User Perceptions & Preferences for Smart Home Device Updates

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Disclaimer

Any mention of commercial products or reference to commercial organizations is for information only; it does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the products mentioned are necessarily the best available for the purpose.

Motivation

- Updates are important security mechanisms but may be inconsistent and underutilized

- An understanding of consumers' perceptions and preferences can inform manufacturers' practices and help improve consumers' behaviors

Research Efforts

Interviews of smart home users
(n=40)

Smart home users' experiences, challenges, and perceptions (including privacy & security)

Survey focused on updates
(n=412)

Users' perceptions, experiences, challenges, and preferences related to smart home updates

SURVEY

Devices

- Voice assistants
- Security devices
- Thermostats
- Lighting devices
- Environmental sensors

Participant Demographics

U.S. population. Participants recruited to be diverse across:
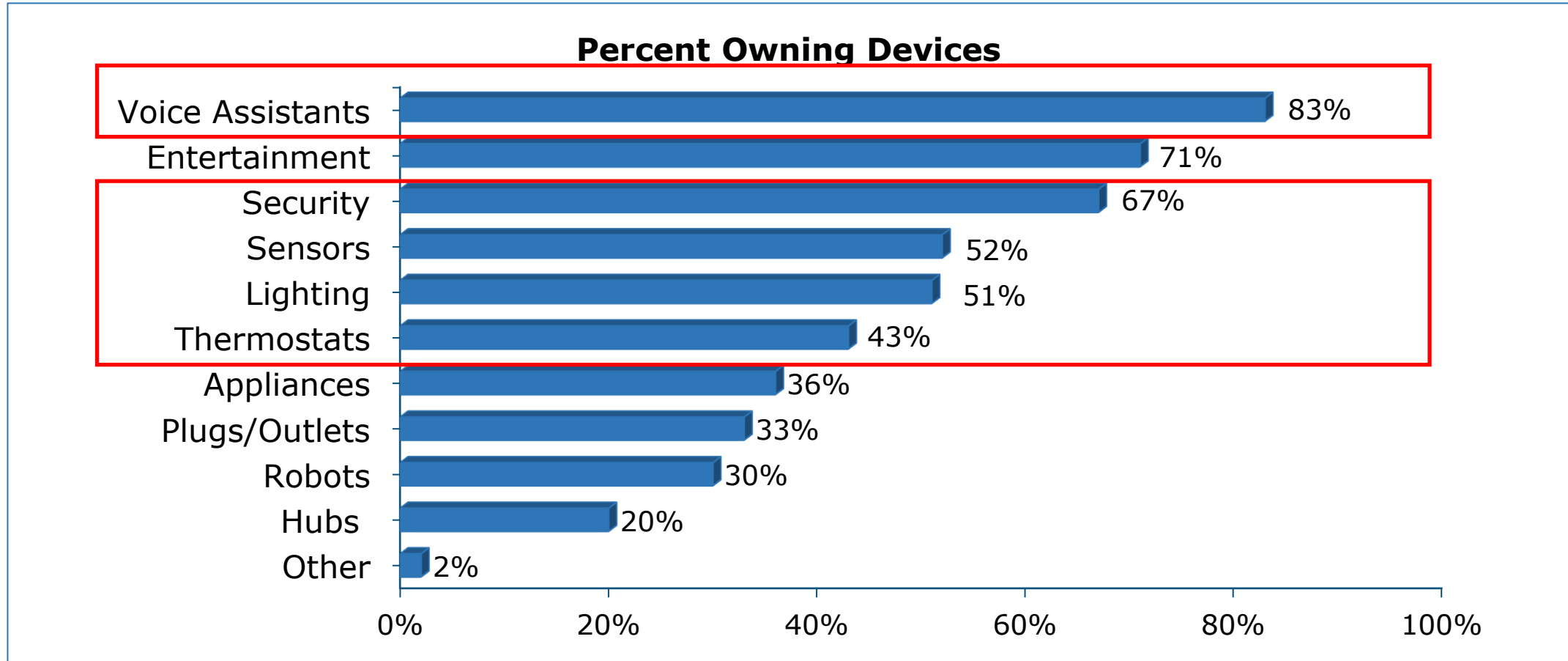
- region
- income
- education
- age

- urbanicity
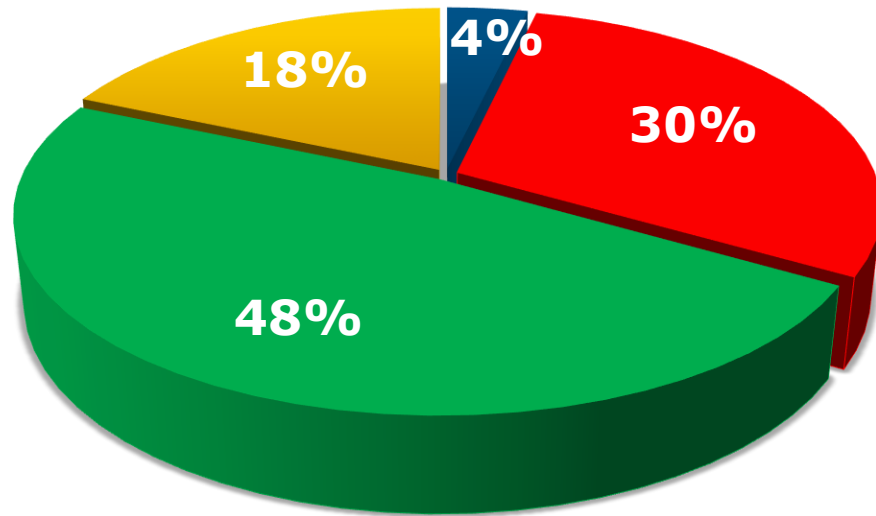- race
- ethnicity
- gender

n=412

84% did NOT work in an IT or cybersecurity-related field

Types of Devices Owned

Percent Owning Devices

Device	Percent
Voice Assistants	83%
Entertainment	71%
Security	67%
Sensors	52%
Lighting	51%
Thermostats	43%
Appliances	36%
Plugs/Outlets	33%
Robots	30%
Hubs	20%
Other	2%

Device Ownership

Length of Ownership of Devices

- Less than 1 year
- 1-2 years
- 3-5 years
- 6 or more years

4%
30%
48%
18%

76% owned 5 or more devices
36% owned 10 or more devices

Average of over 9 devices owned per participant

RESULTS

Update Purpose & Importance

Reasons to Update

67% Add new features

59% Increase performance

33% Improve privacy

22% Fix bugs or functionality

61% Improve stability/reliability

54% Improve/fix security

29% Ensure support/warranty

3% Don't want updates

Interviews: Update Importance

" [smart home updates] would have the highest priorities than any of the other apps on my phone...because that's the security of my home. "

