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COMMENTARY

Acceptability of Community Saliva Testing in Controlling the COVID-19 Pandemic: Lessons Learned from Two Case Studies in Nursing Homes and Schools

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Abstract: Current public health debate centers on COVID-19 testing methods and strategies. In some communities, high transmission risk may justify routine testing, and this requires test methods that are safe and efficient for both patients and the administrative or health-care workers administering them. Saliva testing appears to satisfy those criteria. There is, however, little documentation on the acceptability of this method among beneficiaries. This article presents the lessons learned from a pilot study on the use of saliva testing for routine screening of nursing home and secondary school personnel in Wallonia (the French-speaking part of Belgium), conducted in December 2020 to April 2021, respectively. Administrators at the facilities in question seemed to think highly of saliva testing and wished to continue it after the pilot study was over. This result reinforces the criteria (the noninvasive aspect, in particular) supporting a key role for saliva testing in monitoring community spread of the virus. Nevertheless, wider-scale deployment of this particular method will only be possible if the testing strategy as a whole takes a health promotion approach.

Keywords: pandemic, COVID-19, community monitoring, preventive health behavior, saliva testing

Introduction

For more than a year, the COVID-19 pandemic has compelled public health actors to find new ways to monitor propagation/transmission of the virus while minimizing social and economic impacts on human activity. Among the various measures aimed at monitoring and controlling the pandemic's spread in the population, testing is vital.[1] In mid-September 2020, the European Centre for Disease Prevention and Control emphasized the need for flexible strategies that can be quickly adapted – in particular, to the epidemiology of the health situation and to local resources.[2]

Mass testing has been recommended for high transmission-risk contexts.[3] Nursing homes and schools are considered such high-risk contexts – the former because of the vulnerability of their residents, for whom Covid-19 is more life-threatening, and the latter because of the potential greater number of social contacts and higher rate of asymptomatic infection among those who frequent them.

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However, mass testing requires simple, inexpensive, readily-available strategies that can be repeated frequently. Saliva testing meets these criteria. After several months of debate over the merits of saliva testing, the consensus now seems to be that saliva tests are as sensitive as nasopharyngeal swabs, justifying the view that they could become the new gold standard for community-based screening for SARS-CoV-2.[4–6] Many countries (eg, South Korea, Germany, and Japan) are already using routine saliva tests to control the spread of the virus while preserving social and economic activity.[7]

However, while the test's ability to detect the virus is necessary (sensitivity), it is not the only requirement for adopting a population-based screening test. Indeed, before using a system to routinely test a population (or some population subgroup), the test's acceptability to the beneficiaries should be examined.[8] In this paper, we will report the results of two pilot studies on the acceptability of a saliva-based mass SARS-CoV-2 screening strategy in two pilot studies conducted, respectively, at nursing homes and secondary schools, in Wallonia (the French-speaking part of Belgium).

Context and Organization of the Testing in the Two Pilot Studies

In collaboration with the University of Liege, government authorities responsible for elder health and secondary education in Wallonia decided to launch two pilot projects, in nursing homes and secondary schools, respectively, to prospectively study the benefits of longitudinal, voluntary, anonymous mass SARS-CoV-2 screening using a saliva test.

A standardized saliva testing procedure was developed, as described previously;[9] a summary of that procedure, in five steps, is shown in Box 1.

The school screenings were organized the same way, except for steps 1, 4, and 5. For steps 1 and 4, the kits/samples were transported from the relay points to the schools and from the schools to the relay points by drivers. For step 5, the laboratory communicated the result to the participant via text message and posted it on a secure web platform.

Additional information on the laboratory analysis of the saliva samples can be found in the article by Saegerman et al.[9] The acceptability study being discussed in this paper pertains to the entire procedure described above.

