



Deliverable
D-IA.2.2.OH-Harmony-
Cap.2.4
Results and evaluation of
the final survey

Work package 2 of
OH-Harmony-Cap:
Development of the
OHLabCap

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P35-INIAV, P36-INSa, P39-SLV, P40-FOHM,
P41-SVA



GENERAL INFORMATION

European Joint Programme full title	Promoting One Health in Europe through joint actions on foodborne zoonoses, antimicrobial resistance and emerging microbiological hazards
European Joint Programme acronym	One Health EJP
Funding	This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 773830.
Grant Agreement	Grant agreement n° 773830
Start Date	01/01/2018
Duration	60 Months

DOCUMENT MANAGEMENT

JIP/JRP deliverable	D-IA.2.2.OH-Harmony-Cap.2.4
Project Acronym	JIP04-IA2.2-OH-Harmony-Cap
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Due month of the report	M57
Actual submission month	M61 COVID-19 pandemic caused delays in the work. To be able to include also the responses that were received after the original deadline, the delivery of this Deliverable was delayed with one month.
Type <i>R: Document, report DEC: Websites, patent filings, videos, etc.; OTHER</i>	R Save date: 23-Jan-23 OH-HARMONY-CAP - One Health EJP
Dissemination level <i>PU: Public (default) CO: confidential, only for members of the consortium (including the Commission Services)</i>	PU This is the default setting. If this project deliverable should be confidential, please add justification here (may be assessed by PMT):
Dissemination <i>Author's suggestion to inform the following possible interested parties.</i>	<div> OHEJP WP 1 <input type="checkbox"/> OHEJP WP 2 <input type="checkbox"/> OHEJP WP 3 <input checked="" type="checkbox"/> </div> <div> OHEJP WP 4 <input checked="" type="checkbox"/> OHEJP WP 5 <input checked="" type="checkbox"/> OHEJP WP 6 <input type="checkbox"/> </div> <div> OHEJP WP 7 <input checked="" type="checkbox"/> Project Management Team <input checked="" type="checkbox"/> </div> <div> Communication Team <input checked="" type="checkbox"/> Scientific Steering Board <input type="checkbox"/> </div> <div> National Stakeholders/Program Owners Committee <input type="checkbox"/> </div> <div> EFSA <input checked="" type="checkbox"/> ECDC <input checked="" type="checkbox"/> </div> <div> Other international stakeholder(s): </div>



Social Media:

Other recipient(s): Project Leaders of One Health projects that focus on the pathogens included in this work: including TOXOSOURCES, PARADISE, MEmE, and CARE.

Abbreviations

AH	Animal Health
AMR	Antimicrobial resistance
EJP	European Joint Programme
ETEC	Enterotoxigenic <i>E. coli</i>
EU/EEA	European Union/European Economic Area
EULabCap	EU Laboratory Capability Monitoring System (1)
FS	Food Safety
MATRIX	An EU-co-funded project within the framework of the One Health European Joint Programme aimed at the implementation of One Health Surveillance in European countries
NRL	National reference laboratory
OH	One Health
OHLabCap	OH-HARMONY-CAP tool
PH	Public Health
Stx	Shiga toxin
STEC	Shiga toxin-producing <i>E. coli</i>
WGS	Whole Genome Sequencing
WP	Work Package



Content

OHLabCap: results and evaluation of the final survey	5
1. WP2-T2: Scoring of collected data and chosen indicators (OH-Harmony-Cap NRLs and other participating diagnostic laboratories)	5
EXECUTIVE SUMMARY	5
2. General observations and recommendations	6
3. Structure and overview of indicators	7
4. Collection and analysis the final survey results	9
Adaptability	10
4.1.1. Provision and regulation	10
Capacity	11
4.1.2. Provision and regulation	11
4.1.3. Test utilisation (diagnostic and confirmatory)	12
4.1.4. Test utilisation (diagnostic and confirmatory); bacteria and parasites	13
4.1.5. Storage	14
4.1.6. Country capacity	15
Capability	16
4.1.7. Provision and regulation	16
4.1.8. Test utilisation (diagnostic and confirmatory)	19
4.1.9. Test guidelines (diagnostic and confirmatory)	21
4.1.10. Antimicrobial resistance	23
4.1.11. Whole genome sequencing	24
4.1.12. Country capability	26
Interoperability and communication	28
4.1.13. Provision and regulation	28
4.1.14. National disease networks	29
4.1.15. EU disease networks	30
4.1.16. Intersectoral network	31
4.1.17. Dissemination	32
4.1.18. Country Interoperability and communication	33
5. Conclusions	35



OHLABCAP: RESULTS OF THE FINAL SURVEY

OHLabCap: results and evaluation of the final survey

This is a public deliverable of One Health EJP Joint Research Project, Integrative Action-2.3, OH-Harmony-Cap: One Health Harmonisation of Protocols for the Detection of Foodborne Pathogens and AMR Determinants

<https://onehealthjep.eu/jip-oh-harmony-cap/>

OH-Harmony-CAP is a 3-year project, which aims to collect information on current adaptabilities, capabilities, capacities, and interoperability and communication at both the National Reference Laboratory (NRL) and the primary diagnostic level. The quantitative description of current and best practices and the development of harmonised protocols will identify and possibly close the gaps and suggest future studies of how best to detect and characterise food borne pathogens across the One Health sectors. This report describes the development and presents the results from the first OHLabCap tool.

1. WP2-T2: Scoring of collected data and chosen indicators (OH-Harmony-Cap NRLs and other participating diagnostic laboratories)

EXECUTIVE SUMMARY

The One Health (OH) laboratories (medical, veterinary and/or food/feed and environmental) across EU/EEA countries should be surveyed for performance competences *i.e.*, adaptability, capacity, capability, and interoperability and communication. For this, a benchmarking instrument 'OHLabCap' is developed in the One Health EJP project OH-Harmony-Cap. This instrument will be able to identify gaps and needs necessary to develop and implement harmonised and interoperable protocols for the detection and typing of foodborne pathogens and AMR determinants across the OH fields.

The development work has the following steps:

- A pilot survey was conducted in 2020. This report is the final version of the OHLabCap tool, which was conducted in 2021
- The final survey was sent to all known networks' administrators *i.e.* ECDC, EFSA, and representing all 31 EU/EEA countries. The aim was to conduct a proper survey based on the recommendations and experience from the pilot survey conducted in 2019, [Deliverable D-IA.2.3.OH-Harmony-Cap.2.1: Completed Pilot Survey | Zenodo](#).
- The final survey covered six priority bacteria and five priority parasites together with the antimicrobial resistance (AMR) testing of *Salmonella* and *Campylobacter*
 - Shiga toxin-producing *E. coli* (STEC), *Salmonella*, *Campylobacter*, *Shigella*, *Yersinia*, and *Listeria*
 - *Cryptosporidium* spp., *Echinococcus granulosus* (*sensu lato*), *Echinococcus multilocularis*, *Toxoplasma gondii*, and *Trichinella* spp.
- The final survey included 52 questions that covered adaptability, capability, capacity, and interoperability and communication. The EU Survey tool was used.
- The final survey results were analysed by applying "scoring options" similar to those used in pilot survey. The scoring was based on a compilation of indicators (questions included in the pilot survey), across three dimensions (primary diagnostic testing, NRL services, and interoperability and communication)
- The final study had 122 laboratory participants from 25 countries.

The pilot survey and report can be found here: [Deliverable D-IA.2.2.OH-Harmony-Cap.2.1: Completed Pilot Survey | Zenodo](#).



This deliverable summarizes the results of the final survey, and key conclusions and recommendations made based on them.

DISCLAIMER:

The results, comments and analyses in this report should not be taken as a final representation of the entire EU/EEA level because of the considerable differences in the number of laboratories in each of the participating countries. Hopefully, this report can form the basis of further development of the OHLabCap tool (D-IA.2.3.OH-Harmony-Cap.2.3)

2. General observations and recommendations

General observations

When designing the OHLabCap we used the EULabCap as a model which applies three dimensions and 10 targets. However, the EULabCap is very broad and was only focussed on public health (PH). The OHLabCap covers AH, PH and FS and focuses on fewer pathogens and is therefore more detailed and specific. In light of the Covid-19 pandemic, we also added a fourth target *i.e.* adaptability.

The classification and scoring of these performance competences *i.e.*, adaptability, capacity, capability, interoperability and communication have – to some extent - been clarified. Main issues were primarily related to definitions of the main performance competences. Discussions involved the interpretation of the competences capability and capacity, which were originally defined in the EULabCap:

- Laboratory capability - the ability to perform the following functions: manage laboratory activities; perform sample management; conduct testing and analysis for routine and surge capacity; support public health investigations and report results [1].
- Laboratory capacity - consists of output services completed over a defined time period for each capability [2].

In the OHLabCap, adaptability was defined as the ability and preparedness to make organisational, personnel and methodological changes.

The OHLabCap monitoring tool also used three dimensions: 1) Primary diagnostic testing, 2) NRL services, and 3) Interoperability and communication. Of note, this latter dimension was changed from “Surveillance/epidemic response support” in the EULabCap. The number of targets was increased to 15.

The OHLabCap highlighted major differences across the One Health microbiological systems in place in the participating countries. Of particular concern, is the lack of accreditation and standardisation in the human clinical diagnostic laboratories compared to the food/feed and veterinary laboratories, where a few standardised ISO standards are followed.

Further, due to the high participation within some countries we have an (almost) complete picture of the microbiological system within that country. There are several ways in which the results of the OHLabCap can be visualised *i.e.* by sector or by country. This report presents an integrated One Health map of the levels of competences adaptability/capability/capacity/interoperability and communication in the two main sectors human diagnostics (PH) and non-human (AH and FS) laboratories on a National and sub-national level at an EU level, and for each of the chosen organisms for the NRLs and primary diagnostic laboratories in the EU/EEA countries. Finally, a few selected countries are shown.

It became quite clear during the early analysis that the original intention to analyse the human, veterinary and food/feed laboratories separately was not possible. Several laboratories have dual or more functions, particularly the veterinary laboratories, which also analyse food samples, **Table 2**. Therefore, it was decided to combine the veterinary, food/feed and environmental laboratories into one non-human group. Any laboratory analysing human specimens were categorised as human.

Note, this tool does not include an evaluation of surveillance capacities and capabilities (OH-EpiCap), which is included in MATRIX (see [MATRIX - One Health EJP](#)).



Specific observations on the EU level

Provision and regulation

Generally lower in the non-human, sub-national level, adaptability in particular, than human and non-human national level. Capability is medium for the six priority bacteria in the human laboratories and low in the non-human laboratories. Parasites are low in the human and even lower in the non-human laboratories. Interoperability and communication is very high for the human laboratories and the non-human national laboratories, and above medium for the non-human sub-national laboratories.

Diagnostic utilisation

Capacity quite low in the non-human sub-national laboratories but a little higher in the national and human national laboratories. Capability is slightly higher. Both capacity and capability scores low for *Shigella* and *Yersinia*. Capacity is below medium and capability higher for for the five parasites

Diagnostic guidelines

Capability is below medium for the human laboratories and above medium for the non-human laboratories. *Trichinella* has the highest score and *Shigella* the lowest.

Storage

Generally higher in the human sector, however: no storage of *Campylobacter*.

Antimicrobial drug susceptibility testing

Considerably low in the non-human sub-national level but quite high in the human sector and above medium for the national non-human laboratories.

Whole genome sequencing for surveillance

Almost non-existing in the non-human, sub-national level and also very low in the human and non-human national sectors. In the human laboratories scores are above medium for the *Listeria*, *Salmonella* and STEC, but low for *Shigella* and *Yersinia* and the five parasites. In the non-human laboratories, the score is above medium for STEC, but otherwise very low.

National disease networks

Very low in the non-human, sub-national level and very high in the human and medium for the non-human, national sectors

Active participation in EU disease networks

Medium level on the national levels, both very low in the sub-national level.

Interoperability and communications

Both the intersectoral network and dissemination is above medium on the national levels, but both are very low in the sub-national level. Intersectoral network is below medium for *Shigella* and *Yersinia*, and below medium for the parasites, except for *Trichinella* for the non-human laboratories.

Specific observations on the model organisms are presented under each specific competence

3. Structure and overview of indicators

The final survey contained three dimensions and 10 selected targets as shown in **Figure 1**.



Structural overview of OHLabCap

Three dimensions 10 targets	Primary diagnostic testing	NRL services	Interoperability and communication
	Provision and regulation	Provision and regulation	National surveillance networks
	Diagnostic guidelines	Whole genome sequencing for surveillance	Active participation in EU disease networks
	Diagnostic testing and surveillance		National outbreak response support
	Antimicrobial drug susceptibility testing		Communications

19/11/2020

Figure 1. The structure of the OHLabCap survey.

Performances	Targets	No. of indicators	Questions
Adaptability	Provisions and regulation	3	6,7,8
	Test utilisation (diagnostic and confirmatory)	2	24,25
Capacity	Provisions and regulation	2	5,9
	Test utilisation (diagnostic and confirmatory)	5	11,14,15,26,27
	Storage	2	31,32
Capability	Provisions and regulation	7	12,13,16-19,47
	Test utilisation (diagnostic and confirmatory)	2	20,33
	Test guidelines (diagnostic and confirmatory)	3	21-23
	Whole genome sequencing	1	34
	Antimicrobial resistance	2	28-29
Interoperability and communication	Provisions and regulation	1	48
	National disease networks	5	38-39, 43, 44, 45
	EU disease networks	3	41,42,43
	Intersectoral network	6	30, 35-37,40,46
	Dissemination	4	49-52
Total	15	47	47

Figure 2. Performances, targets and indicators of the OHLabCap survey. Number of questions and indicators for each of the four performances and fifteen targets.

