IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/16/20

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 10/16/20 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
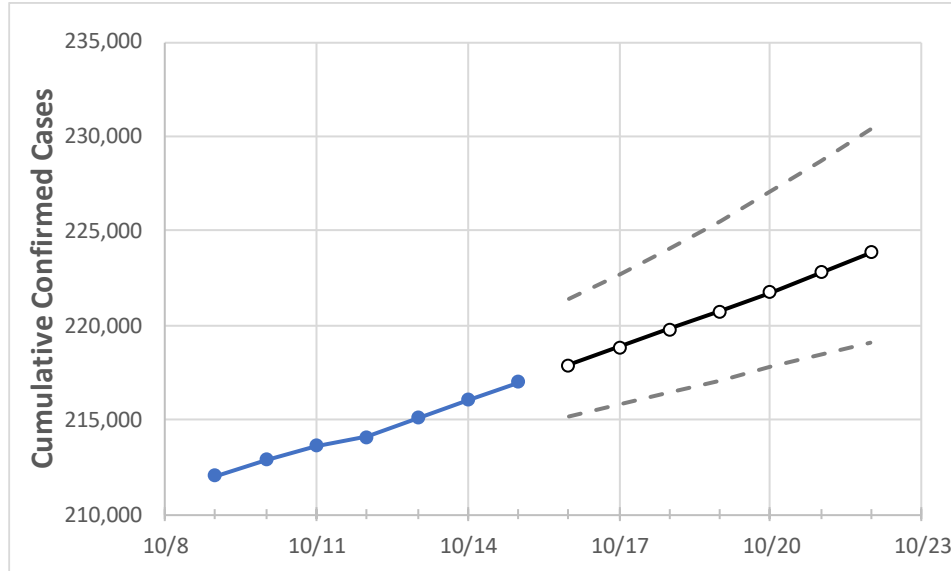
	Actual Confirmed Cases On:				Projected Cases For:						
	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21	10/22
New Jersey	214,097	215,085	216,023	216,994	217,899	218,828	219,782	220,762	221,768	222,802	223,863

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:						
	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21	10/22
Bergen	23,221	23,323	23,391	23,495	23,583	23,676	23,773	23,875	23,982	24,093	24,211
Burlington	7,559	7,598	7,662	7,703	7,735	7,767	7,800	7,833	7,867	7,902	7,936
Camden	10,494	10,553	10,590	10,646	10,695	10,745	10,796	10,849	10,904	10,961	11,019
Essex	21,821	21,913	22,018	22,129	22,228	22,333	22,445	22,564	22,691	22,825	22,968
Gloucester	4,981	5,008	5,043	5,072	5,092	5,111	5,131	5,150	5,169	5,187	5,206
Hudson	21,222	21,286	21,347	21,425	21,487	21,552	21,621	21,693	21,769	21,849	21,933
Hunterdon	1,457	1,461	1,466	1,469	1,476	1,482	1,489	1,496	1,503	1,511	1,518
Mercer	8,829	8,850	8,866	8,894	8,911	8,928	8,946	8,965	8,984	9,003	9,023
Middlesex	20,394	20,475	20,552	20,646	20,721	20,797	20,875	20,954	21,035	21,118	21,203
Monmouth	12,851	12,936	13,020	13,099	13,189	13,281	13,377	13,475	13,576	13,680	13,787
Morris	8,167	8,215	8,230	8,280	8,308	8,336	8,365	8,396	8,427	8,460	8,493
Ocean	15,255	15,375	15,578	15,684	15,814	15,946	16,079	16,215	16,352	16,491	16,633
Passaic	19,627	19,693	19,768	19,812	19,870	19,930	19,992	20,056	20,123	20,193	20,265
Somerset	6,023	6,045	6,060	6,089	6,100	6,112	6,123	6,134	6,146	6,157	6,168
Sussex	1,581	1,584	1,587	1,589	1,592	1,595	1,598	1,600	1,603	1,606	1,609
Union	18,247	18,316	18,375	18,440	18,505	18,573	18,644	18,718	18,796	18,878	18,963
Warren	1,484	1,488	1,493	1,495	1,499	1,502	1,506	1,510	1,514	1,519	1,523

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:		
	10/12	10/13	10/14	10/15	10/17	10/19	10/21
Bergen	23,221	23,323	23,391	23,495	23,676 (4,735) [1,136] {568}	23,875 (4,775) [1,146] {573}	24,093 (4,819) [1,156] {578}
Burlington	7,559	7,598	7,662	7,703	7,767 (1,553) [373] {186}	7,833 (1,567) [376] {188}	7,902 (1,580) [379] {190}
Camden	10,494	10,553	10,590	10,646	10,745 (2,149) [516] {258}	10,849 (2,170) [521] {260}	10,961 (2,192) [526] {263}
Essex	21,821	21,913	22,018	22,129	22,333 (4,467) [1,072] {536}	22,564 (4,513) [1,083] {542}	22,825 (4,565) [1,096] {548}
Gloucester	4,981	5,008	5,043	5,072	5,111 (1,022) [245] {123}	5,150 (1,030) [247] {124}	5,187 (1,037) [249] {124}
Hudson	21,222	21,286	21,347	21,425	21,552 (4,310) [1,035] {517}	21,693 (4,339) [1,041] {521}	21,849 (4,370) [1,049] {524}
Hunterdon	1,457	1,461	1,466	1,469	1,482 (296) [71] {36}	1,496 (299) [72] {36}	1,511 (302) [73] {36}
Mercer	8,829	8,850	8,866	8,894	8,928 (1,786) [429] {214}	8,965 (1,793) [430] {215}	9,003 (1,801) [432] {216}
Middlesex	20,394	20,475	20,552	20,646	20,797 (4,159) [998] {499}	20,954 (4,191) [1,006] {503}	21,118 (4,224) [1,014] {507}
Monmouth	12,851	12,936	13,020	13,099	13,281 (2,656) [638] {319}	13,475 (2,695) [647] {323}	13,680 (2,736) [657] {328}
Morris	8,167	8,215	8,230	8,280	8,336 (1,667) [400] {200}	8,396 (1,679) [403] {202}	8,460 (1,692) [406] {203}
Ocean	15,255	15,375	15,578	15,684	15,946 (3,189) [765] {383}	16,215 (3,243) [778] {389}	16,491 (3,298) [792] {396}
Passaic	19,627	19,693	19,768	19,812	19,930 (3,986) [957] {478}	20,056 (4,011) [963] {481}	20,193 (4,039) [969] {485}
Somerset	6,023	6,045	6,060	6,089	6,112 (1,222) [293] {147}	6,134 (1,227) [294] {147}	6,157 (1,231) [296] {148}
Sussex	1,581	1,584	1,587	1,589	1,595 (319) [77] {38}	1,600 (320) [77] {38}	1,606 (321) [77] {39}
Union	18,247	18,316	18,375	18,440	18,573 (3,715) [891] {446}	18,718 (3,744) [898] {449}	18,878 (3,776) [906] {453}
Warren	1,484	1,488	1,493	1,495	1,502 (300) [72] {36}	1,510 (302) [72] {36}	1,519 (304) [73] {36}

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.