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Expert guidance on target product profile development for AMR diagnostic tests

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ABSTRACT

Diagnostics are widely considered crucial in the fight against antimicrobial resistance (AMR), which is expected to kill 10 million people annually by 2030. Nevertheless, there remains a substantial gap between the need for AMR diagnostics versus their development and implementation. To help address this problem, target product profiles (TPP) have been developed to focus developers' attention on the key aspects of AMR diagnostic tests. However, during discussion between a multisectoral working group of 51 international experts from industry, academia and healthcare, it was noted that specific AMR-related TPPs could be extended by incorporating the interdependencies between the key characteristics associated with the development of such TPPs. Subsequently, the working group identified 46 characteristics associated with six main categories (ie, Intended Use, Diagnostic Question, Test Description, Assay Protocol, Performance and Commercial). The interdependencies of these characteristics were then identified and mapped against each other to generate new insights for use by stakeholders. Specifically, it may not be possible for diagnostics developers to achieve all of the recommendations in every category of a TPP and this publication indicates how prioritising specific TPP characteristics during diagnostics development may influence (or not) a range of other TPP characteristics associated with the diagnostic. The use of such guidance, in conjunction with specific TPPs, could lead to more efficient AMR diagnostics development.

SUMMARY BOX

⇒ The growing challenge of antimicrobial resistance (AMR) requires novel diagnostic solutions, for example via the increasing development and use of rapid diagnostics being promoted in multiple strategic initiatives and policy interventions globally.

⇒ One of the major barriers in AMR diagnostics is the large gap between the need for diagnostics versus their development and implementation. In this respect, accessible Target Product Profiles (TPPs) for innovators, contain information that can help them to create diagnostics that are effectively adopted and implemented into end users' environments.

⇒ The Joint Programming Initiative on Antimicrobial Resistance (JPIAMR) Transnational Working Group 'Antimicrobial Resistance - Rapid Diagnostic Test' (AMR-RDT) generated a guidance document for AMR TPP development.

⇒ This guidance takes into account 46 essential characteristics that are grouped into 6 main categories, including the interdependences between these characteristics. The guidance allows potential prioritisation of TPP characteristics during AMR diagnostics development, adding substantial value for academic and business stakeholders involved in AMR diagnostics development, as well as for AMR policy makers.

BACKGROUND

The development and implementation of rapid diagnostics for infectious diseases could reduce time-to-result, improve patient management decisions, help select appropriate therapies, facilitate streamlining during clinical trials and assist in the development and prescription of narrow spectrum antibiotics. Such tests could offer also evidence-based (instead of symptom-based) results that influence clinician decision-making regarding which antibiotics to include or exclude during patient treatment. Molecular methods, automated systems, innovative sampling approaches are all components supporting AMR diagnostics. As an example, 800 million users of a diagnostic tool that discriminates bacterial versus other infections in primary care are expected in 2040.[1] While rapid diagnostics are widely considered a top priority tool to combat the global threat of AMR,[2] there is still a large gap between the need for diagnostics versus their development

and implementation.[3 4] In this respect, a Joint Programming Initiative on Antimicrobial Resistance (JPIAMR)-funded multisectoral working group (AMR-RDT) was established. The working group comprised 51 international experts from industry, academia/research, public health and non-profit/non-governmental organisations (online supplemental table S1). One of the subjects discussed was the potential improvement of the content and structure of specific target product profiles (TPP) that are used during the development of diagnostic tests for AMR prevention and diagnosis.

TPPs are strategic documents that are widely used to define diagnostics development and are generated via scoping, drafting, consensus building and updating steps.[5 6] TPPs comprise lists of characteristics together with minimum acceptable or optimal values that are intended to guide research and development efforts for new diagnostics. They help to ensure that newly developed diagnostics meet application, performance, user, economic and regulatory requirements.[5] These characteristics are often listed with quantitative minimum (acceptable or required) and optimal (desirable) values.

The importance of TPPs has previously been emphasised by Murtagh *et al*, who stated that diagnostics developers value the existence of TPPs, as they provide structured and specific guidance for the development of novel technological diagnostics.[7] Moreover, developing a diagnostic test according to a TPP recommendation could potentially help its Health Technology Assessment, while potentially accelerating time-to-market, acceptability, adoption and implementation,[8] since the development was done based on a consensus-derived use case-specific TPP document.

There are three main types of bodies initiating TPPs, namely (1) industry, (2) public bodies/NGOs and (3) regulatory agencies such as the US Food and Drug Administration (FDA).[9] We focus on the first two categories and we believe that our findings are applicable to both; the latter have been applied (mostly) in the field of pharmaceuticals and are not always one-to-one transferable to diagnostic tests. In the case of industry-led TPP initiatives, companies usually use market research, business development strategies and scientific due diligence to analyse user needs.[10] In the case of public bodies/NGO-led TPPs, several examples are available.[11–16] As an example, guided by a landscape analysis and technical assessment of potential gaps, the WHO developed and published in 2020 AMR-related TPPs for quite specific/narrow purposes, namely (1) a multiplex platform for identification and resistance/antimicrobial susceptibility testing of prioritised bacterial pathogens at level 2 healthcare facilities, and (2) a platform to detect phenotypic antimicrobial susceptibility of prioritised bacterial pathogens to facilitate antibiotic stewardship at level 2 and ideally also level 1 healthcare facilities. Additionally, a WHO directory lists several TPPs for diagnostic products[17] (outside the AMR field), while other non-profit organisations such as UNICEF (eg, for Yellow Fever and Zika viruses, Diagnostic Aid for Acute Respiratory Infection and others),[18] PATH (eg, for malaria, trachoma and neglected tropical diseases)[19–21] and the Foundation for Innovative New Diagnostics (FIND) (sometimes in cooperation with the WHO),[16 22 23] have also developed diagnostics-related TPPs. However, the development of TPPs for medical diagnostics is not per se standardised, with a systematic review by Cocco *et al*[5] indicating four potential limitations to current TPP development, namely (1) subjectivity of input sources; (2) poor transparency in methodology reporting; (3) clinical utility and (4) cost-effectiveness. It was also found that interdependencies between test characteristics are usually overlooked within TPPs to date.[6] Furthermore, Murtagh *et al* utilised TPP experience gained from the WHO initiative for point-of-care testing for sexually transmitted infections to state that 'it would be useful to prioritise each performance/operational characteristic of the test and to provide a rationale as to why certain characteristics are considered important',[7] which is indeed missing from the current state-of-the-art of TPPs.

The aim of this publication is to present guidance on the context (external factors that may influence a particular characteristic) and interdependencies (connections between different characteristics) of AMR TPP characteristics, with the intention of guiding relevant stakeholders to prioritise the most appropriate TPP characteristics for their particular diagnostic and to appreciate how placing a priority on a single TPP characteristic may directly impact on several other important TPP characteristics.

JPIAMR AMR-RDT WORKING GROUP AND APPROACH

In 2016, the JPIAMR provided funding to selected networks to 'enhance resource alignment and maximise existing and future efforts to combat AMR by pushing forward the conceptualisation of ideas'. One of the funded networks was the 'Rapid Diagnostics Test' (AMR-RDT) working group. Candidates for this working group were experts recruited (via email) by its coordinator (Prof. Till T Bachmann) and by suggestions made by existing members of the AMR-RDT group. This was based on their fields of expertise, type of entity that they work, country of residence/work and gender. Previous cooperation and personal communications between members allowed the broad participation of 51 members, forming a single focus group, including 29/51 (57%) diagnostic innovators established at research/academic entities, 10/51 (20%) companies, 8/51 (16%) non-profit/non-governmental organisations (NGOs)/associations and 4/51 (8%) public health bodies. More details of the composition of the working group can be found in online supplemental table S1. The working group was funded for 12 months from 1 January to 31 December 2017. The kick-off meeting took place physically in Brussels, Belgium on 1 February 2017 with regular meetings taking place electronically once per month and towards the end once per 2 weeks. The final physical meeting

took place in Brussels, Belgium on February 2018. The working group remained connected via virtual meetings and email and ensured that the reported findings remained up to date for this publication.

With respect to the current publication, the experts' opinions were gathered via emails and in real-time during the consultations and data was added to Microsoft Office (Excel, Word files). The 'Essential Qualitative Information' including, 'Characteristic', 'Qualitative Explanation', 'Examples of External Influencing Factors' and 'Influencing Characteristics' for AMR diagnostic test TPP are shown in online supplemental table S2. This qualitative data was converted to quantitative by attributing the numerical value '1' when the working group judged that an interdependency between two characteristics occurred (online supplemental table S3). This quantitative data was then analysed using the Cytoscape open source software platform for visualising complex networks[24] in order to acquire the AMR TPP interaction network diagram shown in figure 1. Further details are available in the figure legend.

