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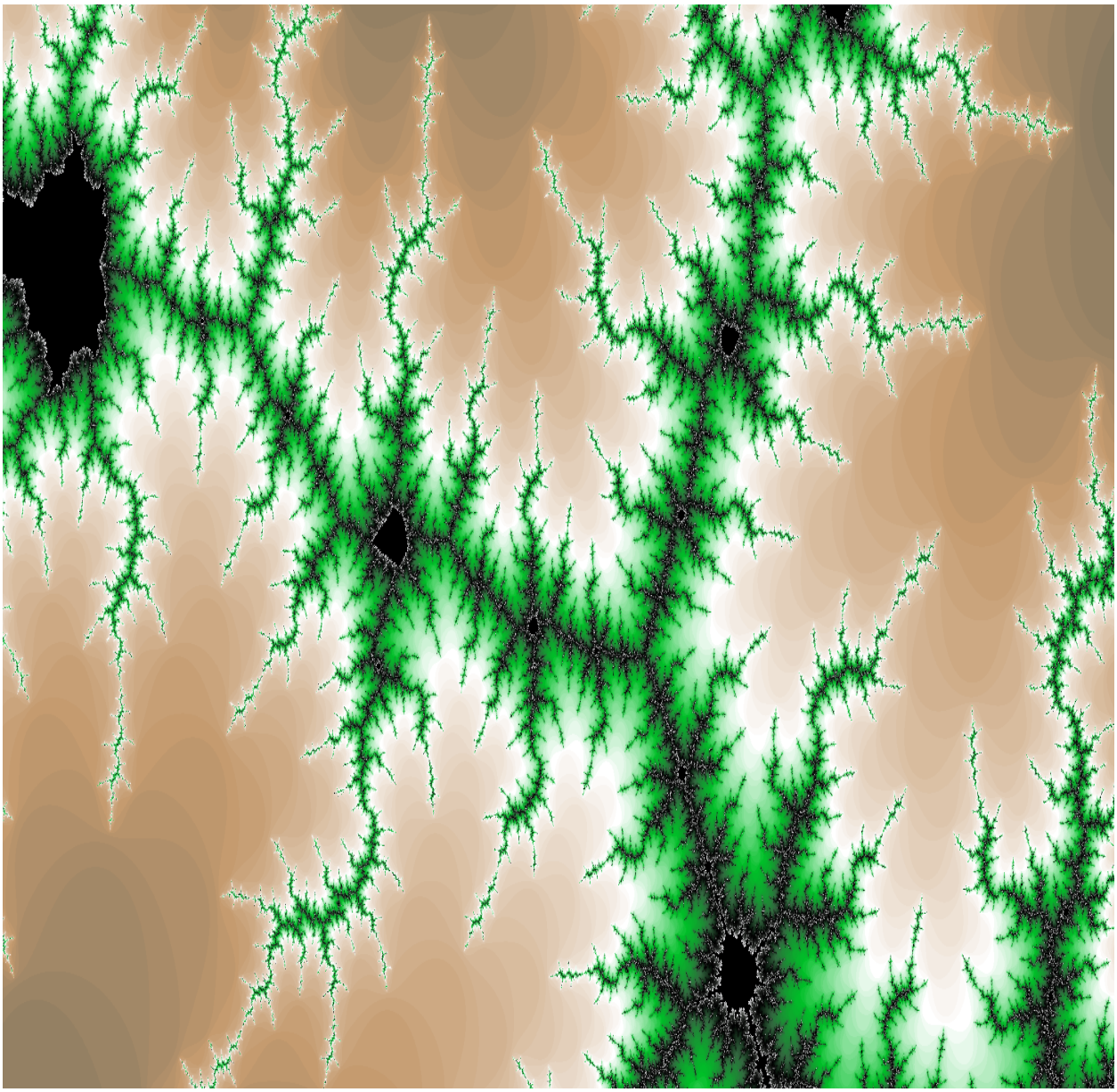
2019 Artificial Intelligence Survey



asrt

American Society of Radiologic Technologists

Table of Contents

Executive Summary

Key Takeaways

- Respondents are largely comfortable with technology and frequently use it in their everyday lives.
- Most respondents are broadly familiar with the concepts of Artificial Intelligence and Machine Learning.
- Respondents were mixed in their familiarity with AI features on their equipment; however, a majority are confident that those features function correctly and provide trustworthy results. A vocal minority are more skeptical.
- Respondents indicated a lack of standardized process for resolving discrepancies between machine-recommended procedures and technologist judgment.
- Respondents were inclined to see AI as having a beneficial impact on considerations such as safety and quality but worried about a deleterious effect on the more "human" aspects of the profession, such as patient interaction and creativity.
- Respondents showed no widespread consensus that AI would adversely affect their professional prospects.

Sampling

In August 2019, an invitation to participate in the *2019 Artificial Intelligence Survey* was sent via email to 20,000 ASRT members.

At the close of the survey in Sept. 2019, 416 participants had completed the questionnaire, resulting in a 2.1% response rate.

At its widest, a sample size of 416 yields a margin of error of ± 4.8% at the 95% confidence level.

Demographics

Respondents were asked demographic questions about their age, education and professional status.

Respondents were asked to identify the disciplines in which they are active. The top three are:

- Radiography (54.7%)
- Computed Tomography (20.7%)
- Mammography (13.3%)

Most respondents work at a hospital (58.6%), 10.2% work at an imaging center and 8.5% work at a large clinic.

A plurality of respondents work in an urban setting (44.9%), 38.8% work in a suburban setting and 16% work in a rural setting.

The three most common job titles among respondents are:

- Staff technologist/therapist (69.2%)
- Chief technologist (9.7%)
- Supervisor/assistant chief technologist (5.8%)

Most respondents are employed full time (82.3%), with another 13.8% employed part time.

A plurality of respondents (45.5%) list an associate degree as their highest level of education, 33.4% list a bachelor's degree and 10.9% list a certificate.

The average age of respondents is 42.9 years.

Overall Comfort With Technology

Respondents were asked questions designed to gauge their general attitudes toward technology and their use of technology in areas beyond the radiologic sciences.

Most respondents (95.9%) describe themselves as "someone who enjoys technology."

Respondents were asked how frequently they use a variety of common technological applications in their everyday lives. The three most common activities among respondents in terms of daily participation are:

- Browsing the internet (87.0% do this daily)
- Using a search engine such as Google (86.5% do this daily)
- Using social media such as Facebook or Instagram (70.3% do this daily)

Respondents were asked about their familiarity with software used outside of the radiologic sciences. The most commonly used software by those who claim "advanced user" status are:

- Microsoft Office Suite (22.5% advanced users)
- Financial/accounting software (2.9% advanced users)
- Adobe Creative Cloud (2.2% advanced users)

General Understanding of AI and ML

Respondents were provided with commonly used definitions of both Artificial Intelligence and Machine Learning and asked whether they were familiar with the concepts as defined.

"Artificial Intelligence (AI): Human intelligence exhibited by machines; the science of designing computer systems to perform tasks that require human intelligence, including visual perception, speech recognition and decision-making."

Most respondents (88.6%) are familiar with this understanding of AI.

"Machine Learning (ML): Approach to achieve artificial intelligence; a type of artificial intelligence that provides computers with the ability to learn without being programmed. Using a set of algorithms, the computer reviews large data sets, looks for patterns and makes predictions that improve with increased exposure to data."

Most respondents (74.2%) are familiar with this understanding of ML.

Most respondents (94.7%) say that the definitions provided are in line with their understanding of AI and ML.

Most respondents (94.7%) are aware that AI has already been implemented in many everyday applications such as Siri and Alexa.

Opinion was divided when respondents were asked about their comfort level with AI being implemented in their home, car or devices:

- 39.5% are comfortable or very comfortable with AI in these settings
- 35.2% are neutral
- 25.3% are uncomfortable or very uncomfortable

Use of AI/ML in the Radiologic Sciences

Respondents were asked about their usage and awareness of AI/ML features on the equipment they routinely use in their job.

A majority of respondents (54.8%) say their department uses automated postprocessing of images before they are sent to PACS, 22.7% say their department does not use automated postprocessing and 22.5% are unsure.

Respondents received all questions about equipment, regardless of the areas in which they actively work. During analysis, equipment-related questions were cross-tabulated by discipline to factor out respondents who were unfamiliar with particular types of equipment.

For radiography equipment, cross-tabulated by the 223 respondents who actively work in radiography:

- The most commonly used AI/ML feature is isocenter alignment/detector alignment assistance
    - 48.9% use this feature
    - 18.8% don't know about the feature
    - 28.3% answered "not applicable"
- The least commonly used AI/ML feature is procedure guidance
    - 18.6% use this feature

    - 25.3% don't know about this feature
    - 48.0% answered "not applicable"

For computed tomography equipment, cross-tabulated by the 83 respondents who actively work in CT:

- The most commonly used AI/ML feature is procedure guidance
    - 30.1% use this feature
    - 30.1% don't know about this feature
    - 33.7% answered "not applicable"
- The least commonly used feature is C-view mapping
    - 8.6% use this feature
    - 48.1% don't know about this feature
    - 39.5% answered "not applicable"

For interventional equipment, cross-tabulated by the 20 respondents who actively work in an interventional discipline:

- The most commonly used AI/ML feature is vessel measurement
    - 70.0% use this feature
    - 15.0% answered "not applicable"
- The least commonly used feature is gating for cardiac procedures
    - 25.0% use this feature
    - 75.0% answered "not applicable"

For radiation therapy equipment, cross-tabulated by the 51 respondents who actively work in radiation therapy:

- The most commonly used AI/ML feature is online 4D cone-beam CT
    - 56.9% use this feature
    - 15.7% don't know about this feature
    - 23.5% answered "not applicable"
- The least commonly used feature is intervention guidance
    - 10.2% use this feature
    - 32.7% don't know about this feature
    - 46.9% answered "not applicable"

For magnetic resonance equipment, cross-tabulated by the 51 respondents who actively work in magnetic resonance imaging:

- The most commonly used AI/ML feature is automated image reconstruction
    - 63.5% use this feature
    - 23.1% don't know about this feature
    - 11.5% answered "not applicable"
- The least commonly used feature is disorders of consciousness brainwave activity analysis algorithm
    - 2.0% use this feature
    - 54.9% don't know about this feature
    - 43.1% answered "not applicable"

Most respondents believe the AI/ML features on their equipment are reliable. Asked how often they felt these features are operating correctly:

- 9.7% say "always"
- 74.2% say "most of the time"
- 6.7% say "rarely"
- 9.4% say "never"

Asked how frequently they use the AI/ML features on the equipment they use:

- 18.3% use them all the time
- 34.5% use them most of the time
- 20.9% use them some of the time
- 10.4% rarely use them
- 15.9% never use them

Respondents were asked questions related to discrepancies between machine-recommended procedures and technologist judgment.

Asked how their institution resolves discrepancies, a plurality (45.0%) indicated

that the process for resolution depends on the features; another 29.8% indicated that the process is self-regulated.

Relatively few respondents indicated that their facility experiences frequent discrepancies:

- 7.3% experience discrepancies more than half the time.
- 28.8% experience discrepancies between 16-50% of the time
- 52.0% experience discrepancies between 1-15% of the time
- 12.0% never experience discrepancies

In the event of a discrepancy, most respondents (62.8%) say their institution does not require consulting a second technologist to ignore the machine's advice.

Most respondents (54.8%) say they received training on AI/ML features through onsite education; 32.1% received no training and 10.4% received training at a vendor facility.

Effects of AI/ML

Respondents were asked to rate whether the effects of AI would be beneficial, neutral or negative for a variety of specific considerations.

Responses skewed toward higher proportions of respondents seeing beneficial or neutral effects from AI implementation rather than negative effects.

The considerations for which respondents were most likely to see a beneficial effect were:

- Motion artifact recognition (72.2%)
- Radiation exposure (71.4%)
- Quality of scans/treatments (70.4%)

The considerations for which respondents were most likely to see a neutral effect were:

- Throughput (53.2%)
- Creativity (52.9%)
- Responsible implementation (52.4%)

The considerations for which respondents were most likely to see a negative effect were:

- Patient interaction (30.8%)
- Expense (25.6%)
- Creativity (19.7%)

Respondents were asked to reflect on how they believe AI will affect the role of the radiologic technologist in terms of their role and in terms of how the profession will change. Given that age might influence respondents' thoughts about these questions, responses were cross-tabulated by age.

Scope of Professional Role

- A slim majority (53.5%) of respondents across all age ranges believe AI will not change the scope of their role
    - 30.8% of those in the 18 to 24 age group believe AI will expand their professional role, the highest of any age cohort
    - 33.0% of those in the 34 to 43 cohort believe AI will reduce their professional role
    - 80.0% of those 63 or older anticipate no change in their professional role, likely due to imminent retirement
- A plurality (38.6%) of respondents across all age cohorts believe AI will not change the scope of their role in the profession in general
    - Those most likely to see possibilities for an expanding scope were again the youngest age cohort (18 to 24); 38.5% of them anticipate expanded opportunities for roles similar to their own in the profession
    - 40.0% of those aged 63 or over believe AI will reduce the scope of similar roles
    - 42.9% of those 44 to 53 believe there will be no change in similar roles

Staffing

- Across all age groups, most respondents (62.7%) believe AI will not affect staffing levels for their role

  - 9.2% of the 54 to 62 age group see potential for expanded staffing levels in their role, the highest of any cohort
  - 38.2% of the 34 to 43 age group believe AI will reduce staffing levels in their role
  - 70.0% of the 63 and older age group foresee no change in staffing levels for their role
- A plurality of respondents (46.4%) across every age cohort expect no change in staffing levels for the profession as a whole
  - The cohort most concerned about a reduction in staffing levels in the profession was the 34 to 43 age group: 49.4% believe AI will reduce staffing levels
  - The 63 and older age group was the most optimistic cohort about the effect of AI on staffing levels; 20.0% believe staffing will expand
  - The 63 and older demographic was also the most likely group to expect no change in staffing levels, with 60.0% predicting no change

Specialized Roles

- A plurality of respondents (47.3%) across all ages foresee no change in their role as far as specialized roles dealing with AI
  - 50.0% of the youngest age group (18 to 24) expect their role to expand into new opportunities dealing with AI
  - The 25 to 33 demographic was the cohort most likely to anticipate a reduction in their roles' opportunities dealing with AI (13.9%)
  - The 63 and older demographic was the most likely to expect no change in their roles' opportunities with respect to AI (70.0%)
- A plurality of respondents (48.2%) across all ages expect that opportunities for specialized roles dealing with AI will expand in the profession, in general
  - A majority (56.0%) of the 18 to 24 demographic expect specialized roles dealing with AI to expand for the profession
  - The 34 to 43 cohort is the age group most likely to expect a reduction in specialized roles (20.5%)
  - The 63 and older demographic is most likely to expect no change in specialized roles (50.0%)

Asked how much they trust AI/ML features at work, respondents were what might be described as cautiously trusting: while only 1.8% say they trust these features completely, 30.9% trust them a great deal and another 52.3% trust them somewhat. Only 15.0% say they trust AI features very little or not at all.

