

Examination of personality types as predictors of safety attitudes/behaviours, in support of enhancing safety in healthcare: a scoping review

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Yejin Kil

*Department of Nursing and Midwifery, Education and Health Sciences,
University of Limerick, Limerick, Ireland, and
Margaret Graham and Anna V. Chatzi
University of Limerick, Limerick, Ireland*

Abstract

Purpose – Provisions for the minimisation of human error are essential through governance structures such as recruitment, human resource allocation and education/training. As predictors of safety attitudes/behaviours, employees' personality traits (e.g. conscientiousness, sensation-seeking, agreeableness, etc.) have been examined in relation to human error and safety education.

Design/methodology/approach – This review aimed to explore research activity on the safety attitudes of healthcare staff and their relationship with the different types of personalities, compared to other complex and highly regulated industries. A scoping review was conducted on five electronic databases on all industrial/work areas from 2001 to July 2023. A total of 60 studies were included in this review.

Findings – Studies were categorised as driving/traffic and industrial to draw useful comparisons between healthcare. Certain employees' personality traits were matched to positive and negative relationships with safety attitudes/behaviours. Results are proposed to be used as a baseline when conducting further relevant research in healthcare.

Research limitations/implications – Only two studies were identified in the healthcare sector.

Originality/value – The necessity for additional research in healthcare and for comparisons to other complex and highly regulated industries has been established. Safety will be enhanced through healthcare governance through personality-based recruitment, human resource allocation and education/training.

Keywords Healthcare governance, Personality traits, Safety attitudes, Safety behaviours, Human error

Paper type Literature review

1. Introduction

Approximately 1,900,000 people of the global population died from work-related diseases and injuries in 2016 (World Health Organization, 2021), leading to a burden on the healthcare system, reduced productivity, and a devastating effect on household income (World Health Organization, 2021). Studies have shown that significant social and financial costs have been incurred in work-related incidents (Hobbs, 2008; Doerr, 2020). For instance, in the United States, an estimated 1 billion dollars per week is spent on workers' compensation for occupational incidents or accidents (Doerr, 2020).



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Workplace incidents and accidents were caused by human error or unsafe behaviour (Kotzé and Steyn, 2013; Alizadeh *et al.*, 2022). In this respect, the influence of the “human factor” has been considered in work-related incidents and accidents (Kotzé and Steyn, 2013). Comprehending human factors can help organizations improve human performance, prevent workplace accidents, and mitigate the impact of human error (Arfanis *et al.*, 2011; Toppazzini and Wiener, 2017). Human error is considered as the main culprit of accidents in the workplace (Postlethwaite *et al.*, 2009). Error is in the nature of human beings (Macêdo Damascena *et al.*, 2022). It refers to an unintentional deviation from safe practice (Sameera *et al.*, 2021), resulting from human physiological and cognitive limitations (Toff, 2010).

Human factors research in aviation has grown by identifying that human error has a significant impact on the sector’s economy, health, and environment (Chatzi *et al.*, 2019). The human factor is commonly described as “the environmental, organizational and job-related factors, along with human and individual characteristics, which impact on workplace behaviour and potentially health and safety” (O’Connor and O’Dea, 2021). Other industries (e.g. construction, healthcare, metal, manufacturing, nuclear) have also recognized the importance of human factors and have conducted relevant studies to reduce and mitigate the occurrence and effects of error in the workplace (Leonard *et al.*, 2004; Flin, 2007; Arfanis *et al.*, 2011; Tao *et al.*, 2021).

Among other human factors, personality traits (conscientiousness, sensation-seeking, agreeableness, extraversion, normlessness, neuroticism, and openness) have been mostly studied (Beus *et al.*, 2015; Luo *et al.*, 2023). Considering minimisation of human error through governance structures such as recruitment, human resource allocation and education/training, employees’ personality traits have been examined as predictors of safety attitudes/behaviours. The investigation of their relationship and relevant interventions to human error and safety education could influence attitudes or even behaviours and thus improve safety of care.