The current publication utilised scoping, drafting and consensus-building within the JPIAMR AMR-RDT working group to develop the presented information. Once published, stakeholder interest and comment should allow regular updating of the information presented.

The limitations of the current study include the fact that more than half of the working group participants originated from EU/EEA with few representatives from LMICs, where the characteristic *Retail price* may be most important. Nevertheless, the authors feel that the working group included a good representation of expertise from different AMR sectors and would not expect major differences in the interdependencies if a more diverse working group would have been recruited. Also,

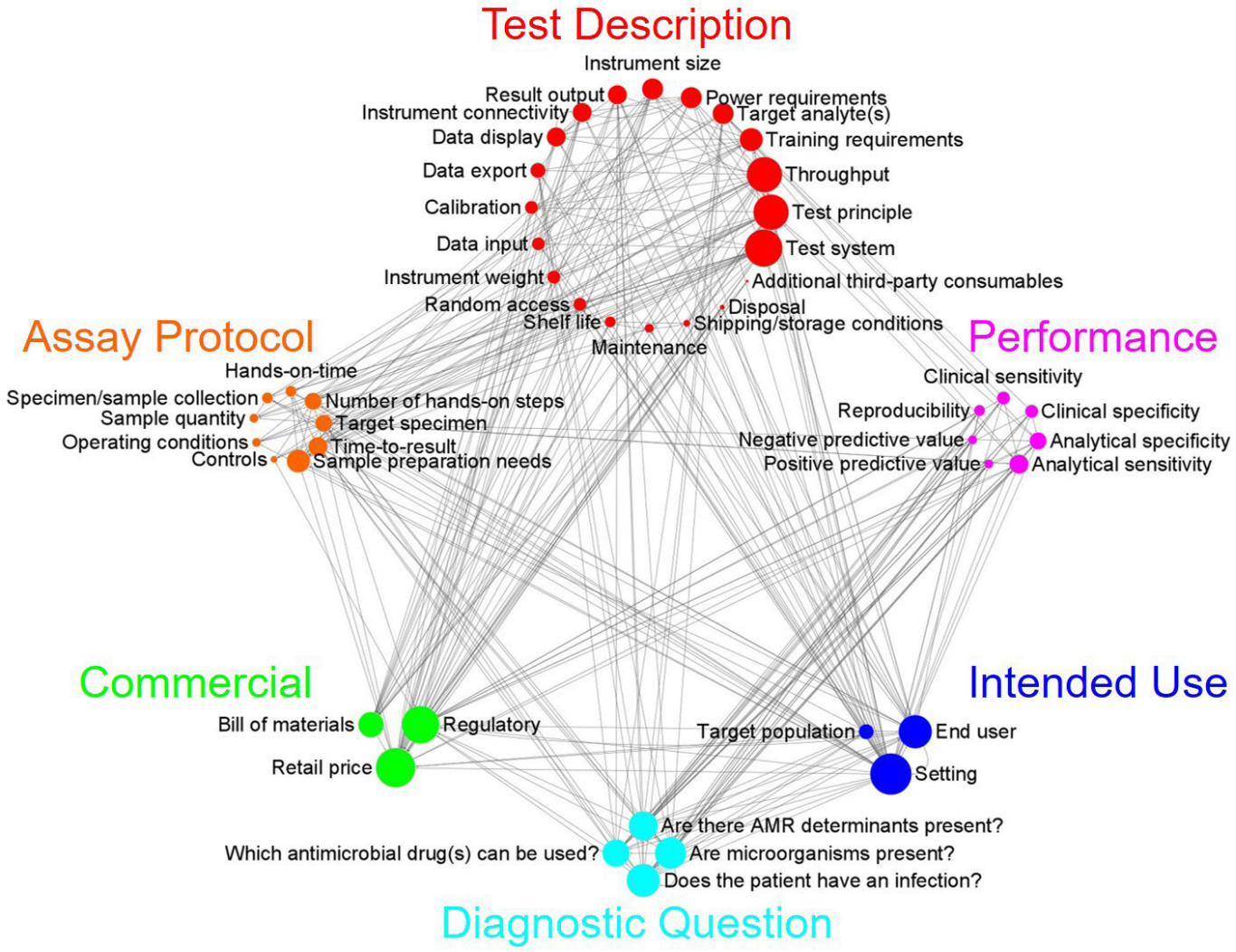

Figure 1 Target product profile Interaction Network Diagram. Lines indicate the presence of an interaction between the different characteristics. Characteristics are shown in black text and are grouped into six different categories, marked in coloured text (refer also to online supplemental table S2). Each characteristic is accompanied by a node (circle). The node size represents the number of interactions that this characteristic is involved with (online supplemental table S3), meaning that the more the lines connected to a node, the bigger the node. For absolute quantification of how many connections are related to each characteristic (node), please refer to online supplemental table S3. AMR, antimicrobial resistance.

it should be noted that this publication is not intended to create 'one more TPP', nor to be a systematic review or landscape analysis of TPPs like other studies.[5 25] Instead, it was based on expert opinions and background expertise of the JPIAMR AMR-RDT working group, through discussions and without the distribution of dedicated or standardised questionnaires or surveys. Although there may be slight differences in the characteristics and their categories terminology used in this publication compared with previous ones, this is not unusual for TPP-related documents,[6] especially as our aim was not to keep the same terminology, but to provide as complete and representative a set of characteristics as possible.

TPP CHARACTERISTICS AND INTERDEPENDENCIES

The authors provide 46 key characteristics and their interdependencies. These characteristics are grouped into six main categories, as shown in figure 1, and the first column of online supplemental table S2. Of these categories: (1) 'Intended Use' includes three key characteristics that essentially render each TPP, case-specific; (2) 'Diagnostic Question' includes four characteristics that are exactly the diagnostic questions that AMR diagnostics developers will have to address; (3) 'Test Description' includes 20 characteristics that are related to the instrument, the generated data and storage/shelf life; (4) 'Assay Protocol' includes nine characteristics that refer to the specimen properties, quantity, hands-on requirements, controls and operating conditions; (5) 'Performance' contains seven characteristics that define the analytical, clinical sensitivity and specificity, positive/negative predictive value and reproducibility and (6) 'Commercial' gathers three characteristics relevant to price and regulatory issues. Such TPP characteristics will also have to be met by developers in evaluation studies for the process of commercialisation of their tests.[26]

Contrary to specific use-case TPPs (that list quantitative ranges and values for each characteristic) and with a broad audience of AMR specialists in mind, we provide a qualitative explanation of characteristics (second column in online supplemental table S2), allowing TPP developers to assign their own context-specific value to characteristics dependent on their own use-case AMR TPP.

We also identified and describe the external factors (third column in online supplemental table S2) that may influence the quantitative ranges of each characteristic. Such information on external factors is typically not found in TPPs. Examples of such key external factors are as follows: (1) intended or available treatment or management option; (2) target markets; (3) accessibility; (4) the expected frequency of use (of the diagnostic test); (5) competitor performance and (6) business model and health economics—the latter being in line with earlier studies that recommend an early economic evaluation of diagnostic technologies[27 28] and integration of such evaluation into TPP development for medical tests.[21] Notably, there were no characteristics with zero external influencing factors.

All characteristics (first column of online supplemental table S2) had at least one influencing characteristic (fourth column of online supplemental table S2) and three characteristics were influenced by >10 other characteristics: (1) *Retail price* by 15; (2) *Training requirements* by 12 and (3) *Bill of materials* by 12. On the other hand, the characteristics that were least influenced by other characteristics were as follows: (1) *Additional third-party consumables* by 1; (2) *Are microorganisms present* by 2 and (3) *Setting* by 2.

Forty out of 46 characteristics act as 'influencing characteristics' (thereby defining interdependencies). The most influential characteristics are the *Setting*, *Test system*, *Test principle* and *Does the patient have an infection*, which have interdependencies with 39, 20 and (the latter two) with 18 of the 46 characteristics, respectively. The six that do not act as influencing characteristics (and do not appear in the fourth column of online supplemental table S2) are: *Disposal, Maintenance, Negative Predictive Value, Positive Predictive Value, Training requirements* and *Reproducibility*.

