IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/10/22

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 <u>not</u> 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 1/10/22 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
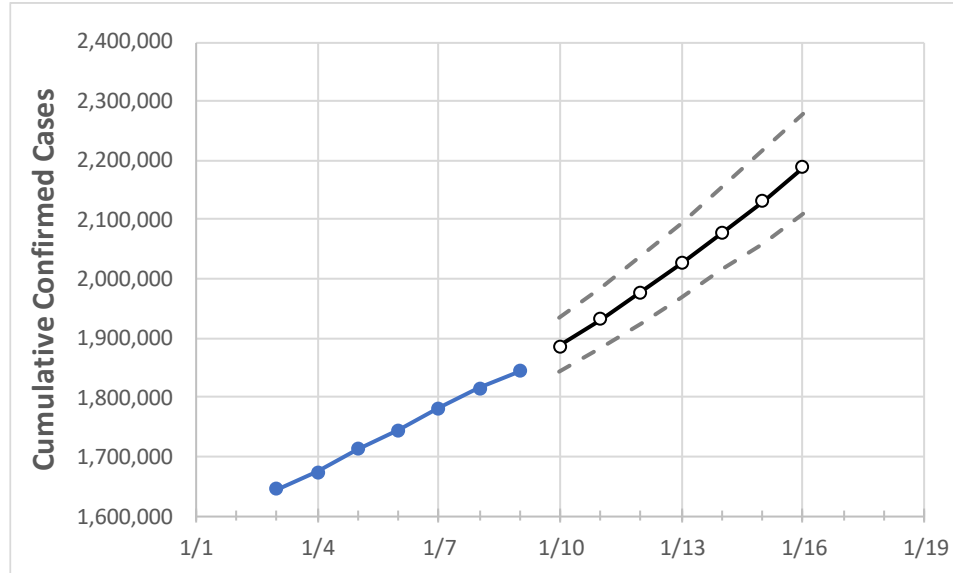
	Actual Confirmed Cases On:				Projected Cases For:						
	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16
New Jersey	1,744,002	1,782,463	1,815,163	1,843,677	1,886,189	1,931,304	1,977,615	2,026,638	2,077,582	2,131,141	2,188,276

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:						
	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16
Bergen	175,750	179,690	183,161	185,731	190,478	195,424	200,725	206,078	211,893	218,108	224,427
Burlington	78,653	80,490	82,084	83,530	85,380	87,309	89,346	91,514	93,773	96,187	98,726
Camden	96,181	98,458	100,590	102,426	104,833	107,380	110,036	112,875	115,879	119,005	122,352
Essex	173,220	177,129	180,218	183,325	189,470	195,879	202,608	209,669	217,046	224,861	232,791
Gloucester	54,211	55,203	56,363	57,374	58,503	59,689	60,926	62,232	63,604	65,050	66,575
Hudson	133,400	136,423	139,723	142,344	145,711	149,237	152,874	156,862	160,947	165,362	169,950
Hunterdon	18,503	19,055	19,417	19,705	20,208	20,744	21,290	21,879	22,485	23,149	23,826
Mercer	57,431	58,851	60,064	61,101	62,655	64,286	66,037	67,872	69,802	71,832	73,990
Middlesex	151,676	155,121	157,690	159,953	163,811	167,774	171,893	176,312	180,919	185,842	191,004
Monmouth	132,835	135,558	137,819	139,771	142,459	145,228	148,156	151,149	154,293	157,564	160,900
Morris	90,976	93,417	95,349	97,006	99,564	102,243	105,007	107,916	110,972	114,199	117,529
Ocean	130,882	133,340	135,374	137,186	139,473	141,898	144,440	147,015	149,806	152,639	155,622
Passaic	117,133	119,749	122,101	123,940	127,234	130,699	134,245	138,031	142,104	146,328	150,744
Somerset	53,355	54,839	55,732	56,673	58,205	59,841	61,506	63,284	65,136	67,096	69,108
Sussex	27,091	27,571	27,931	28,362	28,952	29,550	30,182	30,831	31,502	32,216	32,943
Union	117,627	119,799	121,842	123,547	127,104	130,788	134,706	138,765	143,057	147,730	152,462
Warren	18,691	19,144	19,472	19,819	20,230	20,664	21,099	21,570	22,051	22,563	23,086

