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

Date: 1/14/22

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 1/14/22 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.

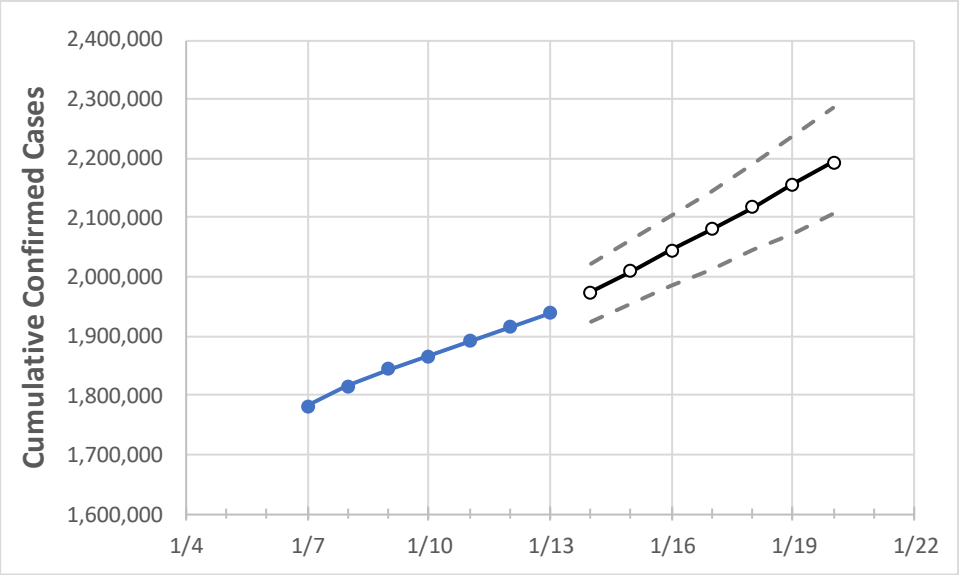
IEM's Modeling Lead

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:						
	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20
New Jersey	1,866,735	1,892,142	1,915,417	1,939,089	1,974,030	2,009,093	2,044,689	2,080,740	2,117,207	2,155,715	2,193,689

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:						
	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20
Bergen	188,288	190,864	193,361	195,515	198,721	201,913	205,067	208,311	211,589	214,858	218,151
Burlington	84,509	85,573	86,601	87,775	89,399	91,070	92,778	94,548	96,391	98,297	100,267
Camden	103,954	105,493	107,134	108,609	111,538	114,595	117,692	121,042	124,497	128,204	132,045
Essex	185,276	187,866	189,925	192,332	195,085	197,870	200,534	203,232	205,841	208,465	211,117
Gloucester	57,887	58,795	59,730	60,498	61,563	62,641	63,768	64,912	66,094	67,316	68,584
Hudson	144,284	146,619	149,029	150,981	153,678	156,437	159,281	162,137	165,067	168,116	171,171
Hunterdon	20,071	20,463	20,787	21,006	21,445	21,900	22,351	22,811	23,298	23,796	24,284
Mercer	62,012	63,104	64,033	65,039	66,327	67,644	69,050	70,434	71,870	73,337	74,827
Middlesex	162,189	164,057	165,614	167,448	170,332	173,191	176,094	179,127	182,182	185,391	188,470
Monmouth	141,204	142,867	144,343	145,918	148,348	150,769	153,193	155,754	158,351	160,956	163,679
Morris	98,336	99,829	101,033	102,615	104,709	106,872	109,001	111,158	113,470	115,816	118,052
Ocean	138,521	140,072	141,393	143,101	145,274	147,574	149,865	152,302	154,731	157,273	159,884
Passaic	125,529	127,127	128,519	129,897	132,187	134,486	136,806	139,117	141,482	143,990	146,456
Somerset	57,457	58,252	58,902	59,548	60,605	61,666	62,697	63,761	64,891	66,001	67,093
Sussex	28,755	29,127	29,510	29,825	30,433	31,054	31,693	32,361	33,038	33,756	34,464
Union	125,035	126,609	127,888	129,031	131,005	132,963	134,922	136,859	138,814	140,833	142,780
Warren	20,043	20,386	20,678	20,886	21,269	21,654	22,041	22,438	22,846	23,261	23,684

