

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

Date: 2/18/21

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 2/18/21 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.

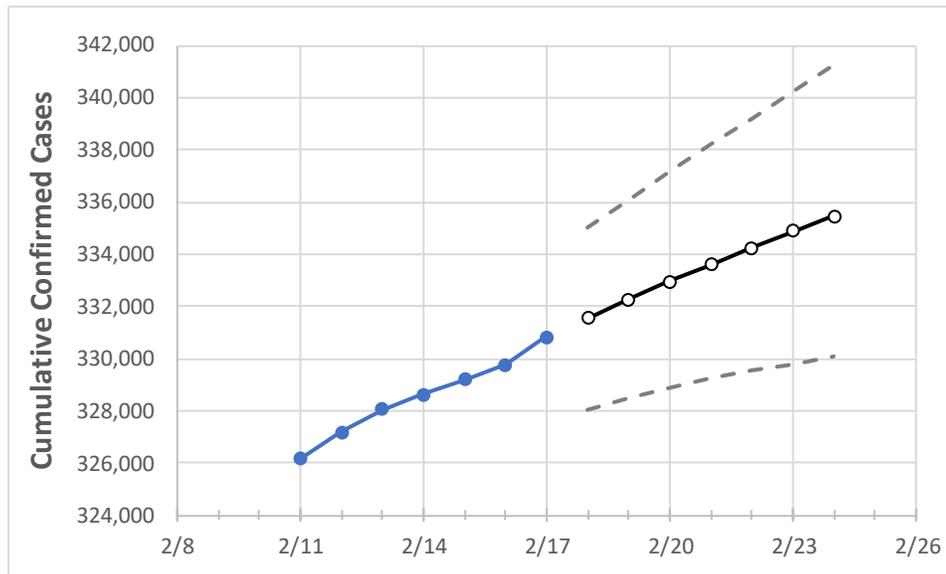
IEM's Modeling Lead

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:							
	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24	
Washington	328,613	329,180	329,746	330,807	331,553	332,278	332,949	333,614	334,250	334,880	335,455	

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:							
	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24	
Benton	14,661	14,677	14,693	14,742	14,766	14,789	14,811	14,832	14,852	14,870	14,888	
Clark	18,367	18,392	18,416	18,504	18,541	18,576	18,609	18,641	18,673	18,703	18,731	
Grant	7,458	7,470	7,482	7,500	7,517	7,533	7,548	7,564	7,579	7,593	7,607	
Island	1,264	1,265	1,267	1,267	1,270	1,273	1,277	1,279	1,282	1,285	1,288	
King	81,701	81,862	82,022	82,201	82,372	82,539	82,702	82,857	83,006	83,151	83,294	
Kitsap	5,562	5,570	5,577	5,596	5,615	5,634	5,651	5,668	5,686	5,702	5,717	
Pierce	36,489	36,569	36,648	36,870	37,000	37,127	37,256	37,379	37,496	37,611	37,732	
Skagit	4,287	4,290	4,294	4,297	4,303	4,309	4,314	4,319	4,324	4,329	4,333	
Snohomish	29,129	29,192	29,256	29,386	29,465	29,544	29,623	29,699	29,773	29,845	29,912	
Spokane	35,209	35,284	35,359	35,431	35,504	35,574	35,638	35,699	35,756	35,811	35,866	
Thurston	6,817	6,861	6,906	6,918	6,948	6,978	7,008	7,037	7,067	7,095	7,123	
Whatcom	6,238	6,252	6,265	6,300	6,330	6,359	6,387	6,416	6,444	6,472	6,497	
Yakima	25,934	25,958	25,983	26,005	26,047	26,084	26,119	26,150	26,182	26,209	26,233	

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:											
	2/14	2/15	2/16	2/17	2/19				2/21				2/23			
Benton	14,661	14,677	14,693	14,742	14,789	(2,958)	[710]	{355}	14,832	(2,966)	[712]	{356}	14,870	(2,974)	[714]	{357}
Clark	18,367	18,392	18,416	18,504	18,576	(3,715)	[892]	{446}	18,641	(3,728)	[895]	{447}	18,703	(3,741)	[898]	{449}
Grant	7,458	7,470	7,482	7,500	7,533	(1,507)	[362]	{181}	7,564	(1,513)	[363]	{182}	7,593	(1,519)	[364]	{182}
Island	1,264	1,265	1,267	1,267	1,273	(255)	[61]	{31}	1,279	(256)	[61]	{31}	1,285	(257)	[62]	{31}
King	81,701	81,862	82,022	82,201	82,539	(16,508)	[3,962]	{1,981}	82,857	(16,571)	[3,977]	{1,989}	83,151	(16,630)	[3,991]	{1,996}
Kitsap	5,562	5,570	5,577	5,596	5,634	(1,127)	[270]	{135}	5,668	(1,134)	[272]	{136}	5,702	(1,140)	[274]	{137}
Pierce	36,489	36,569	36,648	36,870	37,127	(7,425)	[1,782]	{891}	37,379	(7,476)	[1,794]	{897}	37,611	(7,522)	[1,805]	{903}
Skagit	4,287	4,290	4,294	4,297	4,309	(862)	[207]	{103}	4,319	(864)	[207]	{104}	4,329	(866)	[208]	{104}
Snohomish	29,129	29,192	29,256	29,386	29,544	(5,909)	[1,418]	{709}	29,699	(5,940)	[1,426]	{713}	29,845	(5,969)	[1,433]	{716}
Spokane	35,209	35,284	35,359	35,431	35,574	(7,115)	[1,708]	{854}	35,699	(7,140)	[1,714]	{857}	35,811	(7,162)	[1,719]	{859}
Thurston	6,817	6,861	6,906	6,918	6,978	(1,396)	[335]	{167}	7,037	(1,407)	[338]	{169}	7,095	(1,419)	[341]	{170}
Whatcom	6,238	6,252	6,265	6,300	6,359	(1,272)	[305]	{153}	6,416	(1,283)	[308]	{154}	6,472	(1,294)	[311]	{155}
Yakima	25,934	25,958	25,983	26,005	26,084	(5,217)	[1,252]	{626}	26,150	(5,230)	[1,255]	{628}	26,209	(5,242)	[1,258]	{629}

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.