IEM's AI Modeling: Short-term COVID-19 Projections
Date: 11/30/20

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 <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 11/30/20 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
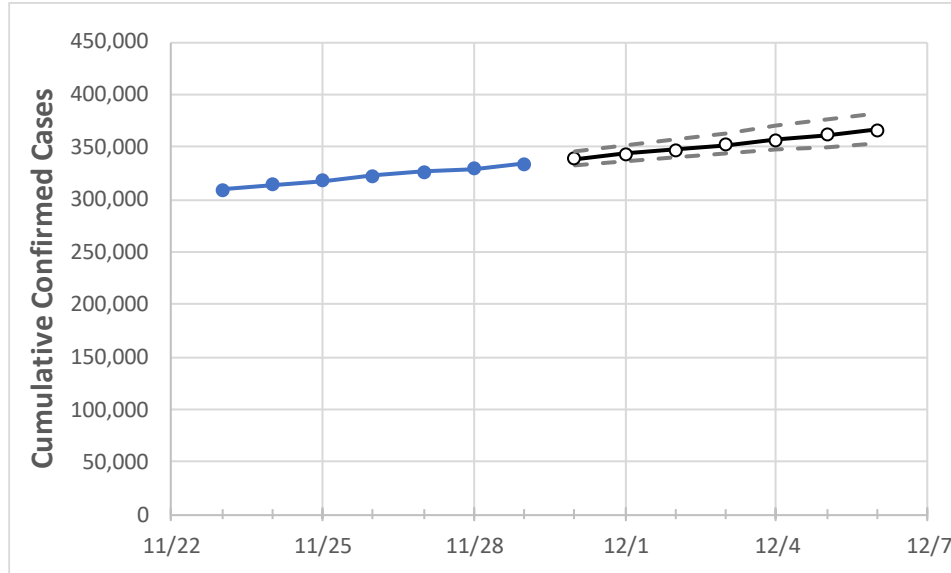
	Actual Confirmed Cases On:				Projected Cases For:						
	11/26	11/27	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6
New Jersey	322,378	326,473	329,553	334,114	338,514	342,983	347,523	352,136	356,821	361,580	366,415

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:						
	11/26	11/27	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6
Bergen	33,328	33,875	34,083	34,583	35,022	35,473	35,936	36,410	36,897	37,396	37,907
Burlington	13,020	13,217	13,284	13,636	13,893	14,158	14,431	14,712	15,002	15,301	15,608
Camden	18,007	18,378	18,497	18,956	19,278	19,607	19,944	20,287	20,638	20,996	21,361
Essex	34,155	34,478	34,632	35,041	35,363	35,684	36,005	36,326	36,646	36,966	37,286
Gloucester	8,573	8,711	8,765	8,932	9,061	9,191	9,322	9,453	9,585	9,718	9,851
Hudson	30,410	30,746	30,928	31,432	31,793	32,162	32,538	32,922	33,314	33,714	34,122
Hunterdon	2,347	2,380	2,402	2,469	2,506	2,545	2,584	2,624	2,664	2,706	2,748
Mercer	13,256	13,414	13,485	13,724	13,922	14,122	14,323	14,527	14,731	14,938	15,146
Middlesex	29,267	29,602	29,817	30,273	30,628	30,989	31,356	31,731	32,112	32,501	32,897
Monmouth	19,692	19,918	20,036	20,447	20,735	21,029	21,330	21,637	21,952	22,273	22,601
Morris	12,980	13,159	13,312	13,515	13,712	13,913	14,120	14,331	14,548	14,770	14,998
Ocean	21,006	21,303	21,457	21,748	22,029	22,320	22,622	22,935	23,260	23,596	23,945
Passaic	28,894	29,148	29,281	29,849	30,189	30,534	30,883	31,238	31,598	31,963	32,333
Somerset	8,726	8,839	8,908	9,032	9,133	9,236	9,339	9,443	9,548	9,653	9,760
Sussex	2,435	2,475	2,504	2,549	2,588	2,627	2,668	2,709	2,751	2,795	2,839
Union	27,457	27,709	27,803	28,255	28,550	28,848	29,148	29,451	29,756	30,064	30,374
Warren	2,373	2,414	2,435	2,495	2,529	2,564	2,600	2,636	2,672	2,709	2,747

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:		
	11/26	11/27	11/28	11/29	12/1	12/3	12/5
Bergen	33,328	33,875	34,083	34,583	35,473 (7,095) [1,703] {851}	36,410 (7,282) [1,748] {874}	37,396 (7,479) [1,795] {897}
Burlington	13,020	13,217	13,284	13,636	14,158 (2,832) [680] {340}	14,712 (2,942) [706] {353}	15,301 (3,060) [734] {367}
Camden	18,007	18,378	18,497	18,956	19,607 (3,921) [941] {471}	20,287 (4,057) [974] {487}	20,996 (4,199) [1,008] {504}
Essex	34,155	34,478	34,632	35,041	35,684 (7,137) [1,713] {856}	36,326 (7,265) [1,744] {872}	36,966 (7,393) [1,774] {887}
Gloucester	8,573	8,711	8,765	8,932	9,191 (1,838) [441] {221}	9,453 (1,891) [454] {227}	9,718 (1,944) [466] {233}
Hudson	30,410	30,746	30,928	31,432	32,162 (6,432) [1,544] {772}	32,922 (6,584) [1,580] {790}	33,714 (6,743) [1,618] {809}
Hunterdon	2,347	2,380	2,402	2,469	2,545 (509) [122] {61}	2,624 (525) [126] {63}	2,706 (541) [130] {65}
Mercer	13,256	13,414	13,485	13,724	14,122 (2,824) [678] {339}	14,527 (2,905) [697] {349}	14,938 (2,988) [717] {359}
Middlesex	29,267	29,602	29,817	30,273	30,989 (6,198) [1,487] {744}	31,731 (6,346) [1,523] {762}	32,501 (6,500) [1,560] {780}
Monmouth	19,692	19,918	20,036	20,447	21,029 (4,206) [1,009] {505}	21,637 (4,327) [1,039] {519}	22,273 (4,455) [1,069] {535}
Morris	12,980	13,159	13,312	13,515	13,913 (2,783) [668] {334}	14,331 (2,866) [688] {344}	14,770 (2,954) [709] {354}
Ocean	21,006	21,303	21,457	21,748	22,320 (4,464) [1,071] {536}	22,935 (4,587) [1,101] {550}	23,596 (4,719) [1,133] {566}
Passaic	28,894	29,148	29,281	29,849	30,534 (6,107) [1,466] {733}	31,238 (6,248) [1,499] {750}	31,963 (6,393) [1,534] {767}
Somerset	8,726	8,839	8,908	9,032	9,236 (1,847) [443] {222}	9,443 (1,889) [453] {227}	9,653 (1,931) [463] {232}
Sussex	2,435	2,475	2,504	2,549	2,627 (525) [126] {63}	2,709 (542) [130] {65}	2,795 (559) [134] {67}
Union	27,457	27,709	27,803	28,255	28,848 (5,770) [1,385] {692}	29,451 (5,890) [1,414] {707}	30,064 (6,013) [1,443] {722}
Warren	2,373	2,414	2,435	2,495	2,564 (513) [123] {62}	2,636 (527) [127] {63}	2,709 (542) [130] {65}

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.