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:											
	1/10	1/11	1/12	1/13	1/15				1/17				1/19			
Bergen	188,288	190,864	193,361	195,515	201,913	(40,383)	[9,692]	{4,846}	208,311	(41,662)	[9,999]	{4,999}	214,858	(42,972)	[10,313]	{5,157}
Burlington	84,509	85,573	86,601	87,775	91,070	(18,214)	[4,371]	{2,186}	94,548	(18,910)	[4,538]	{2,269}	98,297	(19,659)	[4,718]	{2,359}
Camden	103,954	105,493	107,134	108,609	114,595	(22,919)	[5,501]	{2,750}	121,042	(24,208)	[5,810]	{2,905}	128,204	(25,641)	[6,154]	{3,077}
Essex	185,276	187,866	189,925	192,332	197,870	(39,574)	[9,498]	{4,749}	203,232	(40,646)	[9,755]	{4,878}	208,465	(41,693)	[10,006]	{5,003}
Gloucester	57,887	58,795	59,730	60,498	62,641	(12,528)	[3,007]	{1,503}	64,912	(12,982)	[3,116]	{1,558}	67,316	(13,463)	[3,231]	{1,616}
Hudson	144,284	146,619	149,029	150,981	156,437	(31,287)	[7,509]	{3,754}	162,137	(32,427)	[7,783]	{3,891}	168,116	(33,623)	[8,070]	{4,035}
Hunterdon	20,071	20,463	20,787	21,006	21,900	(4,380)	[1,051]	{526}	22,811	(4,562)	[1,095]	{547}	23,796	(4,759)	[1,142]	{571}
Mercer	62,012	63,104	64,033	65,039	67,644	(13,529)	[3,247]	{1,623}	70,434	(14,087)	[3,381]	{1,690}	73,337	(14,667)	[3,520]	{1,760}
Middlesex	162,189	164,057	165,614	167,448	173,191	(34,638)	[8,313]	{4,157}	179,127	(35,825)	[8,598]	{4,299}	185,391	(37,078)	[8,899]	{4,449}
Monmouth	141,204	142,867	144,343	145,918	150,769	(30,154)	[7,237]	{3,618}	155,754	(31,151)	[7,476]	{3,738}	160,956	(32,191)	[7,726]	{3,863}
Morris	98,336	99,829	101,033	102,615	106,872	(21,374)	[5,130]	{2,565}	111,158	(22,232)	[5,336]	{2,668}	115,816	(23,163)	[5,559]	{2,780}
Ocean	138,521	140,072	141,393	143,101	147,574	(29,515)	[7,084]	{3,542}	152,302	(30,460)	[7,310]	{3,655}	157,273	(31,455)	[7,549]	{3,775}
Passaic	125,529	127,127	128,519	129,897	134,486	(26,897)	[6,455]	{3,228}	139,117	(27,823)	[6,678]	{3,339}	143,990	(28,798)	[6,912]	{3,456}
Somerset	57,457	58,252	58,902	59,548	61,666	(12,333)	[2,960]	{1,480}	63,761	(12,752)	[3,061]	{1,530}	66,001	(13,200)	[3,168]	{1,584}
Sussex	28,755	29,127	29,510	29,825	31,054	(6,211)	[1,491]	{745}	32,361	(6,472)	[1,553]	{777}	33,756	(6,751)	[1,620]	{810}
Union	125,035	126,609	127,888	129,031	132,963	(26,593)	[6,382]	{3,191}	136,859	(27,372)	[6,569]	{3,285}	140,833	(28,167)	[6,760]	{3,380}
Warren	20,043	20,386	20,678	20,886	21,654	(4,331)	[1,039]	{520}	22,438	(4,488)	[1,077]	{539}	23,261	(4,652)	[1,117]	{558}

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.