" I don't think the end user actually really cares. As long as the thing works, it works. "
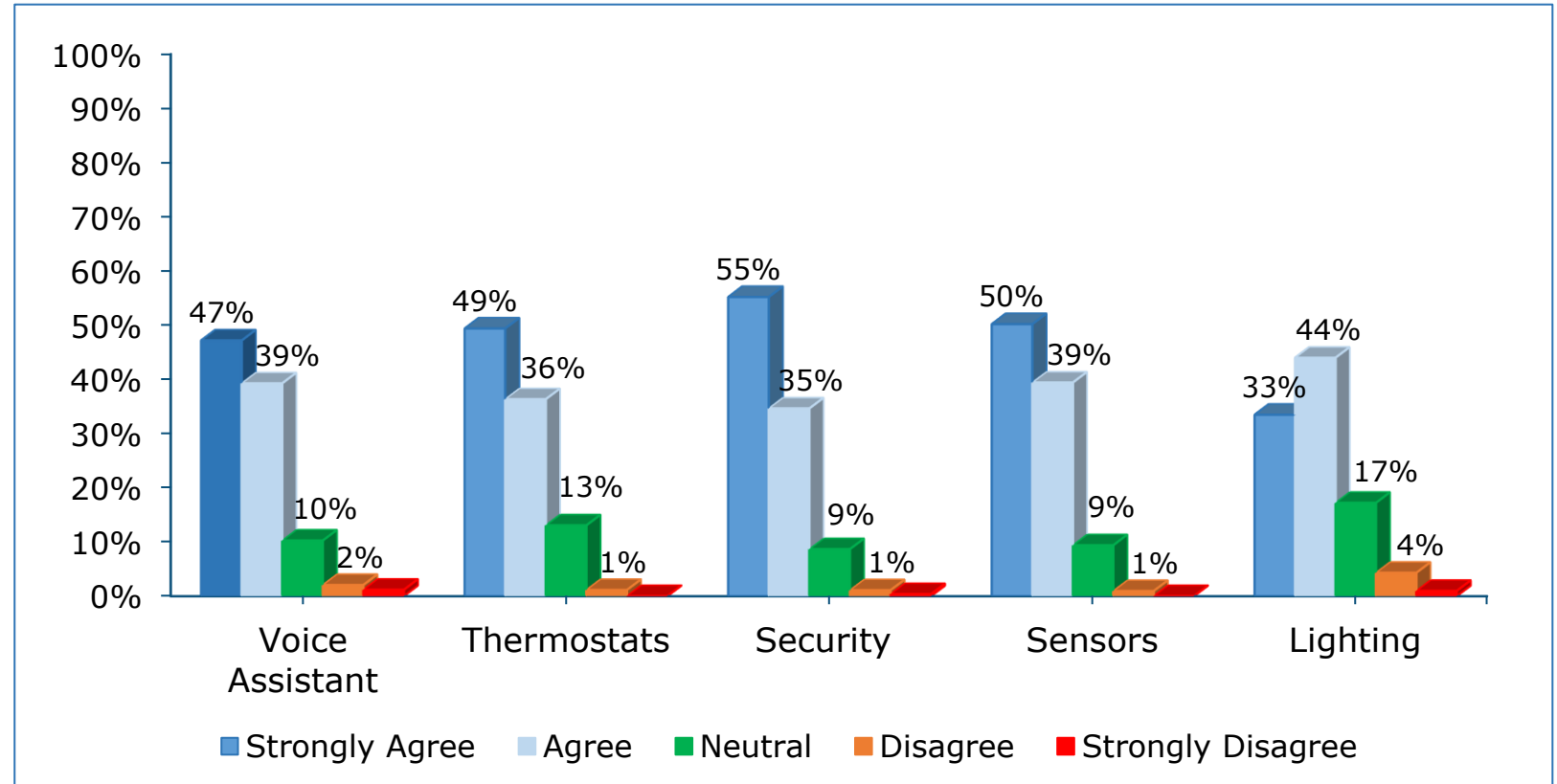
Importance of Updates

Agreed/Strongly Agreed

90% - Security devices

89% - Sensors

86% - Voice assistants

85% - Thermostats
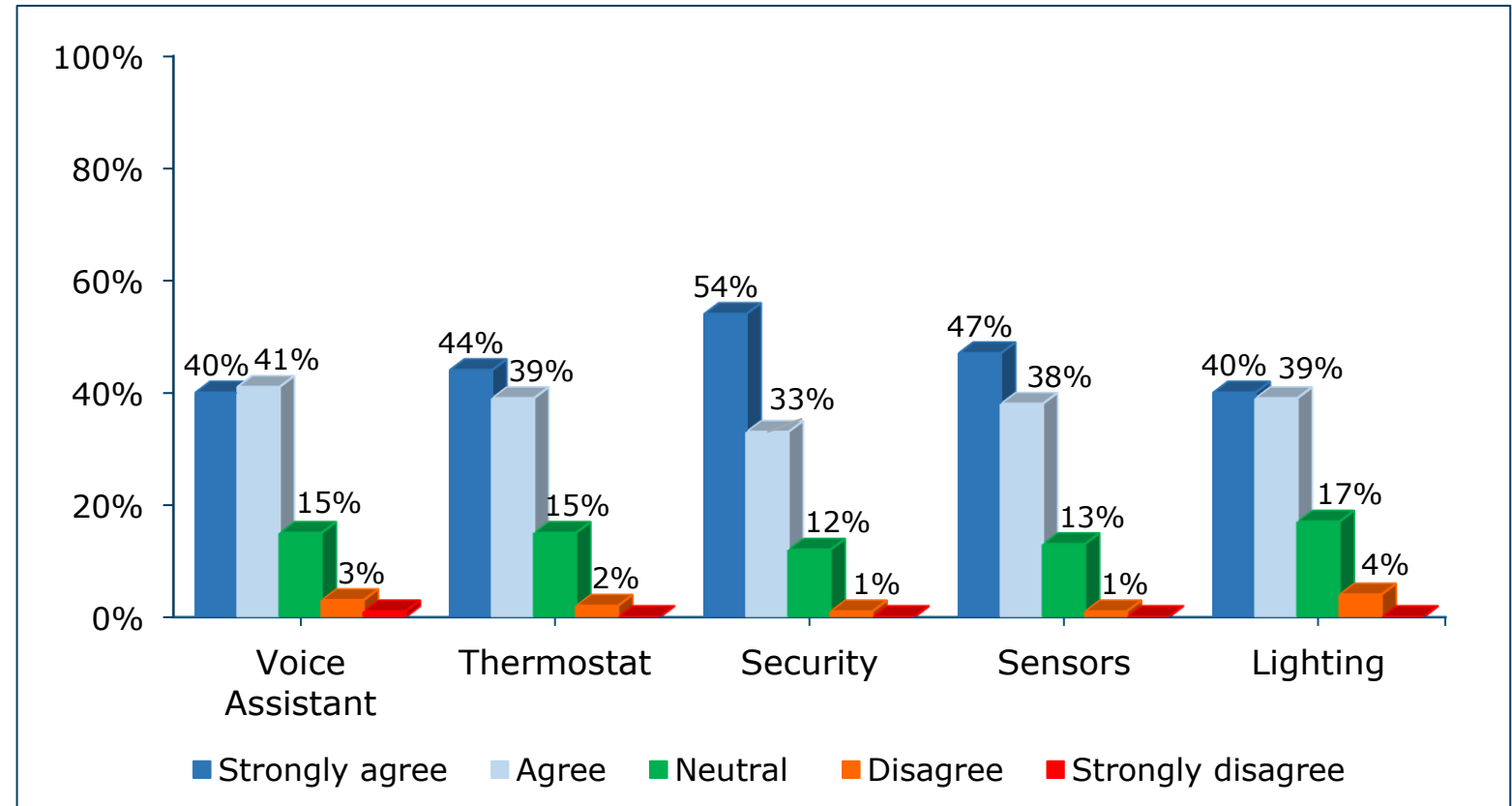
77% - Lighting

Chart data:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Voice Assistant	47%	39%	10%	2%	
Thermostats	49%	36%	13%	1%	
Security	55%	35%	9%	1%	
Sensors	50%	39%	9%	1%	
Lighting	33%	44%	17%	4%	

