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# Online Cheating in the Registration of Unsupervised Rapid Antigen Test Results

**Dr Donald O. Besong**
*(Data Scientist)*
*An independent researcher and*
*member of the Alumni of Imperial College London,*
*England*

**Abstract**

If there are not too many candidates for rapid antigen tests compared to the number of medics available (let's term this as a *mild scenario*), candidates can scan their results or share live videos of their test with medics [2]. These methods are already being used by various providers of rapid antigen tests [2], which is a valid way to verify candidates' test results for mild scenarios.

Now imagine the adverse scenario where urgent unsupervised tests are needed for mass evacuation and isolation, attending work and meetings or travel (let's term this as an *adverse scenario*). In this scenario, there would be too many candidates for testing [2].

Rapid antigen tests from an approved company [1] are sufficiently accurate, and their clinical validity is beyond the scope of this paper. This study is only concerned with the online registration of results. However, the abovementioned scanning/video registration methods would be impractical in the above-defined adverse scenario. This is because scans and videos require the availability of medics. When the lockdowns were lifted, we faced an adverse situation. Expert companies in this field stepped in to help. For instance, HCA [14] partnered with Healgen [20] so that candidates could register their test results via a Web portal. However, there was no mechanism to verify whether or not candidates cheated. Therefore, the reporting phase of an unsupervised test in an adverse scenario is open for cheating: if a candidate's result was actually positive, or if they did not take the test at all, they can still register a negative outcome with 100% success on the online portal [2].

In this paper, I convince the reader that there may be a hugely lucrative area of online cheating – the registration of unsupervised rapid antigen test results. I also propose a potential artificial intelligence (AI) solution, as well as a novel creative solution which I am already working on in my next paper.

**Keywords:** online cheating; registration of lateral flow test results; COVID software; COVID misinformation; unsupervised tests; antifraud COVID testing

## INTRODUCTION

### The Phenomenon of Cheating in Online Tests

There is a vast literature exploring cheating and deception. Becker [8] was the first to discuss the rationale of individuals who perform illegal acts.

Online academic cheating related to the COVID-19 crisis has already been studied. Researchers conducted a nationwide online assessment throughout Germany by contacting students through an official mailing list [3]. The study was conducted by asking students whether they had cheated in online exams during the COVID-19 pandemic to compare the numbers to prepandemic statistics. Researchers also carried out a similar survey on Turkish university students to determine the common types of e-dishonesty among undergraduates. These were found to include fraudulence, plagiarism, falsification, delinquency, and unauthorised help. The second part of that research work was a factor analysis to determine the reasons students cheated in online tests. These were identified as individual factors, institutional policies and peer pressure [5].

This manuscript is solely about mechanisms for the reporting or registration of unsupervised COVID test results obtained from rapid antigen test devices. Particularly, it discusses the adverse scenario where intended users of test kits might cheat by simply reporting their desired results. I hope that if this discussion catches on, there will in future be one more category to the list of topics depicted in *Figure 1* below, namely, *reporting/registration of test results*.

There are several papers on online cheating. However, these are only about cheating in online academic exams. For instance, statistical methods have been used to compare students' grades in proctored online tests with those from unproctored situations. Proctoring was done using online proctoring software. The results found that the proctored tests produced higher overall results and were completed within shorter times. This is because whenever an online exam is proctored, students do not spend valuable time scouring the Internet for answers [5]. There has also been research that examines the association between attitudes on cheating and cognitive moral development [6].

One of the most interesting manuscripts on this subject presented evidence of cheating that took place in online examinations during COVID-19 lockdowns [7]. In that paper, they mentioned that one of the methods that online proctoring tools have used

to detect if a student has cheated is access logs, which would flag a student who answers a question correctly in too short a time necessary for that question. They emphasise that the student should not know the strategy used in the proctoring tool. Had they known, they would have most likely submitted their answers in a longer time period so that their access log would look perfectly 'normal' [8].

