



Driver Behaviour & Automated Vehicles

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Overview

- > **Background**
- > **Methodology**
- > **Knowledge and attitudes**
- > **Behaviour**
 - > technology acceptance
 - > trust in automation
 - > behavioural adaption
- > **Conclusions**



Background: Automation forecast





Methodology

- > **Random, representative sample of 2,662 Canadians stratified by region:**
 - » valid licence
 - » driven in past 30 days
- > **Demographics:**
 - » males (53.0%) & females (47.0%)
 - » age range of 16 to 93 years
 - » 95% CI, $\pm 1.9\%$ (margin of error)
- > **Four focus groups (drivers and non-drivers).**





Questionnaire

- > **Two types of self-driving vehicles explored:**
 - » limited self-driving vehicles (LSDVs); and,
 - » fully self-driving vehicles (FSDVs).
- > **Driver knowledge, attitudes, practices/behaviour (KAP).**
- > **Features of driver behaviour:**
 - » technology acceptance in relation to perceived ease of use and perceived usefulness;
 - » trust in automation; and,
 - » behavioural adaptation.



Driver KAP

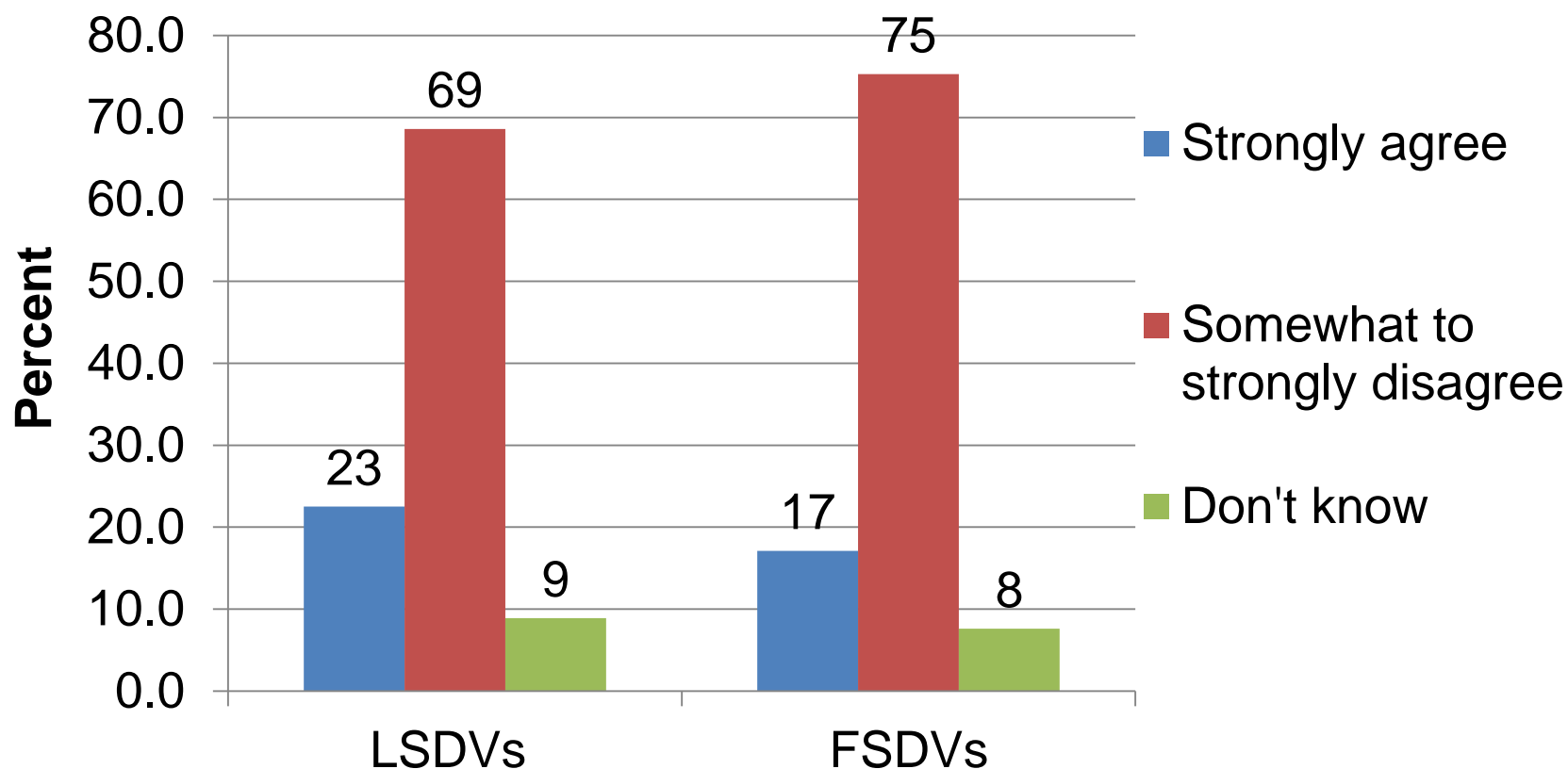
- > Familiar with AV technology: 63%.
- > Familiar with SDV technology: 39%.
- > Enjoys driving: 69%.
 - » Increased by age, if male, and drove longer distances.
- > Think SDVs will be very relaxing: 22%
- > Think SDVs will be very stressful: 41%.





