

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

Date: 4/20/21

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 4/20/21 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.

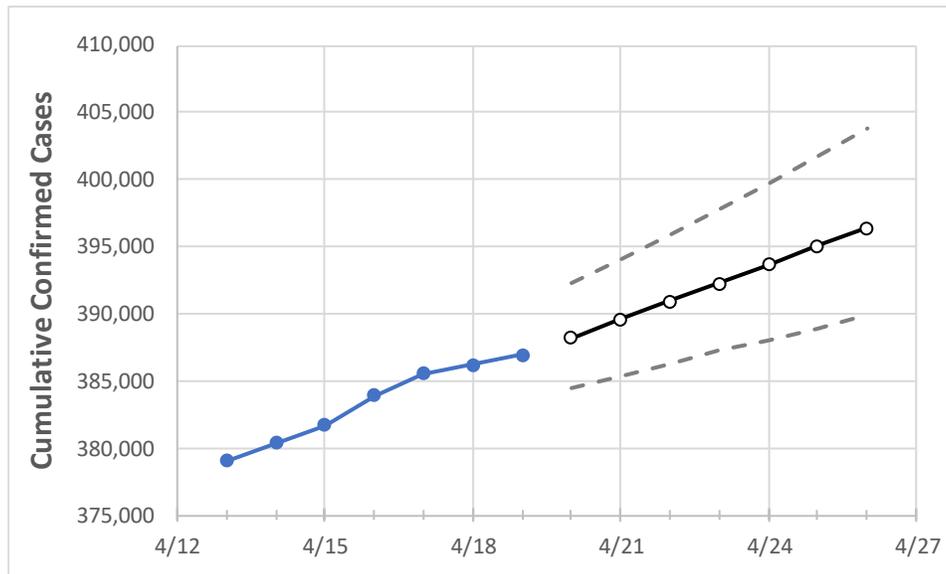
IEM's Modeling Lead

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.

Washington State Projections



	Actual Confirmed Cases On:				Projected Cases For:							
	4/16	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	
Washington	383,894	385,549	386,235	386,920	388,229	389,574	390,890	392,260	393,664	395,033	396,415	

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.

Washington Counties

	Actual Confirmed Cases On:				Projected Cases For:							
	4/16	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	
Benton	16,165	16,206	16,220	16,233	16,267	16,300	16,334	16,369	16,404	16,441	16,477	
Clark	21,243	21,334	21,394	21,453	21,536	21,622	21,710	21,799	21,890	21,986	22,085	
Grant	8,247	8,271	8,284	8,297	8,315	8,334	8,351	8,371	8,391	8,412	8,434	
Island	1,540	1,549	1,552	1,555	1,561	1,566	1,572	1,579	1,585	1,592	1,599	
King	96,335	96,808	97,019	97,230	97,581	97,938	98,299	98,663	99,029	99,402	99,766	
Kitsap	6,992	7,054	7,072	7,089	7,130	7,173	7,217	7,259	7,304	7,349	7,396	
Pierce	45,662	45,950	46,151	46,351	46,571	46,796	47,026	47,263	47,496	47,732	47,975	
Skagit	5,021	5,048	5,061	5,074	5,098	5,122	5,147	5,172	5,198	5,225	5,253	
Snohomish	34,031	34,237	34,287	34,337	34,476	34,618	34,763	34,909	35,060	35,219	35,378	
Spokane	39,905	40,069	40,111	40,153	40,259	40,370	40,485	40,600	40,718	40,835	40,950	
Thurston	8,330	8,386	8,397	8,407	8,441	8,476	8,510	8,547	8,584	8,622	8,660	
Whatcom	7,955	8,018	8,015	8,011	8,044	8,079	8,114	8,150	8,187	8,226	8,265	
Yakima	28,858	28,926	28,944	28,961	29,010	29,058	29,107	29,154	29,204	29,252	29,302	

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:											
	4/16	4/17	4/18	4/19	4/21				4/23				4/25			
Benton	16,165	16,206	16,220	16,233	16,300	(3,260)	[782]	{391}	16,369	(3,274)	[786]	{393}	16,441	(3,288)	[789]	{395}
Clark	21,243	21,334	21,394	21,453	21,622	(4,324)	[1,038]	{519}	21,799	(4,360)	[1,046]	{523}	21,986	(4,397)	[1,055]	{528}
Grant	8,247	8,271	8,284	8,297	8,334	(1,667)	[400]	{200}	8,371	(1,674)	[402]	{201}	8,412	(1,682)	[404]	{202}
Island	1,540	1,549	1,552	1,555	1,566	(313)	[75]	{38}	1,579	(316)	[76]	{38}	1,592	(318)	[76]	{38}
King	96,335	96,808	97,019	97,230	97,938	(19,588)	[4,701]	{2,351}	98,663	(19,733)	[4,736]	{2,368}	99,402	(19,880)	[4,771]	{2,386}
Kitsap	6,992	7,054	7,072	7,089	7,173	(1,435)	[344]	{172}	7,259	(1,452)	[348]	{174}	7,349	(1,470)	[353]	{176}
Pierce	45,662	45,950	46,151	46,351	46,796	(9,359)	[2,246]	{1,123}	47,263	(9,453)	[2,269]	{1,134}	47,732	(9,546)	[2,291]	{1,146}
Skagit	5,021	5,048	5,061	5,074	5,122	(1,024)	[246]	{123}	5,172	(1,034)	[248]	{124}	5,225	(1,045)	[251]	{125}
Snohomish	34,031	34,237	34,287	34,337	34,618	(6,924)	[1,662]	{831}	34,909	(6,982)	[1,676]	{838}	35,219	(7,044)	[1,691]	{845}
Spokane	39,905	40,069	40,111	40,153	40,370	(8,074)	[1,938]	{969}	40,600	(8,120)	[1,949]	{974}	40,835	(8,167)	[1,960]	{980}
Thurston	8,330	8,386	8,397	8,407	8,476	(1,695)	[407]	{203}	8,547	(1,709)	[410]	{205}	8,622	(1,724)	[414]	{207}
Whatcom	7,955	8,018	8,015	8,011	8,079	(1,616)	[388]	{194}	8,150	(1,630)	[391]	{196}	8,226	(1,645)	[395]	{197}
Yakima	28,858	28,926	28,944	28,961	29,058	(5,812)	[1,395]	{697}	29,154	(5,831)	[1,399]	{700}	29,252	(5,850)	[1,404]	{702}

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.