IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/15/21

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 9/15/21 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
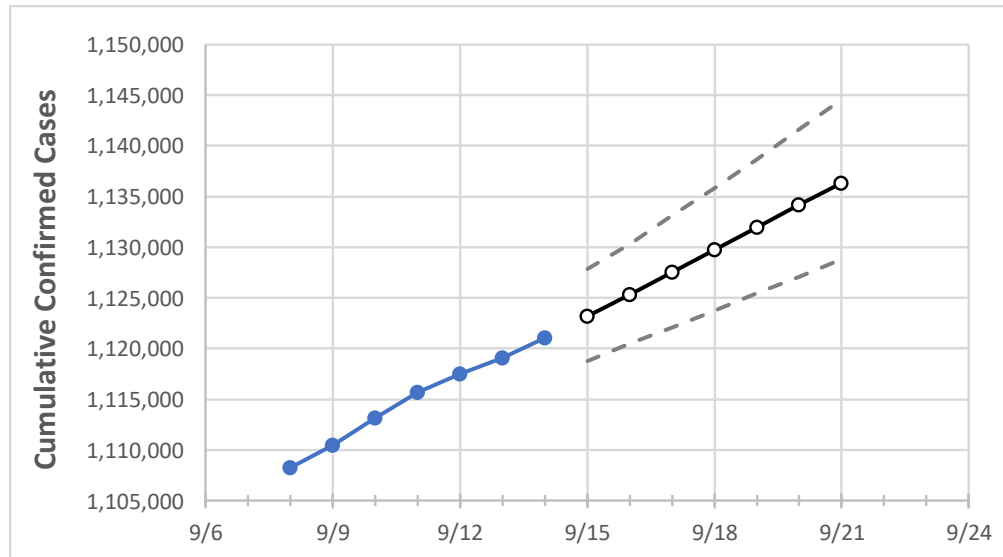
	Actual Confirmed Cases On:				Projected Cases For:						
	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21
New Jersey	1,115,659	1,117,506	1,119,051	1,121,089	1,123,203	1,125,353	1,127,525	1,129,716	1,131,933	1,134,153	1,136,329

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:						
	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21
Bergen	113,188	113,340	113,448	113,652	113,831	114,008	114,189	114,372	114,557	114,749	114,930
Burlington	49,802	49,907	50,030	50,120	50,238	50,359	50,480	50,598	50,721	50,847	50,956
Camden	61,919	62,071	62,212	62,340	62,492	62,644	62,793	62,952	63,113	63,275	63,432
Essex	101,737	101,836	101,903	102,099	102,247	102,404	102,549	102,714	102,867	103,024	103,181
Gloucester	34,370	34,472	34,544	34,640	34,736	34,838	34,934	35,040	35,138	35,240	35,349
Hudson	93,825	93,983	94,071	94,141	94,257	94,373	94,495	94,618	94,740	94,865	94,987
Hunterdon	10,983	10,999	11,017	11,035	11,057	11,079	11,100	11,123	11,144	11,166	11,188
Mercer	36,952	37,013	37,057	37,096	37,153	37,208	37,262	37,320	37,375	37,430	37,485
Middlesex	100,247	100,414	100,571	100,721	100,913	101,108	101,305	101,503	101,712	101,919	102,117
Monmouth	85,649	85,815	85,941	86,115	86,312	86,503	86,694	86,888	87,080	87,284	87,472
Morris	54,521	54,597	54,654	54,746	54,843	54,943	55,040	55,137	55,236	55,339	55,437
Ocean	85,452	85,603	85,729	85,962	86,185	86,403	86,618	86,845	87,064	87,292	87,524
Passaic	77,890	77,967	78,019	78,150	78,242	78,337	78,431	78,524	78,620	78,713	78,809
Somerset	32,895	32,936	32,989	33,028	33,085	33,143	33,200	33,261	33,316	33,376	33,434
Sussex	15,367	15,389	15,413	15,455	15,491	15,528	15,564	15,601	15,637	15,675	15,715
Union	76,639	76,746	76,815	76,947	77,054	77,163	77,271	77,381	77,490	77,608	77,717
Warren	11,004	11,026	11,050	11,067	11,099	11,131	11,163	11,196	11,230	11,265	11,300

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:		
	9/11	9/12	9/13	9/14	9/16	9/18	9/20
Bergen	113,188	113,340	113,448	113,652	114,008 (22,802) [5,472] {2,736}	114,372 (22,874) [5,490] {2,745}	114,749 (22,950) [5,508] {2,754}
Burlington	49,802	49,907	50,030	50,120	50,359 (10,072) [2,417] {1,209}	50,598 (10,120) [2,429] {1,214}	50,847 (10,169) [2,441] {1,220}
Camden	61,919	62,071	62,212	62,340	62,644 (12,529) [3,007] {1,503}	62,952 (12,590) [3,022] {1,511}	63,275 (12,655) [3,037] {1,519}
Essex	101,737	101,836	101,903	102,099	102,404 (20,481) [4,915] {2,458}	102,714 (20,543) [4,930] {2,465}	103,024 (20,605) [4,945] {2,473}
Gloucester	34,370	34,472	34,544	34,640	34,838 (6,968) [1,672] {836}	35,040 (7,008) [1,682] {841}	35,240 (7,048) [1,692] {846}
Hudson	93,825	93,983	94,071	94,141	94,373 (18,875) [4,530] {2,265}	94,618 (18,924) [4,542] {2,271}	94,865 (18,973) [4,554] {2,277}
Hunterdon	10,983	10,999	11,017	11,035	11,079 (2,216) [532] {266}	11,123 (2,225) [534] {267}	11,166 (2,233) [536] {268}
Mercer	36,952	37,013	37,057	37,096	37,208 (7,442) [1,786] {893}	37,320 (7,464) [1,791] {896}	37,430 (7,486) [1,797] {898}
Middlesex	100,247	100,414	100,571	100,721	101,108 (20,222) [4,853] {2,427}	101,503 (20,301) [4,872] {2,436}	101,919 (20,384) [4,892] {2,446}
Monmouth	85,649	85,815	85,941	86,115	86,503 (17,301) [4,152] {2,076}	86,888 (17,378) [4,171] {2,085}	87,284 (17,457) [4,190] {2,095}
Morris	54,521	54,597	54,654	54,746	54,943 (10,989) [2,637] {1,319}	55,137 (11,027) [2,647] {1,323}	55,339 (11,068) [2,656] {1,328}
Ocean	85,452	85,603	85,729	85,962	86,403 (17,281) [4,147] {2,074}	86,845 (17,369) [4,169] {2,084}	87,292 (17,458) [4,190] {2,095}
Passaic	77,890	77,967	78,019	78,150	78,337 (15,667) [3,760] {1,880}	78,524 (15,705) [3,769] {1,885}	78,713 (15,743) [3,778] {1,889}
Somerset	32,895	32,936	32,989	33,028	33,143 (6,629) [1,591] {795}	33,261 (6,652) [1,597] {798}	33,376 (6,675) [1,602] {801}
Sussex	15,367	15,389	15,413	15,455	15,528 (3,106) [745] {373}	15,601 (3,120) [749] {374}	15,675 (3,135) [752] {376}
Union	76,639	76,746	76,815	76,947	77,163 (15,433) [3,704] {1,852}	77,381 (15,476) [3,714] {1,857}	77,608 (15,522) [3,725] {1,863}
Warren	11,004	11,026	11,050	11,067	11,131 (2,226) [534] {267}	11,196 (2,239) [537] {269}	11,265 (2,253) [541] {270}

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.