What can we learn from Finnish data about medical fitness to drive?
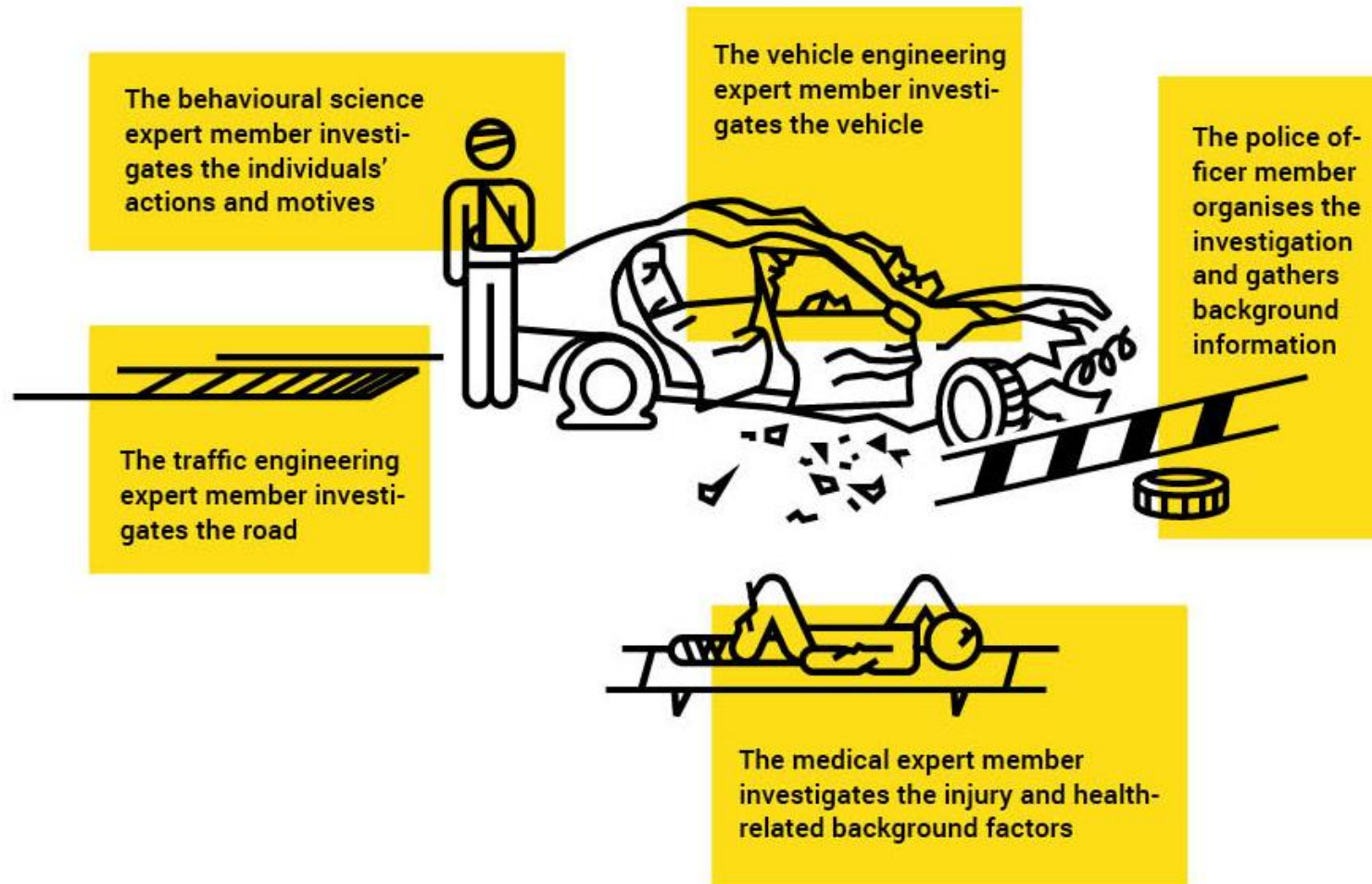
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Investigation teams

- 20 multidisciplinary teams
  - Police officer
  - Vehicle specialist
  - Road specialist
  - Physician
  - Behavioural scientist

- Independent
  - Act on the Investigation of Road and Cross-Country Traffic Accidents 24/2001, revised in 2016 (512/2016)
  - No stand on guilt or insurance compensation

- Standardised investigation forms and method
  - Gathered data covers 90-95% of all fatal road crashes in Finland
  - Hundreds of data items are gathered per crash

Accident investigation in Finland

The behavioural science expert member investigates the individuals' actions and motives