Driver KAP

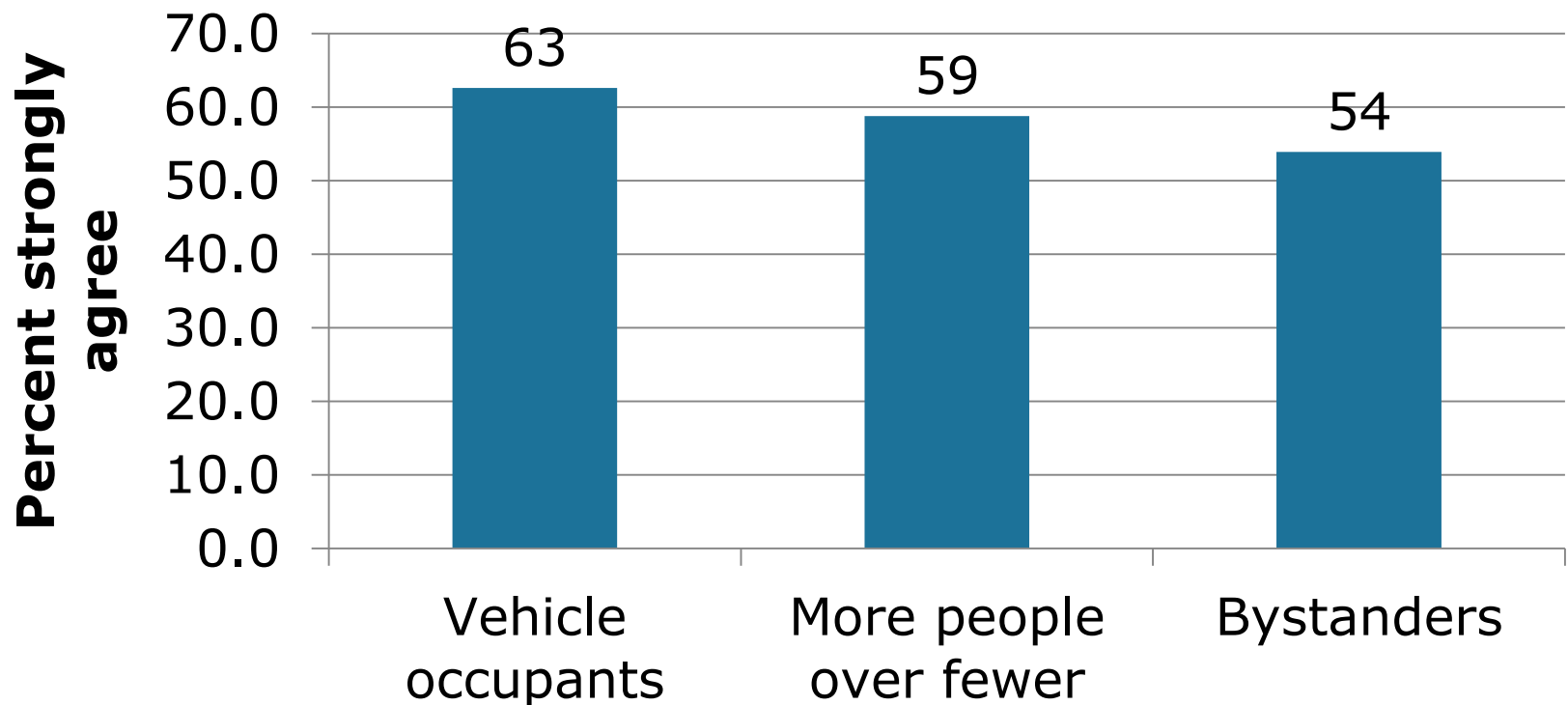
Driver would use LSDVs and FSDVs if available today.