The scores of each indicator were:

- 0 (low)
- 1 (median)
- 2 (high)
- not applicable (NA)/ not relevant (NR)

Scoring of each target were set at a scale from 0 to 10. Performances, targets and indicators are shown in **Figure 2**. The maximum score was 540.



4. Collection and analysis the final survey results

The final survey invitation was circulated among existing ECDC, EFSA and DTU networks. The invitation was sent to more than 445 laboratories. The total of 122 participating laboratories were:

- Fifty-nine laboratories at a National level
- Thirty-four laboratories exclusively at a regional level
- Twenty-nine at multiple levels *i.e.* both regional and local level

Table 1 shows the distribution of these categories by country.

Table 1 Participating countries (n=25) and number of responding laboratories at different levels

Country	No. of responding laboratories	National level	Regional level	Multiple levels
Austria	1	1	0	0
Belgium	2	2	0	0
Croatia	2	1	0	1
Czech Republic	1	1	0	0
Denmark	7	2	1	4
Estonia	2	1	1	0
Finland	7	5	0	2
France	9	3	1	5
Germany	20	5	14	1
Hungary	2	2	0	0
Ireland	1	1	0	0
Italy	4	2	1	1
Latvia	1	1	0	0
Lithuania	1	1	0	0
Luxembourg	1	1	0	0
Netherlands	6	5	0	1
Norway	8	3	1	4
Poland	28	14	9	5
Portugal	8	1	4	3
Romania	2	1	1	0
Serbia	1	0	0	1
Slovakia	2	2	0	0
Spain	2	2	0	0
Sweden	1	1	0	0
UK	3	1	1	1
Total	122	59	34	29

The results are presented so that the individual laboratories cannot be identified. The order they are presented in in the figures is uniform across the figures. The distribution between animal, human, food/feed laboratories is shown in **Table 2**.

Table 2. Number of responding laboratories stratified by laboratory type: animal, human, food/feed.

Laboratory type	No. of responding laboratories
Animals	5
Animals; Food / feed	7
Animals; Food / feed; Environment	41
Animals; Humans	1
Animals; Humans; Environment	2
Animals; Humans; Food / feed	1



Animals; Humans; Food / feed; Environment	7
Food / feed	10
Food / feed; Environment	18
Humans	27
Humans; Food / feed; Environment	3
Total	122

Characteristics of the responders are shown by country and model organisms in **Figure 3**

Responders (n=122) by country (n=25)

Pathogen

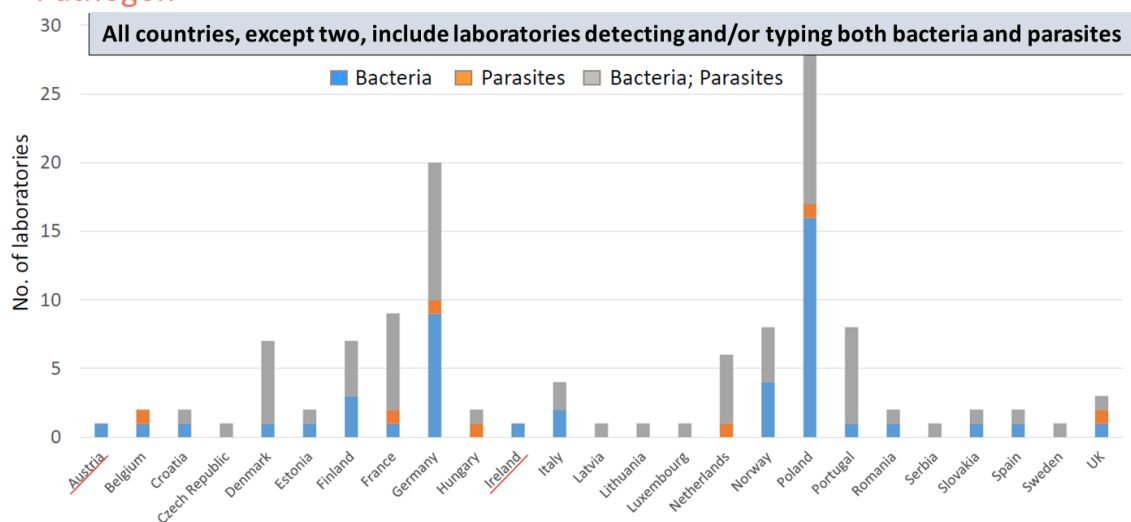


Figure 3. Responders by country and model organisms, bacteria and parasites.

Adaptability

4.1.1. *Provision and regulation*

Overview

- Three questions (6, 7 and 8), 3 indicators, max score: 6
- Human national level: 16 countries
- Human sub-national level: 7 countries
- Non-human national level: 19 countries
- Non-human sub-national level: 7 countries



Provision and regulation

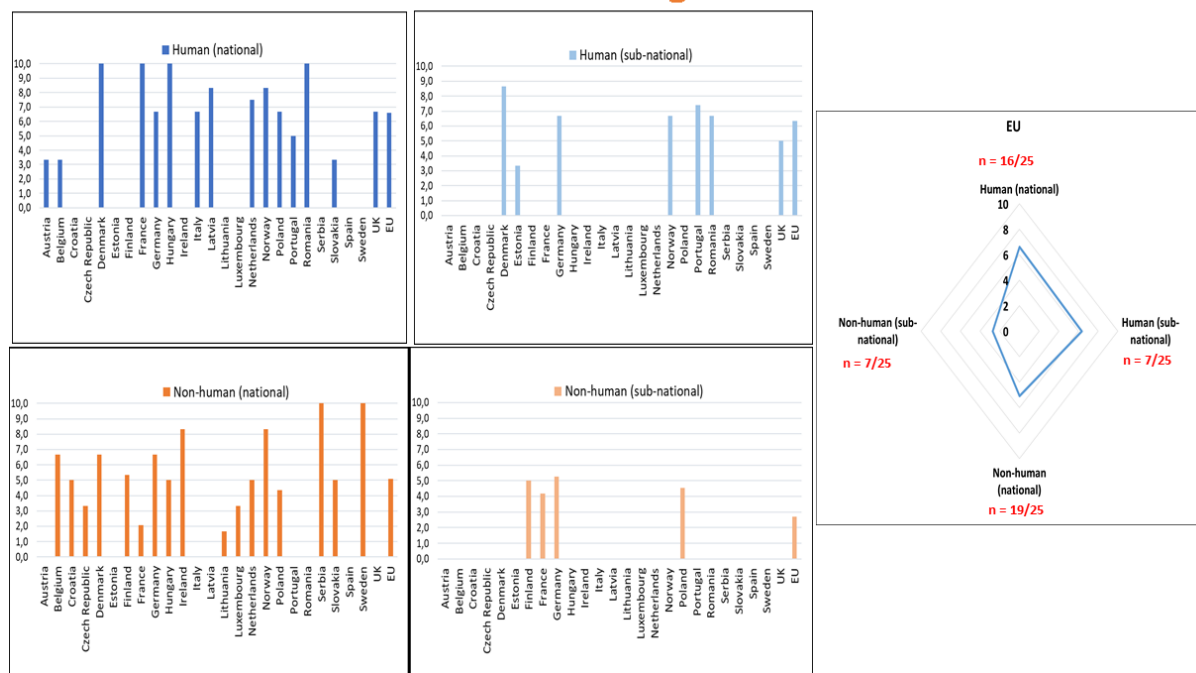


Figure 4. Adaptability score for provision and regulation summarized for EU based on 49/122 responding laboratories, representing «n» responding countries (in red) stratified by laboratory type and source. Laboratories analysing multiple types of materials are grouped into human laboratories if they include analyses of human material. Laboratories operating at different levels are grouped with national level laboratories if they operate on a national level.

Comments

The scores for adaptability on provision and regulation is medium (5.1 - 6.6) for the national and human sub-national but low (2.7) for the non-human sub-national laboratories.

Capacity

4.1.2. Provision and regulation

Overview

- Two questions (5 and 9), 2 indicators, max score: 4
- Human national level: 16 countries
- Human sub-national level: 7 countries
- Non-human national level: 19 countries
- Non-human sub-national level: 7 countries



Provision and regulation

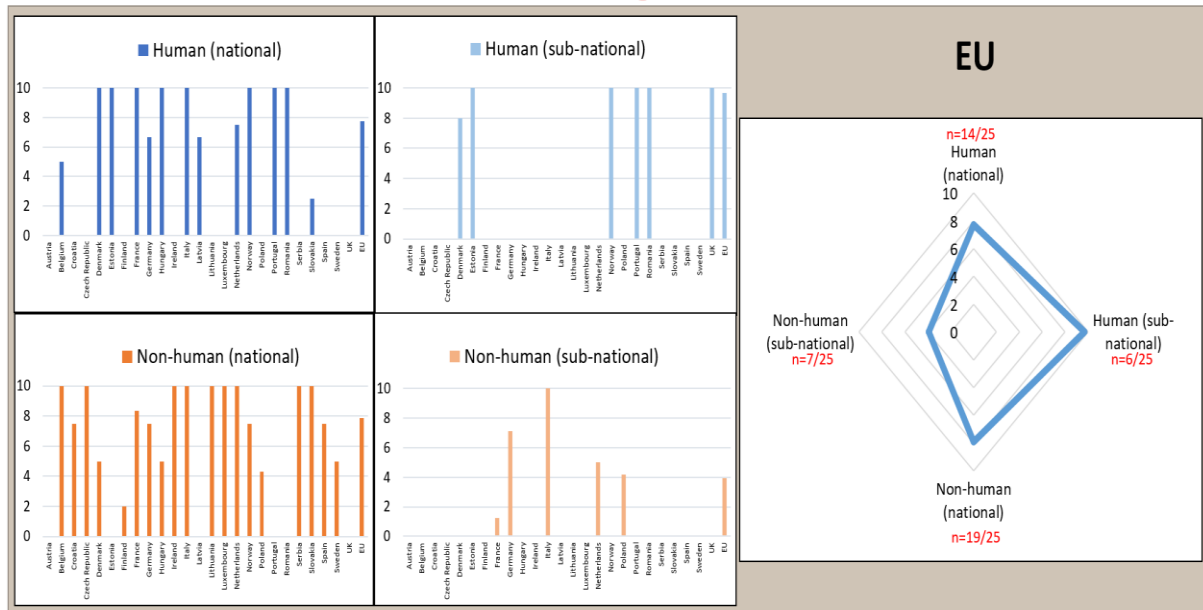


Figure 5. Capacity score for provision and regulation summarized for EU based on 46/122 responding laboratories, representing «n» responding countries (in red) stratified by laboratory type and source. Laboratories analysing multiple types of materials are grouped into human laboratories if they include analyses of human material. Laboratories operating at different levels are grouped with national level laboratories if they operate on a national level.

Comments

The scores for capacity on provision and regulation is high (7.7 – 7.9) for the national and human sub-national but low (3.9) for the non-human sub-national laboratories.

4.1.3. Test utilisation (diagnostic and confirmatory)

Overview

- Five questions (11, 14, 15, 26 and 27), 5 indicators, max score: 70
- Human national level: 16 countries
- Human sub-national level: 7 countries
- Non-human national level: 19 countries
- Non-human sub-national level: 7 countries

Test utilisation

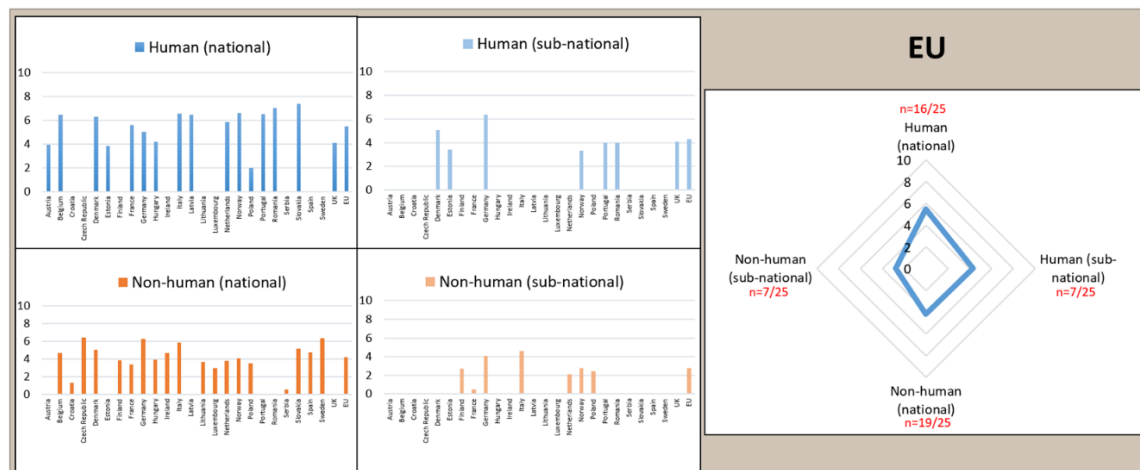




Figure 6. Capacity score for test utilisation summarized for EU based on 49/122 responding laboratories, representing «n» responding countries (in red) stratified by laboratory type and source. Laboratories analysing multiple types of materials are grouped into human laboratories if they include analyses of human material. Laboratories operating at different levels are grouped with national level laboratories if they operate on a national level.

Comments

The scores for capacity on test utilisation (diagnostic and confirmatory) are medium (4.2 – 5.5) for the national and human sub-national but low (2.7) for the non-human sub-national laboratories.

