Supplementary Material

General practitioners' perceptions on opportunistic single-time point screening for atrial fibrillation: a European quantitative survey

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- **1** Supplementary annexes
- **1.1** Supplementary annex 1: Survey on primary health care professionals' perceptions of opportunistic screening for atrial fibrillation

Dear colleague,

Atrial fibrillation (AF) is often asymptomatic and therefore unrecognized in our patients, who are nevertheless at increased risk of stroke. The aim of this survey is to evaluate perceptions about AF screening.

You/Your practice are/is invited to participate in a short online survey, which will take 5-7 minutes of your time.

When we refer to 'opportunistic* AF screening' we mainly refer to the use of a handheld device such as the one below in patient ≥ 65 or patients at AF risk, unless otherwise indicated.



* Opportunistic screening: health care professional specifically checks for AF during routine consultations for other reasons.

Your participation would be greatly appreciated!

If you have any concerns or questions, please do not hesitate to contact:

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- Lien Desteghe: lien.desteghe@uantwerpen.be, Antwerp University | Antwerp University Hospital

Responding to this survey is voluntary. The collected anonymized data will be kept for a maximum of 10 years. Data collected will not be transferred to any third party and handling of the anonymized data will be in accordance with the European Regulation 2016/679 with regards to data protection.

Consent form:

I agree that I have understood the above information.

I understand that once the survey is submitted it will not be possible to ascertain which data belongs to me and the researchers will be unable to delete these data.

Yes
No

AFFECT-EU receiving funding from the European Union's Horizon 2020 research and innovation Programme under grant agreement N°847770. This reflects the authors' view only. The Commission is not responsible for any use that may be made of the information it contains.

1. Personal information:

1.1 What is your profession?

- General practitioner
- Allied healthcare professional
- Nurse
- Other:

1.2 What is your gender?

- Male
- Female
- Transgender
- Prefer not to say

1.3 How old are you?

Years

1.4 Country/region:_____

2. Your perceptions concerning AF screening and current approaches to screening in general:

2.1 Is a standardized disease screening approach / disease programme (case detection) for the following conditions already implemented in your region (please tick as appropriate)?

	yes	no
Diabetes		
Elevated cholesterol		
Atrial fibrillation		
High blood pressure		
Colon cancer		
Breast cancer		
Prostate cancer		
Cervical cancer		

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2.2 How would you rate the need for a standardized screening programme approach for the following conditions (irrespective of whether it is mandatory or not in your region) based on your clinical practice?

Diabetes	° Low High	10	20	30 .	40	50 .	60 	70 .	80 	90 .	100
Elevated											
cholesterol	0	10	20	30	40	50	60	70	80	90	100
Atrial fibrillation	0	10	20	30	40	50	60	70	80 .	90	100
High blood pressure	0	10	20	30	40 	50	60 	70	80	90	100
Colon cancer	0	10	20	30	40	50	60 .	70	80	90	100
Breast cancer	0	10	20	30	40	50	60 	70	80	90	100
Prostate cancer	0	10	20	30	40	50	60	70	80 	90	100
Cervical cancer	0	10	20	30	40	50	60 	70	80 	90	100
General health check up	0 	10	20 	30 	40 	50 	60 	70 	80 	90	100

2.2 Do you have an ECG device at your clinical practice? (multiple answers possible)

- 12-lead ECG
 3-lead ECG
 Single-lead ECG (handheld)
 Other:
- -No
- 2.3 A patient ≥ 65 years comes to your practice for an outpatient visit (for whatever reason); do you take this opportunity to do any of the following checks (if time permits)? (multiple answers possible as relevant to your practice)
 - Pulse check
 - Ausculation of heart sounds

Blood pressure check

Rhythm check with a 12-lead ECG

Rhythm check with a 3-lead ECG

Rhythm check with a single-lead ECG (handheld)

Blood sample (e.g. lipids, thyroid status etc.)

Smoking check

No routine (age-based) work-up is applied

Other: Specify_____

3. Feasibility of opportunistic single-lead ECG screening:

3.1 How confident are you to rule out atrial fibrillation (AF) rhythm present on this 30second single-lead ECG rhythm strip such as shown below?