Hussein et al. [9] carried out an extensive comparative study and evaluation of tools used to combat online cheating (online proctoring tools). ProctorU, Kryterion, Respondus, BVirtual, AIProctor, ProctorU Open Source, Examity and Proctorio were among the tools evaluated in the study [9]. The functionalities evaluated were grouped into the following:

1. proctoring features (human–proctor availability, data transfer encryption, proctor management, recorded review, automated proctoring, incident logs etc.)
2. lockdown features (browser lockdown, computer operations lockdown, keystroke alerts etc.)
3. authentication options (facial recognition, photo comparison, keystroke analytics, biometrics etc.)
4. webcam features (camera view angles, panning etc.)

The studies in those papers are not related to COVID-19. The only reason the 'COVID' keyword appears in those manuscripts is coincidental – referring to the pandemic period.

This paper therefore outlines its differences from previous research on online cheating in *Table 1*, hence necessitating this study.

**Table 1.** Comparing this paper to previous work on online cheating.

| | **Cheating in Online Academic Tests** | **Cheating in Reporting Unsupervised Rapid Antigen Test Results** |
|---|---|---|
| Literature | In [9], as well as many others | none |
| Where keyword 'COVID' comes in | Pandemic period | The actual clinical aspects of the disease and the clinical test |
| What is tested | Knowledge of university modules | Presence of COVID antigens |
| Answers sorted on the Web portal | Knowledge of university modules | 'Infected' or 'not infected' |
| What to cheat on | Knowledge of university modules to achieve better grades | The desired infection status which is often 'not infected' |

| | **Cheating in Online Academic Tests** | **Cheating in Reporting Unsupervised Rapid Antigen Test Results** |
|---|---|---|
| How to cheat on Web portals so far | Googling answers to questions and copying the answer to the portal, hiring someone who is more apt to give correct answers | Simply choosing the desired status, e.g. 'not infected' on the portal |
| how to counter cheating | Using software that detects whether other programs or browser tabs are open on the student's computer, using identification tools, as well as many other proctoring tools | Not yet done; this manuscript proposes a new solution |
| Examples of software to counter cheating | Universities use third-party vendors: Proctortrack, Software Secure, and ProctorU | None; this manuscript proposes a new solution |

*Table 1* shows that online academic exams differ from COVID-19 testing in many aspects, especially the way online cheating may be achieved.

The Internet is currently used in the field of medicine. Paul et al. described how the Internet is being employed in multicentre clinical trials to facilitate data collection [18]. Although Paul et al. [18] mentioned Internet security as an issue (also discussed in [19]), they did not mention online cheating since the data in clinical trials are entered by dedicated medical professionals at medical centres (i.e. in randomised clinical trials). My paper purports that the aspect of data validity should inspire various software solutions for the registration of unsupervised rapid antigen test results during serious pandemics such as the adverse scenario described earlier.

The problem of online cheating in clinical settings (particularly unsupervised rapid antigen tests) has not yet been addressed in previous papers and is the subject of this study. The closest subject has been about attitudes towards academic online testing [3]–[10] and many others. However, this paper will convince the reader that academic online testing has little or no resemblance to clinical testing and that the proctoring methods of the former cannot be used in the registration of COVID test results in the adverse scenario.

There is therefore no research work conducted about cheating in the online registration of unsupervised rapid antigen test results.

**Why a candidate might deliberately register a fake result**

Any member of civil society is aware of the ridiculous abundance of misinformation surrounding COVID-19. On 10 June 2020, the European Commission published its communication on disinformation related to the COVID-19 crisis, urging platforms to do more to combat fake content online [10]. Despite such efforts, misinformation about this virus still abounds. In February 2022, a panel of American doctors organised a free event where they discussed the unique responsibility of doctors in combating misinformation about COVID-19, covering the role of social media algorithms in exacerbating such a problem [11].

During an unsupervised rapid antigen test, there are several reasons why a candidate might simply report any desired result without actually taking the test. In the most familiar case where the desired result is negative, here are a few reasons why a candidate might not take the test seriously:

1. Although they might believe that COVID-19 is a reality, they might still believe that their immune system is too strong.
2. They might not believe that the virus exists.
3. They might believe in the conspiracy theory that the swabs are contaminated.
4. They might simply be lazy or too busy.