4.1.4. Test utilisation (diagnostic and confirmatory); bacteria and parasites

Test utilisation (diagnostic and confirmatory)

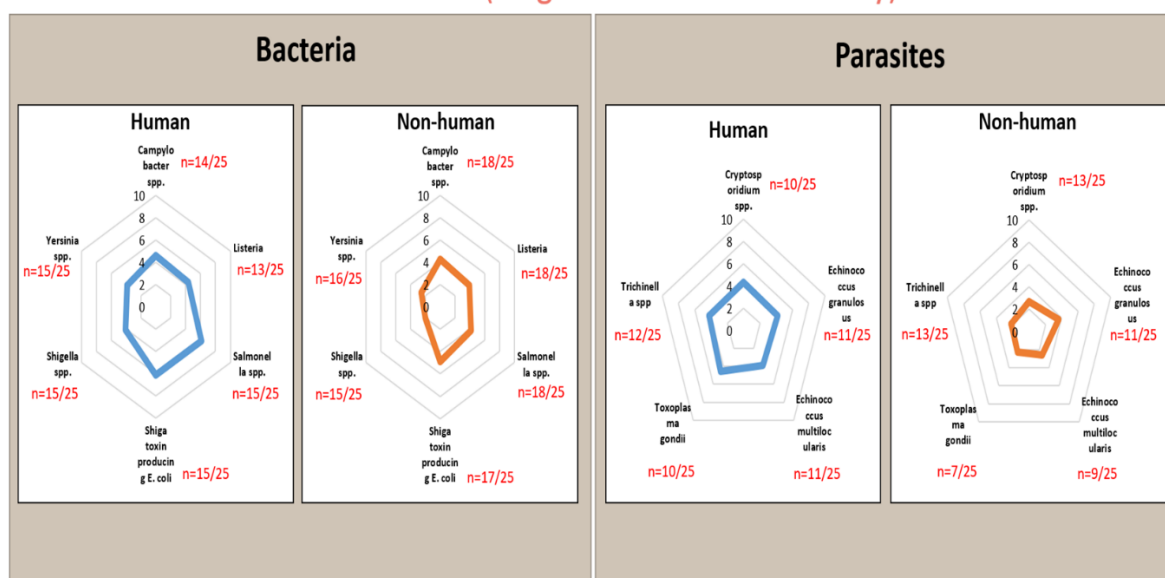


Figure 7. Relative average capacity scores by the human/non-human laboratories on **test utilisation (diagnostic and confirmatory)** split into the six priority bacteria and the five priority parasites.

Table 3. Average and range capacity scores by the human/non-human laboratories on **test utilisation (diagnostic and confirmatory)** split into the six priority bacteria and the five priority parasites.

Capacity - Test utilisation (diagnostic and confirmatory)				
Model organism	Human		Non-human	
	Average	range	average	Range
<i>Campylobacter spp.</i>	4,6	0 - 8,3	4,3	0 – 10
<i>Listeria</i>	4,4	1,7 - 8,3	4,0	0 - 8,3
<i>Salmonella spp.</i>	6,1	1,7 - 8,3	4,2	0 - 8,3
Shiga toxin producing <i>E. coli</i>	6,1	0 - 8,3	4,9	0 - 8,3
<i>Shigella spp.</i>	4,1	0 - 7,5	2,0	0 - 6,7
<i>Yersinia spp.</i>	3,9	0 - 8,3	2,5	0 - 6,7
<i>Cryptosporidium spp.</i>	4,3	0 - 6,7	2,7	0 – 10
<i>Echinococcus granulosus</i>	4,2	0 - 6,7	3,6	0 – 10
<i>Echinococcus multilocularis</i>	3,9	0 - 5,8	2,6	0 – 5
<i>Toxoplasma gondii</i>	4,6	0 - 7,5	2,3	0 – 10
<i>Trichinella spp</i>	4,2	0 - 10	2,2	0 - 7,5



Comments

The scores for capacity on test utilisation (diagnostic and confirmatory) for the six priority bacteria and five parasites are medium (4.0 – 6.1) for the bacteria *Campylobacter*, *Listeria*, *Salmonella* and STEC in the human and non-human laboratories, but low (3.9) for *Yersinia* (human) and for *Shigella* (2.0) and *Yersinia* (2.5) (non-human). The score is low for all five parasites (3.9 – 4.6) (human) and (2.2 – 3.6) (non-human) laboratories.

4.1.5. Storage

Overview

- 3 questions (31, 31a and 32), 33 indicators (six priority bacteria and five parasites), max score: 66

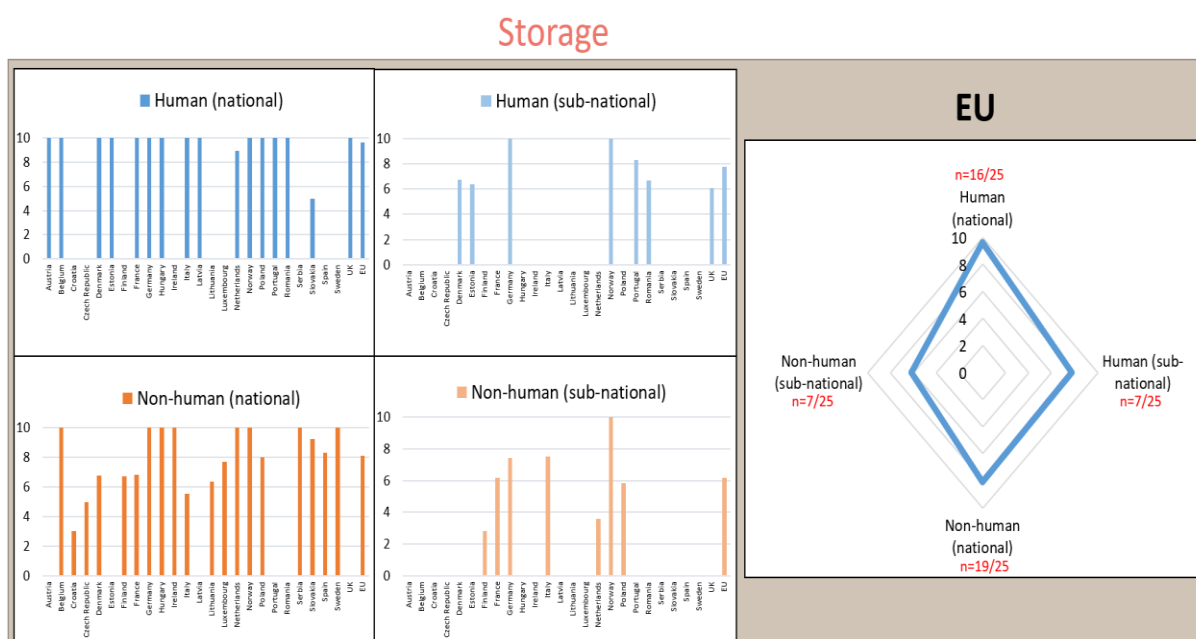


Figure 8. Capacity score for storage summarized for EU based on 49/122 responding laboratories, representing «n» responding countries (in red) stratified by laboratory type and source. Laboratories analysing multiple types of materials are grouped into human laboratories if they include analyses of human material. Laboratories operating at different levels are grouped with national level laboratories if they operate on a national level.

Comments

The scores for capacity on storage are high (7.7 – 9.6) for the national and human sub-national and a little lower (6.8) for the non-human sub-national laboratories.

Table 4. Average and range capacity scores by the human/non-human laboratories on **storage** split into the six priority bacteria and the five priority parasites.

Capacity – Storage				
Model organism	Human		Non-human	
	Average	range	average	range
<i>Campylobacter spp.</i>	0,1	0 - 2	0,0	0 - 0
<i>Listeria</i>	9,0	5 - 10	7,9	5 - 10
<i>Salmonella spp.</i>	9,0	5 - 10	8,3	5 - 10
Shiga toxin producing <i>E. coli</i>	9,1	5 - 10	7,2	0 - 10
<i>Shigella spp.</i>	9,1	5 - 10	6,8	0 - 10



<i>Yersinia spp.</i>	8,9	5 - 10	7,2	0 - 10
<i>Cryptosporidium spp.</i>	8,2	5 - 10	5,6	0 - 10
<i>Echinococcus granulosus</i>	7,8	5 - 10	4,5	0 - 10
<i>Echinococcus multilocularis</i>	7,7	5 - 10	5,4	0 - 10
<i>Toxoplasma gondii</i>	7,9	5 - 10	4,4	0 - 10
<i>Trichinella spp</i>	7,9	5 - 10	6,0	0 - 10

Comments

The scores for capacity on storage for the six priority bacteria and five parasites are very high (6.8 – 9.1) for the bacteria *Listeria*, *Salmonella*, STEC, *Shigella* and *Yersinia* in the human and non-human laboratories, but almost non-existing for *Campylobacter*. The score is high for all five parasites (7.8 – 8.2) for the human-, and medium (4.4 – 6.0) for the non-human laboratories.

4.1.6. Country capacity

Two countries had more than ten participating laboratories, Germany (20) and Poland (28), see **Table 1** and **Figure 3**.

Country capacity: Germany

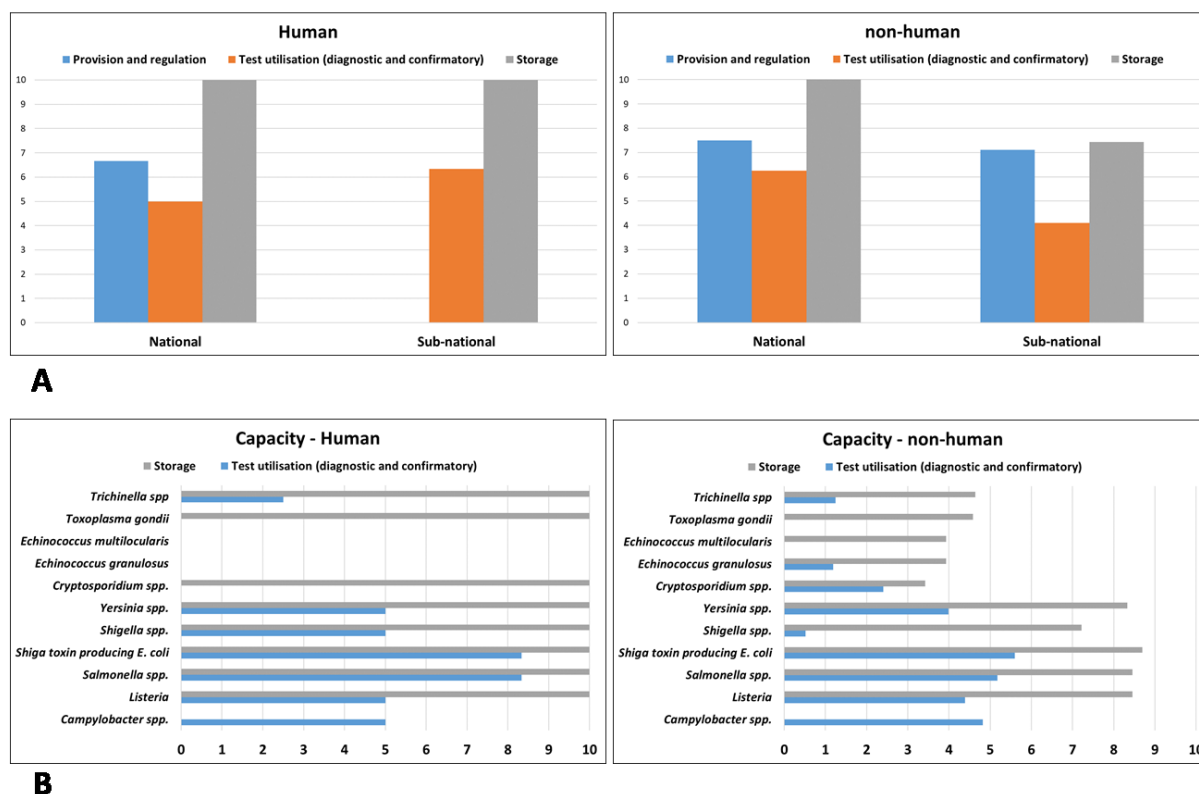


Figure 9. Capacity scores for Germany: Provision and regulation, test utilisation (diagnostic and confirmatory) and storage.

A: Human/non-human on national and sub-national level.

B: Human/non-human laboratories split into the six priority bacteria and the five priority parasites.



