



# Provider attitudes and satisfaction with rapid preoperative point-of-care COVID-19 testing using ID NOW™

## Attitudes et satisfaction des travailleurs de la santé à l'égard du dépistage préopératoire rapide de la COVID-19 au point de service à l'aide d'ID NOW™

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### Abstract

**Purpose** Healthcare workers have experienced high levels of anxiety during the COVID-19 pandemic, particularly when caring for patients with unknown infection status. We trialled rapid preoperative point-of-care COVID-19 testing using the Abbott ID NOW™ COVID-19 for clinical validation in an urgent surgical population at a single centre in British Columbia, Canada. Here, we sought to determine the opinions and beliefs of operating room (OR) staff on the usefulness and effectiveness of point-of-care tests on workflow and wellbeing in the OR.

**Methods** This descriptive study used a mixed-methods cross-sectional survey of all OR staff (nurses, anesthesiologists, surgeons, and ancillary staff) at a single centre after using the ID NOW for three months. Outcomes of interest included healthcare worker satisfaction with the ID NOW, effects on OR workflow, and worries about COVID-19 transmission.

**Results** The overall response rate was 56% ( $n = 133$ ), and was highest among anesthesiologists (100%,  $n = 38$ ). Respondents were satisfied with the performance of the ID NOW for rapid COVID-19 testing in preoperative patients, giving it a mean (standard deviation [SD]) rate of 4.4 [1.4] on a five-point scale. Most (115/128, 90%) recommended continued use of the ID NOW on asymptomatic patients while there are active cases of COVID-19 in the community. Respondents felt that preoperative COVID-19 testing with the ID NOW made the OR safer for staff (mean [SD] rate, 4.2 [0.8]) and patients (mean [SD] rate, 4.0 [0.9]).

**Conclusion** During the COVID-19 pandemic, it is important to maintain the physical and mental wellbeing of hospital staff. Rapid point-of-care testing increased the sense of workplace safety, improved morale, and reduced worry associated with COVID-19 without excessive disruption of OR workflow.

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### Résumé

**Objectif** Les travailleurs de la santé ont connu des niveaux élevés d'anxiété au cours de la pandémie de COVID-19, en particulier lorsqu'ils prenaient soin de patients dont le statut infectieux était inconnu. Nous avons testé le dépistage préopératoire rapide de la COVID-19 au point de service avec le dispositif ID NOW™ COVID-19 d'Abbott pour validation clinique auprès d'une population devant bénéficier de chirurgie urgente dans un seul centre en Colombie-Britannique, au Canada. Notre objectif était ici de déterminer les opinions et les croyances du personnel de la salle d'opération (SOP) quant à l'utilité et à l'efficacité des tests au point de service en matière de flux de travail et de bien-être en salle d'opération.

**Méthode** Cette étude descriptive a utilisé un sondage transversal à méthodes mixtes auprès de tout le personnel de la SOP (infirmières, anesthésiologistes, chirurgiens et personnel auxiliaire) dans un seul centre après avoir utilisé le système ID NOW pendant trois mois. Les issues de l'étude comprenaient la satisfaction des travailleurs de la santé à l'égard de ID NOW, les effets sur le flux de travail de la SOP et les inquiétudes concernant la transmission de la COVID-19.

**Résultats** Le taux de réponse global a été de 56 % ( $n = 133$ ), et était le plus élevé chez les anesthésiologistes (100 %,  $n = 38$ ). Les répondants étaient satisfaits de la performance de ID NOW pour le dépistage rapide de la COVID-19 chez les patients préopératoires, lui accordant une note moyenne (écart type [ÉT]) de 4,4 [1,4] sur une échelle à cinq points. La plupart (115/128, 90 %) ont recommandé de continuer à utiliser ID NOW avec les patients asymptomatiques tant qu'il y a des cas actifs de COVID-19 dans la communauté. Les répondants étaient d'avis que le dépistage préopératoire de la COVID-19 avec ID NOW rendait la SOP plus sécuritaire pour le personnel (note moyenne [ÉT], 4,2 [0,8]) et les patients (note moyenne [ÉT], 4,0 [0,9]).

