IEM's AI Modeling: Short-term COVID-19 Projections
Date: 2/8/21

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 <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 2/8/21 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
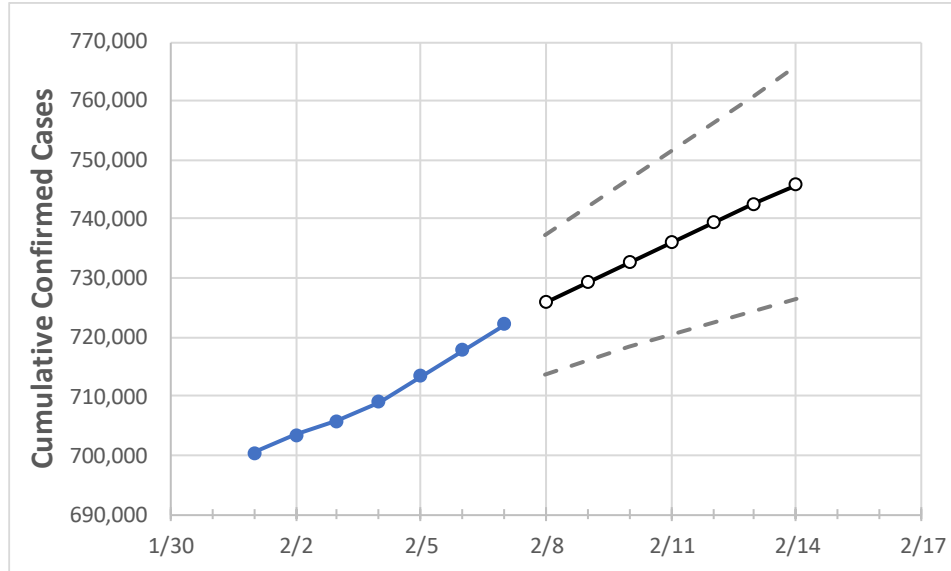
	Actual Confirmed Cases On:				Projected Cases For:						
	2/4	2/5	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14
New Jersey	709,096	713,324	717,835	722,167	725,816	729,284	732,644	736,065	739,344	742,538	745,759

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:						
	2/4	2/5	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14
Bergen	68,542	69,047	69,523	69,951	70,337	70,728	71,104	71,475	71,846	72,199	72,548
Burlington	32,202	32,422	32,610	32,811	32,986	33,156	33,322	33,485	33,645	33,802	33,953
Camden	40,930	41,113	41,264	41,419	41,559	41,694	41,823	41,944	42,059	42,171	42,275
Essex	66,173	66,503	66,849	67,316	67,660	67,993	68,320	68,636	68,952	69,267	69,570
Gloucester	22,268	22,389	22,489	22,579	22,673	22,764	22,852	22,935	23,011	23,087	23,159
Hudson	62,256	62,569	62,928	63,293	63,565	63,832	64,089	64,335	64,582	64,814	65,045
Hunterdon	6,028	6,052	6,130	6,183	6,220	6,257	6,293	6,329	6,365	6,400	6,434
Mercer	25,446	25,550	25,706	25,812	25,920	26,023	26,126	26,225	26,322	26,416	26,509
Middlesex	65,251	65,616	66,087	66,494	66,853	67,205	67,556	67,887	68,219	68,540	68,860
Monmouth	50,005	50,314	50,695	51,104	51,379	51,646	51,901	52,152	52,390	52,633	52,867
Morris	33,050	33,302	33,557	33,849	34,081	34,314	34,543	34,768	34,986	35,196	35,409
Ocean	51,439	51,802	52,187	52,585	52,913	53,242	53,555	53,870	54,171	54,476	54,773
Passaic	52,025	52,422	52,644	52,866	53,080	53,294	53,502	53,708	53,914	54,113	54,317
Somerset	20,295	20,424	20,591	20,728	20,840	20,950	21,059	21,168	21,273	21,381	21,485
Sussex	8,001	8,054	8,132	8,200	8,243	8,286	8,326	8,364	8,402	8,436	8,471
Union	51,932	52,122	52,393	52,602	52,793	52,975	53,158	53,333	53,504	53,670	53,830
Warren	6,238	6,302	6,350	6,394	6,437	6,479	6,520	6,561	6,602	6,642	6,682

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:		
	2/4	2/5	2/6	2/7	2/9	2/11	2/13
Bergen	68,542	69,047	69,523	69,951	70,728 (14,146) [3,395] {1,697}	71,475 (14,295) [3,431] {1,715}	72,199 (14,440) [3,466] {1,733}
Burlington	32,202	32,422	32,610	32,811	33,156 (6,631) [1,591] {796}	33,485 (6,697) [1,607] {804}	33,802 (6,760) [1,622] {811}
Camden	40,930	41,113	41,264	41,419	41,694 (8,339) [2,001] {1,001}	41,944 (8,389) [2,013] {1,007}	42,171 (8,434) [2,024] {1,012}
Essex	66,173	66,503	66,849	67,316	67,993 (13,599) [3,264] {1,632}	68,636 (13,727) [3,295] {1,647}	69,267 (13,853) [3,325] {1,662}
Gloucester	22,268	22,389	22,489	22,579	22,764 (4,553) [1,093] {546}	22,935 (4,587) [1,101] {550}	23,087 (4,617) [1,108] {554}
Hudson	62,256	62,569	62,928	63,293	63,832 (12,766) [3,064] {1,532}	64,335 (12,867) [3,088] {1,544}	64,814 (12,963) [3,111] {1,556}
Hunterdon	6,028	6,052	6,130	6,183	6,257 (1,251) [300] {150}	6,329 (1,266) [304] {152}	6,400 (1,280) [307] {154}
Mercer	25,446	25,550	25,706	25,812	26,023 (5,205) [1,249] {625}	26,225 (5,245) [1,259] {629}	26,416 (5,283) [1,268] {634}
Middlesex	65,251	65,616	66,087	66,494	67,205 (13,441) [3,226] {1,613}	67,887 (13,577) [3,259] {1,629}	68,540 (13,708) [3,290] {1,645}
Monmouth	50,005	50,314	50,695	51,104	51,646 (10,329) [2,479] {1,240}	52,152 (10,430) [2,503] {1,252}	52,633 (10,527) [2,526] {1,263}
Morris	33,050	33,302	33,557	33,849	34,314 (6,863) [1,647] {824}	34,768 (6,954) [1,669] {834}	35,196 (7,039) [1,689] {845}
Ocean	51,439	51,802	52,187	52,585	53,242 (10,648) [2,556] {1,278}	53,870 (10,774) [2,586] {1,293}	54,476 (10,895) [2,615] {1,307}
Passaic	52,025	52,422	52,644	52,866	53,294 (10,659) [2,558] {1,279}	53,708 (10,742) [2,578] {1,289}	54,113 (10,823) [2,597] {1,299}
Somerset	20,295	20,424	20,591	20,728	20,950 (4,190) [1,006] {503}	21,168 (4,234) [1,016] {508}	21,381 (4,276) [1,026] {513}
Sussex	8,001	8,054	8,132	8,200	8,286 (1,657) [398] {199}	8,364 (1,673) [401] {201}	8,436 (1,687) [405] {202}
Union	51,932	52,122	52,393	52,602	52,975 (10,595) [2,543] {1,271}	53,333 (10,667) [2,560] {1,280}	53,670 (10,734) [2,576] {1,288}
Warren	6,238	6,302	6,350	6,394	6,479 (1,296) [311] {155}	6,561 (1,312) [315] {157}	6,642 (1,328) [319] {159}

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.