Unintended consequences of e-cigarettes: poisonings, fires & explosions

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Overview

Poisonings, Fires, Explosions related to e-cigarettes reported in published literature

Causes and consequences and considerations

Evidence reviews commissioned by Public Health England/ Dept Health & Social Care

2015

E-cigarettes: an evidence review

2018

Evidence review of EC & HTP

Focus on cessation and health risks

2019

Vaping in England

Focus on SE indicators

2020

Vaping in England

Focus on mental health & pregnancy

2021

Vaping in England

Focus on smoking cessation

2022

Nicotine vaping in England: an evidence update including health risks and perceptions, 2022

A report commissioned by the Office for Health Improvement and Disparities

Published 29 September 2022

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Methods

Summarised reports from

UK National Poisons information Service

American Association of Poison Control Centers' National Poison Data System

Systematic reviews of published case reports

Freedom of Infomation requests to fire services in England

Poisonings

UK National Poisons Information Service

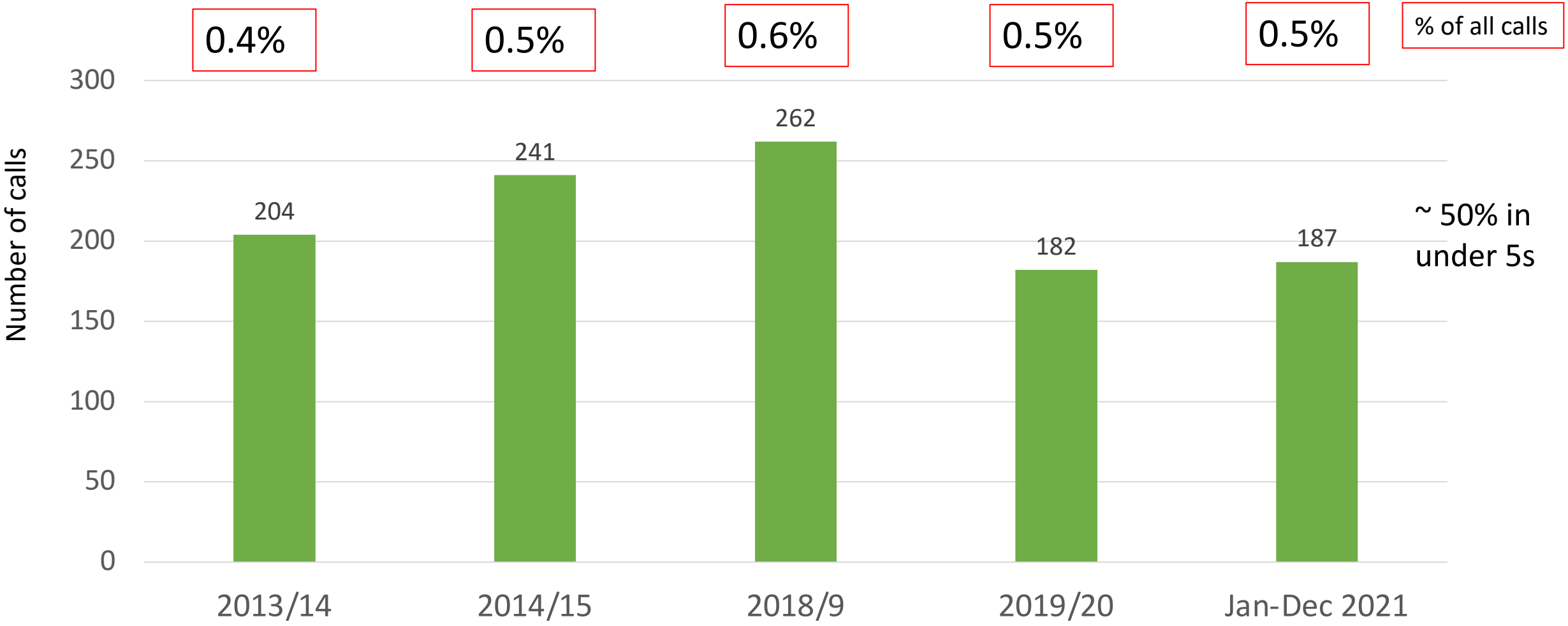
A network of 4 poisons units commissioned by the UK Health Security Agency (formally PHE)