The vehicle engineering expert member investigates the vehicle

The police officer member organises the investigation and gathers background information

The traffic engineering expert member investigates the road

The medical expert member investigates the injury and health-related background factors

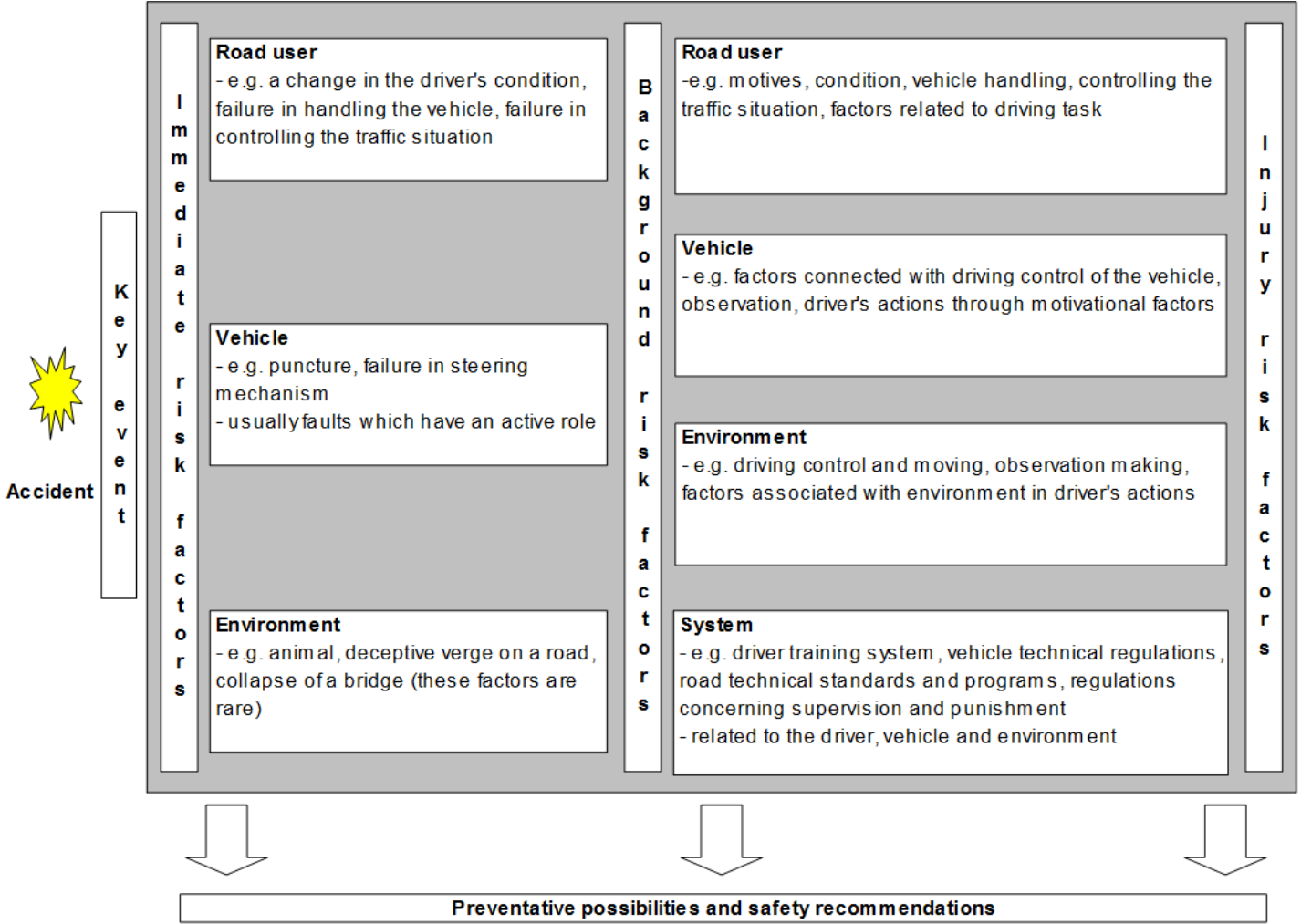# Why did it happen? – the investigation method*

- Key event
  - Description of what took place and where
  - Immediately before the accident

- Risk factors
  - Immediate risk factor (one active)
    - Road user (e.g. seizure, observational error)
    - Vehicle (e.g. puncture)
    - Environment (e.g. deceptive verge on a road)

  - Background risk factors (many)
    - Road user (e.g. haste, inexperience)
    - Vehicle (e.g. loading, shades)
    - Environment (e.g. weather, visual guidance)
    - System (e.g. driver training system)

* Salo, I., Parkkari, K., Sulander, P., Keskinen, E., 2007. In-depth on-the-Spot Road Accident Investigation in Finland, in: Proceedings of 2nd International Conference on ESAR „Expert Symposium on Accident Research". Bundesanstalt für Straßenwesen, Hannover, Germany, pp. 28–37.