Country capacity: Poland

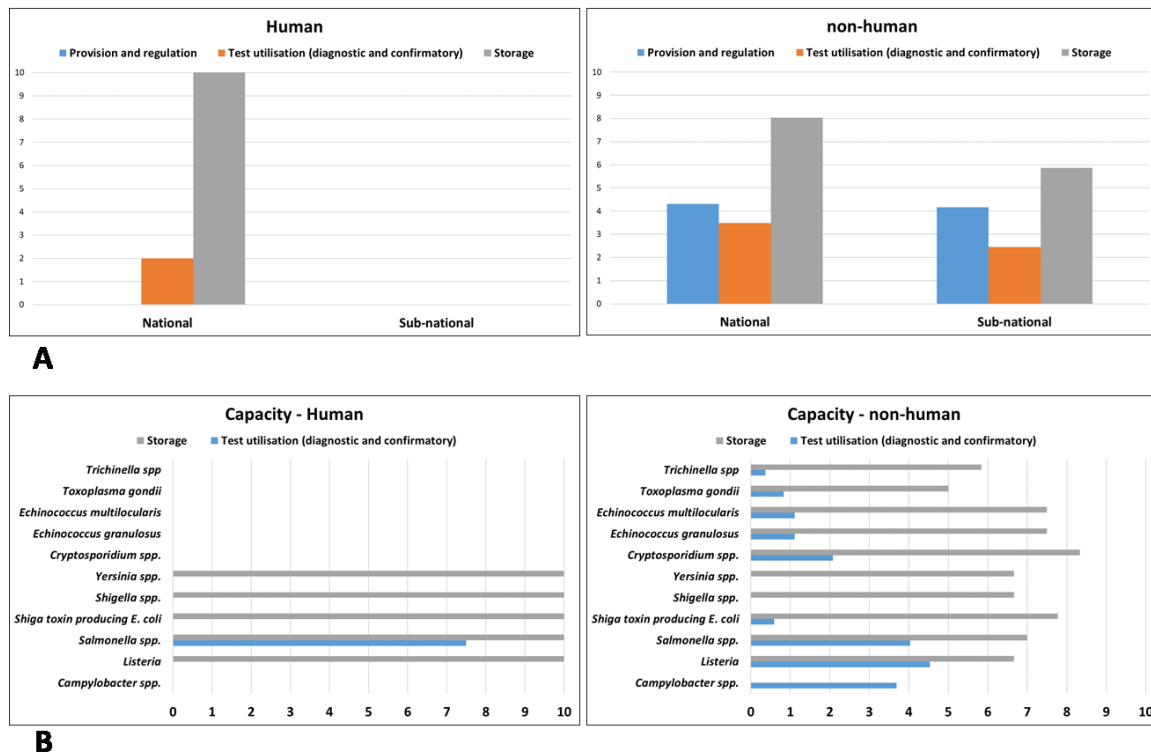


Figure 10. Capacity scores for Poland: Provision and regulation, test utilisation (diagnostic and confirmatory) and storage.

A: Human/non-human on national and sub-national level.

B: Human/non-human laboratories split into the six priority bacteria and the five priority parasites.

Capability

4.1.7. Provision and regulation

Overview

7 questions (12, 13, 16-19 and 47), 7 indicators, max score 40.



Provision and regulation

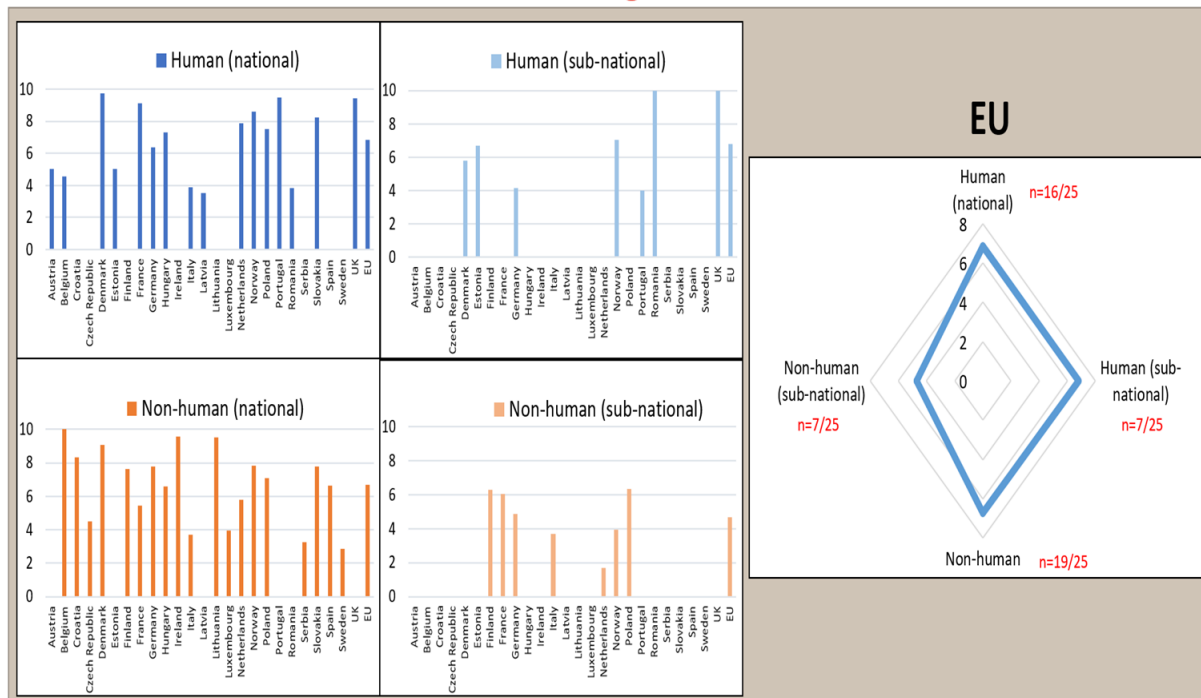


Figure 11. Capability score for provision and regulation summarized for EU based on 52/122 responding laboratories, representing «n» responding countries (in red) stratified by laboratory type and source. Laboratories analysing multiple types of materials are grouped into human laboratories if they include analyses of human material. Laboratories operating at different levels are grouped with national level laboratories if they operate on a national level.

Comments

The scores for capability on provision and regulation are medium (6.7 – 6.8) for the national and human sub-national and below medium (4.7) for the non-human sub-national laboratories.

Provision and regulation

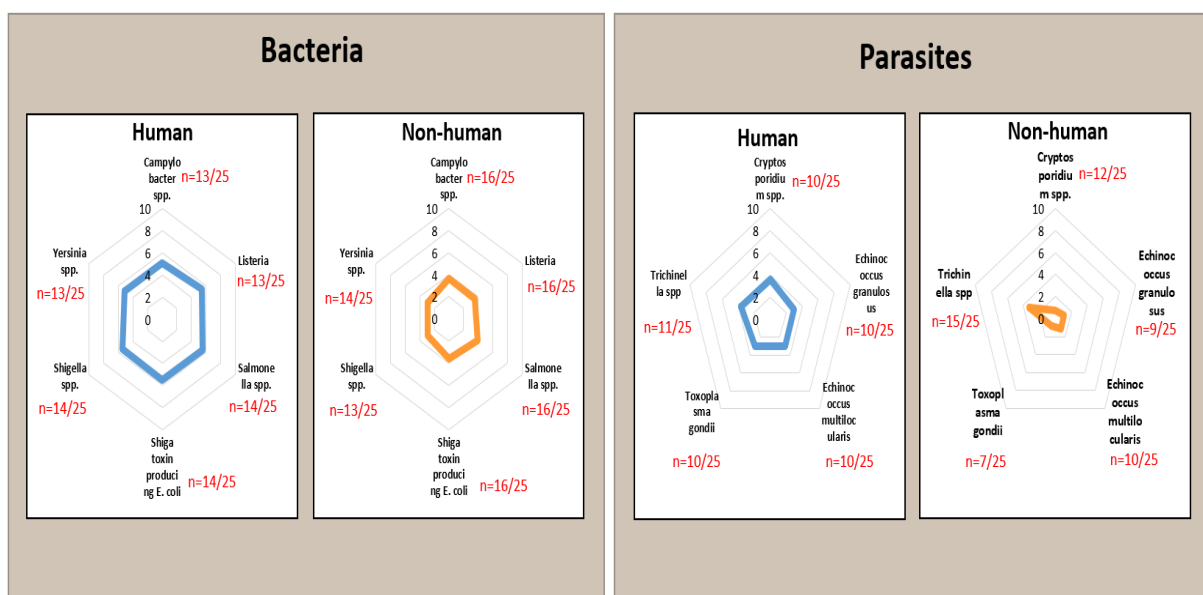




Figure 12. Relative average capability scores by the human/non-human laboratories on **provision and regulation** split into the six priority bacteria and the five priority parasites.



Table 5. Average and range capability scores by the human/non-human laboratories on **provision and regulation** split into the six priority bacteria and the five priority parasites.

Capability - Provision and Regulation				
Model organism	Human		Non-human	
	Average	range	average	range
<i>Campylobacter spp.</i>	5,1	0 - 10	3,7	0 - 10
<i>Listeria</i>	5,4	0 - 10	3,6	0 - 10
<i>Salmonella spp.</i>	5,5	0 - 10	3,9	0 - 10
<i>Shiga toxin producing E. coli</i>	5,5	0 - 10	3,6	0 - 10
<i>Shigella spp.</i>	5,4	0 - 10	2,9	0 - 10
<i>Yersinia spp.</i>	5,1	0 - 10	2,9	0 - 10
<i>Cryptosporidium spp.</i>	3,6	0 - 10	0,8	0 - 10
<i>Echinococcus granulosus</i>	3,0	0 - 10	1,1	0 - 10
<i>Echinococcus multilocularis</i>	3,0	0 - 10	1,1	0 - 10
<i>Toxoplasma gondii</i>	3,0	0 - 10	0,8	0 - 10
<i>Trichinella spp</i>	3,7	0 - 10	3,3	0 - 10

Comments

The scores for capability on provision and regulation for the six priority bacteria and five parasites are medium (5.1 – 5.5) for the six bacteria *Campylobacter*, *Listeria*, *Salmonella*, STEC, *Shigella* and *Yersinia* in the human and below medium (2.7 – 3.9) for the non-human laboratories. The score is low for all five parasites (3.0 – 3.7) for the human, and very low (0.8 – 3.3) for the non-human laboratories.

4.1.8. Test utilisation (diagnostic and confirmatory)

Overview

- 2 questions (20 and 33), 2 indicators, max score 44.

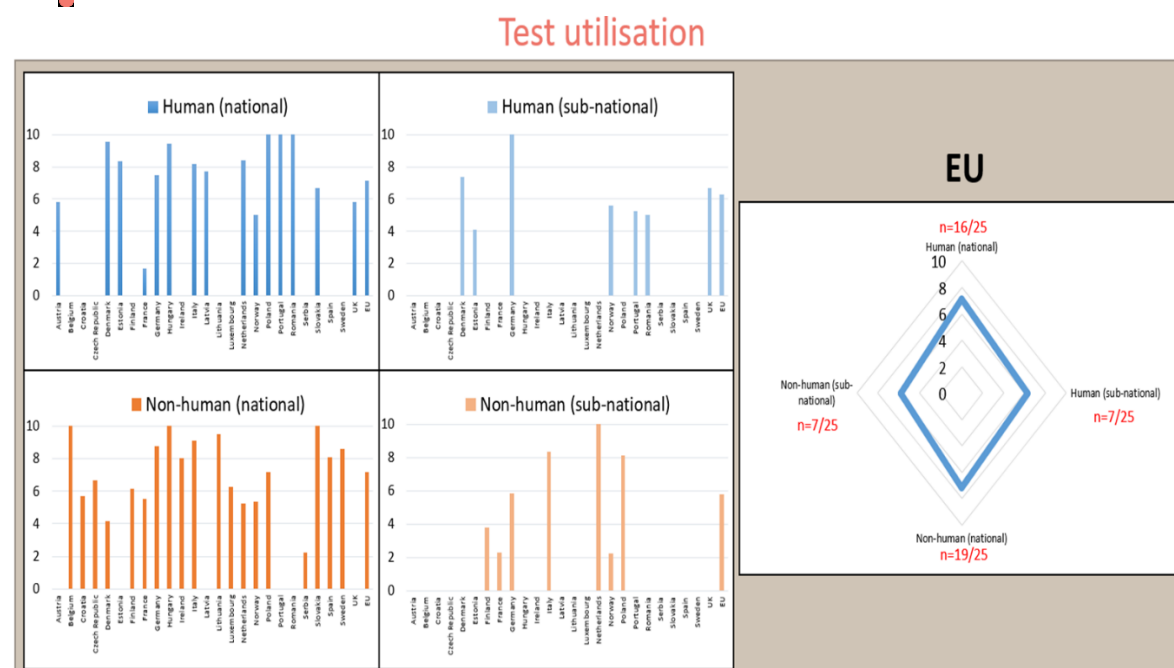


Figure 13. Capability score for **test utilisation (diagnostic and confirmatory)** summarized for EU based on 52/122 responding laboratories, representing «n» responding countries (in red) stratified by laboratory type and source. Laboratories analysing multiple types of materials are grouped into human



laboratories if they include analyses of human material. Laboratories operating at different levels are grouped with national level laboratories if they operate on a national level.

Comments

The scores for capability on test utilisation are higher than medium (6.3 – 7.2) for the national and human sub-national and medium (5.8) for the non-human sub-national laboratories.