Whatever the case may be, these candidates still wish to travel for holidays, attend work, or be present at events. Therefore, some might register fraudulent negative results.

**How test results are currently registered**

During unsupervised rapid antigen tests, once the user has completed their test, they must register their result. Let us assume that all clinical criteria concerning the devices are met. There are several ways that test results are currently being registered (or reported):

**Table 2.** Registration of test results.

| Method | Use case | Comments |
|---|---|---|
| 1. Medic administers test on candidate and directly reads off and logs the result. | Test administered by medic either in the lab or in candidate's home. This is a supervised test. | Report is most reliable. Practical if there are many medics relative to the number of candidates. |
| 2. Medic reads off remote candidate's scanned test device. Examples of suppliers offering this option are Cerulean Health Ltd [12] and Confirm Testing [13]. | Test performed remotely at home by candidate. | Report can be as reliable as in method 1. Practical if there are many medics relative to the number of candidates. |

| Method | Use case | Comments |
|---|---|---|
| 3. Medic supervises test on live video and logs the result. An example of suppliers offering this option is Cerulean Health Ltd [13]. | Test performed remotely at home by candidate, supervised on video. | Report can be as reliable as in method 1.<br>Practical if there are many medics relative to the number of candidates. |
| 4. Candidate registers result by selecting 'positive' or 'negative' from an option box provided on a Web portal. An example of suppliers using the method is HCA [14]. Several people in my business circle including myself have personally done tests for back-to-office purposes on this platform. | Test performed remotely at home by candidate, completely unsupervised. | Requires complete trust of candidate. Practical if there are too many candidates relative to available medics such that supervision is inapplicable. However, a lot of candidates cheat. |

Remember that our concern is method 4 in *Table 2*, where there needs to be a massive number of tests performed on short notice.

Also take note that for the scanning of rapid antigen test strips (method 2 in *Table 2*), I believe the test strips have unique identification numbers that are also verified to make sure that the candidate does not reuse test strips. I have not personally performed tests using this method but believe that this is already the case.

**Possible Solutions**

Several strategies to tighten the registration of results in unsupervised testing could come to mind for adverse scenarios (see *Table 3* below):

**Table 3.** Registration of test results.

| Solution | Comment |
|---|---|
| 1. Medic administers test on candidate and then directly reads off and logs the result, or reads off remote candidate's scanned test device. | Not feasible because of the high number of candidates as defined in the adverse scenario being discussed in this paper. |
| 2. Candidate's scanned test device interpreted using artificial intelligence/image recognition. | This could be an interesting tool to develop. However, this could also be quite involved, possibly coupled by its computational overhead, probabilistic error and scalability issues. This method is worth investigating. |

| Solution | Comment |
|---|---|
| 3. Candidate reports the values they read from their test device but does not know what those values mean. | This only involves producing test strips having either of two different configurations. This can be easily upscaled if one more letter is added to the face of the well to have three different configurations. A database is needed, which is a trivial matter. As for the Web portal, an existing portal such as that used by HCA [22] can be modified and used. |

## MATERIALS AND METHODS

The abundance and multiplicity in diagnostics/testing research has led to numerous competitive players on the market. The European Commission has done a great job to publish a list of recognised producers of rapid antigen test kits [1].

The European Commission has agreed on several clinical criteria for any manufacturer's test to be valid [1]. The Therapeutic Goods Association (TGA) [15], part of the Australian government, goes further by imposing criteria on software or apps for use with COVID-19 rapid antigen self-tests intended to analyse and enable the interpretation of test results [15]. The software addressed by the TGA are classified as medical devices and therefore beyond the scope of my manuscript. This distinction is implied in TGA's paper when they stated that 'Software that is used simply for registration, viewing, recording of results and tracking, or for generation or update of a digital health record, would not be a medical device and so would not be regulated by the TGA'. My paper only discusses the recording of results and is therefore not about medical devices. Neither does this paper concern itself with clinical procedures or accuracy of COVID testing.

