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Short original article

Low risk of environmental contagion by SARS-CoV-2 in non-sanitary spaces

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ABSTRACT

Objective: To study the presence of SARS-CoV-2 on surfaces (high, medium and low contact) and airs in non-sanitary spaces with high public influx to evaluate the risk of environmental contagion.

Methods: Surfaces and airs were analysed by RT-qPCR to detect the presence of SARS-CoV-2.

Results: 394 surfaces and air samples were obtained from spaces with high public influx such as offices, shopping centres and nursing homes. The virus was not detected in any of the samples analysed.

Conclusion: Although we cannot emphatically conclude that there is no risk of environmental 27 infection by SARS-CoV-2 in non-sanitary spaces, we can affirm that the risk is almost non-existent.

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Bajo riesgo de contagio ambiental por SARS-CoV-2 en espacios no sanitarios

RESUMEN

Objetivo: Estudiar la presencia de SARS-CoV-2 en superficies (alto, medio y bajo contacto) y aires de espacios no sanitarios pero de elevada afluencia de público para evaluar el riesgo de contagio ambiental. **Método:** Se ha realizado el análisis de las superficies y de los aires por RT-qPCR para detectar la presencia de SARS-CoV-2. 10

Resultados: Se obtuvieron 394 superficies y 23 muestras de aire de espacios de alta afluencia de personas como oficinas, centros comerciales y residencias de ancianos. El virus no fue detectado en ninguna de las muestras analizadas.

Conclusión: Aunque no podemos concluir rotundamente que no existe un riesgo de infección ambiental por SARS-CoV-2 en espacios no sanitarios, sí que podemos afirmar que el riesgo es casi nulo.

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Introduction

The first cases of the new coronavirus disease (COVID-19) were detected in China in December 2019. In January 2020, the World Health Organization acknowledged that type 2 coronavirus (SARS-CoV-2) was the cause of COVID-19. In Spain, the first case was

recorded on 31 January 2020 in La Gomera,¹ and on 11 March the World Health Organization declared the disease a pandemic.

Like other human coronaviruses, its transmission route was described by person-to-person contact, by respiratory droplets, aerosols and contact with contaminated surfaces.² Evidence of environmental contamination has been demonstrated in health-care settings for both SARS-CoV^{3,4} and MERS-CoV.^{5,6} More recently, SARS-CoV-2 has been found in areas around the bed, in the toilet of infected patients and even in hospital corridors.⁷⁻⁹ Laboratory tests show that SARS-CoV-2 can survive on surfaces for up to several

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days,^{10,11} emphasising the risk of fomite-mediated transmission even further, particularly in healthcare settings. Even so, environmental contamination is low in these settings.^{8,12} Regarding non-healthcare environments, there are already articles in which a low risk of transmission from the inanimate environment has been observed.¹³

This study evaluates the degree of contamination by the SARS-CoV-2 virus on surfaces and air in non-healthcare spaces.

Methods

For one year (from 19 May 2020 to 14 May 2021) 394 surface samples and 23 air samples were collected (Appendix B supplementary material, annex 1). The surface samples were taken in different centres grouped into: category 1 (shopping centres, museums and schools), category 2 (medical centres, research centres, hospitals and residences) and category 3 (companies and offices). Sixteen (16) samples were collected from category 1, 19 samples from category 2 and 359 samples from category 3.

A total of 43 samples (35 surface samples and eight air samples) were collected from spaces where COVID-19 cases had previously been reported.

The 394 surface samples were classified according to the use made of them: 228 samples of high-touch surfaces for collective use (photocopier, banisters, door handles/knobs, coffee-maker, time-card machine), 85 samples of low-touch surfaces for collective use (meeting room tables, dining room tables, benches, waste baskets) and 60 samples of surfaces for individual use (keyboards, mice, screens and phones). In addition to these surfaces, 21 samples related to air-conditioning control were also collected.

In 146 samples, sampling time correlated with surface disinfection time, hence information is available on whether the sampling was pre- (71 samples) or post-disinfection (75 samples).

Collection of surface samples

To analyse the presence of SARS-CoV-2 genetic material, a sterile polypropylene plastic swab moistened with viral transport medium (Biocomma, Guangdong, China) was used to take samples from 25 cm² of surface. The swabs were transported to the laboratory in a refrigerated container. The RNA of the samples was extracted with the Patho Gene-spinTM (iNtRON, New Taipei, China) commercial kit within 48 h after sampling.