**Conclusion** Pendant la pandémie de COVID-19, il est important de maintenir le bien-être physique et mental du personnel hospitalier. Le dépistage rapide au point de service a accru le sentiment de sécurité au travail, amélioré le moral et réduit l'inquiétude associée à la COVID-19, sans perturbation excessive du flux de travail de la SOP.

**Keywords** ID NOW · COVID-19 · Point-of-care · Satisfaction · Healthcare provider morale

## Introduction

The potential for presymptomatic and asymptomatic transmission of SARS-CoV-2, the virus responsible for COVID-19, has been well documented.<sup>1-4</sup> Healthcare workers are at increased risk of infection through occupational exposure of many pathogens, including SARS-CoV-2. The United Kingdom has reported high rates of COVID-19 infection and death in their healthcare providers.<sup>5,6</sup> Healthcare workers in the operating room (OR) are at particularly increased risk as aerosol-generating procedures increase the transmission of respiratory pathogens.<sup>7,8</sup> Although preoperative testing is recommended for all elective surgical patients in regions with SARS-CoV-2,<sup>9</sup> emergency surgery patients are less likely to have test results available prior to their operative management. This may result in fear and anxiety among

OR staff and patients, which may be alleviated with point-of-care rapid COVID-19 testing prior to surgery.

Laboratory nucleic acid testing (NAT) of nasopharyngeal (NP) swabs, endotracheal swabs, and saline gargle tests are considered the gold standard to determine the presence of SARS-CoV-2. Although highly sensitive and specific, test results can take 24–72 hr. The Abbott ID NOW™ COVID-19 (Abbott Diagnostics Scarborough, Inc., Scarborough, ME, USA) is a portable, Health Canada-approved molecular COVID-19 test that uses proprietary enzymes and thermal control for expedient amplification of SARS-CoV-2 RNA. This rapid point-of-care test can be done in around 15 min. In a review of diagnostic accuracy in symptomatic and high-risk populations, the ID NOW COVID-19 was shown to have a sensitivity of 73.0% and specificity of 99.7%.<sup>10</sup> As part of a clinical validation project for a largely asymptomatic population, in collaboration with the British Columbia Centre for Disease Control (BCCDC), the Royal Columbian Hospital (RCH) OR was the first OR in British Columbia to pilot the ID NOW COVID-19 bedside test in emergency surgery patients.<sup>11</sup>

Healthcare workers have experienced higher than average rates of anxiety and depression, particularly during the COVID-19 pandemic.<sup>12</sup> A review of the psychological impact of infectious outbreaks on healthcare workers showed that post-traumatic stress, depression, anxiety, and sleep disturbances were frequently reported.<sup>13</sup> Exposure to COVID-19 through clinical work is associated with moderate to high burnout and workplace exhaustion in healthcare workers.<sup>14</sup> Reduction in the uncertainty of workplace coronavirus exposure could alleviate some of the stress and anxiety experienced by healthcare workers.<sup>15</sup>

While the objective of the overall project was to determine test performance of the ID NOW COVID-19 in the preoperative patient population, the focus of this study was to describe the operational feasibility and value of rapid point-of-care testing to surgical teams in the planning of patient management. Specifically, we sought to assess the opinions and beliefs of OR staff around the usefulness, ease of operation, and effect of point-of-care tests on workflow and wellbeing in the OR.

## Methods

### Study design

This descriptive mixed-methods cross-sectional study was approved by the institutional Research Ethics Board (FHREB 2021-018). Email invitations were sent to all OR staff (nurses, anesthesiologists, surgeons, and other

