

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

Date: 12/31/20

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 12/31/20 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.**

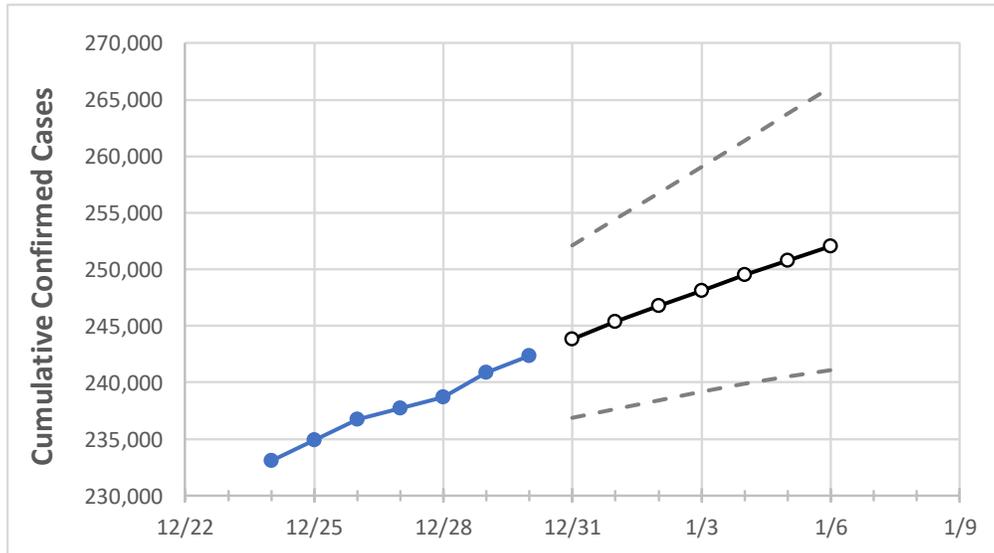
### IEM's Modeling Lead

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:						
	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4	1/5	1/6
Washington	237,696	238,672	240,846	242,330	243,839	245,330	246,757	248,105	249,487	250,792	252,064

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:						
	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4	1/5	1/6
Benton	11,320	11,345	11,419	11,477	11,531	11,579	11,629	11,676	11,720	11,764	11,804
Clark	12,892	12,948	13,064	13,172	13,260	13,347	13,435	13,521	13,603	13,684	13,766
Grant	5,795	5,812	5,851	5,879	5,910	5,941	5,971	6,000	6,028	6,056	6,082
Island	895	895	900	913	917	922	926	931	935	939	943
King	60,921	61,148	61,455	61,710	61,989	62,264	62,530	62,789	63,035	63,265	63,502
Kitsap	3,743	3,757	3,787	3,806	3,839	3,871	3,902	3,935	3,965	3,995	4,025
Pierce	24,944	25,070	25,205	25,464	25,666	25,870	26,073	26,272	26,472	26,671	26,870
Skagit	3,156	3,167	3,178	3,237	3,259	3,284	3,306	3,328	3,350	3,372	3,392
Snohomish	21,363	21,462	21,707	21,837	21,992	22,143	22,285	22,426	22,562	22,689	22,822
Spokane	24,529	24,655	25,084	25,179	25,352	25,525	25,695	25,863	26,030	26,193	26,359
Thurston	4,560	4,581	4,626	4,648	4,683	4,717	4,750	4,783	4,815	4,847	4,878
Whatcom	3,329	3,346	3,360	3,397	3,421	3,445	3,468	3,491	3,514	3,537	3,559
Yakima	18,946	19,069	19,191	19,281	19,448	19,610	19,773	19,936	20,102	20,264	20,426

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:											
	12/27	12/28	12/29	12/30	1/1				1/3				1/5			
Benton	11,320	11,345	11,419	11,477	11,579	(2,316)	[556]	{278}	11,676	(2,335)	[560]	{280}	11,764	(2,353)	[565]	{282}
Clark	12,892	12,948	13,064	13,172	13,347	(2,669)	[641]	{320}	13,521	(2,704)	[649]	{324}	13,684	(2,737)	[657]	{328}
Grant	5,795	5,812	5,851	5,879	5,941	(1,188)	[285]	{143}	6,000	(1,200)	[288]	{144}	6,056	(1,211)	[291]	{145}
Island	895	895	900	913	922	(184)	[44]	{22}	931	(186)	[45]	{22}	939	(188)	[45]	{23}
King	60,921	61,148	61,455	61,710	62,264	(12,453)	[2,989]	{1,494}	62,789	(12,558)	[3,014]	{1,507}	63,265	(12,653)	[3,037]	{1,518}
Kitsap	3,743	3,757	3,787	3,806	3,871	(774)	[186]	{93}	3,935	(787)	[189]	{94}	3,995	(799)	[192]	{96}
Pierce	24,944	25,070	25,205	25,464	25,870	(5,174)	[1,242]	{621}	26,272	(5,254)	[1,261]	{631}	26,671	(5,334)	[1,280]	{640}
Skagit	3,156	3,167	3,178	3,237	3,284	(657)	[158]	{79}	3,328	(666)	[160]	{80}	3,372	(674)	[162]	{81}
Snohomish	21,363	21,462	21,707	21,837	22,143	(4,429)	[1,063]	{531}	22,426	(4,485)	[1,076]	{538}	22,689	(4,538)	[1,089]	{545}
Spokane	24,529	24,655	25,084	25,179	25,525	(5,105)	[1,225]	{613}	25,863	(5,173)	[1,241]	{621}	26,193	(5,239)	[1,257]	{629}
Thurston	4,560	4,581	4,626	4,648	4,717	(943)	[226]	{113}	4,783	(957)	[230]	{115}	4,847	(969)	[233]	{116}
Whatcom	3,329	3,346	3,360	3,397	3,445	(689)	[165]	{83}	3,491	(698)	[168]	{84}	3,537	(707)	[170]	{85}
Yakima	18,946	19,069	19,191	19,281	19,610	(3,922)	[941]	{471}	19,936	(3,987)	[957]	{478}	20,264	(4,053)	[973]	{486}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.