Risk accumulation model
(adapted from the VALT method 2003)

Key event	Immediate risk factors	Background risk factors	Injury risk factors
Accident	**Road user** - e.g. a change in the driver's condition, failure in handling the vehicle, failure in controlling the traffic situation	**Road user** -e.g. motives, condition, vehicle handling, controlling the traffic situation, factors related to driving task	
	Vehicle - e.g. puncture, failure in steering mechanism - usually faults which have an active role	**Vehicle** - e.g. factors connected with driving control of the vehicle, observation, driver's actions through motivational factors	
		Environment - e.g. driving control and moving, observation making, factors associated with environment in driver's actions	
	Environment - e.g. animal, deceptive verge on a road, collapse of a bridge (these factors are rare)	**System** - e.g. driver training system, vehicle technical regulations, road technical standards and programs, regulations concerning supervision and punishment - related to the driver, vehicle and environment	

Preventative possibilities and safety recommendations

Medical condition as an immediate risk factor (2014-18)

"According to the investigation method, a sudden illness attack suffered by the driver is classified as an immediate risk factor for an accident in cases where the attack directly caused the accident.

Accidents of this kind usually include the sudden death of a driver while steering a vehicle, which often causes the vehicle to collide with roadside objects or with another vehicle.

Sometimes the attack progresses in a manner slow enough to allow the driver to stop the vehicle."

141 (16% of all fatal motor vehicle road accidents) were caused by an illness attack suffered by the driver

- The accidents involved 179 people, 169 of whom died and 10 suffered minor injuries.
- In 124 (88%) accidents, the at-fault driver was a male with a median age of 66 years.
- An illness attack usually led to a single vehicle accident, most typically driving off the road (n=106, 75%).
- Typically, the driver of the at fault vehicle drove a passenger car or van (n=122, 87%)
  - In nine accidents (6 %), the driver drove a heavy vehicle and in two accidents a tractor (1%)

Medical condition as an immediate risk factor (2014-18)

Driver disease [# of accidents]	Cardiovascular disease	Mental disorders	Reduced mobility	Cerebrovascular diseases	Epilepsy	Diabetes mellitus	Substance depency
Cardiovascular disease	**119**	7	18	10	6	28	15
Mental disorders	7	**7**	0	0	2	3	2
Reduced mobility	18	0	**18**	2	0	4	1
Cerebrovascular diseases	10	0	2	**12**	1	1	2
Epilepsy	6	2	0	1	**8**	1	3
Diabetes mellitus	28	3	4	1	1	**29**	8
Substance depency	15	2	1	2	3	8	**19**

Table 1: The most common medical conditions suffered by the driver at fault in accidents which involved a medical condition as an immediate risk factor (141 accidents)

*Reading guide: The medical conditions have been cross-tabulated to show multimorbidity. In this table, the diagonal in bold type shows the number of accidents in which the condition in question has occurred. For example, seven drivers suffered from a mental illness. Respectively, the other numbers on the same line or in the same column show how many times one accident has involved two different medical conditions (for example, two drivers suffered from both mental disorder and epilepsy).

Medical condition as a background risk factor (2014-18)

"Accumulation of background risks usually leads to the emergence of an immediate risk factor for accidents. However, it is usually difficult to analyse how a single background risk factor has affected the occurrence of an accident. This is because the interrelationships between different background risk factors are complex.

A driver's medical condition may act as a background factor in different ways. A driver may be in a great physical condition but still drive in the wrong direction on a one-way street because of, for example, a sudden brain disorder.

On the other hand, the driver's physical functioning may deteriorate in which case the use of controls may be slower than usual, or the driver may make mistakes while driving."

352 accidents (33% of all fatal motor vehicle road accidents) involved a medical condition as a background risk

- The accidents involved 806 people, 391 of whom died, 73 suffered serious injuries, 161 suffered minor injuries and 181 did not suffer any injuries
- 90 % (n=316) of the at-fault drivers were male with a median age of 40 years
- The most common immediate risk factors were different kinds of vehicle control errors (n=103, 29%)
    - 76% of drivers at fault making these kinds of mistakes were intoxicated
- The second most common immediate risk was an accident caused deliberately (n=99, 28%)

Medical condition as a background risk factor (2014-18)