Comparison to Other IT

Smart home updates are:

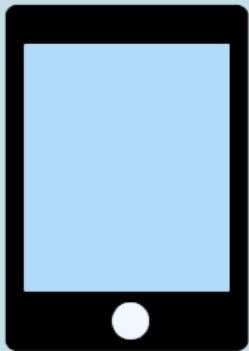| Mobile phones	Less - Somewhat Less Important **12%** Equally or More Important **87%**

Computers	Less – Somewhat Less Important **13%** Equally or More Important **85%**

Tablets	Less – Somewhat Less Important **9%** Equally or More Important **85%**

Fitness Trackers	Less – Somewhat Less Important **7%** Equally or More Important **79%**

Updates Unnecessary

Unnecessary When Device is Working Just Fine
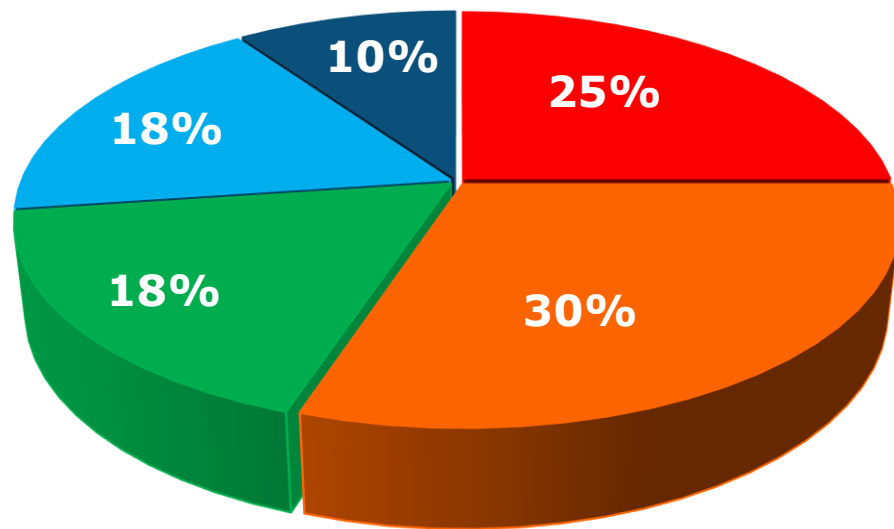
- 25% Strongly disagree
- 30% Disagree
- 18% Neutral
- 18% Agree
- 10% Strongly agree

Unnecessary When Don't Use Devices Enough
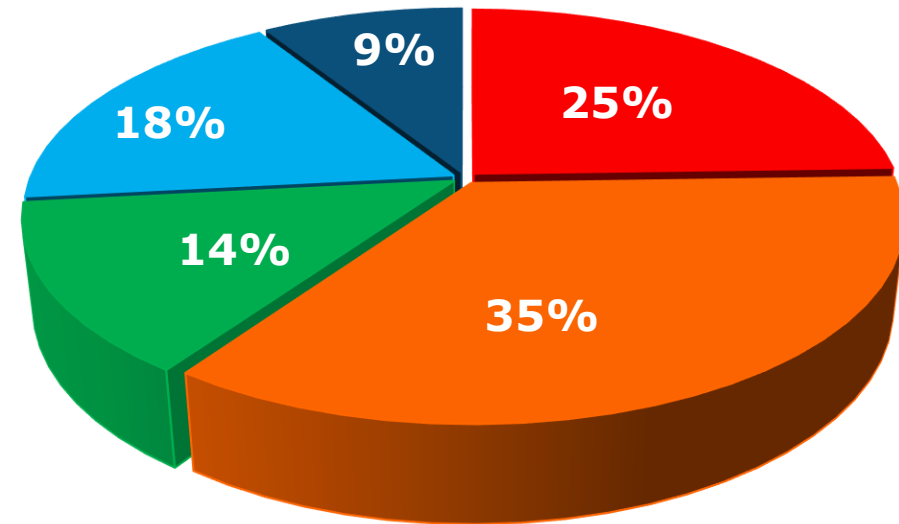
- 25% Strongly disagree
- 35% Disagree
- 14% Neutral
- 18% Agree
- 9% Strongly agree

RESULTS

Update Issues

Interviews: Update Issues

> I've had to reset my TVs many times because the software update didn't work or kind of messed things up.
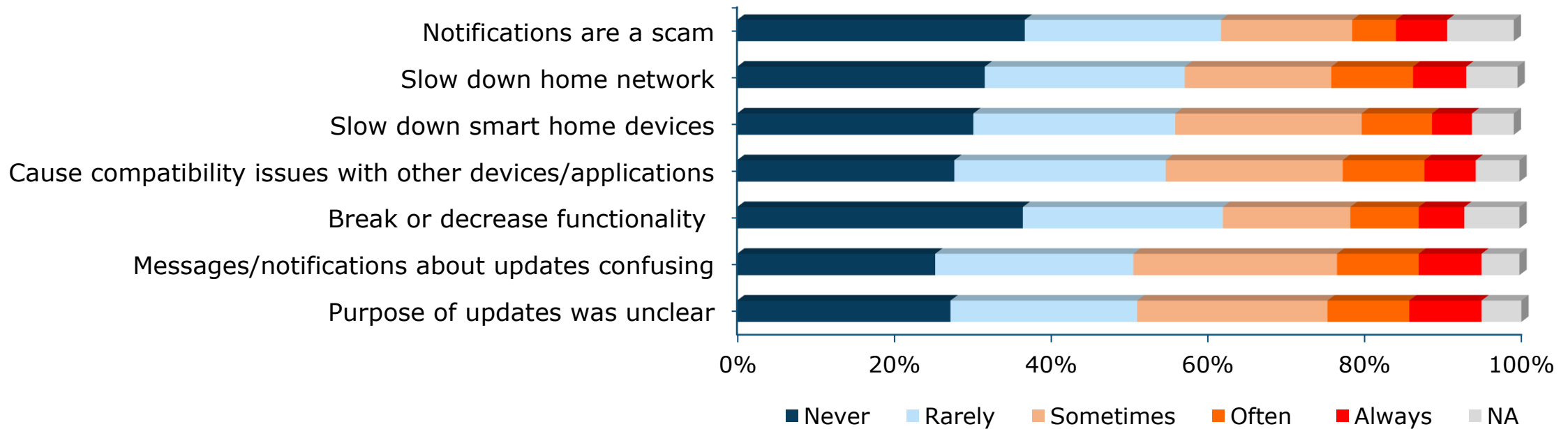
Update Issues