At the 'category level', the number of connections are as follows: (1) 'Intended Use' with 14; (2) 'Diagnostic Question' with 11; (3) 'Test Description' with 128; (4) 'Assay Protocol' with 53; (5) 'Performance' with 51 and (6) 'Commercial' with 37. All of the aforementioned quantitative information is summarised in figure 2 and provided in online supplemental table S3.

RELATIONSHIPS BETWEEN INTERDEPENDENCIES

Figure 1 and online supplemental tables 2 and 3 show that each TPP characteristic (represented with a node in figure 1) is potentially interdependent with other characteristics and provides some measure of the 'quantity' of that relationship (ie, the number of connections between characteristics). For TPP users, this means that placing priorities on a single TPP characteristic may have an impact on an entire range of other TPP characteristics.

In more detail, the categories 'Test Description' and 'Assay Protocol' are closely linked, as most diagnostics innovators would expect. More surprisingly, only two of the 'Test Description' nodes (*Test principle* and *Target analytes*) have connections with the 'Performance' category. Instead, strong links exist between the 'Performance' category and 'Commercial' and 'Intended Use'. This highlights the strong influence of commercial drivers and the desired application of the AMR-related diagnostic test. Similarly, how well a test must perform ('Performance') is most prominently driven by what the end-user wants to know when using the test ('Diagnostic Question'). It is also revealing to see the dominance of *Setting* (large node) over *End user* and *Target population*, which underpins the importance of the location of the target population over who is doing or receiving the test. Other highly influential characteristics in the network

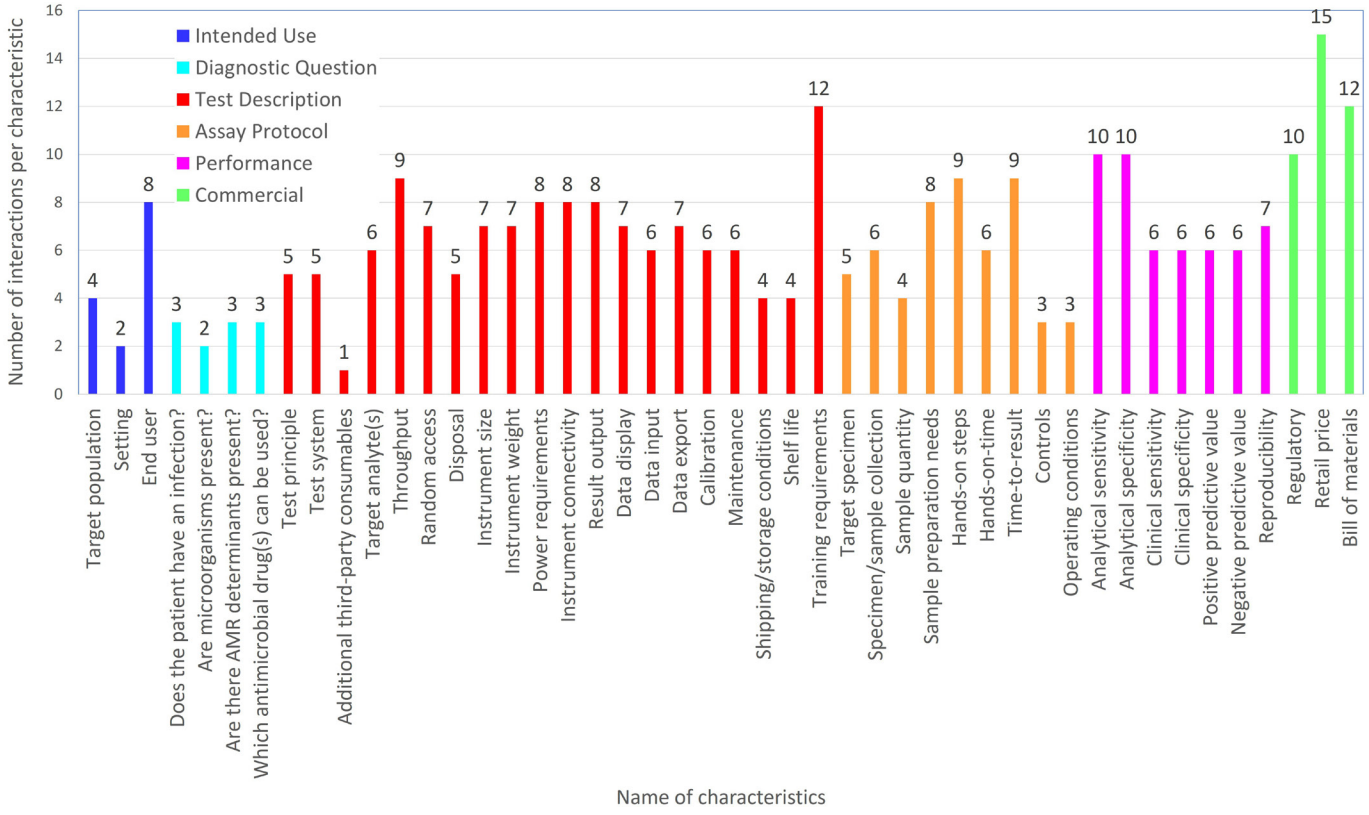

Figure 2 Bar diagram depicting the number of interconnections of each of the 46 identified key TPP characteristics that were associated with six different colour coded categories (see also figure 1). TPP, target product profile.

are *Retail price*, *Regulatory*, *Test system*, *Test principle* and *Throughput*. Interestingly, *Test system* is not connected to the 'Performance' and 'Diagnostic Question' categories. However, the *Test principle* is indeed connected with the 'Performance' category. This makes sense, as the analytical sensitivity is generally higher with a molecular than a phenotypic assay. Thus, the 'Diagnostic Question' defines the *Test system* and *Test principle* via the *Setting* and *End user*. For the influential 'Commercial' category, only *Regulatory* has links with the 'Diagnostic Question'. Finally, the most decisive cost per test aspect is covered by *Bill of materials* (almost entirely linked to 'Test Description' category) and *Retail price* which has wider connections to all categories except 'Diagnostic Question'.

Contrary to use case-specific TPPs, the novelty and highlight of this guidance lies in the fact that TPP development is approached from a general rather than a use case-specific perspective. We provide 46 key characteristics, as well as external influencing factors and guidance on their interdependencies between characteristics that can help diagnostic developers to approach AMR TPPs in a more structured and priority-driven manner. The main guidance is shown in the qualitative schematic representation (figure 1) and the quantitative correlation (figure 2) of interdependencies between characteristics. The importance of the publication lies in the fact that the concept of interconnected AMR TPP characteristics will offer added value to AMR diagnostic product developers, helping them prioritise the interactions/nodes that are likely to have the greatest impact on the final AMR diagnostic product. It also allows such developers to discover if, when or how a change in one test characteristic may subsequently affect other test characteristics.

CONCLUSION

The importance of this study lies in the interdependencies that have been identified between different characteristics associated with AMR diagnostic TPPs. Such interactions may not yet be evident when following the standard TPPs currently available, meaning that this information will be useful in helping AMR diagnostics developers to prioritise the different TPP characteristics associated with their own particular AMR diagnostic and provide a basis to explain why certain characteristics are considered important. The guidance is expected to be applied and used by diverse AMR stakeholders, including: (1) developers of use case-specific TPPs, for example, companies, or non-commercial bodies such as academic, research experts, non-profit/non-governmental organisations, associations, etc.; (2) developers of AMR diagnostic tests (in fields ranging from (bio)chemistry, medicine, engineering and information technology, etc) and (3) health technology assessment agencies, reimbursement bodies and insurance companies.

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Contributors TTB, KM, JPH, AvB, GL, GA, HG, JM-G, JV, KB, PM, SL and VDG acquired, analysed and interpreted data, drafted and revised the manuscript. AR, GSS, HP, RS, RWP and TvS revised the manuscript. All authors approved the final version of the manuscript. TTB is coordinator and lead contact for the JPIAMR AMR-RDT working group.

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Competing interests TTB is an advisor for (compensated) CARB-X, Module Innovations, Indian Biotechnology Industry Research Assistance Council (BIRAC) and (not compensated) Longitude Prize, Joint Programming Initiative for Antimicrobial Resistance, all outside the submitted work. JPH is a member of Scientific Advisory Board of Vitamica, outside the submitted work. AvB was an employee of bioMérieux and is currently with BaseClear. GL is an employee of Curetis, but neither company had direct influence on the submitted work. KB is inventor of pending patents related to infectious disease diagnostics and received grants, honoraria and travel support from the EU/INTERREG, the German Federal Ministry of Education and Research and the Federal Ministry for Economic Affairs, the Netherlands Research Council for Applied and Technical Sciences as well as from Becton Dickinson, bioMérieux, Bruker Daltonik, Hain Lifescience, Roche Molecular Systems, ThermoFisher; outside the submitted work. TvS reports grants from GSK Research Grant, personal fees from Pfizer, outside the submitted work. VdG reports personal fees from GVM CARE AND RESEARCH, outside the submitted work.