It provides 24-hour information and advice to NHS healthcare professionals to support the management of patients with suspected poisoning across the UK

Information and advice are provided via 2 sources:

- 1. TOXBASE, an online poisons information database
- **2. A 24-hour telephone advice service** (tends to used for complex cases, where info not easily available on TOXBASE)

Telephone enquiries to NPIS about e-cigarettes/e-liquids



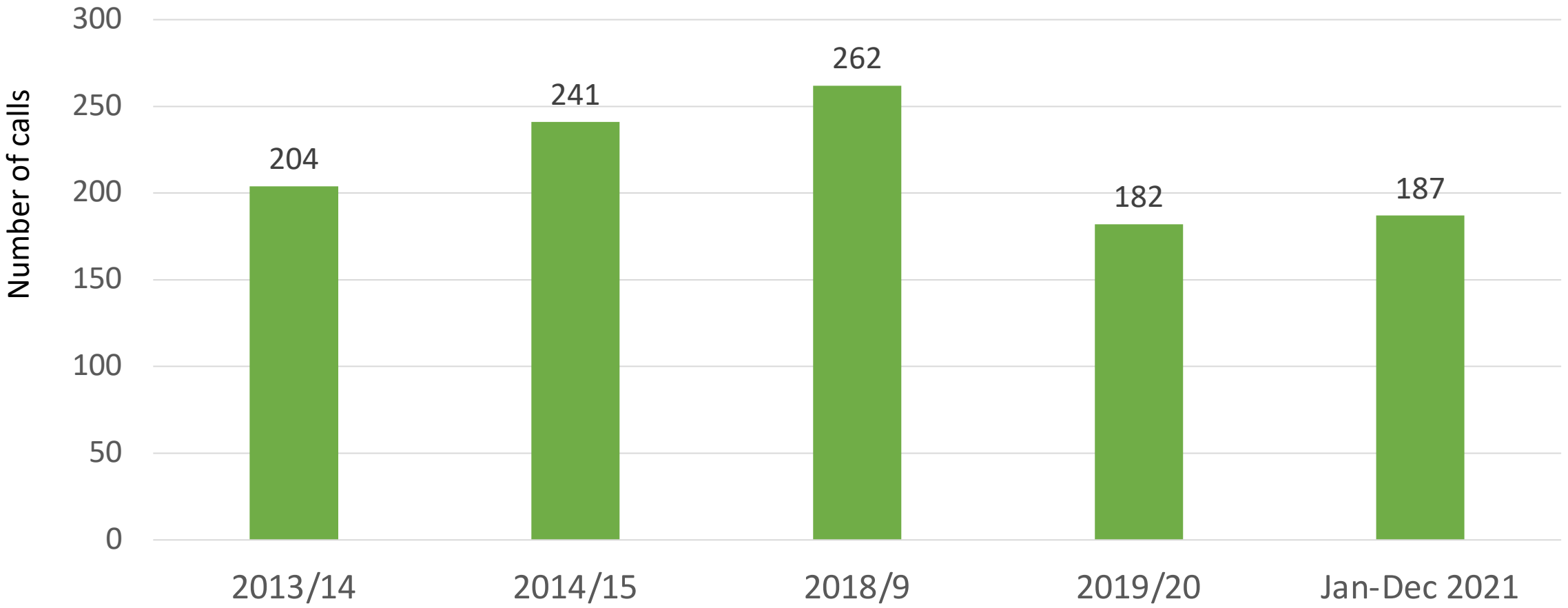
Telephone enquiries about EC & e-liquids to NPIS & severity of toxicity

Moderate to severe toxicity

n=8

n=5

n=8



Telephone enquiries about EC & e-liquids to NPIS: toxicity

69-85% **accidental**

Most common route - **swallowing**

Ocular (mistaken for eye drops)

moderate –severe clinical features associated with ingestion included mouth irritation, anxiety, nausea, vomiting, dizziness and palpitations

