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

Date: 7/10/20

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 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 7/10/20 11 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.

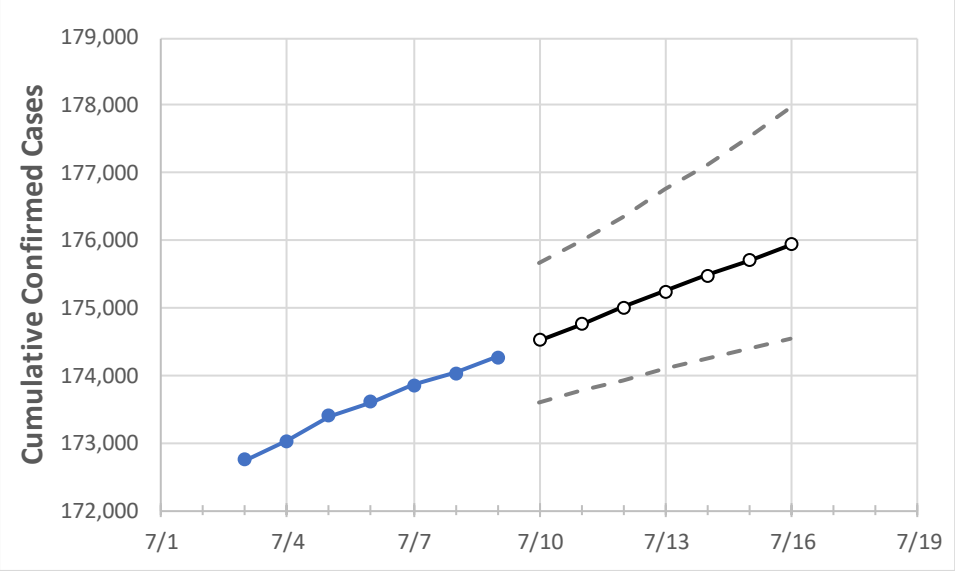
IEM's Modeling Lead

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:						
	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15	7/16
New Jersey	173,604	173,850	174,034	174,270	174,518	174,762	175,003	175,241	175,475	175,707	175,936

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 20%, and are often within 10%, of actual confirmed cases.

New Jersey Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15	7/16
Bergen	19,655	19,676	19,732	19,771	19,809	19,846	19,884	19,922	19,960	19,998	20,037
Burlington	5,277	5,295	5,306	5,316	5,330	5,344	5,358	5,372	5,386	5,400	5,414
Camden	7,496	7,536	7,573	7,600	7,630	7,661	7,692	7,725	7,758	7,792	7,827
Essex	18,895	18,918	18,920	18,928	18,940	18,951	18,962	18,972	18,982	18,991	19,000
Gloucester	2,656	2,671	2,691	2,697	2,710	2,722	2,735	2,748	2,761	2,774	2,787
Hudson	18,990	19,016	19,024	19,037	19,061	19,081	19,101	19,120	19,139	19,160	19,179
Hunterdon	1,090	1,091	1,091	1,094	1,095	1,097	1,098	1,099	1,100	1,101	1,102
Mercer	7,745	7,751	7,758	7,765	7,773	7,781	7,789	7,796	7,803	7,810	7,816
Middlesex	16,952	16,952	16,952	16,952	16,977	17,002	17,027	17,052	17,078	17,103	17,130
Monmouth	9,320	9,346	9,362	9,371	9,389	9,406	9,424	9,441	9,457	9,474	9,490
Morris	6,820	6,830	6,854	6,864	6,880	6,892	6,906	6,919	6,931	6,943	6,957
Ocean	9,716	9,738	9,753	9,773	9,788	9,802	9,817	9,831	9,845	9,859	9,872
Passaic	16,963	16,974	16,978	17,000	17,009	17,017	17,025	17,033	17,041	17,048	17,055
Somerset	4,943	4,945	4,950	4,952	4,958	4,965	4,972	4,979	4,986	4,993	5,000
Sussex	1,211	1,214	1,219	1,220	1,222	1,224	1,226	1,229	1,231	1,233	1,235
Union	16,432	16,443	16,453	16,462	16,479	16,498	16,519	16,542	16,568	16,596	16,627
Warren	1,255	1,258	1,261	1,261	1,265	1,269	1,273	1,278	1,282	1,287	1,293

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:		
	7/6	7/7	7/8	7/9	7/11	7/13	7/15
Bergen	19,655	19,676	19,732	19,771	19,846 (3,969) [953] {476}	19,922 (3,984) [956] {478}	19,998 (4,000) [960] {480}
Burlington	5,277	5,295	5,306	5,316	5,344 (1,069) [257] {128}	5,372 (1,074) [258] {129}	5,400 (1,080) [259] {130}
Camden	7,496	7,536	7,573	7,600	7,661 (1,532) [368] {184}	7,725 (1,545) [371] {185}	7,792 (1,558) [374] {187}
Essex	18,895	18,918	18,920	18,928	18,951 (3,790) [910] {455}	18,972 (3,794) [911] {455}	18,991 (3,798) [912] {456}
Gloucester	2,656	2,671	2,691	2,697	2,722 (544) [131] {65}	2,748 (550) [132] {66}	2,774 (555) [133] {67}
Hudson	18,990	19,016	19,024	19,037	19,081 (3,816) [916] {458}	19,120 (3,824) [918] {459}	19,160 (3,832) [920] {460}
Hunterdon	1,090	1,091	1,091	1,094	1,097 (219) [53] {26}	1,099 (220) [53] {26}	1,101 (220) [53] {26}
Mercer	7,745	7,751	7,758	7,765	7,781 (1,556) [373] {187}	7,796 (1,559) [374] {187}	7,810 (1,562) [375] {187}
Middlesex	16,952	16,952	16,952	16,952	17,002 (3,400) [816] {408}	17,052 (3,410) [818] {409}	17,103 (3,421) [821] {410}
Monmouth	9,320	9,346	9,362	9,371	9,406 (1,881) [452] {226}	9,441 (1,888) [453] {227}	9,474 (1,895) [455] {227}
Morris	6,820	6,830	6,854	6,864	6,892 (1,378) [331] {165}	6,919 (1,384) [332] {166}	6,943 (1,389) [333] {167}
Ocean	9,716	9,738	9,753	9,773	9,802 (1,960) [471] {235}	9,831 (1,966) [472] {236}	9,859 (1,972) [473] {237}
Passaic	16,963	16,974	16,978	17,000	17,017 (3,403) [817] {408}	17,033 (3,407) [818] {409}	17,048 (3,410) [818] {409}
Somerset	4,943	4,945	4,950	4,952	4,965 (993) [238] {119}	4,979 (996) [239] {119}	4,993 (999) [240] {120}
Sussex	1,211	1,214	1,219	1,220	1,224 (245) [59] {29}	1,229 (246) [59] {29}	1,233 (247) [59] {30}
Union	16,432	16,443	16,453	16,462	16,498 (3,300) [792] {396}	16,542 (3,308) [794] {397}	16,596 (3,319) [797] {398}
Warren	1,255	1,258	1,261	1,261	1,269 (254) [61] {30}	1,278 (256) [61] {31}	1,287 (257) [62] {31}

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.