*Figure 1* below shows the proportion of each of the various topics under which coronavirus publications are classified [16].

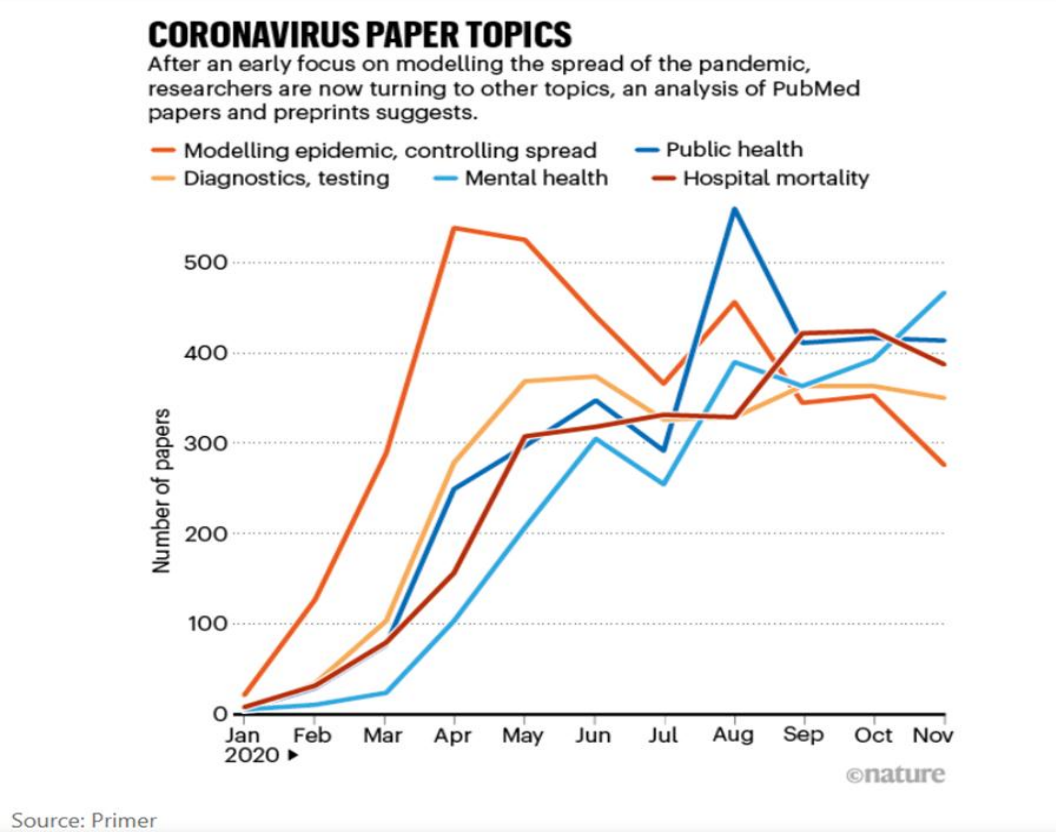


**Fig 1.** Coronavirus topics, courtesy of *Nature Magazine* [16]

A close look at *Figure 1* from an article in *Nature Magazine* [16] shows that the subject of the online registration of COVID test results has not been addressed.

Studies have found that in emergency hospital settings, rapid diagnosis and isolation of SARS-CoV-2 patients are required [17]. In such settings, a rapid turnaround time is critical. Timely and accurate testing for SARS-CoV-2 plays a crucial role in limiting the spread of the virus [17]. However, the work in [17] only concerns itself with clinical accuracy, and I could not find a paper that examines the reporting layer of these tests.

## RESULTS AND CONCLUSION

*Table 1* reveals that online academic cheating is completely different from the reporting of unsupervised COVID tests. The differences are multifaceted (see *Table 1*). At the same time, a major leader in scientific research [16] showed that the subject of registration software that discourages or eliminates cheating after unsupervised COVID tests has not been explored in the literature (this research gap is also emphasised by the information in *Table 1*).

