IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/4/21

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 8/4/21 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
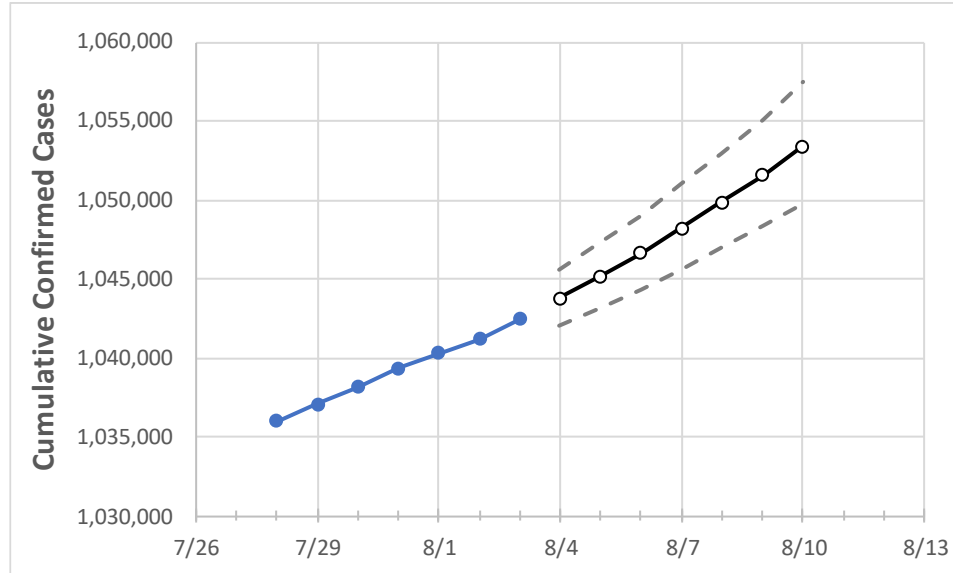
	Actual Confirmed Cases On:				Projected Cases For:						
	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
New Jersey	1,039,353	1,040,281	1,041,159	1,042,472	1,043,794	1,045,177	1,046,644	1,048,203	1,049,840	1,051,553	1,053,408

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:						
	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
Bergen	106,588	106,692	106,777	106,906	107,044	107,190	107,343	107,507	107,682	107,865	108,058
Burlington	45,196	45,250	45,311	45,378	45,452	45,529	45,612	45,701	45,795	45,896	46,004
Camden	56,793	56,844	56,885	56,974	57,043	57,117	57,194	57,277	57,364	57,454	57,551
Essex	95,975	96,050	96,134	96,249	96,365	96,487	96,614	96,749	96,892	97,038	97,192
Gloucester	31,206	31,232	31,261	31,336	31,384	31,439	31,498	31,557	31,623	31,696	31,774
Hudson	89,430	89,525	89,583	89,702	89,812	89,930	90,059	90,197	90,348	90,509	90,681
Hunterdon	10,078	10,087	10,096	10,108	10,121	10,135	10,150	10,165	10,181	10,198	10,216
Mercer	34,604	34,638	34,660	34,692	34,732	34,774	34,820	34,870	34,924	34,979	35,040
Middlesex	94,003	94,049	94,145	94,256	94,370	94,493	94,622	94,759	94,904	95,056	95,216
Monmouth	78,212	78,332	78,434	78,591	78,744	78,905	79,071	79,249	79,432	79,622	79,824
Morris	51,127	51,154	51,184	51,227	51,275	51,324	51,376	51,429	51,485	51,542	51,605
Ocean	77,943	78,017	78,073	78,141	78,245	78,351	78,465	78,579	78,700	78,826	78,962
Passaic	74,231	74,272	74,315	74,381	74,440	74,504	74,571	74,642	74,714	74,792	74,875
Somerset	30,746	30,765	30,800	30,844	30,884	30,925	30,970	31,016	31,065	31,117	31,173
Sussex	14,305	14,316	14,330	14,346	14,362	14,380	14,398	14,418	14,439	14,462	14,485
Union	72,717	72,773	72,813	72,857	72,921	72,990	73,060	73,133	73,211	73,291	73,374
Warren	10,134	10,140	10,144	10,154	10,160	10,166	10,173	10,180	10,188	10,195	10,203

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:		
	7/31	8/1	8/2	8/3	8/5	8/7	8/9
Bergen	106,588	106,692	106,777	106,906	107,190 (21,438) [5,145] {2,573}	107,507 (21,501) [5,160] {2,580}	107,865 (21,573) [5,178] {2,589}
Burlington	45,196	45,250	45,311	45,378	45,529 (9,106) [2,185] {1,093}	45,701 (9,140) [2,194] {1,097}	45,896 (9,179) [2,203] {1,102}
Camden	56,793	56,844	56,885	56,974	57,117 (11,423) [2,742] {1,371}	57,277 (11,455) [2,749] {1,375}	57,454 (11,491) [2,758] {1,379}
Essex	95,975	96,050	96,134	96,249	96,487 (19,297) [4,631] {2,316}	96,749 (19,350) [4,644] {2,322}	97,038 (19,408) [4,658] {2,329}
Gloucester	31,206	31,232	31,261	31,336	31,439 (6,288) [1,509] {755}	31,557 (6,311) [1,515] {757}	31,696 (6,339) [1,521] {761}
Hudson	89,430	89,525	89,583	89,702	89,930 (17,986) [4,317] {2,158}	90,197 (18,039) [4,329] {2,165}	90,509 (18,102) [4,344] {2,172}
Hunterdon	10,078	10,087	10,096	10,108	10,135 (2,027) [486] {243}	10,165 (2,033) [488] {244}	10,198 (2,040) [489] {245}
Mercer	34,604	34,638	34,660	34,692	34,774 (6,955) [1,669] {835}	34,870 (6,974) [1,674] {837}	34,979 (6,996) [1,679] {840}
Middlesex	94,003	94,049	94,145	94,256	94,493 (18,899) [4,536] {2,268}	94,759 (18,952) [4,548] {2,274}	95,056 (19,011) [4,563] {2,281}
Monmouth	78,212	78,332	78,434	78,591	78,905 (15,781) [3,787] {1,894}	79,249 (15,850) [3,804] {1,902}	79,622 (15,924) [3,822] {1,911}
Morris	51,127	51,154	51,184	51,227	51,324 (10,265) [2,464] {1,232}	51,429 (10,286) [2,469] {1,234}	51,542 (10,308) [2,474] {1,237}
Ocean	77,943	78,017	78,073	78,141	78,351 (15,670) [3,761] {1,880}	78,579 (15,716) [3,772] {1,886}	78,826 (15,765) [3,784] {1,892}
Passaic	74,231	74,272	74,315	74,381	74,504 (14,901) [3,576] {1,788}	74,642 (14,928) [3,583] {1,791}	74,792 (14,958) [3,590] {1,795}
Somerset	30,746	30,765	30,800	30,844	30,925 (6,185) [1,484] {742}	31,016 (6,203) [1,489] {744}	31,117 (6,223) [1,494] {747}
Sussex	14,305	14,316	14,330	14,346	14,380 (2,876) [690] {345}	14,418 (2,884) [692] {346}	14,462 (2,892) [694] {347}
Union	72,717	72,773	72,813	72,857	72,990 (14,598) [3,504] {1,752}	73,133 (14,627) [3,510] {1,755}	73,291 (14,658) [3,518] {1,759}
Warren	10,134	10,140	10,144	10,154	10,166 (2,033) [488] {244}	10,180 (2,036) [489] {244}	10,195 (2,039) [489] {245}

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.