FUTURE OF POINT OF CARE & RAPID TESTING

A GLOBAL STUDY AMONG GPs, HOSPITAL DOCTORS & PHARMACISTS

US, EU, CHINA

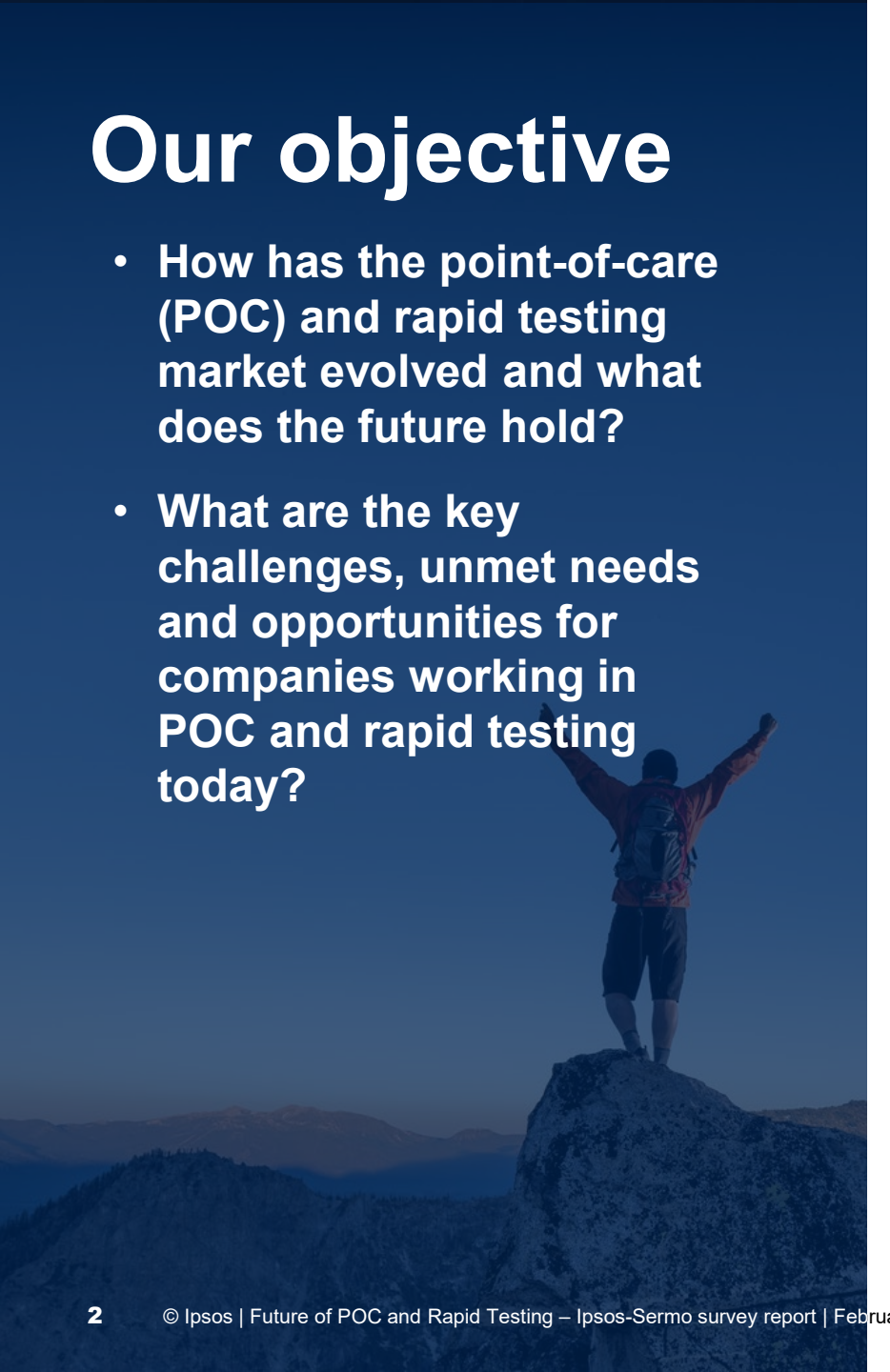
February 2022

sermo

Ipsos

Our objective

- **How has the point-of-care (POC) and rapid testing market evolved and what does the future hold?**
- **What are the key challenges, unmet needs and opportunities for companies working in POC and rapid testing today?**



The research

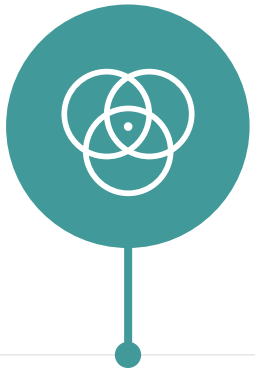
Respondents

- Healthcare professionals (HCPs): GPs, hospital doctors and pharmacists
- Stakeholders in pharma/biotech companies

Methodology & geographic coverage

- Quantitative:
  - 634 HCPs, panel survey (April 2021)
    - UK, EU4, US, China
- Qualitative:
  - 30 HCPs, 30-min TDIs (Sept-Oct 2021)
    - UK, France, Germany, US, China
  - Six stakeholder interviews across four biopharma companies (including OceanDx)

The Future of POC and Rapid Testing



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Current Landscape

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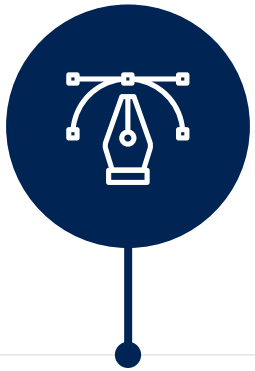
Innovations



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Future Trends & Opportunities

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Conclusions

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CURRENT LANDSCAPE

01

Introduction

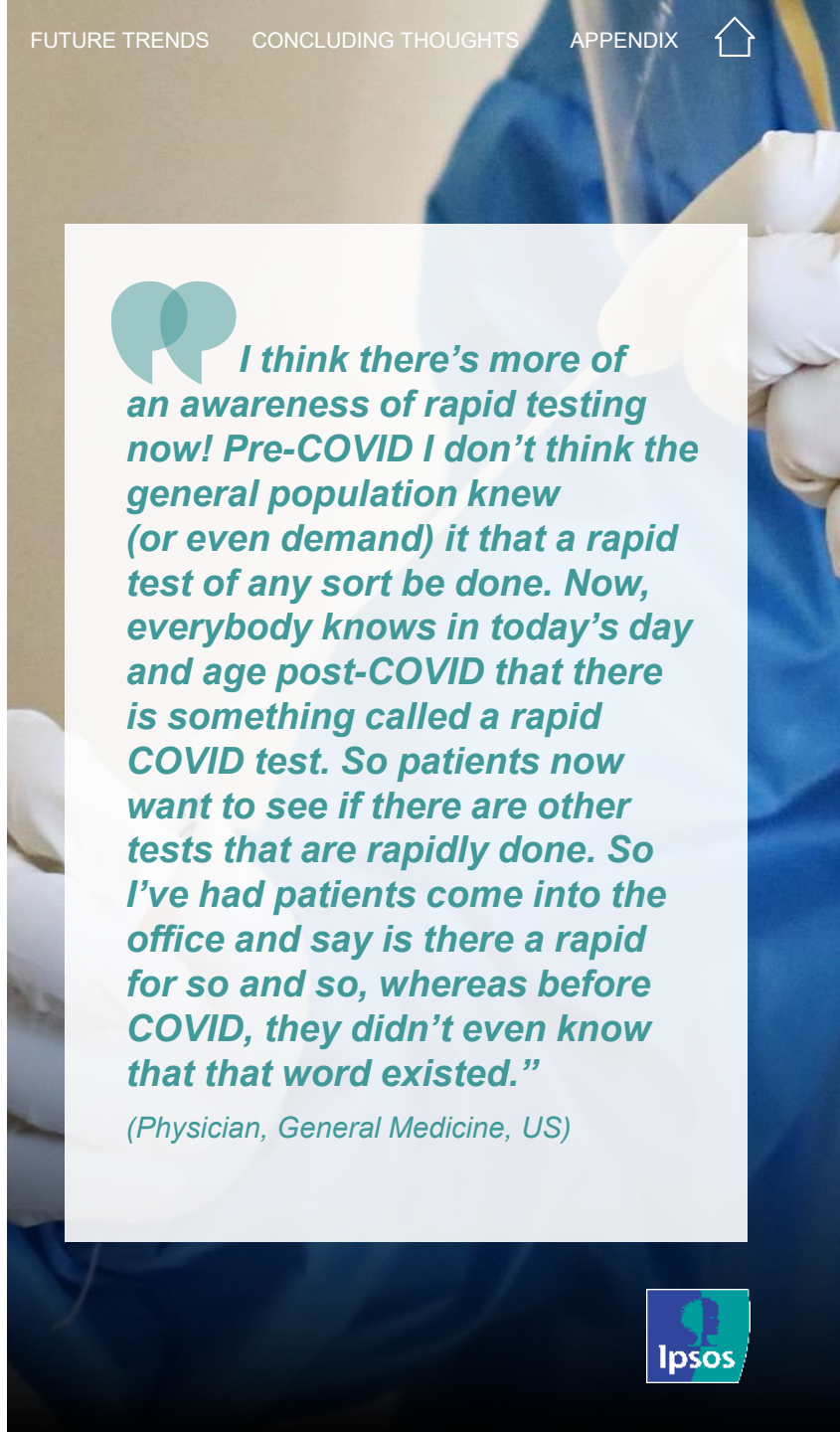
POC and Rapid Testing: Shaped by the COVID-19 pandemic