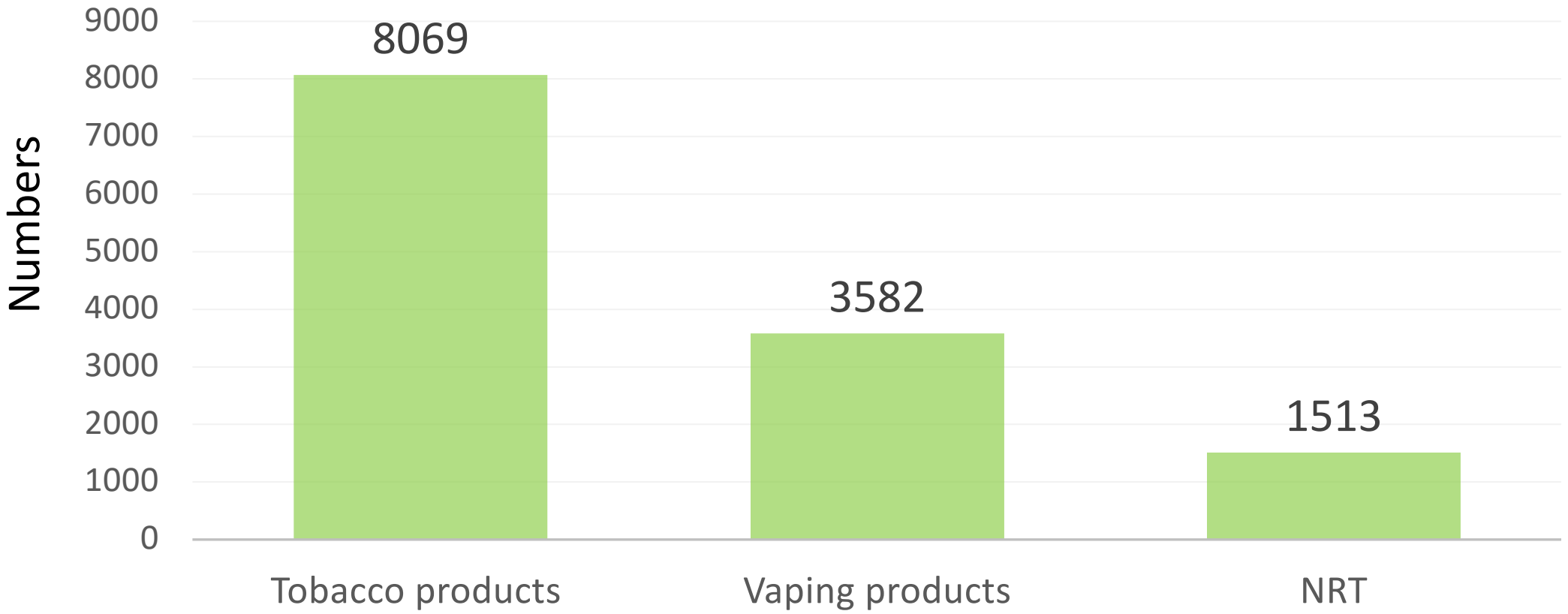
The American Association of Poison Control Centers' National Poison Data System (AAPCC-NPDS)

- Collect near real time data from all 55 national poisons centres in the US
- Take calls from public health agencies and members of the public
- Poison centre staff record and upload data for every 'exposure case', rather than calls

Only included this data source in our 2022 report and only for the year 2020

AAPCC-NPDS Reports for 2020

Involved under 5s	84%	75%	60%



Adverse effects

AAPCC-NPDS

Majority – no or minor effect

There were more major adverse effects for vaping products (n=16) and one exposure case resulted in death (no details are given) compared with seven major adverse effects for tobacco products.

Systematic reviews (poisonings)

Studies from poisons centres (worldwide)

- 18 studies (2015-2021)
- Sample sizes ranged 26 to 17,358
- Most accidental
- Most common route – swallowing
- Most common symptoms nausea, vomiting, dizziness, tachycardia
- 7 fatalities were reported across all 18 studies

Only 1 study reported the dose of nicotine according to body weight; among 31 cases, the median dose of ingested nicotine was 0.50mg/kg (range 0.04 to 11.25mg/kg)[1]

Oertova et al .Clin Pharmacol Toxicol 2020: 127: 39-46

Case reports/series (worldwide)

2015-2017

- 11 case reports
- 5 were accidental poisoning (1 fatality)
- 3 intentional (2 fatalities)
- 3 unknown intent (2 fatalities)

2017-2021

9 case reports of 10 patients

4 accidental poisoning

6 intentional (2 fatalities)