Top Issues (sometimes, often, or always)

45% - messages/notifications about updates are confusing

44% - purpose of updates is unclear

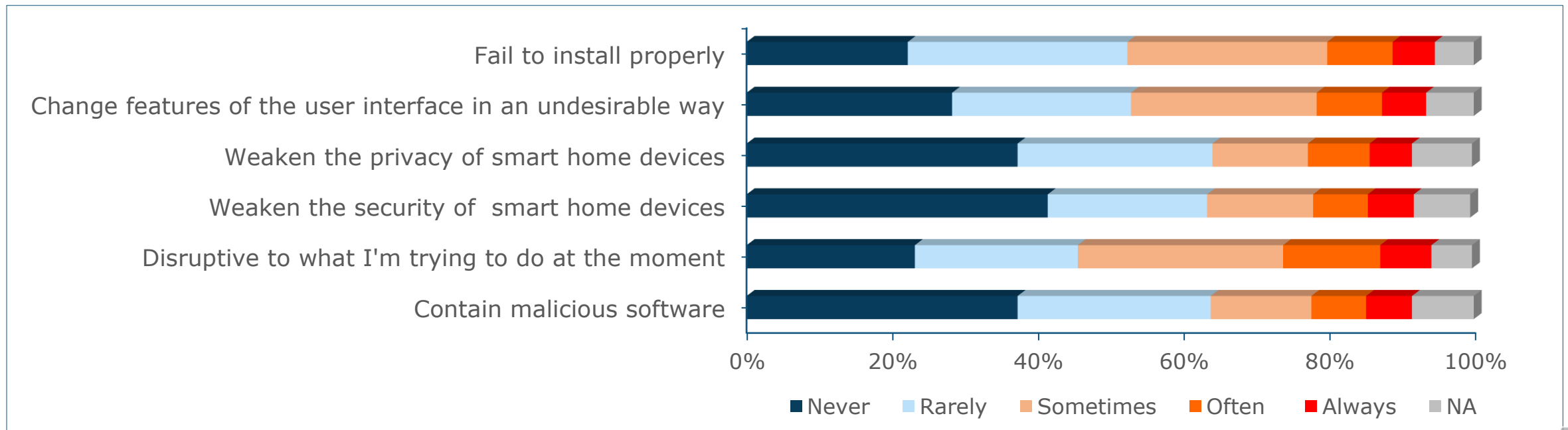40% - cause compatibility issues with other devices/applications

Legend: ■ Never ■ Rarely ■ Sometimes ■ Often ■ Always ■ NA

Update Issues (continued)

Top Issues (sometimes, often, or always)

49% - disruptive to what I am trying to do at the moment

43% - fail to install properly

41% - change features of the user interface in an undesirable way

RESULTS

Update Modes & Notifications

Interviews: Update Modes & Notifications

> They don't notify me when there's an update. I guess I just kind of assume that they happen as they go. You would think that I'd get an email, but I guess I don't. That might be nice.

> Some of them notify me, others update automatically, and others I'll find out about either through an email or just because I'm kind of monitoring technology news in general.

Current Update Modes

Device	Automatic	Both Manual & Automatic	Manual Updates	Don't Know
Voice assistants	46%	26%	14%	15%
Thermostats	37%	29%	20%	13%
Security	36%	27%	25%	13%
Sensors	32%	26%	26%	14%
Lighting	31%	23%	23%	21%

Update Mode Preferences
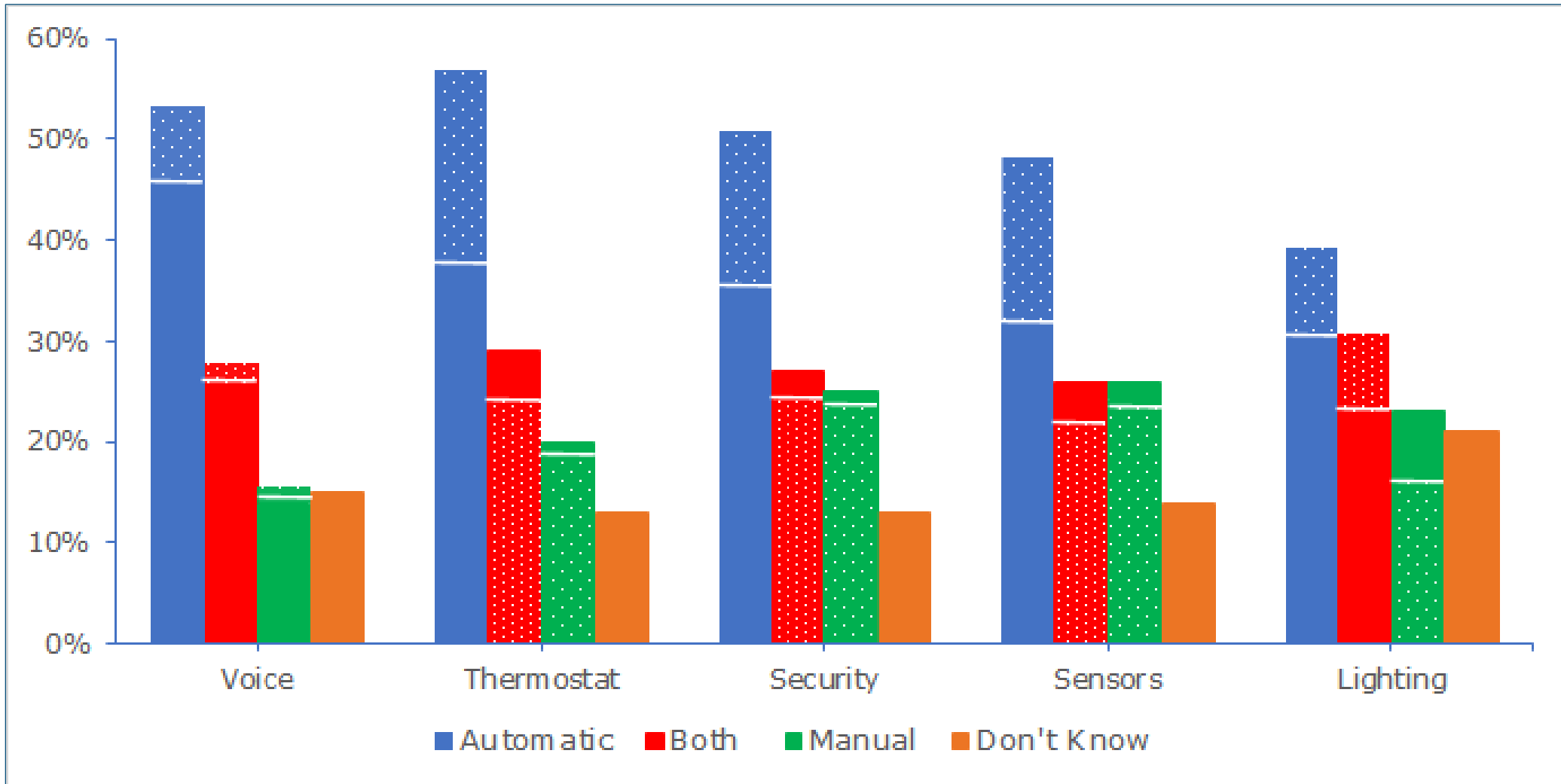
Update Notifications