Since this paper is geared towards a good understanding of the fact that the registration of results after unsupervised rapid antigen tests has not been studied and written about and that there are no known methods to combat cheating in an adverse pandemic scenario, it is best to present this section in the form of a Q&A. The reader should read this section in the manner that suits them: they may want to respond to the questions without peeking at the correct answer. The reader might also want to formulate their own questions and send them to me with or without answers.

**1.** Describe some of the methods used by online proctoring tools to detect academic cheating and discuss how similar methods have been applied to detect or discourage cheating during the reporting of unsupervised COVID test results. Please consider a scenario where there are too many candidates relative to the number of medics so that the results need to be determined entirely by the software.

Answer:

- Identification software in online academic exams [9]: This includes fingerprint and iris scanners. These have not yet been applied in unsupervised rapid antigen testing though I wonder if they would add any value.
- Webcam features [9]: In principle, this is similar to methods 2 and 3 from *Table 2*. Therefore, this has already been used to report results in unsupervised rapid antigen tests for the mild scenario. The reader should consult *Table 2* to understand why these methods are irrelevant in the adverse scenario defined earlier.

**2.** Relevant to this paper, why should microbiology researchers and students examine various existing products (e.g. software) that are integrated with clinical products within their area of research?

a. To seek employment

b. To improve the existing integrated products

c. To spy on competitors

d. None of the above

Answer: b.

To improve the existing integrated products. I have used various test kits [2] that led me to realise that there are no mechanisms in reporting portals to combat cheating after an unsupervised COVID test is completed.

**3.** Assume a serious pandemic caused by a COVID-19 strain. Is there any mechanism to discourage or reduce cheating in the reporting/registration stage of the unsupervised test?

a. Yes, the Web portals that are currently used for answering ‘negative’ or ‘positive’ can serve the purpose in any scenario.

b. No, but there are research papers proposing AI/image recognition processes that companies can readily implement.

c. No, but there will never be such a need again in the future.

d. No. This is the issue that this paper and another study [2] discussed. I am convinced that research is needed in this area.

Answer: d.

No, this is the issue that this paper highlights. The curious reader is urged to further read on this [2] and to contact companies such as HCA [2] if they can collaborate to implement a marketable solution.

**4.** Assume a serious pandemic caused by a COVID-19 strain. That is, in a pandemic scenario where urgent mass evacuation/isolation or the familiar back-to-office scheme is necessary [2]. How can an existing method already being used in registering unsupervised rapid antigen test results be adapted to manage an overwhelming number of candidates?

a. By installing CCTV cameras in most houses and using method 3 in *Table 2* (live video sharing).

b. By training more medical personnel to read and register scanned test strips using methods 2 in *Table 2* (test strip scans).

c. By creating image recognition/artificial intelligence programs that detect positive and negative results from scanned test strips that candidates register using methods 2 in *Table 2* (test strip scans).

d. There is no way existing techniques can be adapted for this scenario.

Answer: c.

By creating image recognition/artificial intelligence programs. Every test strip should have a unique identification number that is scanned together with the result. Artificial Intelligence (AI) should then recognise the image of a positive as well as negative result. Therefore, this would not require medical staff, and hence, the method is suitable for serious epidemics as defined in the question. Bansal et al. used image recognition on CT scan images of SARS-CoV-2 positive and negative patients and observe promising predictions [21]. Although CT scanning requires the presence of medics, the AI technique in the study may be transferable to unsupervised rapid antigen tests that would require no medical staff since it is trivial for candidates/patients to scan their own test strips.

**5.** Please state two take-home conclusions or findings from this research work.

Answer:

- There is currently no software for the reliable registration of completely unsupervised rapid antigen test results, and this problem has not yet been addressed in science journals. Literature on academic online cheating does not discuss any form of COVID testing.
- Creating software programs to detect cheating in the online registration of

completely unsupervised rapid antigen test results might offer a new lucrative area for research and software development.

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