Respondents were also asked the extent to which they trust AI/ML features on their equipment to accurately incorporate data about patient medical history in making adjustments to scheduled examinations. Only 2.3% trust these adjustments completely, 20.4% trust them a great deal, 54.6% trust them somewhat, 12.6% trust them very little and 5.9% don't trust them at all.

A majority of respondents believe that data privacy and data security (52.0% and 51.7%, respectively) will greatly affect the adoption of AI in health care. Further, 51.8% of respondents believe algorithmic bias will have some effect on the adoption of AI, and 50.9% believe decision support tools will have some effect.

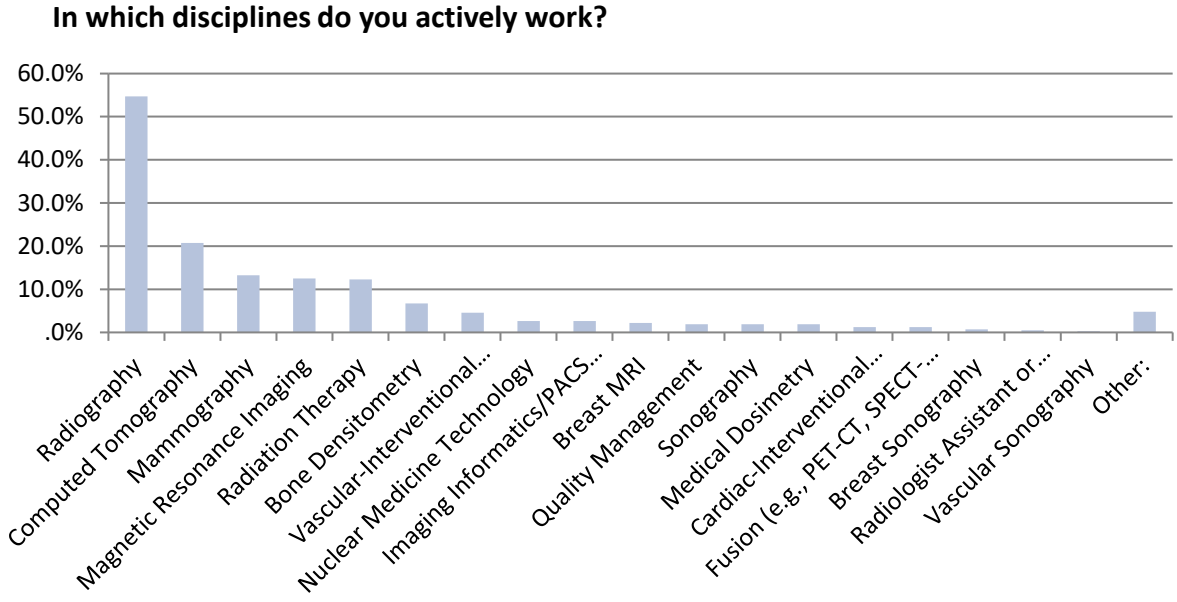
The majority of respondents (90.5%) say patients are not asking whether their exams are machine controlled.

A follow-up question allowed respondents to elaborate on patient feedback with respect to AI: 15.5% say their patients are more comfortable with machine-controlled examinations, 52.0% say patients are less comfortable with machine-controlled examinations, and 32.4% say “other.”

Demographics

In which disciplines do you actively work? (Please check all that apply)

	N	Percent of Cases
Radiography	227	54.7%
Computed Tomography	86	20.7%
Mammography	55	13.3%
Magnetic Resonance Imaging	52	12.5%
Radiation Therapy	51	12.3%
Bone Densitometry	28	6.7%
Vascular-Interventional Radiography	19	4.6%
Nuclear Medicine Technology	11	2.7%
Imaging Informatics/PACS Administrator	11	2.7%
Breast MRI	9	2.2%
Quality Management	8	1.9%
Sonography	8	1.9%
Medical Dosimetry	8	1.9%
Cardiac-Interventional Radiography	5	1.2%
Fusion (e.g., PET-CT, SPECT-CT)	5	1.2%
Breast Sonography	3	.7%
Radiologist Assistant or Radiology Practitioner Assistant	2	.5%
Vascular Sonography	1	.2%
Other:	20	4.8%



In what state is your workplace located?

State	N
Alabama	6
Alaska	5
Arizona	8
Arkansas	6
California	36
Colorado	14
Connecticut	8
Delaware	1
Florida	27
Georgia	9

State	N
Hawaii	3
Idaho	1
Illinois	19
Indiana	20
Iowa	9
Kansas	3
Kentucky	4
Louisiana	8
Maine	1
Maryland/DC	9

State	N
Massachusetts	12
Michigan	17
Minnesota	9
Mississippi	2
Missouri	21
Montana	2
Nebraska	3
Nevada	6
New Hampshire	5
New Jersey	11

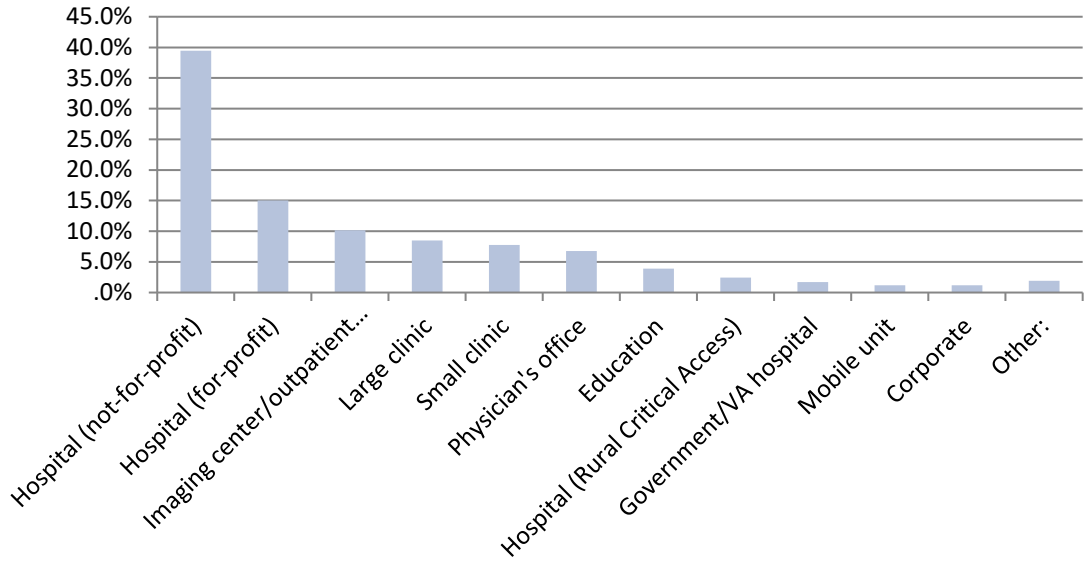
State	N
New Mexico	1
New York	15
North Carolina	24
North Dakota	3
Ohio	11
Oklahoma	2
Oregon	9
Pennsylvania	7
Rhode Island	0
South Carolina	4

State	N
South Dakota	0
Tennessee	7
Texas	15
Utah	2
Vermont	0
Virginia	3
Washington	9
West Virginia	0
Wisconsin	12
Wyoming	1

In which employment setting do you practice most of the time?

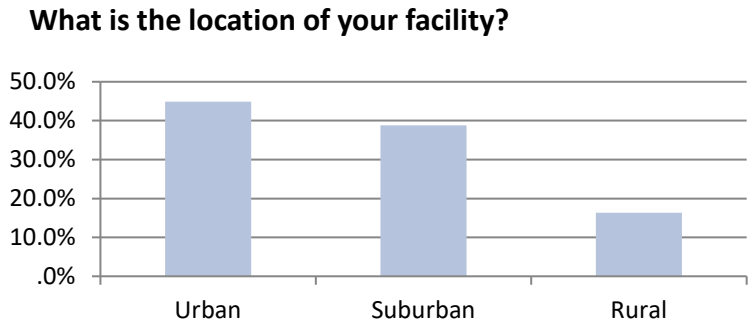
	N	Valid Percent
Hospital (not-for-profit)	163	39.5%
Hospital (for-profit)	62	15.0%
Imaging center/outpatient imaging facility	42	10.2%
Large clinic	35	8.5%
Small clinic	32	7.7%
Physician's office	28	6.8%
Education	16	3.9%
Hospital (Rural Critical Access)	10	2.4%
Government/VA hospital	7	1.7%
Mobile unit	5	1.2%
Corporate	5	1.2%
Other	8	1.9%
Total	413	100.0%

In which employment setting do you practice most of the time?



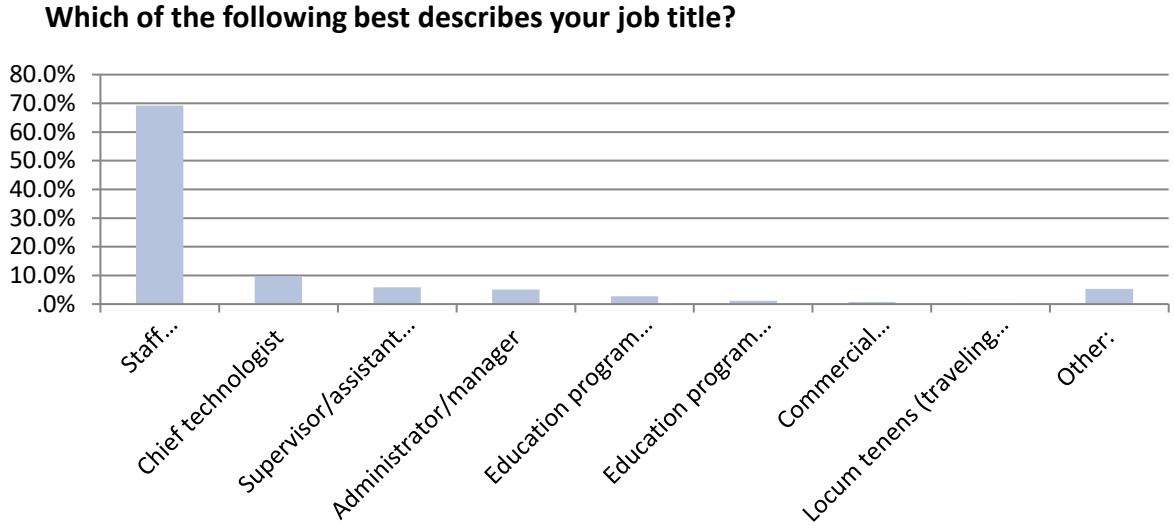
What is the location of your facility?

	N	Valid Percent
Urban	184	44.9%
Suburban	159	38.8%
Rural	67	16.3%
Total	410	100.0%



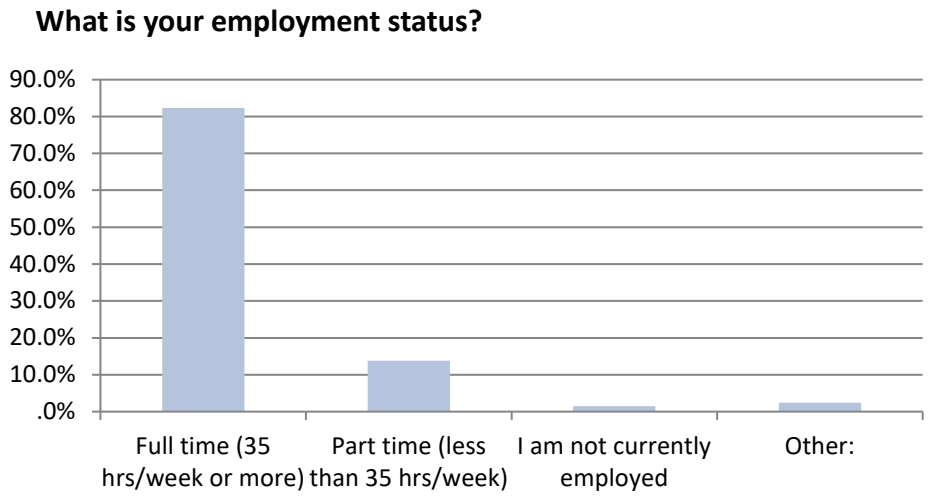
Which of the following best describes your job title?

	N	Valid Percent
Staff technologist/therapist	285	69.2%
Chief technologist	40	9.7%
Supervisor/assistant chief technologist	24	5.8%
Administrator/manager	21	5.1%
Education program faculty	11	2.7%
Education program director	5	1.2%
Commercial representative (e.g., sales, applications specialist)	3	.7%
Locum tenens (traveling temporary employee)	1	.2%
Other	22	5.3%
Total	412	100.0%



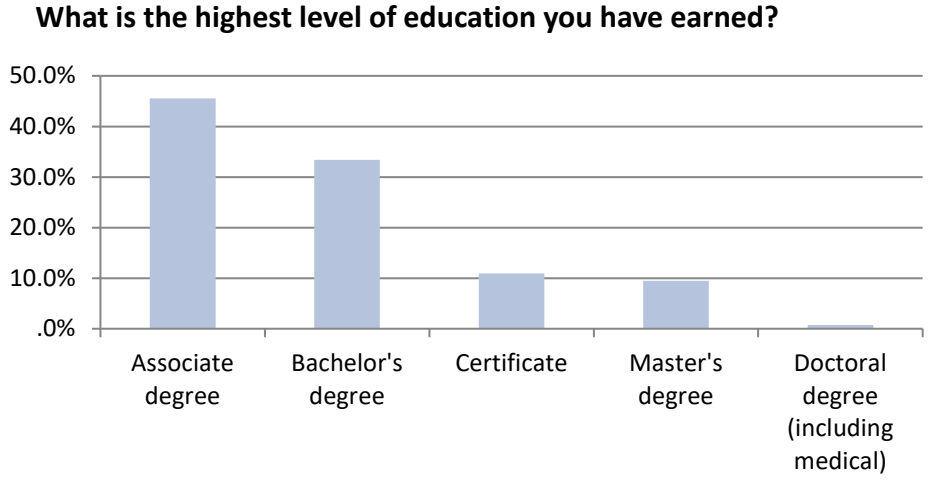
What is your employment status?

