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CASE STUDY

Jan Breydel Stadium in Belgium uses AerosolSense Sampler for soccer match

Would a soccer stadium be a good place to conduct a COVID-19 surveillance study? Professor. Emmanuel Andre, of KU Leuven and the Belgian First Division A of the Jupiler Pro League thought so. At the end of May, 2021, they did just that. Like other countries around the globe that are seeing a reduction in COVID-19 cases, Belgium is eager to reopen and get back to pre-pandemic activity. But the question is "Can we do that safely?"

Situation

Professor Andre, a microbiologist and researcher at KU Leuven, has been involved in public health initiatives in Belgium. He served as Belgium's interfederal spokesperson for the fight against COVID-19 and as a member of a group of advisers to Belgium's Prime Minister on the containment exit strategy.

As part of his public health response, Professor Andre wanted to evaluate the combination of COVID-19 testing and air sampling at a very large event, one that had potential to be a super spreader. The Jan Breydel stadium in Belgium had previously been used as a testing site, and the researchers knew they would get enough volunteers at a soccer match to conduct a study. Demonstrating the effectiveness of testing and air sampling in helping to avoid virus transmission at a large, outdoor events could help support the reopening of other venues and activities in Belgium.

The event was organized by Club Bruges, the first-place soccer team, and the Juliper Pro League. Additional authorities and institutions included KU Leuven, the City of Bruges, and Bruges Police.

What They Wanted to Accomplish

The researchers wanted to develop a risk mitigation plan that would:

- Correlate individual nasal swab testing (PCR and rapid antigen testing) with air sampling with subsequent PCR.
- Determine whether evidence of virus transmission exists during a controlled, mass outdoor event.
- Determine whether potential superspreading events can be monitored by using rapid testing and social distancing measures during outdoor activities with the support of air surveillance.
- Determine whether individual testing failed by testing the air in multiple indoor areas of the stadium for the presence of SARS-CoV-2.

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Solution

The solution was a combination of testing methods: individual nasal swab tests (rapid antigen test and PCR), air sampling, and surface testing. In addition, all attendees were required to practice hand hygiene and to wear masks at the stadium.

Two types of COVID-19 tests were used:

- PCR (polymerase chain reaction) testing is the gold standard for analyzing for the presence of pathogens. Although PCR is more specific and sensitive, results can take between four hours (when a laboratory is onsite) and 24 hours (when the sample is sent to an outside laboratory).

- Rapid antigen testing detects certain proteins in the SARS CoV-2 virus. While this test provides fast results, it is not as accurate and sensitive as PCR testing.

The Thermo Scientific™ AerosolSense™ Sampler, a new in-air pathogen surveillance solution, was used to perform air sampling (Figure 1). The solution delivers timely and highly reliable insight into in-air pathogen presence for monitoring and improving facility safety protocols.

The AerosolSense Sampler collects air samples through an omnidirectional inlet. A cartridge installed into the sampler contains the collection substrate. The air sample is directed toward the collection substrate through an accelerating slit impactor. Particles are trapped on the collection substrate as the air is drawn through the sampler. When the sampling cycle completes, the sample cartridge is removed and analyzed using PCR testing.

Figure 1 AerosolSense Sampler

Set-up

Three days before the match volunteers who would be seated in the VIP section of the stadium underwent nasal swabs that were analyzed using PCR. On the day of the match, volunteers were divided into four groups, and all volunteers except those in the VIP section had a rapid antigen test, a PCR test, or both. And seven days after the match, except for the VIP attendees, volunteers were tested using PCR (Table 1).

Initially, the AerosolSense Samplers were located in the individual testing area while tests were performed and ran for one hour and 40 minutes. The VIP section and the men's restroom were tested during the match itself. Figure 2 shows the locations of the samplers in the individual testing area.

	Test Strategy	Number of people	Rapid test		PCR day of match		PCR day 7	
Group A	PCR three days before match and AerosolSense Sampler	25	-		-		0	0%
Group B	Rapid test + PCR and AerosolSense Sampler	151	151	100%	151	100%	127	84.11%
Group C	Rapid test and AerosolSense Sampler	67	67	100%	0	100%	32	47.76%
Group D	Rapid test and AerosolSense Sampler	30	30	100%	-	-	-	-
Total	N/A	243	218	89.71%	151	62.14%	159	65.43%

Table 1 Study design showing the groups, the test strategy for each group and the number of volunteers tested.

