

# COVID-19 self-testing, a way to “live side by side with the coronavirus”: results from a qualitative study in Indonesia

**Catherine Thomas**

Peduli Hati Bangsa

**Sonjelle Shilton** (✉ [sonjelle.shilton@finddx.org](mailto:sonjelle.shilton@finddx.org))

Foundation for Innovative New Diagnostics

**Caroline Thomas**

Peduli Hati Bangsa

**Claudius Mone Iye**

Peduli Hati Bangsa

**Guillermo Z. Martínez-Pérez**

Foundation for Innovative New Diagnostics

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## Research Article

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# Abstract

**Background** Alongside mass vaccination for COVID-19, sustainable decentralized SARS-CoV-2 screening strategies are needed to empower local communities and help them contribute to health authorities' efforts to end the pandemic in low- and middle-income countries. Indonesia is among the nations with an overstretched health system that may benefit from technological innovations such as SARS-CoV-2 self-testing to detect asymptomatic cases and interrupt the transmission of the virus to healthy individuals.

**Methods** In mid-2021, we conducted a qualitative research study with the aim of understanding key decision-makers' values and preferences regarding the implementation of COVID-19 self-testing in Indonesia. This research received ethics approval from the Universitas Katolik Indonesia Atma Jaya and used a thematic comparative analysis approach to explore the insights expressed by healthcare workers, representatives of civil society, and potential self-testing implementers in three geographies: Jakarta, Banten, and North Sulawesi.

**Results** Thirty semi-structured interviews and six focus group discussions were carried out. As per the informants' narratives, the Indonesian public might accept self-testing as a tool that will help them test for COVID-19 at their own convenience. Concerns were expressed about the possibility of the public doubting the reliability of self-testing kits if these were not properly regulated and if counterfeit kits were known to be on the market. Fear of stigma, isolation, and clinical care costs were perceived to be among the drivers for self-test users to not report a reactive result. These fears might be mitigated, as per the study informants' opinions, by awareness raising, passing of regulations, and participatory engagement of a range of community actors, such as village officers.

**Conclusions** Decision-makers consider self-testing a to-be-welcomed screening tool that could contribute to ensuring earlier access to treatment and decrease transmission of SARS-CoV-2 in Indonesia.

## Background

COVID-19 disease is caused by the novel SARS-CoV-2 virus, first identified in Wuhan, China, in December 2019 [1]. On 11 March 2020, the World Health Organization (WHO) declared COVID-19 a global pandemic [2]. Providing decentralized case screening is an effective way to detect infected carriers early and help halt the transmission of SARS-CoV-2. Screening using rapid, point-of-care (PoC) diagnostics allows to trace at-risk contacts, to isolate infected individuals, and to accelerate access to treatment where necessary.

PoC diagnostics include portable real-time reverse transcription polymerase chain reaction (RT-PCR) machines [3], professional rapid antigen tests (RATs) [4], and self-testing devices for lay people [5, 6]. Of these, PoC RT-PCR is the most accurate but expensive and dependent on the availability of trained personnel, optimal reagents supply, and specimen collection systems [3]. RATs are a more affordable and deployable option than RT-PCR [4], although their utilization is also difficult where there is a dearth of healthcare workers or where these workers are overburdened with their existing duties. Indonesia is

among those LMICs where the provision of mass screening to the entire territory, especially so for populations living in hard-to-reach areas, is not feasible.

Research in Indonesia has already demonstrated the acceptability of self-testing for HIV among men who purchase sex [7] and for hepatitis C virus among people who live with HIV and people who use injectable drugs [8]. Similar research is necessary to understand the populations' values around SARS-CoV-2 self-testing (hereafter referred to as "self-testing"). Self-testing can assist people who cannot access facility-based testing to know if they are infected and thus help prevent further transmission.

Self-testing has not yet been broadly adopted in all LMICs. For example, as of January 2022, regulatory authorities in Brazil were discussing the regulation of self-tests for public use [9]. Further evidence is needed for LMICs to uptake self-testing in a safe and effective way. Mapping stakeholders' views and perceptions are crucial steps to inform the design of strategies for implementing self-testing. To tackle this dearth of evidence, we conducted this qualitative research to assess decision-makers' values in relation to SARS-CoV-2 self-testing to diagnose and prevent the spread of SARS-CoV-2.

## Methods

This study followed the methodology proposed by Kielmann et al. [10] for conducting qualitative investigations in LMIC settings. The research was conducted Jakarta, Banten province, and North Sulawesi with the aim of obtaining representations from individuals exposed to different socio-cultural and economic environments.

This qualitative research was conducted alongside a larger, population-based survey conducted in the same geographies that had the goal of assessing values around and acceptability of SARS-CoV-2 self-testing among the general publics and the healthcare workforce [11].