COVID-19 has transformed the landscape for POC and Rapid Testing. Historically rapid tests were mostly used in ER (A&E) to enable physicians to make decisions about patients in life-or-death situations. But, the urgency of isolating infected patients and the chaos of overwhelmed hospitals has accelerated the development of a rapid COVID-19 antigenic test, which yields instant results and can be administered by a GP, nurse, pharmacist or patient.

This has opened the door to the possibility of instant diagnosis and decision making across other therapy areas, beyond emergency wards. Physicians have gained control of end-to-end patient care, removing the need to wait for a third party to collect sample, send it to a lab for testing and share the results. It can all be done then and there, at point-of-care, whilst the patient waits 15 minutes for the results.

Patients too are empowered by this new responsibility for their own health and are keen for more control. In some markets, such as the UK, patients have started asking their primary care physician or pharmacist about other rapid tests, which suggests that the demand for home testing is likely to increase.

As rapid tests become more sophisticated in terms of speed, quality and connected health and artificial intelligence features, HCPs envision that they will become part of the routine diagnostic process. These tests will be more widespread across a number of therapy areas, even becoming self-administered by patients, empowering both physicians and patients in the process.



"I think there's more of an awareness of rapid testing now! Pre-COVID I don't think the general population knew (or even demand) it that a rapid test of any sort be done. Now, everybody knows in today's day and age post-COVID that there is something called a rapid COVID test. So patients now want to see if there are other tests that are rapidly done. So I've had patients come into the office and say is there a rapid for so and so, whereas before COVID, they didn't even know that that word existed."

(Physician, General Medicine, US)

Source: Ipsos (online panel survey among 634 HCPs in EU4, UK, US & China, April 2021; qualitative TDIs with 6 HCPs per market in France, Germany, UK, US & China in Sept-Oct 2021, 6 Stakeholder interviews across 4 biopharma companies)

Defining POC and rapid tests

Considered overlapping terms

Location

POC tests are performed *'then and there'* in a medical facility (hospital, clinic, independent practice), often at the patient bedside if in hospital, without the need for a laboratory.

Rapid tests are not always taken at POC. These tests can be run in any type of medical setting (clinic, independent practice, hospital, pharmacy or medical laboratory), or even in the patient's home.

Turnaround Time

Rapid tests are so called because they have a very quick turnaround time: described as **quick, immediate, instant, in real-time**. Timeframe is usually within an hour outside the laboratory.

In the US and France, tests that must be run in the laboratory and yield results within 24 hours are also qualified as rapid tests.

Therapy areas

POC/ rapid tests are crucial in three key areas of health:

- **Emergency situations** requiring patient isolation/ triage (e.g., COVID-19) or when patients' lives are at stake (e.g., heart attack/failure)
- **Chronic diseases** that require regular monitoring (e.g., diabetes, blood clotting disorders)
- Diseases that have a better prognosis with **early intervention** (e.g., HIV).

More Physician Control

Rapid turnaround time and on-site testing enables physicians to reach an immediate initial diagnosis, **giving them more control** over the speed of treatment decisions. In China, HCPs include medical imaging as POC tests, citing mobile B-ultrasounds, x-rays, CT scans and Pet-CT scans. While the need for instant decisions continues to be crucial in A&E/ ER, they are now **highlighted as important by specialists in other therapy areas and by GPs.**

Source: Ipsos-Sermo survey (online panel survey among 634 HCPs in EU4, UK, US & China, April 2021; qualitative TDIs with 6 HCPs per market in France, Germany, UK, US & China in Sept-Oct 2021, 6 stakeholder interviews across 4 biopharma companies)

Therapy areas and associated rapid tests

Currently being used in practice

Tests outside the laboratory are either lateral flow / strip tests or require a cartridge machine (usually run whilst the patient waits). Multiplex testing is also used to test multiple infectious diseases. BioFire (multiple infectious diseases) is cited in the US whilst TROD (HIV/ Hep B/ Hep C; COVID-19/ Flu) is cited in France. Some physicians prefer to send samples to the laboratory (in parallel to self-administered tests) to confirm diagnosis.

Cardiovascular	Infectious Diseases	STIs / GYN-OB	Endocrine (Diabetes)	Gastrointestinal / Colorectal	General Health
• Brain natriuretic peptide (BNP) test (heart failure)* • PT/INR test (clotting disorder/VTE)* • Troponin test (heart attack)* • D-dimer test (clotting disorder/DVT)*	• RSV • Influenza • Streptococcus/Step-throat • COVID-19 test (ART)* • C-reactive protein (CRP) test (inflammation/infection) • Procalcitonin (PCT) test (sepsis/bacterial infections)*	• HIV • Hepatitis B • Hepatitis C • Pregnancy • Streptococcus B*	• Rapid blood glucose test • Hemoglobin A1c (HbA1c) test • Ketone test	• Clostridium difficile • Faecal occult blood test	• Blood gas analysis (ABG test) • Haemoglobin tests • Lipid profile • Traumatic brain injury (TBI) test*

Therapy areas needing immediate clinical decisions

Source: Ipsos-Sermo survey (online panel survey among 634 HCPs in EU4, UK, US & China, April 2021; qualitative TDIs with 6 HCPs per market in France, Germany, UK, US & China in Sept-Oct 2021, 6 stakeholder interviews across 4 biopharma companies)

