

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

Date: 11/9/20

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 11/9/20 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.

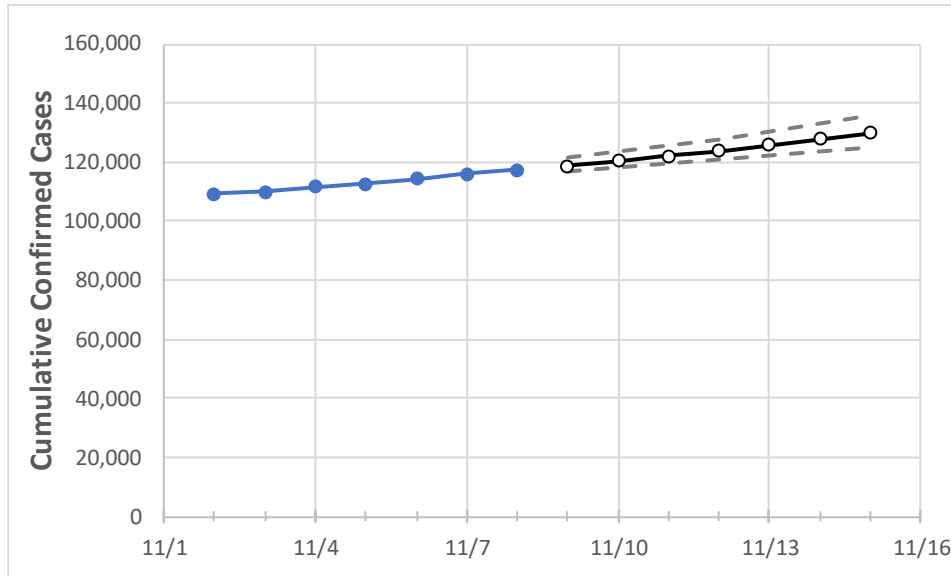
IEM's Modeling Lead

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:						
	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	
Washington	112,550	114,241	116,011	117,331	118,821	120,398	122,067	123,834	125,703	127,681	129,773	

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:						
	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	
Benton	5,646	5,690	5,808	5,898	5,977	6,064	6,158	6,260	6,371	6,492	6,624	
Clark	4,826	4,942	5,069	5,113	5,197	5,287	5,382	5,483	5,590	5,703	5,823	
Grant	3,417	3,433	3,442	3,450	3,458	3,466	3,474	3,482	3,490	3,499	3,507	
Island	419	427	430	432	436	440	445	450	455	460	465	
King	29,316	29,832	30,363	30,854	31,272	31,716	32,187	32,688	33,220	33,785	34,385	
Kitsap	1,648	1,671	1,697	1,726	1,752	1,780	1,810	1,841	1,875	1,911	1,949	
Pierce	11,046	11,214	11,404	11,563	11,720	11,884	12,055	12,234	12,421	12,617	12,822	
Skagit	1,338	1,370	1,390	1,402	1,423	1,446	1,472	1,501	1,533	1,569	1,609	
Snohomish	9,503	9,727	9,939	10,077	10,256	10,448	10,655	10,877	11,114	11,370	11,644	
Spokane	10,287	10,499	10,735	10,914	11,080	11,255	11,437	11,628	11,829	12,038	12,258	
Thurston	1,777	1,808	1,837	1,859	1,884	1,909	1,935	1,961	1,989	2,017	2,047	
Whatcom	1,670	1,682	1,694	1,696	1,704	1,712	1,720	1,728	1,737	1,745	1,754	
Yakima	12,103	12,139	12,185	12,203	12,233	12,264	12,297	12,331	12,366	12,403	12,441	

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:											
	11/5	11/6	11/7	11/8	11/10				11/12				11/14			
Benton	5,646	5,690	5,808	5,898	6,064	(1,213)	[291]	{146}	6,260	(1,252)	[300]	{150}	6,492	(1,298)	[312]	{156}
Clark	4,826	4,942	5,069	5,113	5,287	(1,057)	[254]	{127}	5,483	(1,097)	[263]	{132}	5,703	(1,141)	[274]	{137}
Grant	3,417	3,433	3,442	3,450	3,466	(693)	[166]	{83}	3,482	(696)	[167]	{84}	3,499	(700)	[168]	{84}
Island	419	427	430	432	440	(88)	[21]	{11}	450	(90)	[22]	{11}	460	(92)	[22]	{11}
King	29,316	29,832	30,363	30,854	31,716	(6,343)	[1,522]	{761}	32,688	(6,538)	[1,569]	{785}	33,785	(6,757)	[1,622]	{811}
Kitsap	1,648	1,671	1,697	1,726	1,780	(356)	[85]	{43}	1,841	(368)	[88]	{44}	1,911	(382)	[92]	{46}
Pierce	11,046	11,214	11,404	11,563	11,884	(2,377)	[570]	{285}	12,234	(2,447)	[587]	{294}	12,617	(2,523)	[606]	{303}
Skagit	1,338	1,370	1,390	1,402	1,446	(289)	[69]	{35}	1,501	(300)	[72]	{36}	1,569	(314)	[75]	{38}
Snohomish	9,503	9,727	9,939	10,077	10,448	(2,090)	[502]	{251}	10,877	(2,175)	[522]	{261}	11,370	(2,274)	[546]	{273}
Spokane	10,287	10,499	10,735	10,914	11,255	(2,251)	[540]	{270}	11,628	(2,326)	[558]	{279}	12,038	(2,408)	[578]	{289}
Thurston	1,777	1,808	1,837	1,859	1,909	(382)	[92]	{46}	1,961	(392)	[94]	{47}	2,017	(403)	[97]	{48}
Whatcom	1,670	1,682	1,694	1,696	1,712	(342)	[82]	{41}	1,728	(346)	[83]	{41}	1,745	(349)	[84]	{42}
Yakima	12,103	12,139	12,185	12,203	12,264	(2,453)	[589]	{294}	12,331	(2,466)	[592]	{296}	12,403	(2,481)	[595]	{298}

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.