- not confident
- slightly confident
- somewhat confident
- _____ fairly confident ______ completely confident



3.2 What would assist in improving your confidence to rule out AF based on such kind of single-lead ECG (see above)? (multiple answers possible)

More education on ECG in general and novel ECG devices in particular

] Tele-healthcare service for upload of the ECG/ tracing and rapid advice within the same _day

Standardized follow-up pathway and possibility for rapid referral to a cardiologist Other procedures:_____

Nothing; I am already confident in ruling out AF based on a single-lead ECG; no external help needed

4. Implementation requirements and barriers

4.1 Please identify the TWO MAIN obstacles for implementing opportunistic single-lead ECG screening for patients over ≥ 65 years or patients at AF risk (as in the figure below) at the current stage in your practice (even if it would be reimbursed)



I would need more education before undertaking AF screening.

I am concerned about detecting false positives that could lead to anxiety/harm to patient.

I am not confident about commencing treatment once AF has been diagnosed.

There are insufficient resources to perform AF screening in my practice (i.e. personnel, ECG qualification)

- Other: specify_
- None, I can easily start conducting AF screening
- None, I have already implemented AF screening

4.2 How could these obstacles be overcome to conduct AF screening in patients from your practice if reimbursed? Please choose TWO MAIN strategies that could be implemented.

AF screening could be integrated with other programmes (e.g. flu vaccination, cancer screening)

Additional settings (e.g. pharmacists or other healthcare professions) could be involved in screening

Provision of patient leaflets or other information to increase patient education

Integrated primary care software systems with algorithms to identify patients suitable for AF screening based on their age and/or medical history

Providing a structured way of analyses of the tracings via a telehealth center.

Integrating advice pathways from experts to GP's how to interpret ECGs and prescribe appropriately.

4.3 Would your current practice have capacity to conduct ECG patch screening for 2 weeks for relevant patients e.g. 2-5 patients each week. (Please see approach below)



4.4 Do you have any further comments or suggestions about AF screening implementation in your practice?

1.2 Supplementary annex 2: Validation of the survey

The survey was validated for its content and further refined during four consecutive phases. In the first phase, experts of the AFFECT-EU consortium involved in AF patient care (Ben Freedman, Coral L. Hanson, Daniel Engler, Hein Heidbuchel, Lis Neubeck, Renate B. Schnabel) reviewed the survey and provided specific feedback on the content considering five aspects: (i) is it a valid tool to answer our research questions?; (ii) does the survey address all the relevant issues or are there any obvious omissions?; (iii) is the order of the questions correct and is the flow logical?; (iv) is the text easy to read and comprehend?; and (v) is the questionnaire length appropriate? Secondly, four GPs were asked to provide feedback on the same five aspects. In the third phase, the content of the survey was discussed during a workshop with the AFFECT-EU consortium partners. During the final phase, three GPs reviewed the updated version of the survey and after their feedback, a final optimisation of the survey occurred.

2 Supplementary tables

2.1 Supplementary table 1: Availability of a standardised screening approach for different conditions, presented for different European regions.

Condition	All respondents (n = 659)	Eastern Europe (n = 238)	Western Europe	Southern Europe (n = 80)	Northern Europe (n = 66)	UK & Ireland (n = 55)	P-value between regions
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Atrial fibrillation	79 (12.0)	28 (11.8)	19 (8.6)	16 (20.0)	5 (7.6)	11 (20.0)	0.019
Prostate cancer	226 (34.3)	88 (37.0)	91 (41.4)	33 (41.3)	5 (7.6)	9 (16.4)	<0.001
Elevated cholesterol	375 (56.9)	135 (56.7)	120 (54.5)	63 (78.8)	33 (50.0)	24 (43.6)	<0.001
General health check up	394 (59.8)	157 (66.0)	129 (58.6)	54 (67.5)	29 (43.9)	25 (45.5)	0.002
High blood pressure	413 (62.7)	159 (66.8)	124 (56.4)	67 (83.8)	35 (53.0)	28 (50.9)	<0.001
Diabetes	420 (63.7)	142 (59.7)	148 (67.3)	62 (77.5)	38 (57.6)	30 (54.5)	0.014
Colon cancer	466 (70.7)	102 (42.9)	214 (97.3)	79 (98.8)	19 (28.8)	52 (94.5)	<0.001
Breast cancer	540 (81.9)	128 (53.8)	217 (98.6)	78 (97.5)	66 (100.0)	51 (92.7)	<0.001
Cervical cancer	574 (87.1)	185 (77.7)	197 (89.5)	75 (93.8)	64 (97.0)	53 (96.4)	<0.001

