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Healthcare understanding of COVID-19 antibody ☆

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ABSTRACT

Objective: : The SARS-CoV-2 pandemic has shed light on the difficulties in spreading uniform information. We rely on national and international organizations to provide scientifically accurate information to the public at large. With so many different sources of information, often not scientific, there appears to be an incomplete understanding of many aspects of SARS-CoV-2 infection. We sought to gain information about healthcare worker understanding of the implications of a positive serum COVID-19 antibody test result. We identified a broad range of responses among all categories of healthcare workers in our facility. Most notably we found that there was not complete understanding that there can be asymptomatic spread of COVID-19 infection.
Methods: : We provided health literacy and opinion questions to the healthcare workers of our facility.
Results: : Upon analysis of the data, we identified many differences in level of understanding among our healthcare workers.
Conclusion: : We identified a lack of consensus on important details leading to potentially growing uncertainty with respect to SARS-COV-2 antibody. A diminished health literacy with respect to antibody testing could potentially suggest future issues with understanding the importance of vaccination benefits.

Introduction

Many questions have arisen in light of the new viral pathogen, SARS-CoV-2 (COVID-19) being introduced to the human population. With hope waning that the pandemic could be controlled with social distancing measures, the next steps for the Public Health system were to be able to determine the true prevalence of disease. In theory, it was felt that this would help governments make decisions about returning to normal life. The Johns Hopkins University Center for Global Health Security has carefully outlined information about COVID-19 serology or antibody testing. Questions raised include: which is the most accurate antibody test to use, is there a specific antibody level that correlates with immunity and if so, how long does immunity last [3]. The concept of an immunity passport has even been raised as a way to "clear" someone to return to work [5].

Since vaccines have become available, the question initially arose as to whether to vaccinate those with a positive antibody. At present the recommendations are to provide vaccination to all citizens who wish to receive it regardless of prior infection status due to concerns for waning immunity after infection. Hepatitis B is a model for using antibody status

as a determiner for when post exposure prophylaxis or vaccination is needed [10]. There has been confusion in interpreting the antibody levels with Hepatitis B with respect to understanding who qualifies for vaccination. The Centers for Disease Control has provided guidance to assist healthcare workers about the different variations of serology results, and the correct interpretation of Hepatitis B serologies [8]. It is notable that initially the same confusion had arisen with Sars-CoV-2 antibody test results, especially since quantitative testing is not readily available. There is a reduction in levels of neutralizing antibodies in 2–3 months [6]. This would suggest a decrease in natural protection occurring after that time frame. Vaccination has continued in a schedule put forth by the CDC, but there is also considerable hesitancy on the part of many people with respect to safety and potential side effects of a new vaccine. Among the healthcare worker population who have previously been infected, some feel that they do not need to be vaccinated as they will have long lasting natural immunity.

According to the CDC, asymptomatic or presymptomatic transmission is well documented. The risk of transmission from asymptomatic patients appears less than from symptomatic patients, but it is not zero. For example, in the Singapore study, the risk of secondary infection was

approximately 4 times higher among contacts of symptomatic patients versus asymptomatic patients. In order to reduce community transmission of SARs-CoV2, the CDC recommends partnering with public health practitioners, healthcare providers, pharmacies, employers, and faith leaders. The CDC repeatedly recommends promoting high vaccination coverage rates, along with rigorous mitigation strategies (masking, distancing, improved ventilation, and disinfection) along with appropriate quarantine and isolation practices, in order to prevent and control outbreaks in high risk settings [14].

Review of literature

With SARS-CoV-2 infection, total antibody levels have been shown to increase within 2 weeks after symptoms develop as seen with other viral infections [7]. After a viral infection, antibodies are produced and of those, some of them are neutralizing and can offset the infectivity of the virus [9]. High titers of SARS-CoV-2 IgG detected by ELISA have been correlated with the presence of neutralizing antibodies [13]. In a review of SARS-COV-2 diagnostic tests, PCR testing and antibody testing timeline was reviewed showing the IgM and IgG tests can become positive as early as 2 weeks, overlapping with positive PCR testing for a few weeks [11]. There are many commercially available molecular assays, including rapid tests which should mean that the time for result is less than one hour. There is variable false negativity [4]. There is no defined national protocol available for which test to use, and even less information available about comparison of results. Within the same healthcare system, employees may obtain lab testing from different locations based on their insurance. These tests may not be comparable. Despite the numerous available tests and studies looking at the presence of different antibody value ranges, the actual degree and duration of protection conferred by a positive SARS-CoV-2 antibody is felt to be approximately three months.

From our own personal experience working with SARS-COV-2 infected patients, we understand the significant psychological impact that the SARS-CoV-2 pandemic has had on healthcare workers at all levels. This has been seen with prior Infectious Disease outbreaks such as SARS (Severe Acute Respiratory Syndrome) [16]. In a paper looking at the psychological impact on healthcare workers caring for patients with SARS, about 10% of the respondents had experienced high levels of posttraumatic stress symptoms since the outbreak had begun [16]. We feel that some of the stress with respect to our current pandemic may be due to a lack of understanding of the pathophysiology of

SARS-CoV-2 with respect to testing and understanding what result suggests immunity.

The purpose of this study is to gage the understanding of healthcare workers about antibody testing. The antibody test has two components, SARS-CoV-2 IgM for acute infection and SARS-CoV-2 IgG which typically indicates immunity. We can take the information we glean from this study and potentially apply it to the general population to direct educational resources to ensure understanding of the SARS-CoV-2 viral testing and implications of results.