9-23% Were not/didn't know if notified about availability

21-28% Were not/didn't know if notified about installation
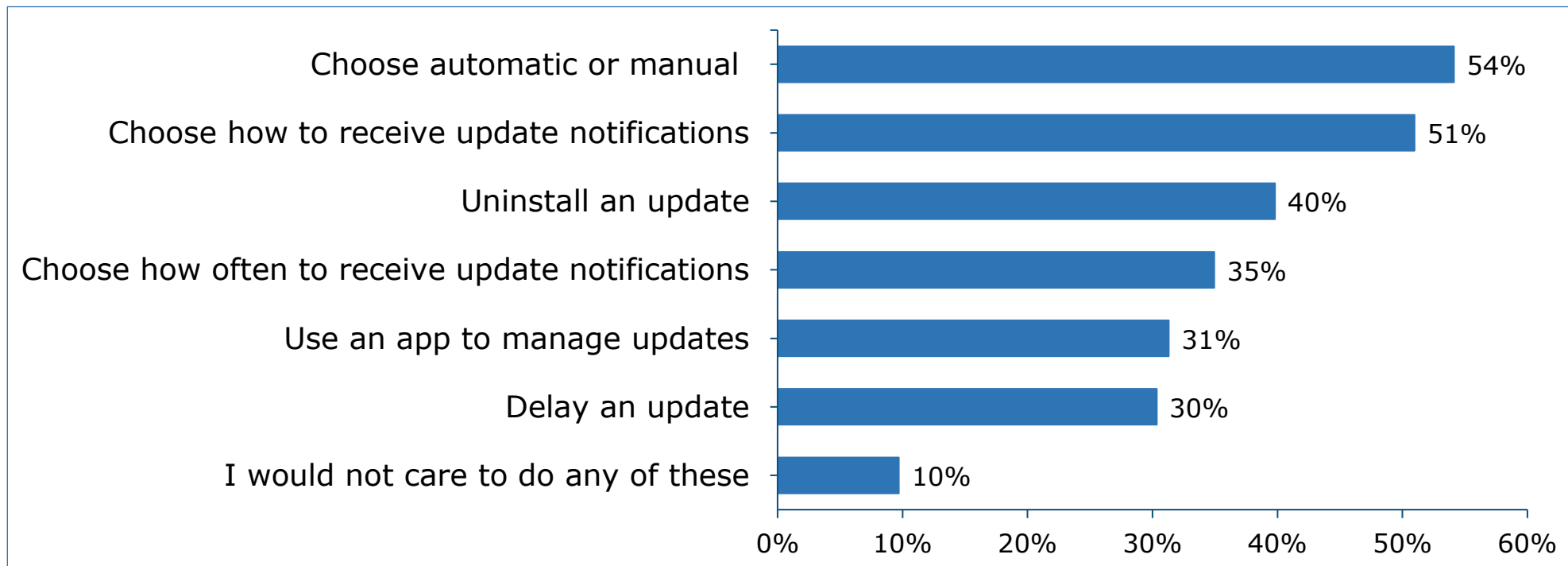
> 40% Would prefer to be notified via the device app

Wish List

54% - want to choose automatic or manual updates

51% - want to choose how to receive update notifications

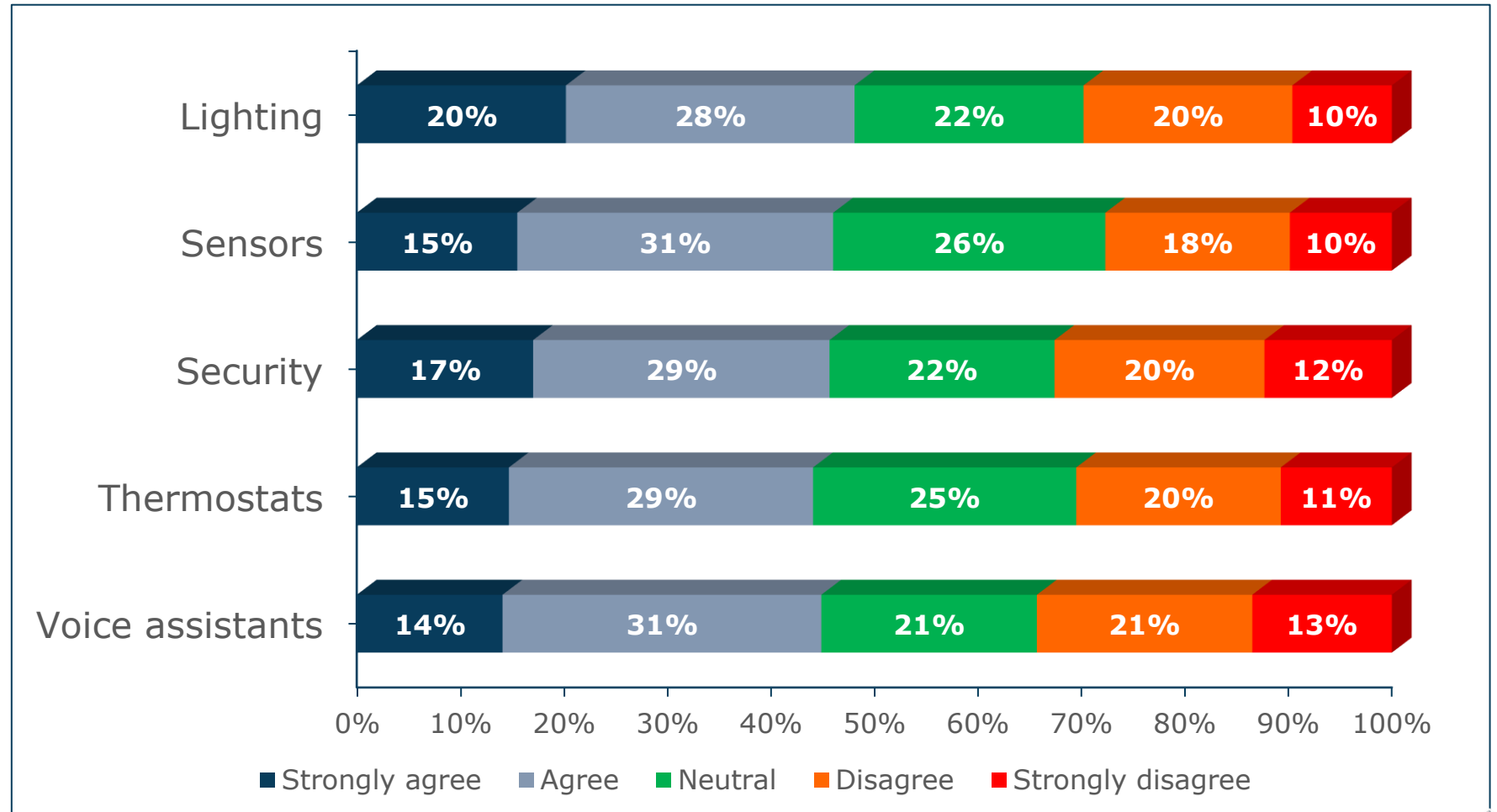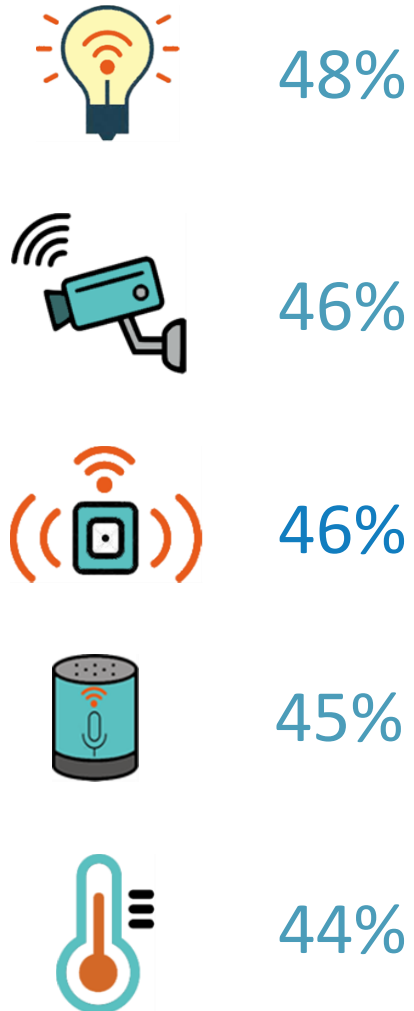| Category	Percentage
Choose automatic or manual	54%
Choose how to receive update notifications	51%
Uninstall an update	40%
Choose how often to receive update notifications	35%
Use an app to manage updates	31%
Delay an update	30%
I would not care to do any of these	10%