Box 1 General organization of saliva-based screening at Wallonian nursing homes

1- Distribution of kits to the staff to be tested

Saliva self-collection kits were distributed at thirteen relay points located throughout the Wallonia region. Each relay point had its own location and hours of operation. Each participating facility designated one individual to go to its relay point to pick up the self-collection kits. The administrators at each nursing home organized collection kit pick-up from the relay point and distribution to their staff. How the kits would be distributed internally was left up to facility administrators, so that each facility's specific needs could be taken into account.

2- Sample collection by workers

Each worker collected a saliva sample using the kit provided, following the instructions included in the individual box they received. All of the samples were collected on the same day in a given facility. Nursing home administrators announced that date to their staff. Each worker noted the number of (or photographed) the bar code on their sample tube, so they could get their individual result in a confidential and anonymous manner.

3- Submission of samples by nursing home staff

Administrators announced the location, date, and time at which samples would be collected in the nursing home. These were set in such a way that all of the facility's samples could be submitted before closing time, at the collection point, on the designated day. The nursing homes organized the collection of samples within their facility using equipment made available to them.

4- Transport of samples from the nursing homes to the relay points.

The facility's administrators or a designated individual transported the samples to the relay point in a safe manner (health-wise). Once the relay point closed for the day, all of the received samples are transferred to the analysis Laboratory. The laboratory began analyzing the samples immediately.

5- Communication of results. As soon as an analysis was complete, the lab posted the result to a secure web platform. The results could then be retrieved in one of two ways: the person who collected the sample could get their individual result by entering their sample's barcode number on the dedicated, secure web platform (anonymously), or nursing home administrators could consult the completely anonymized statistical information for their facility on the secure web platform, to which they had access.

Administrators or administrative associates were invited to participate in a survey aimed at characterizing their experience implementing routine staff testing. Those data were collected via telephone interviews by researchers trained in a standardized approach. The evaluation was done at the end of the three-week pilot phase of testing. The acceptability of the screening system was evaluated using the following indicators and measurements: Receptivity to testing and desire to continue it; perceived quality of the test; clarity/precision/practicability of the procedure; difficulties encountered when implementing the various phases of the procedure. The data were analyzed to yield descriptive statistics on indicators described above, accompanied by additional qualitative assessments garnered during the interviews. The collected data were handled by the research team in accordance with the required regulatory and ethics procedures.

The ethics committee of the University Hospital of Liège (Comité d'Ethique Hospitalo-Universitaire de Liège, Belgium) determined this study was exempt from review and did not oppose the undertaking of the study. An information letter was sent to all potential participant. As the participation was based on a voluntary basis and as the participation to the survey was made by phone call, we collect only oral consent (included publication of anonymized responses).

Lessons Learned

The data presented below were provided by facility administrators involved in procedure for testing their staff who agreed to participate in our survey; they represented 439 nursing homes and 19 schools (around 35.000 and 1500 members of staff, respectively).

Lesson 1: Strategy Received Very Favorably by the Facilities

Testing was greeted (very) favorably by the administrations of the facilities studied – 96.9% in the nursing homes and 100% in the schools – and this was certainly related to the tragic role of Belgian nursing homes with regard to Covid deaths in our country.[10] The favorable reception in the schools, however, confirms the wider community's need for tools to monitor the spread of the virus, given the heavy toll that school openings, closings, and reopenings take. Too few resources have been invested in monitoring the virus' spread in living environments. In this regard, the present study confirms the results of other studies showing high acceptability of saliva tests.[11–13] Although we did not compare our data to other testing systems, the results on the intention to continue – which were also very positive (94.5% for nursing homes and 100% for schools) – confirm the interest in saliva testing reported by the participating facilities, even after experiencing some system-related technical and operational difficulties, described below. If saliva-based community screening strategies are not being used more widely, the blame cannot be placed on how beneficiary facilities and their members feel about them.

