

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/24/20**

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 12/24/20 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.

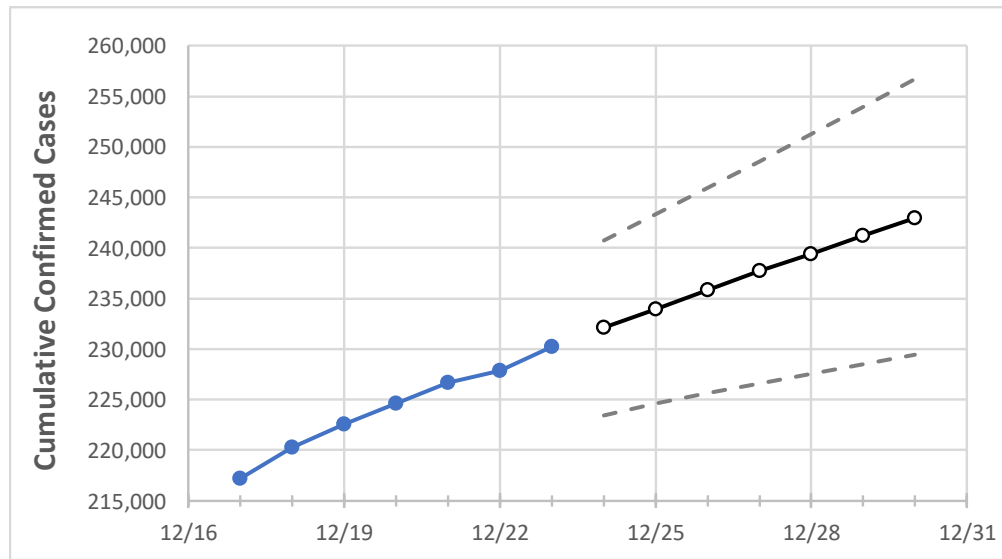
IEM's Modeling Lead

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.

Washington State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28	12/29	12/30
Washington	224,618	226,635	227,887	230,202	232,135	233,962	235,848	237,704	239,434	241,194	242,921

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.

Washington Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28	12/29	12/30
Benton	10,801	10,903	11,011	11,072	11,165	11,256	11,347	11,433	11,521	11,610	11,692
Clark	12,122	12,213	12,324	12,477	12,579	12,680	12,778	12,878	12,973	13,063	13,149
Grant	5,488	5,511	5,544	5,650	5,707	5,763	5,821	5,877	5,935	5,991	6,051
Island	856	860	864	872	878	883	888	894	898	903	908
King	58,265	58,747	58,968	59,383	59,817	60,223	60,616	61,012	61,402	61,772	62,121
Kitsap	3,431	3,459	3,493	3,560	3,599	3,638	3,677	3,718	3,757	3,795	3,832
Pierce	23,281	23,447	23,612	23,914	24,100	24,281	24,454	24,610	24,770	24,926	25,071
Skagit	2,963	3,005	3,011	3,068	3,103	3,136	3,170	3,204	3,238	3,272	3,306
Snohomish	20,046	20,273	20,407	20,656	20,852	21,047	21,236	21,422	21,600	21,782	21,949
Spokane	23,236	23,440	23,571	23,768	23,933	24,089	24,231	24,373	24,502	24,633	24,757
Thurston	4,257	4,302	4,342	4,380	4,422	4,463	4,502	4,542	4,581	4,620	4,658
Whatcom	3,144	3,186	3,197	3,239	3,270	3,302	3,334	3,366	3,399	3,431	3,463
Yakima	17,615	17,792	17,981	18,161	18,341	18,518	18,702	18,890	19,080	19,285	19,486

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.

Washington Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:											
	12/20	12/21	12/22	12/23	12/25				12/27				12/29			
Benton	10,801	10,903	11,011	11,072	11,256	(2,251)	[540]	{270}	11,433	(2,287)	[549]	{274}	11,610	(2,322)	[557]	{279}
Clark	12,122	12,213	12,324	12,477	12,680	(2,536)	[609]	{304}	12,878	(2,576)	[618]	{309}	13,063	(2,613)	[627]	{314}
Grant	5,488	5,511	5,544	5,650	5,763	(1,153)	[277]	{138}	5,877	(1,175)	[282]	{141}	5,991	(1,198)	[288]	{144}
Island	856	860	864	872	883	(177)	[42]	{21}	894	(179)	[43]	{21}	903	(181)	[43]	{22}
King	58,265	58,747	58,968	59,383	60,223	(12,045)	[2,891]	{1,445}	61,012	(12,202)	[2,929]	{1,464}	61,772	(12,354)	[2,965]	{1,483}
Kitsap	3,431	3,459	3,493	3,560	3,638	(728)	[175]	{87}	3,718	(744)	[178]	{89}	3,795	(759)	[182]	{91}
Pierce	23,281	23,447	23,612	23,914	24,281	(4,856)	[1,166]	{583}	24,610	(4,922)	[1,181]	{591}	24,926	(4,985)	[1,196]	{598}
Skagit	2,963	3,005	3,011	3,068	3,136	(627)	[151]	{75}	3,204	(641)	[154]	{77}	3,272	(654)	[157]	{79}
Snohomish	20,046	20,273	20,407	20,656	21,047	(4,209)	[1,010]	{505}	21,422	(4,284)	[1,028]	{514}	21,782	(4,356)	[1,046]	{523}
Spokane	23,236	23,440	23,571	23,768	24,089	(4,818)	[1,156]	{578}	24,373	(4,875)	[1,170]	{585}	24,633	(4,927)	[1,182]	{591}
Thurston	4,257	4,302	4,342	4,380	4,463	(893)	[214]	{107}	4,542	(908)	[218]	{109}	4,620	(924)	[222]	{111}
Whatcom	3,144	3,186	3,197	3,239	3,302	(660)	[158]	{79}	3,366	(673)	[162]	{81}	3,431	(686)	[165]	{82}
Yakima	17,615	17,792	17,981	18,161	18,518	(3,704)	[889]	{444}	18,890	(3,778)	[907]	{453}	19,285	(3,857)	[926]	{463}

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.