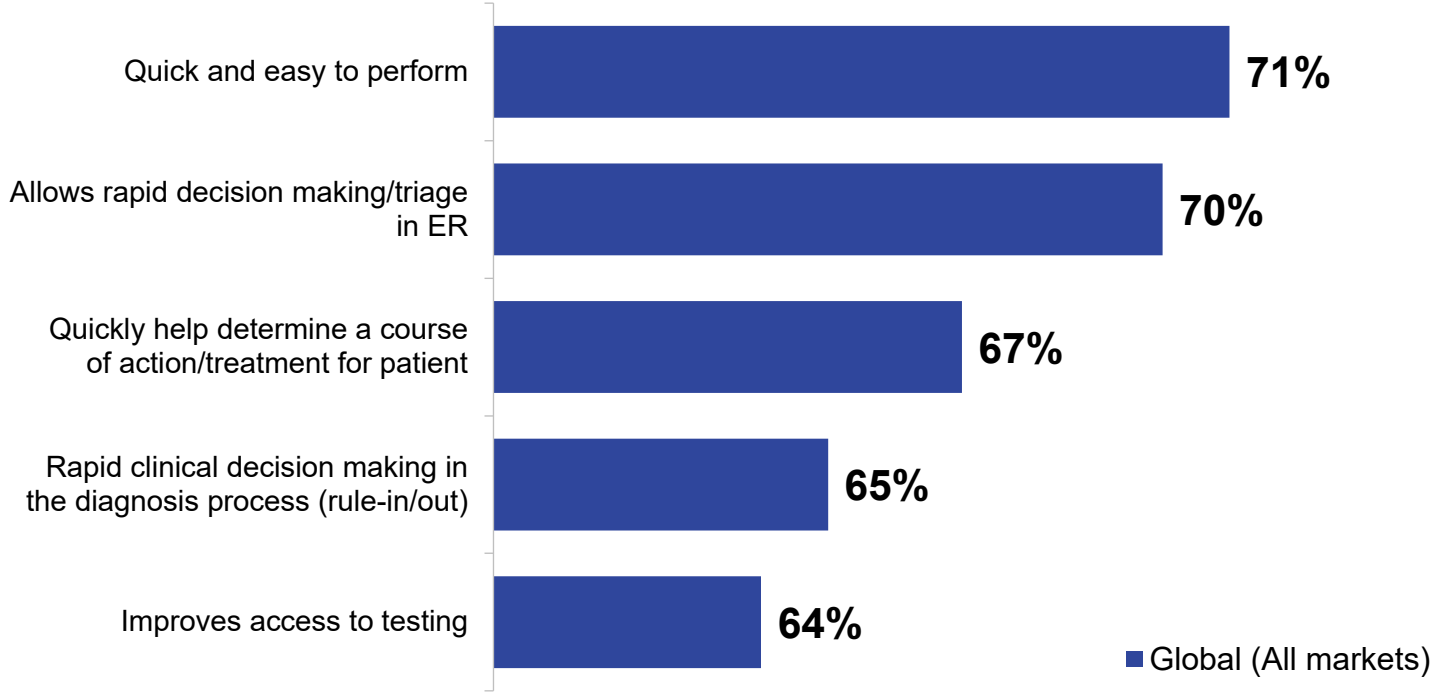
Benefits of POC / rapid tests

Ease of use and support for rapid decision-making are top positives

I think it's relevant everywhere. I think it's relevant in the outpatient world where you may want to get an answer for someone who's in your clinic for a number of questions. I think it's relevant in the emergency room, I think it's relevant in the ICU for different reasons. In the ICU, and in the ER, partly, you just want immediate answers because immediate answers then will lead to important decisions and prognosis and therapies. In the outpatient world, I think it's just logistically easier for the patient and the provider to know quickly"

(Physician, ICU, US)

Top 5 benefits

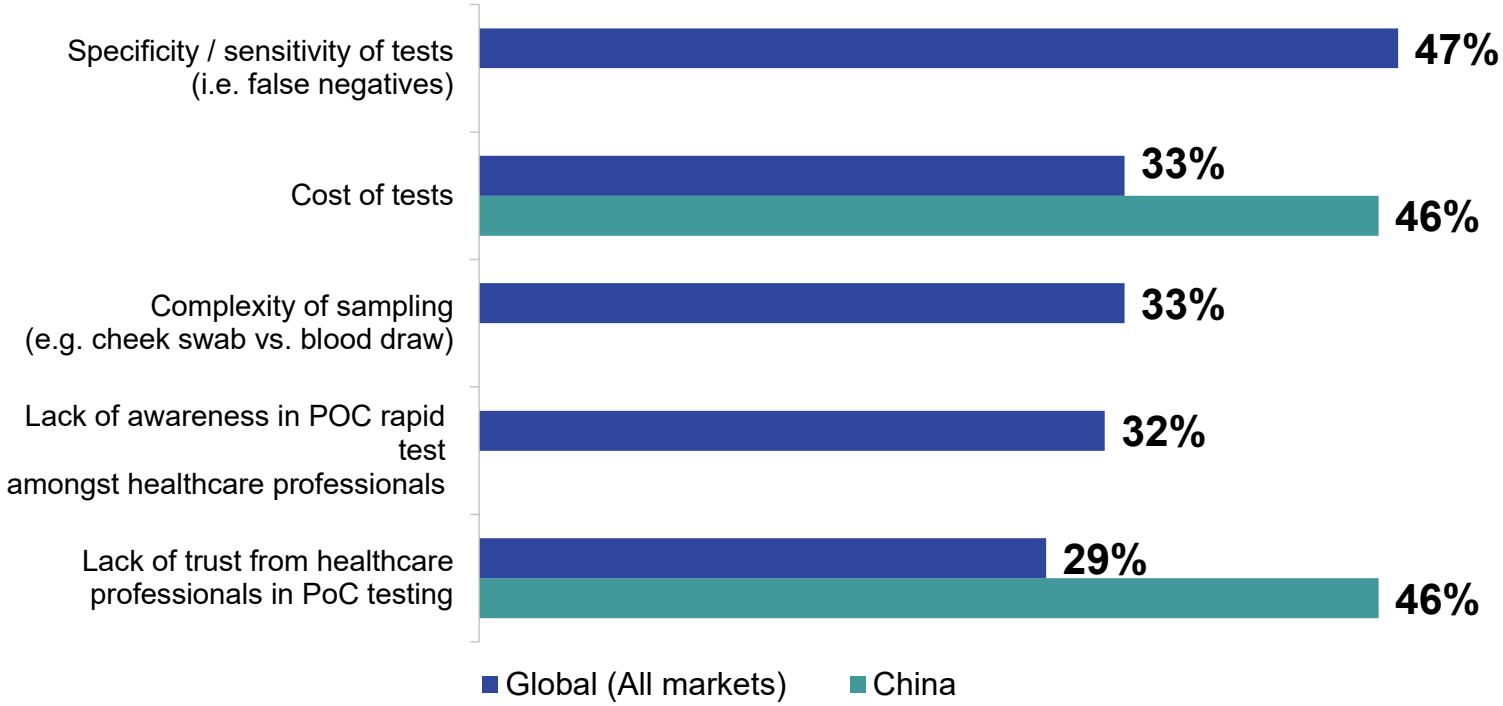


Question: *From the healthcare professional point of view, what are the main advantages of point of care / rapid testing in an in-office/hospital / pharmacy setting?*
Base: *All respondents Total (n=634), China (n=48), France (n=75), Germany (n=75), Italy (n=75), Spain (n=81), UK(n=76), USA (n=204)*
Source: *Ipsos-Sermo survey (online panel survey among 634 HCPs in EU4, UK, US & China, April 2021)*

Challenges of POC / rapid tests

Accuracy remains a key challenge across markets

Top 5 challenges



Overall accuracy is an important consideration for POC and rapid test manufacturers in the future development of testing kits – to help drive adoption

Question: *What are the main barriers to using (more) point of care / rapid testing in an in-office / hospital / pharmacy setting?*
Base: *All respondents Total (n=634), China (n=48), France (n=75), Germany (n=75), Italy (n=75), Spain (n=81), UK(n=76), USA (n=204)*
Source: *Ipsos-Sermo survey (online panel survey among 634 HCPs in EU4, UK, US & China, April 2021)*

Challenges of POC / rapid tests

Accuracy remains a key challenge across markets

Whilst several HCPs report that tests in some therapy areas have become more accurate (e.g., glucose testing), overall, POC tests and rapid tests tend to remain less accurate compared to tests run in a laboratory.

The cost of tests and a lack of trust in POC/ rapid testing are bigger issues in China than other markets. Chinese HCPs reported wide differences in accuracy and stability between manufacturers, especially local ones.

"The difficulty is then about the quality assurance, and how do you make sure that the results you are getting are truly reflective of what a lab test would give you?"

(Physician Emergency medicine, UK)

"Main challenges are false positive and negative rate, which causes misdiagnosis, panic, and diagnosis errors."

(Chief Physician, Infectious disease, China)

"One challenge is its price war. If the price is lower, more people can afford it. The second challenge is to inform the customers of the convenient usage of the device. Third is the popularity of the tests. If you make no advertisement, there will be no popularity. Then you can only rely on the clerk's recommendation of it."

(Pharmacist, China)

***Question**: What are the main barriers to using (more) point of care / rapid testing in an in-office / hospital / pharmacy setting?*
***Base**: All respondents Total (n=634), China (n=48), France (n=75), Germany (n=75), Italy (n=75), Spain (n=81), UK(n=76), USA (n=204)*
***Source**: Ipsos-Sermo survey (online panel survey among 634 HCPs in EU4, UK, US & China, April 2021) © Ipsos 2021, all rights reserved*

Home Testing

From physician control to patient empowerment

The **pandemic has raised awareness of in-home rapid testing** amongst patients, at least for diagnosing COVID-19. Home testing has always existed for diabetes, pregnancy and HIV, but these were used by specific population groups. Most of the population is aware of COVID-19 rapid tests and are well-versed in self-administering a nasal swab test. HCPs feel this unlocks the possibility for other home tests and have seen an increased interest and demand for home testing for conditions such as lipid profile, ketone or UTIs.

*"I think **public awareness of healthcare has become much stronger now**. In the past many people were ignorant of their health for example high blood pressure. In contrast nowadays, I feel want to take care of themselves." (Internal Medicine, China)*

Generally, at-home tests are seen as an asset to patients since they **minimize travel time, waiting and cost**. In addition, patients are wary of going to medical facilities due to the pandemic. Specialists in sexual health, for instance, highlight how HIV home tests have revolutionized this therapy area, where stigma was preventing patients from getting themselves tested. In markets such as France, where access to physicians is becoming more difficult due to shortage, home testing will be a real asset.