Test utilisation

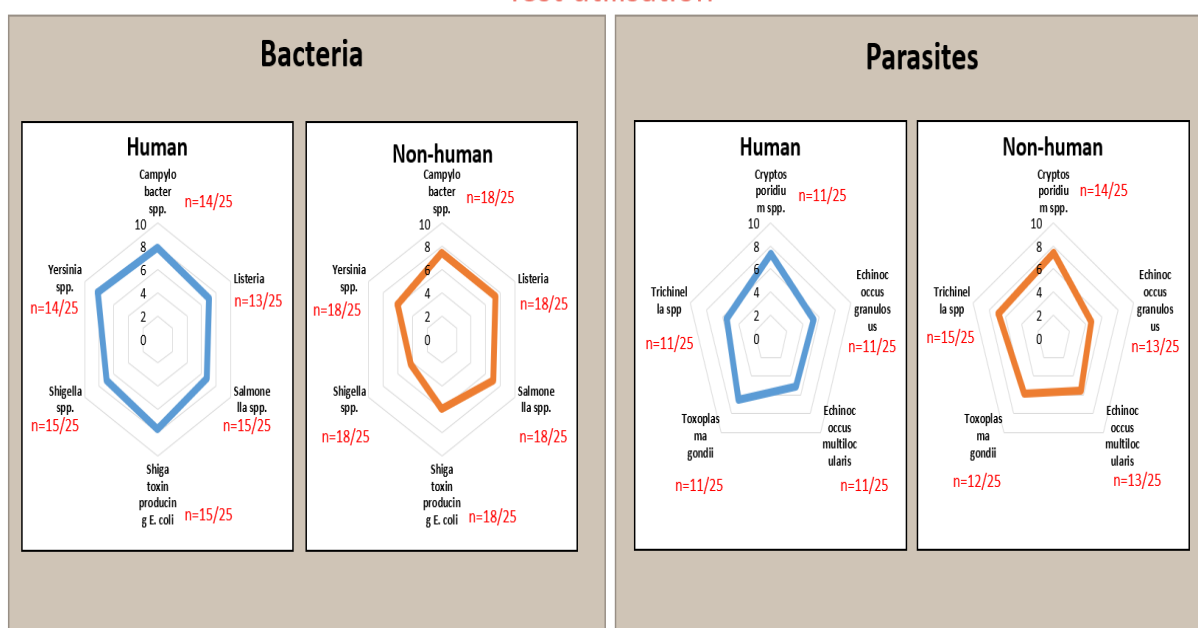


Figure 14. Relative average capability scores by the human/non-human laboratories on **test utilisation (diagnostic and confirmatory)** split into the six priority bacteria and the five priority parasites.

Table 6. Average and range capability scores by the human/non-human laboratories on **test utilisation (diagnostic and confirmatory)** split into the six priority bacteria and the five priority parasites.

Capability - Test utilisation (diagnostic and confirmatory)				
Model organism	Human		Non-human	
	Average	range	average	range
<i>Campylobacter spp.</i>	7,9	5 - 10	7,5	2,1 - 10
<i>Listeria</i>	7,0	2,5 - 10	7,4	5 - 10
<i>Salmonella spp.</i>	6,8	0 - 10	7,1	5 - 10
<i>Shiga toxin producing E. coli</i>	7,7	4 - 10	5,9	0 - 10
<i>Shigella spp.</i>	7,0	0 - 10	4,3	0 - 10
<i>Yersinia spp.</i>	8,2	5 - 10	6,1	0 - 10
<i>Cryptosporidium spp.</i>	7,3	5 - 10	7,4	0 - 10
<i>Echinococcus granulosus</i>	5,3	0 - 10	4,7	0 - 10
<i>Echinococcus multilocularis</i>	5,1	0 - 10	5,5	0 - 10
<i>Toxoplasma gondii</i>	6,5	0 - 10	5,9	0 - 10
<i>Trichinella spp</i>	5,5	0 - 10	6,8	2,8 - 10

Comments

The scores for capability on test utilisation for the six priority bacteria and five parasites are high (6.8 – 8.2) for the six bacteria *Campylobacter*, *Listeria*, *Salmonella*, STEC, *Shigella* and *Yersinia* in the human and above medium (5.9 – 7.5) for the non-human laboratories, except for *Shigella* (4.3). The score is



medium or above for all five parasites for the human (5.3 – 7.3), and for the non-human (4.7 – 7.4) laboratories.

4.1.9. Test guidelines (diagnostic and confirmatory)

Overview

- 3 questions (21 - 23), 3 indicators, max score 66.

Test guidelines

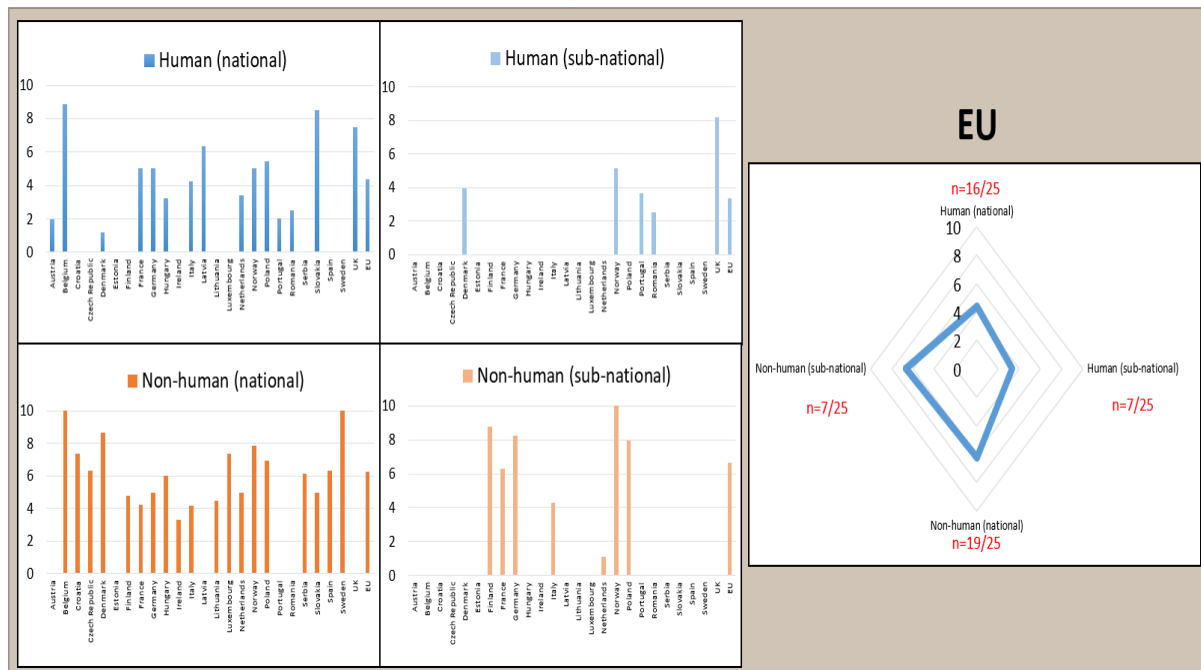


Figure 15. Capability score for **test guidelines (diagnostic and confirmatory)** summarized for EU based on 52/122 responding laboratories, representing «n» responding countries (in red) stratified by laboratory type and source. Laboratories analysing multiple types of materials are grouped into human laboratories if they include analyses of human material. Laboratories operating at different levels are grouped with national level laboratories if they operate on a national level.

Comments

The scores for capability on test guidelines are below medium (3.4 – 4.4) for the human laboratories and above medium (6.3 – 6.7) for the non-human laboratories.

Test guidelines

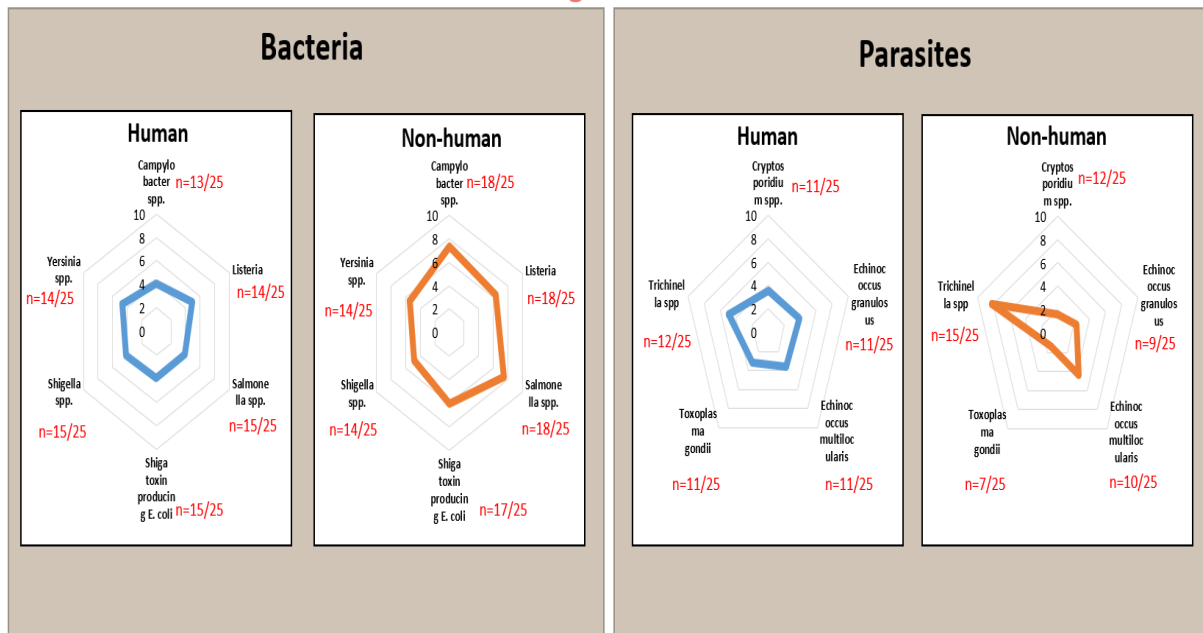


Figure 16. Relative average capability scores by the human/non-human laboratories on **test guidelines (diagnostic and confirmatory)** split into the six priority bacteria and the five priority parasites.



Table 7. Average and range capability scores by the human/non-human laboratories on test guidelines (diagnostic and confirmatory) split into the six priority bacteria and the five priority parasites.

Capability - Test guidelines (diagnostic and confirmatory)				
Model organism	Human		Non-human	
	Average	Range	average	Range
<i>Campylobacter spp.</i>	4,0	0 - 9,2	7,3	3,3 - 10
<i>Listeria</i>	4,9	0 – 10	6,4	0 – 10
<i>Salmonella spp.</i>	3,9	0 - 9,2	7,5	3,3 - 10
<i>Shiga toxin producing E. coli</i>	4,0	0 - 9,2	6,1	0 – 10
<i>Shigella spp.</i>	4,1	0 - 9,2	4,8	0 – 10
<i>Yersinia spp.</i>	4,6	0 – 10	5,4	0 – 10
<i>Cryptosporidium spp.</i>	3,6	0 - 6,7	1,6	0 - 10
<i>Echinococcus granulosus</i>	3,9	0 - 8,3	2,4	0 - 10
<i>Echinococcus multilocularis</i>	3,6	0 - 8,3	4,3	0 - 10
<i>Toxoplasma gondii</i>	3,2	0 - 7,5	1,4	0 – 4
<i>Trichinella spp</i>	5,0	0 – 10	8,2	0 - 10

Comments

The scores for capability on test guidelines for the six priority bacteria and five parasites are below medium (3.2 – 4.9) for the six bacteria *Campylobacter*, *Listeria*, *Salmonella*, STEC, *Shigella* and *Yersinia* and the five parasites except for *Trichinella* which is medium (5.0) in the human laboratories. The score is medium or above for all bacteria (5.4 – 7.5), except for *Shigella* (4.8) and quite low for the parasites (1.4 – 4.3), except for *Trichinella* (8.2) for the non-human laboratories.

4.1.10. Antimicrobial resistance

Overview

4 questions (28, 28a, 29a and 29), 2 indicators, max score 8.

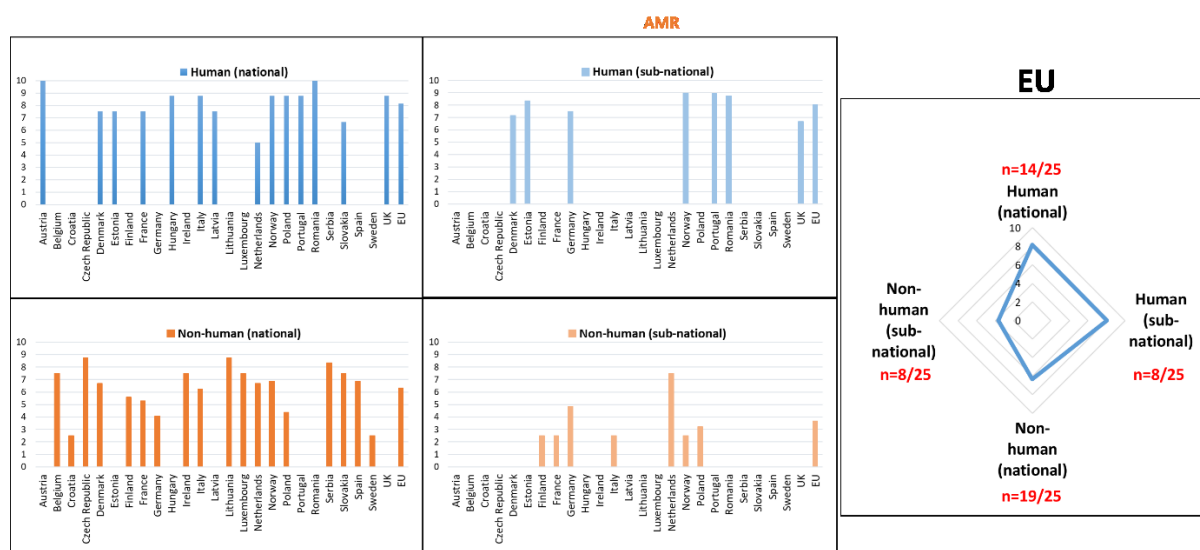


Figure 17. Capability score for antimicrobial resistance (AMR) summarized for EU based on 49/122 responding laboratories, representing «n» responding countries (in red) stratified by laboratory type and source. Laboratories analysing multiple types of materials are grouped into human laboratories if they include analyses of human material. Laboratories operating at different levels are grouped with national level laboratories if they operate on a national level.



Comments

The scores for capability on AMR are quite high (8.0 – 8.2) for the human laboratories and above medium (6.3) for the national non-human laboratories, but low (3.7) for the sub-national laboratories.

4.1.11. Whole genome sequencing

Overview

1 question (34), 1 indicator, max score 44.