## Study populations

The study included: healthcare workers (HCWs) engaged in COVID-19 prevention and care; potential implementers (PIs) of self-testing programs; and representatives or spokespersons of civil society groups (RCSs). Eligibility criteria to participate in the study were that informants had be aged more than 18 years, they had to give informed consent, and they had to speak Bahasa Indonesia.

## Sampling procedures

Efforts were made to ensure maximum variation of sampling in terms of gender identity, urban and rural workplaces, and professional and institutional profiles. The study teams produced sex-disaggregated lists of at least 50 profiles per study population. To avoid convenience sampling, these lists were randomly rearranged using the RANDOM.Org® randomizer. The interviewers contacted shortlisted informants by phone, starting with the first name on each list, and provided them with information about the study's aim and procedures. Those who expressed an interest in the study were invited to participate.

# Data processing

Depending on participant preferences, data collection was conducted either using Zoom® teleconferencing software or in-person.

The data collection was led in Bahasa Indonesia by trained research assistants (CT, CM) with experience in qualitative research. The same 45-item structured guide administered in order was used for the semi-structured interviews (SSIs) and the focus group discussions (FGDs). The guide included questions around six themes: knowledge of conventional COVID-19 testing; values around self-testing; the public's preferences for self-testing delivery; safe and effective use of self-testing; actions upon receiving a reactive self-test result; and future prospects for the distribution of self-tests.

Encounters were audio-recorded and transcribed verbatim by research assistants. Transcripts were cross-checked against the recordings for accuracy and completeness then subsequently translated from Bahasa Indonesia into English.

## Data analysis

Transcripts were uploaded into Quirkos®. A thematic comparative analysis was applied [10]. Initially, all transcripts were deductively coded using a pre-defined coding scheme. Whenever emerging themes were identified, new codes were inductively created. In parallel with the coding, the analysts (CT, CT) prepared reflexive memos to control for the risk of informant bias. Iteratively with the coding, the dataset was analyzed using a four-stage approach: transcript by transcript at first; followed by a theme-by-theme, sex-sensitive comparison of coded narratives across all transcripts, then by a theme-by-theme, rural versus urban-sensitive comparison of coded narratives across all transcripts; and finally, a trans-population comparison of the key findings. Attention was paid to the memos to ensure that no informant biases from the analysts were being introduced. COREQ guidelines were considered when reporting [12].

## Ethics approval

The survey protocol received ethical clearance from the Universitas Katolik Indonesia Atma Jaya (Ref.: 0674A/III/LPPM-PM.10.05/06/2021). All informants provided written consent.

## Results

### Participants' characteristics

A total of 53 decision-makers participated in 30 semi-structured interviews (Table 1) and 6 focus group discussions (Table 2). Of these, 27 were cis male individuals and one was a trans female individual. Twenty-seven informants were based in Jakarta, and the rest were based in Banten and North Sulawesi. The majority (n=39) had completed undergraduate university studies.

### Knowledge of COVID-19 detection and testing

Vaccination and vitamin intake were mentioned by all study groups as means to prevent COVID-19 disease. No informant mentioned routine screening or testing as a means to impede further transmission of the virus that causes COVID-19. However, it was made clear that many Indonesian people seek a COVID-19 diagnosis when they travel; when they start to experience COVID-19-related symptoms or when they know that they have been in close contact with a case.

When individuals need to obtain a test, the most accessible diagnostics for them would be facility based test available in public or private hospitals, laboratories and clinics; train stations; and in the *Puskesmas* (i.e., a network of government-funded primary-level healthcare centers).

Multiple deterrents to the uptake of health professional-provided testing were identified. The fear of having to isolate which could limit their ability to earn their daily income was described as a major deterrent for testing. As one male PI from Jakarta noted, there are some people who “are grateful just being able to buy rice” and who may not want to test and risk isolation, because to them “it’s better to eat”.

In some instances, poverty may intersect with the belief that COVID-19 “does not exist” as a reason to refuse testing; this was described as not frequent, although also as “not uncommon”. No informant in this study was able to elaborate on which rumors, events, or misunderstandings could be the origins of this belief.

Another deterrent to testing that might be common to those who do not have the resources to use private testing services relates to the various health system-related inconveniences (e.g., long queues and turnaround times of results, limited testing hours and tests-per-day quotas in some facilities, and the risk involved in encountering people infected with COVID-19 in the clinic), which were described as possible reasons not to seek a test in public health facilities. Some RCSs in North Sulawesi remarked that the distance to testing sites, be they private or public, especially for those living on the islands, was a difficult impediment to overcome.

