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

Date: 1/24/22

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 1/24/22 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.

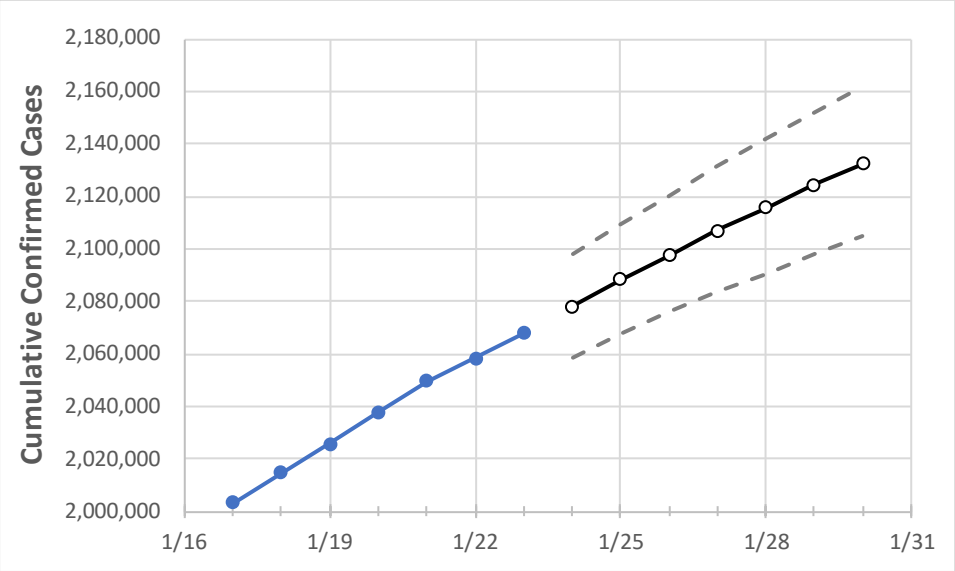
IEM's Modeling Lead

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:						
	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30
New Jersey	2,037,690	2,049,573	2,058,497	2,067,692	2,078,050	2,088,490	2,097,646	2,107,010	2,115,881	2,124,373	2,132,263

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:						
	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30
Bergen	205,847	207,078	207,946	208,895	209,943	210,941	211,834	212,745	213,624	214,444	215,217
Burlington	92,975	93,673	94,240	94,719	95,310	95,864	96,411	96,925	97,429	97,935	98,411
Camden	115,910	116,646	117,326	118,124	118,985	119,822	120,588	121,359	122,100	122,812	123,516
Essex	200,614	201,485	202,007	202,653	203,430	204,203	204,886	205,559	206,205	206,813	207,409
Gloucester	64,060	64,436	64,766	65,252	65,667	66,103	66,513	66,897	67,278	67,665	68,023
Hudson	159,877	160,698	161,181	161,614	162,546	163,455	164,309	165,117	165,915	166,692	167,435
Hunterdon	22,361	22,545	22,651	22,730	22,883	23,034	23,173	23,306	23,444	23,573	23,695
Mercer	69,332	69,857	70,243	70,560	71,055	71,532	71,983	72,429	72,855	73,290	73,679
Middlesex	175,371	176,259	176,999	177,626	178,418	179,179	179,879	180,575	181,216	181,862	182,457
Monmouth	152,065	152,795	153,520	154,441	155,130	155,766	156,379	156,964	157,522	158,068	158,584
Morris	109,707	110,368	110,876	111,287	112,020	112,746	113,388	114,052	114,681	115,276	115,906
Ocean	149,821	150,682	151,477	152,433	153,210	153,971	154,688	155,382	156,047	156,727	157,348
Passaic	135,504	136,338	136,717	137,198	137,742	138,234	138,718	139,160	139,615	140,031	140,408
Somerset	62,706	63,058	63,298	63,517	63,833	64,148	64,416	64,704	64,955	65,224	65,445
Sussex	31,367	31,563	31,731	31,842	32,009	32,175	32,323	32,473	32,616	32,751	32,889
Union	133,807	134,636	135,061	135,340	135,818	136,240	136,647	137,039	137,409	137,752	138,074
Warren	22,073	22,238	22,344	22,412	22,544	22,672	22,792	22,908	23,019	23,131	23,241