	N	Valid Percent
Full time (35 hours/week or more)	340	82.3%
Part time (less than 35 hours/week)	57	13.8%
I am not currently employed	6	1.5%
Other	10	2.4%
Total	413	100.0%



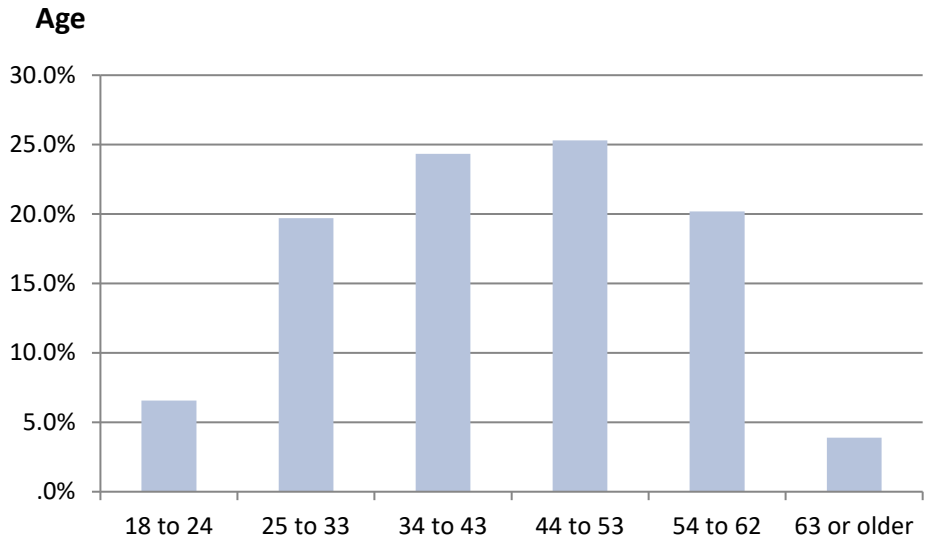
What is the highest level of education you have earned?

	N	Valid Percent
Associate degree	188	45.5%
Bachelor's degree	138	33.4%
Certificate	45	10.9%
Master's degree	39	9.4%
Doctoral degree (including medical)	3	.7%
Total	413	100.0%



Age

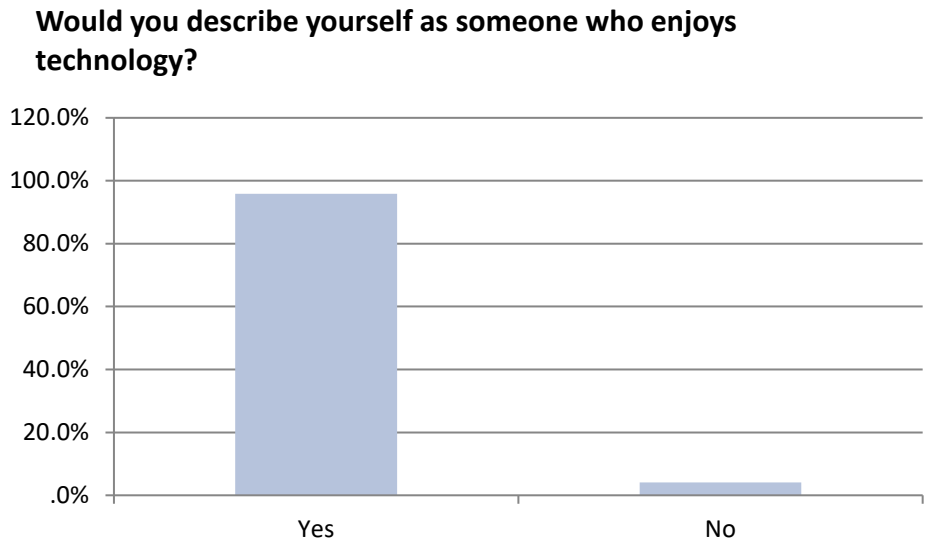
	N	Valid Percent
18 to 24	27	6.6%
25 to 33	81	19.7%
34 to 43	100	24.3%
44 to 53	104	25.3%
54 to 62	83	20.2%
63 or older	16	3.9%
Total	411	100.0%
Mean	**42.9** ***(SD=12.2)***	
Percentiles	*5th=24.0, 25th=33.0, 50th=43.0, 75th=53.0, 95th=62.0*	



Overall comfort with technology

Would you describe yourself as someone who enjoys technology?

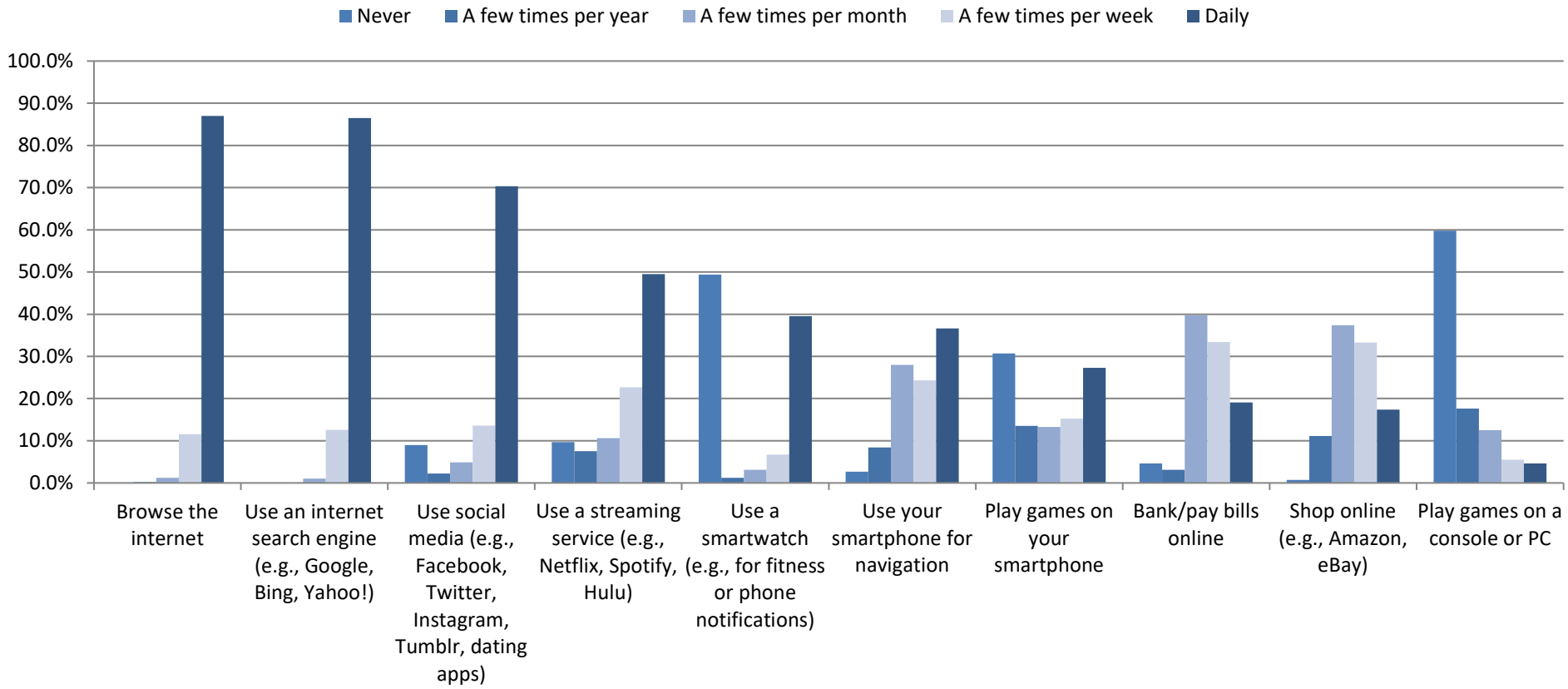
	N	Valid Percent
Yes	394	95.9%
No	17	4.1%
Total	411	100.0%



On average, how frequently do you do each of the following?

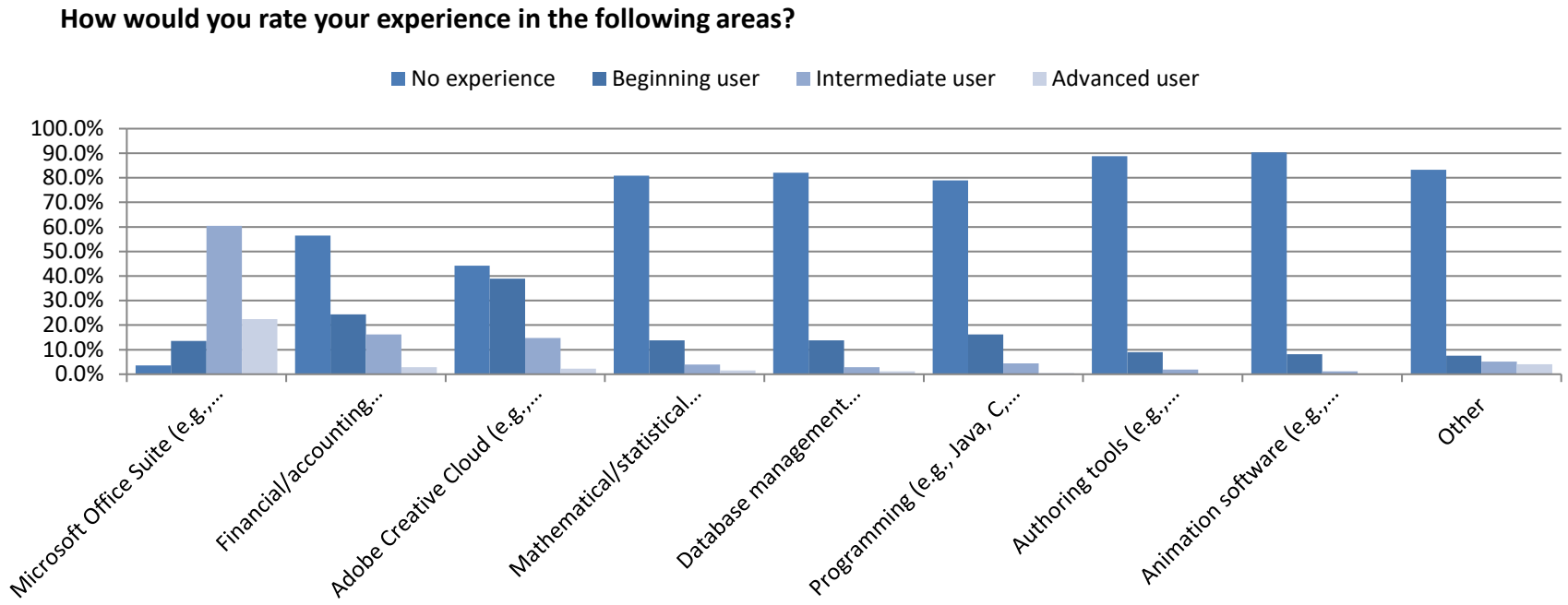
	Never		A few times per year		A few times per month		A few times per week		Daily		Total	
	N	Valid Percent	N	Valid Percent	N	Valid Percent	N	Valid Percent	N	Valid Percent	N	Valid Percent
Browse the internet	0	0.0%	1	0.2%	5	1.2%	48	11.6%	361	87.0%	415	100.0%
Use an internet search engine (e.g., Google, Bing, Yahoo!)	0	0.0%	0	0.0%	4	1.0%	52	12.6%	358	86.5%	414	100.0%
Use social media (e.g., Facebook, Twitter, Instagram, Tumblr, dating apps)	37	9.0%	9	2.2%	20	4.9%	56	13.6%	289	70.3%	411	100.0%
Shop online (e.g., Amazon, eBay)	3	0.7%	46	11.1%	155	37.4%	138	33.3%	72	17.4%	414	100.0%
Bank/pay bills online	19	4.6%	13	3.1%	164	39.7%	138	33.4%	79	19.1%	413	100.0%
Use your smartphone for navigation	11	2.7%	35	8.4%	116	28.0%	101	24.3%	152	36.6%	415	100.0%
Use a streaming service (e.g., Netflix, Spotify, Hulu)	40	9.7%	31	7.5%	44	10.6%	94	22.7%	205	49.5%	414	100.0%
Play games on your smartphone	127	30.7%	56	13.5%	55	13.3%	63	15.2%	113	27.3%	414	100.0%
Play games on a console or PC	248	59.8%	73	17.6%	52	12.5%	23	5.5%	19	4.6%	415	100.0%
Use a smartwatch (e.g., for fitness or phone notifications)	205	49.4%	5	1.2%	13	3.1%	28	6.7%	164	39.5%	415	100.0%

On average, how frequently do you do each of the following?



How would you rate your experience in the following areas?

