

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/23/20**

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 12/23/20 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.

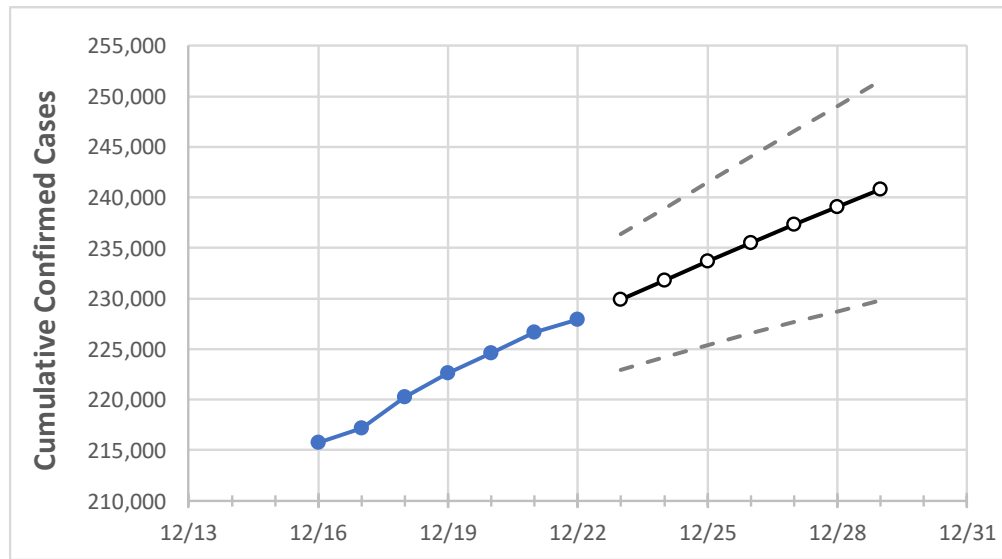
IEM's Modeling Lead

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:						
	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28	12/29
Washington	222,600	224,618	226,635	227,887	229,869	231,796	233,653	235,485	237,284	239,062	240,764

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:							
	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28	12/29	
Benton	10,698	10,801	10,903	11,011	11,112	11,215	11,318	11,416	11,515	11,611	11,709	
Clark	12,030	12,122	12,213	12,324	12,423	12,519	12,611	12,700	12,790	12,876	12,959	
Grant	5,465	5,488	5,511	5,544	5,588	5,632	5,674	5,717	5,759	5,799	5,839	
Island	851	856	860	864	869	875	880	885	890	894	899	
King	57,783	58,265	58,747	58,968	59,408	59,840	60,256	60,656	61,059	61,440	61,809	
Kitsap	3,402	3,431	3,459	3,493	3,527	3,560	3,592	3,623	3,655	3,686	3,718	
Pierce	23,114	23,281	23,447	23,612	23,801	23,980	24,159	24,326	24,494	24,653	24,803	
Skagit	2,921	2,963	3,005	3,011	3,042	3,075	3,107	3,139	3,170	3,201	3,232	
Snohomish	19,819	20,046	20,273	20,407	20,601	20,789	20,967	21,143	21,317	21,493	21,663	
Spokane	23,032	23,236	23,440	23,571	23,739	23,906	24,064	24,219	24,373	24,526	24,664	
Thurston	4,211	4,257	4,302	4,342	4,385	4,428	4,469	4,510	4,551	4,591	4,631	
Whatcom	3,102	3,144	3,186	3,197	3,226	3,254	3,283	3,311	3,340	3,368	3,395	
Yakima	17,438	17,615	17,792	17,981	18,152	18,330	18,511	18,698	18,881	19,069	19,256	

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:											
	12/19	12/20	12/21	12/22	12/24				12/26				12/28			
Benton	10,698	10,801	10,903	11,011	11,215	(2,243)	[538]	{269}	11,416	(2,283)	[548]	{274}	11,611	(2,322)	[557]	{279}
Clark	12,030	12,122	12,213	12,324	12,519	(2,504)	[601]	{300}	12,700	(2,540)	[610]	{305}	12,876	(2,575)	[618]	{309}
Grant	5,465	5,488	5,511	5,544	5,632	(1,126)	[270]	{135}	5,717	(1,143)	[274]	{137}	5,799	(1,160)	[278]	{139}
Island	851	856	860	864	875	(175)	[42]	{21}	885	(177)	[42]	{21}	894	(179)	[43]	{21}
King	57,783	58,265	58,747	58,968	59,840	(11,968)	[2,872]	{1,436}	60,656	(12,131)	[2,912]	{1,456}	61,440	(12,288)	[2,949]	{1,475}
Kitsap	3,402	3,431	3,459	3,493	3,560	(712)	[171]	{85}	3,623	(725)	[174]	{87}	3,686	(737)	[177]	{88}
Pierce	23,114	23,281	23,447	23,612	23,980	(4,796)	[1,151]	{576}	24,326	(4,865)	[1,168]	{584}	24,653	(4,931)	[1,183]	{592}
Skagit	2,921	2,963	3,005	3,011	3,075	(615)	[148]	{74}	3,139	(628)	[151]	{75}	3,201	(640)	[154]	{77}
Snohomish	19,819	20,046	20,273	20,407	20,789	(4,158)	[998]	{499}	21,143	(4,229)	[1,015]	{507}	21,493	(4,299)	[1,032]	{516}
Spokane	23,032	23,236	23,440	23,571	23,906	(4,781)	[1,148]	{574}	24,219	(4,844)	[1,163]	{581}	24,526	(4,905)	[1,177]	{589}
Thurston	4,211	4,257	4,302	4,342	4,428	(886)	[213]	{106}	4,510	(902)	[217]	{108}	4,591	(918)	[220]	{110}
Whatcom	3,102	3,144	3,186	3,197	3,254	(651)	[156]	{78}	3,311	(662)	[159]	{79}	3,368	(674)	[162]	{81}
Yakima	17,438	17,615	17,792	17,981	18,330	(3,666)	[880]	{440}	18,698	(3,740)	[897]	{449}	19,069	(3,814)	[915]	{458}

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.