

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

Date: 12/14/20

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 12/14/20 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.

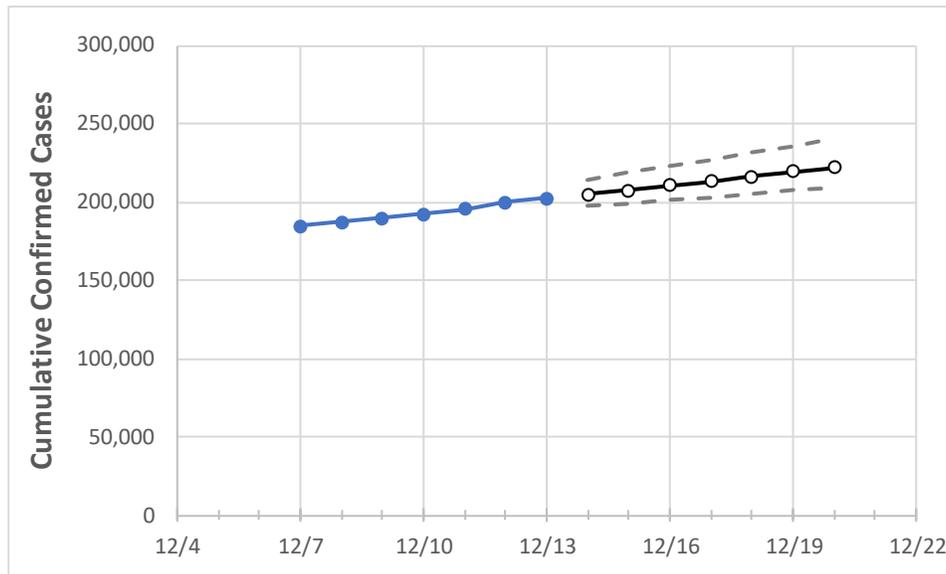
IEM's Modeling Lead

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:							
	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	
Washington	192,413	195,554	199,735	202,063	204,827	207,625	210,459	213,328	216,233	219,174	222,152	

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:							
	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	
Benton	9,423	9,562	9,760	9,863	9,975	10,088	10,202	10,318	10,434	10,552	10,671	
Clark	10,525	10,773	10,974	11,109	11,288	11,469	11,652	11,837	12,025	12,214	12,406	
Grant	4,529	4,562	4,593	4,611	4,643	4,676	4,709	4,743	4,777	4,812	4,847	
Island	759	767	782	784	793	801	810	819	828	837	847	
King	51,596	52,398	53,282	53,927	54,599	55,277	55,960	56,648	57,342	58,041	58,745	
Kitsap	2,988	3,029	3,087	3,121	3,173	3,227	3,281	3,337	3,394	3,452	3,512	
Pierce	19,925	20,280	21,134	21,460	21,800	22,146	22,500	22,861	23,230	23,606	23,989	
Skagit	2,399	2,462	2,519	2,558	2,604	2,651	2,700	2,751	2,803	2,857	2,913	
Snohomish	17,210	17,587	17,942	18,202	18,467	18,736	19,009	19,286	19,568	19,853	20,143	
Spokane	20,194	20,544	21,033	21,361	21,676	21,996	22,319	22,647	22,980	23,316	23,658	
Thurston	3,519	3,580	3,633	3,686	3,732	3,779	3,826	3,873	3,920	3,968	4,017	
Whatcom	2,802	2,834	2,879	2,906	2,937	2,968	2,999	3,030	3,061	3,093	3,125	
Yakima	15,055	15,271	15,548	15,679	15,821	15,969	16,122	16,281	16,446	16,617	16,794	

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:											
	12/10	12/11	12/12	12/13	12/15			12/17			12/19					
Benton	9,423	9,562	9,760	9,863	10,088	(2,018)	[484]	{242}	10,318	(2,064)	[495]	{248}	10,552	(2,110)	[506]	{253}
Clark	10,525	10,773	10,974	11,109	11,469	(2,294)	[551]	{275}	11,837	(2,367)	[568]	{284}	12,214	(2,443)	[586]	{293}
Grant	4,529	4,562	4,593	4,611	4,676	(935)	[224]	{112}	4,743	(949)	[228]	{114}	4,812	(962)	[231]	{115}
Island	759	767	782	784	801	(160)	[38]	{19}	819	(164)	[39]	{20}	837	(167)	[40]	{20}
King	51,596	52,398	53,282	53,927	55,277	(11,055)	[2,653]	{1,327}	56,648	(11,330)	[2,719]	{1,360}	58,041	(11,608)	[2,786]	{1,393}
Kitsap	2,988	3,029	3,087	3,121	3,227	(645)	[155]	{77}	3,337	(667)	[160]	{80}	3,452	(690)	[166]	{83}
Pierce	19,925	20,280	21,134	21,460	22,146	(4,429)	[1,063]	{532}	22,861	(4,572)	[1,097]	{549}	23,606	(4,721)	[1,133]	{567}
Skagit	2,399	2,462	2,519	2,558	2,651	(530)	[127]	{64}	2,751	(550)	[132]	{66}	2,857	(571)	[137]	{69}
Snohomish	17,210	17,587	17,942	18,202	18,736	(3,747)	[899]	{450}	19,286	(3,857)	[926]	{463}	19,853	(3,971)	[953]	{476}
Spokane	20,194	20,544	21,033	21,361	21,996	(4,399)	[1,056]	{528}	22,647	(4,529)	[1,087]	{544}	23,316	(4,663)	[1,119]	{560}
Thurston	3,519	3,580	3,633	3,686	3,779	(756)	[181]	{91}	3,873	(775)	[186]	{93}	3,968	(794)	[190]	{95}
Whatcom	2,802	2,834	2,879	2,906	2,968	(594)	[142]	{71}	3,030	(606)	[145]	{73}	3,093	(619)	[148]	{74}
Yakima	15,055	15,271	15,548	15,679	15,969	(3,194)	[766]	{383}	16,281	(3,256)	[781]	{391}	16,617	(3,323)	[798]	{399}

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.