	No experience		Beginning user		Intermediate user		Advanced user		Total	
	N	Valid Percent	N	Valid Percent	N	Valid Percent	N	Valid Percent	N	Valid Percent
Microsoft Office Suite (e.g., Word, Excel, PowerPoint)	15	3.6%	56	13.5%	250	60.4%	93	22.5%	414	100.0%
Financial/accounting software (e.g., QuickBooks)	234	56.5%	101	24.4%	67	16.2%	12	2.9%	414	100.0%
Mathematical/statistical analysis software (e.g., MATLAB, SPSS, Mathematica, SAS)	334	80.9%	57	13.8%	16	3.9%	6	1.5%	413	100.0%
Programming (e.g., Java, C, Python)	326	78.9%	67	16.2%	18	4.4%	2	0.5%	413	100.0%
Database management (e.g., SQL)	339	82.1%	57	13.8%	12	2.9%	5	1.2%	413	100.0%
Authoring tools (e.g., Captivate, Articulate)	365	88.8%	37	9.0%	8	1.9%	1	0.2%	411	100.0%
Animation software (e.g., Vyond, Autodesk Maya)	373	90.3%	34	8.2%	5	1.2%	1	0.2%	413	100.0%
Adobe Creative Cloud (e.g., Photoshop, Illustrator, Audition)	183	44.2%	161	38.9%	61	14.7%	9	2.2%	414	100.0%
Other	245	83.3%	22	7.5%	15	5.1%	12	4.1%	294	100.0%



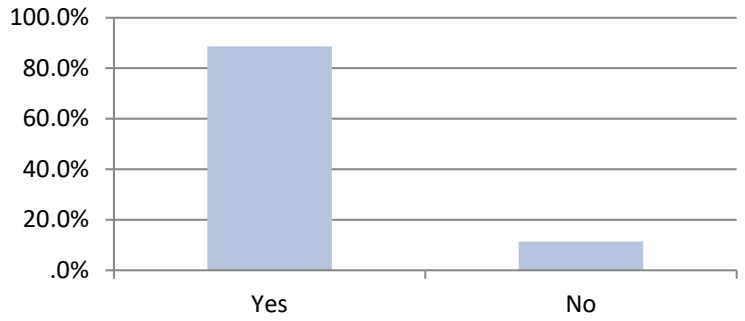
General Understanding of AI and ML

Artificial Intelligence (AI): Human intelligence exhibited by machines; the science of designing computer systems to perform tasks that require human intelligence, including visual perception, speech recognition and decision-making.

Are you familiar with this concept?

	N	Valid Percent
Yes	367	88.6%
No	47	11.4%
Total	414	100.0%

Are you familiar with this concept (AI)?

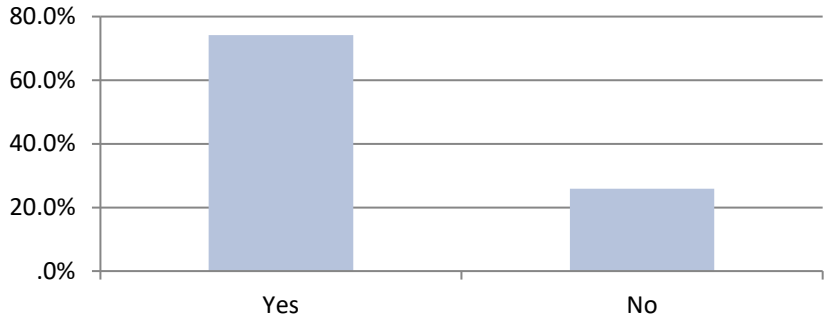


Machine Learning (ML): Approach to achieve artificial intelligence; a type of artificial intelligence that provides computers with the ability to learn without being programmed. Using a set of algorithms, the computer reviews large data sets, looks for patterns and makes predictions that improve with increased exposure to data.

Are you familiar with this concept?

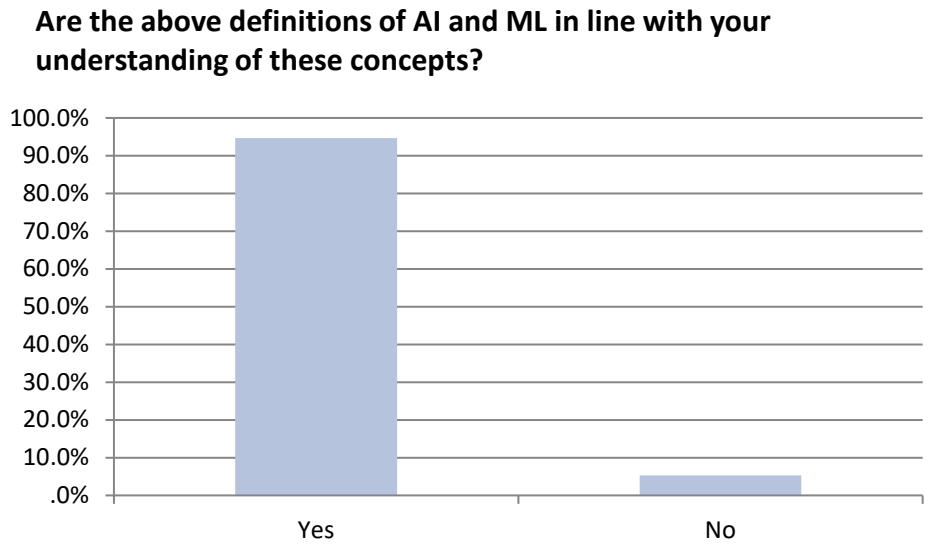
	N	Valid Percent
Yes	307	74.2%
No	107	25.8%
Total	414	100.0%

Are you familiar with this concept (ML)?



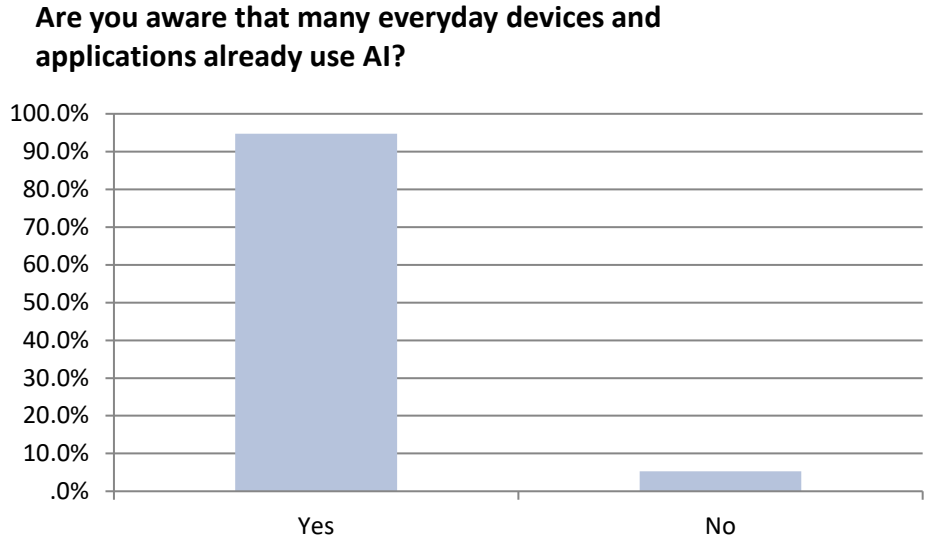
Are the above definitions of AI and ML in line with your understanding of these concepts?

	N	Valid Percent
Yes	393	94.7%
No	22	5.3%
Total	415	100.0%



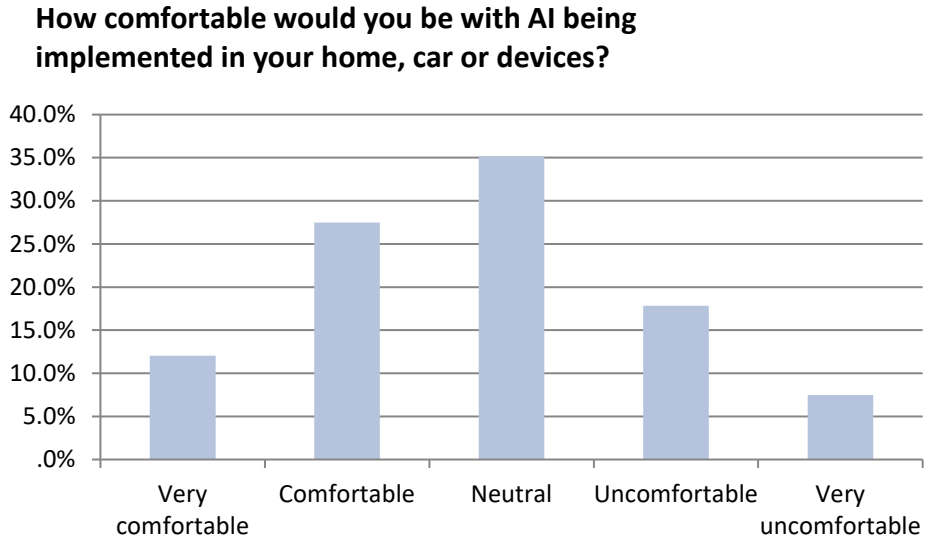
Are you aware that many everyday devices and applications such as Siri, Alexa, Google Assistant, Facebook and Netflix already use AI, for example, by making recommendations based on data about user preferences?

	N	Valid Percent
Yes	392	94.7%
No	22	5.3%
Total	414	100.0%



How comfortable would you be with AI being implemented in your home, car or devices?

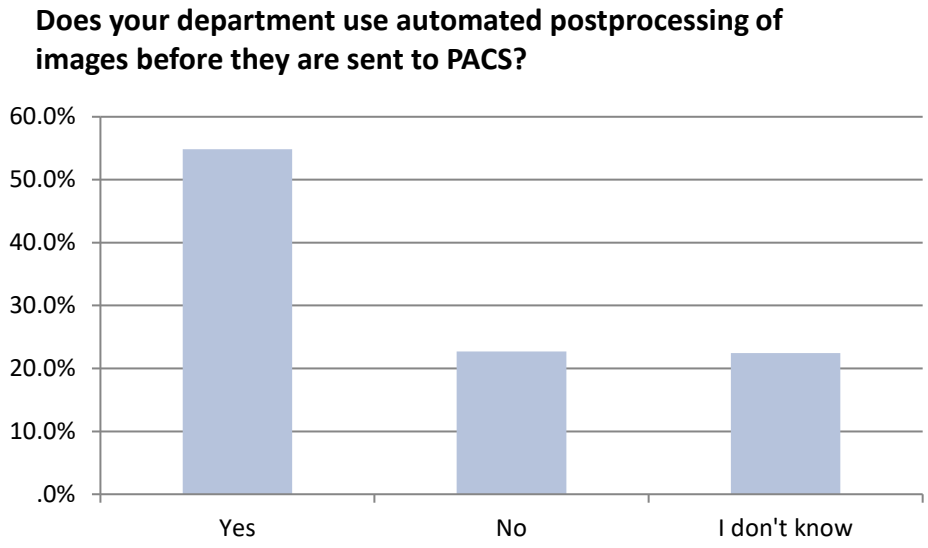
	N	Valid Percent
Very comfortable	50	12.0%
Comfortable	114	27.5%
Neutral	146	35.2%
Uncomfortable	74	17.8%
Very uncomfortable	31	7.5%
Total	415	100.0%



Use of AI/ML in the Radiologic Sciences

Does your department use automated postprocessing of images before they are sent to PACS?

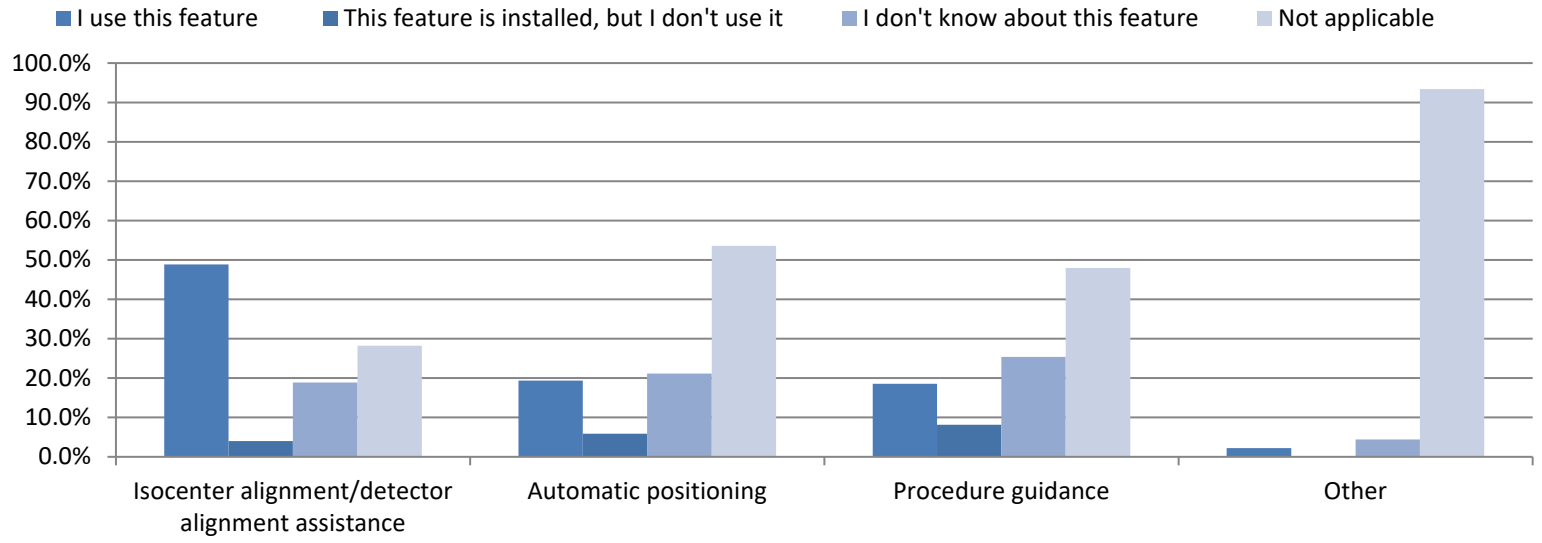
	N	Valid Percent
Yes	227	54.8%
No	94	22.7%
I don't know	93	22.5%
Total	414	100.0%



For the radiography equipment you use, please indicate your use/awareness of the following AI/ML/automated features:

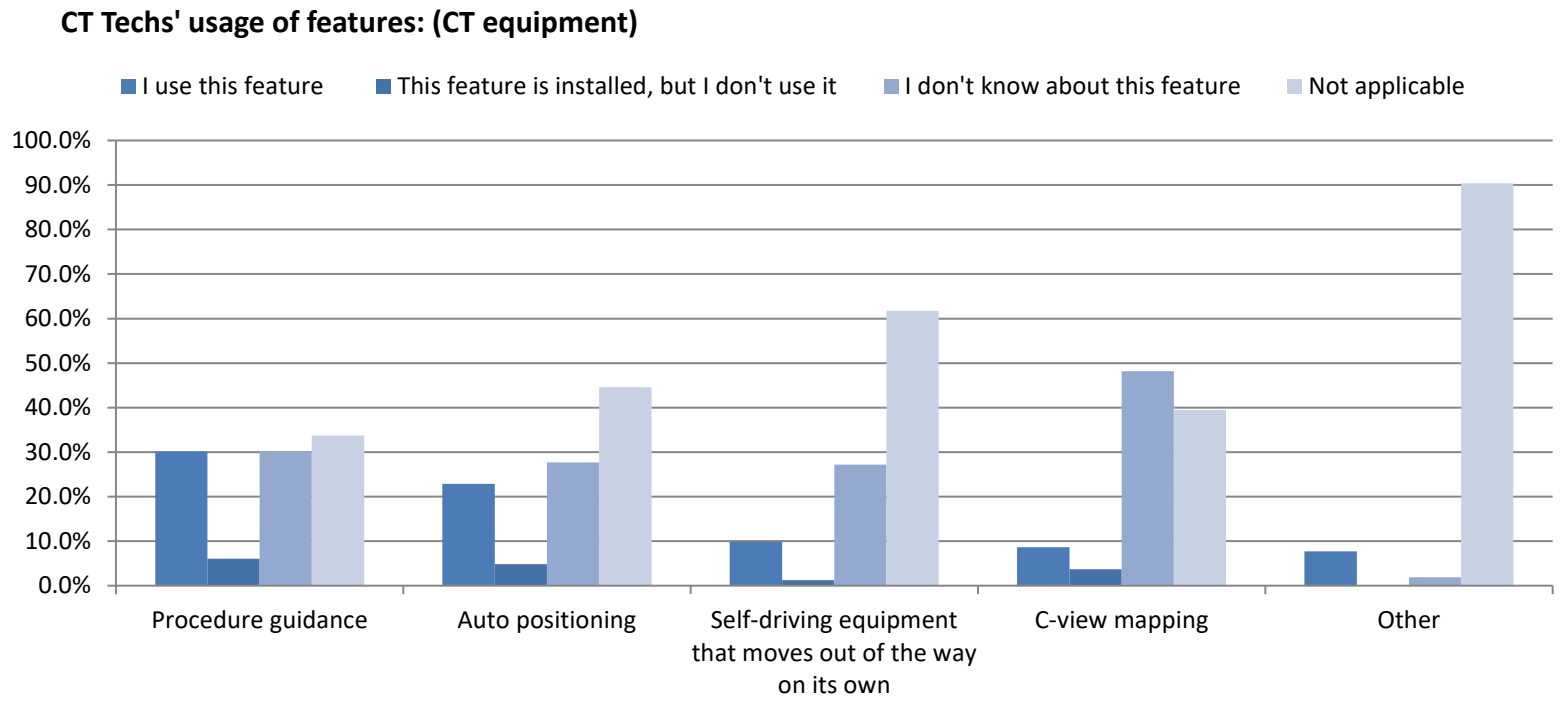
	I use this feature		This feature is installed, but I don't use it		I don't know about this feature		Not applicable		Total	
	N	Valid Percent	N	Valid Percent	N	Valid Percent	N	Valid Percent	N	Valid Percent
Isocenter alignment/detector alignment assistance	109	48.9%	9	4.0%	42	18.8%	63	28.3%	223	100.0%
Automatic positioning	43	19.4%	13	5.9%	47	21.2%	119	53.6%	222	100.0%
Procedure guidance	41	18.6%	18	8.1%	56	25.3%	106	48.0%	221	100.0%
Other	3	2.2%	0	.0%	6	4.4%	127	93.4%	136	100.0%

Radiographers' usage of features: (Radiography equipment)



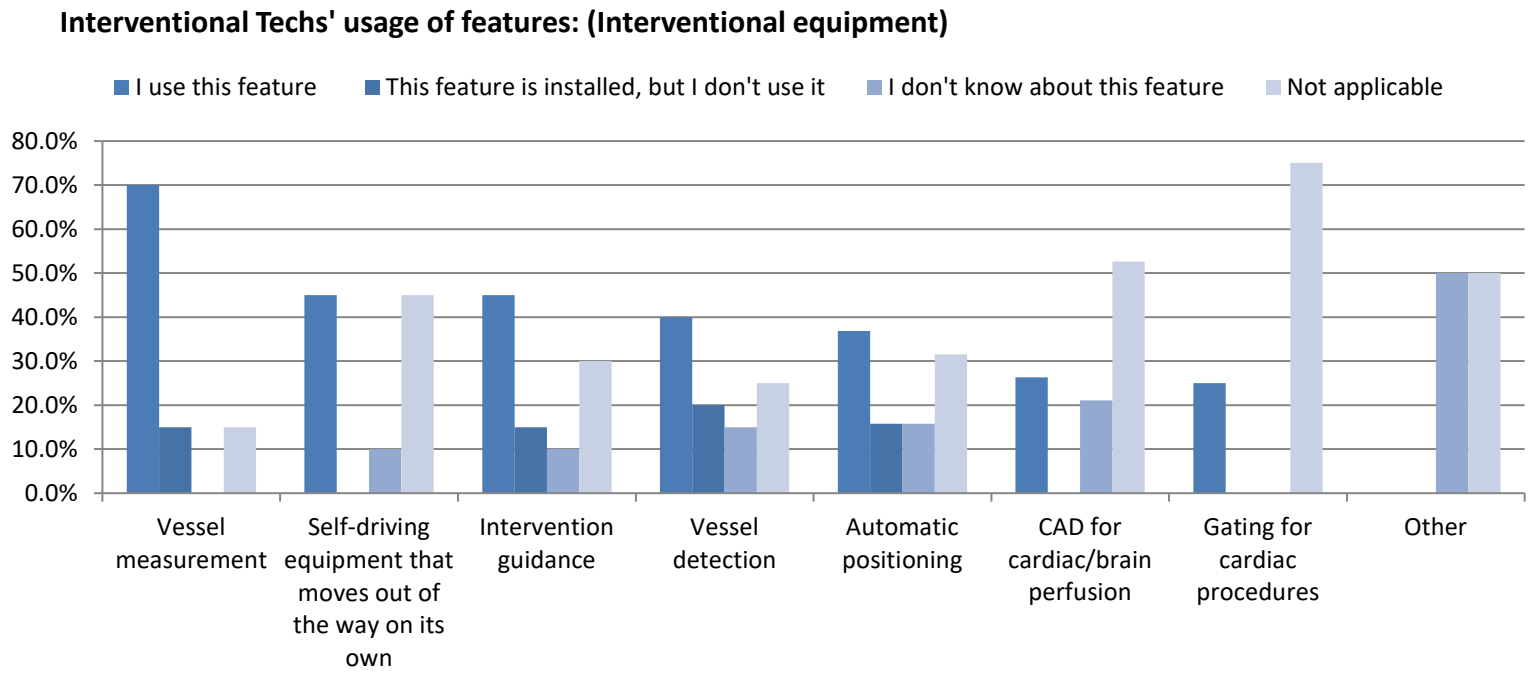
For the computed tomography equipment you use, please indicate your use/awareness of the following AI/ML/automated features:

	I use this feature		This feature is installed, but I don't use it		I don't know about this feature		Not applicable		Total	
	N	Valid Percent	N	Valid Percent	N	Valid Percent	N	Valid Percent	N	Valid Percent
Procedure guidance	25	30.1%	5	6.0%	25	30.1%	28	33.7%	83	100.0%
Auto positioning	19	22.9%	4	4.8%	23	27.7%	37	44.6%	83	100.0%
Self-driving equipment that moves out of the way on its own	8	9.9%	1	1.2%	22	27.2%	50	61.7%	81	100.0%
C-view mapping	7	8.6%	3	3.7%	39	48.1%	32	39.5%	81	100.0%
Other	4	7.7%	.0	.0%	1	1.9%	47	90.4%	52	100.0%



For the interventional equipment you use, please indicate your use/awareness of the following AI/ML/automated features:

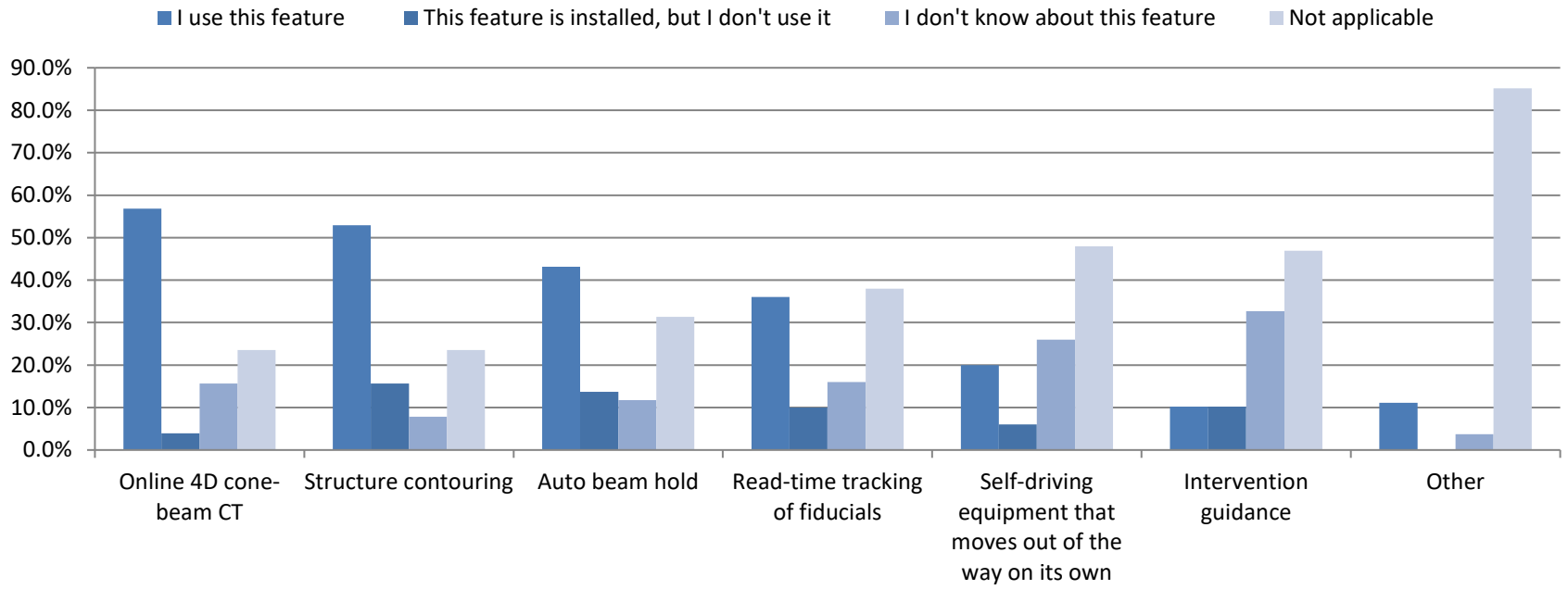
	I use this feature		This feature is installed, but I don't use it		I don't know about this feature		Not applicable		Total	
	N	Valid Percent	N	Valid Percent	N	Valid Percent	N	Valid Percent	N	Valid Percent
Vessel measurement	14	70.0%	3	15.0%	0	.0%	3	15.0%	20	100.0%
Self-driving equipment that moves out of the way on its own	9	45.0%	0	.0%	2	10.0%	9	45.0%	20	100.0%
Intervention guidance	9	45.0%	3	15.0%	2	10.0%	6	30.0%	20	100.0%
Vessel detection	8	40.0%	4	20.0%	3	15.0%	5	25.0%	20	100.0%
Automatic positioning	7	36.8%	3	15.8%	3	15.8%	6	31.6%	19	100.0%
CAD for cardiac/brain perfusion	5	26.3%	0	.0%	4	21.1%	10	52.6%	19	100.0%
Gating for cardiac procedures	5	25.0%	0	.0%	0	.0%	15	75.0%	20	100.0%
Other	0	.0%	0	.0%	8	50.0%	8	50.0%	16	100.0%



For the radiation therapy equipment you use, please indicate your use/awareness of the following AI/ML/automated features:

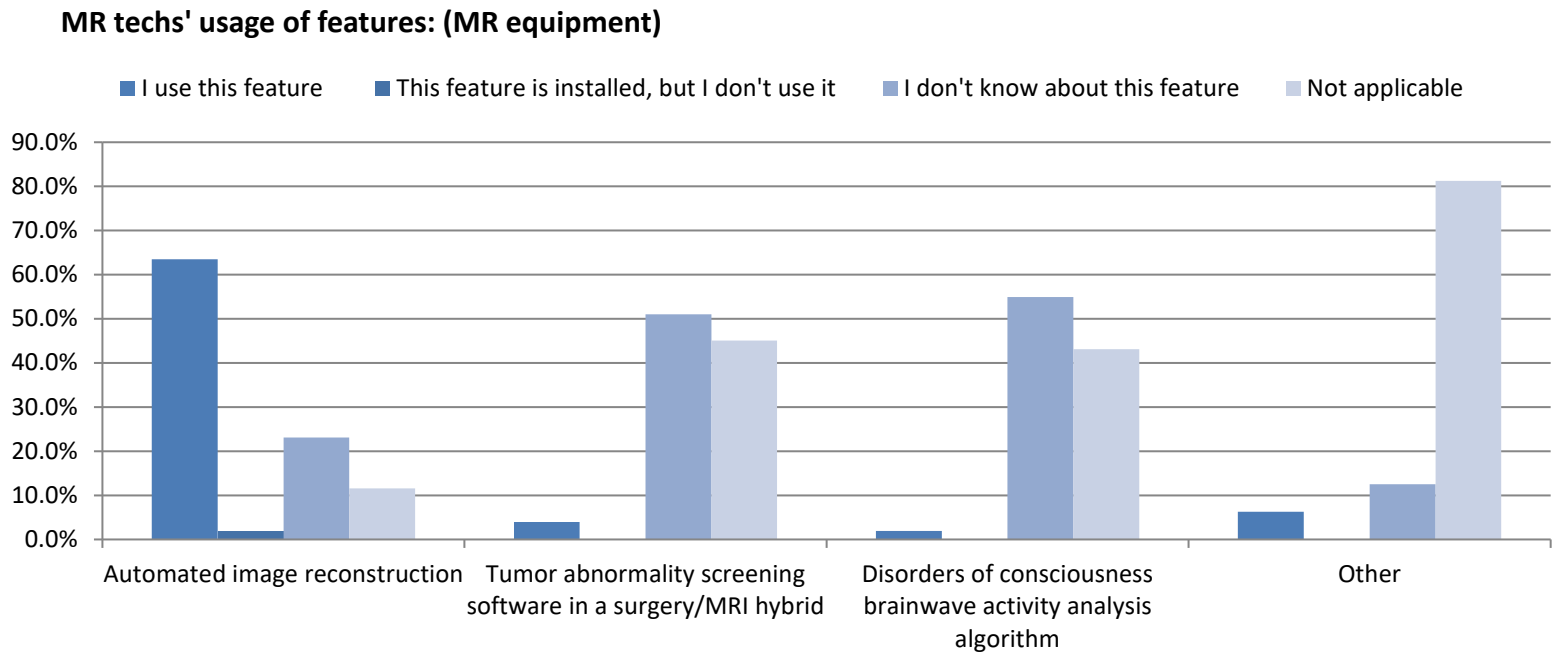
	I use this feature		This feature is installed, but I don't use it		I don't know about this feature		Not applicable		Total	
	N	Valid Percent	N	Valid Percent	N	Valid Percent	N	Valid Percent	N	Valid Percent
Online 4D cone-beam CT	29	56.9%	2	3.9%	8	15.7%	12	23.5%	51	100.0%
Structure contouring	27	52.9%	8	15.7%	4	7.8%	12	23.5%	51	100.0%
Auto beam hold	22	43.1%	7	13.7%	6	11.8%	16	31.4%	51	100.0%
Read-time tracking of fiducials	18	36.0%	5	10.0%	8	16.0%	19	38.0%	50	100.0%
Self-driving equipment that moves out of the way on its own	10	20.0%	3	6.0%	13	26.0%	24	48.0%	50	100.0%
Intervention guidance	5	10.2%	5	10.2%	16	32.7%	23	46.9%	49	100.0%
Other	3	11.1%	0	.0%	1	3.7%	23	85.2%	27	100.0%