Methods

We distributed a questionnaire to employees of Broward Health Medical Center, a large teaching hospital, between the dates of March 9, 2020 and May 30, 2020. Questionnaires were distributed to all willing employees. These were employees involved in both direct patient care and those who did not have hands-on patient care. Both groups worked in the hospital. We identified these as health care and non-health-care workers. We contacted the head of each department to assess the best time to meet with the largest number of people in each department. The surveys were handed out to the group and handed back to the researcher when completed. Also, questionnaires were handed out to those who, when asked, stated they had not received a questionnaire previously.

The questionnaire consisted of 12 questions with 3 main sections:

occupation and work history, literacy questions regarding knowledge about COVID, and opinion questions regarding stress level and future antibody testing. This questionnaire was created collectively by the authors with questions designed to obtain information about the employee work status and general knowledge about antibody testing. This information was based in part on our prior understanding and knowledge of Hepatitis B screening questions [8].

The different departments were categorized into groups: Category B1 (administration, clinical education, and epidemiology), Category B2 (radiology tech, respiratory therapy, and phlebotomy), Category B3 (occupational therapy, speech therapy, dietitian, and physical therapy), Category B4 (ARNP provider, nurse practitioner, and PA provider), Category B5 (unit secretary and pharmacy). Environmental services, nursing, nurse assistant, physician, resident, and transportation were all separate groups. There was a separate analysis completed with grouping into two categories. Category 1 consisted of occupations with direct patient contact (ARNP provider, dietitian, environmental services, nurse, nurse assistant, nurse practitioner, occupational therapy, PA, phlebotomist, physical therapy, physician, radiology tech, resident, respiratory therapy, speech therapy, transportation, and unit secretary). Category 2 consisted of occupations without direct patient contact (administration, clinical education, epidemiology, and pharmacy).

Hypothesis testing for associations between job category and answers was performed using Pearson's Chi-squared test or Fisher's Exact test, as appropriate. The percentage correct among literacy questions (for which percentage correct as a designation would be valid) was calculated, and a Kruskal-Wallis Test with follow up was performed for each categorization scheme.

We received 389 completed questionnaires of 500 that had been distributed. In an effort to diminish selection bias and increase the number of completed surveys, we waited while the respondents completed the questionnaires so we could collect them. There may still have been selection bias with those more interested in research more likely to respond to the questionnaire. with the following category breakdown: 25 from Category B1 (administration, clinical education, epidemiology), 35 from Category B2 (radiology tech, respiratory therapy, phlebotomy), 20 from Category B3 (occupational therapy, speech therapy, dietitian, physical therapy), 12 from Category B4 (ARNP provider, nurse practitioner, PA provider), 23 from Category B5 (unit secretary, pharmacy), 19 from environmental services, 109 from nurses, 29 from nurse assistants, 53 from physicians, 40 from residents, and 24 from transportation. The analysis which grouped responders into patient care and non-patient care locations did not yield any statistically significant differences so the remainder of the results will use the aforementioned category scheme.

Survey questions

COVID-19 SURVEY
SARS-CoV-2 is the virus that causes COVID-19 infection.
Did you work any day at this hospital between March 9 and May 30, 2020? Yes _ No _

1. **Do you know what a COVID-19 serum antibody result (IgM or IgG) measures?**
   ○ Yes
   ○ No
   ○ Don't Know
2. **A positive COVID-19 serum IgM antibody result indicates that a person is currently infected with COVID-19.**
   ○ Yes
   ○ No
   ○ Don't Know
3. **Do you believe that a positive COVID-19 serum IgM antibody means you have protection against becoming infected?**
   ○ Yes

○ No
○ Don't Know

4 **Would knowledge of a positive COVID-19 serum IgM antibody result in you feeling less stress about contracting COVID-19?**
○ Yes
○ No
○ Don't Know

5 **A positive COVID-19 serum IgG antibody result indicates that a person has previously been infected with COVID-19.**
○ Yes
○ No
○ Don't Know

6 **Do you believe that a positive COVID-19 serum IgG antibody means you have protection against becoming infected?**
○ Yes
○ No
○ Don't Know

7 **Would knowledge of a positive COVID-19 serum IgG antibody result in you feeling less stress about contracting COVID-19?**
○ Yes
○ No
○ Don't Know

8 **Can a person have asymptomatic infection with COVID-19?**
○ Yes
○ No
○ Don't Know

9 **When it is available, do you plan to be tested for COVID-19 antibody levels?**
○ Yes
○ No
○ Don't Know

10 **If an antibody result is positive, do you know how long immunity lasts?**
○ Yes
○ No
○ Don't Know

11 **Do you have immunity to Hepatitis B?**
○ Yes
○ No
○ Don't Know

12 **What is your position in the hospital:**
○ Physician
○ Physician Assistant
○ Nurse
○ Nurse Assistant
○ Occupational Therapist
○ Speech Therapist
○ Unit Secretary
○ Phlebotomist
○ Administration
○ Pharmacy
○ Environmental Services
○ Transportation
○ None of the above

Results

Literacy questions

Question 1**: Do you know what a COVID-19 serum antibody result (IgM or IgG) measures?**

There was a statistically significant association ($p < 0.0001$) when considering all categories, with physicians and residents selecting "yes" at higher rates (92% and 90% respectively) compared to the overall sample (56%).

Question 2*:* **A positive COVID-19 serum IgM antibody result indicates that a person is currently infected with COVID-19. Correct answer identified as YES**

There was a statistically significant association ($p < 0.0001$) when considering all categories, with physicians and residents correctly selecting "yes" at higher rates (58% and 80% respectively) compared to the overall sample (36%).