*"I believe, having the possibility to do it at home, in a **comfortable environment, with flexibility** - whenever you want to or need to, **without having to pay for each use**, is really worth spending proper money once, in order to buy the device. And then you can use it no limits, like a Nespresso coffee machine, where you just buy the small materials periodically. It could be very good and very practical." (GP, Germany)*

HCPs see home testing as going hand in hand with the **evolution of connected health**, where a patient self-tests and has a teleconsultation. HCPs envision that the rapid test market will open to laypersons in the near future, with **patients taking more responsibility for their health** and taking control of diagnosis and treatment for certain therapy areas.

*"The selling point is **people want to know about their health**. They do not want to delay their treatment. And that drives the market. At the same time, they will get the result within minutes. And this will make the rapid testing home market grow." (GP, UK)*

Source: Ipsos-Sermo survey (Qualitative TDIs with 6 HCPs per market in France, Germany, UK, US & China in Sept-Oct 2021, 6 Stakeholder interviews across 4 biopharma companies)

Home Testing

Despite the advantages, home testing raises some concerns

It is important for POC and rapid test manufacturers to think about addressing or alleviating some of these concerns within the marketing and positioning of future tests.

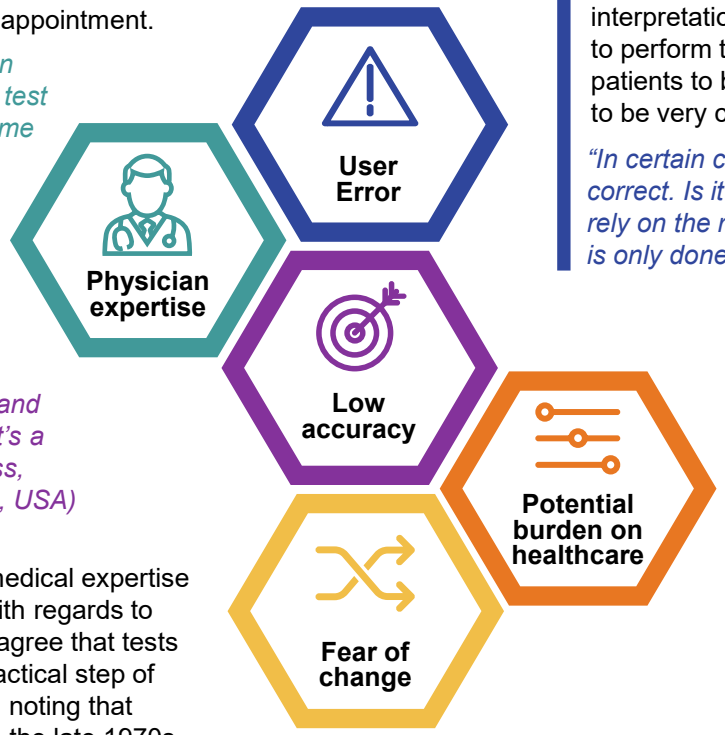
Some serious conditions still need to be treated by a qualified physician. An initial diagnosis from a home test would need to be followed up with a medical appointment.

"It shouldn't be a substitute for big deal decisions. If someone is sick, then they should probably be evaluated. But if it's something like a pregnancy test or even a COVID test for asymptomatic or mildly symptomatic, those [home tests] are appropriate." (Pulmonary Critical Care Physician, USA)

Some tests such as glucose and Covid are seen as reliable, however accuracy of home testing remains a concern. In China, quality of home tests is mentioned as an issue with local manufacturers. There is optimism that home tests will continue to develop and improve, but POC or even laboratory tests may still need to be performed in parallel.

"I think the at-home tests need to be a little bit more efficient or effective and a little bit more sensitive and specific, I think. If they can do that, I think it's a great market, as long as the false positive tests or false negatives, I guess, are- the chances of error should be low." (Infectious Disease Pharmacist, USA)

There also appears to be some reluctance by some HCPs to see their medical expertise being replaced by home tests - they fear losing the end-to-end control with regards to speed of diagnosis and decision making. In France in particular, HCPs agree that tests must be prescribed by a qualified physician for home use, even if the practical step of collecting and testing sample is done by the patient. However, it is worth noting that similar concerns arose when home pregnancy tests became available in the late 1970s, and these are now widely available in non-specialist outlets.



Home tests must show a straightforward result – positive or negative to make interpretation easy for the patient. There is a risk the patients will not be able to perform the test properly, leading to inaccurate results – it is important for patients to be shown how to use the test for the first time or instructions need to be very clear.

"In certain circumstances, it might endanger patients when the result is not correct. Is it a test that the patient is doing regularly, where you know you can rely on the result because the patient is very experienced in it, or is it a test that is only done occasionally? Then I would repeat it. (GP, Germany)

Increase in home testing will in a way prevent the number of hospital visits. However, it can go either way creating pressure on hospitals due to increase in volume of tests and patients running to hospitals out of fear even though medical might needed in many cases.

"We have seen many people rushing to hospitals if they get positive Covid tests, even though they do have any/ minimal symptoms and do not need hospital visit. Hence if such tests are accessible without any control from the medical professionals, then in future we have more tests, more people can potentially try to access care even though they do not necessarily need it. This will create huge burden on the system." (GP, UK)

Source: Ipsos-Sermo survey (Qualitative TDIs with 6 HCPs per market in France, Germany, UK, US & China in Sept-Oct 2021, 6 Stakeholder interviews across 4 biopharma companies)

POC testing workflow

POC testing – HCP collects sample

Non-emergency hospital setting

HCP collects sample

↓

POC device technician runs test

↓

HCP receives results, usually through EMR

A&E/ER Independent practice, Pharmacies

HCP collects sample

↓

HCP runs test at the bedside/ during consultation/ in store

↓

HCP reads results then and there

Home testing postal service (UK)

Online provider or pharmacy (COVID-19, STIs)

Patient draws sample at home

↓

Patient sends sample to lab via dropbox or post

↓

Lab or Provider or Pharmacy allocates results direct to consumer

↓

Teleconsultation is provided by physician (appointed by the online provider)

Source: Ipsos-Sermo survey (Qualitative TDIs with 6 HCPs per market in France, Germany, UK, US & China in Sept-Oct 2021)

In Summary

Impact of COVID-19: More, better, faster growth in POC and rapid testing

The COVID-19 pandemic has had a huge impact on the development of POC and rapid testing devices. The urgent need for quick results and population-scale testing has transformed the POC and rapid test market and opened the door for home testing.

The pandemic has highlighted the importance and convenience of rapid tests to reach quick diagnosis and treatment decisions. Where POC/ rapid tests were already widely used in the ICU and ER due to the urgent nature of patient care, they have now entered other wards as well as independent practices and pharmacies and have become part of clinical practice in an increasing number of therapy areas.

"Through Corona, it has become a booming field, manufacturing these rapid tests and making them available. But I think we haven't reached the end of that. Because with advancing technological developments, it's becoming easier and cheaper to offer a one-off test also for the home at a price which is actually affordable for the user." *(Pharmacist, Germany)*

As a result, the demand for rapid tests generally has exploded for multiple therapy areas. For example, there has been an increase in demand for influenza and RSV tests, to simultaneously test for respiratory infections with similar symptoms to COVID-19.

"Before the epidemic, I personally had never done any tests for flu. We had them, but they'd expire, and we'd throw them away. It's true that we did buy them because we had to, but people didn't ask for them. We didn't do any." *(Pharmacist, France)*

Manufacturers have rushed to enter the market, leading to a wider selection of POC/ rapid tests within the same therapy areas with varying levels of quality. In China, there has been an increase in locally manufactured testing devices (such as blood glucose meters) though HCPs report that their quality tends to be lower compared with non-local manufacturers. Tests across therapy areas have also become more affordable as a result of the competition.

Source: Ipsos-Sermo survey (online panel survey among 634 HCPs in EU4, UK, US & China, April 2021; qualitative TDIs with 6 HCPs per market in France, Germany, UK, US & China in Sept-Oct 2021, 6 Stakeholder interviews across 4 biopharma companies)

INNOVATIONS

02

Current Innovation

Innovation strengthens physician control as well as expanding rapid test use within more healthcare specialisms

Connected Health

Across all markets, most HCPs report that devices link directly to the hospital's/ practice's EMR system, to **deliver results to patient files in real time** (the physician is usually alerted about and abnormal results). In the UK and China especially, HCPs are enthusiastic about the future development of AI generally and can see its **benefits in terms of assisting rather than replacing physicians.**

Democratising rapid tests

More HCPs are now running rapid tests without the need for a laboratory: what started out as increased control for physicians in their place of practice, has now **extended to pharmacists and EMTs/ paramedics** (who also administer rapid tests). In the case of EMTs they use the tests to **inform relevant specialists as soon as the patient reaches A&E/ the ER.**

More therapy areas

Apart from COVID-19, POC and rapid tests have very recently been **developed in more therapy areas to help speedy diagnosis and treatment**. HCPs in Europe and the US mention POC tests for sepsis and TBI. In China over the past two years, rapid uric acid tests to detect kidney disease and gout have become extremely popular.