Radiation therapists' usage of features: (Radiation therapy equipment)



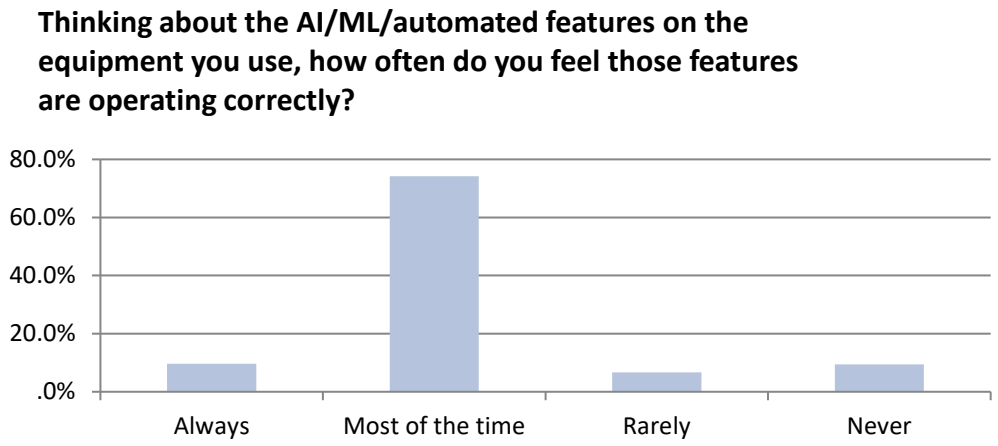
For the magnetic resonance imaging equipment you use, please indicate your use/awareness of the following AI/ML/automated features:

	I use this feature		This feature is installed, but I don't use it		I don't know about this feature		Not applicable		Total	
	N	Valid Percent	N	Valid Percent	N	Valid Percent	N	Valid Percent	N	Valid Percent
Automated image reconstruction	33	63.5%	1	1.9%	12	23.1%	6	11.5%	52	100.0%
Tumor abnormality screening software in a surgery/MRI hybrid	2	3.9%	0	.0%	26	51.0%	23	45.1%	51	100.0%
Disorders of consciousness brainwave activity analysis algorithm	1	2.0%	0	.0%	28	54.9%	22	43.1%	51	100.0%
Other	2	6.3%	0	.0%	4	12.5%	26	81.3%	32	100.0%



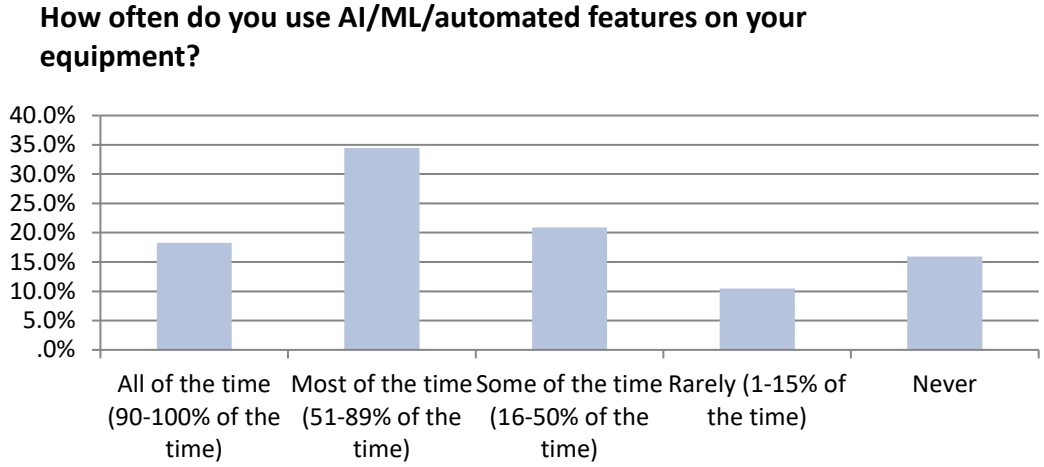
Thinking about the AI/ML/automated features on the equipment you use, how often do you feel those features are operating correctly?

	N	Valid Percent
Always	36	9.7%
Most of the time	276	74.2%
Rarely	25	6.7%
Never	35	9.4%
Total	372	100.0%



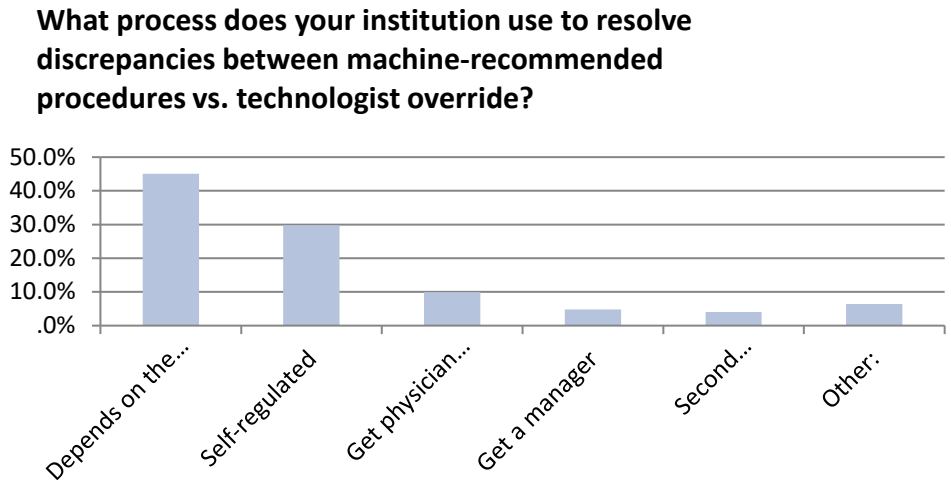
How often do you use AI/ML/automated features on your equipment?

	N	Valid Percent
All of the time (90-100% of the time)	70	18.3%
Most of the time (51-89% of the time)	132	34.5%
Some of the time (16-50% of the time)	80	20.9%
Rarely (1-15% of the time)	40	10.4%
Never	61	15.9%
Total	383	100.0%



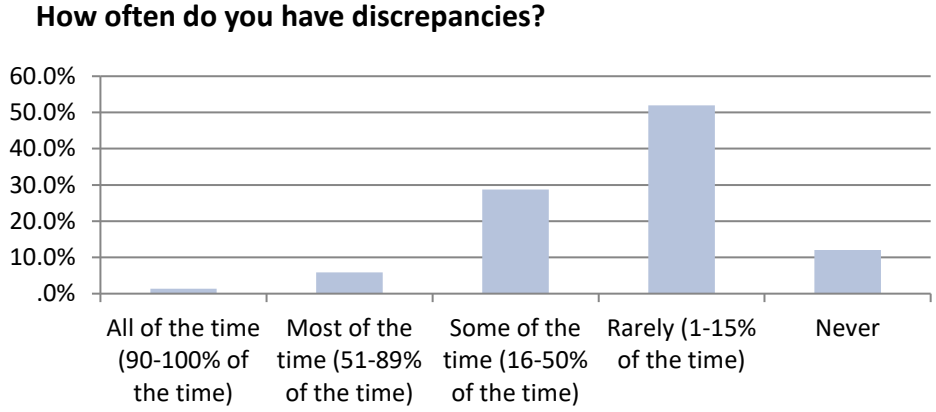
What process does your institution use to resolve discrepancies between machine-recommended procedures vs. technologist override?

	N	Valid Percent
Depends on the feature	168	45.0%
Self-regulated	111	29.8%
Get physician approval	37	9.9%
Get a manager	18	4.8%
Second technologist	15	4.0%
Other:	24	6.4%
Total	373	100.0%



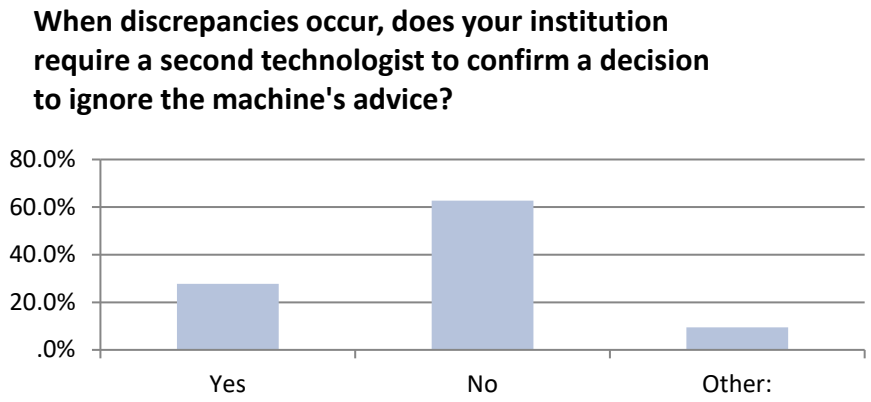
How often do you have discrepancies?

	N	Valid Percent
All of the time (90-100% of the time)	5	1.4%
Most of the time (51-89% of the time)	21	5.9%
Some of the time (16-50% of the time)	103	28.8%
Rarely (1-15% of the time)	186	52.0%
Never	43	12.0%
Total	358	100.0%



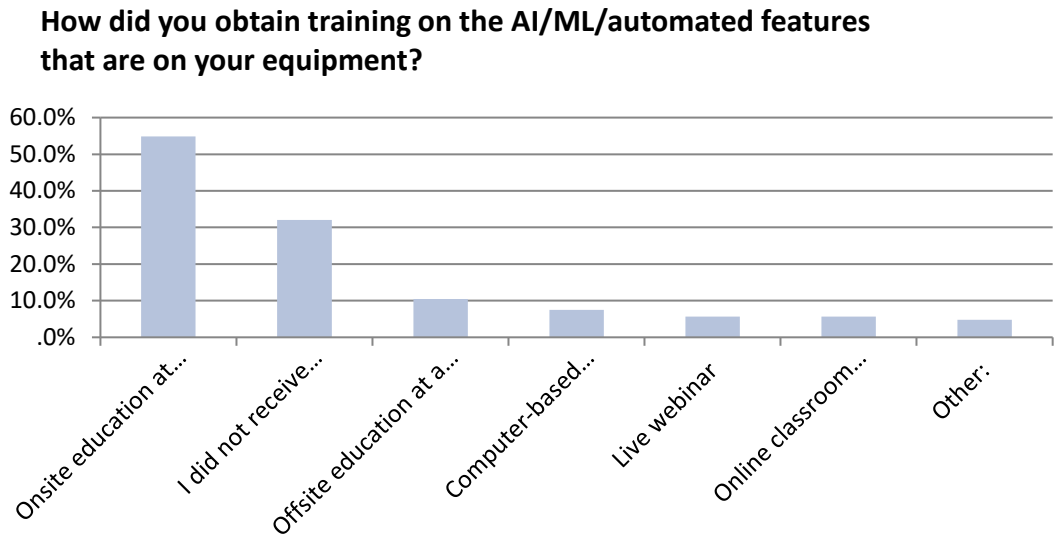
When discrepancies occur, does your institution require a second technologist to confirm a decision to ignore the machine's advice?