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:		
	1/6	1/7	1/8	1/9	1/11	1/13	1/15
Bergen	175,750	179,690	183,161	185,731	195,424 (39,085) [9,380] {4,690}	206,078 (41,216) [9,892] {4,946}	218,108 (43,622) [10,469] {5,235}
Burlington	78,653	80,490	82,084	83,530	87,309 (17,462) [4,191] {2,095}	91,514 (18,303) [4,393] {2,196}	96,187 (19,237) [4,617] {2,308}
Camden	96,181	98,458	100,590	102,426	107,380 (21,476) [5,154] {2,577}	112,875 (22,575) [5,418] {2,709}	119,005 (23,801) [5,712] {2,856}
Essex	173,220	177,129	180,218	183,325	195,879 (39,176) [9,402] {4,701}	209,669 (41,934) [10,064] {5,032}	224,861 (44,972) [10,793] {5,397}
Gloucester	54,211	55,203	56,363	57,374	59,689 (11,938) [2,865] {1,433}	62,232 (12,446) [2,987] {1,494}	65,050 (13,010) [3,122] {1,561}
Hudson	133,400	136,423	139,723	142,344	149,237 (29,847) [7,163] {3,582}	156,862 (31,372) [7,529] {3,765}	165,362 (33,072) [7,937] {3,969}
Hunterdon	18,503	19,055	19,417	19,705	20,744 (4,149) [996] {498}	21,879 (4,376) [1,050] {525}	23,149 (4,630) [1,111] {556}
Mercer	57,431	58,851	60,064	61,101	64,286 (12,857) [3,086] {1,543}	67,872 (13,574) [3,258] {1,629}	71,832 (14,366) [3,448] {1,724}
Middlesex	151,676	155,121	157,690	159,953	167,774 (33,555) [8,053] {4,027}	176,312 (35,262) [8,463] {4,231}	185,842 (37,168) [8,920] {4,460}
Monmouth	132,835	135,558	137,819	139,771	145,228 (29,046) [6,971] {3,485}	151,149 (30,230) [7,255] {3,628}	157,564 (31,513) [7,563] {3,782}
Morris	90,976	93,417	95,349	97,006	102,243 (20,449) [4,908] {2,454}	107,916 (21,583) [5,180] {2,590}	114,199 (22,840) [5,482] {2,741}
Ocean	130,882	133,340	135,374	137,186	141,898 (28,380) [6,811] {3,406}	147,015 (29,403) [7,057] {3,528}	152,639 (30,528) [7,327] {3,663}
Passaic	117,133	119,749	122,101	123,940	130,699 (26,140) [6,274] {3,137}	138,031 (27,606) [6,625] {3,313}	146,328 (29,266) [7,024] {3,512}
Somerset	53,355	54,839	55,732	56,673	59,841 (11,968) [2,872] {1,436}	63,284 (12,657) [3,038] {1,519}	67,096 (13,419) [3,221] {1,610}
Sussex	27,091	27,571	27,931	28,362	29,550 (5,910) [1,418] {709}	30,831 (6,166) [1,480] {740}	32,216 (6,443) [1,546] {773}
Union	117,627	119,799	121,842	123,547	130,788 (26,158) [6,278] {3,139}	138,765 (27,753) [6,661] {3,330}	147,730 (29,546) [7,091] {3,546}
Warren	18,691	19,144	19,472	19,819	20,664 (4,133) [992] {496}	21,570 (4,314) [1,035] {518}	22,563 (4,513) [1,083] {542}

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.