Whole genome sequencing

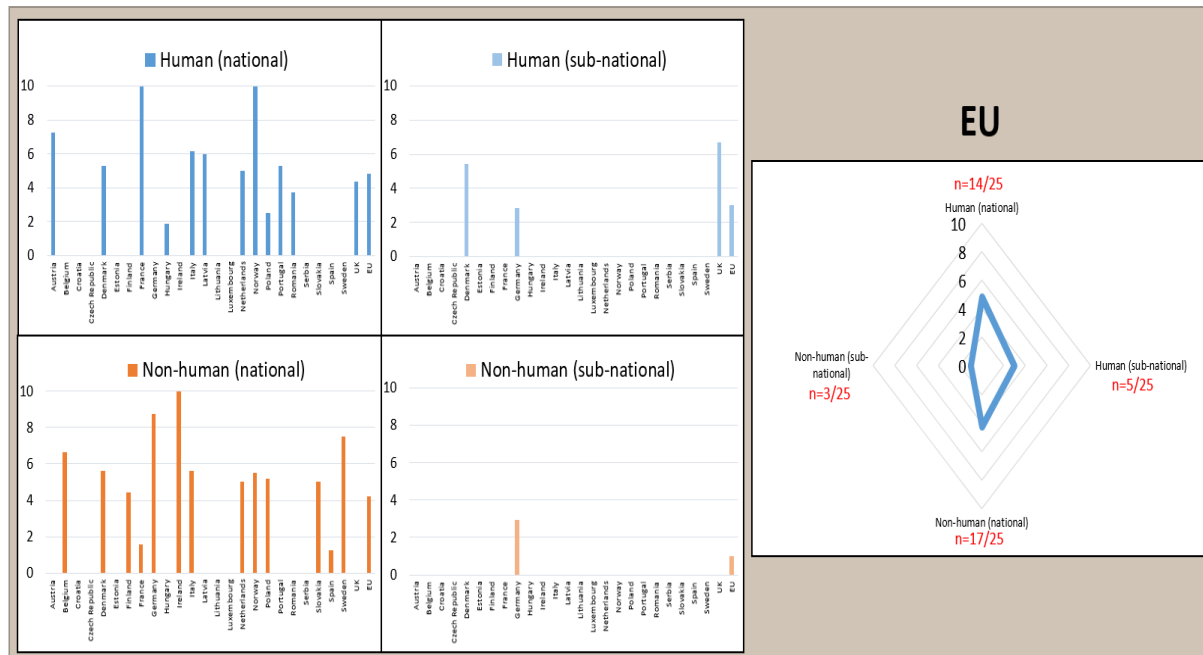


Figure 18. Capability score for **whole genome sequencing** summarized for EU based on 42/122 responding laboratories, representing «n» responding countries (in red) stratified by laboratory type and source. Laboratories analysing multiple types of materials are grouped into human laboratories if they include analyses of human material. Laboratories operating at different levels are grouped with national level laboratories if they operate on a national level.

Comments

The scores for capability on whole genome sequencing are below medium (3.0 – 4.8) for the human laboratories and the non-human national laboratories. It is very low (1.0) for the non-human sub-national laboratories.



Whole genome sequencing

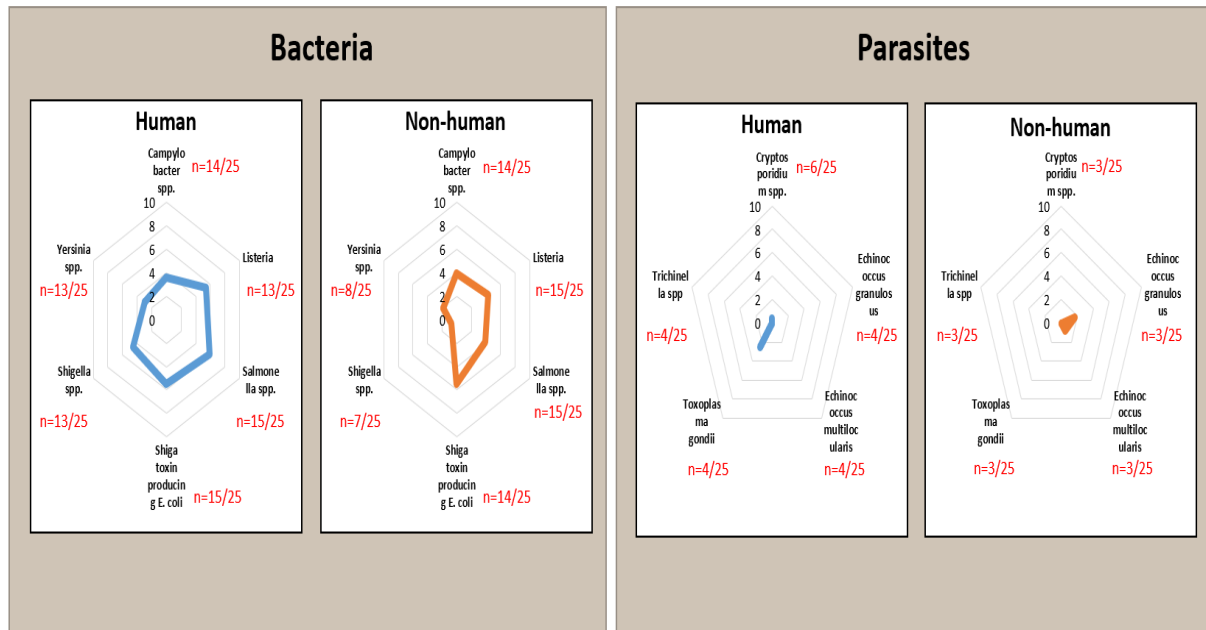


Figure 19. Relative average capability scores by the human/non-human laboratories on **whole genome sequencing** split into the six priority bacteria and the five priority parasites.



Table 8. Average and range capability scores by the human/non-human laboratories on **whole genome sequencing** split into the six priority bacteria and the five priority parasites.

Capability - Whole genome sequencing				
Model organism	Human		Non-human	
	Average	range	average	range
<i>Campylobacter spp.</i>	3,6	0 - 10	3,9	0 - 10
<i>Listeria</i>	5,4	0 - 10	4,3	0 - 10
<i>Salmonella spp.</i>	5,9	0 - 10	3,9	0 - 10
<i>Shiga toxin producing E. coli</i>	5,5	0 - 10	5,5	0 - 10
<i>Shigella spp.</i>	4,6	0 - 10	0,7	0 - 5
<i>Yersinia spp.</i>	3,0	0 - 10	1,9	0 - 7,5
<i>Cryptosporidium spp.</i>	0,4	0 - 2,5	0	0
<i>Echinococcus granulosus</i>	0	0	1,7	0 - 5
<i>Echinococcus multilocularis</i>	0	0	0,8	0 - 2,5
<i>Toxoplasma gondii</i>	2,5	0 - 10	0	0
<i>Trichinella spp</i>	0	0	0	0

Comments

The scores for capability on whole genome sequencing for the six priority bacteria and five parasites are above medium (5.4 – 5.9) for the *Listeria*, *Salmonella* and STEC, but low for *Shigella* (4.6) and *Yersinia* (3.0) and the five parasites (0 – 2.5) in the human laboratories. The score is above medium for STEC (5.5), but below medium for the other bacteria (0.7 – 4.3) and quite low for the parasites (0 – 1.7) for the non-human laboratories.

4.1.12. Country capability

Two countries had more than ten participating laboratories, Germany (20) and Poland (28), see **Table 1** and **Figure 3**.

Country capability: Germany

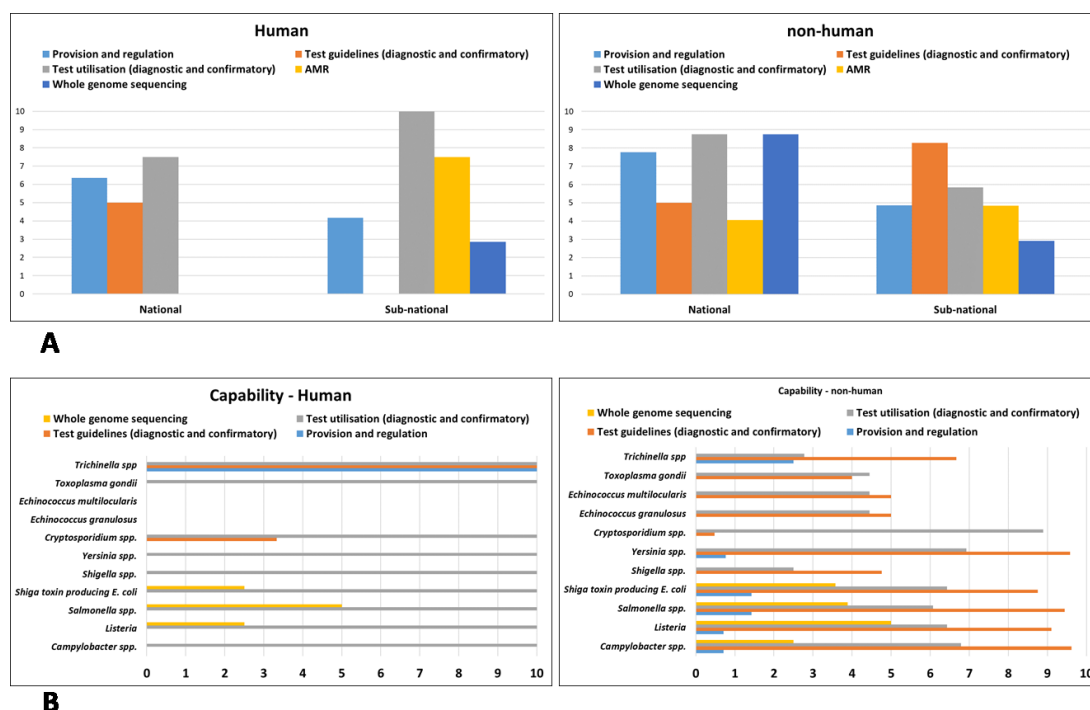




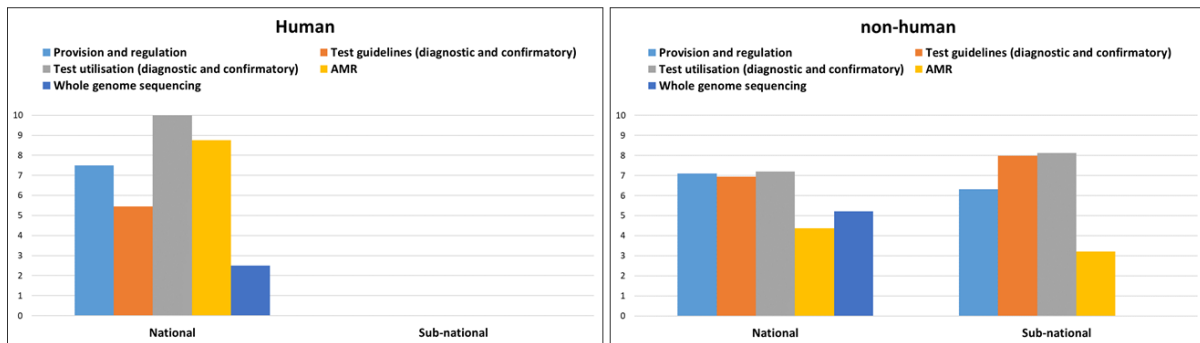
Figure 20. Capability scores for Germany: Provision and regulation, test utilisation **and test guidelines** (diagnostic and confirmatory), **whole genome sequencing** and storage.

A: Human/non-human on national and sub-national level.

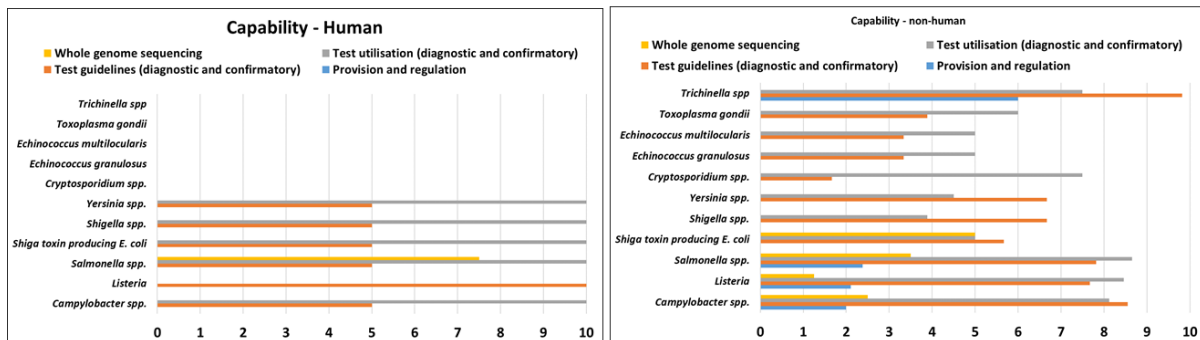
B: Human/non-human laboratories split into the six priority bacteria and the five priority parasites.



Country capability: Poland



A



B

Figure 21. Capability scores for Poland: Provision and regulation, test utilisation and test guidelines (diagnostic and confirmatory), whole genome sequencing and AMR.

A: Human/non-human on national and sub-national level.

B: Human/non-human laboratories split into the six priority bacteria and the five priority parasites.

Interoperability and communication

4.1.13. Provision and regulation

Overview

1 question (48) , 1 indicator, max score 2.