RESULTS

Manufacturer Support

Interviews: Manufacturer Support

> " I would hope that over time the companies that support these devices would continue to update their firmware…I think in some cases that's happened, but I think in other cases the devices just get abandoned. "

Concern for Loss of Support

48%

46%

46%

45%

44%

Device	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Lighting	20%	28%	22%	20%	10%
Sensors	15%	31%	26%	18%	10%
Security	17%	29%	22%	20%	12%
Thermostats	15%	29%	25%	20%	11%
Voice assistants	14%	31%	21%	21%	13%

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

■ Strongly agree ■ Agree ■ Neutral ■ Disagree ■ Strongly disagree

Specific Concerns for Loss of Support

NIST

51% Thermostat owners concerned that parts/accessories no longer available as compared to **25%** or less of other device owners.

39-48% Of owners across the five categories are concerned the devices will eventually stop working.

≈40% Of security (**42%**), thermostat (**40%**) and sensors (**39%**) owners are concerned that security bug fixes will no longer be released.

Actions if Support Lost

40% — Of sensor device owners would replace it as soon as possible with a new or different device

≈1/3 — Of owners across the five categories would replace it with a new or different device eventually but not right away.

5-10% — Would throw the device out without replacing it, with 10% of voice assistant & lighting device owners answering they would throw those devices out.

Preference for Support Notifications
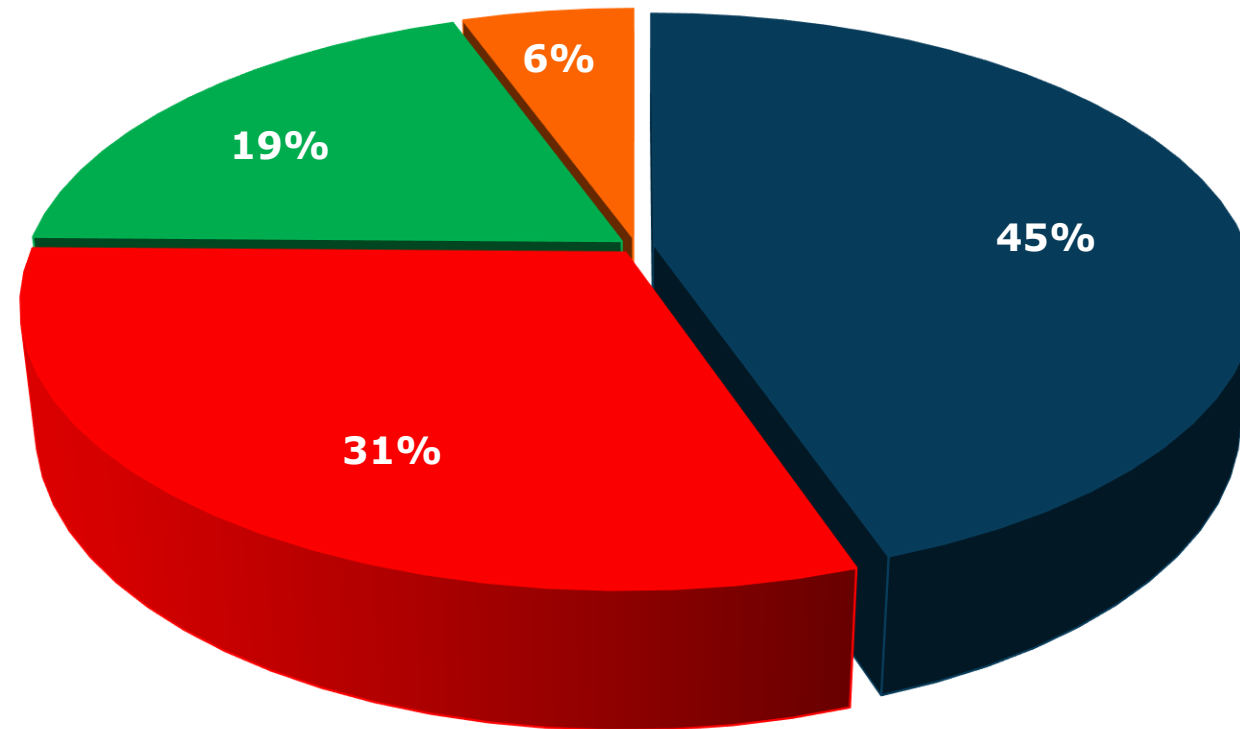
- Email
- Message sent to the smart home app
- Letter/postcard in the mail
- Prefer not to be notified

45%
31%
19%
6%

RESULTS

Security & Privacy Perceptions

Security Concerns

Moderately/Extremely

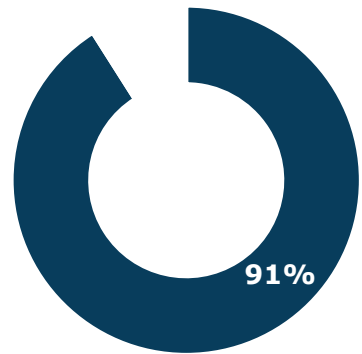43% - Security devices

38% - Voice assistants
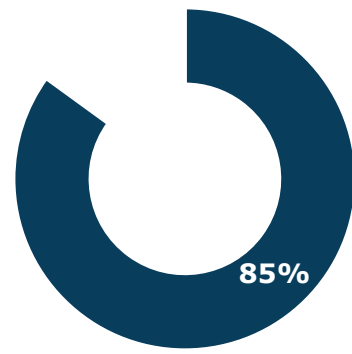
35% - Sensors

33% - Thermostats

28% - Lighting

Chart: Security Concerns by device type

Device	Not at all concerned	Slightly concerned	Somewhat concerned	Moderately concerned	Extremely concerned
Lighting			15%	15%	14%
Sensors			14%	18%	19%
Security			16%	21%	23%
Thermostat			18%	19%	15%
Assistants			23%	20%	19%

