IEM's AI Modeling: Short-term COVID-19 Projections

Date: 1/13/21

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 not 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 1/13/21 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.

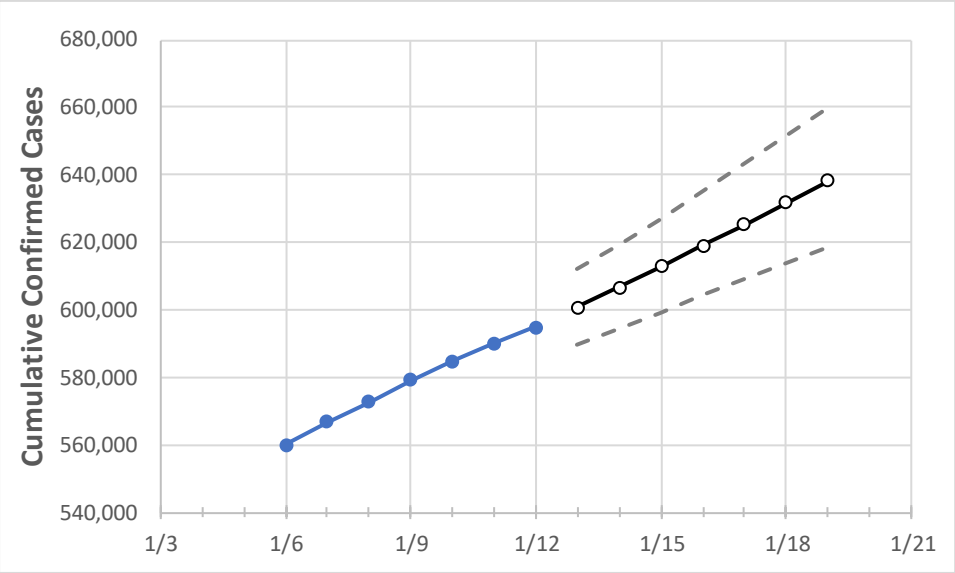
IEM's Modeling Lead

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:						
	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19
New Jersey	579,250	584,828	590,162	594,749	600,753	606,802	612,992	619,140	625,381	631,785	638,261

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:						
	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19
Bergen	56,390	56,890	57,259	57,609	58,119	58,636	59,165	59,696	60,234	60,773	61,311
Burlington	25,949	26,167	26,361	26,782	27,091	27,406	27,722	28,044	28,370	28,696	29,027
Camden	34,294	34,601	34,802	35,012	35,330	35,651	35,967	36,288	36,619	36,946	37,270
Essex	54,999	55,454	55,789	56,168	56,629	57,094	57,564	58,040	58,524	59,015	59,512
Gloucester	17,900	18,062	18,191	18,393	18,617	18,845	19,075	19,305	19,542	19,782	20,022
Hudson	51,668	52,036	52,546	52,954	53,447	53,951	54,465	54,979	55,506	56,016	56,548
Hunterdon	4,651	4,714	4,764	4,833	4,901	4,971	5,044	5,117	5,194	5,274	5,355
Mercer	21,320	21,515	21,652	21,849	22,043	22,240	22,439	22,643	22,847	23,062	23,278
Middlesex	52,627	53,218	53,852	54,224	54,792	55,366	55,946	56,527	57,112	57,697	58,305
Monmouth	39,157	39,698	40,185	40,500	41,024	41,559	42,102	42,661	43,220	43,800	44,391
Morris	25,880	26,149	26,488	26,691	26,987	27,293	27,601	27,921	28,232	28,556	28,895
Ocean	40,126	40,548	41,075	41,410	41,909	42,410	42,912	43,429	43,948	44,471	45,009
Passaic	45,386	45,642	45,892	46,104	46,343	46,579	46,825	47,066	47,310	47,558	47,796
Somerset	16,622	16,772	16,926	17,056	17,223	17,395	17,576	17,756	17,939	18,121	18,307
Sussex	5,894	6,027	6,108	6,185	6,298	6,415	6,531	6,653	6,779	6,908	7,040
Union	44,264	44,664	45,006	45,409	45,792	46,186	46,587	46,994	47,421	47,852	48,294
Warren	4,854	4,929	4,999	5,038	5,101	5,165	5,230	5,295	5,361	5,432	5,501

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:		
	1/9	1/10	1/11	1/12	1/14	1/16	1/18
Bergen	56,390	56,890	57,259	57,609	58,636 (11,727) [2,815] {1,407}	59,696 (11,939) [2,865] {1,433}	60,773 (12,155) [2,917] {1,459}
Burlington	25,949	26,167	26,361	26,782	27,406 (5,481) [1,315] {658}	28,044 (5,609) [1,346] {673}	28,696 (5,739) [1,377] {689}
Camden	34,294	34,601	34,802	35,012	35,651 (7,130) [1,711] {856}	36,288 (7,258) [1,742] {871}	36,946 (7,389) [1,773] {887}
Essex	54,999	55,454	55,789	56,168	57,094 (11,419) [2,741] {1,370}	58,040 (11,608) [2,786] {1,393}	59,015 (11,803) [2,833] {1,416}
Gloucester	17,900	18,062	18,191	18,393	18,845 (3,769) [905] {452}	19,305 (3,861) [927] {463}	19,782 (3,956) [950] {475}
Hudson	51,668	52,036	52,546	52,954	53,951 (10,790) [2,590] {1,295}	54,979 (10,996) [2,639] {1,319}	56,016 (11,203) [2,689] {1,344}
Hunterdon	4,651	4,714	4,764	4,833	4,971 (994) [239] {119}	5,117 (1,023) [246] {123}	5,274 (1,055) [253] {127}
Mercer	21,320	21,515	21,652	21,849	22,240 (4,448) [1,068] {534}	22,643 (4,529) [1,087] {543}	23,062 (4,612) [1,107] {553}
Middlesex	52,627	53,218	53,852	54,224	55,366 (11,073) [2,658] {1,329}	56,527 (11,305) [2,713] {1,357}	57,697 (11,539) [2,769] {1,385}
Monmouth	39,157	39,698	40,185	40,500	41,559 (8,312) [1,995] {997}	42,661 (8,532) [2,048] {1,024}	43,800 (8,760) [2,102] {1,051}
Morris	25,880	26,149	26,488	26,691	27,293 (5,459) [1,310] {655}	27,921 (5,584) [1,340] {670}	28,556 (5,711) [1,371] {685}
Ocean	40,126	40,548	41,075	41,410	42,410 (8,482) [2,036] {1,018}	43,429 (8,686) [2,085] {1,042}	44,471 (8,894) [2,135] {1,067}
Passaic	45,386	45,642	45,892	46,104	46,579 (9,316) [2,236] {1,118}	47,066 (9,413) [2,259] {1,130}	47,558 (9,512) [2,283] {1,141}
Somerset	16,622	16,772	16,926	17,056	17,395 (3,479) [835] {417}	17,756 (3,551) [852] {426}	18,121 (3,624) [870] {435}
Sussex	5,894	6,027	6,108	6,185	6,415 (1,283) [308] {154}	6,653 (1,331) [319] {160}	6,908 (1,382) [332] {166}
Union	44,264	44,664	45,006	45,409	46,186 (9,237) [2,217] {1,108}	46,994 (9,399) [2,256] {1,128}	47,852 (9,570) [2,297] {1,148}
Warren	4,854	4,929	4,999	5,038	5,165 (1,033) [248] {124}	5,295 (1,059) [254] {127}	5,432 (1,086) [261] {130}

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.