Technology performance

Some changes were happening prior to COVID-19, but the pandemic has accelerated the evolution. Some tests, for instance, have **improved in quality with more accurate results** (for example, glucose tests, PT/INR tests). Cartridge machines have become smaller, yielding results more quickly, and yielding **more data out of a single or smaller sample.**

Source: Ipsos-Sermo survey (Qualitative TDIs with 6 HCPs per market in France, Germany, UK, US & China in Sept-Oct 2021, 6 Stakeholder interviews across 4 biopharma companies)

Market access

Factors to consider

Accuracy

Specificity and **sensitivity** have become much more reliable for rapid testing, but there is still room for improvement across all markets.

Particularly for locally manufactured tests in China.

Healthcare coverage

In China and the US, tests must be **affordable** for patients or **reimbursed by private insurance**.

Insurance is usually capped and will not cover all medical treatment and procedures, so low prices are critical.

Some hospitals will not purchase devices which don't meet these requirements, since the return on investment must be guaranteed.

Regulations

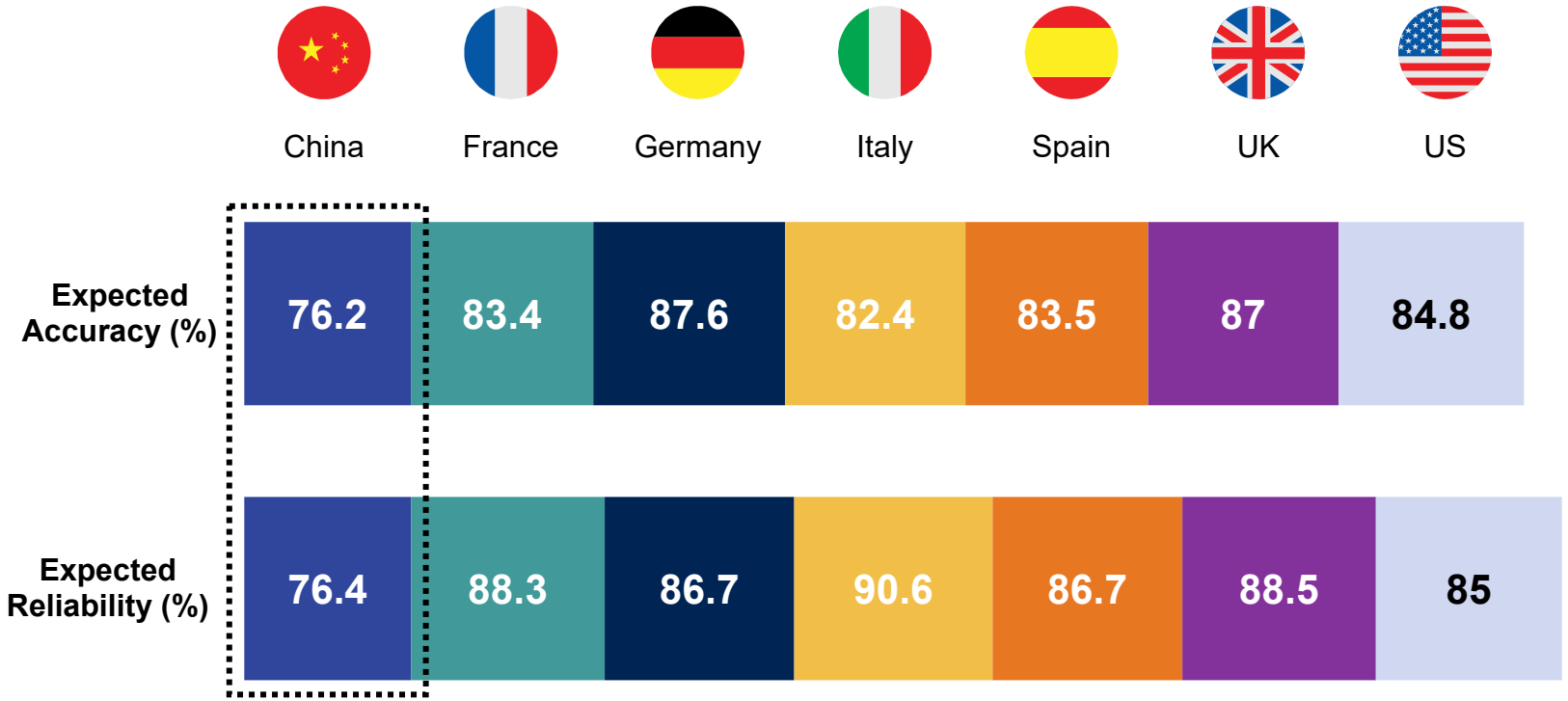
The UK regulatory bodies are seen to be bureaucratic, with legislation that cannot be quickly modified to accommodate developments such as AI.

Although not a major barrier to POC or rapid testing, HCPs expect approvals may not be given as quickly as necessary.

Source: Ipsos-Sermo survey (Qualitative TDIs with 6 HCPs per market in France, Germany, UK, US & China in Sept-Oct 2021)

Accuracy remains an area of concern

Expectations are high for precise results



Average >80% accuracy and nearly 90% reliability expected

Expectations of respondents in China are lower than in all other markets

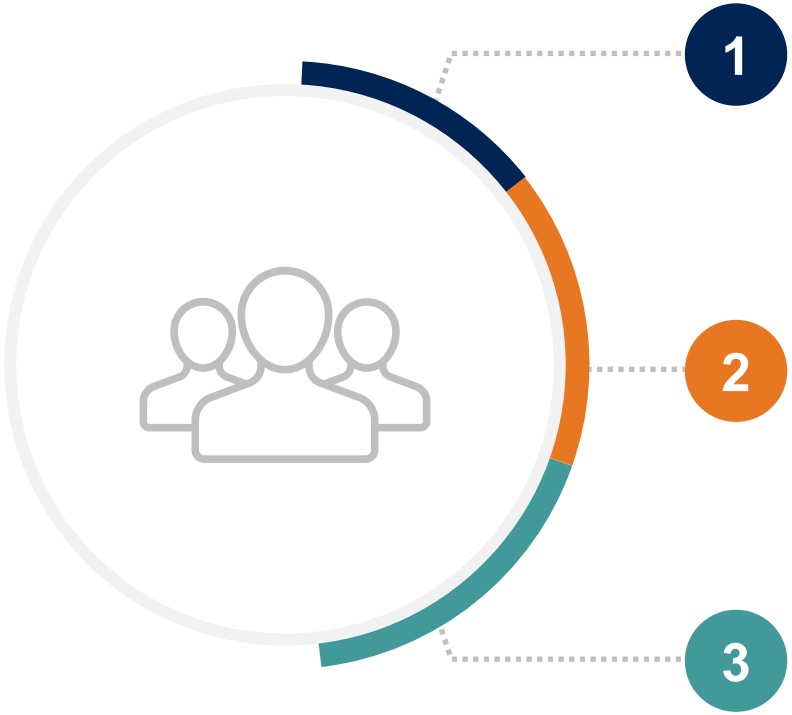
Question: *What is the MINIMUM level of % accuracy and reliability which is acceptable for point of care / rapid testing?*
Base: *All respondents Total (n=634), China (n=48), France (n=75), Germany (n=75), Italy (n=75), Spain (n=81), UK (n=76), USA (n=204)*
Source: *Ipsos-Sermo survey (online panel survey among 634 HCPs in EU4, UK, US & China, April 2021) © Ipsos 2021, all rights reserved*

FUTURE TRENDS

03

Meeting patient and HCP needs

Physicians envision future trends that continue to empower them



Improved technology: Accuracy, speed and easier interpretation

Technology will improve, especially in terms of accuracy (specificity/ sensitivity) and faster turnaround times. Cartridge machines will become more modern with increasingly better performance. Tests will be easier to run and interpret. HCPs in the US and UK envision the explosion of multiplex tests in the future enabling faster decision making. Three fifths of the HCPs we surveyed agree that linking POC devices and electronic medical records will enable test results to be shared instantly with care providers.