Data are presented as absolute numbers and percentages of respondents who indicated a screening approach was present in their region. It is important to note that Eastern Europe is mainly represented by Romania (87.4% of Eastern European respondents).

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Condition		All respondents (n = 659)	Eastern Europe (n = 238)	Western Europe (n = 220)	Southern Europe (n = 80)	Northern Europe (n = 66)	UK & Ireland (n = 55)	P-value between regions
Atrial fibrillation	(1) (2)	82.7 ± 23.4 93 (71 – 100)	$92.5 \pm 16.7 \\ 100 (96 - 100)$	$77.2 \pm 24.9 \\ 83 (61 - 100)$	84.2 ± 20.5 90 (78.3 - 100)	$63.3 \pm 26.3 \\ 63 (50 - 82.3)$	83.1 ± 21.5 90 (76 - 100)	<0.001
Prostate cancer	(1) (2)	73.2 ± 31.6 86 (50 - 100)	91.6 ± 18.0 100 (91.8 - 100)	66.9 ± 31.7 77.5 (50 – 98)	68.3 ± 32.3 78 (40 – 100)	$\begin{array}{c} 49.4 \pm 33.3 \\ 50 \; (20-80.5) \end{array}$	54.5 ± 33.4 57 (21 – 86)	<0.001
Elevated cholesterol	(1) (2)	79.4 ± 25.2 89 (70 – 100)	$\begin{array}{c} 91.7 \pm 17.4 \\ 100 \ (90-100) \end{array}$	71.3 ± 27.0 78.5 (52 – 95)	82.4 ± 21.8 92 (73 – 100)	65.1 ± 28.4 70.5 (46.5 - 86.3)	71.1 ± 22.9 75 (50 – 92)	<0.001
General health check-up	(1) (2)	$\begin{array}{c} 75.3\pm 30.6 \\ 100 \; (52-100) \end{array}$	$\begin{array}{c} 93.3 \pm 17.6 \\ 100 \ (99.8 - 100) \end{array}$	$71.7 \pm 29.6 \\ 80 \ (51 - 100)$	$\begin{array}{c} 70.6\pm 30.4\\ 80\;(50-100)\end{array}$	$\begin{array}{c} 46.3\pm 31.2\\ 50~(18.8-71.3)\end{array}$	53.6 ± 31.0 50 (26 - 80)	<0.001
High blood pressure	(1) (2)	$\begin{array}{c} 89.1 \pm 18.0 \\ 100 \; (83 - 100) \end{array}$	$\begin{array}{c} 96.2 \pm 11.1 \\ 100 \; (100-100) \end{array}$	$\begin{array}{c} 85.7 \pm 19.6 \\ 91.5 \; (80-100) \end{array}$	$\begin{array}{c} 90.3\pm14.0\\ 96.5\;(86.3-100)\end{array}$	77.2 ± 24.7 85 (61.8 – 100)	84.2 ± 18.3 91 (72 - 100)	<0.001
Diabetes	(1) (2)	$\begin{array}{c} 88.2\pm18.9\\ 100\;(81-100)\end{array}$	$\begin{array}{c} 94.3 \pm 15.0 \\ 100 \ (98-100) \end{array}$	$\begin{array}{c} 85.9\pm 20.4\\ 93\;(80-100)\end{array}$	$\begin{array}{c} 89.5\pm16.7\\ 96\ (82.3-100)\end{array}$	$\begin{array}{c} 76.2\pm22.6\\ 80~(61.8-97.8)\end{array}$	$\begin{array}{c} 83.5\pm 16.5\\ 86\ (75-100)\end{array}$	<0.001
Colon cancer	(1) (2)	87.2 ± 21.2 100 (81 - 100)	$\begin{array}{c} 92.8\pm 16.2\\ 100~(96.8-100)\end{array}$	87.5 ± 20.8 98.5 (82 - 100)	$\begin{array}{c} 93.0 \pm 14.2 \\ 100 \ (90.3 - 100) \end{array}$	$\begin{array}{c} 62.3 \pm 26.6 \\ 60 \; (45.8 - 84.3) \end{array}$	82.6 ± 21.1 90 (70 – 100)	<0.001
Breast cancer	(1) (2)	$\begin{array}{c} 87.7\pm20.7\\ 100\;(81-100)\end{array}$	$\begin{array}{c} 94.9 \pm 13.2 \\ 100 \; (100-100) \end{array}$	84.2 ± 23.1 94.5 (77.3 – 100)	$\begin{array}{c} 92.3 \pm 14.2 \\ 100 \ (90-100) \end{array}$	$\begin{array}{c} 76.0 \pm 24.4 \\ 82 \; (60-100) \end{array}$	78.1 ± 26.1 89 (60 – 100)	<0.001
Cervical cancer	(1) (2)	$\begin{array}{c} 89.7 \pm 18.3 \\ 100 \; (85 - 100) \end{array}$	$\begin{array}{c} 94.7\pm14.5\\ 100\;(100-100)\end{array}$	87.1 ± 19.8 98 (80 - 100)	$\begin{array}{c} 92.2\pm14.8\\ 100\ (90-100) \end{array}$	81.5 ± 21.0 89.5 (69.8 - 100)	84.3 ± 21.7 95 (75 – 100)	<0.001