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Table S1: Full list of members of JPIAMR AMR-RDT Working Group during the study.

	Name Surname	Organisation name	Type	Country	LMIC/ HIC	Gender
1.	Till T. Bachmann (coordinator)	University of Edinburgh	University/Research	UK	HIC	M
2.	Alex van Belkum	BioMérieux, current BaseClear	Industry	FR	HIC	M
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4.	Aman Russom	KTH Royal Institute of Technology	University/Research	SE	HIC	M
5.	Andrew Shepherd	GlobalDx (formerly Omega Diagnostics)	Industry	UK	HIC	M
6.	Ann Van den Bruel	NIHR Diagnostic Evidence Cooperative	Non-profit, NGO, Association	UK	HIC	F
7.	Annika Eriksson	HemoCue AB	Industry	SE	HIC	F
8.	Barbara Fallowfield	British In Vitro Diagnostics Association (left)	Industry	UK	HIC	F
9.	Cassandra Kelly-Cirino	Foundation for Innovative New Diagnostics	Non-profit, NGO, Association	CH	HIC	F
10.	Carla Deakin	NICE	Non-profit, NGO, Association	UK	HIC	F
11.	Eiichi Tamiya	Osaka University	University/Research	JP	HIC	M
12.	Francis Moussy	World Health Organization, *Observer*	Non-profit, NGO, Association	CH	HIC	M
13.	Franck Molina	European Diagnostics Cluster Alliance	Non-profit, NGO, Association	FR	HIC	M
14.	Frank Apostel	R-Biopharm	Industry	DE	HIC	M
15.	Harald Peter	Fraunhofer IZI-BB	University/Research	DE	HIC	M
16.	Gerd Lüdke	Curetis GmbH	Industry	DE	HIC	M
17.	Guido Werner	Robert Koch Institute	University/Research	DE	HIC	M
18.	Gunnar S. Simonsen	University Hospital of North Norway and UiT – The Arctic University of Norway	University/Research	NO	HIC	M
19.	Gyorgy Abel	Lahey Hospital, Harvard Medical School	University/Research	US	HIC	M
20.	Herman Goossens	Antwerp University	University/Research	BE	HIC	M
21.	Jacob Moran-Gilad	Ben-Gurion University of the Negev	University/Research	IL	HIC	M
22.	James Fraser	Chipcare	Industry	CA	HIC	M
23.	Jean François de Lavison	Ahimsa Fund	Non-profit, NGO, Association	FR	HIC	M
24.	John P. Hays	Erasmus University Medical Center Rotterdam	University/Research	NL	HIC	M
25.	John Rex	F2G, Ltd. (ex AstraZeneca)	Industry	US	HIC	M
26.	Jordi Vila	University of Barcelona, Hospital Clinic, ISGlobal	University/Research	ES	HIC	M
27.	Karsten Becker	University Hospital Münster (current University Medicine Greifswald)	University/Research	DE	HIC	M

28.	Kate Templeton	NHS Lothian	Public Health	UK	HIC	F
29.	Kirsten Miller-Duys	Hyrax Biosciences	Industry	SA	LMIC	F
30.	Konstantinos Mitsakakis	Hahn-Schickard & University of Freiburg	University/Research	DE	HIC	M
31.	Manica Balasegeram	GARDP/DNDI	Non-profit, NGO, Association	CH	HIC	M
32.	Mark Woolhouse	University of Edinburgh	University/Research	UK	HIC	M
33.	Neil Butler	Spectromics	Industry	UK	HIC	M
34.	Neil Woodford	Public Health England	Public Health	UK	HIC	M
35.	Paul Savelkoul	Maastricht University	University/Research	NL	HIC	M
36.	Petra Gastmeier	Charite Belin, Infect Control 2020	University/Research	DE	HIC	F
37.	Philippe Lagace-Wiens	University of Manitoba (left)	University/Research	CA	HIC	M
38.	Rangarajan Sampath	Foundation for Innovative New Diagnostics (current Siemens Healthineers)	Non-profit, NGO, Association	CH	HIC	M
39.	Ramanan Laxminarayan	Center for Disease Dynamics, Economics & Policy	University/Research	US/IN	LMIC	M
40.	Rosanna Peeling	London School of Hygiene &Tropical Medicine	University/Research	UK	HIC	F
41.	Saturnino Luz	Usher Institute	University/Research	UK	HIC	M
42.	Sören Schubert	Max von Pettenkofer Institute Munich	University/Research	DE	HIC	M
43.	Stephan Harbarth	University of Geneva	University/Research	CH	HIC	M
44.	Sue Hill	NHS England	Public Health	UK	HIC	F
45.	Tracy Merlin	University of Adelaide	University/Research	AU	HIC	F
46.	Taslimarif Saiyed	Centre for Cellular and Molecular Platforms	University/Research	IN	LMIC	M
47.	Thomas Wichelhaus	University Frankfurt; Paul Ehrlich Society	University/Research	DE	HIC	M
48.	Tjeerd van Staa	Farr Institute; University of Manchester	University/Research	UK	HIC	M
49.	Valentina Di Gregori	San Pier Damiano Hospital GVM Care and Research	University/Research	IT	HIC	F
50.	Wouter van der Wijngaart	KTH Royal Institute of Technology	University/Research	SE	HIC	M
51.	Wilfried von Eiff	HHL Leipzig	University/Research	DE	HIC	M

Geographically the working group included 48/51 (94%) experts from High Income Countries (HICs): European Union (EU) and European Economic Area (EEA) 22/51 (43%); UK 14/51 (27%); Switzerland 5/51 (10%); USA 2/51 (4%); Canada 2/51 (4%); Australia 1/51 (2%); Israel 1/51 (2%); Japan 1/51 (2%), as well as 3/51 (6%) from Low- and Middle-Income Countries (LMICs): South Africa 1/51 (2%); India 2/51 (4%), and a more overall representation through members from FIND.

Gender-wise, the group consisted of 39/51 (76%) male and 12/51 (24%) female members.

The summary is given below.

Participating Country	Absolute number	Percent
Israel	1	2%
Japan	1	2%
South Africa	1	2%
Australia	1	2%
India	2	4%
Canada	2	4%
USA	2	4%
Switzerland	5	10%
UK	14	27%
European Union (EU) and European Economic Area (EEA)	**22**	**43%**
Germany (DE)	10	20%
Italy (IT)	1	2%
Belgium (BE)	1	2%
Sweden (SE)	3	6%
The Netherlands (NL)	2	4%
Spain (ES)	1	2%
Norway (NO)	1	2%
France (FR)	3	6%

Participations from High Income Countries (HICs) and Low/Middle-Income Countries (LMICs)	Absolute number	Percent
HICs	48	94%
LMICs	3	6%

Gender participations	Absolute number	Percent
Male	39	76%
Female	12	24%

Table S2: Essential Qualitative Information for AMR Diagnostic Test Target Product Profiles (TPP).