Question 3: **Do you believe that a positive COVID-19 serum IgM antibody means you have protection against becoming infected? Correct answer identified as: Do not know**

Regarding Question 3, there was a statistically significant association ($p < 0.0001$) when considering all categories, with Categories B1, B2, B3, and B5 selecting "yes" at higher rates than the overall sample (36%) while residents and transportation selected "yes" at lower rates.

Question 5: **A positive COVID-19 serum IgG antibody result indicates that a person has previously been infected with COVID-19. Correct answer identified as: Yes**

There was a statistically significant association ($p < 0.0001$) when considering all categories, with physicians and residents correctly selecting "yes" at higher rates (92% and 93% respectively) compared to the overall sample (70%).

Question 6: **Do you believe that a positive COVID-19 serum IgG antibody means you have protection against becoming infected? Correct answer: Yes (without specifying period of time).**

There was a statistically significant association ($p = 0.0006$) when considering all categories with environmental services and transportation correctly selecting "yes" at lower rates (5% and 4% respectively) compared to the overall sample (22%).

Regarding Question 6, there was a statistically significant association ($p < 0.0001$) when considering all categories, with environmental services and transportation selecting "yes" at lower rates (21% and 17% respectively) compared to the overall sample (37%).

Question 8: **Can a person have asymptomatic infection with COVID-19? Correct answer identified as Yes**

There was a statistically significant association ($p < 0.0001$) when considering all categories, with environmental services and transportation correctly selecting "yes" at lower rates (47% and 21% respectively) compared to the overall sample (87%).

Regarding Question 8, there was a statistically significant association ($p = 0.0004$) when considering all categories, with Category B3 selecting "yes" at higher rates (80%) and transportation at lower rates (21%) compared to the overall sample (63%).

Question 10: **If an antibody result is positive, do you know how long immunity lasts? Correct answers identified as No/Do not know**

There were two "correct" answers here, which was designated as No/Don't know. Since the time this survey was completed there is more of an understanding that immunity lasts for approximately 90 days. However at the time the survey was completed, this information was not well established.

Question 11: **Do you have immunity to Hepatitis B? Correct answer identified as Yes or No**

There was a statistically significant association ($p < 0.0001$) when considering all categories, with physicians and residents selecting "yes" at higher rates (87% and 98% respectively) and transportation at lower rates (42%) compared to the overall sample (70%).

Summary and review of findings

When grouping the literacy questions together, Physicians and Residents answered correctly at significantly higher rates compared to the majority of other categories while Transportation were more likely to have answered correctly at significantly lower rates. The physicians and residents may have been receiving more training with respect to this topic.

Nurses had low knowledge with only 21% knowing that positive IgM means current or recent infection (Fig. 2). This is a low percentage compared to what we would have expected from them based on their clinical work and level of clinical training.

A larger number of respondents than expected did not know that a positive COVID- IgG indicated prior infection (Fig. 4). This included both health-care workers and non-healthcare workers.

With respect to the question asking if COVID-19 IgM or IgG provides protection, a clarification question to those who answered in the affirmative would be to query how long the protection is expected to last (Figs. 3, 5).

When asked if an asymptomatic person can spread COVID-19 infection, we did not expect to have so many respondents answer either Do Not Know or No (Fig. 6). This highlights an important area which may be impacting the uptake of mask wearing as a universal precaution. While at work masks are mandated, however it would be interesting to ask how many of the respondents do not feel it necessary to wear masks outside of work if they are without any symptoms.

It was expected that people would not know how long immunity would last if an antibody result was positive, and in fact only a few answered yes to this question (Fig. 7). The correct answer was defined as no or don't know. Non patient care location staff all answered correctly except one person (Category A2 superior to A1). We found it interesting that anyone answered yes, with affirmative responses higher in environmental services and nurse assistant groups.

A large number of nurses and nurse assistants did not know their Hepatitis B antibody status despite their patient care responsibilities and associated risk of exposure (Fig. 8). In the nursing group (25%) and (50%) of nursing assistants did not know if they were immune - notable because of close patient contact. Overall 30% of frontline workers did not know their immune status. Hepatitis B immune status is typically something asked or tested for at the time of employment.

It is possible that participants felt that obtaining a serum antibody test would result in some consequence at work such as limiting their work options. This was not stated to be true but may have been assumed and affected the response.

For participants who have previously tested SARS-CoV-2 positive, they may have also felt some concern in stating that they would want an antibody test. While this questionnaire was anonymous there could have been an inference that results from this could result in some policy development with respect to testing.

Opinion questions

Question 4: **Would knowledge of a positive COVID-19 serum IgM antibody result in you feeling less stress about contracting COVID-19?**

Question 7: **Would knowledge of a positive COVID-19 serum IgG antibody result in you feeling less stress about contracting COVID-19?**

There were similar responses to the questions asking about stress associated with knowledge of IgM and IgG. Only 36% of the patient care group would feel less stress with knowledge of IgG. Within that group, 17% of transportation and 21% environmental would feel less stress. This lower stress level may possibly have been because they had less understanding about what the antibody level means.

Question 9: **When it is available, do you plan to be tested for COVID-19 antibody levels?**

Review of this data shows that overall more non-patient care than patient care personnel would be tested. It was a small difference and not statistically different. Within the patient care group, there was overall high interest except with transportation who were least likely to say yes to testing (21%) followed by Physician extenders (B4) at 42%

It is notable that only slightly more than half of physician/nurse categories would opt in for antibody testing, but the ancillary patient care groups (B3) most likely.

People who were identified as being more literate in the subject matter were more likely (60%) to plan to get the antibody test when offered. Those with less literacy were not as likely (20%). People are presented with a lot of information but feel overwhelmed by it and do not know what it means. Depending on the education level, a person may not be able to process the information presented. Transportation/Environmental in general chose "Don't know" frequently.