Optimisation of process to reduce HCP workload

HCPs hope that their workload will be reduced due to improvements in hospital processes and protocols. Especially in the European markets surveyed, where hospitals and practices are currently overstrained. Rapid tests will continue to support triage in the ER, improving patient flow and time to treatment leading to improved patient experience and HCP satisfaction.

Covering more therapy and disease areas

HCPs envision that rapid tests will be extended to more therapy areas, increasing the speed of decision-making and, in turn, improving patient outcomes across a much broader range of diseases.

Source: Ipsos-Sermo survey (online panel survey among 634 HCPs in EU4, UK, US & China, April 2021; qualitative TDIs with 6 HCPs per market in France, Germany, UK, US & China in Sept-Oct 2021, 6 Stakeholder interviews across 4 biopharma companies)

Meeting patient and HCP needs

Physicians envision future trends that continue to empower them

It is so-called intellectualization because all equipment will definitely have computers in the future, including artificial intelligence. The health care network will communicate with the hospital in the future.

There will be critical value management in the hospitals in future. Critical data will jump out, with artificial intelligence, or with data analysis. It will communicate with relevant departments and decisions will be made faster. (GP, UK)

Source: Ipsos-Sermo survey (online panel survey among 634 HCPs in EU4, UK, US & China, April 2021; qualitative TDIs with 6 HCPs per market in France, Germany, UK, US & China in Sept-Oct 2021, 6 Stakeholder interviews across 4 biopharma companies)

Therapy areas

Which therapy areas would benefit from rapid testing?

Oncology	Neurological	STIs
• HPV to detect cervical cancer • Cancer biomarkers to detect lung or gastric cancers • Faecal occult blood test to detect colorectal cancer	• Dementia • Stroke	• Gonorrhea • Chlamydia

Infectious diseases (respiratory)	Infectious diseases (respiratory)	General Health
• Different strains of flu • Different COVID-19 variants	• Meningitis	• Vitamin and mineral levels (e.g., iron, vitamin D)

Rapid tests in oncology are in high demand in all the markets, especially for common cancers with poor prognosis. This is important for reducing patient waiting times and the associated stresses. In future, HCPs are also interested in seeing more and improved cancer biomarkers to detect lung or gastric cancers, as well as rapid faecal occult blood test (FOBT) to check stool samples for hidden blood.

Where is innovation happening? Well, I would say bloodborne viruses and sexual health. I could see it in Oncology, where you are trying to support a patient at home. In IC and Critical Care, it's very slow. *(GP, UK)*

As the population ages, HCPs envision that neurological conditions such as dementia and stroke would benefit from rapid testing. POC testing in infectious diseases will continue to grow with advanced rapid tests developed for the detection of different strains of flu, different COVID-19 variants and other respiratory pathogens. Also, there will be more awareness among people for wellness related testing (e.g., periodic testing of vitamin D, B12, iron, cholesterol, etc.)

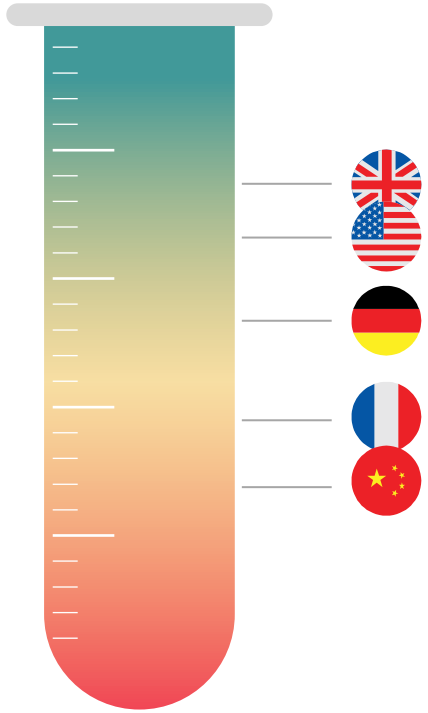
Some people are asking, is there any home test that I can do my cholesterol and vitamin D deficiency etc. People are asking but we do not have that rapid home test currently*. (GP, France)*

Source: Ipsos-Sermo survey (Qualitative TDIs with 6 HCPs per market in France, Germany, UK, US & China in Sept-Oct 2021, 6 Stakeholder interviews across 4 biopharma companies)

Syndromic / Multiplex testing

Further empowering physicians

All markets are receptive to syndromic testing - especially the UK and US



Syndromic/ multiplex testing is expected to grow in the future, further empowering physicians as HCPs in all markets see the benefits of multiplex testing in optimizing process and faster decision-making.

It will be considered as a first step in the diagnostic process to **eliminate potential diseases.**

When a patient exhibits several clinical signs and symptoms, it is difficult to tell, for example, if a patient has a respiratory complaint or a cardiac complaint. In these situations, multiplex testing is useful for ruling out diagnosis. It helps in terms of **time optimization** – as it offers a single test to detect multiple pathogens

Another benefit is that the sample collection is easier, **more convenient** and comfortable for the patient. It also provides more data points to HCPs from a single sample.

Overall, HCPs report that multiplex testing is **cost effective**, except in China where it is comparatively more expensive.

However, there are some concerns, particularly relating to the accuracy of the multiplex tests. The quality of results when testing multiple pathogens at once is questioned by HCPs. Single plex is still seen as more accurate/ reliable. There may be a trade-off between urgency and accuracy, and accuracy cannot be unreasonably low.

In terms of regional differences, all markets are receptive to syndromic testing, however, some are more enthusiastic than others, especially the UK and US.

> *Syndromic testing is has a huge score. It will definably grow in future, than the single-plex testing. It must be safe and reliable.*
>
> *(Physician Infectious diseases, UK)*

Source: Ipsos-Sermo survey (Qualitative TDIs with 6 HCPs per market in France, Germany, UK, US & China in Sept-Oct 2021, 6 Stakeholder interviews across 4 biopharma companies)

Artificial Intelligence

More empowerment and optimisation

1. Connected health/ AI top of mind development – envisage future of healthcare as connected

2. AI perceived as great tool to assist physicians in patient care

3. Foresee medical devices analysing patient data – reducing human error and workload

4. HCPs see POC / rapid testing being supported by AI too (particularly for home testing)

When talking about future innovations, HCPs are excited about **Connected health & Artificial Intelligence**. In the UK, China and the US in particular, AI is perceived as a great tool to assist physicians in patient care.

The algorithmic capabilities of machine learning will support HCPs in diagnostic decision making. In imaging, for example, AI will pick up the blind spots that are not visible to the human eye. HCPs expect to have more POC testing solutions driven by AI and data analytics to reduce their workload. They also talk about **AI and connected health evolving together in the future**, particularly for home testing (e.g., technology where the patient uploads a 3D image of their skin on an app/ software for detecting skin cancer).

> ***This kind of auxiliary diagnosis and treatment equipment can help doctors clinically through AI, or big data. After all, human brains or thinking sometimes still have blind spots. When this patient comes, his data can be quickly sorted and analysed by means of AI, thus aiding the doctor."***
>
> *(Intensive Care Unit, China)*

Source: Ipsos-Sermo survey (Qualitative TDIs with 6 HCPs per market in France, Germany, UK, US & China in Sept-Oct 2021, 6 Stakeholder interviews across 4 biopharma companies)

Home tests

Patients in control of their health

Connected health/ AI

In future, for minor infections patients will perform a home test, followed by a quick online consultation and an antibiotic to be sent to their home address. So, the point of care with connected smartphone apps is a potential opportunity in coming years.

Outpatient care

HCPs also report a benefit in home tests that could support outpatient care in the areas of oncology, dialysis, etc. Aging patients particularly would benefit from regular home tests for cardiovascular diseases and monitoring general wellness.

Holistic health monitoring

People increasingly want to test themselves and avoid doctor visits. They would want to have rapid tests at home as a staple of their first aid kits. There is an opportunity in manufacturing a package diagnostic kit to detect infectious diseases at home (e.g., COVID-19, flu strains, hepatitis viruses) in one rapid multiplex test. Or a wellness monitoring kit to detect sugar, cholesterol, iron, vitamins, etc. in a single test. Awareness is going to increase where people would like to gift wellness monitoring kits as presents.