Finally, fears around stigma, “disgrace and shame”, and, as one Banten nurse explained, of “dying alone in the hospital during self-isolation”, were mentioned as deterrents that might have played a major role at the start of the pandemic. From the informants’ perspective, nowadays, fears around stigma and death are less prevalent than they were during the early part of 2020, when having COVID-19 was perceived as being like suffering “leprosy in the days of the Prophets”.

### **Values around COVID-19 self-testing**

Although some informants, including a few HCWs, thought that “COVID-19 self-testing” was a term that referred to people voluntarily seeking professional testing services and paying for them, the majority of informants were aware of the existence and availability of self-testing in Indonesia. The internet, social messaging groups, and the mass media were mentioned as common sources of information about self-testing.

Some informants reported having already used self-testing. One male PI, a branch manager in Jakarta, showed the interviewer the saliva self-tests that he stocked at home for the “fifteen relatives” who were living in his compound. Another informant, a midwife from Jakarta, explained how she herself used professional RATs for home administration:

*“My boy had symptoms like coughing at night, having a cold, and he said ‘Please examine me’. And we used Lungene<sup>®</sup>. I checked, and it was positive.”* Female, midwife, Jakarta

Self-testing is a screening approach that is seemingly endorsed by some professionals in the healthcare sector. As explained by a female nurse from Banten, self-testing was also promoted by *Puskesmas* in some rural areas. Reportedly, some neighborhood officials (e.g., youth groups, village advisory officers) received training by *Puskesmas* on how to teach villagers to self-test and to ensure that their results were reported to the local healthcare facility. Another HCW, a male physician from Jakarta, expressed that self-tests are easy to use and can be rapidly interpreted by lay people without having to rely on health services. This opinion was shared by the majority of the sample surveyed.

It was emphasized that self-testing would be beneficial for early treatment and to prevent transmission. Self-testing would enable non-infected people to test in private without needing to go to a facility where they could be exposed to people who were infected. A male RCS valued how self-testing is “the” solution to overcoming barriers to testing, as in the medium-term it will inevitably be integrated in people’s daily lives, because he perceived that society is moving toward accepting that everybody will need to live “side by side” with COVID-19.

*“I don’t believe this pandemic will end. This will continue. Finally, it will become endemic. Yes, we have to live side by side with the coronavirus.”* Male, Patient Group leader, Jakarta

Nevertheless, not all HCWs supported self-testing, mainly because of the possibility of invalid results due to user error. Other disadvantages identified by the HCWs included the challenges in reporting, recording, and monitoring of COVID-19 cases detected via self-testing. Difficulties for case tracing and the risk of false results were also mentioned by some PIs and RCSs, who also expressed doubts about the healthcare system’s preparedness to manage the increase in the number of cases that might occur if communities began to undertake widespread self-testing.

If clear pathways for reporting, tracing, and accessing care were to be provided to the target end-users of self-testing, the main beneficiaries of this strategy could be the general population (i.e., if previously sensitized) and specific groups of people who are at increased risk of COVID-19 due to their personal vulnerabilities (e.g., comorbidities, being elderly) or to the nature of their occupation (e.g., students and teachers who are exposed to many different people on a daily basis).

For the HCW informants to recommend self-testing to their communities, it was emphasized that certain prerequisites should be met, such as: the self-test kits must be used for screening and not to confirm a diagnosis; they must have high accuracy, be easy to use, and be packaged with user instructions in

Bahasa Indonesia; they must be recognized by the Ministry of Health; and they must be delivered alongside training for their target end-users. It was also noted by some PIs and RCSs that, for them to recommend self-testing to their employees and neighboring communities, the kits should be accurate, user-friendly, and health authority-endorsed.

### **Preferences for service delivery**

The Indonesian public might prefer saliva self-tests, as these are perceived as being easier, more comfortable, and less painful devices than self-tests that use other specimen types. Nasal swab or finger-prick self-tests were described as “scary”, “traumatizing”, and complicated. Due to the discomfort associated with the insertion of a swab into the nasopharyngeal cavity, some PIs suggested that these self-tests may increase the risk of user errors.

*“There are people whose swab tools have just touched the front of the nose and they won’t continue...I’m afraid they haven’t finished reading the instructions and the interpretation might be wrong, painful, and more uncomfortable to the user.”* Male, Head of Hospital Division, Jakarta

Despite these perceptions, a few RCSs and PIs expressed a preference for swab or blood-based self-tests, as they were perceived to be more accurate. Some HCWs reflected that any choice around which self-tests to use should be based on the devices’ sensitivity and specificity rather than on the specimen required.