1 review[1] of case reports of 31 adults from 11 countries

- 7 were accidental
- 1 unknown
- 23 intentional (11 fatalities)

In the non-fatalities, the highest plasma concentration of nicotine was 800 µg L^{-1}, while the lowest concentration in the people who died 1600 µg L^{-1}

1. Maessen et al Clin Toxicol (Phila) 2019: 58: 1-8.

Considerations for preventing poisonings

Need to put accidental and intentional poisoning into context

Recommended regulations for

- childproof packaging
- labelling to reinforce safe storage, away from similar looking medicines such as eye or ear drops and children's medicine

Fires

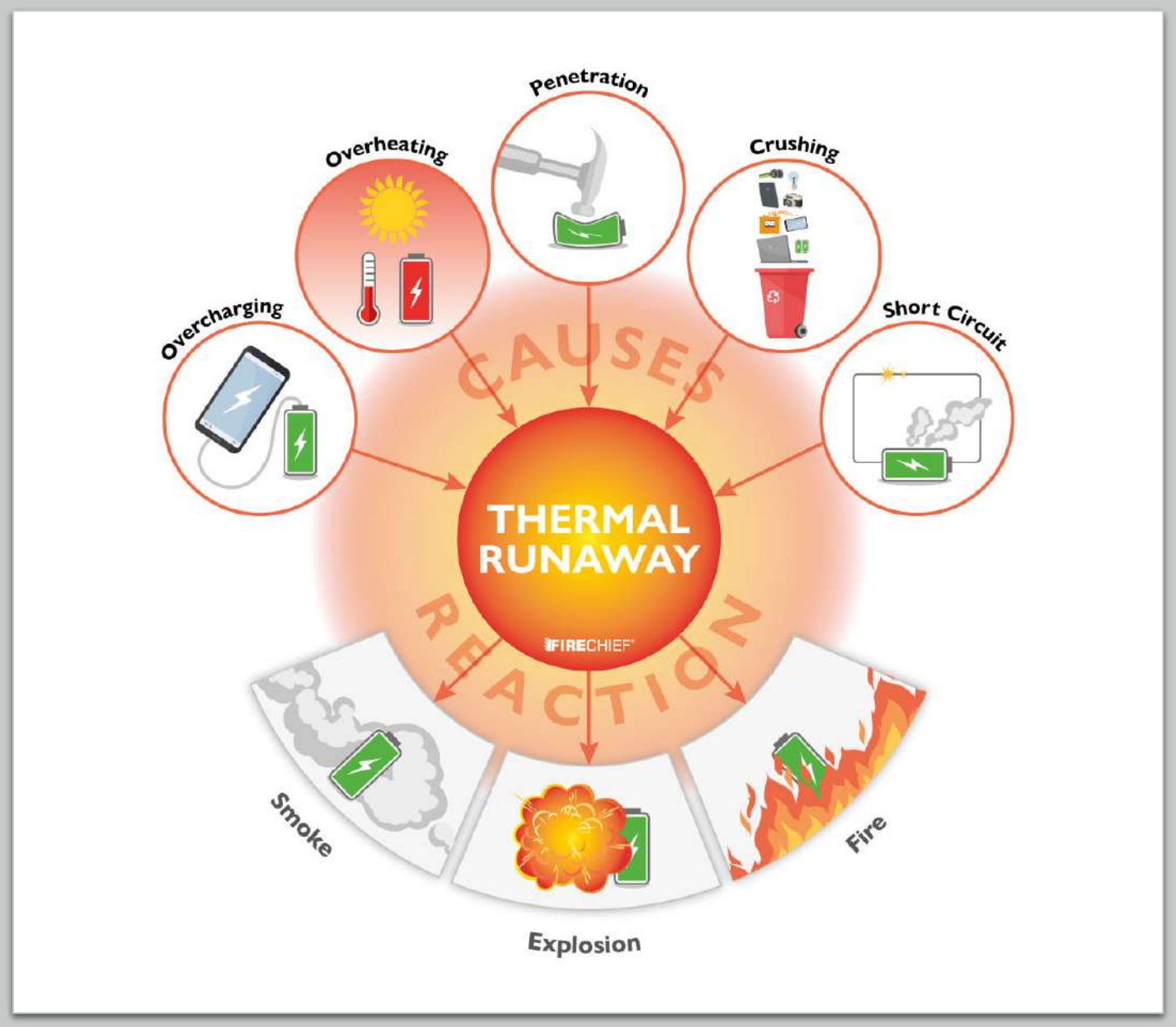
Fires: London Fire Brigade (2017-2021)