Legend:
- Not at all concerned
- Slightly concerned
- Somewhat concerned
- Moderately concerned
- Extremely concerned
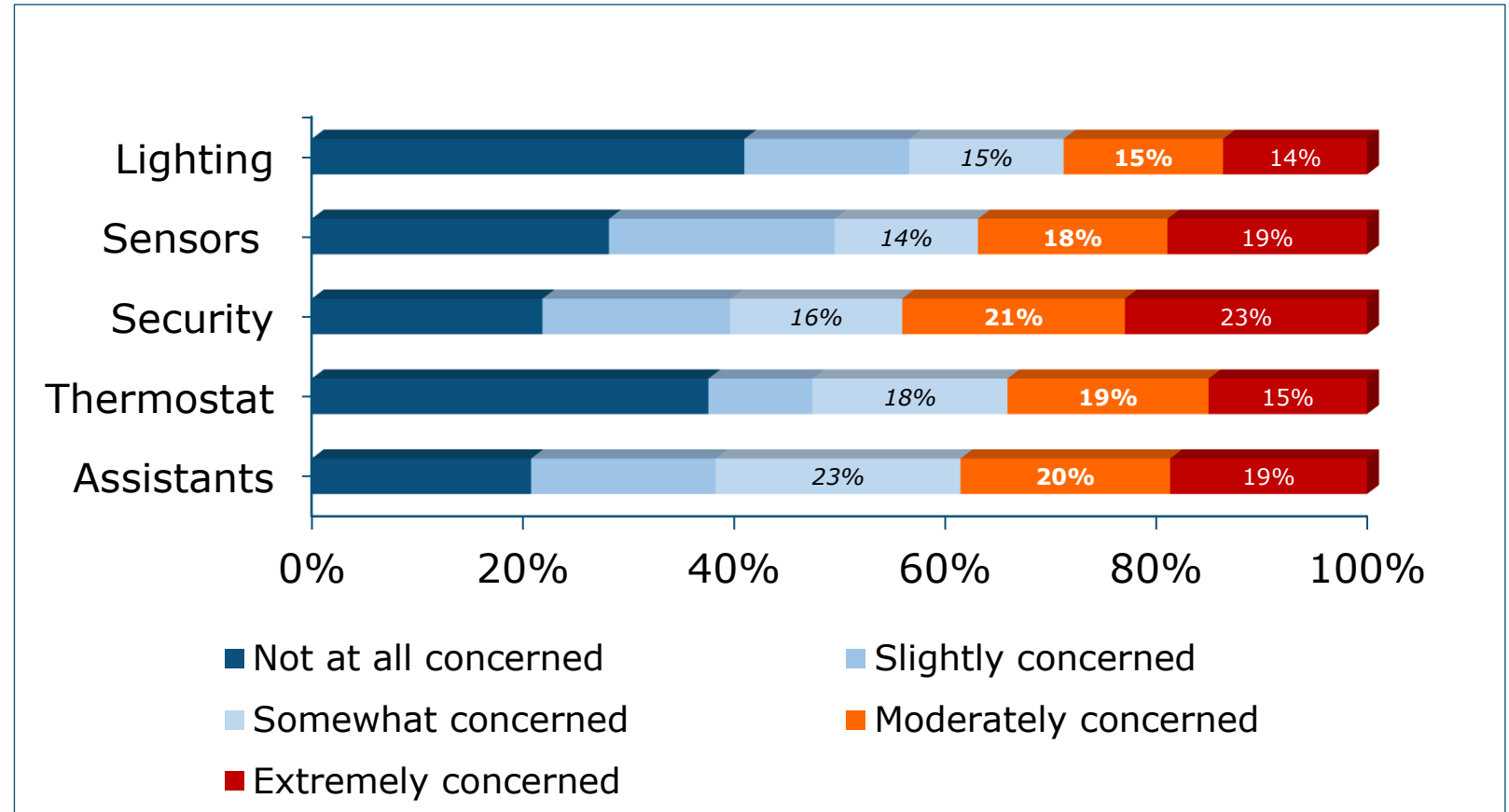
Devices are Secure