*“If the accuracy is the same with currently available antigen swab, and the price is cheaper, I highly recommend it.”* Male, physician, North Sulawesi

There was agreement that self-tests could be made widely available at pharmacies, drug or medical equipment stores, and at *Puskesmas* sites. Also, a few informants suggested that self-tests could be made available at schools, offices, or companies. Many RCSs from the rural areas suggested that self-tests should be made available at neighborhood associations in any *Rukun Warga* (i.e., division of regions under the villages) or *Rukun Tetangga* (i.e., division of villages under *Rukun Warga*). A few PIs indicated that self-tests should be made available at any public place, such as transport terminals, stations, airports, malls, and markets. One male PI opined that the distribution could follow the distribution line of consumer goods such as “Coca-Cola and cigarettes” which was, according to him, “the widest and best-proven distribution chain”. When discussing who the distributors could be and where the distribution points should be, a concern about “counterfeit products” was raised by a few PIs, who thought that the risk of fake self-tests being made available to the public needed to be considered. To prevent acquisition of “counterfeited” kits, these PIs would not recommend buying self-tests in websites other than known “flagship stores” and those websites that receive official government permission to sell self-tests.

*“People are very creative with counterfeiting. Fake products. What needs to be anticipated is how to guarantee that the product in circulation is the original product.”* Female, Vice Principal, Banten

Irrespective of where self-tests could be accessed, it was emphasized that they should be affordable, especially for low- to middle-income groups. There was no consensus on how much a device should cost. HCWs' responses varied from IDR 25,000 (1.76 USD) to IDR 150,000 (10.57 USD), RCSs' responses ranged from IDR 15,000 (1.05 USD) to IDR 500,000 (35.05 USD), and PIs' responses ranged from IDR 10,000 (0.7 USD) to IDR 200,000 (14.02 USD).

The public's preferred location for self-testing might be their own home. Some RCSs from Jakarta suggested that some individuals might prefer to self-test at their workplace, at public transportation stations, or even at markets. Nevertheless, some HCWs were clear that they would discourage self-testing in any public space, as the procedure would require an individual to remove their mask.

*"If done in groups, in the end, instead of keeping the health protocol, we carry out risk behavior for transmission. Also, don't do it in a narrow place. And, when there are roommates, for example. Or at the office, don't hold it in meeting places. It's better to stay in your own place."* Male, family physician, Jakarta

Even if performed in their own homes, some end-users may need assistance from a third person to self-test. As explained by one trans-woman RCS from Jakarta, many transgender individuals may be illiterate and would need assistance. Some RCSs and PIs thought that supervised use of self-tests in the home could be achieved with the aid of family members, partners, or even healthcare workers. Nevertheless, like their refusal to accept that people should self-test in public spaces, some HCWs disagreed that self-testing should require any aid from a third person who might then be unnecessarily exposed to the virus (i.e., in the event that the self-tester was infected with SARS-CoV-2).

### **Supporting the safe use of self-testing**

As the risk of invalid results was voiced as a likely impediment for the HCW informants to recommend self-testing, it was suggested that staff from either private pharmacies or *Puskesmas* clinics could teach end-users how to use them. Correct usage could also be ensured, as per all groups' suggestions, through education provided by village officers at the *Rukun Tetangga*-level and by other population-recognized experts, using a wide range of formats, including video tutorials which could be uploaded to YouTube-like platforms.

User instructions should be written in non-complicated vocabulary, in a legible font size, and be accompanied by easy-to-interpret pictorials. User instructions must be inserted in each self-testing kit, and they could include QR-code links to online tutorials. User instructions should be clear about the kit's accuracy, how to use it, how to read the result, and what its expiry date and government license number is. Some RCSs also expressed that the instructions should indicate the risks involved in self-testing, in reference to the possibility of invalid results if the instructions are not properly followed. There was consensus that an explanation on what to do following the reading of the results should be a key component of the user instructions.

Reporting of a positive result could be done by going to any *Puskesmas* clinic, contacting the local COVID-19 Task Force, or using available reporting technology (e.g, hotlines, telemedicine, and tracing apps). A transgender RCS suggested that transgender individuals might report their results via trained community members, while some PIs suggested that some people might choose to report a result to their employer.

*"Maybe you can use an application from the government that has been used, such as Peduli Lindungi. Report the results directly in the application. So, everyone who accesses the place can also be notified for the test."* Female, patient group leader, Jakarta

Despite their preference for facility-based post-test counseling only, a few HCWs discussed the role that the community-based *Tim Reaksi Cepat* (quick response teams) could play in ensuring linkage to care for those self-testing positive. Although technological aids such as telemedicine apps were suggested, a few urban RCSs expressed that some of these already available aids are not always user-friendly.