Provision and regulation

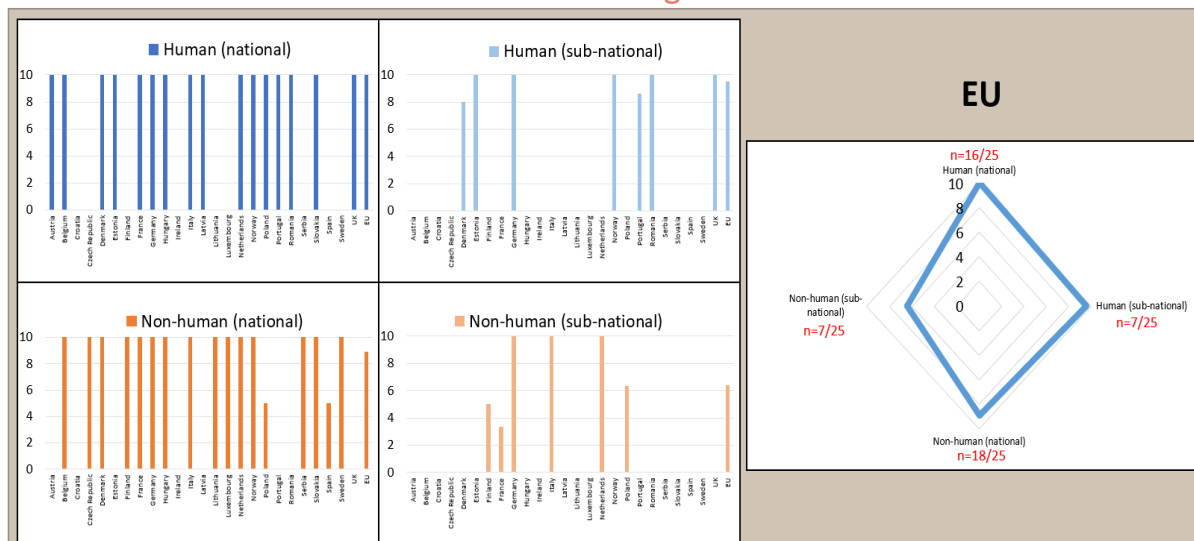




Figure 22. Interoperability and communication score for provision and regulation summarized for EU based on 42/122 responding laboratories, representing «n» responding countries (in red) stratified by laboratory type and source. Laboratories analysing multiple types of materials are grouped into human laboratories if they include analyses of human material. Laboratories operating at different levels are grouped with national level laboratories if they operate on a national level.

Comments

The scores for Interoperability and communication on provision and regulation are very high (8.9 – 10.0) for the human laboratories and the non-human national laboratories. It is above medium (6.4) for the non-human sub-national laboratories.

4.1.14. National disease networks

Overview

5 questions (38, 39, 43-45) 39 indicators, max score 78

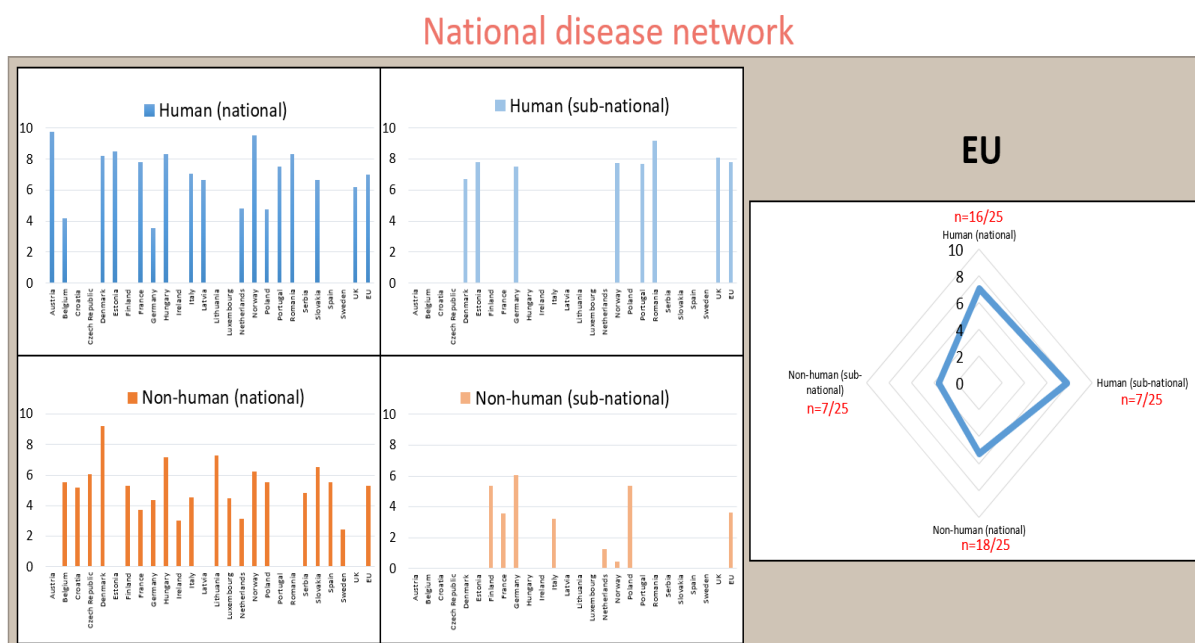


Figure 23. Interoperability and communication score for national disease networks summarized for EU based on 52/122 responding laboratories, representing «n» responding countries (in red) stratified by laboratory type and source. Laboratories analysing multiple types of materials are grouped into human laboratories if they include analyses of human material. Laboratories operating at different levels are grouped with national level laboratories if they operate on a national level.

Comments

The scores for Interoperability and communication on national disease networks are very high (7.0 – 7.8) for the human laboratories and medium (5.3) the non-human national laboratories. It is low (3.6) for the non-human sub-national laboratories.

Table 9. Average and range interoperability and communication scores by the human/non-human laboratories on national disease networks split into the six priority bacteria and the five priority parasites.

Interoperability and communication - National disease network				
Model organism	Human		Non-human	
	Average	range	average	range
<i>Campylobacter spp.</i>	6,7	0 - 9,3	6,7	1,4 - 10
<i>Listeria</i>	6,5	0 - 9	6,6	0 - 10



<i>Salmonella spp.</i>	8,3	5 - 10	7,7	3,3 - 10
<i>Shiga toxin producing E. coli</i>	8,4	5 - 10	5,6	0 - 10
<i>Shigella spp.</i>	7,7	3,3 - 10	2,0	0 - 8,3
<i>Yersinia spp.</i>	6,1	0 - 9,3	3,2	0 - 10
<i>Cryptosporidium spp.</i>	5,2	0 - 10	1,1	0 - 10
<i>Echinococcus granulosus</i>	5,7	0 - 10	2,2	0 - 10
<i>Echinococcus multilocularis</i>	5,6	0 - 10	2,8	0 - 10
<i>Toxoplasma gondii</i>	4,2	0 - 10	0,9	0 - 10
<i>Trichinella spp</i>	6,1	0 - 10	5,3	0 - 10

Comments

The scores for Interoperability and communication on national disease networks for the six priority bacteria and five parasites are high and above medium for the six bacteria (6.1 – 8.4), but lower (4.2 – 6.1) for the parasites in the human laboratories. Scores are high (6.6 – 7.7) for *Campylobacter*, *Listeria* and *Salmonella*, medium (5.6) for STEC and low (2.0 - 3.2) for *Shigella* and *Yersinia*, and low (0.9 – 2.8) for the parasites, except for *Trichinella* (5.3) for the non-human laboratories.

4.1.15. EU disease networks

Overview

3 questions (41 - 43) 34 indicators, max score 68

EU disease network

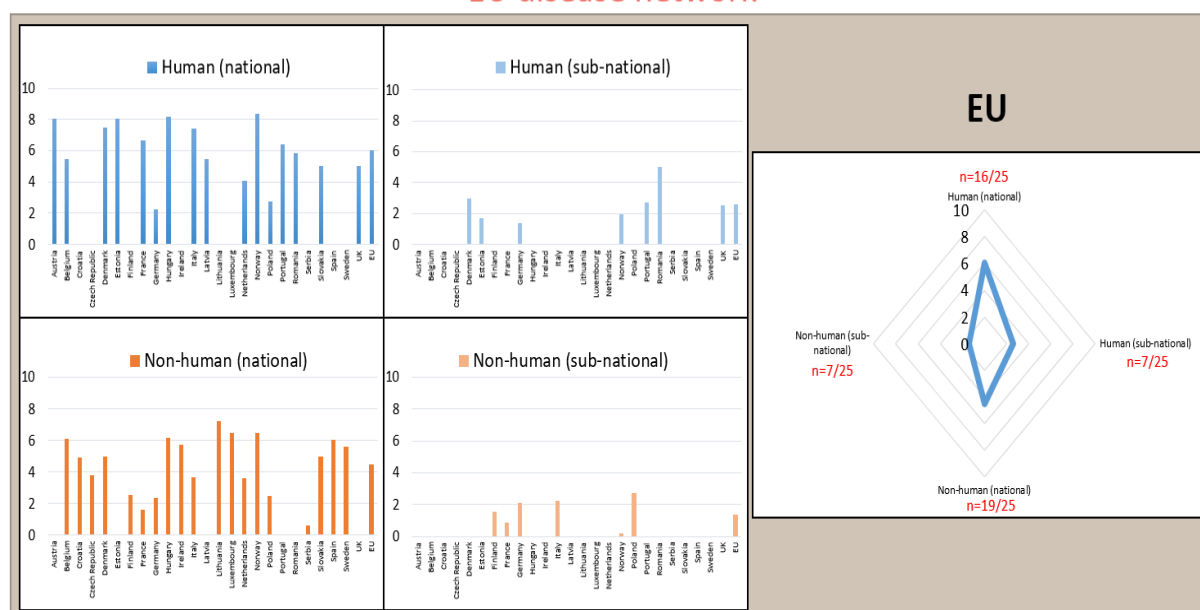


Figure 24. Interoperability and communication score for EU disease networks summarized for EU based on 52/122 responding laboratories, representing «n» responding countries (in red) stratified by laboratory type and source. Laboratories analysing multiple types of materials are grouped into human laboratories if they include analyses of human material. Laboratories operating at different levels are grouped with national level laboratories if they operate on a national level.

Comments

The scores for Interoperability and communication on EU disease networks are above medium (6.0) for the human national laboratories and below medium (4.5) the non-human national laboratories. It is low (2.6 and 1.4) for the human and non-human sub-national laboratories.



Table 10. Average and range interoperability and communication scores by the human/non-human laboratories on EU disease networks split into the six priority bacteria and the five priority parasites.

Interoperability and communication - EU disease network				
Model organism	Human		Non-human	
	Average	range	average	range
<i>Campylobacter spp.</i>	4,6	0 - 10	5,9	0,2 - 10
<i>Listeria</i>	4,2	0 - 10	5,5	1,3 - 10
<i>Salmonella spp.</i>	6,1	1,7 - 10	6,3	1,7 - 10
<i>Shiga toxin producing E. coli</i>	5,4	1,7 - 10	4,7	0 - 10
<i>Shigella spp.</i>	4,6	0 - 10	1,5	0 - 6,7
<i>Yersinia spp.</i>	4,1	0 - 10	2,1	0 - 10
<i>Cryptosporidium spp.</i>	3,6	0 - 8,3	1,0	0 - 6,7
<i>Echinococcus granulosus</i>	4,2	0 - 8,3	1,9	0 - 8,3
<i>Echinococcus multilocularis</i>	4,0	0 - 8,3	2,3	0 - 8,3
<i>Toxoplasma gondii</i>	3,2	0 - 8,3	0,4	0 - 5
<i>Trichinella spp</i>	4,4	0,8 - 8,3	3,8	0 - 8,3

Comments

The scores for Interoperability and communication on EU disease networks for the six priority bacteria and five parasites are around medium for the six bacteria (4.1 – 6.1), but below medium (3.2 – 4.4) for the parasites in the human laboratories. Scores are above medium (5.5 – 6.3) for *Campylobacter*, *Listeria* and *Salmonella*, below medium (4.7) for STEC and low (1.5 – 2.1) for *Shigella* and *Yersinia*, and low (0.4 – 2.3) for the parasites, except for *Trichinella* (3.8) for the non-human laboratories.