Additionally, people with increased knowledge may realize that there is not a clear understanding of what a positive antibody test signifies.

Discussion

Dr. Amesh A. Adalja, at Johns Hopkins University, states healthcare workers should be held to a higher standard because of their knowledge and firsthand experience with COVID-19 infections [1]. However, in our study certain groups of healthcare workers did not know the meaning of results of serum antibody tests (Fig. 1). In particular, that positive serum IgG antibody represents previous infection and may mean strong protection. Physicians, nurse practitioners, and physician assistants, all correctly selected yes at higher rates compared to the overall sample identifying that a positive IgG indicates previous infection and could mean you have protection. Environmental workers and transportation workers were more likely to be incorrect. Other groups placed in the middle. Also, the majority of healthcare workers knew that you could have infection and remain asymptomatic. Environmental workers and transportation workers had a minority of correct responses.

The most plausible explanation is that these various groups do not all share the same awareness, knowledge or literacy. This may be because they do not have equal access to adequate health information or there may be a lack of understanding of it. Maintaining up to date medical knowledge depends on having time to review, and having access to trusted, consistent or actionable health information, which could be delayed in publications or even lacking, such as in the early stages of SARS-CoV-2 infection [1].

Conclusion

In summary, physicians and residents knew the most regarding what serum antibodies mean. This was not surprising because of the different levels of health literacy. In contrast, the Environmental and Transportation employees knew the least regarding what serum antibodies mean. Health literacy takes into account the ability to receive healthcare, understand health information and take personal steps to better self care. "Health literacy has emerged over the past three decades as one of the strongest psychosocial determinants of health, and it has also been shown to explain a range of health disparities" [15].

Improving health literacy may be achieved through better communication skills and educational programs, taking into consideration a healthcare worker's ability to process data and understand science. It would be important to take into account their intellectual honesty. For example, consider the amount of evasion needed to refuse vaccination by a healthcare worker [1]. Communication, tailored to specific groups, should be very specific and it should focus on adherence to mitigation strategies via emails from administration and leaders; video messages; virtual Town Hall meetings; and possibly include mandatory requirements for employment.

Being told that risk of transmission to others from persons with positive antibodies, either from previous infection or vaccination, is unknown, should be a key impetus for continuing to practice protective measures. Such measures or prophylactic behaviors in public settings could include masking, social distancing, avoiding crowds, handwashing and disinfecting. These measures alson with vaccination, are our best bet for a slow but sure return to normalcy.

Having a strong understanding of a medical condition is considered one of the strongest psychosocial determinants of health. With this in
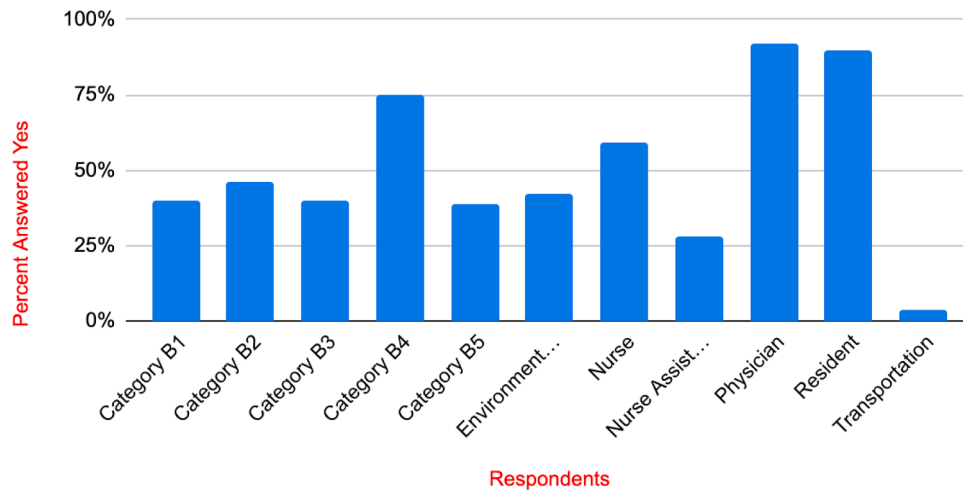
Fig. 1. Question 1: Do you know what a COVID-19 serum antibody result (IgM or IgG) measures?.
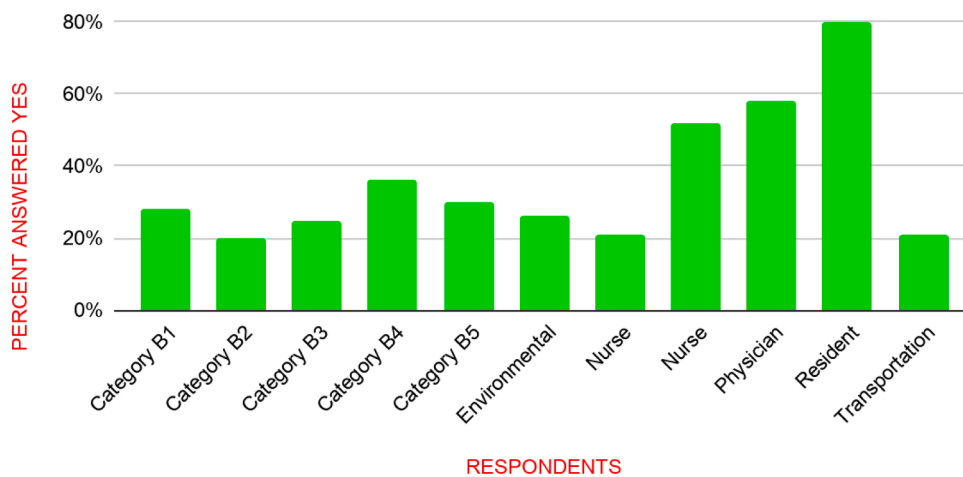

