

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

Date: 12/8/20

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 12/8/20 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.**

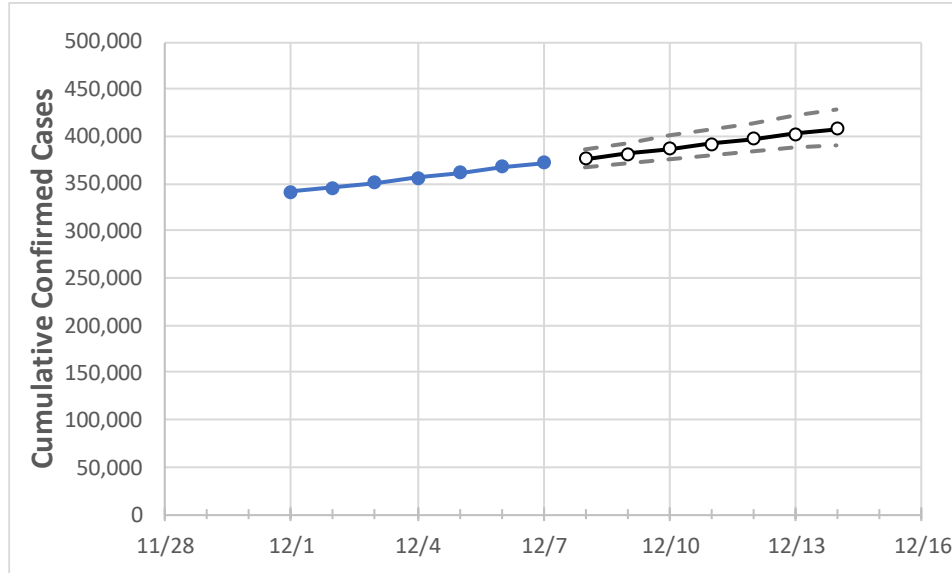
### IEM's Modeling Lead

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:							
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	
New Jersey	356,662	361,986	368,016	371,579	376,552	381,614	386,766	392,011	397,349	402,783	408,314	

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:							
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	
Bergen	36,840	37,350	37,893	38,227	38,706	39,194	39,691	40,199	40,717	41,245	41,783	
Burlington	14,647	14,990	15,305	15,547	15,812	16,082	16,359	16,642	16,931	17,227	17,530	
Camden	20,727	21,071	21,578	21,793	22,153	22,519	22,893	23,273	23,661	24,057	24,459	
Essex	37,134	37,736	38,252	38,574	38,997	39,428	39,866	40,313	40,767	41,229	41,699	
Gloucester	9,848	10,025	10,271	10,355	10,511	10,669	10,830	10,993	11,159	11,328	11,499	
Hudson	33,429	33,842	34,393	34,661	35,082	35,512	35,951	36,399	36,857	37,324	37,801	
Hunterdon	2,653	2,687	2,742	2,765	2,803	2,842	2,881	2,921	2,962	3,003	3,044	
Mercer	14,531	14,727	14,936	15,069	15,249	15,429	15,610	15,792	15,974	16,158	16,342	
Middlesex	32,468	33,016	33,475	33,834	34,285	34,747	35,220	35,704	36,201	36,709	37,230	
Monmouth	22,030	22,376	22,837	23,076	23,421	23,773	24,134	24,503	24,881	25,267	25,662	
Morris	14,456	14,684	14,982	15,159	15,376	15,597	15,822	16,051	16,285	16,523	16,765	
Ocean	23,240	23,558	23,969	24,227	24,581	24,948	25,328	25,722	26,129	26,550	26,987	
Passaic	31,802	32,315	32,776	33,174	33,603	34,040	34,486	34,940	35,404	35,876	36,358	
Somerset	9,606	9,718	9,829	9,909	10,019	10,130	10,242	10,355	10,469	10,584	10,700	
Sussex	2,808	2,868	2,950	2,984	3,039	3,095	3,154	3,215	3,277	3,342	3,410	
Union	29,579	29,831	30,205	30,390	30,658	30,927	31,196	31,465	31,734	32,004	32,274	
Warren	2,672	2,721	2,770	2,807	2,845	2,885	2,925	2,965	3,007	3,049	3,092	

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:											
	12/4	12/5	12/6	12/7	12/9			12/11			12/13					
Bergen	36,840	37,350	37,893	38,227	39,194	(7,839)	[1,881]	{941}	40,199	(8,040)	[1,930]	{965}	41,245	(8,249)	[1,980]	{990}
Burlington	14,647	14,990	15,305	15,547	16,082	(3,216)	[772]	{386}	16,642	(3,328)	[799]	{399}	17,227	(3,445)	[827]	{413}
Camden	20,727	21,071	21,578	21,793	22,519	(4,504)	[1,081]	{540}	23,273	(4,655)	[1,117]	{559}	24,057	(4,811)	[1,155]	{577}
Essex	37,134	37,736	38,252	38,574	39,428	(7,886)	[1,893]	{946}	40,313	(8,063)	[1,935]	{968}	41,229	(8,246)	[1,979]	{989}
Gloucester	9,848	10,025	10,271	10,355	10,669	(2,134)	[512]	{256}	10,993	(2,199)	[528]	{264}	11,328	(2,266)	[544]	{272}
Hudson	33,429	33,842	34,393	34,661	35,512	(7,102)	[1,705]	{852}	36,399	(7,280)	[1,747]	{874}	37,324	(7,465)	[1,792]	{896}
Hunterdon	2,653	2,687	2,742	2,765	2,842	(568)	[136]	{68}	2,921	(584)	[140]	{70}	3,003	(601)	[144]	{72}
Mercer	14,531	14,727	14,936	15,069	15,429	(3,086)	[741]	{370}	15,792	(3,158)	[758]	{379}	16,158	(3,232)	[776]	{388}
Middlesex	32,468	33,016	33,475	33,834	34,747	(6,949)	[1,668]	{834}	35,704	(7,141)	[1,714]	{857}	36,709	(7,342)	[1,762]	{881}
Monmouth	22,030	22,376	22,837	23,076	23,773	(4,755)	[1,141]	{571}	24,503	(4,901)	[1,176]	{588}	25,267	(5,053)	[1,213]	{606}
Morris	14,456	14,684	14,982	15,159	15,597	(3,119)	[749]	{374}	16,051	(3,210)	[770]	{385}	16,523	(3,305)	[793]	{397}
Ocean	23,240	23,558	23,969	24,227	24,948	(4,990)	[1,198]	{599}	25,722	(5,144)	[1,235]	{617}	26,550	(5,310)	[1,274]	{637}
Passaic	31,802	32,315	32,776	33,174	34,040	(6,808)	[1,634]	{817}	34,940	(6,988)	[1,677]	{839}	35,876	(7,175)	[1,722]	{861}
Somerset	9,606	9,718	9,829	9,909	10,130	(2,026)	[486]	{243}	10,355	(2,071)	[497]	{249}	10,584	(2,117)	[508]	{254}
Sussex	2,808	2,868	2,950	2,984	3,095	(619)	[149]	{74}	3,215	(643)	[154]	{77}	3,342	(668)	[160]	{80}
Union	29,579	29,831	30,205	30,390	30,927	(6,185)	[1,484]	{742}	31,465	(6,293)	[1,510]	{755}	32,004	(6,401)	[1,536]	{768}
Warren	2,672	2,721	2,770	2,807	2,885	(577)	[138]	{69}	2,965	(593)	[142]	{71}	3,049	(610)	[146]	{73}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.