Lesson 2: Support People's Motivation to Be Involved in the Process

The positive results described above in terms of receptivity and intention to continue testing can be explained, at least in part, by the results shown in Table 1, which summarize some of the components that the scientific literature reports as

Table 1 Perception of Saliva Testing by Nursing Home (n=439) and School (n=19) Administrations

	Nursing Homes	Schools
Percentage of agreement regarding the usefulness of the testing in terms of:		
- Added value with regard to other preventive measures	84.2	100
- Anticipated benefits outweighing the effort needed to do testing	81.7	94.7
- Feeling that the test is effective	72.4	94.7
Percentage of agreement regarding the quality of the procedure in terms of:		
- Clarity	82	94.7
- Precision	87.6	94.7
- Practicability	80	84.2

fostering motivation for positive health behaviors. The criteria used to assess the testing relate to the benefits of the action being taken, and the clarity, precision, and practicability parameters relate to control and a sense of self-efficacy regarding the action to be taken. These are some of the basic factors behind motivation and engagement in preventive health measures[14] that have been reported in the literature as indicating a strong intention to continue.

The results were more positive for schools than for nursing homes. We can posit at least two hypotheses for this: (1) the fact that a medical setting is more demanding about the procedures and testing (in particular, greater debate over the test's effectiveness among the healthcare staff); and (2) the time lag between the pilot study in the nursing homes and in the schools, which made it possible to improve the tools and strategy in the schools based on feedback from the nursing home participants, and greater recognition of the test used.

Lesson 3: Consider More Than Just the Technical Aspects of a Testing Strategy

The last part of the results (Table 2) indicates, first of all, the need to consider the strategy as a whole. If one step does not work, the entire strategy falls apart. So it's important to think about the strategy systemically and systematically, from the technical quality of the testing device to the promotion of testing among the target population.

In particular, the most common difficulties involved saliva self-collection by the staff, retrieving the results, and following up on them. The first – ie, difficulties producing saliva in the morning – indicates the need to quickly consider a gargle-type system[15] and determine whether it would be easier to self-administer. The second shows the need to look beyond just the technical aspects of the analysis (the speed and quality of sample analysis) and come up with a system that allows rapid result retrieval and follow-up consistent with ethical and regulatory requirements. While these are sensitive personal health data, given the public health stakes, the link between the laboratory and a decentralized results management platform should allow quick decisions about follow-up and rapid, ethical contact with the audience concerned. This is already the case for the nasopharyngeal tests officially recognized by the Belgian federal government.

General Discussion

These conclusions should be considered within the inherent limitations of this type of study, which has a different design than original research with limited study variables, lack of comparison with groups using another testing system, short three-week time frame (which prevented gauging the effect of longer familiarization with the device), limited characterization of the respondents, and acceptability study based solely on statements by facility administrators. While the results should be viewed in light of the above limitations, we believe there are some cross-cutting lessons that can be drawn from these case studies. These lessons are complementary to other studies that aim to identify evidence-based good practices on how to implement an operational system of Covid-19 population-based testing.[16–18]

At a time when saliva testing's place in the Covid-19 screening arsenal is in question, the data presented here show what beneficiaries have to say about this particular device. In that sense, this article is original, because user/citizen views are too often being ignored when deciding on public action in this crisis.[19]

Despite the limitations discussed above, these results showed that people who have used the device have found it very acceptable. The high favorability numbers regarding the desire to continue testing beyond the pilot phase are proof of that. This only reinforces the criteria (the noninvasive aspect, in particular) supporting a key role for saliva testing in monitoring community spread of the virus. As acceptability is a key factor in a sustainable population monitoring, our results provide a window of opportunity to consider different self-collection techniques (in particular salivary techniques) that should be considered comparatively.[20,21]

Taken as a whole, our results also argued for presenting the testing strategy as part of a health promotion effort. Indeed, some of the data from our study showed the need to understand and study user support for the screening process. It is not enough that a test be technically and biomedically effective; the population has to support it – that is, understand its added value and its use, and follow-up on it (in particular, by going to check the results). This inevitably requires that we use the perceptions of those involved in improving the testing system. The improvement in results between the two pilot studies (nursing homes and then schools) suggests that the overall screening strategy got better thanks to user feedback from the first pilot study. This should encourage the scientific community to devise solutions for screening –