> 60% think that devices are secure for all categories
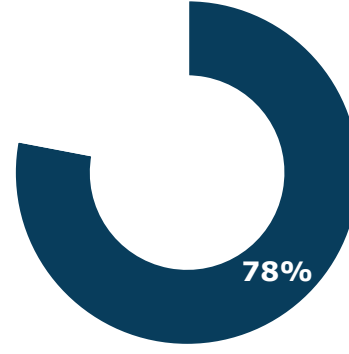
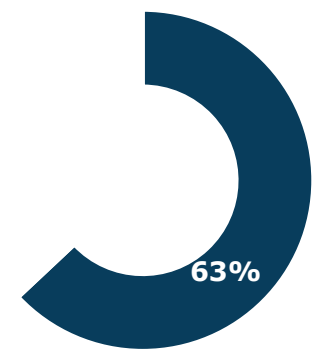| 91%	85%	78%	77%	63%
Thermostats	**Lighting**	**Sensors**	**Security**	**Voice Assistants**
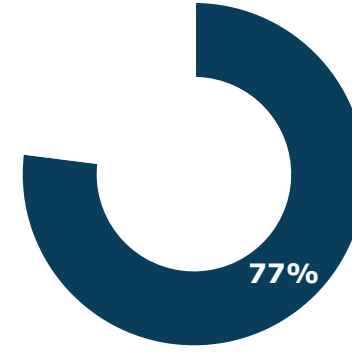
Privacy Concerns
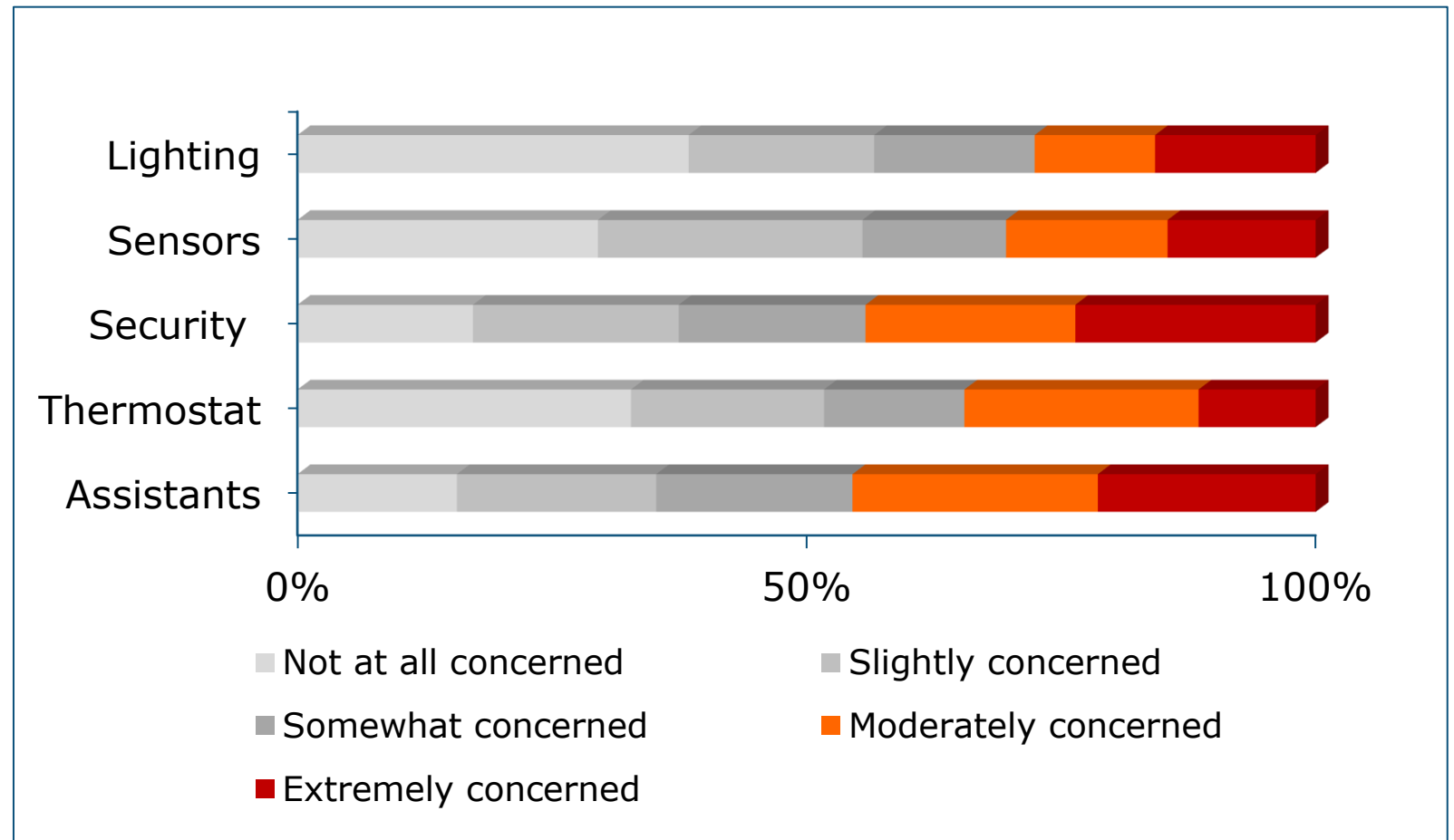
Moderately/Extremely
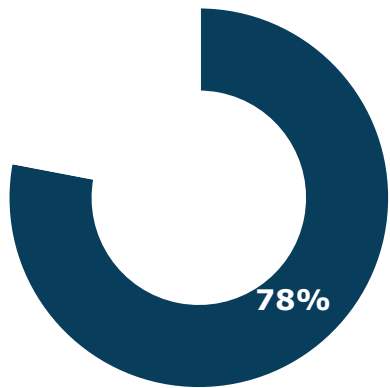
44% - Voice assistants

43% - Security devices

34% - Thermostats
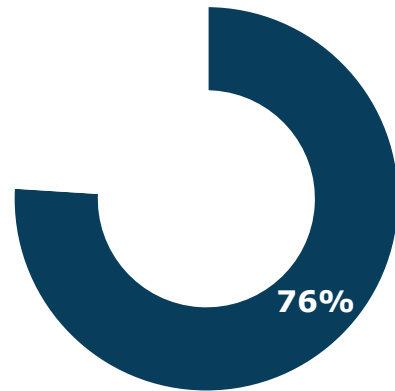
32% - Sensors

27% - Lighting

Devices Protect Privacy

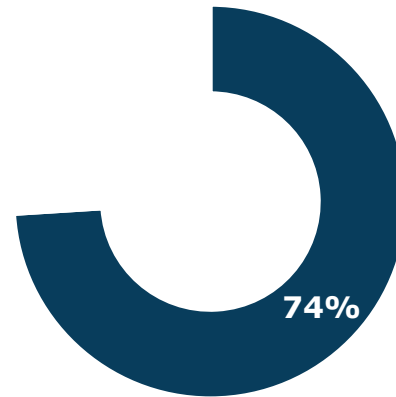> 60% Agree (agree & strongly agree) that devices protect privacy

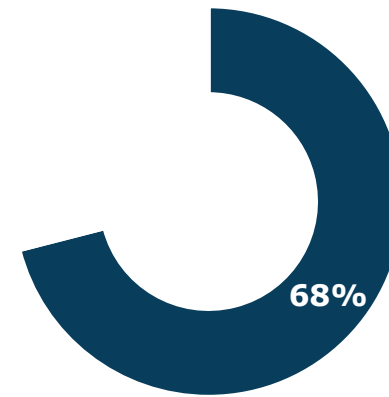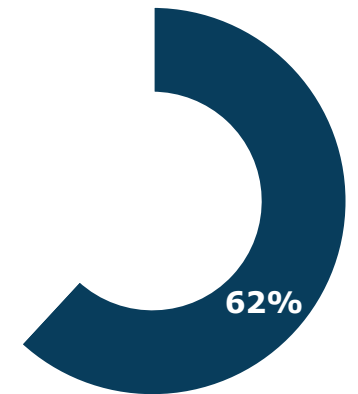| Security	Sensors	Thermostats	Lighting	Voice Assistants
78%	76%	74%	68%	62%

TAKEAWAYS

Results Summary

Participants generally feel that updates are important and urgent, with over half citing security fixes as being a top reason for updating

Update purpose may be unclear, and notifications and update modes are inconsistent across different devices

Participants have experienced compatibility problems after update installation as well as updates failing to properly install

Preference for automatic updates and choosing how to receive update notifications

Results Summary

Almost half are concerned about loss of manufacturer support

Security, sensor, and thermostat owners are concerned about no longer receiving security fixes

Less than half have security/privacy concerns, with most concern voiced for voice assistants and smart security devices

Participants generally think that their devices are secure and private

Towards Usable Updates

Transparency

- Update mode
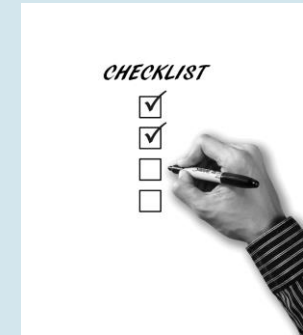- Purpose
- Criticality

End-of-life Information

- Support expiration
- Information to help consumers understand implications of loss of support

Update Options

- Enable automatic updates
- Configure notifications

Rollback Mechanism

- Fall-back for updates with unintended consequences

40

Thank you!

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NIST Usable Cybersecurity Program:

https://csrc.nist.gov/usable-cybersecurity