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

Date: 1/21/22

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 1/21/22 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.

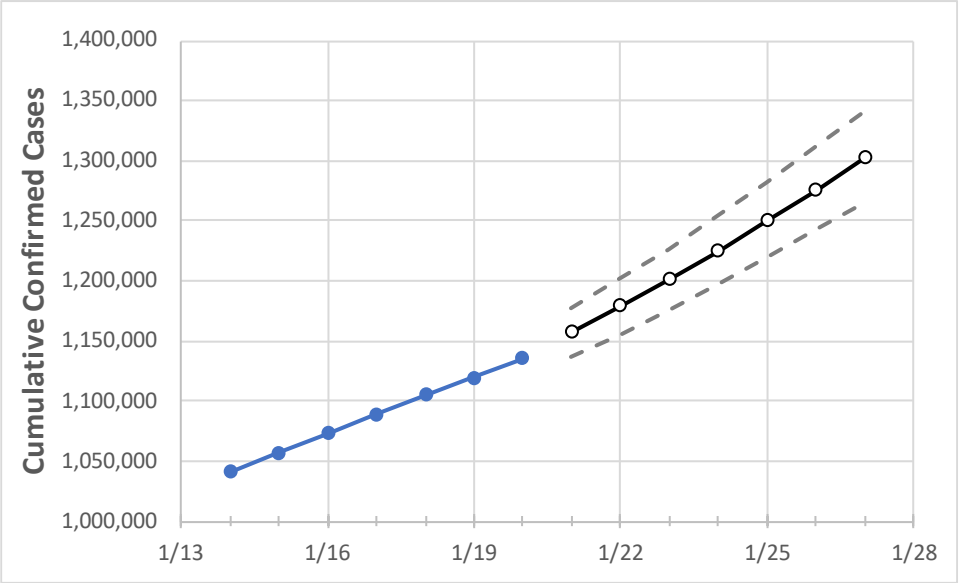
IEM's Modeling Lead

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:						
	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27
Washington	1,089,581	1,105,622	1,119,228	1,135,778	1,157,321	1,179,507	1,201,714	1,225,405	1,250,059	1,275,780	1,302,784

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:						
	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27
Benton	38,854	39,270	39,652	40,219	40,851	41,497	42,200	42,930	43,702	44,540	45,411
Clark	64,915	66,518	67,437	66,692	68,395	70,209	72,090	74,033	76,130	78,300	80,592
Grant	19,925	20,070	20,154	20,354	20,583	20,830	21,089	21,344	21,625	21,915	22,217
Island	6,937	7,058	7,119	7,270	7,474	7,690	7,915	8,138	8,391	8,644	8,917
King	281,814	286,617	290,923	296,665	303,608	310,642	317,948	325,322	333,000	340,993	349,285
Kitsap	27,394	27,908	28,466	29,088	29,798	30,547	31,311	32,120	32,949	33,841	34,757
Pierce	145,482	147,725	149,328	151,414	153,952	156,598	159,255	161,988	164,792	167,660	170,593
Skagit	17,358	17,521	17,689	18,001	18,325	18,655	18,996	19,365	19,749	20,134	20,546
Snohomish	108,603	110,207	111,857	114,447	117,025	119,603	122,285	125,083	127,987	131,023	134,200
Spokane	93,759	94,890	95,506	96,571	97,905	99,277	100,716	102,227	103,798	105,491	107,232
Thurston	35,174	35,795	36,353	36,758	37,441	38,131	38,836	39,569	40,307	41,080	41,863
Whatcom	27,042	27,439	27,827	28,301	28,908	29,537	30,167	30,843	31,539	32,281	33,038
Yakima	53,615	54,213	55,062	55,699	56,549	57,423	58,364	59,348	60,405	61,504	62,682

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:		
	1/17	1/18	1/19	1/20	1/22	1/24	1/26
Benton	38,854	39,270	39,652	40,219	41,497 (8,299) [1,992] {996}	42,930 (8,586) [2,061] {1,030}	44,540 (8,908) [2,138] {1,069}
Clark	64,915	66,518	67,437	66,692	70,209 (14,042) [3,370] {1,685}	74,033 (14,807) [3,554] {1,777}	78,300 (15,660) [3,758] {1,879}
Grant	19,925	20,070	20,154	20,354	20,830 (4,166) [1,000] {500}	21,344 (4,269) [1,025] {512}	21,915 (4,383) [1,052] {526}
Island	6,937	7,058	7,119	7,270	7,690 (1,538) [369] {185}	8,138 (1,628) [391] {195}	8,644 (1,729) [415] {207}
King	281,814	286,617	290,923	296,665	310,642 (62,128) [14,911] {7,455}	325,322 (65,064) [15,615] {7,808}	340,993 (68,199) [16,368] {8,184}
Kitsap	27,394	27,908	28,466	29,088	30,547 (6,109) [1,466] {733}	32,120 (6,424) [1,542] {771}	33,841 (6,768) [1,624] {812}
Pierce	145,482	147,725	149,328	151,414	156,598 (31,320) [7,517] {3,758}	161,988 (32,398) [7,775] {3,888}	167,660 (33,532) [8,048] {4,024}
Skagit	17,358	17,521	17,689	18,001	18,655 (3,731) [895] {448}	19,365 (3,873) [930] {465}	20,134 (4,027) [966] {483}
Snohomish	108,603	110,207	111,857	114,447	119,603 (23,921) [5,741] {2,870}	125,083 (25,017) [6,004] {3,002}	131,023 (26,205) [6,289] {3,145}
Spokane	93,759	94,890	95,506	96,571	99,277 (19,855) [4,765] {2,383}	102,227 (20,445) [4,907] {2,453}	105,491 (21,098) [5,064] {2,532}
Thurston	35,174	35,795	36,353	36,758	38,131 (7,626) [1,830] {915}	39,569 (7,914) [1,899] {950}	41,080 (8,216) [1,972] {986}
Whatcom	27,042	27,439	27,827	28,301	29,537 (5,907) [1,418] {709}	30,843 (6,169) [1,480] {740}	32,281 (6,456) [1,550] {775}
Yakima	53,615	54,213	55,062	55,699	57,423 (11,485) [2,756] {1,378}	59,348 (11,870) [2,849] {1,424}	61,504 (12,301) [2,952] {1,476}

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.