ancillary staff) who were active in the clinical validation trial period during which the ID NOW COVID-19 was used for point-of-care preoperative testing in urgent surgical patients. Other ancillary staff included anesthesia assistants, trainees (residents and medical students), perfusionists, surgical assistants, and OR aides. Staff, who were not working during the time the ID NOW was in use were excluded. The email linked to a REDCap<sup>16</sup> survey after informed consent was given. Data were collected during a two-week period after the ID NOW machines had already been in use for three months. Prior to use, OR staff were educated about the imperfect sensitivity and specificity of the ID NOW COVID-19 (73.0% and 99.7% respectively in published reports;<sup>10</sup> 82.5% and 98.4%, respectively, in an internal report on a high-risk population in British Columbia). Operating room staff were informed that the test performance had not yet been well-characterized in low-risk settings and therefore results were to be interpreted as presumptive until NP/NAT testing returned. Operating room staff were instructed to continue screening all patients by symptoms and exposure history, as per the BCCDC Infection Prevention and Control Protocol for Surgical Procedures,<sup>17</sup> a system that sorts patients into colour-coded risk groups (green, yellow, red). Healthcare workers were instructed to never “downgrade” based on a negative ID NOW COVID-19 result, but could “upgrade” (e.g., from green to yellow or red) if the ID NOW result was positive. During this time, British Columbia was at the tail of its second wave, with an average weekly incidence of 78 per 100,000. The Fraser Health region was the most affected region, with a weekly incidence of 117 per 100,000 and test positivity rates of 10.1%.<sup>18</sup> The exact pre-test probability of patients was unknown because asymptomatic population-level testing was not performed in British Columbia. Nevertheless, OR staff were aware that pre-test probability was increasing when case counts and test positivity rates were increasing.

### Measures

For this survey, the primary outcome was healthcare worker satisfaction with ID NOW COVID-19 rapid testing and their overall wellbeing in the OR, as measured by how satisfied they were with its use and how likely they were to recommend its continued use in a pandemic environment. Secondary outcomes included whether ID NOW changed the provider’s sense of safety for themselves and for others (ancillary staff and patients), changed worries about COVID-19 transmission, and changed personal protective equipment (PPE) usage. The survey instrument is shown in the Electronic Supplementary Material [ESM] eAppendix 1.

This was primarily a descriptive study. Several comparisons were made, including degree of worry before and after the introduction of the ID NOW COVID-19. Likert responses were treated as continuous data and compared with paired *t* tests. All statistical analyses were performed in Stata 13 (StataCorp LLC, College Station, TX, USA), except for 95% confidential interval (CI) calculations for test characteristics, which were performed using MedCalc for Windows, version 19.8 (MedCalc Software Ltd, Ostend, Belgium).<sup>19</sup> Qualitative results were coded and summarized in Microsoft Excel (Microsoft Corporation, Redmond, WA, USA).

### Results

The survey (see ESM, eAppendix 1) was sent by email linking to a de-identified REDCap database to 236 OR staff over two weeks in March 2021. The overall response rate (defined as opening the survey and answering at least one question) was 56% ( $N = 133$ ), with the highest response from anesthesiologists (100%,  $N = 38$ ) (Table 1). Some respondents did not answer all survey questions, so response rates for each question varied. The survey was primarily sent to nurses, anesthesiologists, and surgeons, but an attempt was made to capture as many OR workers as possible, with invitations extended to anesthesia residents, medical students, perfusionists, anesthesia assistants, surgical assists, and OR aides (categorized collectively as “other”). To preserve anonymity, age was identified by decile. The median age decile was 40–49 yr, with an interquartile range of 30–49 yr. Twenty out of 132 respondents (15%) self-identified as having a comorbidity that would place them at increased risk for severe COVID-19.

### Test characteristics

From 16 December 2020 to 1 April 2021, the ID NOW COVID-19 test was used by a nurse or anesthesiologist to test 1,100 urgent surgical patients. Concurrent NP swabs were sent for standard laboratory NAT. There were 1,093 true negative tests, two true positives, two false negatives (both had cycle threshold [Ct] values  $> 25$ , reflecting lower infectivity),<sup>20</sup> and three false positives (all negative on a repeated ID NOW test). The test had a sensitivity of 50% (95% CI, 6.8 to 93.2) and a specificity of 99.7% (95% CI, 99.2 to 99.9). When considering lower Ct values only to be positive and only two repeat ID NOW-positive results as true positives, both sensitivity and specificity were improved to 100%. The clinical implications of the diagnostic performance of the ID NOW COVID-19 were discussed in a recent Letter to the Editor.<sup>11</sup> Notably, the