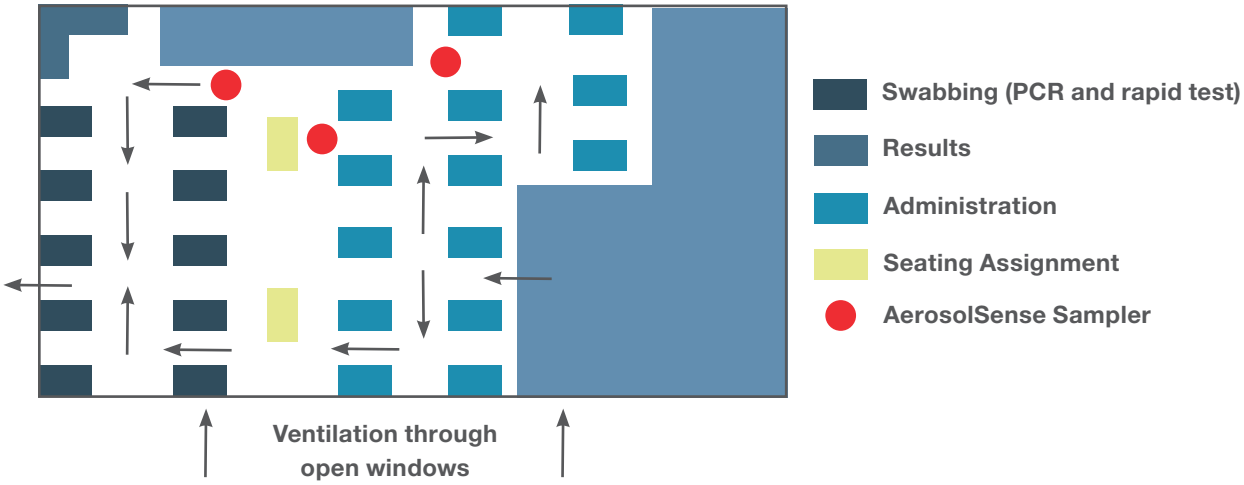

Figure 2 AerosolSense Sampler locations in the individual testing area

Surface swab tests were performed in four locations: the handrailing from the individual testing area to the stadium; the bar in the VIP room; the VIP restrooms; and the men's restrooms.

Volunteers were required to wear masks in the stadium. Masks were removed only for individual testing and for eating and drinking in the VIP area.

In addition, all volunteers sanitized their hands twice before entering the testing area, once after testing, and once at ticket collection.

Results

All rapid nasal swab tests were negative. The PCR nasal swab tests that were done three days before the event were negative as well. On the day of the match, PCR nasal swab testing found one positive case. This individual was retested three days after the match and found to be negative.

The AerosolSense Sampler was able to identify the presence of SARS-CoV-2 virus in the air of the individual testing area at the time an individual who was tested positive (detected by PCR) accessed the same area. That positive tested individual was in the individual testing area for less than 10 minutes, which demonstrates the sensitivity of the solution. Table 2 shows the locations of the AerosolSense samplers, the run times, and the results.

	Location	Run time	PCR results
AerosolSense result 1	Individual testing area	1 hour, 42 minutes	Positive
AerosolSense result 2	Individual testing area	1 hour, 41 minutes	Negative
AerosolSense result 3	Individual testing area	1 hour, 37 minutes	Negative
AerosolSense result 4	Men's restroom	2 hours	Negative
AerosolSense result 5	Boardroom (VIP room)	3 hours	Negative
AerosolSense result 6	Club 1000 (VIP room)	3 hours	Negative

Table 2 AerosolSense results

	Location	Result
Surface swab 1	Men's restroom	Negative
Surface swab 2	VIP area	Negative
Surface swab 3	VIP restroom	Negative
Surface swab 4	Hand railing from the individual swabbing area to the stadium.	Negative

Table 3: Surface swab test results

Table 3 shows the locations from which surface swabs were taken and the results.

Conclusions and implications

The AerosolSense Sampler serves as a good surveillance strategy in social events like a soccer match. The sampler's capture efficiency and subsequent PCR detection provided high sensitivity to identify the presence of SARS-CoV-2 even when a positive individual spent only a few minutes in the individual testing area.

They concluded that a controlled, outdoor mass event can be a low risk for virus transmission under these conditions:

- Rapid tests (nasal swabbing) are used preventively.
- Social distancing rules and crowd control measures are in place.
- Face masks are worn.

The AerosolSense Sampler can be considered as an alternative to individual testing in low-risk events with several other safety protocols in place. When the risk of transmission is elevated, the AerosolSense Sampler paired with PCR should be complemented with pre-event testing. When a postive sample is detected in the air, a post-event testing should also be conducted.

The researchers' experience demonstrated that rapid testing and social distancing, with the support of air surveillance provides a monitoring strategy that is transferrable to other large outdoor venues.