509	25,585	25,661	25,738	25,816	25,893	25,972
Hudson	73,595	73,816	74,064	74,437	74,741	75,049	75,355	75,658	75,964	76,267	76,568
Hunterdon	7,454	7,490	7,523	7,580	7,622	7,666	7,710	7,754	7,799	7,843	7,889
Mercer	29,057	29,126	29,195	29,315	29,406	29,497	29,589	29,680	29,772	29,862	29,955
Middlesex	76,797	77,082	77,485	77,871	78,204	78,537	78,874	79,215	79,560	79,901	80,249
Monmouth	61,647	61,940	62,277	62,683	63,067	63,440	63,823	64,213	64,609	65,008	65,409
Morris	40,821	40,975	41,199	41,464	41,734	42,013	42,295	42,577	42,870	43,167	43,460
Ocean	62,815	63,049	63,358	63,683	63,992	64,295	64,598	64,907	65,210	65,519	65,837
Passaic	59,896	60,111	60,392	60,625	60,870	61,115	61,361	61,613	61,867	62,123	62,386
Somerset	24,411	24,495	24,618	24,725	24,844	24,964	25,083	25,206	25,328	25,453	25,577
Sussex	9,968	10,011	10,061	10,137	10,207	10,278	10,351	10,427	10,503	10,579	10,657
Union	59,826	60,047	60,286	60,518	60,751	60,986	61,223	61,466	61,705	61,944	62,186
Warren	7,592	7,624	7,658	7,726	7,769	7,813	7,858	7,904	7,949	7,996	8,043

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:		
	3/14	3/15	3/16	3/17	3/19	3/21	3/23
Bergen	83,263	83,594	84,076	84,573	85,449 (17,090) [4,102] {2,051}	86,333 (17,267) [4,144] {2,072}	87,223 (17,445) [4,187] {2,093}
Burlington	37,136	37,226	37,336	37,508	37,776 (7,555) [1,813] {907}	38,051 (7,610) [1,826] {913}	38,329 (7,666) [1,840] {920}
Camden	45,899	45,994	46,111	46,318	46,585 (9,317) [2,236] {1,118}	46,856 (9,371) [2,249] {1,125}	47,130 (9,426) [2,262] {1,131}
Essex	78,065	78,308	78,676	79,098	79,789 (15,958) [3,830] {1,915}	80,487 (16,097) [3,863] {1,932}	81,200 (16,240) [3,898] {1,949}
Gloucester	25,206	25,243	25,318	25,433	25,585 (5,117) [1,228] {614}	25,738 (5,148) [1,235] {618}	25,893 (5,179) [1,243] {621}
Hudson	73,595	73,816	74,064	74,437	75,049 (15,010) [3,602] {1,801}	75,658 (15,132) [3,632] {1,816}	76,267 (15,253) [3,661] {1,830}
Hunterdon	7,454	7,490	7,523	7,580	7,666 (1,533) [368] {184}	7,754 (1,551) [372] {186}	7,843 (1,569) [376] {188}
Mercer	29,057	29,126	29,195	29,315	29,497 (5,899) [1,416] {708}	29,680 (5,936) [1,425] {712}	29,862 (5,972) [1,433] {717}
Middlesex	76,797	77,082	77,485	77,871	78,537 (15,707) [3,770] {1,885}	79,215 (15,843) [3,802] {1,901}	79,901 (15,980) [3,835] {1,918}
Monmouth	61,647	61,940	62,277	62,683	63,440 (12,688) [3,045] {1,523}	64,213 (12,843) [3,082] {1,541}	65,008 (13,002) [3,120] {1,560}
Morris	40,821	40,975	41,199	41,464	42,013 (8,403) [2,017] {1,008}	42,577 (8,515) [2,044] {1,022}	43,167 (8,633) [2,072] {1,036}
Ocean	62,815	63,049	63,358	63,683	64,295 (12,859) [3,086] {1,543}	64,907 (12,981) [3,116] {1,558}	65,519 (13,104) [3,145] {1,572}
Passaic	59,896	60,111	60,392	60,625	61,115 (12,223) [2,934] {1,467}	61,613 (12,323) [2,957] {1,479}	62,123 (12,425) [2,982] {1,491}
Somerset	24,411	24,495	24,618	24,725	24,964 (4,993) [1,198] {599}	25,206 (5,041) [1,210] {605}	25,453 (5,091) [1,222] {611}
Sussex	9,968	10,011	10,061	10,137	10,278 (2,056) [493] {247}	10,427 (2,085) [500] {250}	10,579 (2,116) [508] {254}
Union	59,826	60,047	60,286	60,518	60,986 (12,197) [2,927] {1,464}	61,466 (12,293) [2,950] {1,475}	61,944 (12,389) [2,973] {1,487}
Warren	7,592	7,624	7,658	7,726	7,813 (1,563) [375] {188}	7,904 (1,581) [379] {190}	7,996 (1,599) [384] {192}

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.