Characteristic	Qualitative explanation	Examples of External Influencing Factors	Influencing Characteristics (taken from column 1)
Category 'Intended Use'			
Target population	Patients presenting with symptoms indicating an infection. Patients needing monitoring or decision on management and treatment. Screening and surveillance cohorts	Age, gender	Does the patient have an infection? Are microorganisms present (if so, which ones)? Are there Antimicrobial Resistance (AMR) determinants present? Which antimicrobial drug(s) can be used?
Setting	Home, community (e.g. care home, mobile/pop-up ambulatory units), primary care (e.g. general practitioners, doctors' office), pharmacies, emergency department, hospital, intensive care unit	Predominant touch points for target population, location of target population (geography, urban/rural etc.), healthcare system, availability of utilities	Target population, end user
End user (the person performing the test)	Lay person, community health worker, nurse, medical/laboratory technician, general practitioner, medical specialist, clinical scientist, pharmacist	Guidelines defining user qualification	Setting, Does the patient have an infection? Are microorganisms present (if so, which ones)? Are there Antimicrobial Resistance (AMR) determinants present? Which antimicrobial drug(s) can be used? test principle, test system, regulatory
Category 'Diagnostic Question'			
Does the patient have an infection?	Yes (acute, recurrent, relapsing, chronic)/no	Intended or available treatment or management option, scientific knowledge and evidence, disease indication, relative risk of	Setting, Are microorganisms present (if so, which ones)? Are there Antimicrobial Resistance (AMR) determinants present?

		morbidity/mortality, infectivity/transmission	
Are microorganisms present (if so, which ones)?	Yes/no (pathogens/non-pathogens; Gram positive/negative bacteria; spore formers; mycobacteria; spirochaetes; mycoplasmas; viruses; fungi; parasites; phylogenetic classification e.g. species/strain/type)	Intended or available treatment or management option, scientific knowledge and evidence, disease indication, relative risk of morbidity/mortality, infectivity/transmission, WHO prioritisation level	Setting, Does the patient have an infection?
Are there Antimicrobial Resistance (AMR) determinants present (if so, which ones)?	Yes/no (antibacterial-, antifungal-, antiviral-, antiparasitic-resistance; class; name of mechanism/gene; gene sequence)	Intended or available treatment or management option, scientific knowledge and evidence, disease indication, local/regional epidemiology of disease and antimicrobial resistance	Setting, Does the patient have an infection? Are microorganisms present (if so, which ones)?
Which antimicrobial drug(s) can be used?	Sensitivity (Resistant, Sensitive, Sensitive to increased exposure (intermediate); e.g. Minimal Inhibitory Concentration (MIC)) to an individual or panel of antibacterial, antifungal, antiviral, antiparasitic drugs	Intended or available treatment or management option, scientific knowledge and evidence, disease indication, local/regional epidemiology of disease and antimicrobial resistance	Setting, Does the patient have an infection? Are microorganisms present (if so, which ones)?
Category 'Test Description'			
Test principle	Phenotype, genotype, molecular; detection through culture, optical, electrochemical, mass spectrometric, magnetic, mechanical, thermal, acoustic, piezoelectric methods	Health economics	Setting, target analyte(s), time-to-result, analytical sensitivity, analytical specificity
Test system	Instrument (with or without disposable cartridge), instrument-free test/strip/cartridge, sampling device/consumable, additional reagents	Assay complexity, stability of assay components	Setting, test principle, target specimen, sample quantity, operating conditions

Additional third-party consumables	Allowed, not allowed	Intellectual property rights, test tolerance towards non-original consumables, business model	Regulatory
Target analyte(s)	Cells, microorganisms, cell envelope components, vesicles, proteins, nucleic acids, lipids, carbohydrates, small molecules, ions	Scientific knowledge and evidence, intellectual property rights	Diagnostic question (all characteristics), clinical sensitivity, clinical specificity
Throughput[1]	One - multiple test/time	Prevalence/incidence of disease, business model, organisation of working time (shifts vs 24/7), assay complexity	Target population, setting, test principle, test system, instrument size, hands-on steps, time-to-result, retail price, bill of materials
Random access[2]	Yes/No	Prevalence/incidence of disease, assay complexity, business model, organisation of working time (shifts vs 24/7)	Target population, setting, test principle, test system, instrument size, time-to-result, retail price
Disposal	Disposable/reusable/recyclable/biodegradable materials, treatment for biohazard/non-biohazard, toxic/non-toxic waste	Target markets, health economics, public opinion, sustainability of materials	Setting, end user, regulatory, retail price, bill of materials
Instrument size	Instrument free, wearable, handheld, portable, table top, free standing, large, high throughput, automated laboratory systems	Health economics, automation, instrument stacking requirements	Setting, test principle, throughput, instrument weight, sample preparation needs, retail price, bill of materials
Instrument weight	Grams to many kilograms	Target markets, health economics, automation, instrument stacking requirements	Setting, test principle, throughput, instrument size, sample preparation needs, retail price, bill of materials
Power requirements	Mains, battery, solar, self-powered, human-powered, none	Target markets, health economics, automation	Setting, test principle, test system, throughput, instrument

[1] number of tests per unit of time
[2] capacity to add additional samples while others are still being processed

			connectivity, data display, sample preparation needs, operating conditions
Instrument connectivity	No/Yes (connection to hospital information system, electronic health record, epidemiological surveillance, cloud storage, remote access, instrument performance monitoring, data storage and archiving, type of connection (WiFi, Bluetooth, LAN, USB, …))	Target markets, availability of middleware, availability of data protection mechanisms, quality assurance requirements	Setting, end user, power requirements, data display, data input, data export, regulatory, retail price
Result output	Qualitative, quantitative, semi-quantitative	Health economics, assay complexity	Target population, setting, end user, diagnostic question (all characteristics), retail price
Data display	For instrument-free test/strip/cartridge: visual (colour, screen) For instrument-based test: On-/Off-instrument (screen, printout), visual (numeric, textual, colour, graphical), auditory (speech, notification sounds)	Target markets, accessibility (lighting conditions, background noise)	Setting, end user, throughput, power requirements, instrument connectivity, result output, retail price
Data input	Patient ID, Lot/cartridge ID, operator ID, metadata (location, laboratory, date); Manual entry (keypad, touchscreen), automated entry (bar code, RFID, …)	Target markets, data protection and safety regulations	Setting, end user, test system, throughput, instrument size, retail price
Data export	Patient, test, and instrument data; Manual registration, hardware/software interfaces; Secure, encrypted, anonymised; Real time, on demand	Data storage requirements, data protection and safety regulations	Setting, end user, diagnostic question (all characteristics), throughput
Calibration	No (calibration free)/Yes (Location (On site, remote), mode (self-calibrating, user, company technician), frequency (annual to daily, before each measurement), materials (reference standard/materials e.g. provided by QA/QC organisations))	Business model, frequency of use	Setting, test principle, test system, target analyte(s), throughput, regulatory

Maintenance	Yes (frequency of maintenance, operator)/No	Frequency of use, assay complexity, automation	Setting, end user, test system, throughput, sample preparation needs, operating conditions
Shipping/storage conditions (for instrument and disposable or instrument-free test/strip/cartridge/reagents)	Acceptable temperature range (e.g. cold chain requirements); Ability to withstand dusty conditions; Range for relative humidity/non-condensing humidity; Range for altitude	Instrument materials, stability of assay components, robustness of assay	Setting, test principle, test system, shelf life
Shelf life (for instrument and disposable or instrument-free test/strip/cartridge/reagents)	Range in months (at specified temperature/humidity)	Stability of assay components, business model	Setting, test system, shipping/storage conditions, regulatory
Training requirements	Self-training (Instruction manual printed/online, training video), by qualified users, by company expert; duration of training (minutes, hours, days); recommended, mandatory (plus/minus access controlled)	Assay complexity	Setting, end user, test system, result output, data display, data input, data export, calibration, specimen/sample collection, hands on steps, controls, regulatory
Category 'Assay Protocol'			
Target specimen	Hair, cerebrospinal fluid, sweat, tears, saliva, ear wax, tissue, blood (plasma, serum), lymph, interstitial fluid, sputum, pus, bronchoalveolar lavage, nails, faeces, semen, urine, specimen on swabs, nasal washings, exhaled air	Disease indication, target analyte(s) and location/abundance in/on the body, biological risk, requirement for ease of specimen collection, invasiveness, and processing	Setting, diagnostic question (all characteristics)
Specimen/sample collection	Venipuncture, finger prick, salivation, stool collection, gargling, urination, swab/sputum collection, lumbar puncture, intubation, etc.	Disease indication, target analyte(s) and location/abundance in/on the body, biological risk, requirement for ease of specimen collection, invasiveness, and processing	Setting, end user, test system, target analyte(s), target specimen, sample quantity
Sample quantity	µL - mL, mg , g, number of solid pieces/fragments etc.	Disease indication, target analyte(s) and location/abundance in/on the	Test principle, test system, target analyte(s), analytical sensitivity

