

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

Date: 12/3/20

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 12/3/20 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.

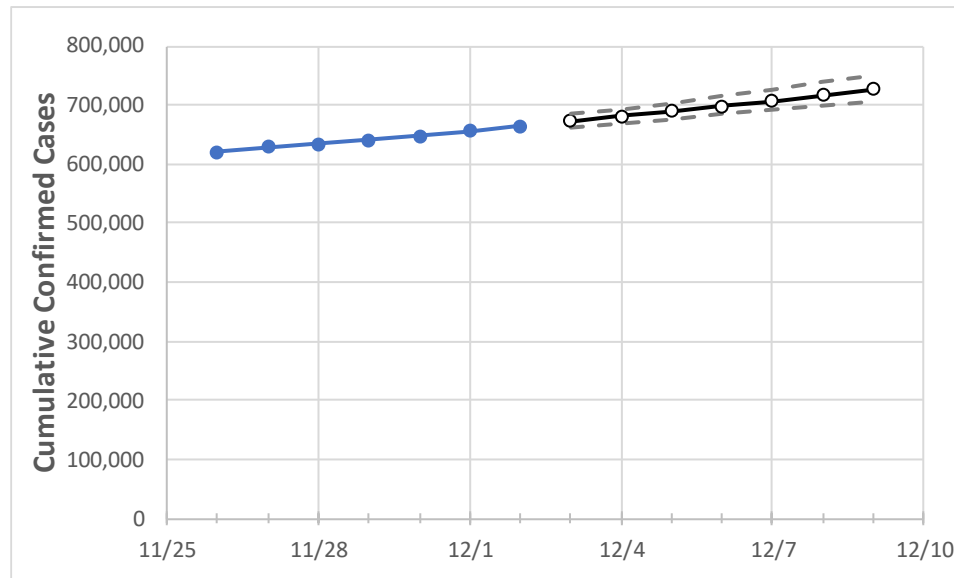
IEM's Modeling Lead

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 York State Projections



	Actual Confirmed Cases On:					Projected Cases For:					
	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9
New York	641,161	647,980	655,265	664,238	672,323	680,682	689,327	698,265	707,506	717,060	726,936

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 York Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9
Albany	5,712	5,816	5,968	6,138	6,269	6,406	6,550	6,701	6,860	7,025	7,199
Bronx	63,548	63,997	64,494	65,005	65,508	66,029	66,571	67,132	67,714	68,318	68,945
Dutchess	7,197	7,284	7,354	7,512	7,614	7,719	7,828	7,942	8,060	8,182	8,309
Erie	24,942	25,427	26,042	26,518	27,151	27,802	28,472	29,160	29,867	30,593	31,340
Kings	88,481	89,127	89,751	90,592	91,289	92,006	92,745	93,506	94,290	95,096	95,926
Monroe	15,138	15,660	16,060	16,588	17,120	17,677	18,260	18,871	19,511	20,181	20,882
Nassau	60,181	60,701	61,162	61,988	62,595	63,223	63,871	64,541	65,233	65,948	66,687
New York	45,030	45,442	45,871	46,328	46,785	47,253	47,733	48,226	48,730	49,248	49,778
Niagara	3,768	3,874	4,019	4,142	4,269	4,402	4,544	4,692	4,849	5,015	5,190
Onondaga	10,701	10,804	10,995	11,281	11,499	11,722	11,948	12,179	12,413	12,652	12,895
Orange	16,801	16,891	17,075	17,283	17,429	17,579	17,732	17,888	18,048	18,211	18,378
Putnam	2,789	2,844	2,884	2,973	3,026	3,083	3,143	3,207	3,275	3,348	3,425
Queens	89,681	90,398	91,056	91,955	92,672	93,413	94,179	94,970	95,787	96,632	97,504
Rensselaer	1,720	1,746	1,795	1,837	1,878	1,920	1,964	2,010	2,058	2,108	2,161
Richmond	22,735	23,015	23,376	23,866	24,207	24,563	24,935	25,322	25,726	26,148	26,587
Rockland	21,502	21,632	21,845	22,048	22,200	22,356	22,515	22,679	22,846	23,018	23,193
Saratoga	2,245	2,293	2,370	2,413	2,477	2,544	2,614	2,689	2,768	2,851	2,939
Schenectady	2,443	2,481	2,555	2,615	2,678	2,746	2,818	2,895	2,976	3,063	3,155
Suffolk	60,414	61,072	61,681	62,647	63,416	64,219	65,055	65,927	66,836	67,783	68,770
Sullivan	2,191	2,202	2,210	2,220	2,235	2,249	2,264	2,279	2,294	2,309	2,325
Tompkins	1,105	1,118	1,139	1,154	1,184	1,216	1,250	1,286	1,324	1,364	1,406
Ulster	3,325	3,381	3,434	3,499	3,559	3,623	3,690	3,761	3,835	3,914	3,997
Westchester	50,110	50,693	51,220	51,790	52,385	53,002	53,644	54,309	55,000	55,716	56,460