Personality traits can be defined as a consistent behavioural pattern of thoughts, emotions, and behaviours that an individual has about the external environment (Ulleberg and Rundmo, 2003; Zheng *et al.*, 2019b). The examination of personality traits, being connected to safety, is an interesting field as past research has revealed relationships between personality traits and accident intervention in the workplace (Hansen, 1988; Beus *et al.*, 2015), and driving behaviour (Luo *et al.*, 2023). In particular agreeableness and conscientiousness have had a negative association with unsafe behaviours in the workplace, and extraversion and neuroticism have had a positive association with them (Beus *et al.*, 2015). Luo *et al.* (2023) found that agreeableness, conscientiousness, and openness are negatively correlated with risky and aggressive driving behaviours, whereas neuroticism is positively correlated with these behaviours. Clarke and Robertson (2005) showed a difference between occupational and non-occupational settings. While agreeableness and neuroticism were associated with accident involvement in occupational settings, conscientiousness and extraversion were associated with accident involvement in non-occupational settings (Clarke and Robertson, 2005).

Beus *et al.* (2015) identified the partial mediation of safety-related behaviours in the relationship between personality traits and accidents. The relationship between personality traits and behaviours is mediated by attitudes, for instance, proactive personality indirectly affects safety behaviour through the mediation of safety attitude (Ji *et al.*, 2019). In addition, the influence of personality traits on risky driving behaviour was mediated by attitudes toward traffic (Lucidi *et al.*, 2019a). Attitudes are commonly defined as affective, cognitive, or behavioural reactions that are favourable or unfavourable to an object (Tao *et al.*, 2021) affecting an individual’s behaviour (Lo *et al.*, 2018). Safety attitudes indicate an individual’s beliefs and emotions about safety policies, procedures, and practices, and a commitment and

responsibility towards safety (Henning *et al.*, 2009). Workers with good safety attitudes are expected to be less engaged with unsafe behaviours (Ji *et al.*, 2019).

The need to intervene in user's attitudes (e.g. driving) has been emphasized to improve their risky behaviour (Lucidi *et al.*, 2019a). However, the understanding of the impact of personality traits on an individual's safety attitude is limited, especially in healthcare. Human factors research in healthcare has been following examples and practices of other industrial fields (Leonard *et al.*, 2004; Flin, 2007). However, healthcare has its unique characteristics such as system complexities, that involve numerous components such as people, instruments, and procedures, that generate errors due to multiple factors (Sousa Santos, 2019). Currently, safety in healthcare is among its priority actions globally (Chatzi and Malliarou, 2023) and the role of safety attitudes needs to be explored further. Hence, in the remit of human factors and safety research, this review aimed to explore relevant research activity globally, with a special focus on healthcare, to identify its related activity and progress in this field.

In this study, all industries were included as the aim was to identify the relevant research activity of healthcare, in comparison to other industries globally.

2. Methods

The scoping review has been selected as the aim of the study is to comprehensively identify and compare research on the relationship between personality traits and safety attitudes/behaviours across healthcare and other industries. This method allows for systematic mapping and discussion of relevant characteristics and concepts in the literature (Munn *et al.*, 2018). This scoping review was conducted based on the methodological guidance for a scoping review by Joanna Briggs Institute Reviewer's Manual (Peters *et al.*, 2020). The protocol was developed by the research team prior to the commencement of the review.

2.1 Research question

The purpose of this review was to explore the relationship between personality traits and safety attitudes/behaviours, not excluding any field of study, with the ultimate goal of exploring healthcare's relevant exposure in relation to other fields. The research questions were constructed based on the Population, Concept, and Context (PCC) framework, which enables readers to identify the focus and context of a review (Peters *et al.*, 2020). The established review questions were as follows:

- Q1. What personality traits have a positive or negative relationship with safety attitudes/behaviours?
- Q2. Are there other identified factors that influence safety attitudes/behaviours other than personality traits?
- Q3. What has been studied on the association between personality traits and safety attitudes/behaviours, especially in the healthcare field?