Driver disease [# of accidents]	Cardiovascular disease	Mental disorders	Reduced mobility	Cerebrovascular diseases	Epilepsy	Diabetes mellitus	Substance depency
Cardiovascular disease	**108**	28	21	11	2	29	57
Mental disorders	28	**162**	22	3	5	7	108
Reduced mobility	21	22	**38**	2	0	5	25
Cerebrovascular diseases	11	3	2	**24**	1	3	4
Epilepsy	2	5	0	1	**9**	0	5
Diabetes mellitus	29	7	5	3	0	**34**	18
Substance depency	57	108	25	4	5	18	**217**

Table 2: The most common medical conditions of the drivers at fault in cases where the condition was a background risk factor (352 accidents: The Reading guide of Table 1 applies here)
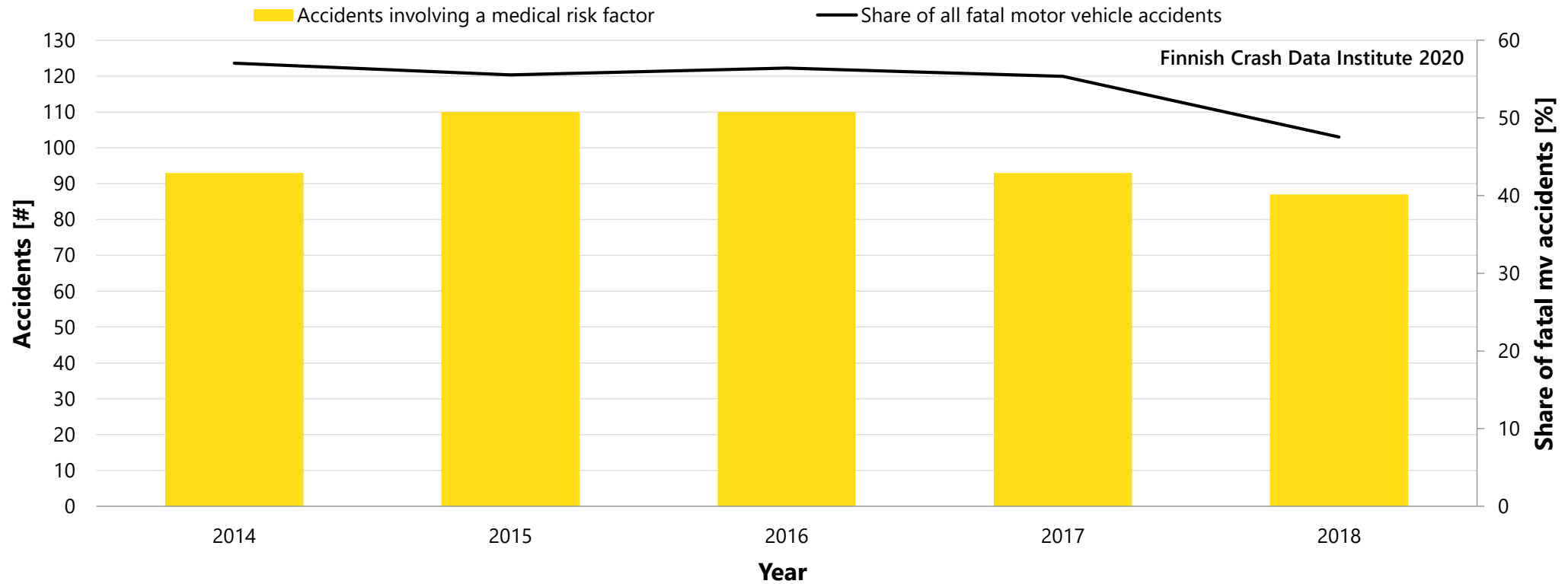
Accidents involving a medical risk factor

Figure 1: Fatal motor vehicle accidents involving a medical condition as immediate or background risk factor.

What have we learned?

- There are three major medical risk factors in fatal motor vehicle accidents
  - Cardiovascular diseases (elderly drivers)
  - Mental illnesses
  - Substance addiction
- The number #1 cure for the problem is the assessment of medical fitness to drive during every medical examination (how does this medical condition affect driving?)
  - #1 prerequisite to reach the above-mentioned goal is to know whether the patient has a driving license and which is the category of it
  - Furthermore, information exchange between different healthcare units and between police and healthcare should be improved
- Current situation regarding driver health monitoring reflects the available data
  - On European level, the problem is the lack of data – sudden illness attacks and suicides are ruled out from the official statistics => no data, no problem!
  - In addition, the asymmetry of data may lead to asymmetry in legislation and monitoring driver fitness (e.g., easily measurable vision requirements outweigh driving risks such as substance addiction)

Further information

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Thank you for your time!

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