		body, biological risk, requirement for ease of specimen collection, invasiveness, and processing	
Sample preparation needs	Yes (homogenisation, liquefying, separation, extraction, purification, stabilisation, dilution) / No	Assay complexity	Setting, end user, test principle, test system, throughput, power requirements, target specimen, retail price
Hands-on steps (from the start of sample processing to result)	Refers to the number of steps from the start of sample processing	Competitor performance, assay complexity, invasiveness, and processing	Setting, end user, test principle, test system, throughput, calibration, sample preparation needs, controls, retail price
Hands-on-time (from the start of sample processing to result)	Seconds, minutes, hours	Competitor performance, assay complexity	Setting, end user, test system, throughput, sample preparation needs, retail price
Time-to-result (TTR) (from the start of sample processing to result)	Minutes, hours	Competitor performance, assay complexity, health economics	Target population, setting, diagnostic question (all characteristics), test principle, throughput, hands-on-time
Controls	Yes (internal process, positive, negative controls) / No	Assay complexity, stability of assay components	Test principle, test system, regulatory
Operating conditions	Temperature range; Range for relative humidity, non-condensing humidity; Compatibility with dusty conditions; Resistance to electromagnetic/mechanical/light interference	Stability of assay components, robustness of assay	Setting, test principle, test system
Category 'Performance'			
Analytical sensitivity (Limit of detection (LOD) of the specific target analyte - disease specific)	Given as number/mass of molecules/cells per test/unit volume	Competitor performance, health economics, relative risk of morbidity/mortality, infectivity/transmission	Setting, diagnostic question (all characteristics), target analyte(s), target specimen, clinical sensitivity, regulatory, retail price
Analytical specificity (Detection of the specific target analyte(s)	Given as a percentage or statistical value	Existence and/or presence of similar target analyte(s),	Setting, diagnostic question (all characteristics), target analyte(s),

without cross reacting with non-target analyte(s) of the same type)		competitor performance, health economics	target specimen, clinical specificity, regulatory, retail price
Clinical sensitivity (Correct identification of a specific disease state)	Given as a percentage range or statistical value compared to an accepted (named) reference method	Threat level, competitor performance, health economics, current gold standard, relative risk of morbidity/mortality, infectivity/transmission	Setting, diagnostic question (all characteristics), regulatory
Clinical specificity (Correct identification of those who do not have a specific disease state)	Given as a percentage range or statistical value compared to an accepted (named) reference method	Threat level, competitor performance, health economics, current gold standard, relative risk of morbidity/mortality, infectivity/transmission	Setting, diagnostic question (all characteristics), regulatory
Positive predictive value (PPV) (The proportion of subjects with a positive test result who truly have the specific disease, biomarker, mutation etc., of interest)	Given as a percentage range or statistical value compared to an accepted (named) reference method	Threat level, competitor performance, health economics, current gold standard, relative risk of morbidity/mortality, infectivity/transmission, disease prevalence, pre-test probability	Setting, diagnostic question (all characteristics), regulatory
Negative predictive value (NPV) (The proportion of subjects with a negative test result who truly do not have the specific disease, biomarker, mutation etc., of interest)	Given as a percentage range or statistical value compared to an accepted (named) reference method	Threat level, competitor performance, health economics, current gold standard, relative risk of morbidity/mortality, infectivity/transmission, disease prevalence, pre-test probability	Setting, diagnostic question (all characteristics), regulatory

Reproducibility (The ability of a test to produce the same result after multiple testing under the same conditions)	Quantitative Coefficient of Variation (CV) in inter/intra batch assessment	Threat level, relative risk of morbidity/mortality, competitor performance, health economics	Setting, end user, diagnostic question (all characteristics), regulatory
Category 'Commercial'			
Regulatory	GMP compliant, certified to international standards, e.g. ISO 13485:2016, by regulatory authorities, e.g. CE-IVD, FDA, NMPA, CDSCO	Business model, target market	Setting, end user, diagnostic question (all characteristics), test principle, test system, target analyte(s), target specimen
Retail price	Range of (named) currency per test; 0 (reagent rental model) or range of (named) currency per instrument	Development costs, business model, target market, and other commercial considerations	Target population, setting, end user, test principle, test system, additional third-party consumables, throughput, random access, instrument size, power requirements, instrument connectivity, result output, data display, shelf life (of disposable/instrument-free test/strip/cartridge/reagents), bill of materials
Bill of materials (BOM, sales BOM)	Range of (named) currency per test; range of (named) currency per instrument	Reagents, manufacturing volume	Test principle, test system, additional third-party consumables, throughput, instrument size, power requirements, instrument connectivity, result output, data display, shelf life (of disposable/instrument-free test/strip/cartridge/reagents), analytical sensitivity, analytical specificity

Table S3: Interactions between characteristics and sum of interactions per characteristic and per category.

Categories of characteristics	Characteristics (taken from column 1 of Supplemental Table S2)	Influencing Characteristics (taken from column 4 of Supplemental Table S2)	Categories of Influencing Characteristics	Presence of an interaction between two characteristics ('1' means 'yes')	Sum of interactions per characteristic	Sum of interactions per category
Intended Use	Target population	Does the patient have an infection?	Diagnostic Question	1	4	14
Intended Use	Target population	Are microorganisms present?	Diagnostic Question	1		
Intended Use	Target population	Are there AMR determinants present?	Diagnostic Question	1		
Intended Use	Target population	Which antimicrobial drug(s) can be used?	Diagnostic Question	1		
Intended Use	Setting	Target population	Intended Use	1	2	
Intended Use	Setting	End user	Intended Use	1		
Intended Use	End user	Setting	Intended Use	1	8	
Intended Use	End user	Does the patient have an infection?	Diagnostic Question	1		
Intended Use	End user	Are microorganisms present?	Diagnostic Question	1		
Intended Use	End user	Are there AMR determinants present?	Diagnostic Question	1		
Intended Use	End user	Which antimicrobial drug(s) can be used?	Diagnostic Question	1		
Intended Use	End user	Test principle	Test Description	1		
Intended Use	End user	Test system	Test Description	1		
Intended Use	End user	Regulatory	Commercial	1		
Diagnostic Question	Does the patient have an infection?	Setting	Intended Use	1	3	11
Diagnostic Question	Does the patient have an infection?	Are microorganisms present?	Diagnostic Question	1		
Diagnostic Question	Does the patient have an infection?	Are there AMR determinants present?	Diagnostic Question	1		
Diagnostic Question	Are microorganisms present?	Setting	Intended Use	1	2	
Diagnostic Question	Are microorganisms present?	Does the patient have an infection?	Diagnostic Question	1		

Diagnostic Question	Are there AMR determinants present?	Setting	Intended Use	1	3	
Diagnostic Question	Are there AMR determinants present?	Does the patient have an infection?	Diagnostic Question	1		
Diagnostic Question	Are there AMR determinants present?	Are microorganisms present?	Diagnostic Question	1		
Diagnostic Question	Which antimicrobial drug(s) can be used?	Setting	Intended Use	1	3	
Diagnostic Question	Which antimicrobial drug(s) can be used?	Does the patient have an infection?	Diagnostic Question	1		
Diagnostic Question	Which antimicrobial drug(s) can be used?	Are microorganisms present?	Diagnostic Question	1		
Test Description	Test principle	Setting	Intended Use	1	5	128
Test Description	Test principle	Target analyte(s)	Test Description	1		
Test Description	Test principle	Time-to-result	Assay Protocol	1		
Test Description	Test principle	Analytical sensitivity	Performance	1		
Test Description	Test principle	Analytical specificity	Performance	1		
Test Description	Test system	Setting	Intended Use	1	5	
Test Description	Test system	Test principle	Test Description	1		
Test Description	Test system	Target specimen	Assay Protocol	1		
Test Description	Test system	Sample quantity	Assay Protocol	1		
Test Description	Test system	Operating conditions	Assay Protocol	1		
Test Description	Additional third-party consumables	Regulatory	Commercial	1	1	
Test Description	Target analyte(s)	Does the patient have an infection?	Diagnostic Question	1	6	
Test Description	Target analyte(s)	Are microorganisms present?	Diagnostic Question	1		
Test Description	Target analyte(s)	Are there AMR determinants present?	Diagnostic Question	1		
Test Description	Target analyte(s)	Which antimicrobial drug(s) can be used?	Diagnostic Question	1		
Test Description	Target analyte(s)	Clinical sensitivity	Performance	1		