*"Sometimes we get ping-ponged at hotlines. Ee call but the person talking is not the person but the machine says: 'Thank you for calling the hotline center. If you want to consult, please press 1.' Then, asked to continue: 'Press 6.' [You] press 6 and later,: 'Operator is busy, please wait."* Male, trade union leader, Jakarta

To ensure linkage to care, some HCWs emphasized the importance of the self-test users' "honesty", while some RCSs mentioned the users' "conscience". However, there were also informants in all groups who recognized that fear of isolating, hunger, and poverty might be a more compelling factor than "honesty" and "conscience" for some asymptomatic individuals who receive a positive self-test result and who might feel that they could manage the infection on their own.

### **Taking action upon receiving a reactive self-test result for COVID-19**

The psychosocial impact of a positive result may depend on the users' understanding and awareness of both COVID-19 disease and the use of self-testing as a screening (not diagnostic, as per some HCWs' opinions) tool. It was indicated that people could be either angry, in denial, worried about the result being false, afraid of being ostracized, or think that they will die soon. The HCWs thought that pre-test counseling on what to do in the event of receiving a positive result would be crucial to mitigate any such potentially harmful effects. Some PIs, emphasized that self-test users might be very concerned about how their neighbors and workmates would react. One female PI from Banten insisted that the impact may be dependent on the level of education and awareness among people in the users' environment. This view was shared by one male PI from Jakarta, a trade union leader, who expressed that the impact in the workplace might be mitigated if there are no punitive measures in place against SARS-CoV-2-infected employees.

On the other hand, the same PI stated that users who receive a positive result may also "think positively" and immediately self-isolate, try to "evacuate" their family, and inform their neighbors and co-workers.

Many RCSs also supported the idea that, if the level of awareness were high, many users would choose to self-isolate by themselves and try to obtain support from their nearest facility or via the COVID-19 hotline. One HCW stated that a factor that might encourage people to report a positive result might be the need to obtain medical clearance letter from their community leader:

*"If you want to go back to work, you must have a certificate of completion of isolation issued by the government. If you don't have that letter, you are not being allowed to work. And, if they don't report at the beginning, for example, and suddenly they get healthy and ask for the letter, the health center won't be issuing the letter: 'We didn't monitor you, why do you ask for an isolation completion letter?'"* Male, occupational medicine specialist, Jakarta

Although the notion that positive actions following a positive result would depend on the awareness of the user and those in their environment was commonplace, this notion was not shared by all informants. There were voices in all groups who doubted that users would report a positive result due to them having financial worries. Even if users did not react badly to a positive result, concerns about the costs of healthcare or fear of losing their job might be an impediment to some reporting the result.

The informants indicated that reporting of a positive result could be done directly, by going to any *Puskesmas* clinic, contacting the local COVID-19 Task Force or designated village officers, or using available reporting technology (e.g, a website, a hotline, telemedicine, or tracing app). Alternatively, a transgender RCS from Jakarta suggested that transgender individuals might want to report a positive self-test result via trained, senior peer community members, while some PIs suggested that, if self-testing ever occurred in working environments, some people might choose to report a positive result with the aid of their employer.

*"Maybe you can use an application from the government that has been used, such as Peduli Lindungi. Report the results directly in the application. So, everyone who accesses the place can also be notified for the test."* Female, tuberculosis youth group leader, Jakarta

For most HCWs, self-testing users who receive a positive result should go to their nearest testing site to receive a confirmatory diagnosis. Despite their preference for facility-based post-test counseling only, a few HCWs discussed the important role that community leaders who are members of community-based *Tim Reaksi Cepat* (quick response teams) could play in monitoring self-test users and in ensuring linkage to care for those self-testing positive. Although technological aids such as telemedicine apps or call centers were suggested as resources to assist with seeking linkage to care, a few urban RCSs expressed that some of these aids are already available and that they are not always user-friendly.

*"Sometimes we get ping-ponged at hotlines. Say, for example, we call but the person talking is not the person but the machine says: 'Thank you for calling the hotline center. If you want to consult, please press 1.' Then, asked to continue: 'Press 6.' [You] press 6 and later, there is an answer: 'Operator is busy, please wait.'"* Male, trade union leader, Jakarta

Irrespective of personal reactions to a positive result, a lack of awareness could also lead some individuals, especially those who feel healthy, to forgo preventive measures such as self-isolation, mask wearing, and social distancing. As with reporting the result, there were informants across all groups who mentioned that some individuals may not self-isolate due to economic concerns. As one informant put it: “They will die not because of COVID, but because they were hungry”. In some specific groups, such as the transgender community, self-isolation could be difficult due to the living conditions of some transgender individuals. There could be, allegedly, transgender individuals who would simply prefer to be isolated in a healthcare facility following a positive self-test:

*“For transgender friends whose home environment is not adequate, it is better not to stay at home for self-isolation. A mechanism must also be considered so that they can do self-isolation in a health facility if there are no severe symptoms.”* Trans-woman RCS, Jakarta

Challenges for self-isolation were anticipated, even for self-test users who would be willing to self-isolate. There was consensus that community support (e.g., providing three meals a day, contacting them via messaging apps, using telemedicine systems) may increase uptake and adherence to isolation.