2.2 Supplementary table 2: Perceived need for a standardised screening approach for different conditions, rated on a scale from 0 to 100, presented for different European regions.

Data are presented as (1) mean \pm standard deviation and as (2) median (Q1 – Q3). It is important to note that Eastern Europe is mainly represented by Romania (87.4% of Eastern European respondents).

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ECG device	All respondents (n = 659)	Eastern Europe (n = 238)	Western Europe (n = 220)	Southern Europe (n = 80)	Northern Europe (n = 66)	UK & Ireland (n = 55)	P-value between regions
12-lead ECG	475 (72.1)	128 (53.8)	179 (81.4)	52 (65.0)	65 (98.5)	51 (92.7)	<0.001
3-lead ECG	43 (6.5)	23 (9.7)	10 (4.5)	1 (1.3)	2 (3.0)	7 (12.7)	0.008
Single-lead ECG (handheld)	71 (10.8)	17 (7.1)	14 (6.4)	4 (5.0)	1 (1.5)	35 (63.6)	<0.001
Other	21 (3.2)	10 (4.2)	5 (2.3)	3 (3.8)	1 (1.5)	2 (3.6)	0.716
No	126 (19.1)	68 (28.6)	33 (15.0)	23 (28.7)	0 (0)	2 (3.6)	<0.001

2.3 Supplementary table 3: The availability of different ECG devices, presented for different European regions.

Data are presented as absolute numbers and percentages of respondents who indicated they had the ECG device available. It is important to note that Eastern Europe is mainly represented by Romania (87.4% of Eastern European respondents).

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2.4 Supplementary table 4: Overview of regular health checks the respondents would perform in a ≥ 65 years patients that comes to their practice for an outpatient visit, presented for different European regions.