4.1.16. Intersectoral network

Overview

- 6 questions (30, 35 – 37, 40 and 46), 18 indicators, max score 36

Intersectoral network

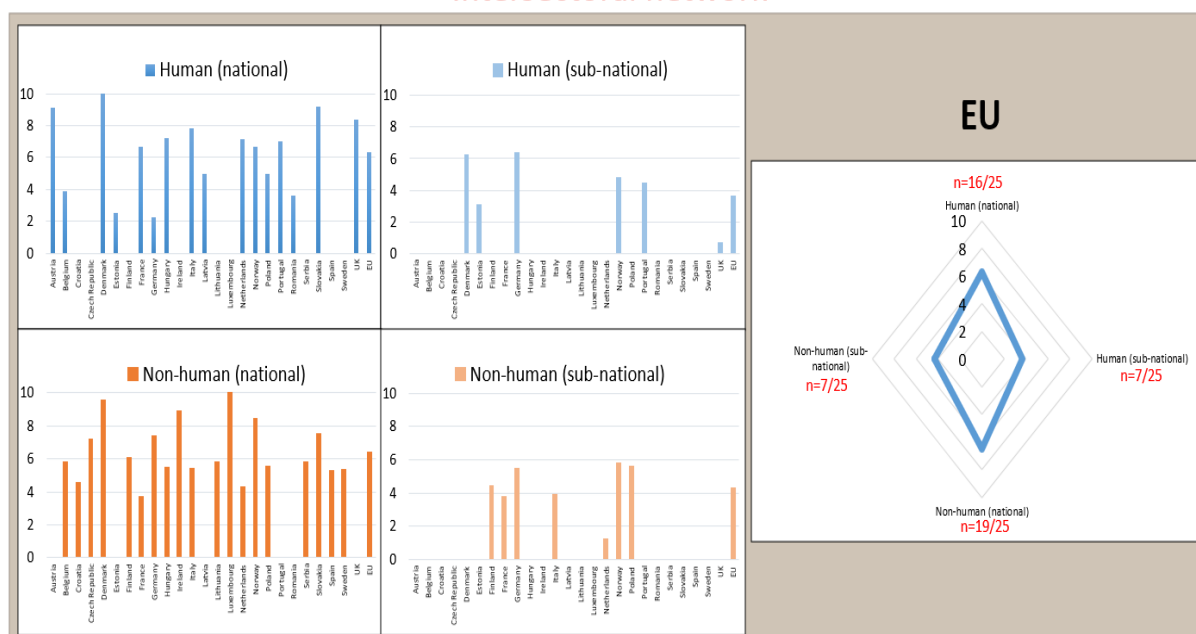


Figure 25. Interoperability and communication score for intersectoral networks summarized for EU based on 52/122 responding laboratories, representing «n» responding countries (in red) stratified by



laboratory type and source. Laboratories analysing multiple types of materials are grouped into human laboratories if they include analyses of human material. Laboratories operating at different levels are grouped with national level laboratories if they operate on a national level.

Comments

The scores for Interoperability and communication on intersectoral networks are above medium (6.3) for the human national laboratories and (6.4) the non-human national laboratories. It is low (3.7 and 4.3) for the human and non-human sub-national laboratories.

Table 11. Average and range interoperability and communication scores by the human/non-human laboratories on intersectoral networks split into the six priority bacteria and the five priority parasites.

Interoperability and communication - Intersectoral network				
Model organism	Human		Non-human	
	Average	range	average	range
<i>Campylobacter spp.</i>	5,6	0 - 10	6,7	2,5 - 10
<i>Listeria</i>	5,7	0 - 10	6,5	0 - 10
<i>Salmonella spp.</i>	6,1	0 - 10	7,1	1,3 - 10
<i>Shiga toxin producing E. coli</i>	6,0	0 - 10	5,1	0 - 10
<i>Shigella spp.</i>	5,1	0 - 10	2,5	0 - 5
<i>Yersinia spp.</i>	5,3	0 - 10	3,5	0 - 7,5
<i>Cryptosporidium spp.</i>	2,7	0 - 10	1,8	0 - 5
<i>Echinococcus granulosus</i>	3,7	0 - 10	3,7	0 - 10
<i>Echinococcus multilocularis</i>	3,8	0 - 10	4,6	0 - 10
<i>Toxoplasma gondii</i>	2,8	0 - 10	2,2	0 - 10
<i>Trichinella spp</i>	3,3	0 - 10	6,4	0 - 10

Comments

The scores for Interoperability and communication on intersectoral networks for the six priority bacteria and five parasites are above medium for the six bacteria (5.1 – 6.1), but below medium (2.7 – 3.8) for the parasites in the human laboratories. Scores are above medium (5.1 – 7.1) for *Campylobacter*, *Listeria*, *Salmonella* and STEC, below medium (2.5 and 3.5) for *Shigella* and *Yersinia*, and below medium (1.8 – 4.6) for the parasites, except for *Trichinella* (6.4) for the non-human laboratories.

4.1.17. Dissemination

Overview

4 questions, 4 indicators, max score 8



Dissemination

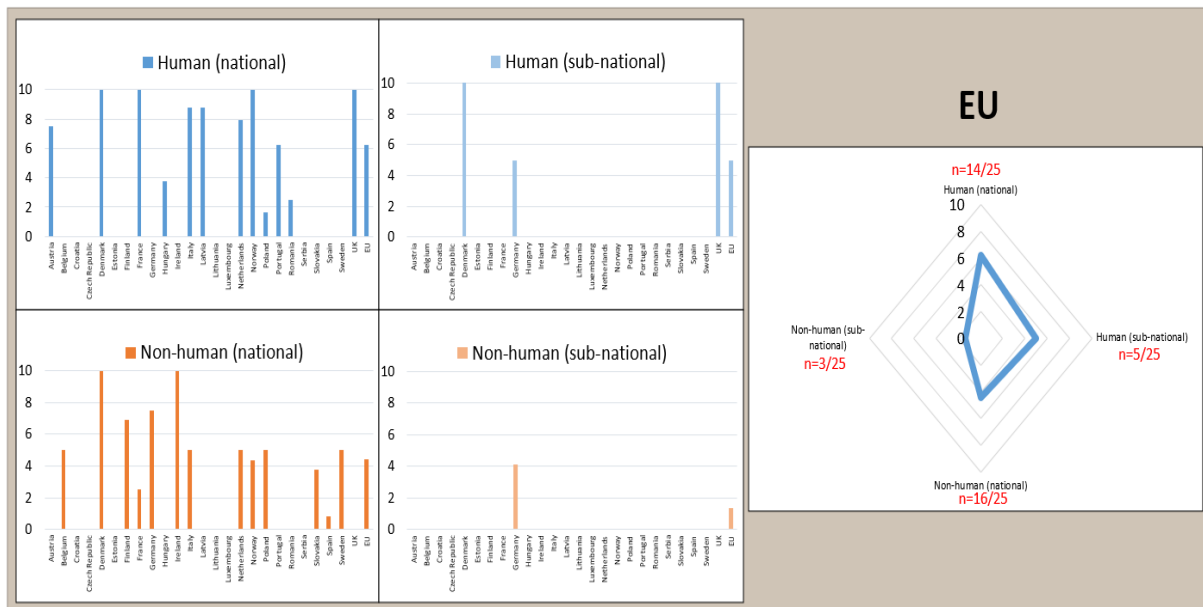


Figure 26. Interoperability and communication score for dissemination summarized for EU based on 41/122 responding laboratories, representing «n» responding countries (in red) stratified by laboratory type and source. Laboratories analysing multiple types of materials are grouped into human laboratories if they include analyses of human material. Laboratories operating at different levels are grouped with national level laboratories if they operate on a national level.

Comments

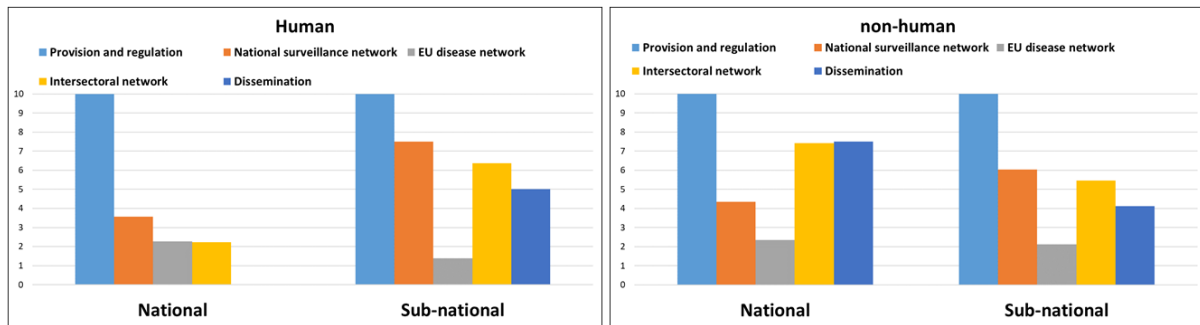
The scores for Interoperability and communication on dissemination are above medium (6.2) for the human national laboratories and medium (5-0) the sub-national laboratories. It is low 4.4 and 1.4 for the non-human national and sub-national laboratories.

4.1.18. Country Interoperability and communication

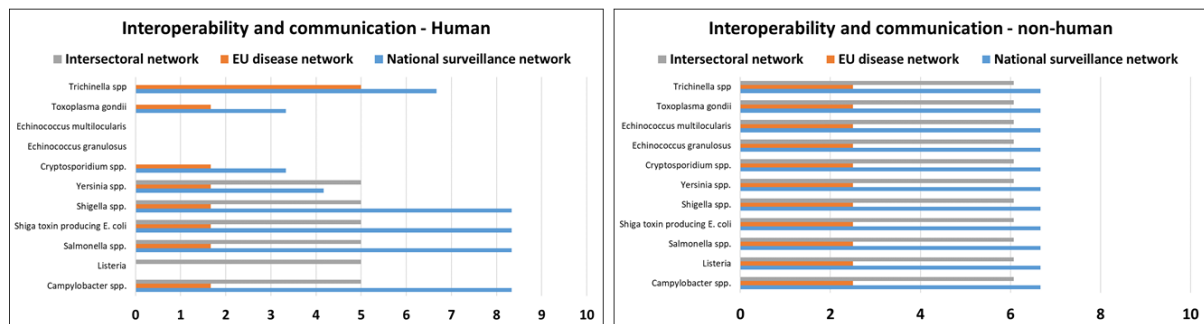
Two countries had more than ten participating laboratories, Germany (20) and Poland (28), see **Table 1** and **Figure 3**.



Country Interoperability and communication: Germany



A



B

Figure 27. Interoperability and communication scores for Germany: Provision and regulation, national disease network, EU disease network, intersectoral network and dissemination.

A: Human/non-human on national and sub-national level.

B: Human/non-human laboratories split into the six priority bacteria and the five priority parasites.



Country capability: Poland

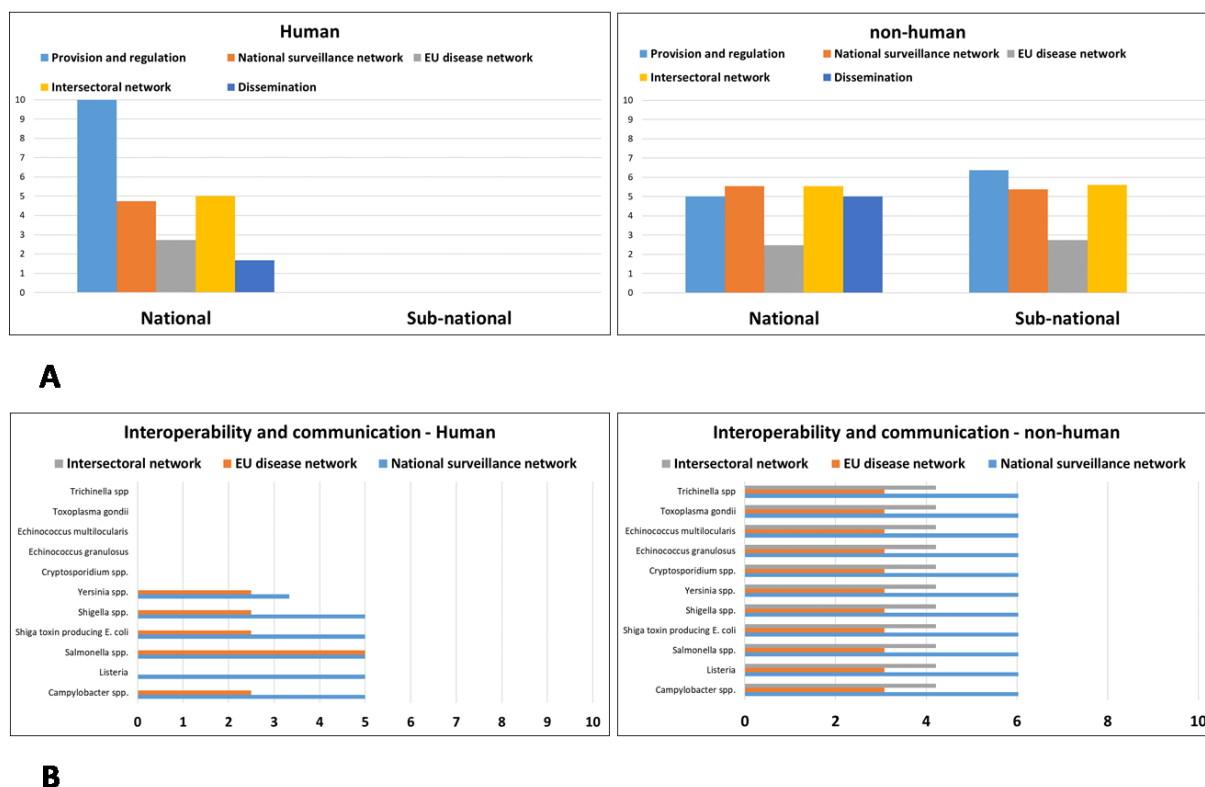


Figure 28. Interoperability and communication scores for Poland: Provision and regulation, national disease network, EU disease network, intersectoral network and dissemination.

A: Human/non-human on national and sub-national level.

B: Human/non-human laboratories split into the six priority bacteria and the five priority parasites.

5. Conclusions

The final survey proved useful, and the results illustrated the complexity of the OH field.

Further clarification of the questions asked and development of the OHLabCap tool of the levels of system adaptability/capability/capacity/interoperability and communication for each of the EU/EEA countries would require additional involvement of all stakeholders and probably focus groups.

Acknowledgements:

Everyone who contributed to this work and all the pilot survey participants are warmly thanked. Colleagues from OHEJP Joint Research Projects MEME, PARADISE and TOXOSOURCES are thanked for their contributions in the discussion on which parasites to include in the survey. The Joint Integrative Projects CARE and MATRIX have also contributed considerably before and during the final joint meeting in Copenhagen.

This project received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 773830.

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Website: [OH-HARMONY-CAP - One Health EJP](#)