	Cigarettes	Vaping products
Ignition source	5706	15
Injuries	676	0
Fatalities	46	0

Explosions

Systematic reviews (injuries caused by explosions)

On very rare occasions, a battery in a vaping device may fail by discharging all its stored energy at once



Searches up to 2021

- 50 published studies – case reports, case series from burns and surveillance centres
- Included ~3000 cases
- Most cases involved males

Circumstances of explosion

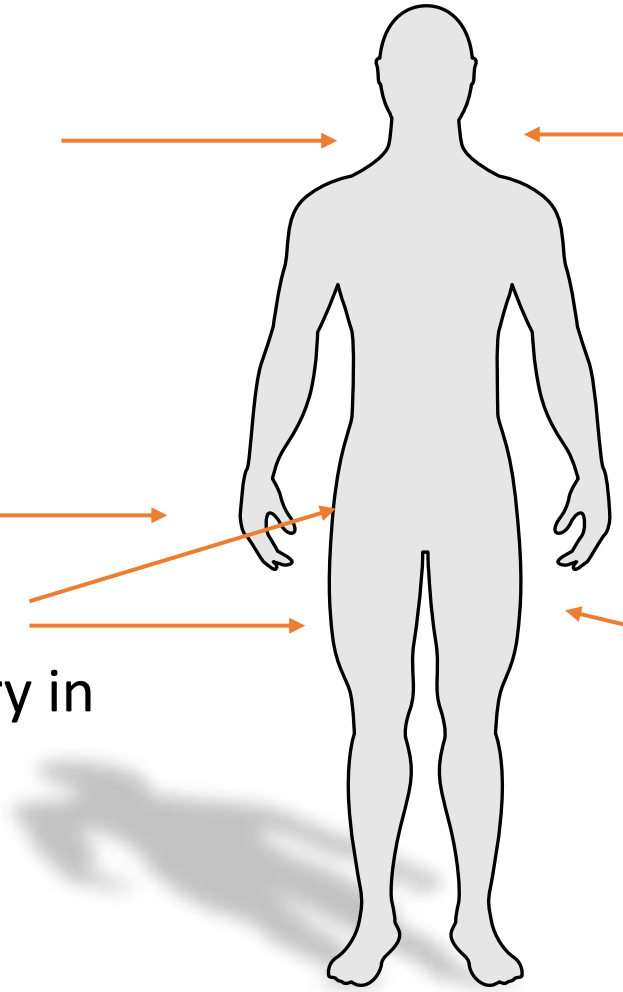
Poor reporting

Nature of injuries

Whilst inhaling

Whilst holding it

Whilst carrying vaping device or spare battery in trouser pocket



Face (teeth)

Hands

Majority to lower extremities

- Thighs
- Buttocks
- Genitalia

Satteson 2018 Hand. 13(3):NP1-NP5

Arnout 2017 Burns 43 e1-e6

1 fatality

38 year old man found dead at home with flames partially covering the room.
Vaping device (whole) in cranium, entered via philtrum region of upper lip