**Table 1** Operating room staff survey respondent demographics and satisfaction with ID NOW COVID-19 testing

	Nurses N = 46	Anesthesiologists N = 38	Surgeons N = 21	Other N = 28	Overall N = 133
Number invited (response rate), n (%)	88 (52%)	38 (100%)	39 (54%)	71 (39%)	236 (56%)
Comorbidities, n (%)	5 (11%)	9 (24%)	2 (10%)	4 (15%)	20 (15%)
Recommendation to continue with ID NOW, n (%)	37 (86%)	35 (92%)	19 (90%)	24 (92%)	115 (90%)
Satisfaction with ID NOW (5-point Likert scale score), mean (SD)	4.1 (1.2)	4.5 (1.0)	4.6 (1.8)	4.6 (1.9)	4.4 (1.4)
Personally ran the test at least once, n (%)	40 (95%)	12 (33%)	1 (5%)	5 (21%)	58 (48%)
Feel that the change in workflow is worthwhile for information obtained, n (%)	32 (76%)	30 (88%)	16 (94%)	17 (81%)	95 (83%)

SD = standard deviation

two true positive patients were asymptomatic at the time of testing (screened “green”) but proceeded with increased precautions and isolation after the positive ID NOW test. Both developed symptoms postoperatively while convalescing on the COVID-19 isolation ward and no known transmission occurred.

#### *Satisfaction with ID NOW COVID-19 point-of-care testing in the OR*

Across all groups, respondents were satisfied to extremely satisfied with the performance of the ID NOW for rapid COVID-19 testing in preoperative patients, giving it a mean (standard deviation [SD]) rating of 4.4 [1.4] on a five-point Likert scale. Most (115/128, 90%) recommended continued use of the ID NOW in asymptomatic patients while there are active cases of COVID-19 in the community.

#### *Ease of use at the point-of-care and change in workflow*

While the ID NOW COVID-19 was in use, testing was done at the point of care. Fifty-eight out of 121 (48%) respondents had run the test at least once, most often by nurses (40/42, 95%) and anesthesiologists (12/36, 33%). Among those that had run the test at least once, 11 respondents (19%) found it difficult or very difficult to run. Among the 23 respondents that had run the test > 25 times, only two found it difficult or very difficult to run (9%). The self-reported mean [SD] time spent on running an ID NOW test was 17.6 [6.6] min. While 64% (37/58) of those that had used the ID NOW felt their workflow was disrupted, they rated it as only a moderate disruption (mean [SD] disruption, 3.4 [1.1] on a five-point scale).

The majority (90/121, 74%) of respondents were aware of a time when their patient underwent ID NOW COVID-19 testing even when they did not personally run the test. Some respondents (22/120, 18%) reported that workflow was improved with ID NOW when they were not the ones

running the test, although many (72/120, 60%) felt that workflow was unchanged. Overall, most (95/114, 83%) respondents felt that changes in workflow caused by ID NOW were worthwhile or extremely worthwhile for the information that was obtained, and very few thought they were not worthwhile (8/114, 7%).

#### *Improved sense of safety and morale*

Mean (SD) ratings on a five-point Likert scale showed that respondents felt that ID NOW COVID-19 testing in the OR had made the OR safer for staff (4.2 [0.8]) and patients (4.0 [0.9]), improved team performance (3.6 [0.9]), and improved morale (4.1 [0.9]). These impressions were consistent across occupations (see Table 2).

#### *Improved confidence in screening*

In British Columbia, a surgical patient’s COVID-19 risk is classified as green, yellow, or red based on self-reported symptoms, risk factors, and test results, when available. Without an ID NOW COVID-19 test, respondents were less confident (mean [SD], 2.8 [1.0] on a five-point scale) that patients screening “green” did not have COVID-19, compared with their confidence (mean [SD], 4.2 [0.8]) when the patient got a negative ID NOW COVID-19 test result. Confidence was improved by 1.3 points (95% CI, 1.1 to 1.5;  $P < 0.001$ ) on the five-point scale that ranged from not at all confident to extremely confident.