Driver KAP

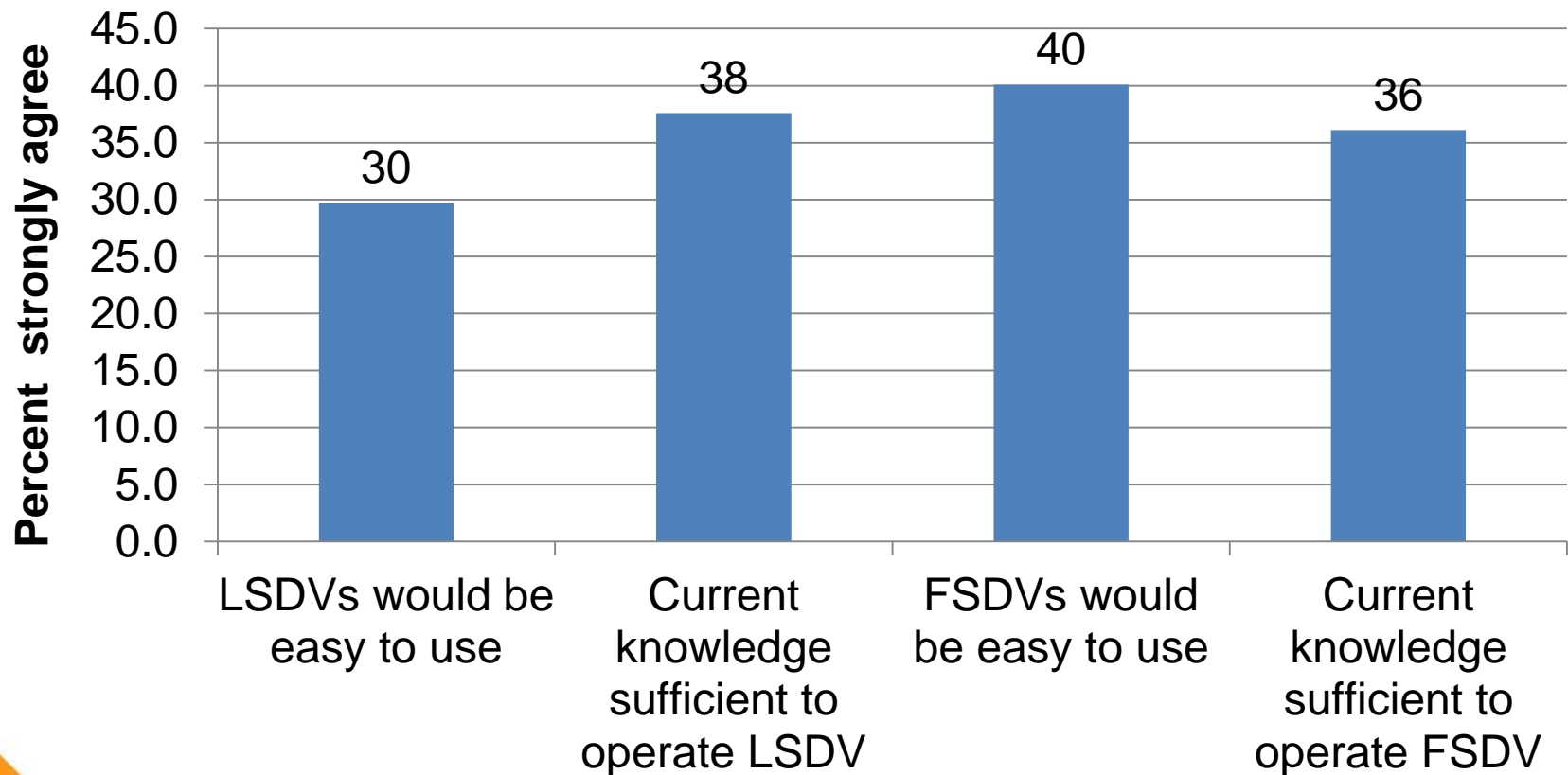
Who drivers think SDVs should protect in an unavoidable collision. [Differences significant ($p < .01$).]





