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

Date: 9/29/21

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 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 9/29/21 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.

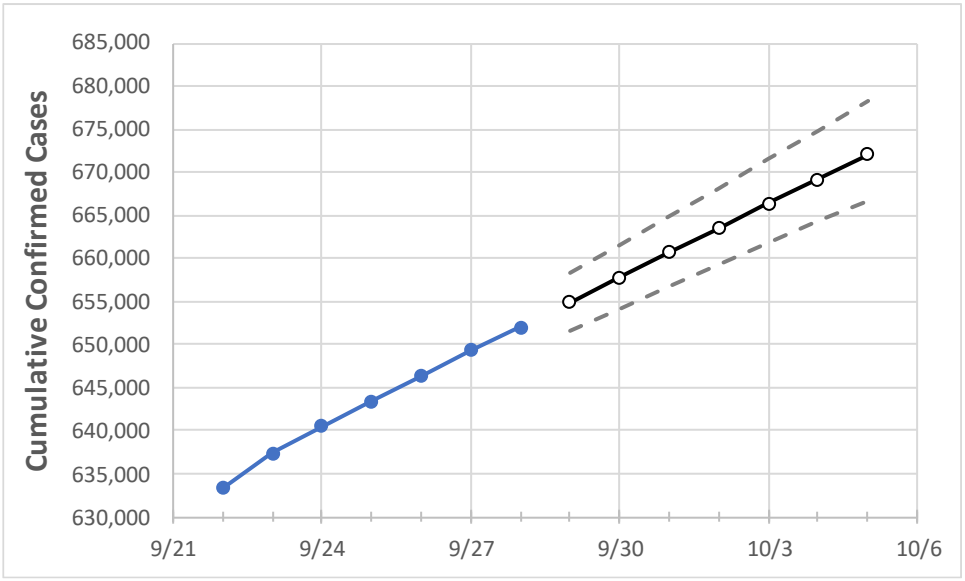
IEM's Modeling Lead

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:						
	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5
Washington	643,425	646,355	649,284	652,011	654,919	657,767	660,673	663,503	666,369	669,231	672,075

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:						
	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5
Benton	28,572	28,707	28,842	28,960	29,090	29,222	29,358	29,485	29,615	29,747	29,873
Clark	36,660	36,810	36,961	37,140	37,306	37,472	37,637	37,804	37,966	38,132	38,300
Grant	14,022	14,093	14,165	14,222	14,294	14,369	14,440	14,513	14,585	14,658	14,730
Island	3,311	3,334	3,358	3,379	3,407	3,436	3,465	3,495	3,525	3,556	3,587
King	149,166	149,681	150,197	150,532	150,995	151,472	151,927	152,395	152,860	153,326	153,786
Kitsap	14,539	14,636	14,734	14,787	14,870	14,952	15,035	15,118	15,197	15,277	15,354
Pierce	81,577	82,028	82,480	82,901	83,320	83,741	84,167	84,598	85,031	85,477	85,908
Skagit	9,200	9,258	9,316	9,353	9,412	9,470	9,530	9,589	9,648	9,708	9,768
Snohomish	57,817	58,052	58,287	58,518	58,771	59,022	59,271	59,518	59,767	60,020	60,270
Spokane	64,141	64,417	64,693	65,010	65,286	65,557	65,834	66,110	66,372	66,650	66,918
Thurston	17,541	17,655	17,770	17,888	17,999	18,112	18,227	18,341	18,459	18,574	18,692
Whatcom	14,255	14,322	14,389	14,483	14,551	14,617	14,684	14,751	14,818	14,884	14,951
Yakima	39,974	40,111	40,247	40,382	40,522	40,660	40,794	40,928	41,060	41,202	41,330

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:		
	9/25	9/26	9/27	9/28	9/30	10/2	10/4
Benton	28,572	28,707	28,842	28,960	29,222 (5,844) [1,403] {701}	29,485 (5,897) [1,415] {708}	29,747 (5,949) [1,428] {714}
Clark	36,660	36,810	36,961	37,140	37,472 (7,494) [1,799] {899}	37,804 (7,561) [1,815] {907}	38,132 (7,626) [1,830] {915}
Grant	14,022	14,093	14,165	14,222	14,369 (2,874) [690] {345}	14,513 (2,903) [697] {348}	14,658 (2,932) [704] {352}
Island	3,311	3,334	3,358	3,379	3,436 (687) [165] {82}	3,495 (699) [168] {84}	3,556 (711) [171] {85}
King	149,166	149,681	150,197	150,532	151,472 (30,294) [7,271] {3,635}	152,395 (30,479) [7,315] {3,657}	153,326 (30,665) [7,360] {3,680}
Kitsap	14,539	14,636	14,734	14,787	14,952 (2,990) [718] {359}	15,118 (3,024) [726] {363}	15,277 (3,055) [733] {367}
Pierce	81,577	82,028	82,480	82,901	83,741 (16,748) [4,020] {2,010}	84,598 (16,920) [4,061] {2,030}	85,477 (17,095) [4,103] {2,051}
Skagit	9,200	9,258	9,316	9,353	9,470 (1,894) [455] {227}	9,589 (1,918) [460] {230}	9,708 (1,942) [466] {233}
Snohomish	57,817	58,052	58,287	58,518	59,022 (11,804) [2,833] {1,417}	59,518 (11,904) [2,857] {1,428}	60,020 (12,004) [2,881] {1,440}
Spokane	64,141	64,417	64,693	65,010	65,557 (13,111) [3,147] {1,573}	66,110 (13,222) [3,173] {1,587}	66,650 (13,330) [3,199] {1,600}
Thurston	17,541	17,655	17,770	17,888	18,112 (3,622) [869] {435}	18,341 (3,668) [880] {440}	18,574 (3,715) [892] {446}
Whatcom	14,255	14,322	14,389	14,483	14,617 (2,923) [702] {351}	14,751 (2,950) [708] {354}	14,884 (2,977) [714] {357}
Yakima	39,974	40,111	40,247	40,382	40,660 (8,132) [1,952] {976}	40,928 (8,186) [1,965] {982}	41,202 (8,240) [1,978] {989}

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.