

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/17/21**

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 12/17/21 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.

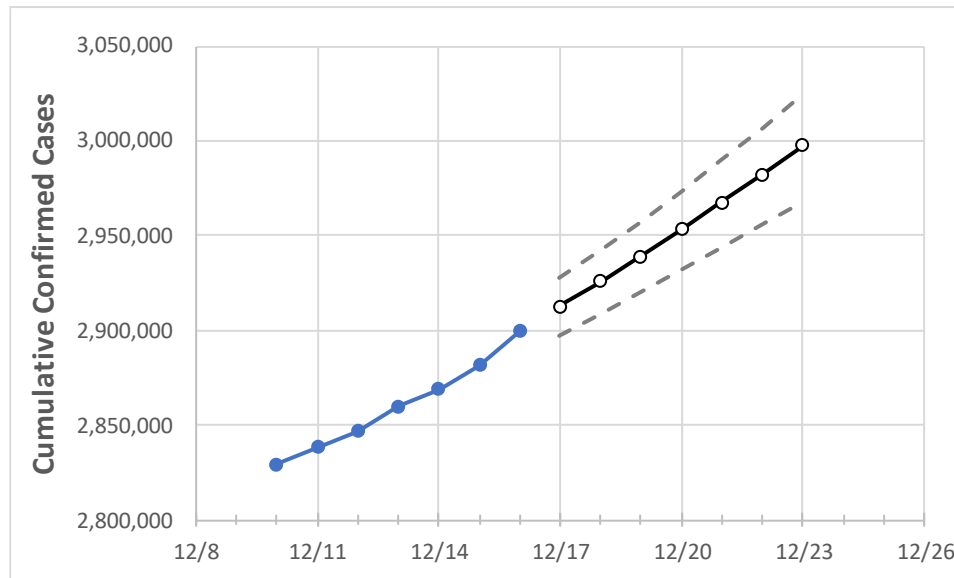
IEM's Modeling Lead

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 York State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23
New York	2,860,036	2,868,885	2,881,565	2,899,469	2,912,481	2,925,797	2,939,220	2,953,246	2,967,587	2,982,245	2,997,660

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

New York Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23
Albany	36,489	36,612	36,773	36,959	37,131	37,305	37,477	37,648	37,824	38,013	38,193
Bronx	217,895	218,393	218,935	219,812	220,402	221,018	221,661	222,338	223,045	223,792	224,549
Dutchess	39,843	39,956	40,109	40,340	40,532	40,723	40,922	41,127	41,342	41,559	41,785
Erie	133,831	134,255	134,688	135,342	135,930	136,517	137,085	137,669	138,243	138,812	139,397
Kings	360,317	361,571	362,933	365,241	366,769	368,436	370,138	371,904	373,745	375,699	377,745
Monroe	104,068	104,330	104,710	105,131	105,564	106,006	106,434	106,865	107,304	107,741	108,170
Nassau	236,612	237,345	238,425	240,073	241,232	242,387	243,613	244,855	246,157	247,524	248,923
New York	184,273	184,959	186,466	189,081	190,445	191,892	193,411	195,022	196,789	198,635	200,620
Niagara	31,118	31,253	31,385	31,529	31,684	31,833	31,985	32,137	32,287	32,433	32,583
Onondaga	63,396	63,582	63,907	64,227	64,531	64,831	65,150	65,465	65,774	66,100	66,420
Orange	65,229	65,453	65,729	66,065	66,343	66,624	66,906	67,193	67,492	67,795	68,104
Putnam	13,808	13,857	13,932	14,000	14,073	14,148	14,224	14,306	14,389	14,477	14,568
Queens	336,419	337,370	338,489	340,143	341,347	342,611	343,923	345,278	346,713	348,179	349,712
Rensselaer	18,862	18,914	19,015	19,102	19,212	19,323	19,431	19,540	19,651	19,767	19,878
Richmond	96,074	96,389	96,676	97,162	97,534	97,927	98,331	98,751	99,185	99,640	100,102
Rockland	56,975	57,095	57,289	57,487	57,643	57,806	57,974	58,148	58,324	58,507	58,693
Saratoga	26,955	27,053	27,214	27,399	27,551	27,704	27,853	28,007	28,159	28,308	28,455
Schenectady	20,577	20,632	20,725	20,814	20,904	20,995	21,084	21,171	21,263	21,355	21,444
Suffolk	268,570	269,284	270,596	272,396	273,746	275,149	276,562	278,011	279,537	281,087	282,680
Sullivan	10,355	10,388	10,464	10,550	10,612	10,672	10,734	10,797	10,861	10,925	10,991
Tompkins	8,423	8,605	8,843	9,234	9,496	9,782	10,084	10,415	10,785	11,176	11,605
Ulster	20,201	20,254	20,331	20,435	20,524	20,615	20,704	20,793	20,887	20,980	21,077
Westchester	152,856	153,148	153,696	154,426	154,987	155,569	156,168	156,807	157,468	158,170	158,883

