IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/11/21

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 1/11/21 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
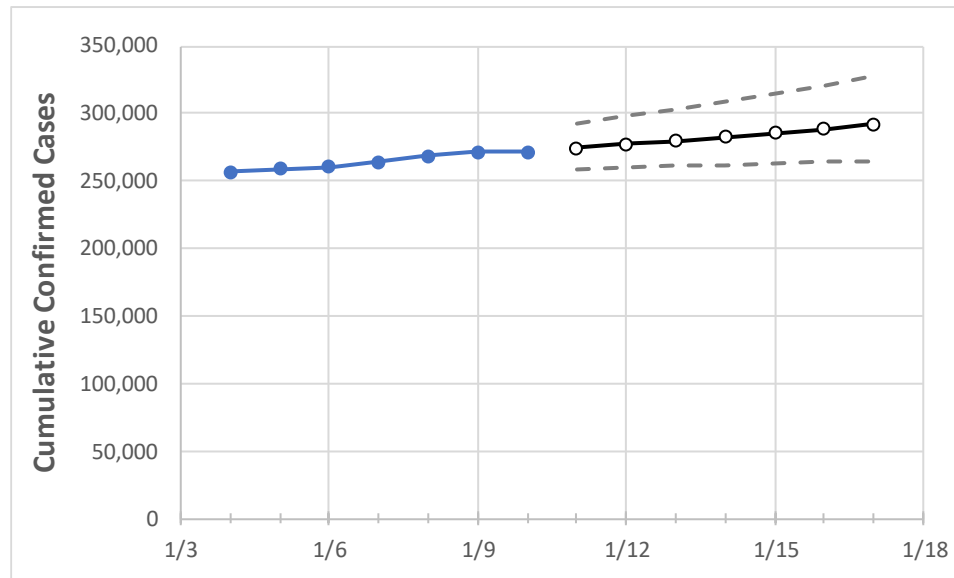
	Actual Confirmed Cases On:				Projected Cases For:						
	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17
Washington	264,012	268,607	271,595	271,595	274,363	277,165	279,941	282,905	285,860	288,867	291,887

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:						
	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17
Benton	12,356	12,582	12,717	12,717	12,831	12,954	13,074	13,197	13,321	13,444	13,574
Clark	14,657	14,846	15,010	15,010	15,214	15,423	15,639	15,863	16,090	16,326	16,573
Grant	6,251	6,313	6,381	6,381	6,427	6,474	6,518	6,567	6,613	6,659	6,706
Island	992	1,012	1,036	1,036	1,050	1,065	1,081	1,097	1,113	1,131	1,149
King	66,998	67,932	68,799	68,799	69,511	70,247	70,998	71,763	72,549	73,341	74,185
Kitsap	4,203	4,271	4,355	4,355	4,403	4,454	4,505	4,556	4,610	4,664	4,719
Pierce	27,769	28,427	28,743	28,743	29,111	29,480	29,849	30,239	30,634	31,050	31,464
Skagit	3,476	3,526	3,552	3,552	3,580	3,607	3,634	3,660	3,688	3,714	3,741
Snohomish	24,038	24,382	24,616	24,616	24,886	25,168	25,448	25,732	26,027	26,322	26,616
Spokane	27,667	28,247	28,492	28,492	28,877	29,283	29,706	30,139	30,576	31,002	31,453
Thurston	5,134	5,261	5,334	5,334	5,395	5,457	5,520	5,583	5,646	5,713	5,781
Whatcom	3,944	4,066	4,134	4,134	4,226	4,320	4,424	4,536	4,651	4,775	4,904
Yakima	21,021	21,467	21,655	21,655	21,864	22,082	22,304	22,521	22,746	22,974	23,194

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: | | |
	1/7	1/8	1/9	1/10	1/12	1/14	1/16
Benton	12,356	12,582	12,717	12,717	12,954 (2,591) [622] {311}	13,197 (2,639) [633] {317}	13,444 (2,689) [645] {323}
Clark	14,657	14,846	15,010	15,010	15,423 (3,085) [740] {370}	15,863 (3,173) [761] {381}	16,326 (3,265) [784] {392}
Grant	6,251	6,313	6,381	6,381	6,474 (1,295) [311] {155}	6,567 (1,313) [315] {158}	6,659 (1,332) [320] {160}
Island	992	1,012	1,036	1,036	1,065 (213) [51] {26}	1,097 (219) [53] {26}	1,131 (226) [54] {27}
King	66,998	67,932	68,799	68,799	70,247 (14,049) [3,372] {1,686}	71,763 (14,353) [3,445] {1,722}	73,341 (14,668) [3,520] {1,760}
Kitsap	4,203	4,271	4,355	4,355	4,454 (891) [214] {107}	4,556 (911) [219] {109}	4,664 (933) [224] {112}
Pierce	27,769	28,427	28,743	28,743	29,480 (5,896) [1,415] {708}	30,239 (6,048) [1,451] {726}	31,050 (6,210) [1,490] {745}
Skagit	3,476	3,526	3,552	3,552	3,607 (721) [173] {87}	3,660 (732) [176] {88}	3,714 (743) [178] {89}
Snohomish	24,038	24,382	24,616	24,616	25,168 (5,034) [1,208] {604}	25,732 (5,146) [1,235] {618}	26,322 (5,264) [1,263] {632}
Spokane	27,667	28,247	28,492	28,492	29,283 (5,857) [1,406] {703}	30,139 (6,028) [1,447] {723}	31,002 (6,200) [1,488] {744}
Thurston	5,134	5,261	5,334	5,334	5,457 (1,091) [262] {131}	5,583 (1,117) [268] {134}	5,713 (1,143) [274] {137}
Whatcom	3,944	4,066	4,134	4,134	4,320 (864) [207] {104}	4,536 (907) [218] {109}	4,775 (955) [229] {115}
Yakima	21,021	21,467	21,655	21,655	22,082 (4,416) [1,060] {530}	22,521 (4,504) [1,081] {540}	22,974 (4,595) [1,103] {551}

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.