IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/4/20

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 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 12/4/20 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
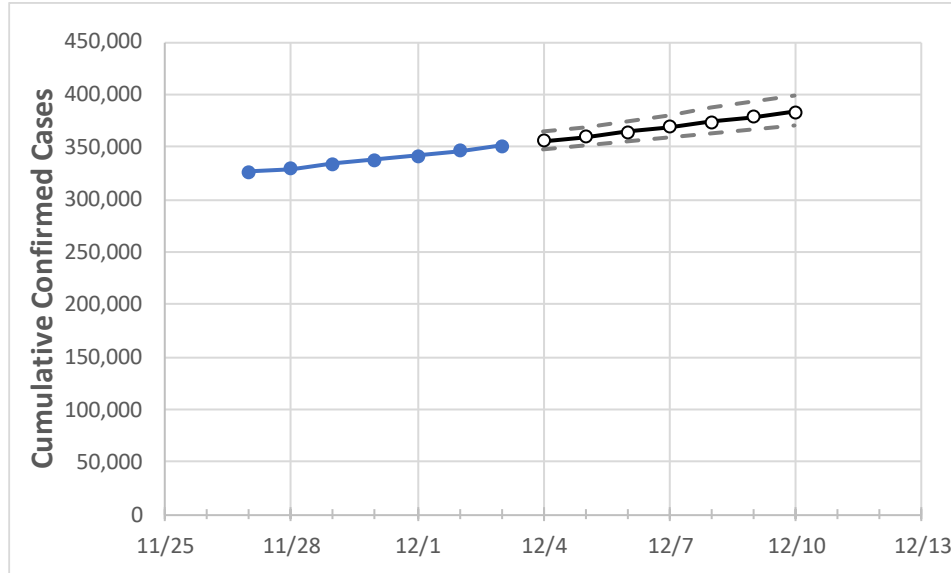
	Actual Confirmed Cases On:				Projected Cases For:						
	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9	12/10
New Jersey	337,304	341,910	346,206	350,999	355,455	359,968	364,538	369,166	373,852	378,597	383,401

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:						
	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9	12/10
Bergen	34,871	35,327	35,726	36,226	36,663	37,108	37,559	38,019	38,486	38,961	39,443
Burlington	13,803	14,017	14,203	14,374	14,605	14,839	15,077	15,320	15,566	15,817	16,072
Camden	19,249	19,501	19,842	20,231	20,569	20,912	21,261	21,616	21,976	22,343	22,715
Essex	35,358	35,788	36,082	36,554	36,899	37,245	37,591	37,939	38,288	38,637	38,988
Gloucester	9,053	9,190	9,331	9,547	9,688	9,830	9,974	10,119	10,265	10,413	10,562
Hudson	31,691	32,033	32,465	32,898	33,276	33,660	34,052	34,451	34,858	35,272	35,694
Hunterdon	2,510	2,535	2,577	2,611	2,648	2,686	2,725	2,764	2,804	2,845	2,886
Mercer	13,797	13,992	14,170	14,347	14,543	14,741	14,941	15,143	15,346	15,551	15,758
Middlesex	30,562	31,107	31,578	32,028	32,427	32,835	33,254	33,683	34,123	34,573	35,034
Monmouth	20,657	20,961	21,267	21,621	21,929	22,243	22,564	22,891	23,225	23,566	23,914
Morris	13,647	13,928	14,118	14,258	14,451	14,646	14,845	15,047	15,251	15,460	15,671
Ocean	21,993	22,277	22,545	22,918	23,228	23,549	23,880	24,222	24,575	24,940	25,316
Passaic	30,180	30,576	31,047	31,340	31,722	32,110	32,503	32,903	33,308	33,719	34,137
Somerset	9,104	9,231	9,360	9,482	9,590	9,700	9,811	9,923	10,037	10,151	10,268
Sussex	2,593	2,655	2,687	2,734	2,779	2,825	2,872	2,921	2,971	3,022	3,075
Union	28,437	28,756	28,969	29,295	29,565	29,834	30,104	30,374	30,645	30,915	31,186
Warren	2,512	2,526	2,570	2,616	2,647	2,679	2,710	2,742	2,774	2,807	2,839

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:		
	11/30	12/1	12/2	12/3	12/5	12/7	12/9
Bergen	34,871	35,327	35,726	36,226	37,108 (7,422) [1,781] {891}	38,019 (7,604) [1,825] {912}	38,961 (7,792) [1,870] {935}
Burlington	13,803	14,017	14,203	14,374	14,839 (2,968) [712] {356}	15,320 (3,064) [735] {368}	15,817 (3,163) [759] {380}
Camden	19,249	19,501	19,842	20,231	20,912 (4,182) [1,004] {502}	21,616 (4,323) [1,038] {519}	22,343 (4,469) [1,072] {536}
Essex	35,358	35,788	36,082	36,554	37,245 (7,449) [1,788] {894}	37,939 (7,588) [1,821] {911}	38,637 (7,727) [1,855] {927}
Gloucester	9,053	9,190	9,331	9,547	9,830 (1,966) [472] {236}	10,119 (2,024) [486] {243}	10,413 (2,083) [500] {250}
Hudson	31,691	32,033	32,465	32,898	33,660 (6,732) [1,616] {808}	34,451 (6,890) [1,654] {827}	35,272 (7,054) [1,693] {847}
Hunterdon	2,510	2,535	2,577	2,611	2,686 (537) [129] {64}	2,764 (553) [133] {66}	2,845 (569) [137] {68}
Mercer	13,797	13,992	14,170	14,347	14,741 (2,948) [708] {354}	15,143 (3,029) [727] {363}	15,551 (3,110) [746] {373}
Middlesex	30,562	31,107	31,578	32,028	32,835 (6,567) [1,576] {788}	33,683 (6,737) [1,617] {808}	34,573 (6,915) [1,659] {830}
Monmouth	20,657	20,961	21,267	21,621	22,243 (4,449) [1,068] {534}	22,891 (4,578) [1,099] {549}	23,566 (4,713) [1,131] {566}
Morris	13,647	13,928	14,118	14,258	14,646 (2,929) [703] {352}	15,047 (3,009) [722] {361}	15,460 (3,092) [742] {371}
Ocean	21,993	22,277	22,545	22,918	23,549 (4,710) [1,130] {565}	24,222 (4,844) [1,163] {581}	24,940 (4,988) [1,197] {599}
Passaic	30,180	30,576	31,047	31,340	32,110 (6,422) [1,541] {771}	32,903 (6,581) [1,579] {790}	33,719 (6,744) [1,619] {809}
Somerset	9,104	9,231	9,360	9,482	9,700 (1,940) [466] {233}	9,923 (1,985) [476] {238}	10,151 (2,030) [487] {244}
Sussex	2,593	2,655	2,687	2,734	2,825 (565) [136] {68}	2,921 (584) [140] {70}	3,022 (604) [145] {73}
Union	28,437	28,756	28,969	29,295	29,834 (5,967) [1,432] {716}	30,374 (6,075) [1,458] {729}	30,915 (6,183) [1,484] {742}
Warren	2,512	2,526	2,570	2,616	2,679 (536) [129] {64}	2,742 (548) [132] {66}	2,807 (561) [135] {67}

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.