#### *Changes in worry before and after ID NOW COVID-19*

Compared with how they recalled feeling before the ID NOW COVID-19 was being used in the OR, respondents reported being less worried about COVID-19 infection while using ID NOW (Table 3). This was consistent across five areas of worry (worry about contracting COVID-19, developing severe COVID-19, transmitting COVID-19 to family members, patients infecting colleagues, and patients

**Table 2** Operating room staff responses to the following question: How has ID NOW testing in the OR changed...?

	Nurses N = 46	Anesthesiologists N = 38	Surgeons N = 21	Other N = 28	Overall N = 133
...the safety of the OR for <b>staff</b> ? (1 = Much less safe, 5 = Much more safe)	4.2 (0.7)	4.3 (0.7)	4.1 (1.1)	4.1 (0.7)	4.2 (0.8)
...the safety of the OR for <b>patients</b> ? (1 = Much less safe, 5 = Much more safe)	4.1 (0.8)	4.0 (0.8)	4.2 (0.7)	3.8 (1.0)	4.0 (0.9)
... <b>team performance</b> in the OR? (1 = Greatly reduced team performance, 5 = Greatly improved team performance)	3.6 (1.0)	3.7 (0.7)	3.8 (1.1)	3.6 (0.9)	3.6 (0.9)
... <b>staff morale</b> ? (1 = Greatly reduced morale, 5 = Greatly improved morale)	4.0 (1.0)	4.4 (0.7)	4.2 (1.2)	3.9 (0.9)	4.1 (0.9)

Values represent 5-point Likert scale scores and are presented as mean (standard deviation)

OR = operating room

**Table 3** Effects of ID NOW testing on worry associated with COVID-19

Degree of worry (1 = not worried at all...5 = extremely worried)	Before ID NOW n = 115	Currently with ID NOW n = 115	P value (compared with before ID NOW)	With ID NOW, but prior to vaccination n = 108	P value (compared with before ID NOW)
Personally becoming infected with COVID-19 due to transmission from an OR patient?	3.7 (1.2)	3.1 (1.3)	< 0.001	3.5 (1.2)	0.009
Personally becoming infected with severe COVID-19 due to transmission from an OR patient?	3.7 (1.3)	3.0 (1.4)	< 0.001	3.4 (1.3)	0.01
Causing family/household members to become sick?	4.0 (1.2)	3.7 (1.3)	0.001	3.8 (1.2)	0.02
Colleagues (other OR staff) becoming infected with COVID-19 due to transmission from an OR patient?	3.9 (1.2)	3.4 (1.2)	< 0.001	3.6 (1.1)	0.002
An infected but asymptomatic patient causing a COVID-19 outbreak due to having surgery or anesthesia?	4.1 (1.0)	3.9 (1.1)	0.002	3.9 (1.1)	< 0.001

Values represent 5-point Likert scale scores and are presented as mean (standard deviation).

P values are from paired *t* tests. Most (112/116, 97%) respondents were vaccinated. Among the vaccinated, most (84/112, 75%) had received two doses at the time of the survey.

OR = operating room

causing hospital outbreaks). Vaccination of healthcare workers in British Columbia occurred while ID NOW was being used, so respondents were also asked to recall their degree of worry prior to vaccination but after ID NOW was introduced. Even accounting for vaccination, the use of ID NOW significantly reduced worry about asymptomatic surgical patients causing disease (see Table 3). While worry decreased after introducing ID NOW and after vaccination, absolute levels of worry were still prominent, particularly regarding worry about causing family to become sick (mean [SD], 3.7 [1.3] on a five-point scale) and about asymptomatic but infected surgical patients causing hospital outbreaks (mean [SD], 3.9 [1.1]).