Table 2 Difficulties Encountered When Implementing Saliva-Based Screening, as Reported by the Administrators at Nursing Homes (n=439) and Schools (n=19)

Step	Facility Type		Description of the Difficulty *	Examples of Concrete Problems Reported by the Participants Interviewed
	Nursing Homes N (%)	Schools N (%)		
Saliva self-collection	94 (22.7)	10 (52.6)	Missing equipment.	"In some boxes pieces were missing (the orange caps) and in others there were more of them."
			The procedure was not clear about how much saliva was needed for doing the test.	"Some people had problems with the orange funnel, when should you stop? Might help to explain that it has to be filled to the second little line, he took the time to explain it to the staff again."
			Inconsistencies between the procedure sent to the facilities and the use instructions.	"The instructions said that you have to remove the bar code label, but that should not have been done for nursing homes. The use instructions need to be changed."
			Problems with sputum, kit assembly, saliva flow in the container, or with the saliva-blocking system.	"Hard to spit in the morning if you haven't eaten, too little saliva, saliva too thick; funnel too small; doesn't run down into the tube well."
Retrieving the results	93 (22.4)	8 (42.1)	Computer difficulties and encoding problems	"A staff member who isn't comfortable with computers was unable to use the portal. So the director showed him the steps." " … some barcodes, once encoded in the system, said they didn't correspond to any tests from a nursing home and didn't display a result."
			Delayed results.	"One staff member got his results later than the other staff members (24 to 48 hrs., while the others got them the day of the collection)."
			Anonymous results and no/delayed follow-up.	"More tedious. The first time, they said the tests were anonymous so there we had to wait to see if people were positive or negative. Not sure whether everyone told. It would be best if the director could have access to all the results." "Not helpful for the administration in terms of traceability, because we don't know which team it's about, etc." "Since it's anonymous, if workers don't keep us informed or don't communicate, it's hard to know who's positive. Some people don't check their results right away, so it takes several hours to find out who's positive."
Transporting the kits (nursing homes only)	52 (12.5)	/	Inconvenient hours and location for the transport of kits to the relay point.	"The distance to the relay point (30 km) a given day at a given time. It's really inconvenient for the team and especially for people who aren't working the day of the test and have to come back, if they live far away."
			Additional workload for administrators or administrative associates.	"Work overload right now, the transport takes additional time"
Retrieving (centralizing) the kits	24 (5.8)	5 (26.3)	Schedule for turning in kits inconvenient, causing some people not to participate in the testing.	"Some people live really far away and sometimes have to do a 40–50 km roundtrip when they aren't working. As a result, some workers don't do the test at all."
Distributing the kits to the staff	23 (5.5)	2 (10.5)	Too few kits for the facility's needs.	"Not always enough kits, our temporary interns and volunteers aren't always included in the allotment."

Notes: /For the pilot study in the schools, kits were transported by drivers, so there is no data for that step. *Difficulties have been considered if cited at least once by the participants.

and for controlling the pandemic, more broadly – that treat beneficiaries/citizens as partners, rather than just beneficiaries.[22]

More broadly, it makes a modest contribution to the argument that any government strategy for managing this crisis – from designing isolation and quarantine measures to devising a vaccination strategy – should take a health promotion approach.[23] We also encourage investment in research aimed at better understanding the factors behind citizen support for public health measures.

Conclusion

Controlling and ending pandemics like the one caused by COVID-19 requires screening methods that meet quality standards – not just technically (test sensitivity/specificity), but also in terms of the convenience and acceptability of the device being studied. The results presented here strengthen the case for considering saliva testing among the methods available, provided it is part of an overall strategy whose scope goes beyond just the technical and biomedical aspects of this particular device.

Disclosure

Benoit Pétré and Marine Paridans are co-first authors for this study. FB and LG are the inventors of the device used in the saliva collection kit. This device was patented (WO2022013235A1) and produced by Diagenode (Seraing, Belgium) under a commercial agreement with the University of Liège. The authors report no other conflicts of interest in this work.

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