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:		
	1/20	1/21	1/22	1/23	1/25	1/27	1/29
Bergen	205,847	207,078	207,946	208,895	210,941 (42,188) [10,125] {5,063}	212,745 (42,549) [10,212] {5,106}	214,444 (42,889) [10,293] {5,147}
Burlington	92,975	93,673	94,240	94,719	95,864 (19,173) [4,601] {2,301}	96,925 (19,385) [4,652] {2,326}	97,935 (19,587) [4,701] {2,350}
Camden	115,910	116,646	117,326	118,124	119,822 (23,964) [5,751] {2,876}	121,359 (24,272) [5,825] {2,913}	122,812 (24,562) [5,895] {2,947}
Essex	200,614	201,485	202,007	202,653	204,203 (40,841) [9,802] {4,901}	205,559 (41,112) [9,867] {4,933}	206,813 (41,363) [9,927] {4,964}
Gloucester	64,060	64,436	64,766	65,252	66,103 (13,221) [3,173] {1,586}	66,897 (13,379) [3,211] {1,606}	67,665 (13,533) [3,248] {1,624}
Hudson	159,877	160,698	161,181	161,614	163,455 (32,691) [7,846] {3,923}	165,117 (33,023) [7,926] {3,963}	166,692 (33,338) [8,001] {4,001}
Hunterdon	22,361	22,545	22,651	22,730	23,034 (4,607) [1,106] {553}	23,306 (4,661) [1,119] {559}	23,573 (4,715) [1,131] {566}
Mercer	69,332	69,857	70,243	70,560	71,532 (14,306) [3,434] {1,717}	72,429 (14,486) [3,477] {1,738}	73,290 (14,658) [3,518] {1,759}
Middlesex	175,371	176,259	176,999	177,626	179,179 (35,836) [8,601] {4,300}	180,575 (36,115) [8,668] {4,334}	181,862 (36,372) [8,729] {4,365}
Monmouth	152,065	152,795	153,520	154,441	155,766 (31,153) [7,477] {3,738}	156,964 (31,393) [7,534] {3,767}	158,068 (31,614) [7,587] {3,794}
Morris	109,707	110,368	110,876	111,287	112,746 (22,549) [5,412] {2,706}	114,052 (22,810) [5,474] {2,737}	115,276 (23,055) [5,533] {2,767}
Ocean	149,821	150,682	151,477	152,433	153,971 (30,794) [7,391] {3,695}	155,382 (31,076) [7,458] {3,729}	156,727 (31,345) [7,523] {3,761}
Passaic	135,504	136,338	136,717	137,198	138,234 (27,647) [6,635] {3,318}	139,160 (27,832) [6,680] {3,340}	140,031 (28,006) [6,721] {3,361}
Somerset	62,706	63,058	63,298	63,517	64,148 (12,830) [3,079] {1,540}	64,704 (12,941) [3,106] {1,553}	65,224 (13,045) [3,131] {1,565}
Sussex	31,367	31,563	31,731	31,842	32,175 (6,435) [1,544] {772}	32,473 (6,495) [1,559] {779}	32,751 (6,550) [1,572] {786}
Union	133,807	134,636	135,061	135,340	136,240 (27,248) [6,540] {3,270}	137,039 (27,408) [6,578] {3,289}	137,752 (27,550) [6,612] {3,306}
Warren	22,073	22,238	22,344	22,412	22,672 (4,534) [1,088] {544}	22,908 (4,582) [1,100] {550}	23,131 (4,626) [1,110] {555}

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.