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

Date: 1/10/22

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 1/10/22 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.

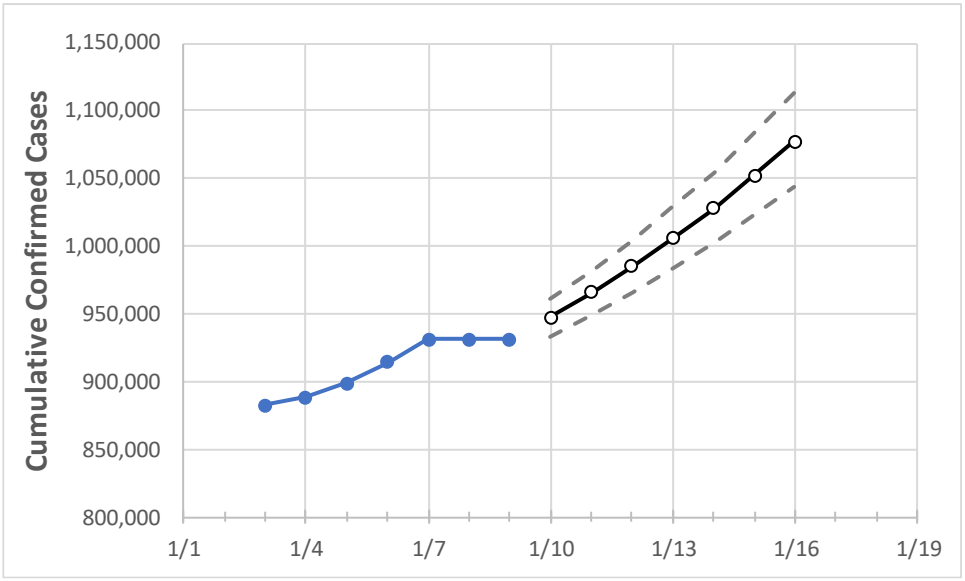
IEM's Modeling Lead

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:						
	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16
Washington	913,980	931,071	931,071	931,071	947,692	965,858	984,975	1,005,703	1,028,138	1,052,228	1,077,528

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:						
	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16
Benton	34,576	34,835	34,835	34,835	35,176	35,549	35,960	36,407	36,896	37,430	38,007
Clark	52,817	53,839	53,839	53,839	54,821	55,875	57,001	58,230	59,573	61,009	62,492
Grant	18,019	18,266	18,266	18,266	18,398	18,537	18,682	18,846	19,010	19,194	19,384
Island	5,415	5,535	5,535	5,535	5,665	5,809	5,965	6,133	6,314	6,516	6,728
King	222,392	228,166	228,166	228,166	233,966	240,146	246,769	253,830	261,354	269,462	278,072
Kitsap	21,868	22,445	22,445	22,445	22,950	23,506	24,110	24,756	25,465	26,225	27,050
Pierce	122,307	125,304	125,304	125,304	128,237	131,433	134,830	138,539	142,445	146,670	151,229
Skagit	14,828	14,969	14,969	14,969	15,145	15,332	15,528	15,739	15,959	16,198	16,445
Snohomish	88,482	90,410	90,410	90,410	92,600	94,945	97,514	100,259	103,241	106,503	110,008
Spokane	83,509	84,452	84,452	84,452	85,292	86,203	87,185	88,234	89,360	90,625	91,938
Thurston	28,995	29,601	29,601	29,601	30,329	31,118	31,945	32,838	33,797	34,819	35,896
Whatcom	22,244	22,696	22,696	22,696	23,164	23,661	24,204	24,787	25,411	26,087	26,810
Yakima	48,126	48,476	48,476	48,476	48,869	49,290	49,754	50,247	50,788	51,370	52,004

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:		
	1/6	1/7	1/8	1/9	1/11	1/13	1/15
Benton	34,576	34,835	34,835	34,835	35,549 (7,110) [1,706] {853}	36,407 (7,281) [1,748] {874}	37,430 (7,486) [1,797] {898}
Clark	52,817	53,839	53,839	53,839	55,875 (11,175) [2,682] {1,341}	58,230 (11,646) [2,795] {1,398}	61,009 (12,202) [2,928] {1,464}
Grant	18,019	18,266	18,266	18,266	18,537 (3,707) [890] {445}	18,846 (3,769) [905] {452}	19,194 (3,839) [921] {461}
Island	5,415	5,535	5,535	5,535	5,809 (1,162) [279] {139}	6,133 (1,227) [294] {147}	6,516 (1,303) [313] {156}
King	222,392	228,166	228,166	228,166	240,146 (48,029) [11,527] {5,763}	253,830 (50,766) [12,184] {6,092}	269,462 (53,892) [12,934] {6,467}
Kitsap	21,868	22,445	22,445	22,445	23,506 (4,701) [1,128] {564}	24,756 (4,951) [1,188] {594}	26,225 (5,245) [1,259] {629}
Pierce	122,307	125,304	125,304	125,304	131,433 (26,287) [6,309] {3,154}	138,539 (27,708) [6,650] {3,325}	146,670 (29,334) [7,040] {3,520}
Skagit	14,828	14,969	14,969	14,969	15,332 (3,066) [736] {368}	15,739 (3,148) [755] {378}	16,198 (3,240) [778] {389}
Snohomish	88,482	90,410	90,410	90,410	94,945 (18,989) [4,557] {2,279}	100,259 (20,052) [4,812] {2,406}	106,503 (21,301) [5,112] {2,556}
Spokane	83,509	84,452	84,452	84,452	86,203 (17,241) [4,138] {2,069}	88,234 (17,647) [4,235] {2,118}	90,625 (18,125) [4,350] {2,175}
Thurston	28,995	29,601	29,601	29,601	31,118 (6,224) [1,494] {747}	32,838 (6,568) [1,576] {788}	34,819 (6,964) [1,671] {836}
Whatcom	22,244	22,696	22,696	22,696	23,661 (4,732) [1,136] {568}	24,787 (4,957) [1,190] {595}	26,087 (5,217) [1,252] {626}
Yakima	48,126	48,476	48,476	48,476	49,290 (9,858) [2,366] {1,183}	50,247 (10,049) [2,412] {1,206}	51,370 (10,274) [2,466] {1,233}

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.