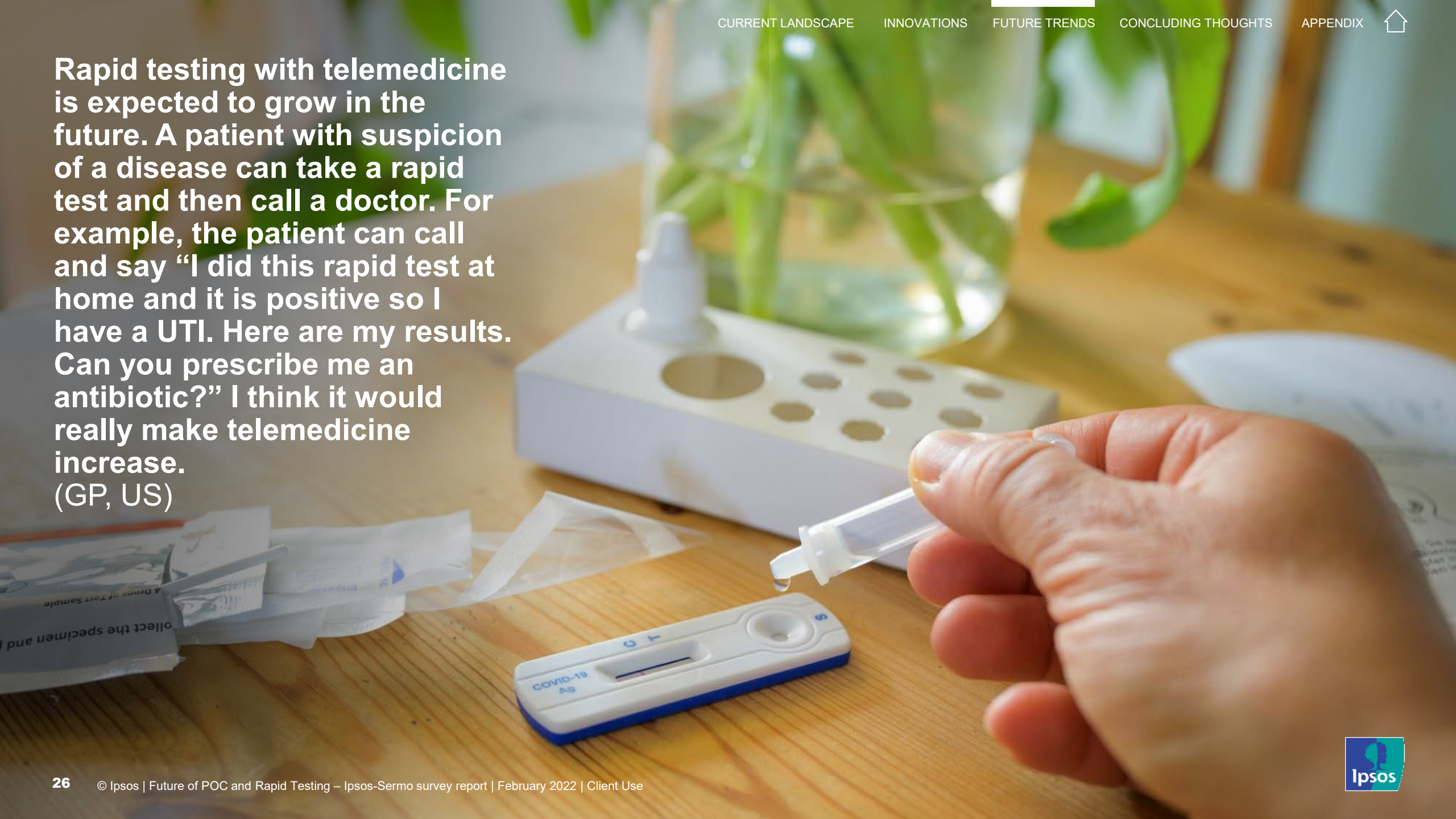
Stigmatising diseases

HCPs report that home tests for HIV have transformed the incidence of testing for this disease. They envision that home testing for other sexually transmitted diseases would have the same effect, and even for other diseases where patients are reluctant to be tested, such as dementia.

In summary, Home tests will complement POC testing, not replace it.
This will reduce HCP workload and potentially relieve an overstrained healthcare system.

Source: Ipsos-Sermo survey (Qualitative TDIs with 6 HCPs per market in France, Germany, UK, US & China in Sept-Oct 2021, 6 Stakeholder interviews across 4 biopharma companies)

Rapid testing with telemedicine is expected to grow in the future. A patient with suspicion of a disease can take a rapid test and then call a doctor. For example, the patient can call and say "I did this rapid test at home and it is positive so I have a UTI. Here are my results. Can you prescribe me an antibiotic?" I think it would really make telemedicine increase.
(GP, US)



Home Tests: Access to care is key

Home tests will complement POC testing, not replace it

Patients are interested in doing their own testing and this will improve engagement, follow-up, and support from healthcare professionals and that is a key component in care, ensuring the patient is supported.

Overall, HCPs across all markets surveyed see the development of home testing as positive. It will reduce workload for HCPs, filtering patients who require symptom management at home and those who require more complex treatments. HCPs also envision that home tests will provide an initial screening at home, but will not replace laboratory testing. Patients will have to visit the hospital for higher level of testing in order to evaluate further to start the treatment.

POC testing will continue to be key for urgent care and more serious and complex diseases. Where necessary, home tests will need to be followed-up with a physician-administered test, to confirm results obtained at home.

Source: Ipsos-Sermo survey (Qualitative TDIs with 6 HCPs per market in France, Germany, UK, US & China in Sept-Oct 2021, 6 Stakeholder interviews across 4 biopharma companies)

You still have to go to hospital for diagnosis and treatment, which means that it is only a primary screening at home, and then I go to the hospital."

(Physician Internal medicine, China)

I think there's only going to be growth in home testing because patients are going to demand it. But I think it can't be a fly-by-night type test. I think it has to come from a company that's reputable in the space that has a 24-hour hotline."

(GP, US)

Rapid testing improves the patient confidence and the selling point will be the... ''People want to know.. they do not want to delay their treatment". And that drives the market, because people want to know. At the same time, like I'll get the result within minutes, so that will make the rapid test grow."

(GP, Germany)

I think, because giving patients, or empowering patients, to look after their own health is really important."

(Physician, Infectious disease, UK)

Sample collection

Easier and less invasive

HOME TEST (Global %)

Home test samples are collected by the patient themselves and it is best to prioritise samples which are the least invasive, easy to collect, and it will not compromise results due to an error or a mistake during sample collection. **Hence saliva, cheek swab and urine are considered as easy to collect samples for home testing.**

POCTs

For POC tests, samples must be easier to collect, for example breath, capillary blood testing (rather than venous blood draw) and saliva. Current innovations have shown that different samples can yield an accurate diagnosis, for instance, saliva instead of blood for HIV, which improves safety since it lowers the risk of contamination from a needle when blood is the sample.

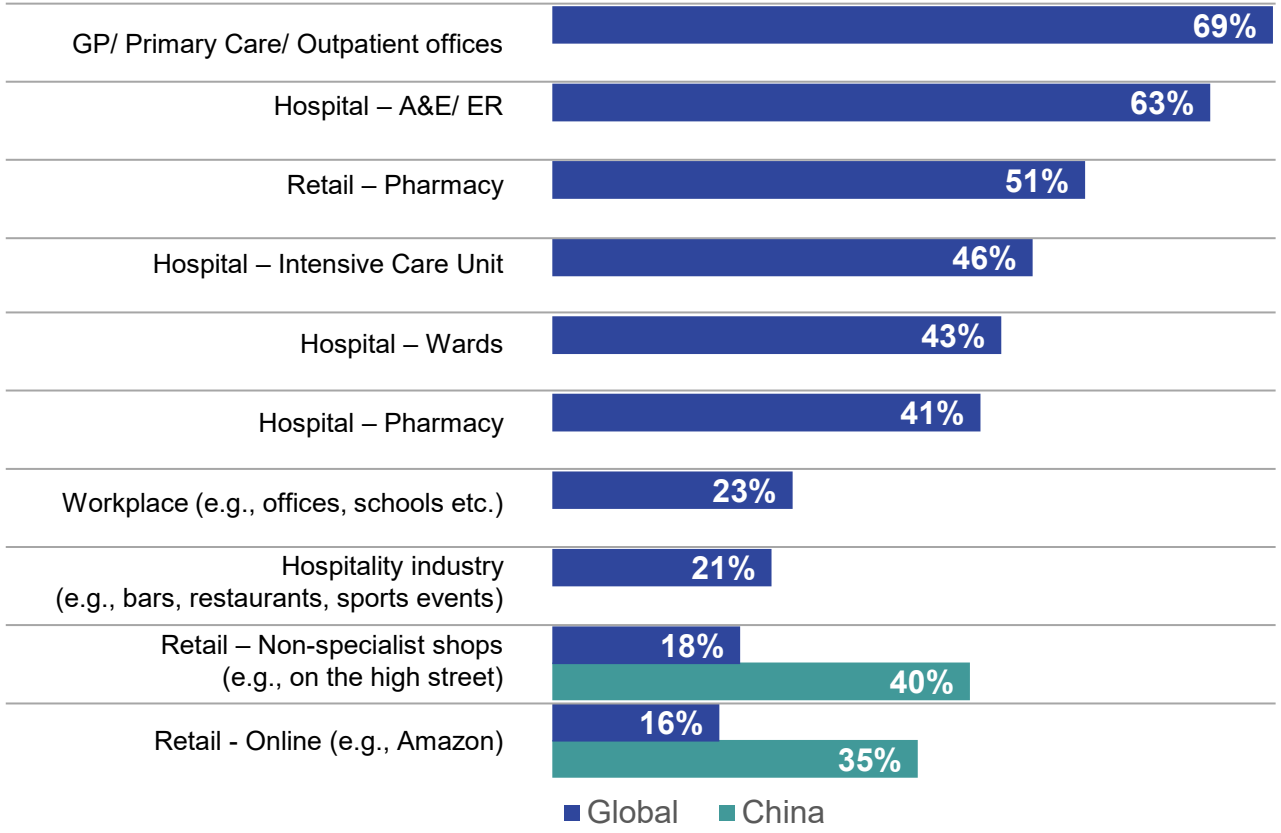
Given the continued issues with accuracy of results in China, HCPs are keen on sample types which are sterile and will yield more accurate results, such as urine, but also pleural effusion ("water on the lungs") rather than mucus.