Fig. 2. Question 2: *A positive COVID-19 serum IgM antibody result indicates that a person is currently infected with COVID-19. Correct answer identified as YES.*
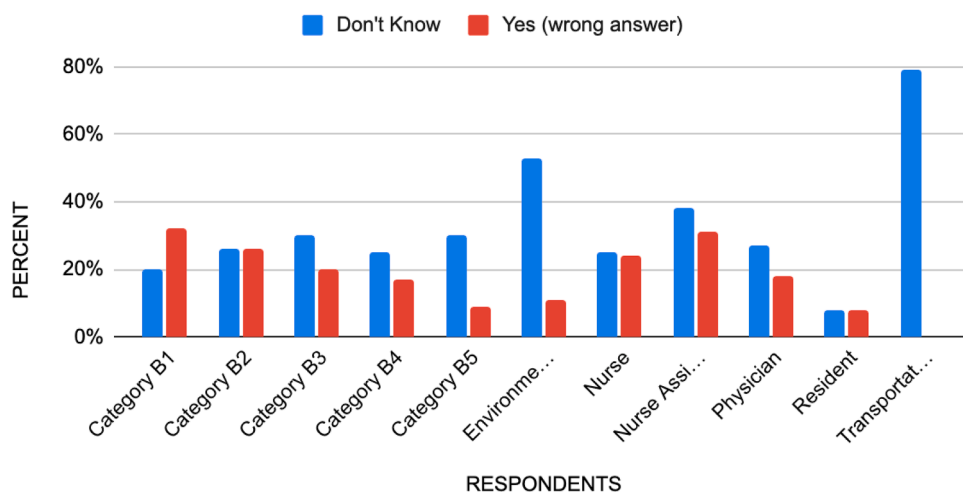

Fig. 3. Question 3: Do you believe that a positive COVID-19 serum IgM antibody means you have protection against becoming infected? Correct answer identified as: Do not know.

mind, we can take into account our survey respondents' wide range of health and literacy disparities and the variations in responses to our survey. As stated by Wolf, et al., those with "low health literacy were less likely to believe that they might become infected." In the case of this COVID-19 outbreak, it can be argued that there were mixed messages regarding the severity of illness and the effectiveness of certain mitigation measures such as mask wearing, particularly from the Federal Government. Interestingly, "individuals with low health literacy
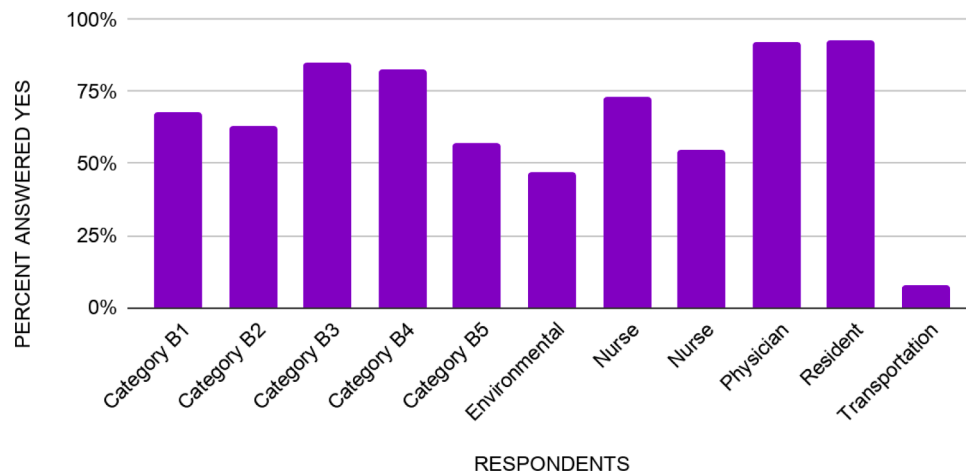
Fig. 4. Question 5: A positive COVID-19 serum IgG antibody result indicates that a person has previously been infected with COVID-19. Correct answer identified as: Yes.
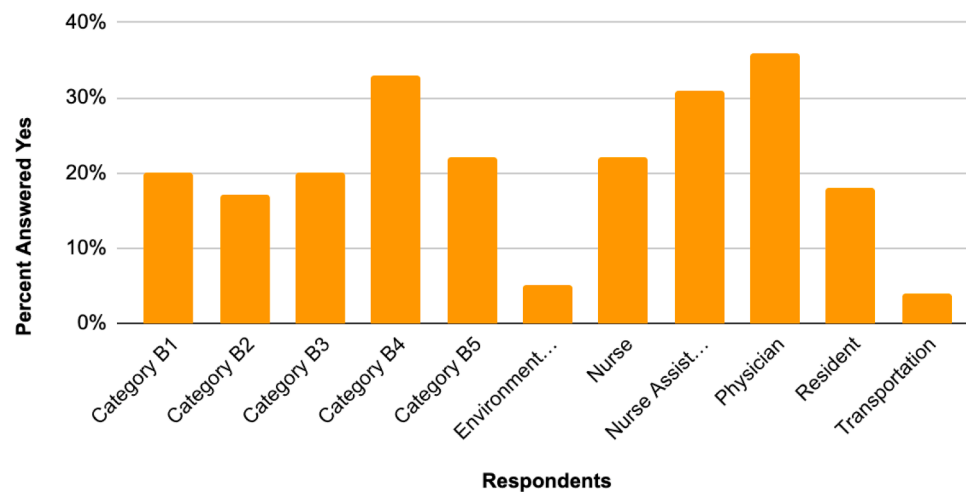

Fig. 5. Question 6: Do you believe that a positive COVID-19 serum IgG antibody means you have protection against becoming infected? Correct answer: Yes (without specifying period of time).

reported not only being less prepared but also having more confidence in the federal government response" [15].