Test Description	Target analyte(s)	Clinical specificity	Performance	1		
Test Description	Throughput	Target population	Intended Use	1	9	
Test Description	Throughput	Setting	Intended Use	1		
Test Description	Throughput	Test principle	Test Description	1		
Test Description	Throughput	Test system	Test Description	1		
Test Description	Throughput	Instrument size	Test Description	1		
Test Description	Throughput	Hands-on steps	Assay Protocol	1		
Test Description	Throughput	Time-to-result	Assay Protocol	1		
Test Description	Throughput	Retail price	Commercial	1		
Test Description	Throughput	Bill of materials	Commercial	1		
Test Description	Random access	Target population	Intended Use	1	7	
Test Description	Random access	Setting	Intended Use	1		
Test Description	Random access	Test principle	Test Description	1		
Test Description	Random access	Test system	Test Description	1		
Test Description	Random access	Instrument size	Test Description	1		
Test Description	Random access	Time-to-result	Assay Protocol	1		
Test Description	Random access	Retail price	Commercial	1		
Test Description	Disposal	Setting	Intended Use	1	5	
Test Description	Disposal	End user	Intended Use	1		
Test Description	Disposal	Regulatory	Commercial	1		
Test Description	Disposal	Retail price	Commercial	1		
Test Description	Disposal	Bill of materials	Commercial	1		
Test Description	Instrument size	Setting	Intended Use	1	7	
Test Description	Instrument size	Test principle	Test Description	1		
Test Description	Instrument size	Throughput	Test Description	1		
Test Description	Instrument size	Instrument weight	Test Description	1		
Test Description	Instrument size	Sample preparation needs	Assay Protocol	1		
Test Description	Instrument size	Retail price	Commercial	1		
Test Description	Instrument size	Bill of materials	Commercial	1		
Test Description	Instrument weight	Setting	Intended Use	1	7	
Test Description	Instrument weight	Test principle	Test Description	1		
Test Description	Instrument weight	Throughput	Test Description	1		
Test Description	Instrument weight	Instrument size	Test Description	1		
Test Description	Instrument weight	Sample preparation needs	Assay Protocol	1		

Test Description	Instrument weight	Retail price	Commercial	1		
Test Description	Instrument weight	Bill of materials	Commercial	1		
Test Description	Power requirements	Setting	Intended Use	1	8	
Test Description	Power requirements	Test principle	Test Description	1		
Test Description	Power requirements	Test system	Test Description	1		
Test Description	Power requirements	Throughput	Test Description	1		
Test Description	Power requirements	Instrument connectivity	Test Description	1		
Test Description	Power requirements	Data display	Test Description	1		
Test Description	Power requirements	Sample preparation needs	Assay Protocol	1		
Test Description	Power requirements	Operating conditions	Assay Protocol	1		
Test Description	Instrument connectivity	Setting	Intended Use	1	8	
Test Description	Instrument connectivity	End user	Intended Use	1		
Test Description	Instrument connectivity	Power requirements	Test Description	1		
Test Description	Instrument connectivity	Data display	Test Description	1		
Test Description	Instrument connectivity	Data input	Test Description	1		
Test Description	Instrument connectivity	Data export	Test Description	1		
Test Description	Instrument connectivity	Regulatory	Commercial	1		
Test Description	Instrument connectivity	Retail price	Commercial	1		
Test Description	Result output	Target population	Intended Use	1	8	
Test Description	Result output	Setting	Intended Use	1		
Test Description	Result output	End user	Intended Use	1		
Test Description	Result output	Does the patient have an infection?	Diagnostic Question	1		
Test Description	Result output	Are microorganisms present?	Diagnostic Question	1		
Test Description	Result output	Are there AMR determinants present?	Diagnostic Question	1		

Test Description	Result output	Which antimicrobial drug(s) can be used?	Diagnostic Question	1		
Test Description	Result output	Retail price	Commercial	1		
Test Description	Data display	Setting	Intended Use	1	7	
Test Description	Data display	End user	Intended Use	1		
Test Description	Data display	Throughput	Test Description	1		
Test Description	Data display	Power requirements	Test Description	1		
Test Description	Data display	Instrument connectivity	Test Description	1		
Test Description	Data display	Result output	Test Description	1		
Test Description	Data display	Retail price	Commercial	1		
Test Description	Data input	Setting	Intended Use	1	6	
Test Description	Data input	End user	Intended Use	1		
Test Description	Data input	Test system	Test Description	1		
Test Description	Data input	Throughput	Test Description	1		
Test Description	Data input	Instrument size	Test Description	1		
Test Description	Data input	Retail price	Commercial	1		
Test Description	Data export	Setting	Intended Use	1	7	
Test Description	Data export	End user	Intended Use	1		
Test Description	Data export	Does the patient have an infection?	Diagnostic Question	1		
Test Description	Data export	Are microorganisms present?	Diagnostic Question	1		
Test Description	Data export	Are there AMR determinants present?	Diagnostic Question	1		
Test Description	Data export	Which antimicrobial drug(s) can be used?	Diagnostic Question	1		
Test Description	Data export	Throughput	Test Description	1		
Test Description	Calibration	Setting	Intended Use	1	6	
Test Description	Calibration	Test principle	Test Description	1		
Test Description	Calibration	Test system	Test Description	1		
Test Description	Calibration	Target analyte(s)	Test Description	1		
Test Description	Calibration	Throughput	Test Description	1		
Test Description	Calibration	Regulatory	Commercial	1		
Test Description	Maintenance	Setting	Intended Use	1	6	
Test Description	Maintenance	End user	Intended Use	1		

Test Description	Maintenance	Test system	Test Description	1		
Test Description	Maintenance	Throughput	Test Description	1		
Test Description	Maintenance	Sample preparation needs	Assay Protocol	1		
Test Description	Maintenance	Operating conditions	Assay Protocol	1		
Test Description	Shipping/storage conditions	Setting	Intended Use	1	4	
Test Description	Shipping/storage conditions	Test principle	Test Description	1		
Test Description	Shipping/storage conditions	Test system	Test Description	1		
Test Description	Shipping/storage conditions	Shelf life	Test Description	1		
Test Description	Shelf life	Setting	Intended Use	1	4	
Test Description	Shelf life	Test system	Test Description	1		
Test Description	Shelf life	Shipping/storage conditions	Test Description	1		
Test Description	Shelf life	Regulatory	Commercial	1		
Test Description	Training requirements	Setting	Intended Use	1	12	
Test Description	Training requirements	End user	Intended Use	1		
Test Description	Training requirements	Test system	Test Description	1		
Test Description	Training requirements	Result output	Test Description	1		
Test Description	Training requirements	Data display	Test Description	1		
Test Description	Training requirements	Data input	Test Description	1		
Test Description	Training requirements	Data export	Test Description	1		
Test Description	Training requirements	Calibration	Test Description	1		
Test Description	Training requirements	Specimen/sample collection	Assay Protocol	1		

Test Description	Training requirements	Hands-on steps	Assay Protocol	1		
Test Description	Training requirements	Controls	Assay Protocol	1		
Test Description	Training requirements	Regulatory	Commercial	1		
Assay Protocol	Target specimen	Setting	Intended Use	1	5	53
Assay Protocol	Target specimen	Does the patient have an infection?	Diagnostic Question	1		
Assay Protocol	Target specimen	Are microorganisms present?	Diagnostic Question	1		
Assay Protocol	Target specimen	Are there AMR determinants present?	Diagnostic Question	1		
Assay Protocol	Target specimen	Which antimicrobial drug(s) can be used?	Diagnostic Question	1		
Assay Protocol	Specimen/sample collection	Setting	Intended Use	1	6	
Assay Protocol	Specimen/sample collection	End user	Intended Use	1		
Assay Protocol	Specimen/sample collection	Test system	Test Description	1		
Assay Protocol	Specimen/sample collection	Target analyte(s)	Test Description	1		
Assay Protocol	Specimen/sample collection	Target specimen	Assay Protocol	1		
Assay Protocol	Specimen/sample collection	Sample quantity	Assay Protocol	1		
Assay Protocol	Sample quantity	Test principle	Test Description	1	4	
Assay Protocol	Sample quantity	Test system	Test Description	1		
Assay Protocol	Sample quantity	Target analyte(s)	Test Description	1		
Assay Protocol	Sample quantity	Analytical sensitivity	Performance	1		
Assay Protocol	Sample preparation needs	Setting	Intended Use	1	8	
Assay Protocol	Sample preparation needs	End user	Intended Use	1		