Technology acceptance: Ease of use

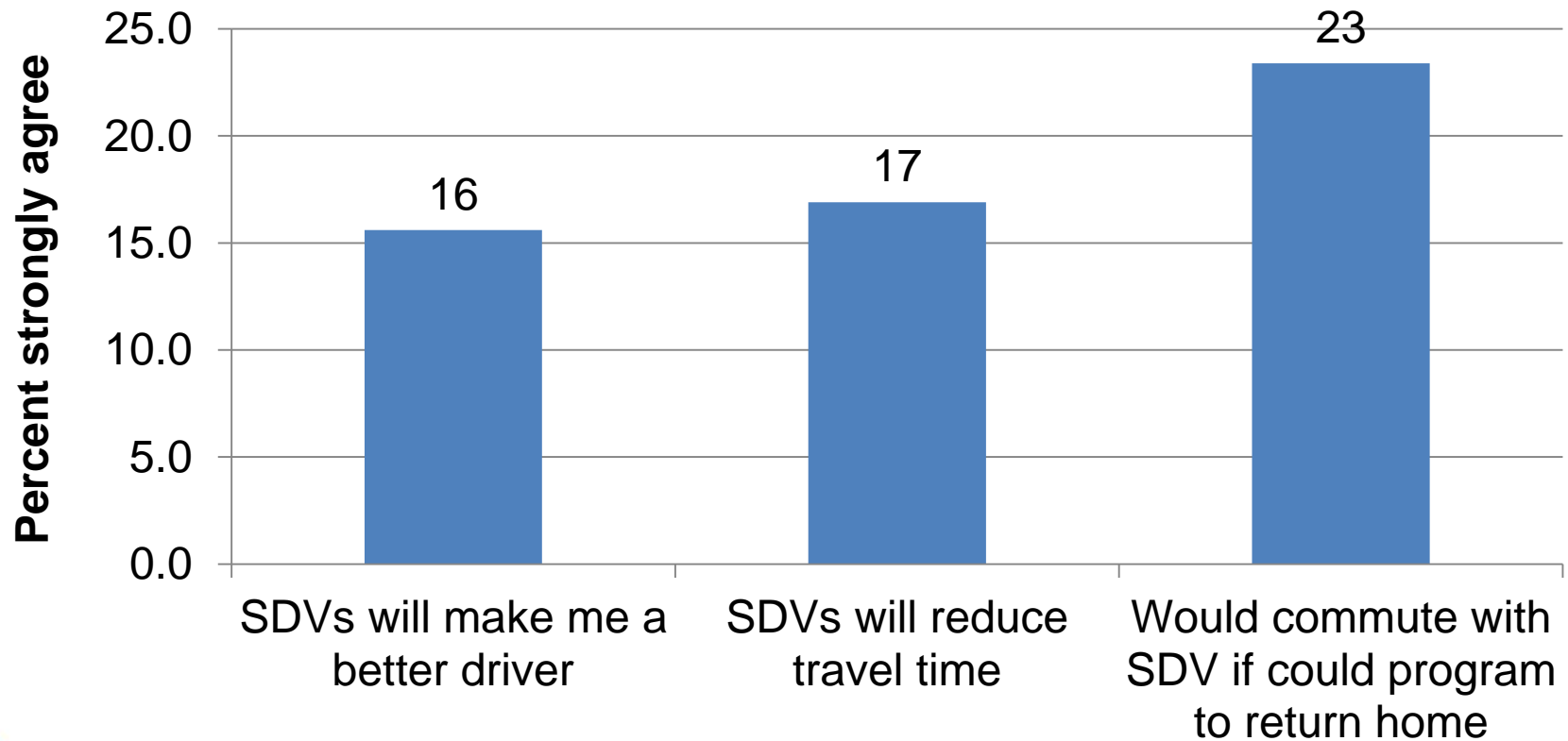
Believe SDVs would be too easy to use.