	N	Valid Percent
Yes	100	27.8%
No	226	62.8%
Other	34	9.4%
Total	360	100.0%



How did you obtain training on the AI/ML/automated features that are on your equipment? (Please check all that apply)

	N	Percent of Cases
Onsite education at your facility	205	54.8%
I did not receive training	120	32.1%
Offsite education at a vendor facility	39	10.4%
Computer-based module	28	7.5%
Live webinar	21	5.6%
Online classroom education	21	5.6%
Other	18	4.8%

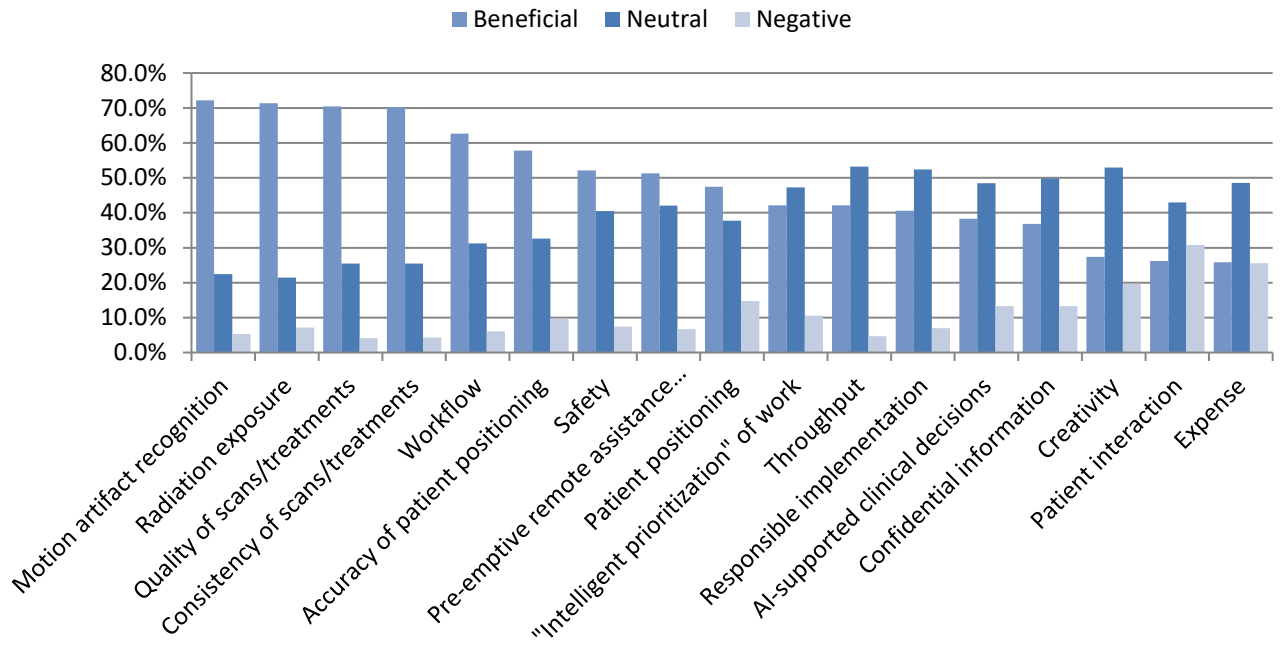


Effects of AI/ML

For the following considerations, please indicate whether you think AI/ML/automated features will be beneficial, neutral or negative:

	Beneficial		Neutral		Negative		Total	
	N	Valid Percent	N	Valid Percent	N	Valid Percent	N	Valid Percent
Motion artifact recognition	283	72.2%	88	22.4%	21	5.4%	392	100.0%
Radiation exposure	279	71.4%	84	21.5%	28	7.2%	391	100.0%
Consistency of scans/treatments	276	70.2%	100	25.4%	17	4.3%	393	100.0%
Quality of scans/treatments	276	70.4%	100	25.5%	16	4.1%	392	100.0%
Workflow	247	62.7%	123	31.2%	24	6.1%	394	100.0%
Accuracy of patient positioning	227	57.8%	128	32.6%	38	9.7%	393	100.0%
Safety	205	52.2%	159	40.5%	29	7.4%	393	100.0%
Pre-emptive remote assistance from vendor, in real time	200	51.3%	164	42.1%	26	6.7%	390	100.0%
Patient positioning	186	47.4%	148	37.8%	58	14.8%	392	100.0%
"Intelligent prioritization" of work	164	42.2%	184	47.3%	41	10.5%	389	100.0%
Throughput	163	42.1%	206	53.2%	18	4.7%	387	100.0%
Responsible implementation	158	40.6%	204	52.4%	27	6.9%	389	100.0%
AI-supported clinical decisions	150	38.3%	190	48.5%	52	13.3%	392	100.0%
Confidential information	144	36.8%	195	49.9%	52	13.3%	391	100.0%
Creativity	107	27.4%	207	52.9%	77	19.7%	391	100.0%
Patient interaction	103	26.2%	169	43.0%	121	30.8%	393	100.0%
Expense	101	25.8%	190	48.6%	100	25.6%	391	100.0%

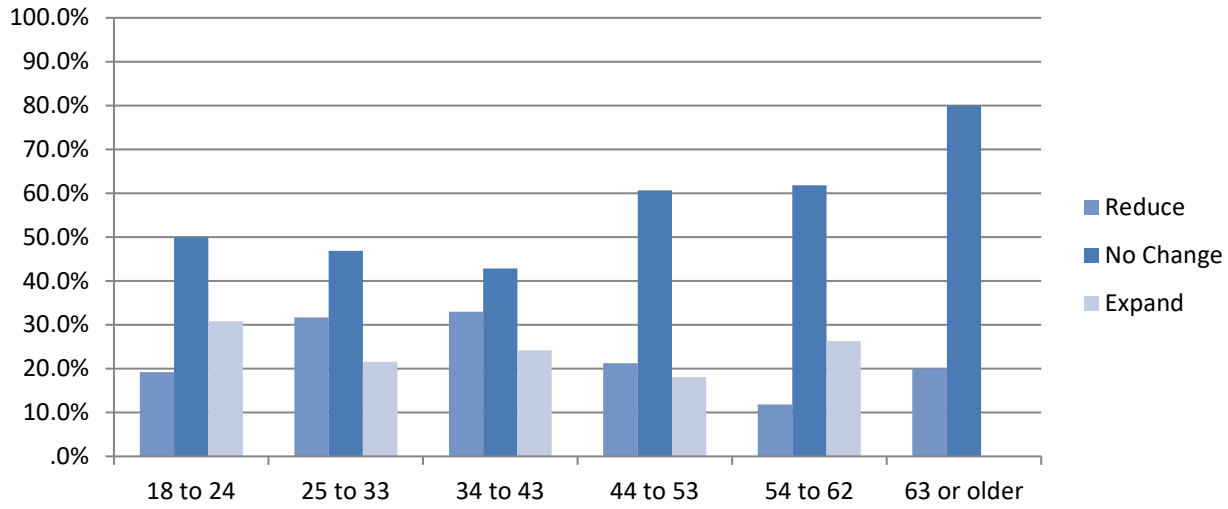
For the following considerations, please indicate whether you think AI/ML/automated features will be beneficial, neutral or negative:



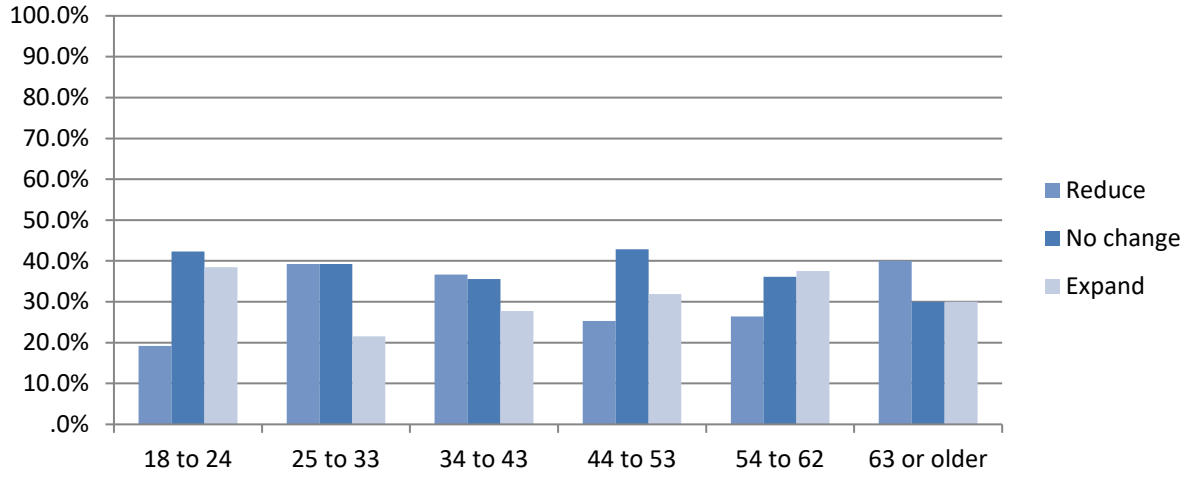
How do you think AI/ML/automated features will affect the scope of your current role?

	My role				The profession, in general			
	Reduce	No Change	Expand	Total N	Reduce	No change	Expand	Total N
18 to 24	19.2%	50.0%	30.8%	***26***	19.2%	42.3%	38.5%	***26***
25 to 33	31.6%	46.8%	21.5%	***79***	39.2%	39.2%	21.5%	***79***
34 to 43	33.0%	42.9%	24.2%	***91***	36.7%	35.6%	27.8%	***90***
44 to 53	21.3%	60.6%	18.1%	***94***	25.3%	42.9%	31.9%	***91***
54 to 62	11.8%	61.8%	26.3%	***76***	26.4%	36.1%	37.5%	***72***
63 or older	20.0%	80.0%		***10***	40.0%	30.0%	30.0%	***10***
All ages	24.2%	53.5%	22.3%	***376***	31.3%	38.6%	30.2%	***368***

Scope: My role



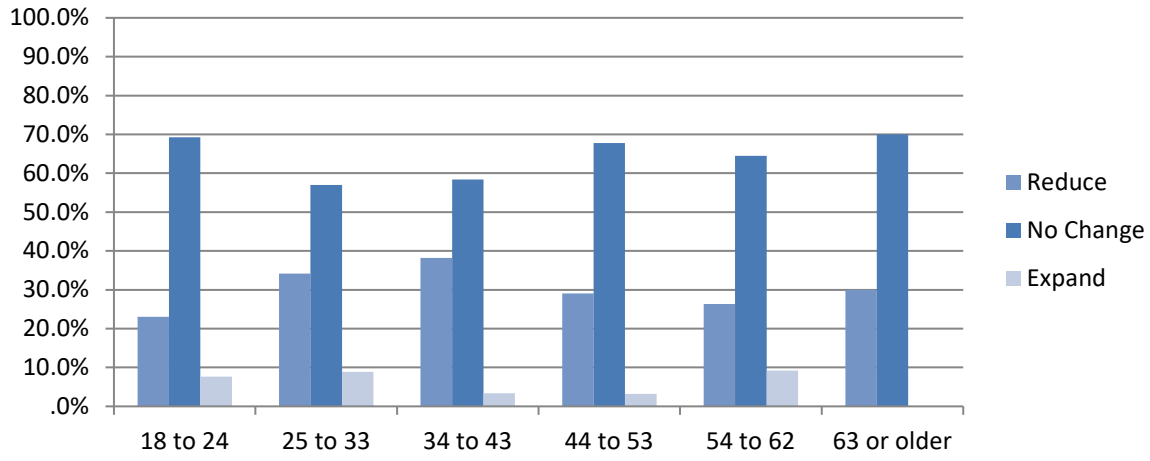
Scope: The profession



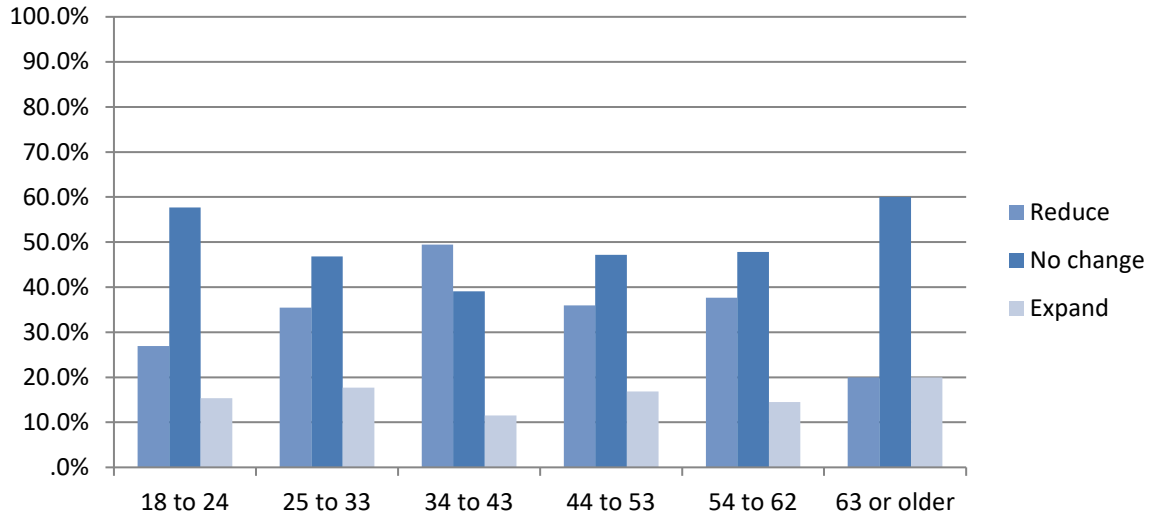
How do you think AI/ML/automated features will affect staffing levels?