Health check	All	Eastern	Western	Southern	Northern	UK & Iroland	P-value
	(n = 659)	(n = 238)	(n = 220)	(n = 80)	(n = 66)	(n = 55)	regions
Blood pressure check	589 (89.4)	234 (98.3)	197 (89.5)	66 (82.5)	44 (66.7)	48 (87.3)	< 0.001
Pulse check	524 (79.5)	227 (95.4)	180 (81.8)	45 (56.3)	30 (45.5)	42 (76.4)	<0.001
Auscultation of heart sounds	504 (76.5)	206 (86.6)	178 (80.9)	53 (66.3)	45 (68.2)	22 (40.0)	<0.001
Smoking check	478 (72.5)	183 (76.9)	147 (66.8)	60 (75.0)	43 (65.2)	45 (81.8)	0.036
Blood sample	251 (38.1)	47 (19.7)	133 (60.5)	30 (37.5)	17 (25.8)	24 (43.6)	<0.001
Rhythm check with a 12-lead ECG	77 (11.7)	43 (18.1)	17 (7.7)	9 (11.3)	3 (4.5)	5 (9.1)	0.003
Rhythm check with a single-lead ECG (handheld)	40 (6.1)	11 (4.6)	8 (3.6)	1 (1.3)	0 (0)	20 (36.4)	<0.001
Rhythm check with a 3-lead ECG	16 (2.4)	12 (5.0)	3 (1.4)	0 (0)	0 (0)	1 (1.8)	0.020
Other (e.g. alcohol check, BMI check)	87 (13.2)	27 (11.3)	43 (19.5)	7 (8.8)	5 (7.6)	5 (9.1)	0.014
No routine (age-based) work-up is applied	41 (6.2)	3 (1.3)	14 (6.4)	6 (7.5)	14 (21.2)	4 (7.3)	<0.001

Data are presented as absolute numbers and percentages of respondents who would perform the health check. It is important to note that Eastern Europe is mainly represented by Romania (87.4% of Eastern European respondents).

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2.5 Supplementary table 5: Confidence level of respondents to rule out atrial fibrillation based on a 30-second single-lead ECG rhythm strip, presented for different European regions.

Confidence level	All respondents (n = 643)	Eastern Europe (n = 231)	Western Europe (n = 213)	Southern Europe (n = 78)	Northern Europe (n = 66)	UK & Ireland (n = 55)	P-value between regions
Not confident	78 (12.1)	34 (14.7)	30 (14.1)	7 (9.0)	5 (7.6)	2 (3.6)	0.093
Slightly confident	58 (9.0)	25 (10.8)	19 (8.9)	3 (3.8)	10 (15.2)	1 (1.8)	0.041
Somewhat confident	126 (19.6)	62 (26.8)	40 (18.8)	8 (10.3)	11 (16.7)	5 (9.1)	0.003
Fairly confident	270 (42.0)	83 (35.9)	84 (39.4)	37 (47.4)	38 (57.6)	28 (50.9)	0.010
Completely confident	111 (17.3)	27 (11.7)	40 (18.8)	23 (29.5)	2 (3.0)	19 (34.5)	<0.001

Data are presented as absolute numbers and percentages. It is important to note that Eastern Europe is mainly represented by Romania (87.4% of Eastern European respondents).

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2.6 Supplementary table 6: Preferred assistance to rule out atrial fibrillation based on a 30-second single-lead ECG rhythm strip, presented for different European regions.

	All	Eastern	Western	Southern	Northern	UK &	P-value
	Respondents	Europe	Europe	Europe	Europe	Ireland	between
	(n=643)	(n = 231)	(n = 213)	(n = 78)	(n = 66)	(n = 55)	regions
More education on ECG in general and novel ECG devices in	28.7	36.3	20.4	29.1	33.1	23.3	<0.001
particular							
Tele-healthcare service for upload of the ECG tracing and	25.2	20.7	30.3	25.9	21.7	27.3	0.002
rapid advice within the same day							
Standardised follow-up pathway and possibility for rapid	23.4	29.6	22.5	11.8	23.2	17.9	<0.001
referral to a cardiologist							
Other procedures	4.6	1.7	6.6	6.4	8.3	2.4	0.005
Nothing; I am already confident in ruling out AF based on a	18.0	11.7	20.2	26.9	13.6	29.1	0.002
single-lead ECG; no external help needed							

The different responses were considered in relation to the total number of indicated reasons and presented as percentages. ECG: electrocardiogram, AF: atrial fibrillation. It is important to note that Eastern Europe is mainly represented by Romania (87.4% of Eastern European respondents).

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2.7 Supplementary table 7: Main obstacles for implementing opportunistic single-lead ECG screening for atrial fibrillation in patients ≥ 65 years or patients at risk of atrial fibrillation, presented for different European regions.