In general, it was believed that people who received a positive result would warn their contacts. Informants explained that it was not uncommon for people in Indonesia to either announce their positive result through social media (e.g., Instagram) or inform village officials via WhatsApp about any infected household member. While there is a possibility that people using self-tests would use social media to let their close ones know that they should take a test, the fear of stigma, as per HCW and RCS narratives, would prevent many people from disclosing their infection.

*“It’s because of stigma. If, for example, they found out one house is positive in the neighborhood... the treatment they get from their neighbor... especially if they sell something, maybe food. They tend to shut their mouth, because they are worried people won’t buy their food anymore.”* Female, psychologist, Jakarta

Fear of pain from the procedure and a fear of shame when requesting self-tests were mentioned as potential barriers to demand for self-testing. Financial barriers, concerns about the kits’ authenticity and accuracy, and distribution issues (where to access the kits, especially for those in rural areas and islands) were mentioned as important barriers to demand that could be eliminated with good planning. It was suggested that HCWs be trained to teach people about self-tests; that self-tests be subsidized and made available at all *Puskesmas* sites; that the kits be packaged with proof of authenticity; and that 24-hour hotline be established. It was suggested that new government and *Badan Pengawas Obat dan Makanan* (i.e., National Agency of Drug and Food Control of Indonesia) regulations should be issued and communicated to healthcare workers at all levels, to enforce any actions needed to mitigate any barriers to demand.

The RCSs insisted that self-testing should be available in all pharmacies and that regulations on stockpiling, on distribution permits, and on medical waste management would be necessary. The PIs

suggested that, to ensure wide distribution of self-tests, it could be helpful to capitalize on structures such as local women's and neighborhoods' associations, and COVID-19 Task Forces.

Demand barriers must be tackled if Indonesia is to encourage the general population to serially self-test. To facilitate serial self-testing, some HCWs suggested that self-tests be incorporated into screening programs at *Rukun Tetangga* and *Rukun Warga*-levels, and be provided in schools and workplaces. Most PIs supported self-testing in the workplace. However, for at-work serial self-testing to be feasible, a few PIs indicated that regulations would be needed to guide their use by small-scale private companies. It was also noted that companies will need to enforce policies to protect people from being fired if they self-test positive.

## Discussion

In Indonesia, many people seek COVID-19 testing but testing facilities are overstretched. Health service-related inconveniences (e.g., waiting times, stock-outs of RATs, and daily testing quotas) are common deterrents for some at-risk asymptomatic and pre-symptomatic people to access testing. Reportedly, some individuals, including some of our informants, procure rapid COVID-19 tests from e-commerce sites and self-administer them, although these tests had not been registered as self-tests by the Indonesian health products regulatory authority (i.e., BPOM) when our data collection was carried out. In this context, our study shows that self-testing, if endorsed by health authorities and distributed alongside awareness-raising and pre- and post-test counseling, could represent an easy to use, private, and convenient solution that would be beneficial in identifying asymptomatic carriers, initiating earlier isolation and contact tracing, and, ultimately, decreasing the transmission rates of SARS-CoV-2 in Indonesia. This is in line with findings from a cross sectional survey in Indonesia which found that 62.7% of people agreed with the concept of people being able to self-test for COVID-19 [13].

No informant in our study was opposed to the potential use of self-testing. Nevertheless, there was no consensus among our informants about how self-testing should be made available to the population or about how self-test users might react following a reactive result. In this regard, all groups agreed that provisions are needed to ensure that the self-tests the population will have access to are authentic, safe, and reliable. It was frequently suggested that the population should only have access to devices approved by the BPOM or commercialized via sites (online or physical) that have been approved by the health authorities.

The issue of having a self-test recognized or legitimized by the BPOM or the Ministry of Health was described as being crucial to gain public trust. Indeed, counterfeit products in Indonesia range from cosmetics, food and beverages, software, leather goods, clothing, and even drugs, causing a loss to the national economy of IDR 65.1 trillion in 2014 [14]. Ensuring public trust in self-testing will require a substantial degree of effort, education, information, and community mobilization by health authorities.

An aspect that was voiced by some study informants was that the impact of self-testing on pandemic control will be dependent on public health stakeholders' capacity to create awareness targeted at fueling

social and community support for self-testers. Self-test users will need to be trusted as much as the self-testing devices they use. There is a need to sensitize healthcare workers, representatives of civil society groups, and implementers in public institutions and private corporations.