Technology acceptance: Usefulness

Usefulness of SDVs in terms of driving.





Technology acceptance: Usefulness

Percent of commuters who would switch to SDVs.

	Vehicle	Public transportation	Bicycle / walk	Car pool	Taxi
Primary means of commuting	84%	8%	7%	1%	0.1%
Percent of commuters who would use SDV instead if it could return home and park itself	20%	33%	15%	n/a	n/a



Technology acceptance: Usefulness

Focus groups.

> Benefits:

- » run errands;
- » vehicle would not sit idle;
- » greater independence/mobility for non-drivers.

> Concerns:

- » increased congestion and pollution;
- » reduced opportunities for human interactions;
- » job loss for professional drivers.

“Could [SDVs] be legally imposed on dangerous drivers?”



Trust in automation

SDV safety.

> **Would feel safe using a vehicle:**

» LSDV (28%) vs FSDV (21%).

> **Driver characteristics:**

» trust decreased as drivers aged.

» trust increased if male and higher education levels.

**“I want a full day’s notice.”
“I want vehicle to pull over.”**

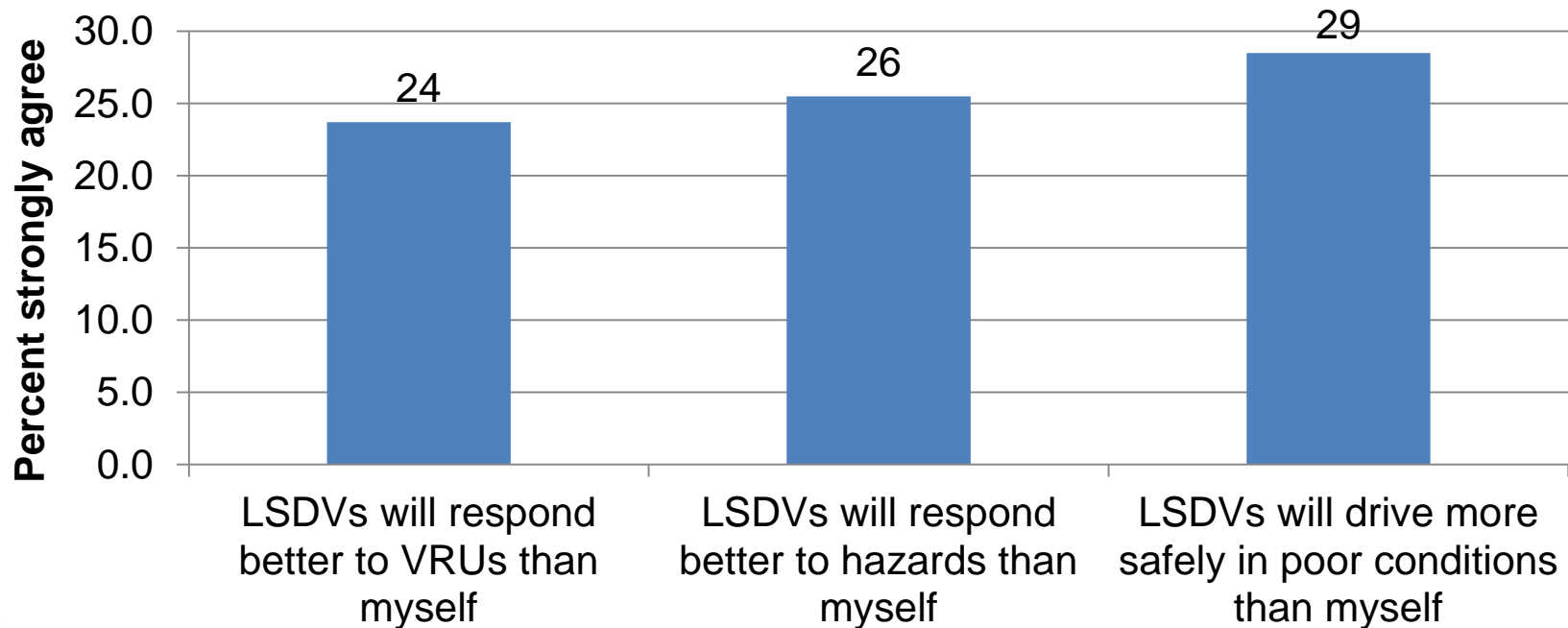
> **Only 31% think warning systems will provide enough notice.**



Trust in automation

SDV performance.