	All	Eastern	Western	Southern	Northern	UK &	P-value
	respondents	Europe	Europe	Europe	Europe	Ireland	between
	(n=596)	(n = 207)	(n = 205)	(n = 71)	(n = 61)	(n = 52)	regions
There are insufficient resources to perform AF screening in my practice (i.e.	18.5	18.8	12.2	26.4	32.0	17.3	0.004
personnel, ECG devices)							
I would need more education before undertaking AF screening	18.2	29.0	14.4	12.7	13.1	3.8	<0.001
I am concerned about detecting false positives that could lead to	10.3	12.1	7.8	9.2	13.9	10.6	0.204
anxiety/harm to patients							
I am not confident about commencing treatment once AF has been	7.0	3.9	13.2	4.2	1.6	4.8	<0.001
diagnosed							
None, I can easily start conducting AF screening	26.0	27.5	27.8	28.2	24.6	11.5	0.165
None, I have already implemented AF screening	6.2	2.4	8.3	4.2	0.0	23.1	<0.001
Other (e.g. lack of evidence benefits AF screening, lack of time,	13.8	6.3	16.3	16.9	14.8	28.8	<0.001
administration issues)							

The different responses were considered in relation to the total number of indicated reasons and presented as percentages. AF: atrial fibrillation, ECG: electrocardiogram. It is important to note that Eastern Europe is mainly represented by Romania (87.4% of Eastern European respondents).

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2.8 Supplementary table 8: Suggested strategies to overcome obstacles concerning opportunistic single-lead ECG screening for atrial fibrillation, presented for different European regions.

	All	Eastern	Western	Southern	Northern	UK &	P-value
	respondents	Europe	Europe	Europe	Europe	Ireland	between
	(n=580)	(n = 205)	(n = 199)	(n = 69)	(n = 60)	(n = 47)	regions
AF screening could be integrated with other programmes (e.g. flu	24.9	22.7	23.1	28.3	29.2	31.9	0.054
vaccination, cancer screening)							
Integrated primary care software systems with algorithms to identify	24.3	26.1	23.9	26.8	24.2	14.9	0.076
patients suitable for AF screening based on their age and/or medical history							
Integrating advice pathways from experts to GPs how to interpret ECGs and	15.5	21.2	16.3	8.0	8.3	7.4	<0.001
prescribe appropriately							
Providing a structured way of analyses of the tracings via a telehealth center	11.1	10.7	12.8	12.3	5.8	10.6	0.237
Provision of patient leaflets or other information to increase patient	10.7	13.7	11.1	6.5	5.0	9.6	0.018
education							
Additional settings (e.g. pharmacists or other healthcare professions) could	6.9	1.7	6.0	11.6	16.7	13.8	<0.001
be involved in screening							
Other (e.g. distribution of validated single-lead devices, more evidence and	6.8	3.9	6.8	6.5	10.8	11.7	0.003
education, decision support tools, better time management)							

The different responses were considered in relation to the total number of indicated reasons and presented as percentages. AF: atrial fibrillation, ECG: electrocardiogram, GP: general practitioner. It is important to note that Eastern Europe is mainly represented by Romania (87.4% of Eastern European respondents).

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2.9 Supplementary table 9: The capacity of respondents to perform opportunistic prolonged atrial fibrillation screening, in which relevant patients wear an electrocardiogram patch for 2 weeks, presented for different European regions.

Opportunistic prolonged screening possible	All respondents (n=596)	Eastern Europe (n = 207)	Western Europe (n = 205)	Southern Europe (n = 71)	Northern Europe (n = 61)	UK & Ireland (n = 52)	P-value between regions
Yes	376 (63.1)	154 (74.4)	127 (62.0)	39 (54.9)	22 (36.1)	34 (65.4)	<0.001
No	106 (17.8)	20 (9.7)	39 (19.0)	17 (23.9)	16 (26.2)	14 (26.9)	0.002
Do not know	114 (19.1)	33 (15.9)	39 (19.0)	15 (21.1)	23 (37.7)	4 (7.7)	<0.001

Data are presented as absolute numbers and percentages. It is important to note that Eastern Europe is mainly represented by Romania (87.4% of Eastern European respondents).

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