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FEATURE

Seattle's covid-19 lessons are yielding hope

The far north western corner of the continental US was hit early and hard. **Bryn Nelson** reports that the region now appears to be successfully climbing its way out of the epidemic

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Everything changed in Seattle on 28 February 2020.

The metropolitan region of about 3.5 million people in Washington State had already documented the first US case of covid-19 on 20 January in a 35 year old man who had visited his family in Wuhan, China. The patient tested positive for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and was immediately hospitalised in an isolation unit at Providence Regional Medical Center in Everett, Washington.[1]

After treatment with remdesivir, the man was released on 3 February. Tracing and monitoring (but not testing) of nearly 70 potential contacts didn't turn up any signs of covid-19, and state health officials breathed a wary sigh of relief.

A sudden crisis

On 28 February the discovery of two new presumptive cases was announced. The first, a woman in her 50s, had recently returned from South Korea.[2] The second, a high school student from a suburb north of Seattle, was identified serendipitously through a research project called the Seattle Flu Study that had shifted course to test for coronavirus.[3] The student had no known links to other cases, making him the first apparent case of community covid-19 transmission in the US.

The same day, officials at EvergreenHealth hospital in Kirkland, a suburb east of Seattle, dropped another bombshell. The hospital's infection control team had grown suspicious of two cases in the intensive care unit and sent swab samples to the state laboratory. Ettore Palazzo, EvergreenHealth's chief medical and quality officer, told *The BMJ* that the hospital saw the exercise as a dry run to test its emergency procedures. But on 28 February, both results came back positive. "We were in shock, to tell the truth," Palazzo said.

The next day, one of the patients died. The 58 year old man with underlying health conditions became the first known fatality from covid-19 in the US and the second case of community transmission. The other patient, a 73 year old woman, had been admitted from the nearby Life Care Center, a long term care and nursing facility. In another hospital, an ailing Life Care employee also tested positive.

The weekend became a blur. Investigators identified a potential outbreak at Life Care that involved over 50 residents, workers, and visitors with similar respiratory symptoms. At EvergreenHealth, staff rushed another eight patients newly linked to the outbreak into negative airflow isolation rooms. Seven of them tested positive for covid-19.

Seattle had suddenly become the US epicentre of the growing covid-19 epidemic. The city and surrounding King County both set up emergency operations centres to coordinate efforts. Hospitals went on high alert, and state governor Jay Inslee declared a state of emergency.

Then on 2 March, Trevor Bedford, a molecular epidemiologist at the Fred Hutchinson Cancer Research Center in Seattle, delivered another stunning assessment. In a blog post, Bedford explained that genomic evidence strongly suggested a link between the state's first case in January and the high school student diagnosed in late February. That meant the virus may have been spreading unnoticed for five weeks. Bedford and collaborators at the Institute for Disease Modelling in Bellevue, Washington, estimated that 570 people in the region had already been infected.

A 10 March model by the same team suggested that a business-as-usual approach would lead to 25 000 infections by 7 April in the two county region including Seattle.[4] The next day, Governor Inslee banned all gatherings of more than 250 people in a broader three county region, followed up on 12 March with school closures in the same counties and then closures throughout the state.

Pleading for equipment

More trouble was brewing. By mid-March, hospitals and health systems such as Providence St Joseph Health, which runs eight medical facilities in the region, were scrambling to locate increasingly scarce personal protective equipment. "We were a day or two away from running out of masks at many of our facilities, and maybe even closer to that with face shields," Becca Bartles, Providence St Joseph Health's executive director of infection prevention, western Washington, told *The BMJ*.

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To tackle the shortage, a team of administrators visited every craft and home improvement store within a 100 mile radius and bought all of the marine grade vinyl, foam, elastic, and two sided industrial tape they could find. The team created a prototype face shield, Bartles said, and made 600 the first day.

It wasn't nearly enough. The health system initially sent out an urgent plea for community support called the "100 million mask challenge."[5] The response was overwhelming. Kaas Tailored, a local upholstery manufacturer, soon converted its production lines into making face shields and surgical masks. Seattle based retailer Nordstrom joined the effort, and Bartles said the healthcare system's combined strategies were helping it reach a production goal of 8000 face shields and 100 000 masks a day.

The patients kept coming. By 18 March, at least 167 covid-19 cases had been linked to the Life Care Center, including 50 cases among staff members and 34 deaths among residents and visitors.[6] Citing multiple deficiencies, inspectors fined the centre more than $600 000 (£490 000; €556 000) and threatened to pull its federal funding. A related study in *Morbidity and Mortality Weekly Report* concluded that staff members working in multiple facilities may have unknowingly helped the virus spread within the nursing facility and to other facilities in the region.[7] Throughout King County, long term care facilities began banning employees from shuttling between them as 30 centres tallied at least one confirmed case each of covid-19.

Widespread testing could have helped the epidemiological surveillance, but capacity has been a weak point across the US.[8] Despite the constraints, Washington led the nation in per capita covid-19 testing for much of March, largely because of the more than 40 000 tests done by the University of Washington virology laboratory in Seattle by the end of the month.

Some welcome news

In the meantime, Seattle's growing compliance with physical distancing directives may have slowed the epidemic enough to stave off catastrophe. Two reports released on 30 March by the Seattle based Institute for Disease Modelling suggested that the early implementation of successively stronger measures, starting with a 4 March recommendation that workers be allowed to work from home, effectively reduced the reproductive value of the coronavirus from 2.7 in late February to 1.4 by 18 March. In other words, each patient went from infecting 2.7 others to 1.4 others, on average.[9 10]

A 23 March state-wide shelter in place directive and the closing of nonessential businesses two days later appeared to have further reduced travel, and the modellers suggested that the region was "on the cusp" of pushing the viral reproductive value to 1, below which the virus wouldn't be able to sustain its spread over time.

Flattening the curve has given the region's hospitals a better shot at accommodating the peak of inpatients expected by mid-April and the projected death toll has decreased, but the accumulated strain is taking a toll. By the end of March, 21 of EvergreenHealth's Kirkland staff had tested positive. The hospital had tallied an additional 273 cases, 49 deaths, and 48 hospitalisations. The numbers were still climbing at other regional facilities as well.

"We are still moving in an uphill direction," Bartles said. Overall, King County had reached 2496 cases and 164 deaths by 31 March. To help relieve the burden, US Army personnel set up a field hospital for non-covid-19 patients in a vast event centre just south of downtown Seattle.

During a 30 March press briefing to announce the new modelling studies, Jeff Duchin, health officer for Seattle and King County Public Health, said he was "cautiously optimistic," but warned against letting up and allowing the virus to coming roaring back. "We need to double down on the measures that appear to be working," he said.

Competing interests: I have read and understood BMJ policy on declaration of interests and have no relevant interests to declare.

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