Assay Protocol	Sample preparation needs	Test principle	Test Description	1		
Assay Protocol	Sample preparation needs	Test system	Test Description	1		
Assay Protocol	Sample preparation needs	Throughput	Test Description	1		
Assay Protocol	Sample preparation needs	Power requirements	Test Description	1		
Assay Protocol	Sample preparation needs	Target specimen	Assay Protocol	1		
Assay Protocol	Sample preparation needs	Retail price	Commercial	1		
Assay Protocol	Hands-on steps	Setting	Intended Use	1	9	
Assay Protocol	Hands-on steps	End user	Intended Use	1		
Assay Protocol	Hands-on steps	Test principle	Test Description	1		
Assay Protocol	Hands-on steps	Test system	Test Description	1		
Assay Protocol	Hands-on steps	Throughput	Test Description	1		
Assay Protocol	Hands-on steps	Calibration	Test Description	1		
Assay Protocol	Hands-on steps	Sample preparation needs	Assay Protocol	1		
Assay Protocol	Hands-on steps	Controls	Assay Protocol	1		
Assay Protocol	Hands-on steps	Retail price	Commercial	1		
Assay Protocol	Hands-on-time	Setting	Intended Use	1	6	
Assay Protocol	Hands-on-time	End user	Intended Use	1		
Assay Protocol	Hands-on-time	Test system	Test Description	1		
Assay Protocol	Hands-on-time	Throughput	Test Description	1		
Assay Protocol	Hands-on-time	Sample preparation needs	Assay Protocol	1		
Assay Protocol	Hands-on-time	Retail price	Commercial	1		
Assay Protocol	Time-to-result	Target population	Intended Use	1	9	
Assay Protocol	Time-to-result	Setting	Intended Use	1		
Assay Protocol	Time-to-result	Does the patient have an infection?	Diagnostic Question	1		
Assay Protocol	Time-to-result	Are microorganisms present?	Diagnostic Question	1		
Assay Protocol	Time-to-result	Are there AMR determinants present?	Diagnostic Question	1		

Assay Protocol	Time-to-result	Which antimicrobial drug(s) can be used?	Diagnostic Question	1		
Assay Protocol	Time-to-result	Test principle	Test Description	1		
Assay Protocol	Time-to-result	Throughput	Test Description	1		
Assay Protocol	Time-to-result	Hands-on-time	Assay Protocol	1		
Assay Protocol	Controls	Test principle	Test Description	1	3	
Assay Protocol	Controls	Test system	Test Description	1		
Assay Protocol	Controls	Regulatory	Commercial	1		
Assay Protocol	Operating conditions	Setting	Intended Use	1	3	
Assay Protocol	Operating conditions	Test principle	Test Description	1		
Assay Protocol	Operating conditions	Test system	Test Description	1		
Performance	Analytical sensitivity	Setting	Intended Use	1	10	51
Performance	Analytical sensitivity	Does the patient have an infection?	Diagnostic Question	1		
Performance	Analytical sensitivity	Are microorganisms present?	Diagnostic Question	1		
Performance	Analytical sensitivity	Are there AMR determinants present?	Diagnostic Question	1		
Performance	Analytical sensitivity	Which antimicrobial drug(s) can be used?	Diagnostic Question	1		
Performance	Analytical sensitivity	Target analyte(s)	Test Description	1		
Performance	Analytical sensitivity	Target specimen	Assay Protocol	1		
Performance	Analytical sensitivity	Clinical sensitivity	Performance	1		
Performance	Analytical sensitivity	Regulatory	Commercial	1		
Performance	Analytical sensitivity	Retail price	Commercial	1		
Performance	Analytical specificity	Setting	Intended Use	1	10	
Performance	Analytical specificity	Does the patient have an infection?	Diagnostic Question	1		
Performance	Analytical specificity	Are microorganisms present?	Diagnostic Question	1		
Performance	Analytical specificity	Are there AMR determinants present?	Diagnostic Question	1		

Performance	Analytical specificity	Which antimicrobial drug(s) can be used?	Diagnostic Question	1		
Performance	Analytical specificity	Target analyte(s)	Test Description	1		
Performance	Analytical specificity	Target specimen	Assay Protocol	1		
Performance	Analytical specificity	Clinical specificity	Performance	1		
Performance	Analytical specificity	Regulatory	Commercial	1		
Performance	Analytical specificity	Retail price	Commercial	1		
Performance	Clinical sensitivity	Setting	Intended Use	1	6	
Performance	Clinical sensitivity	Does the patient have an infection?	Diagnostic Question	1		
Performance	Clinical sensitivity	Are microorganisms present?	Diagnostic Question	1		
Performance	Clinical sensitivity	Are there AMR determinants present?	Diagnostic Question	1		
Performance	Clinical sensitivity	Which antimicrobial drug(s) can be used?	Diagnostic Question	1		
Performance	Clinical sensitivity	Regulatory	Commercial	1		
Performance	Clinical specificity	Setting	Intended Use	1	6	
Performance	Clinical specificity	Does the patient have an infection?	Diagnostic Question	1		
Performance	Clinical specificity	Are microorganisms present?	Diagnostic Question	1		
Performance	Clinical specificity	Are there AMR determinants present?	Diagnostic Question	1		
Performance	Clinical specificity	Which antimicrobial drug(s) can be used?	Diagnostic Question	1		
Performance	Clinical specificity	Regulatory	Commercial	1		
Performance	Positive predictive value	Setting	Intended Use	1	6	
Performance	Positive predictive value	Does the patient have an infection?	Diagnostic Question	1		
Performance	Positive predictive value	Are microorganisms present?	Diagnostic Question	1		
Performance	Positive predictive value	Are there AMR determinants present?	Diagnostic Question	1		

Performance	Positive predictive value	Which antimicrobial drug(s) can be used?	Diagnostic Question	1		
Performance	Positive predictive value	Regulatory	Commercial	1		
Performance	Negative predictive value	Setting	Intended Use	1	6	
Performance	Negative predictive value	Does the patient have an infection?	Diagnostic Question	1		
Performance	Negative predictive value	Are microorganisms present?	Diagnostic Question	1		
Performance	Negative predictive value	Are there AMR determinants present?	Diagnostic Question	1		
Performance	Negative predictive value	Which antimicrobial drug(s) can be used?	Diagnostic Question	1		
Performance	Negative predictive value	Regulatory	Commercial	1		
Performance	Reproducibility	Setting	Intended Use	1	7	
Performance	Reproducibility	End user	Intended Use	1		
Performance	Reproducibility	Does the patient have an infection?	Diagnostic Question	1		
Performance	Reproducibility	Are microorganisms present?	Diagnostic Question	1		
Performance	Reproducibility	Are there AMR determinants present?	Diagnostic Question	1		
Performance	Reproducibility	Which antimicrobial drug(s) can be used?	Diagnostic Question	1		
Performance	Reproducibility	Regulatory	Commercial	1		
Commercial	Regulatory	Setting	Intended Use	1	10	37
Commercial	Regulatory	End user	Intended Use	1		
Commercial	Regulatory	Does the patient have an infection?	Diagnostic Question	1		
Commercial	Regulatory	Are microorganisms present?	Diagnostic Question	1		
Commercial	Regulatory	Are there AMR determinants present?	Diagnostic Question	1		
Commercial	Regulatory	Which antimicrobial drug(s) can be used?	Diagnostic Question	1		

Commercial	Regulatory	Test principle	Test Description	1		
Commercial	Regulatory	Test system	Test Description	1		
Commercial	Regulatory	Target analyte(s)	Test Description	1		
Commercial	Regulatory	Target specimen	Assay Protocol	1		
Commercial	Retail price	Target population	Intended Use	1	15	
Commercial	Retail price	Setting	Intended Use	1		
Commercial	Retail price	End user	Intended Use	1		
Commercial	Retail price	Test principle	Test Description	1		
Commercial	Retail price	Test system	Test Description	1		
Commercial	Retail price	Additional third-party consumables	Test Description	1		
Commercial	Retail price	Throughput	Test Description	1		
Commercial	Retail price	Random access	Test Description	1		
Commercial	Retail price	Instrument size	Test Description	1		
Commercial	Retail price	Power requirements	Test Description	1		
Commercial	Retail price	Instrument connectivity	Test Description	1		
Commercial	Retail price	Result output	Test Description	1		
Commercial	Retail price	Data display	Test Description	1		
Commercial	Retail price	Shelf life	Test Description	1		
Commercial	Retail price	Bill of materials	Commercial	1		
Commercial	Bill of materials	Test principle	Test Description	1	12	
Commercial	Bill of materials	Test system	Test Description	1		
Commercial	Bill of materials	Additional third-party consumables	Test Description	1		
Commercial	Bill of materials	Throughput	Test Description	1		
Commercial	Bill of materials	Instrument size	Test Description	1		
Commercial	Bill of materials	Power requirements	Test Description	1		
Commercial	Bill of materials	Instrument connectivity	Test Description	1		
Commercial	Bill of materials	Result output	Test Description	1		
Commercial	Bill of materials	Data display	Test Description	1		
Commercial	Bill of materials	Shelf life	Test Description	1		
Commercial	Bill of materials	Analytical sensitivity	Performance	1		
Commercial	Bill of materials	Analytical specificity	Performance	1		