Think LSDVs will perform better than respondent in certain situations.





Behavioural adaptation

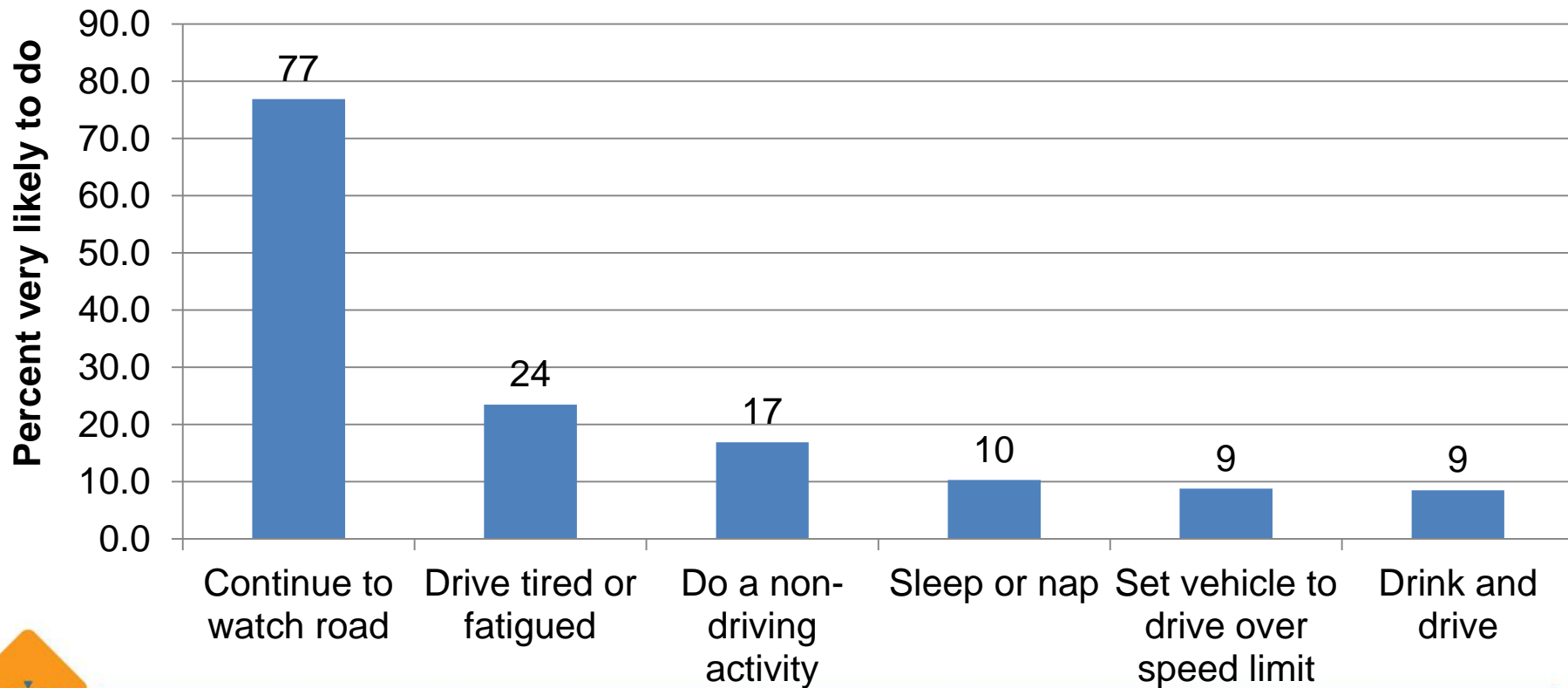
- > **Drivers did not think they would have to pay attention to the driving environment when using SDVs:**
 - » 16% strongly agreed
- > **Characteristics of drivers who thought this:**
 - » decreased as drivers aged; and,
 - » increased if male and if drove greater distances.