	My role				The profession, in general			
	Reduce	No Change	Expand	Total N	Reduce	No change	Expand	Total N
18 to 24	23.1%	69.2%	7.7%	**26**	26.9%	57.7%	15.4%	**26**
25 to 33	34.2%	57.0%	8.9%	**79**	35.4%	46.8%	17.7%	**79**
34 to 43	38.2%	58.4%	3.4%	**89**	49.4%	39.1%	11.5%	**87**
44 to 53	29.0%	67.7%	3.2%	**93**	36.0%	47.2%	16.9%	**89**
54 to 62	26.3%	64.5%	9.2%	**76**	37.7%	47.8%	14.5%	**69**
63 or older	30.0%	70.0%		**10**	20.0%	60.0%	20.0%	**10**
All ages	31.4%	62.7%	5.9%	**373**	38.3%	46.4%	15.3%	**360**

Staffing levels: My role



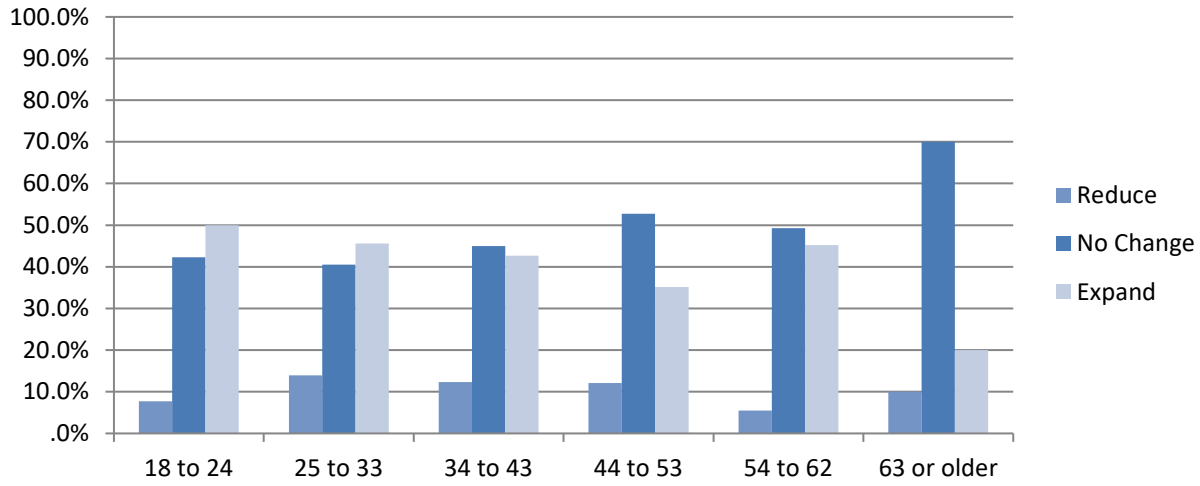
Staffing levels: The profession



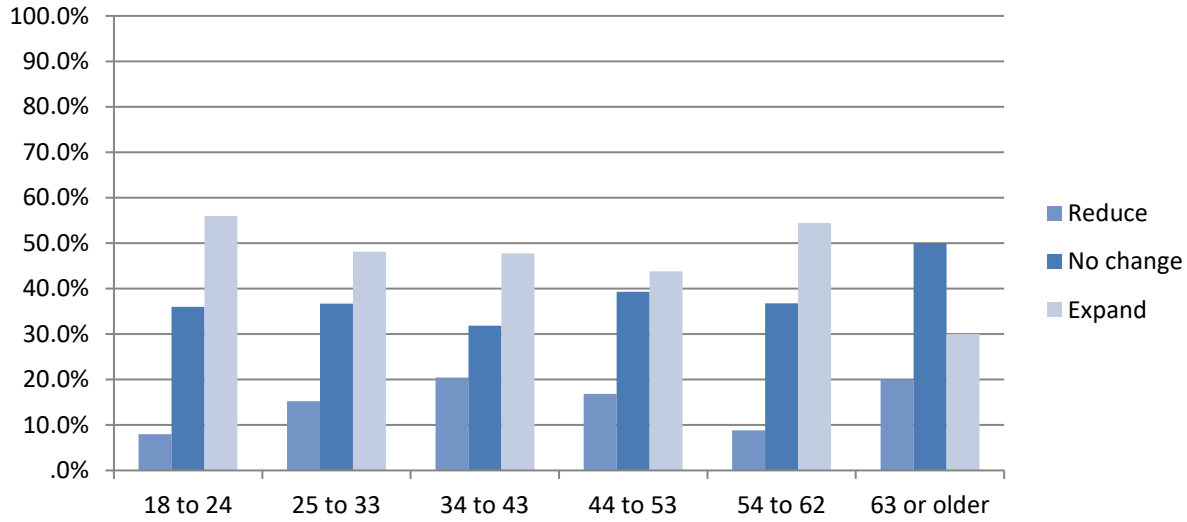
How do you think AI/ML/automated features will affect new, specialized roles dealing with AI/ML/automated features?

	My role				The profession, in general			
	Reduce	No Change	Expand	Total N	Reduce	No change	Expand	Total N
18 to 24	7.7%	42.3%	50.0%	**26**	8.0%	36.0%	56.0%	**25**
25 to 33	13.9%	40.5%	45.6%	**79**	15.2%	36.7%	48.1%	**79**
34 to 43	12.4%	44.9%	42.7%	**89**	20.5%	31.8%	47.7%	**88**
44 to 53	12.1%	52.7%	35.2%	**91**	16.9%	39.3%	43.8%	**89**
54 to 62	5.5%	49.3%	45.2%	**73**	8.8%	36.8%	54.4%	**68**
63 or older	10.0%	70.0%	20.0%	**10**	20.0%	50.0%	30.0%	**10**
All ages	10.9%	47.3%	41.8%	**368**	15.3%	36.5%	48.2%	**359**

New, specialized roles: My role

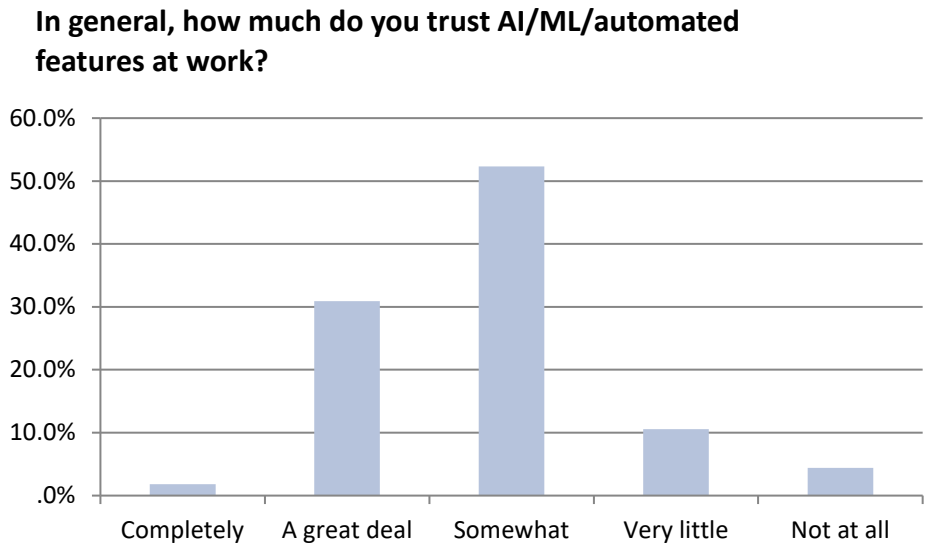


New specialized roles: The profession



In general, how much do you trust AI/ML/automated features at work?

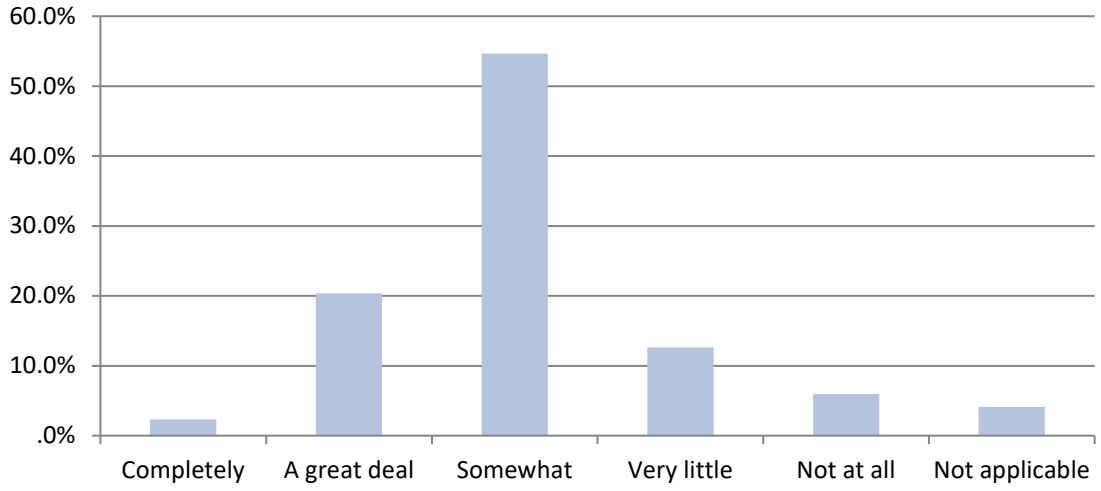
	N	Valid Percent
Completely	7	1.8%
A great deal	120	30.9%
Somewhat	203	52.3%
Very little	41	10.6%
Not at all	17	4.4%
Total	388	100.0%



Some AI/ML/automated features may incorporate patient medical history data when determining how to adjust the parameters for or alter the scheduled examination. How much do you trust AI/ML/automated features to accurately incorporate that data to make correct adjustments?

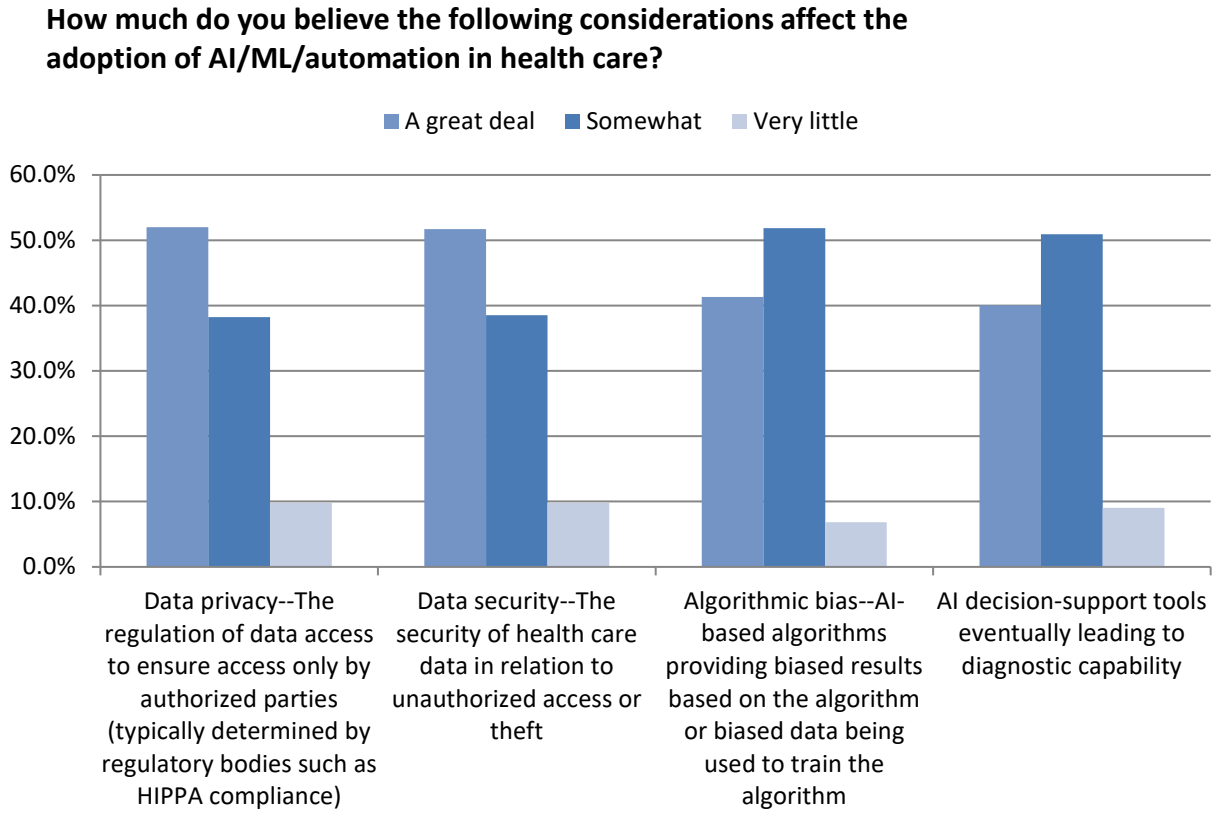
	N	Valid Percent
Completely	9	2.3%
A great deal	79	20.4%
Somewhat	212	54.6%
Very little	49	12.6%
Not at all	23	5.9%
Not applicable	16	4.1%
Total	388	100.0%

How much do you trust AI/ML/automated features to accurately incorporate that data to make correct adjustments?



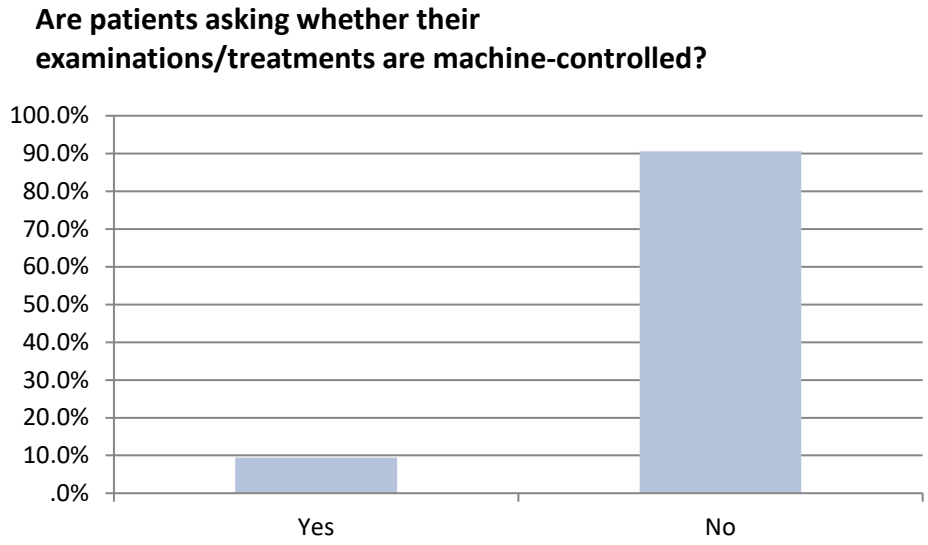
How much do you believe the following considerations affect the adoption of AI/ML/automation in health care?

	A great deal		Somewhat		Very little		Total	
	N	Valid Percent	N	Valid Percent	N	Valid Percent	N	Valid Percent
Data privacy--The regulation of data access to ensure access only by authorized parties (typically determined by regulatory bodies such as HIPAA compliance)	197	52.0%	145	38.3%	37	9.8%	379	100.0%
Data security--The security of health care data in relation to unauthorized access or theft	196	51.7%	146	38.5%	37	9.8%	379	100.0%
Algorithmic bias--AI-based algorithms providing biased results based on the algorithm or biased data being used to train the algorithm	157	41.3%	197	51.8%	26	6.8%	380	100.0%
AI decision-support tools eventually leading to diagnostic capability	151	40.1%	192	50.9%	34	9.0%	377	100.0%



Are patients asking whether their examinations/treatments are machine-controlled?

	N	Valid Percent
Yes	37	9.5%
No	354	90.5%
Total	391	100.0%



If yes, what feedback have they provided to you?

	N	Valid Percent
Patients are less comfortable with machine-controlled examinations/treatments	77	52.0%
Patients are more comfortable with machine-controlled examinations/treatments	23	15.5%
Other:	48	32.4%
Total	148	100.0%