Sensitization efforts must emphasize the requirement to not be punitive or judgmental against or to exclude users who might be perceived as not being capable of making the best use of self-testing kits. Our informants identified myriad factors that may contribute to hesitancy for people to undergo COVID-19 testing in general which may also extend to actions post a positive self-test, such as reluctance to isolate, to warn their contacts or employers, or to report a positive self-test result. Factors identified related to contextual and structural impediments, such as poverty, hunger, and job precariousness, which will not be easy to overcome in the short-term.

A key recommendation arising from this study is the need to consider, as essential decision-makers involved in the rollout of self-testing, community-based agents such as neighborhood groups, youth groups, and village officials at *Rukun Tetangga* and *Rukun Warga*. These agents know first-hand the difficulties faced by the people they support. Due to their empathy, therefore, they may become important front-line actors in the monitoring and support of the proper use of self-testing and in the event of receiving a positive result. In practice, *Puskesmas* clinics might be considered crucial, as they could play a coordinating role between agents from community and public health authorities.

There were HCW informants who perceived that there may be the possibility of user errors; challenges in case reporting; and psychosocial ills following a positive result. In line with this, the distribution of self-tests cannot achieve a successful outcome without educating the public. Education about COVID-19 self-tests, as well as case monitoring, was recommended to be performed in the conventional way (e.g., reporting through *Puskesmas* or neighborhood leaders) and also through the use of telemedicine. Currently, a telemedicine website and the Ministry of Health website have warnings for the public about the risks of using a self-test at home [15, 16]. With the rise in telemedicine in Indonesia, several free apps have been made available for self-isolating patients [17].

Interestingly, a few informants expressed that self-testing may become the “norm” if the epidemiological landscape changes and Indonesians begin to think that they will need to start living alongside COVID-19. It must be noted that, in this study, narratives about the social and economic impact of the pandemic had more weight in the informants’ appreciation of self-testing as a decentralized screening approach than narratives around the morbidity and mortality caused by the disease. There was a unanimous voice in terms of making COVID-19 self-testing kits as affordable as possible. Financial shocks during the pandemic caused people to prioritize their basic needs over COVID-19 testing and isolation, even in the presence of symptoms. One report suggested that, under the most extreme prediction, the poverty rate in Indonesia will increase to 12.4%, indicating that more than 8.5 million people in Indonesia will become impoverished [18]. Public health measures cannot be effective if people’s economics and ability to meet their basic needs are not considered.

Our study has some limitations. The informants were recruited from different geographies, and we pursued diversity with regard to gender identities, location, and socio-professional and institutional profiles. However, this was a qualitative inquiry, and our decision-makers' perspectives may not be representative of all possible opinions in Indonesia. Our findings offer themes and insights that might be characteristic of the specific groups represented in our study. Additionally, it must be noted that social desirability bias may have occurred, as this is commonplace in qualitative research involving group discussions. Also, some data collection encounters were performed via teleconferencing software. The content of encounters conducted online and in-person was not different; however, it must be acknowledged that it is easier to build rapport with interviewees during face-to-face encounters. A final concern is that, with the availability of RATs via e-commerce sites in Indonesia at the time of conducting of the study, the informants might have conflated insights into the self-administration of professional rapid tests and devices marketed as self-tests as identical approaches.

In conclusion, this qualitative study involved different profiles of decision-makers who would be involved in the recommendation, distribution, and implementation of SARS-CoV-2 self-testing in Indonesia. These individuals described how the Indonesian public might accept this innovative screening tool, not only to test for COVID-19 at their own convenience and hence know their status but also to protect their close ones, stop the onward transmission of the virus to other individuals, and help them make decisions about how to continue with their routine economic activities and not jeopardize their households' economies, in ways that would not add further risks to the community. With a proper regulatory framework, training of healthcare workers, and engagement of communities, the decision-makers involved in this study considered SARS-CoV-2 self-testing a screening tool to be welcomed, which could contribute to ensuring earlier access to treatment and decreasing the transmission of SARS-CoV-2 in Indonesia.