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:											
	11/29	11/30	12/1	12/2	12/4				12/6				12/8			
Albany	5,712	5,816	5,968	6,138	6,406	(1,281)	[308]	{154}	6,701	(1,340)	[322]	{161}	7,025	(1,405)	[337]	{169}
Bronx	63,548	63,997	64,494	65,005	66,029	(13,206)	[3,169]	{1,585}	67,132	(13,426)	[3,222]	{1,611}	68,318	(13,664)	[3,279]	{1,640}
Dutchess	7,197	7,284	7,354	7,512	7,719	(1,544)	[371]	{185}	7,942	(1,588)	[381]	{191}	8,182	(1,636)	[393]	{196}
Erie	24,942	25,427	26,042	26,518	27,802	(5,560)	[1,335]	{667}	29,160	(5,832)	[1,400]	{700}	30,593	(6,119)	[1,468]	{734}
Kings	88,481	89,127	89,751	90,592	92,006	(18,401)	[4,416]	{2,208}	93,506	(18,701)	[4,488]	{2,244}	95,096	(19,019)	[4,565]	{2,282}
Monroe	15,138	15,660	16,060	16,588	17,677	(3,535)	[848]	{424}	18,871	(3,774)	[906]	{453}	20,181	(4,036)	[969]	{484}
Nassau	60,181	60,701	61,162	61,988	63,223	(12,645)	[3,035]	{1,517}	64,541	(12,908)	[3,098]	{1,549}	65,948	(13,190)	[3,166]	{1,583}
New York	45,030	45,442	45,871	46,328	47,253	(9,451)	[2,268]	{1,134}	48,226	(9,645)	[2,315]	{1,157}	49,248	(9,850)	[2,364]	{1,182}
Niagara	3,768	3,874	4,019	4,142	4,402	(880)	[211]	{106}	4,692	(938)	[225]	{113}	5,015	(1,003)	[241]	{120}
Onondaga	10,701	10,804	10,995	11,281	11,722	(2,344)	[563]	{281}	12,179	(2,436)	[585]	{292}	12,652	(2,530)	[607]	{304}
Orange	16,801	16,891	17,075	17,283	17,579	(3,516)	[844]	{422}	17,888	(3,578)	[859]	{429}	18,211	(3,642)	[874]	{437}
Putnam	2,789	2,844	2,884	2,973	3,083	(617)	[148]	{74}	3,207	(641)	[154]	{77}	3,348	(670)	[161]	{80}
Queens	89,681	90,398	91,056	91,955	93,413	(18,683)	[4,484]	{2,242}	94,970	(18,994)	[4,559]	{2,279}	96,632	(19,326)	[4,638]	{2,319}
Rensselaer	1,720	1,746	1,795	1,837	1,920	(384)	[92]	{46}	2,010	(402)	[96]	{48}	2,108	(422)	[101]	{51}
Richmond	22,735	23,015	23,376	23,866	24,563	(4,913)	[1,179]	{590}	25,322	(5,064)	[1,215]	{608}	26,148	(5,230)	[1,255]	{628}
Rockland	21,502	21,632	21,845	22,048	22,356	(4,471)	[1,073]	{537}	22,679	(4,536)	[1,089]	{544}	23,018	(4,604)	[1,105]	{552}
Saratoga	2,245	2,293	2,370	2,413	2,544	(509)	[122]	{61}	2,689	(538)	[129]	{65}	2,851	(570)	[137]	{68}
Schenectady	2,443	2,481	2,555	2,615	2,746	(549)	[132]	{66}	2,895	(579)	[139]	{69}	3,063	(613)	[147]	{74}
Suffolk	60,414	61,072	61,681	62,647	64,219	(12,844)	[3,082]	{1,541}	65,927	(13,185)	[3,164]	{1,582}	67,783	(13,557)	[3,254]	{1,627}
Sullivan	2,191	2,202	2,210	2,220	2,249	(450)	[108]	{54}	2,279	(456)	[109]	{55}	2,309	(462)	[111]	{55}
Tompkins	1,105	1,118	1,139	1,154	1,216	(243)	[58]	{29}	1,286	(257)	[62]	{31}	1,364	(273)	[65]	{33}
Ulster	3,325	3,381	3,434	3,499	3,623	(725)	[174]	{87}	3,761	(752)	[181]	{90}	3,914	(783)	[188]	{94}
Westchester	50,110	50,693	51,220	51,790	53,002	(10,600)	[2,544]	{1,272}	54,309	(10,862)	[2,607]	{1,303}	55,716	(11,143)	[2,674]	{1,337}

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.