#### *Changes in management when a positive ID NOW COVID-19 result is encountered*

Among respondents who had been involved in a case where a patient received a positive ID NOW COVID-19 result preoperatively (37/121, 31%), most (28/37, 76%) indicated that the test result changed the way the patient was managed. In an open-ended question regarding how management was changed when a positive ID NOW test was encountered, the most common change was to upgrade the type of precautions used in the OR (mentioned 19 times), delay or cancel the case (mentioned 10 times), and redoing the test (mentioned 6 times).

During the pandemic, RCH OR staff were encouraged to follow the BCCDC Infection Prevention and Control Protocol for Surgical Procedures<sup>17</sup> in selecting PPE. This protocol not only provides guidance based on patient screening status (generally, droplet precautions for “green”, airborne precautions for “yellow/red”), but also allows for some personal latitude in terms of choosing PPE. Most respondents use droplet precautions (87/130, 67%) or standard OR attire (39/130, 30%) when the patient presented to the OR for general anesthesia with no symptoms or risk factors for COVID-19 (screened “green”). When asked how they would prepare if the patient screened “green” but had a positive ID NOW COVID-19 test result, the majority (97/130, 75%) would use more PPE, with most (92/130, 71%) opting for airborne precautions. In interpreting these results, it is important to note that some respondents (e.g., OR aides) are not routinely present in the OR during aerosol-generating procedures and rarely require airborne precautions.

#### Qualitative responses

Respondents were asked in an open-ended fashion *How has the use of ID NOW affected patient care, provider satisfaction, or efficiency?* Full comments are tabulated in ESM eAppendix 2 and summarized by theme in Table 4. There were many comments regarding increased sense of safety and some comments indicated that screening took some time while preparing patients for the OR (Table 4).

#### Discussion

This descriptive mixed-methods cross-sectional study assessed the value of point-of-care COVID-19 testing to surgical teams, with respondents including nurses, anesthesiologists, and surgeons. We found that the use of rapid testing made the OR feel safer, improved team performance and morale, increased confidence in screening, and reduced worry surrounding COVID-19. Qualitative responses indicated that surgical providers felt a sense of relief and reassurance that an additional layer of protection was implemented. Healthcare workers were satisfied with ID NOW COVID-19 testing and supported its continued use during the pandemic, despite minor increases in workload and disruptions to OR flow. Our findings suggest that point-of-care COVID-19 testing for a largely asymptomatic preoperative population is feasible to implement and has various benefits for surgical staff, including improved sense of safety and morale.

The COVID-19 pandemic has considerably affected the mental wellbeing of healthcare providers. It has been associated with increased subjective burden and stress, mood symptoms, and subsequent burnout.<sup>13,14,21,22</sup> Examples of institutional measures that were perceived to improve mental health included strict protective procedures to increase workplace safety, knowledge of virus prevention and transmission, and the ability to offer rapid COVID-19 testing.<sup>23–25</sup> Many point-of-care COVID-19 tests are currently being validated and implemented in hospitals, with the goal of identifying cases early and reducing transmission.<sup>26,27</sup> Similar to prior studies, our

**Table 4** Responses to the question *How has the use of ID NOW affected patient care, provider satisfaction, or efficiency?*

	Number of responses (N = 73)	Representative quote
<i>Positive comments</i>		
Increased COVID risk awareness/PPE choices	17 (23%)	<i>I felt safe providing care for patient and felt confident making a decision on choices of PPE when caring for patient</i>
Increased staff safety/protection	15 (21%)	<i>ID NOW has provided me with a greater sense of safety during the pandemic.</i>
Sense of relief/reassurance for staff	14 (19%)	<i>... When the ID NOW machines came to the OR, I felt like finally public actually cared about us and wanted to make the place safer</i>
Important tool/efficient, fast testing	13 (18%)	<i>It is not perfect but it is another tool we can use to fight back against the pandemic...</i>
<i>Critical comments</i>		
Surgical delays	13 (18%)	<i>...takes longer and more staff to screen, delays time to enter OR</i>
Time consuming	7 (10%)	<i>Another layer of safety, downside is time. It is only 15 mins but in the OR that is valuable.</i>
Decreased OR efficiency	4 (5%)	<i>In some cases has decreased OR efficiency because we are waiting for results before proceeding with a scheduled procedure.</i>

Number of responses indicates the total number of times the response was mentioned (% of all free texts responses given).

