IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/8/21

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 1/8/21 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
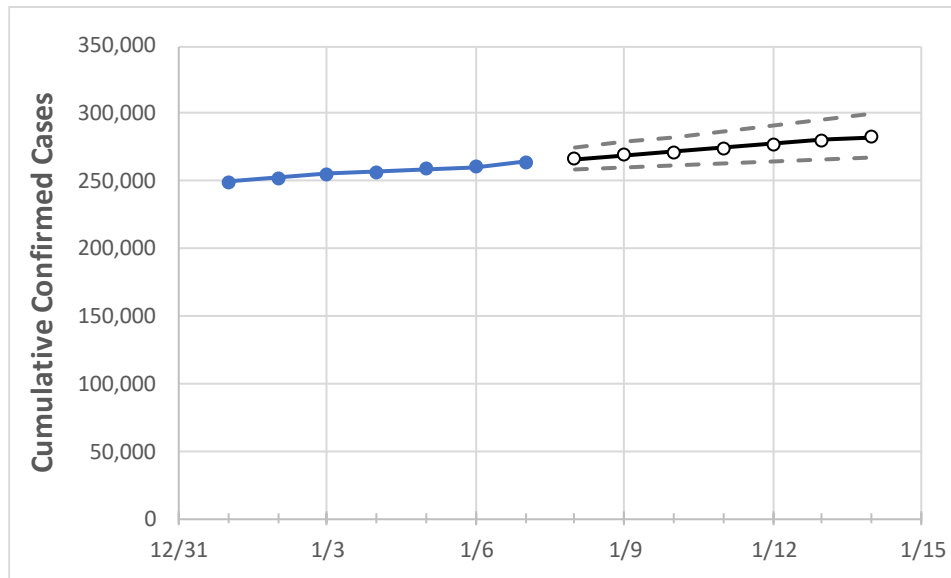
	Actual Confirmed Cases On:				Projected Cases For:						
	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14
Washington	256,435	258,767	260,752	264,012	266,543	269,181	271,823	274,555	277,193	280,058	282,930

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:						
	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14
Benton	11,987	12,063	12,150	12,356	12,460	12,568	12,681	12,796	12,916	13,032	13,150
Clark	14,092	14,431	14,531	14,657	14,853	15,059	15,269	15,489	15,719	15,953	16,203
Grant	6,109	6,145	6,191	6,251	6,293	6,336	6,380	6,424	6,470	6,513	6,558
Island	955	977	985	992	1,002	1,013	1,023	1,034	1,045	1,057	1,069
King	65,570	65,834	66,286	66,998	67,578	68,180	68,785	69,400	70,039	70,693	71,344
Kitsap	4,034	4,076	4,136	4,203	4,249	4,296	4,343	4,390	4,439	4,487	4,536
Pierce	26,975	27,193	27,436	27,769	28,043	28,317	28,597	28,881	29,176	29,466	29,761
Skagit	3,378	3,395	3,420	3,476	3,498	3,521	3,541	3,562	3,582	3,604	3,622
Snohomish	23,186	23,426	23,710	24,038	24,297	24,558	24,822	25,096	25,368	25,643	25,931
Spokane	26,572	26,990	27,230	27,667	28,051	28,447	28,869	29,302	29,756	30,222	30,713
Thurston	4,945	5,015	5,060	5,134	5,188	5,243	5,299	5,357	5,415	5,475	5,535
Whatcom	3,693	3,746	3,773	3,944	4,007	4,073	4,143	4,219	4,292	4,371	4,455
Yakima	20,509	20,712	20,799	21,021	21,214	21,406	21,597	21,790	21,988	22,184	22,373

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:		
	1/4	1/5	1/6	1/7	1/9	1/11	1/13
Benton	11,987	12,063	12,150	12,356	12,568 (2,514) [603] {302}	12,796 (2,559) [614] {307}	13,032 (2,606) [626] {313}
Clark	14,092	14,431	14,531	14,657	15,059 (3,012) [723] {361}	15,489 (3,098) [743] {372}	15,953 (3,191) [766] {383}
Grant	6,109	6,145	6,191	6,251	6,336 (1,267) [304] {152}	6,424 (1,285) [308] {154}	6,513 (1,303) [313] {156}
Island	955	977	985	992	1,013 (203) [49] {24}	1,034 (207) [50] {25}	1,057 (211) [51] {25}
King	65,570	65,834	66,286	66,998	68,180 (13,636) [3,273] {1,636}	69,400 (13,880) [3,331] {1,666}	70,693 (14,139) [3,393] {1,697}
Kitsap	4,034	4,076	4,136	4,203	4,296 (859) [206] {103}	4,390 (878) [211] {105}	4,487 (897) [215] {108}
Pierce	26,975	27,193	27,436	27,769	28,317 (5,663) [1,359] {680}	28,881 (5,776) [1,386] {693}	29,466 (5,893) [1,414] {707}
Skagit	3,378	3,395	3,420	3,476	3,521 (704) [169] {84}	3,562 (712) [171] {85}	3,604 (721) [173] {86}
Snohomish	23,186	23,426	23,710	24,038	24,558 (4,912) [1,179] {589}	25,096 (5,019) [1,205] {602}	25,643 (5,129) [1,231] {615}
Spokane	26,572	26,990	27,230	27,667	28,447 (5,689) [1,365] {683}	29,302 (5,860) [1,406] {703}	30,222 (6,044) [1,451] {725}
Thurston	4,945	5,015	5,060	5,134	5,243 (1,049) [252] {126}	5,357 (1,071) [257] {129}	5,475 (1,095) [263] {131}
Whatcom	3,693	3,746	3,773	3,944	4,073 (815) [196] {98}	4,219 (844) [202] {101}	4,371 (874) [210] {105}
Yakima	20,509	20,712	20,799	21,021	21,406 (4,281) [1,027] {514}	21,790 (4,358) [1,046] {523}	22,184 (4,437) [1,065] {532}

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.