Behavioural adaptation

Activities drivers reported they were very likely to engage in while using LSDVs.





Behavioural adaptation

What drivers reported currently doing versus what they think they will do using LSDVs.

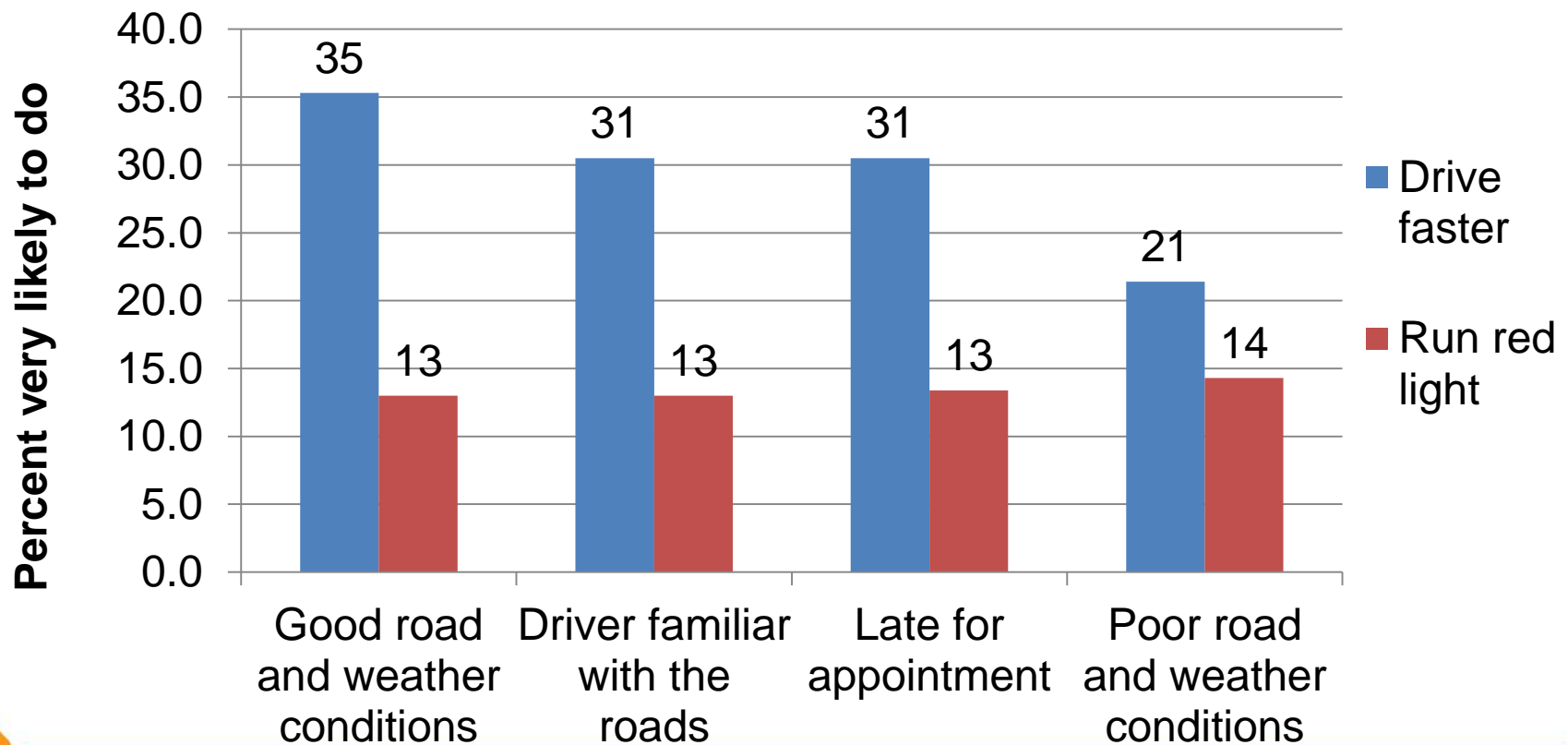
	Currently do this	Would do this using LSDV	Difference
• Continue to watch road	--	77%	--
• Drive tired or fatigued	5%	24%	19%*
• Non-driving activity / distracted	4%	17%	13%*
• Sleep or nap	--	10%	--
• Set vehicle to drive over speed limit	8%	9%	1%
	3%	9%	6%*

*Difference significant $p < 0.001$



Behavioural adaptation

Percent very likely to disengage LSDV in order to drive faster or run a red light.