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 York Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:											
	12/13	12/14	12/15	12/16	12/18				12/20				12/22			
Albany	36,489	36,612	36,773	36,959	37,305	(7,461)	[1,791]	{895}	37,648	(7,530)	[1,807]	{904}	38,013	(7,603)	[1,825]	{912}
Bronx	217,895	218,393	218,935	219,812	221,018	(44,204)	[10,609]	{5,304}	222,338	(44,468)	[10,672]	{5,336}	223,792	(44,758)	[10,742]	{5,371}
Dutchess	39,843	39,956	40,109	40,340	40,723	(8,145)	[1,955]	{977}	41,127	(8,225)	[1,974]	{987}	41,559	(8,312)	[1,995]	{997}
Erie	133,831	134,255	134,688	135,342	136,517	(27,303)	[6,553]	{3,276}	137,669	(27,534)	[6,608]	{3,304}	138,812	(27,762)	[6,663]	{3,331}
Kings	360,317	361,571	362,933	365,241	368,436	(73,687)	[17,685]	{8,842}	371,904	(74,381)	[17,851]	{8,926}	375,699	(75,140)	[18,034]	{9,017}
Monroe	104,068	104,330	104,710	105,131	106,006	(21,201)	[5,088]	{2,544}	106,865	(21,373)	[5,130]	{2,565}	107,741	(21,548)	[5,172]	{2,586}
Nassau	236,612	237,345	238,425	240,073	242,387	(48,477)	[11,635]	{5,817}	244,855	(48,971)	[11,753]	{5,877}	247,524	(49,505)	[11,881]	{5,941}
New York	184,273	184,959	186,466	189,081	191,892	(38,378)	[9,211]	{4,605}	195,022	(39,004)	[9,361]	{4,681}	198,635	(39,727)	[9,534]	{4,767}
Niagara	31,118	31,253	31,385	31,529	31,833	(6,367)	[1,528]	{764}	32,137	(6,427)	[1,543]	{771}	32,433	(6,487)	[1,557]	{778}
Onondaga	63,396	63,582	63,907	64,227	64,831	(12,966)	[3,112]	{1,556}	65,465	(13,093)	[3,142]	{1,571}	66,100	(13,220)	[3,173]	{1,586}
Orange	65,229	65,453	65,729	66,065	66,624	(13,325)	[3,198]	{1,599}	67,193	(13,439)	[3,225]	{1,613}	67,795	(13,559)	[3,254]	{1,627}
Putnam	13,808	13,857	13,932	14,000	14,148	(2,830)	[679]	{340}	14,306	(2,861)	[687]	{343}	14,477	(2,895)	[695]	{347}
Queens	336,419	337,370	338,489	340,143	342,611	(68,522)	[16,445]	{8,223}	345,278	(69,056)	[16,573]	{8,287}	348,179	(69,636)	[16,713]	{8,356}
Rensselaer	18,862	18,914	19,015	19,102	19,323	(3,865)	[927]	{464}	19,540	(3,908)	[938]	{469}	19,767	(3,953)	[949]	{474}
Richmond	96,074	96,389	96,676	97,162	97,927	(19,585)	[4,701]	{2,350}	98,751	(19,750)	[4,740]	{2,370}	99,640	(19,928)	[4,783]	{2,391}
Rockland	56,975	57,095	57,289	57,487	57,806	(11,561)	[2,775]	{1,387}	58,148	(11,630)	[2,791]	{1,396}	58,507	(11,701)	[2,808]	{1,404}
Saratoga	26,955	27,053	27,214	27,399	27,704	(5,541)	[1,330]	{665}	28,007	(5,601)	[1,344]	{672}	28,308	(5,662)	[1,359]	{679}
Schenectady	20,577	20,632	20,725	20,814	20,995	(4,199)	[1,008]	{504}	21,171	(4,234)	[1,016]	{508}	21,355	(4,271)	[1,025]	{513}
Suffolk	268,570	269,284	270,596	272,396	275,149	(55,030)	[13,207]	{6,604}	278,011	(55,602)	[13,345]	{6,672}	281,087	(56,217)	[13,492]	{6,746}
Sullivan	10,355	10,388	10,464	10,550	10,672	(2,134)	[512]	{256}	10,797	(2,159)	[518]	{259}	10,925	(2,185)	[524]	{262}
Tompkins	8,423	8,605	8,843	9,234	9,782	(1,956)	[470]	{235}	10,415	(2,083)	[500]	{250}	11,176	(2,235)	[536]	{268}
Ulster	20,201	20,254	20,331	20,435	20,615	(4,123)	[990]	{495}	20,793	(4,159)	[998]	{499}	20,980	(4,196)	[1,007]	{504}
Westchester	152,856	153,148	153,696	154,426	155,569	(31,114)	[7,467]	{3,734}	156,807	(31,361)	[7,527]	{3,763}	158,170	(31,634)	[7,592]	{3,796}

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.