IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/9/21

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 8/9/21 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
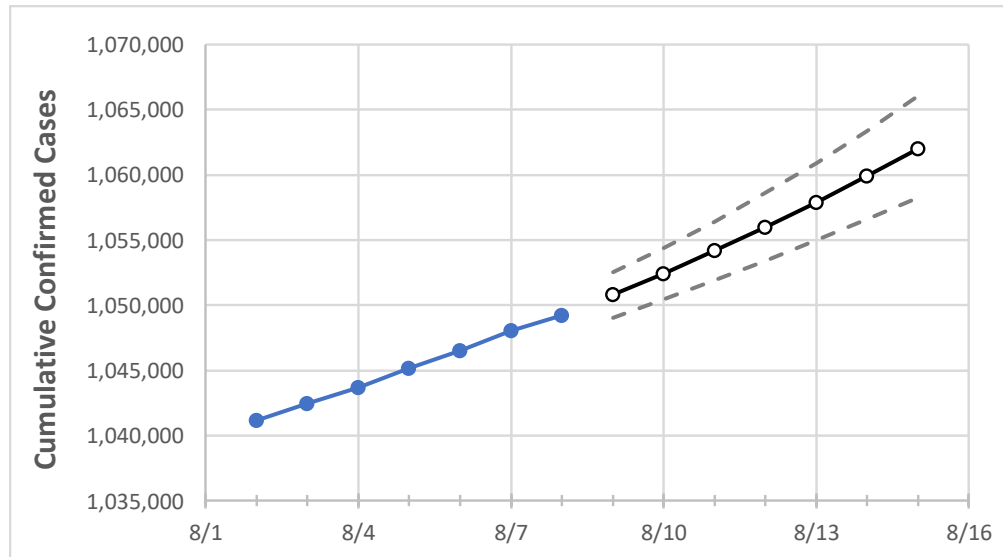
	Actual Confirmed Cases On:				Projected Cases For:						
	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15
New Jersey	1,045,168	1,046,514	1,048,053	1,049,222	1,050,793	1,052,437	1,054,161	1,055,976	1,057,892	1,059,889	1,062,020

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:						
	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15
Bergen	107,133	107,269	107,380	107,471	107,605	107,742	107,885	108,032	108,184	108,341	108,504
Burlington	45,567	45,633	45,731	45,806	45,907	46,014	46,129	46,252	46,383	46,522	46,672
Camden	57,167	57,244	57,379	57,478	57,600	57,734	57,879	58,038	58,209	58,397	58,601
Essex	96,480	96,575	96,688	96,796	96,914	97,038	97,167	97,299	97,434	97,576	97,721
Gloucester	31,418	31,468	31,506	31,557	31,616	31,678	31,746	31,815	31,889	31,967	32,048
Hudson	89,857	89,950	90,068	90,169	90,293	90,424	90,561	90,709	90,868	91,035	91,213
Hunterdon	10,158	10,185	10,207	10,220	10,245	10,272	10,299	10,330	10,363	10,399	10,436
Mercer	34,740	34,779	34,830	34,861	34,903	34,947	34,995	35,044	35,095	35,148	35,205
Middlesex	94,486	94,594	94,712	94,793	94,912	95,037	95,166	95,299	95,439	95,583	95,734
Monmouth	78,923	79,095	79,255	79,374	79,547	79,726	79,909	80,100	80,300	80,510	80,726
Morris	51,357	51,426	51,499	51,556	51,627	51,702	51,781	51,864	51,953	52,045	52,145
Ocean	78,359	78,464	78,586	78,654	78,763	78,876	78,996	79,116	79,245	79,377	79,516
Passaic	74,521	74,585	74,646	74,698	74,770	74,846	74,924	75,008	75,096	75,184	75,279
Somerset	30,925	30,956	30,999	31,033	31,077	31,122	31,169	31,218	31,268	31,322	31,377
Sussex	14,388	14,406	14,426	14,451	14,476	14,503	14,531	14,562	14,596	14,631	14,669
Union	73,000	73,083	73,187	73,265	73,353	73,448	73,548	73,651	73,758	73,872	73,990
Warren	10,176	10,190	10,203	10,205	10,215	10,227	10,239	10,252	10,265	10,279	10,294

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:		
	8/5	8/6	8/7	8/8	8/10	8/12	8/14
Bergen	107,133	107,269	107,380	107,471	107,742 (21,548) [5,172] {2,586}	108,032 (21,606) [5,186] {2,593}	108,341 (21,668) [5,200] {2,600}
Burlington	45,567	45,633	45,731	45,806	46,014 (9,203) [2,209] {1,104}	46,252 (9,250) [2,220] {1,110}	46,522 (9,304) [2,233] {1,117}
Camden	57,167	57,244	57,379	57,478	57,734 (11,547) [2,771] {1,386}	58,038 (11,608) [2,786] {1,393}	58,397 (11,679) [2,803] {1,402}
Essex	96,480	96,575	96,688	96,796	97,038 (19,408) [4,658] {2,329}	97,299 (19,460) [4,670] {2,335}	97,576 (19,515) [4,684] {2,342}
Gloucester	31,418	31,468	31,506	31,557	31,678 (6,336) [1,521] {760}	31,815 (6,363) [1,527] {764}	31,967 (6,393) [1,534] {767}
Hudson	89,857	89,950	90,068	90,169	90,424 (18,085) [4,340] {2,170}	90,709 (18,142) [4,354] {2,177}	91,035 (18,207) [4,370] {2,185}
Hunterdon	10,158	10,185	10,207	10,220	10,272 (2,054) [493] {247}	10,330 (2,066) [496] {248}	10,399 (2,080) [499] {250}
Mercer	34,740	34,779	34,830	34,861	34,947 (6,989) [1,677] {839}	35,044 (7,009) [1,682] {841}	35,148 (7,030) [1,687] {844}
Middlesex	94,486	94,594	94,712	94,793	95,037 (19,007) [4,562] {2,281}	95,299 (19,060) [4,574] {2,287}	95,583 (19,117) [4,588] {2,294}
Monmouth	78,923	79,095	79,255	79,374	79,726 (15,945) [3,827] {1,913}	80,100 (16,020) [3,845] {1,922}	80,510 (16,102) [3,864] {1,932}
Morris	51,357	51,426	51,499	51,556	51,702 (10,340) [2,482] {1,241}	51,864 (10,373) [2,489] {1,245}	52,045 (10,409) [2,498] {1,249}
Ocean	78,359	78,464	78,586	78,654	78,876 (15,775) [3,786] {1,893}	79,116 (15,823) [3,798] {1,899}	79,377 (15,875) [3,810] {1,905}
Passaic	74,521	74,585	74,646	74,698	74,846 (14,969) [3,593] {1,796}	75,008 (15,002) [3,600] {1,800}	75,184 (15,037) [3,609] {1,804}
Somerset	30,925	30,956	30,999	31,033	31,122 (6,224) [1,494] {747}	31,218 (6,244) [1,498] {749}	31,322 (6,264) [1,503] {752}
Sussex	14,388	14,406	14,426	14,451	14,503 (2,901) [696] {348}	14,562 (2,912) [699] {349}	14,631 (2,926) [702] {351}
Union	73,000	73,083	73,187	73,265	73,448 (14,690) [3,525] {1,763}	73,651 (14,730) [3,535] {1,768}	73,872 (14,774) [3,546] {1,773}
Warren	10,176	10,190	10,203	10,205	10,227 (2,045) [491] {245}	10,252 (2,050) [492] {246}	10,279 (2,056) [493] {247}

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.