Collection of air samples

A volume of 1,000 L of air was sampled with an air sampler (Holbach MBASS30v3, Wadern, Germany) using gelatine filters (Sartorius, Gotinga, Germany). The samples were transported to the laboratory in a sterile container until they were processed (48 h in a refrigerated container). The filter was resuspended in 4 ml of water (80-mm filters, 17528-80-ACD). The filter was dissolved at 37°C for 10 min and the RNA was then extracted.

Polymerase chain reaction (PCR) for the detection of SARS-CoV-2 RNA

For the detection of SARS-CoV-2 RNA, the quantitative PCR technique (qPCR) was used by detecting two genes.¹⁴ The primers used are those approved by the European Centre for Disease Prevention and Control (ECDC)¹⁵ for the amplification of the N1 region: 2019-nCoV_N1-F (GACCCAAAATCAGCGAAAT), 2019-nCoV_N1-R (TCTGGTTACTGCCAGTTGAAT) and probe 2019 nCoV_N1-P (FAM-ACCCCGCATTACGTTTGGTGGACC-BHQ1). For the amplification of the RdRp region, the primers and the probe

recommended by the World Health Organization were used: RdRP_SARSR-F2 (GTGARATGGTCATGTGTGCCGG), RdRP_SARSR-R1 (CARATGTTAAASACACTATTAGCATA) and probe RdRP_SARSR-2 (FAM-CAGGTGGAACCTCATCAGGAGATGC-BBQ).

The polymerase used for reverse transcription was TaqPath 1-step RT-qPCR Master Mix (Applied Biosystems, Massachusetts, USA). The mix to perform reverse transcription and amplification was: 5 µl TaqPath 1-step, 1 µl F 500 nM primer, 1 µl R 500 nM primer, 1 µl 125 nM probe, 7 µl H₂O and 5 µl RNA.

The process was carried out in the LightCycler[®] 480 Real-Time PCR System (Roche, Basel, Switzerland) for the detection of viral RNA. The programme used was: 15 min at 50°C, 2 min at 95°C, 40 cycles of 3 s at 95°C and 30 s at 60°C. The technique's detection threshold is 35 viral genomes/cm² for surfaces and 6.25 viral genomes/litre in air samples. The limits of detection were calculated by processing serial dilutions of a known concentration. The established limit was the concentration that amplified in cycle 35. In each round of extraction and analysis, a positive control was added to check the reliability of the technique. A quantified SARS-CoV-2 synthetic RNA was used as a positive control (VR-3276SDTM, 115 ATCC[®]). For the quantification of possible positive samples, qPCR of serial dilutions were performed to obtain the standard curve (Appendix B supplementary material, annex 2).

Results

A total of 417 samples were analysed for the detection of SARS-CoV-2 RNA in non-healthcare spaces. The presence of virus genetic material was not detected in any of the surface or air samples.

Positive PCR controls confirmed successful amplification in all samples. None of the negative PCR controls yielded positive results, eliminating false positives due to cross-contamination.

Discussion

In this study, the presence of genetic material of the SARS-CoV-2 virus was evaluated on high-, medium- and low-contact surfaces in non-healthcare settings, as well as in air samples from common spaces in these areas.

SARS-CoV-2 genetic material was not detected in any of the 417 samples analysed. Previous positive cases of COVID-19 had been reported on 35 of the analysed surfaces and in eight of the analysed air spaces. Our study was carried out in a period in which exceptional measures were in force to control the pandemic: widespread and mandatory use of face covering, limited seating capacity, social distancing and frequent surface cleaning. In this context, our results demonstrate that the risk of transmission through fomites is low. Similar results have been found in other studies in which non-health settings were studied,¹⁶⁻¹⁸ although between 0.5% and 6% positive samples were detected. It must be emphasised that the detection of SARS-CoV-2 RNA does not involve a risk of infection, since only genetic material is being detected and not an infective particle.

This study has certain limitations. Firstly, isolating the virus from the samples was not envisaged, hence in the event of positive results viability could not have been tested. Secondly, no samples were taken from the users of the facilities analysed. Finally, we did not include information about the samples, such as the size of the facilities sampled, the frequency of use of the facilities and the specific incidence in the municipalities where the facilities are located.

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Conflicts of interest

None to declare.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.eimc.2022.01.015>.

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