The majority of the participants who took the survey indicated they would get serum antibody tests, however, nurse practitioners, physician assistants, and transportation employees would not get serum antibody tests at as high a rate as others (Fig. 11). On the one hand, improving health literacy through better communication skills and education may increase the number of participants' willingness to get serum antibody tests. However, the willingness to have serum antibodies tested was not confirmed to be based on health literacy, raising the question as to what is the basis of this behavior? Why do some get the serum antibody tests and others do not? The difference may exist because knowledge of serum antibody status does not seem to uniformly ameliorate stress during this pandemic in our group of respondents. One reason for this is that there are knowledge gaps with respect to antibody testing. Also, titer levels are not widely available and therefore it is unclear what level of protection a person has after infection. "Some patients appear to have weak or undetectable If a positive antibody to HBsAg means you're protected from acquiring seroconversion" [2]. There are many unanswered questions with respect to the clinical utility of antibody testing along with our inability to easily access this test outside of a research setting.

HBV infection, might that thought process have some utility with respect to SARS-CoV-2 infection? Granted, none of the available tests

used to detect SARS-CoV-2 antibodies are as specific to indicate protection as is the presence of HBsAb. There is generally no agreed upon best test for measuring antibodies with neutralizing activity. But eventually, the research community will determine which one of the more than 100 serological tests are the most specific and best correlate with protective immunity. In the meantime, we should pursue programs in order to improve our literacy of SARS-CoV-2 infection, with respect to asymptomatic infection and the need for isolation. This would ultimately increase the level of protection for us and for others around us.

Stress during the COVID-19 pandemic is affected by different variables as described in a survey on awareness and attitudes related to COVID-19: personal sense of seriousness of disease threat, concerns about risk of contracting the disease, how illness would affect daily life, how prepared one feels able to handle the illness along with governmental preparedness [15]. It is important to identify and understand what aspects of stress a person feels susceptible to. "Beyond increasing risk for addiction or suicide, physicians with untreated mental health disorders provide lower quality of care, reduced productivity, and reports of lower work satisfaction" [12].

Among our respondents, only 36% percent indicated they would feel less stress with antibody testing (Figs. 9, 10). We do not know all details of the significance and benefit of a positive antibody for certain but would suspect that the presence of a positive antibody may indicate

previous exposure in the absence of vaccination which was unavailable at the time of the survey. This may indicate that the individual had an asymptomatic or uneventful infection with the COVID virus. The hepatitis B model is a successful parallel viral infection against which the use of antibody testing could be modelled.The limit of this is though is the uncertain knowledge as to what level of antibody titer confer immunity in COVID 19. In our study, but for the practicing professionals, many other respondents had little specific knowledge of their own hepatitis B immunity status. Most of the respondents are likely to be immune given the necessity to show immunity to Hepatitis B as a condition of employment in the hospital. One would think that if one had knowledge of a positive antibody test, especially if said individual was unaware of having had COVID infection, that it would lower the feeling of stress around the issue of COVID but in the study this was not borne out. Across all the groups the relationship between a positive antibody test and lowered stress was inconsistent. More information about the actual predictive value of an antibody test may allow more individuals to have a more positive view of the antibody test and would more consistently garner more interest in the test.

In this study we sought to obtain a deeper understanding of healthcare worker knowledge regarding COVID-19 antibody testing. We divided our questions into Health Literacy and Opinion questions. The most surprising results among all the questions asked was the lack of uniform affirmative response to the literacy question: **Can a person have asymptomatic infection with COVID-19** (Fig. 6)**?** There have been numerous media stories, advertisements and social media postings informing the population that there can be asymptomatic spread of COVID-19. Environmental services and Transportation were the groups that were least likely to answer that question in the affirmative. Possibly the lower than expected affirmative response in the more clinical group as to whether asymptomatic spread occurs may have been related to the evolving information available in the literature regarding the virus, its pathophysiology and lifecycle and spread; especially at the time of the survey. More clinically trained professionals tend to rely on academic dissemination of information to inform their position and knowledge rather than media sources. The paucity of clear data may have influenced the answers provided despite extensive media attention. Groups with the highest medical professional degrees had the most knowledge regarding antibodies. However, having even a small number from any of the other categories, including physicians and nurses, we felt was a concerning finding. Future research and larger sample sizes will provide additional information. COVID-19 and our understanding of it is evolving, and therefore this paper can be considered a live document, with many changes that occur in opinions and knowledge of COVID-19 by healthcare workers.

The question becomes whether we can postulate that a lack of literacy is associated with decreased compliance with mitigation measures. With respect to the question asking about knowledge about Hepatitis B immunity, there was a surprisingly large number of front line at risk workers who did not know their immune status (Fig. 8). Overall 30% of frontline workers did not know their immune status. This may be a result of incomplete education or importance given to hepatitis B immune status, despite its importance in planning post exposure prophylaxis. Since issues around Hepatitis B and immunity are generally mandated by the employer it does not require the individual to have personal literacy or knowledge regarding Hepatitis B. The employee may depend on clearance by the Employee Health Department to work according to the Employer's policy. These policies are being directed through risk management and OSHA rules. Therefore individuals are not incentivised to be aware of their immunity status. The same may hold true in the future for COVID-19 infection.