Table 1  
Sociodemographic profile of the semi-structured interview participants

No	Population	Location	Gender	Age	Education level; Profile
1	Representative of civil society	Rural	Female	27	Undergraduate; Muslim youth leader
2	Representative of civil society	Rural	Female	22	Undergraduate; teacher in non-formal education
3	Representative of civil society	Rural	Male	53	Undergraduate; Catholic men's leader
4	Representative of civil society	Rural	Male	72	Undergraduate; leader of a teacher's association
5	Representative of civil society	Rural	Female	28	Healthcare and housing coordinator for orphans and poor people
6	Representative of civil society	Urban	Female	36	Elementary school; program director of an NGO for victims of human trafficking
7	Healthcare worker	Urban	Male	39	Postgraduate; expert in occupational medicine
8	Representative of civil society	Urban	Male	38	Undergraduate; patient community leader
9	Representative of civil society	Urban	Male	46	Undergraduate; trade union leader
10	Representative of civil society	Urban	Female	40	Undergraduate; national coordinator of a sex worker network
11	Healthcare worker	Rural	Female	41	Undergraduate; physician
12	Healthcare worker	Rural	Male	29	Postgraduate candidate; physician
13	Healthcare worker	Rural	Male	51	Postgraduate; physician
14	Healthcare worker	Rural	Female	49	Undergraduate; head nurse
15	Healthcare worker	Rural	Female	48	Undergraduate; head of a communicable disease department at a community health center
16	Healthcare worker	Urban	Female	39	Undergraduate; clinic head
17	Healthcare worker	Urban	Female	39	Undergraduate; laboratory analyst
18	Healthcare worker	Urban	Male	37	Undergraduate; physician
19	Healthcare worker	Urban	Male	49	Undergraduate; physician
20	Healthcare worker	Urban	Female	37	Undergraduate; nurse

No	Population	Location	Gender	Age	Education level; Profile
21	Potential self-testing implementer	Rural	Male	50	Undergraduate; telecommunication company general manager
22	Potential self-testing implementer	Rural	Female	47	Undergraduate; school principal
23	Potential self-testing implementer	Rural	Male	39	Undergraduate; owner of a tile distribution business
24	Potential self-testing implementer	Rural	Male	38	Senior high school; drug rehabilitation center program manager
25	Potential self-testing implementer	Rural	Female	40	Undergraduate; vice principal of an elementary school
26	Potential self-testing implementer	Urban	Female	38	Postgraduate; vice academic director of a university
27	Potential self-testing implementer	Urban	Female	49	Undergraduate; head of department at the Ministry of Health
28	Potential self-testing implementer	Urban	Male	34	Undergraduate; head of division at a Provincial Health Office
29	Potential self-testing implementer	Urban	Male	45	Graduate; operational director of an major Indonesian restaurant chain
30	Potential self-testing implementer	Urban	Male	41	Undergraduate; automobile branch manager

Table 2  
Sociodemographic profile of the focus group discussion participants

No	Population	Location	Gender	Age	Education level/Profile
1	Representative of civil society	Rural	Male	40	Senior high school; Buddhist community leader
2	Representative of civil society	Rural	Female	46	Undergraduate; area leader of a women's empowerment and children's protection agency
3	Representative of civil society	Rural	Female	49	Undergraduate; youth leader
4	Representative of civil society	Rural	Female	19	Senior high school; program manager of a writer's community
5	Representative of civil society	Urban	Male	48	Undergraduate; founder of a patient care NGO
6	Representative of civil society	Urban	Trans female	61	Undergraduate; chairperson of an NGO for trans women
7	Representative of civil society	Urban	Male	49	Undergraduate; head of a <i>Rukun Tetangga</i> (neighborhood association) in the north Jakarta area
8	Representative of civil society	Urban	Female	39	Senior high school; founder of a youth tuberculosis organization
9	Healthcare worker	Rural	Male	41	Postgraduate; orthopedic surgeon
10	Healthcare worker	Rural	Male	31	Undergraduate; hemodialysis nurse
11	Healthcare worker	Rural	Female	34	Undergraduate; emergency room nurse
12	Healthcare worker	Urban	Female	55	Postgraduate; psychologist
13	Healthcare worker	Urban	Male	36	Undergraduate; physician
14	Healthcare worker	Urban	Male	46	Undergraduate; pharmacist
15	Healthcare worker	Urban	Female	57	Undergraduate; midwife
16	Healthcare worker	Urban	Male	45	Undergraduate; physician
17	Potential self-testing implementer	Rural	Male	60	Undergraduate; area team leader of the COVID-19 Task Force

No	Population	Location	Gender	Age	Education level/Profile
18	Potential self-testing implementer	Rural	Male	41	Undergraduate; Member of the House of Representatives
19	Potential self-testing implementer	Rural	Female	43	Undergraduate; owner of a machinery business
20	Potential self-testing implementer	Rural	Female	23	Undergraduate; regional manager of a lifestyle product retailer
21	Potential self-testing implementer	Urban	Male	45	Postgraduate; Board member of a Association of Indonesia Local Health Office
22	Potential self-testing implementer	Urban	Female	38	Undergraduate; owner of a home cleaning company
23	Potential self-testing implementer	Urban	Male	45	Undergraduate; bank manager

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