> *For some samples, it is not realistic to draw blood at patient's home because it is impossible for the patients to draw themselves. But testing urine and stool should be very casual.*
>
> *(Critical care, China)*

***Base**: All respondents Total (n=634), China (n=48), France (n=75), Germany (n=75), Italy (n=75), Spain (n=81), UK (n=76), USA (n=204)*
***Source**: Ipsos-Sermo survey (online panel survey among 634 HCPs in EU4, UK, US & China, April 2021; qualitative TDIs with 6 HCPs per market in France, Germany, UK, US & China in Sept-Oct 2021, 6 Stakeholder interviews across 4 biopharma companies) © Ipsos 2021, all rights reserved*

Point of sale for rapid tests

Where should they be available?



In terms of access points for rapid tests, the main locations will remain medical facilities:

- **GP/primary physician** practice will be a strategic location since it is usually the first point of care for patients.
- **A&E/ER and ICU** will continue to be key due to the urgent nature of patient care.
- **Pharmacies** will continue to gain importance and contribute to patient empowerment: there are many more pharmacies than hospitals or practices, they are walk-in and don't require an appointment. Pharmacies can act as triage for patients who need physician care and those who can be treated symptomatically.

As we see in the graph, **retail is lower in the list**, showing the reluctance of HCPs to give patients complete autonomy over their health. In addition, there is justified lack of trust over the legitimacy of tests sold via online retail. HCPs from China, however, are much more open to retail both on the high street and online, driven by local manufactures and this may impact quality of the results.

***Base**: All respondents Total (n=634), China (n=48), France (n=75), Germany (n=75), Italy (n=75), Spain (n=81), UK (n=76), USA (n=204)*
***Source**: Ipsos-Sermo survey (online panel survey among 634 HCPs in EU4, UK, US & China, April 2021; qualitative TDIs with 6 HCPs per market in France, Germany, UK, US & China in Sept-Oct 2021, 6 Stakeholder interviews across 4 biopharma companies) © Ipsos 2021, all rights reserved*

Pharmacies

In-store versus online

Pharmacy: in-store

Huge opportunity for growth in all markets

HCPs in all markets are open to making home tests available for sale in pharmacies. Home testing has a huge opportunity for growth in all the markets through pharmacy sales. In France, pharmacists traditionally have a strong advisory role, and it is necessary to have a prescription from a physician to buy tests in France. The situation is similar in Germany where pharmacists would have the opportunity to be more involved in an advisory capacity rather than just selling products.

In the EU and US, prescriptions from HCPs are important for reimbursement purposes.

Pharmacy: online

In the UK and the US, HCPs are keen to increase telemedicine

HCPs from the US, UK and China are relatively more interested in telemedicine and are supportive of tests available to purchase via online pharmacies. Receiving tests at home via post, is seen as time effective and convenient for patients. HCPs even envision that patients could receive antibiotics in the post from pharmacies after a rapid home test followed by a tele-consultation.

***Base**: All respondents Total (n=634), China (n=48), France (n=75), Germany (n=75), Italy (n=75), Spain (n=81), UK (n=76), USA (n=204)*
***Source**: Ipsos-Sermo survey (online panel survey among 634 HCPs in EU4, UK, US & China, April 2021; qualitative TDIs with 6 HCPs per market in France, Germany, UK, US & China in Sept-Oct 2021, 6 Stakeholder interviews across 4 biopharma companies) © Ipsos 2021, all rights reserved*

CONCLUDING THOUGHTS

04

Conclusions

Huge opportunity for growth in both home and POC testing markets

Therapy Areas

In future, POC and home tests have huge potential within oncology, stroke and dementia, particularly with the aging population. There is a need for existing cardiovascular POC tests to be available as home tests and general wellness panels (such as tests for vitamins, cholesterol and minerals) should be developed.

Pharmacies

Pharmacies are the most convenient point of sale for home tests, in-store in all markets (especially in FR and DE where pharmacists have a strong advisory role), and online in the US, UK and CN.

Ease of Use

For both home and POC, HCPs prefer devices that are easy to use, and interpret. They also want easy sample collection for both POC and home testing (saliva, cheek swab, urine and capillary small volume blood will be considered as the sample for the future).

Connected health & AI

AI is seen as a key enabler to support physicians in patient data analysis and diagnostic decision making, and connected health will get more attention for strengthening home tests through apps and telemedicine.

Multiplex testing

HCPs are keen for multiplex testing especially in the US and UK. There is a potential in other markets too due it's convenience, but it should provide an acceptable level of accuracy.

APPENDIX

05

Current trends

Level of agreement	Statements	Notes
59%	POC rapid tests to diagnose an infectious disease should be overseen by healthcare professionals rather than the general public	
54%	Rapid testing increases the likelihood and frequency of someone getting tested for STDs	
49%	Rapid testing is best to help stop the spread of infectious disease and is less useful for chronic conditions	
49%	Availability of over the counter POC rapid tests to detect infectious diseases	In China, it's 75%; reason being – many local suppliers in the market. However, accuracy is a concern.
41%	POC rapid tests will significantly decrease the demand for central laboratory testing	In France, it's 31% and Germany 32%. They believe that laboratory testing is essential in terms of confirming the results, taking appropriate treatment decisions.
35%	A trade-off between accuracy of test result and speed of test result is acceptable	
28%	Rapid testing by members of the public is unreliable due to sampling errors	
22%	I don't care what test methodology is used as long as I get a quick result	
20%	Training required to conduct POC rapid tests is seen as a burden by healthcare professionals.	

Reasons driving patients to self administer a Rapid test

Level of agreement	Statements	Notes
77%	Fast to get results	
67%	Easy to use	
65%	Easy to obtain	
57%	Confidentiality of test result (if patient bought themselves)	
54%	Saves travel time	
51%	Affordable	Need of affordable tests is higher in China. 73% of HCPs demand for cheaper tests.
47%	Less scary than hospital setting	
38%	A requirement to provide a negative result to others	
29%	Lack of access to a hospital	

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About SERMO

SERMO RealTime (a digital HCP-only rapid research tool) provides a valuable add-on to traditional research methods to gather almost instant and affordable insights in today's fast-paced environment.

SERMO RealTime can be used for multiple purposes:

- Refining an upcoming study design.
- Supporting ongoing business decisions.
- Checking on brand messaging and/or visuals.
- Tracking market trends.
- Analysing general sentiment pre- and post-campaign.
- Supporting a workshop discussion.

How does it work?

- Questionnaires can be scripted & launched in 24-48 hours.
- Depending on the target sample respondent & size, surveys can be in field for 1-5 days 76% of all pulse surveys complete in under 5 hours.
- Questions are fielded online to a global panel of 1.8 million HCPs, covering 40+ specialities from 30 countries.
- Target lists can also be uploaded and panel matched.
- Raw data is provided instantly in Excel, and in one to three days in PowerPoint.
- Surveys can have up to 10 questions with two optional screener questions.

THANK YOU.