If healthcare workers are not completely aware of asymptomatic transmission of COVID-19, we understand that the general population would not be fully aware either and this would be an area where significant public health education may be directed. How can we expect people to be compliant with mitigation measures if they do not understand the disease and how it spreads? We would also seek to understand whether there is a benchmark for what number or percentage would represent acceptable Literacy level. Can we postulate that literacy is associated with compliance or lack of compliance with mitigation measures? We do believe this statement to be true. Therefore, how can we expect people to be compliant if they do not understand the disease and how it spreads? Many people rely on media reports for their information. It would be beneficial for such organizations to spend increased time explaining the pathophysiology of the disease. The school system is another area where this information should be taught. It is unclear when this pandemic will end and an all hands on deck approach is needed, starting from the youngest in our society to the oldest.

Conflict of interest statement

The authors declare that there is no conflict of interest.
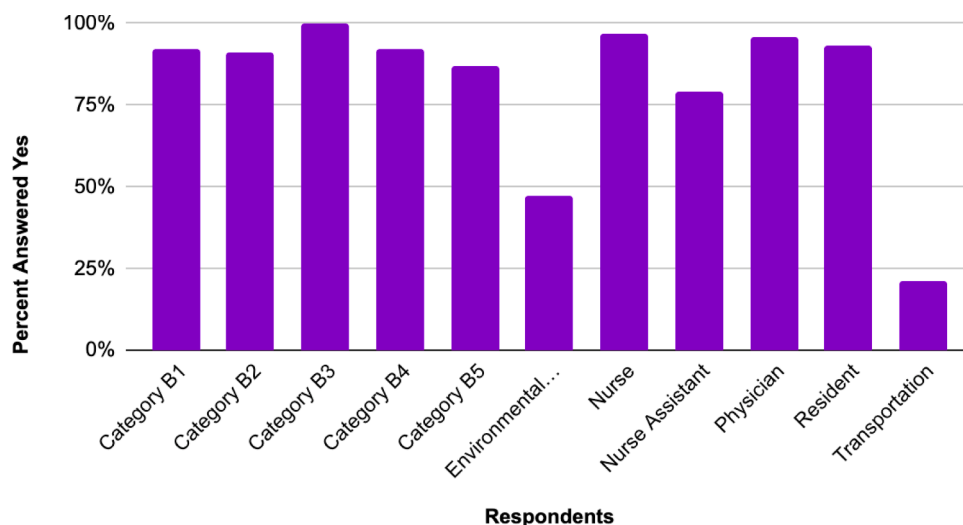
Funding

None.

Fig. 6. Question 8: Can a person have asymptomatic infection with COVID-19? Correct answer identified as Yes.
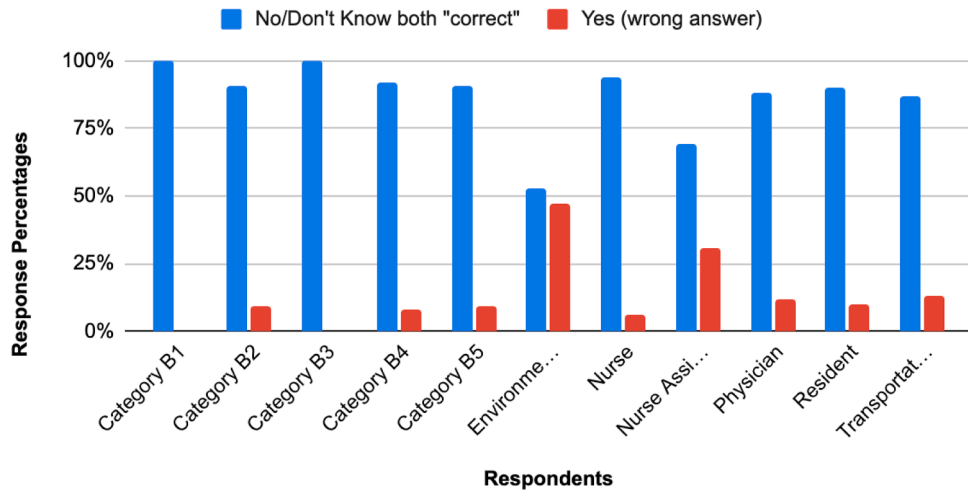
Fig. 7. Question 10: If an antibody result is positive, do you know how long immunity lasts? Correct answers identified as No/Do not know.
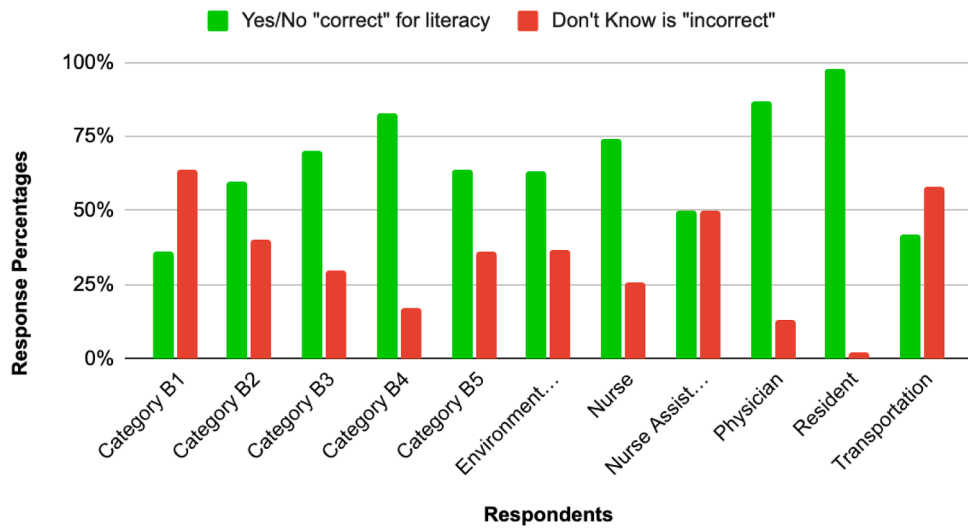

