IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/8/21

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 <u>not</u> 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 4/8/21 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
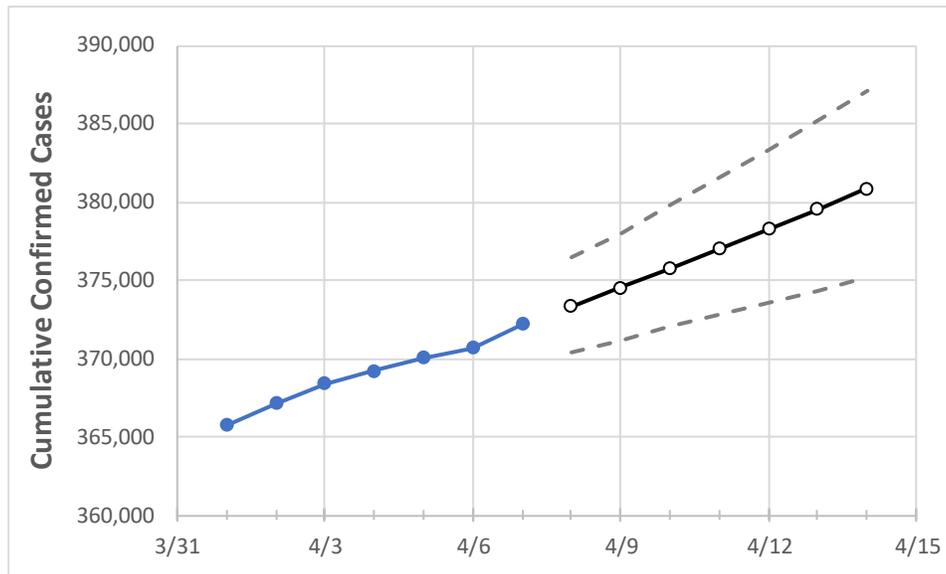
	Actual Confirmed Cases On:				Projected Cases For:						
	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14
Washington	369,210	370,017	370,652	372,170	373,341	374,534	375,746	376,985	378,256	379,533	380,837

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:						
	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14
Benton	15,784	15,801	15,827	15,868	15,895	15,922	15,950	15,979	16,009	16,040	16,071
Clark	20,415	20,445	20,506	20,554	20,604	20,657	20,710	20,764	20,818	20,872	20,926
Grant	8,081	8,086	8,095	8,106	8,114	8,122	8,130	8,137	8,144	8,152	8,158
Island	1,488	1,489	1,493	1,493	1,495	1,498	1,500	1,502	1,504	1,506	1,509
King	92,166	92,476	92,570	93,002	93,341	93,686	94,033	94,379	94,729	95,096	95,472
Kitsap	6,555	6,584	6,604	6,626	6,662	6,699	6,736	6,775	6,813	6,853	6,894
Pierce	43,387	43,535	43,647	43,842	44,040	44,236	44,438	44,648	44,857	45,070	45,282
Skagit	4,783	4,794	4,809	4,838	4,854	4,871	4,890	4,909	4,929	4,950	4,973
Snohomish	32,562	32,638	32,687	32,858	32,978	33,104	33,236	33,375	33,510	33,656	33,812
Spokane	38,729	38,787	38,847	38,968	39,052	39,139	39,225	39,314	39,404	39,493	39,585
Thurston	7,940	7,965	7,979	8,004	8,028	8,052	8,076	8,101	8,124	8,148	8,171
Whatcom	7,637	7,655	7,665	7,705	7,729	7,754	7,778	7,803	7,828	7,852	7,877
Yakima	28,237	28,278	28,334	28,367	28,417	28,469	28,520	28,572	28,626	28,680	28,737

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:		
	4/4	4/5	4/6	4/7	4/9	4/11	4/13
Benton	15,784	15,801	15,827	15,868	15,922 (3,184) [764] {382}	15,979 (3,196) [767] {384}	16,040 (3,208) [770] {385}
Clark	20,415	20,445	20,506	20,554	20,657 (4,131) [992] {496}	20,764 (4,153) [997] {498}	20,872 (4,174) [1,002] {501}
Grant	8,081	8,086	8,095	8,106	8,122 (1,624) [390] {195}	8,137 (1,627) [391] {195}	8,152 (1,630) [391] {196}
Island	1,488	1,489	1,493	1,493	1,498 (300) [72] {36}	1,502 (300) [72] {36}	1,506 (301) [72] {36}
King	92,166	92,476	92,570	93,002	93,686 (18,737) [4,497] {2,248}	94,379 (18,876) [4,530] {2,265}	95,096 (19,019) [4,565] {2,282}
Kitsap	6,555	6,584	6,604	6,626	6,699 (1,340) [322] {161}	6,775 (1,355) [325] {163}	6,853 (1,371) [329] {164}
Pierce	43,387	43,535	43,647	43,842	44,236 (8,847) [2,123] {1,062}	44,648 (8,930) [2,143] {1,072}	45,070 (9,014) [2,163] {1,082}
Skagit	4,783	4,794	4,809	4,838	4,871 (974) [234] {117}	4,909 (982) [236] {118}	4,950 (990) [238] {119}
Snohomish	32,562	32,638	32,687	32,858	33,104 (6,621) [1,589] {794}	33,375 (6,675) [1,602] {801}	33,656 (6,731) [1,615] {808}
Spokane	38,729	38,787	38,847	38,968	39,139 (7,828) [1,879] {939}	39,314 (7,863) [1,887] {944}	39,493 (7,899) [1,896] {948}
Thurston	7,940	7,965	7,979	8,004	8,052 (1,610) [386] {193}	8,101 (1,620) [389] {194}	8,148 (1,630) [391] {196}
Whatcom	7,637	7,655	7,665	7,705	7,754 (1,551) [372] {186}	7,803 (1,561) [375] {187}	7,852 (1,570) [377] {188}
Yakima	28,237	28,278	28,334	28,367	28,469 (5,694) [1,367] {683}	28,572 (5,714) [1,371] {686}	28,680 (5,736) [1,377] {688}

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.