“I may need one or two lessons to use SDVs.”
“Drivers will adapt over time.”

“I will not use [SDVs] unless there is an override feature.”

“I would take over if [the LSDV] was not driving in my style.”

“I won’t use [LSDVs] if the car is not doing what I want.”



Key findings

- > Driver awareness and trust of SDVs is very low whereas non-drivers are more trusting.
- > Expectation to not have to pay attention.
- > Expectation of lots of warning or that SDV will pull over.
- > Expectation SDV will continue to protect occupants.
- > Expectation to use in highest-risk driving situations, but will disengage if not their style.
- > Drivers will not use vehicles without override feature.
- > Concerns about negative outcomes: family interaction, city planning, public transportation and environment.



Good news/bad news

- > **Still time to shape public perceptions and expectations with education.**
- > **Early vs late adopters:**
 - » Drivers who are male, have greater education and drive longer distances are more likely to use and to trust SDVs.
 - » Drivers who are male and drive longer distances are more likely to negatively adapt their driving behaviour.
 - » Older drivers are less likely to use or trust SDVs; most able to afford and reap benefits.



Policy implications

- > Education is essential to prepare drivers!
 - » Misconceptions exist regarding role of driver attention and response time to warnings.
 - » Technology limitations are under-estimated.
- > Early adopters must know how to properly use technology.
- > The ability to 'turn off' technology will have important implications for safety.
- > Expectation that occupants will be protected in an unavoidable collision.



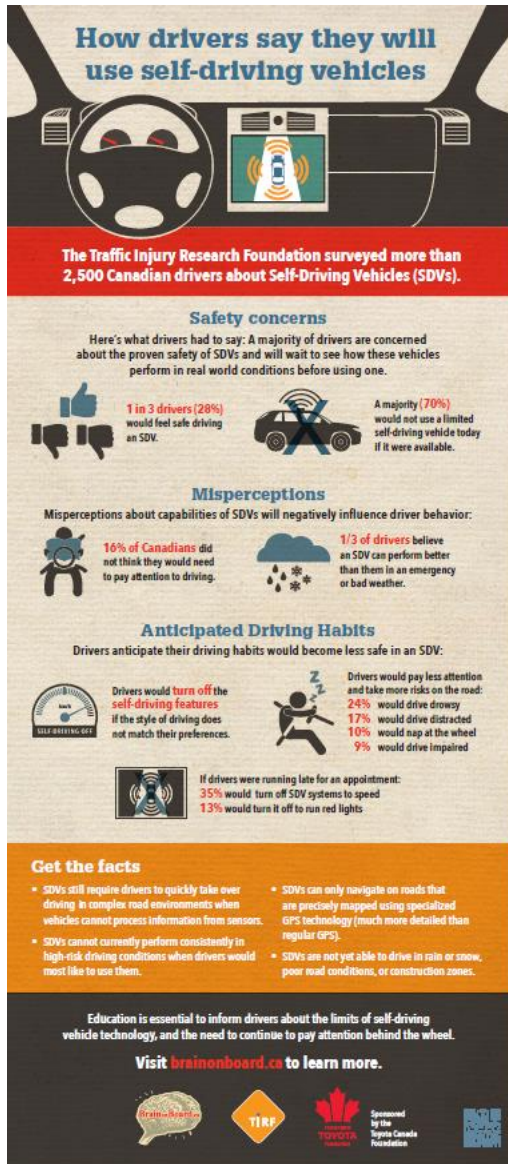


Conclusions

> **Some important measures that speak to the behavioural challenges:**

- » 4
- » 7.2
- » 68





> Sponsored by Toyota Canada Foundation

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