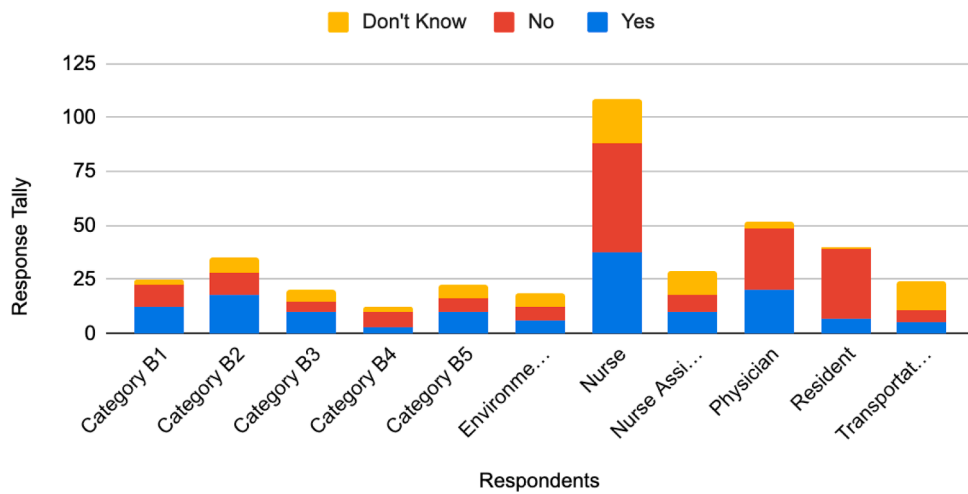**Fig. 8.** Question 11: Do you have immunity to Hepatitis B? Correct answer identified as Yes or No.

Fig. 9. Question 4: Would knowledge of a positive COVID-19 serum IgM antibody result in you feeling less stress about contracting COVID-19?.
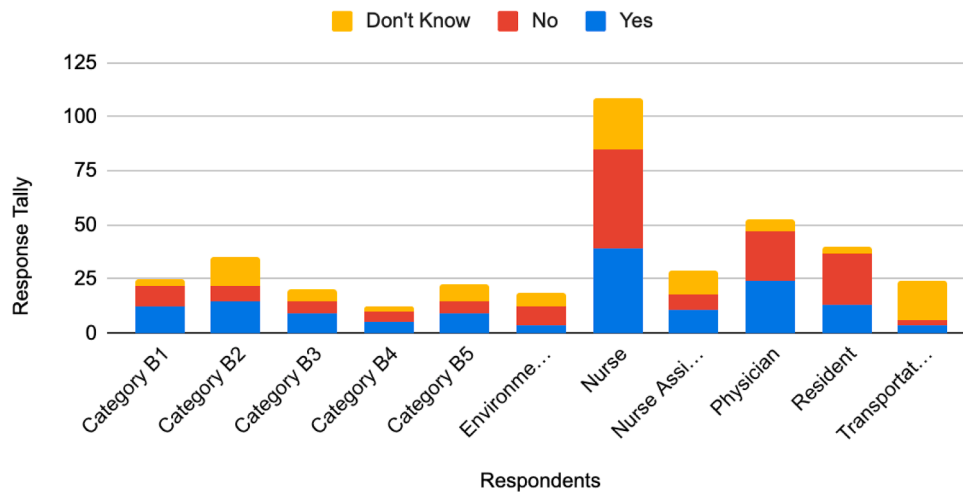
Fig. 10. Question 7: Would knowledge of a positive COVID-19 serum IgG antibody result in you feeling less stress about contracting COVID-19?.
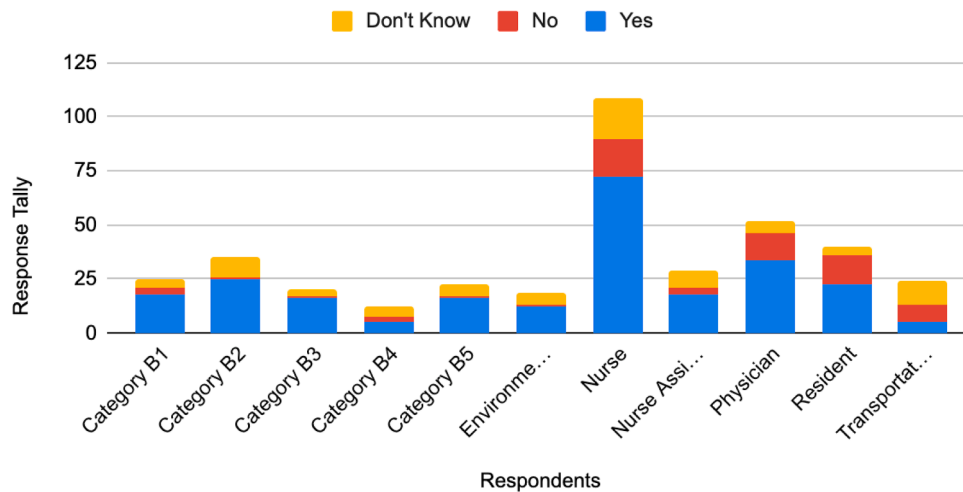

Fig. 11. Question 9: When it is available, do you plan to be tested for COVID-19 antibody levels?.

Ethical approval

Obtained from the Broward Health Medical Center Institutional Review Board

Patient consent

Not required

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