OR = operating room; PPE = personal protective equipment.

results showed that rapid testing has various limitations, including lower sensitivities and interruptions in normal clinical workflow.<sup>28,29</sup> Despite these shortcomings, we found that most frontline OR staff were satisfied with the use of this tool and that point-of-care testing increased feelings of safety and morale.

The surgical environment is a potential source of COVID-19 transmission in the hospital via direct patient contact, contaminated droplet production, and aerosol-generating procedures such as intubation and open airway suctioning.<sup>30–32</sup> Consequently, the implementation of protective measures is important from a public health standpoint. Our findings suggest that, with point-of-care testing, surgical staff have increased confidence in the choice of PPE and precautionary measures, especially in emergent cases when the COVID-19 status may be unknown. Furthermore, asymptomatic infections in the surgical population can have implications not only for the perioperative staff, but also for patient morbidity.<sup>33</sup> Undetected COVID-19 cases can lead to negative postoperative outcomes in patients, including higher postoperative mechanical ventilation rates and increased perioperative morbidity and mortality.<sup>34–36</sup> In our survey of OR staff, respondents felt that point-of-care testing made the OR safer for both staff and patients since high-risk patients could be identified and managed accordingly. While the outcomes of the two true positive patients detected by the ID NOW during the trial period were not specifically broadcast to the OR staff, most were likely aware of these cases. Knowing that a point-of-care test was able to detect two instances of asymptomatic patients, who then proceeded with increased precautions and isolation, and then went on to develop symptoms postoperatively, may have influenced OR staff satisfaction with the ID NOW.

Our study has a few notable limitations. The data come from a single centre, and as a result may not be generalizable to other settings where the perioperative workflow, staffing levels, and existing COVID-19 protocols differ. Furthermore, general hospital safety protocols were frequently changing in a rapidly adapting pandemic environment. This may have created confounding variables that affected the subjective sense of safety and levels of worry in healthcare providers. For example, rollout of the vaccinations against COVID-19 started during our study period. We attempted to control for staff vaccinations by asking respondents to recall how they felt prior to vaccination, which is limited by recall bias. Another limitation is that this study only examined perceived safety, as surveyed at a single point in time. Actual safety (e.g., reduction in nosocomial spread and outbreaks) was beyond the scope of this study. The sense of safety experienced by medical professionals and the role that point-of-care testing might play is highly subjective

and likely varied in time, particularly as disease prevalence waxed and waned during the pandemic. Ultimately, the sensitivity and specificity of the ID NOW performed well in detecting potentially infectious COVID-19 patients;<sup>11</sup> considering only NP tests with low Ct values (indicative of clinically important infectiousness) as positive and requiring two positive ID NOW results to be considered positive, the test performed with 100% sensitivity and 100% specificity. Nevertheless, the diagnostic test characteristics in a largely asymptomatic preoperative population were unknown at the time. The discovery of two asymptomatic preoperative SARS-CoV-2-positive patients through ID NOW testing likely influenced provider satisfaction and morale. Nevertheless, it is unclear exactly how much healthcare workers trusted the test results during the trial period.

As the COVID-19 pandemic continues, it is important to employ strategies that maintain the physical and mental wellbeing of hospital staff. While diagnostic test characteristics are essential to the design of testing policies during the pandemic, consideration for healthcare worker morale and burnout prevention should also play a role. Our findings support rapid point-of-care testing as a tool that can increase a sense of workplace safety, improve morale, and reduce worry associated with COVID-19. We found that point-of-care testing is feasible in the perioperative setting without major impediments to workflow. This approach may also be useful in other environments with high urgent patient turnover, including the emergency department and obstetrical wards.

**Author contributions** Susan M. Lee, Paula Meyler, Michelle Mozel, and Tonia Tauh contributed to all aspects of this manuscript, including study conception and design; acquisition, analysis, and interpretation of data; and drafting the article. Jonathan Choi contributed to the interpretation of data and drafting the article.

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