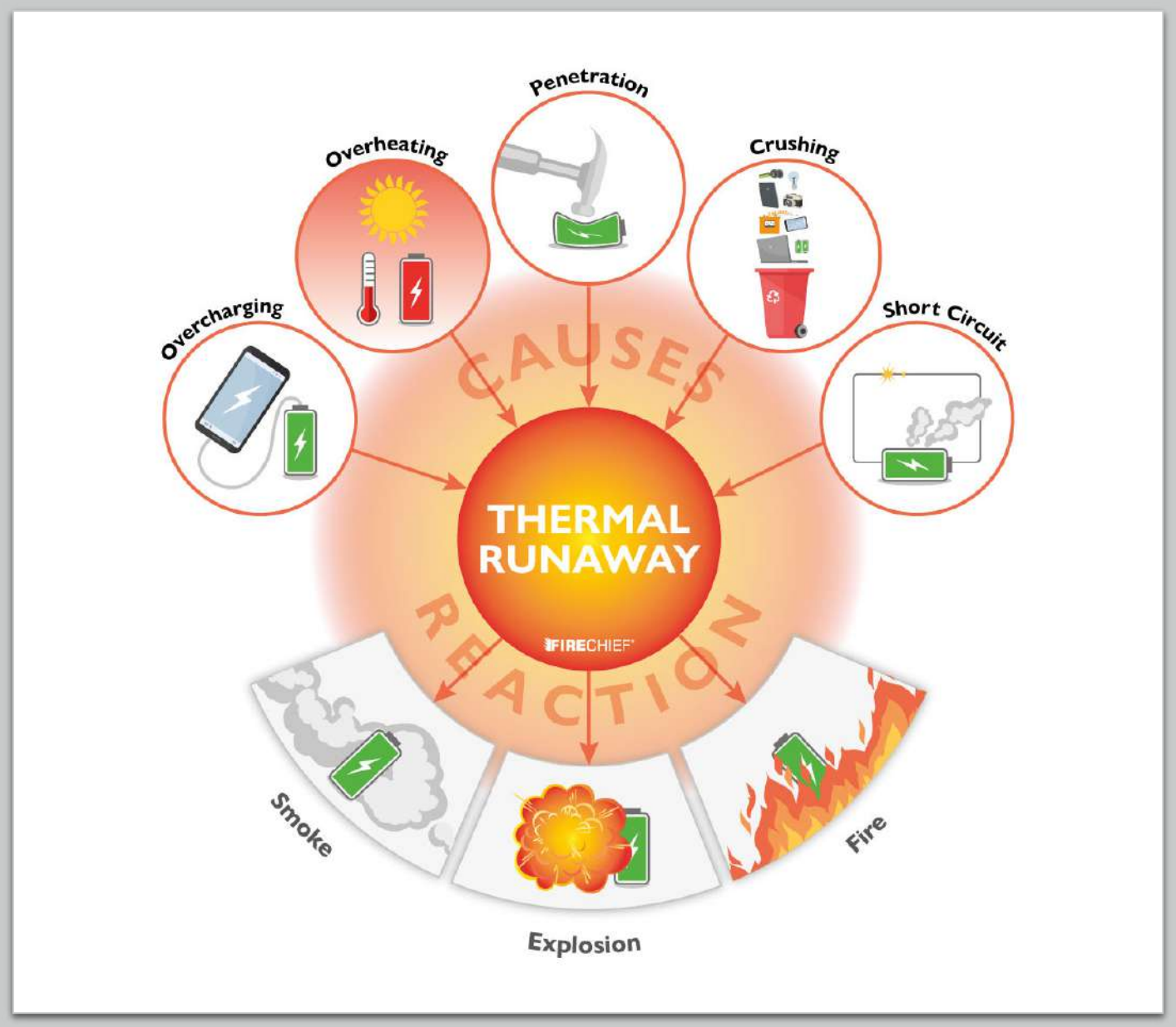
Mechanical mod device (type of device built by the user and unlike other vaping devices, do not have any inbuilt safety features)

Beining et al Forensic Sci 2020: 65: 1365-1367

Possible triggers for thermal runaway reaction

1. exothermic reaction between the lithium and moisture (such as the moist environment created by perspiration in a trouser pocket), resulting in the formation of lithium hydroxide and hydrogen

2. short-circuit by metallic objects commonly found in pockets, such as keys, causing the battery to overheat



Ho (2019) Journal of Wound Care: 28: 758-761. 38.
Dohnalek et al (2019) J of Emerg Med (57: 399-404.

Considerations for preventing explosions & minimising injuries

- Case reports often deal with rare and atypical events and can be easily over- interpreted or misinterpreted, as they often have an emotional appeal on readers
- Vast majority of vaping devices have circuitry to regulate the power and protect vapers from battery malfunctions
- Mechanical mods pose a risk to inexperienced users
- Very low risk if follow basic principals of battery safety
- Increased promotion of advice by relevant authoritative bodies & vape shops, vaping websites could be given on transportation of vaping products and batteries, to avoid thermal runaway incidents e.g. battery sleeves/containers

Key messages
Rare events
Some severe consequences
Are preventable

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