2.2 Search strategy

Electronic searches were made on the following databases (APA PsycINFO, APA PsycARTICLES, CINAHL, SCOPUS, and Web of Science) due to their coverage of health, social, and behavioural sciences from 2001 to July 2023. Reference lists of the existing literature were also searched to identify additional studies that could have been missed from the database search (Table 1).

The employed key search terms were "Personality traits", "Safety attitudes", and "Safety behaviours". Synonyms and relevant words for each keyword were adopted to collect

relevant records. Boolean operators (AND/OR) were used to expand the range of retrieves (Wakefield, 2014). Truncation (*) was used to search for the singular and plural forms of each search term. Therefore, “Personality traits” was searched for using “personalit*” or “personality trait*” or “personality characteristic*” or “personality feature*” or “personality attribute*” or “personality feature*” or “personality type*” or “personality kind*” for “All fields” indexed. In addition, “Safety attitudes” and “Safety behaviours” were searched with “safety*” or “safety attitude*” or “safety behavio*” or “safety perspective*” or “safety mindset*” or “safety viewpoint*” for “All fields” indexed. Language and year of publication restrictions were not applied in the first phase of the search. As the role of personality in safe driving behaviour has been studied since the 1960s (Tao *et al.*, 2021), publications from the 1960s were also retrieved. Initially, 9,074 articles were identified. Subsequently, EndNote was utilized to remove 1,034 duplicates, and 400 additional duplicates were removed manually. One article was removed as it was retracted. The search process was conducted in July 2023. The search strategy was consulted with the assistance of the university librarian.

2.3 Evidence screening and selection

The remaining 7,640 articles were screened based on the title and abstract by the first author of this study. 7,453 articles were excluded if their title or abstract did not include key search terms, and if they addressed irrelevant research topics such as COVID-19, dietary concerns, animal, clinical diagnosis and so on. Thereafter, 187 articles were screened by the following inclusion criteria: (1) Studies that examined the relationship between personality traits and safety attitudes/behaviours (2) Studies written in English (3) Studies that were accessible in full text (4) Peer-reviewed studies were included since the validity, significance, and originality of the studies are verified by experts within the corresponding field (Kelly *et al.*, 2014) (5) Primary studies. Meanwhile, grey literature and publications that did not meet the inclusion criteria has been excluded (Table 2).

A total of 57 articles were included, and 3 additional articles were included by reference list search. One author reviewed the full text of screened articles, and two authors conducted the final selection based on full-text review. All three authors agreed to include the final 60 articles. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for the Scoping Reviews (PRISMA-ScR) checklist was utilized in the screening of relevant studies. The process is illustrated in Figure 1. The followed PRISMA-Scr and PRISMA-S reporting guidelines are included as a supplementary file titled: PRISMA-ScR Checklist and PRISMA-S Checklist correspondingly.

2.4 Data extraction

Included articles were extracted by their region of study, year of publication, study sample, study aims, and study methods. As this was a scoping review, the quality of evidence was not assessed. The extracted data was entered into a Microsoft Excel spreadsheet. Data extraction

Table 1.
Characteristics of
search databases

Database	Characteristics
APA PsycINFO	Psychology, Medicine and Nursing
APA PsycARTICLES	Psychology, Medicine and Nursing
CINAHL	Nursing and allied health database
SCOPUS	Scientific, technical, medical, social sciences and arts and humanities
Web of science	Scientific, technical, medical, social sciences and arts and humanities
Source(s): Authors work	

Inclusion criteria

- 1 Studies that examined the relationship between personality traits and safety attitudes/behaviours
- 2 Studies written in English
- 3 Studies that were accessible in full text
- 4 Peer-reviewed studies were included since the validity, significance, and originality of the studies are verified by experts within the corresponding field
- 5 Primary studies

Exclusion criteria

- 1 Grey literature
- 2 Studies not written in English
- 3 Studies that were not accessible in full text
- 4 Non Peer-reviewed studies
- 5 Non primary studies

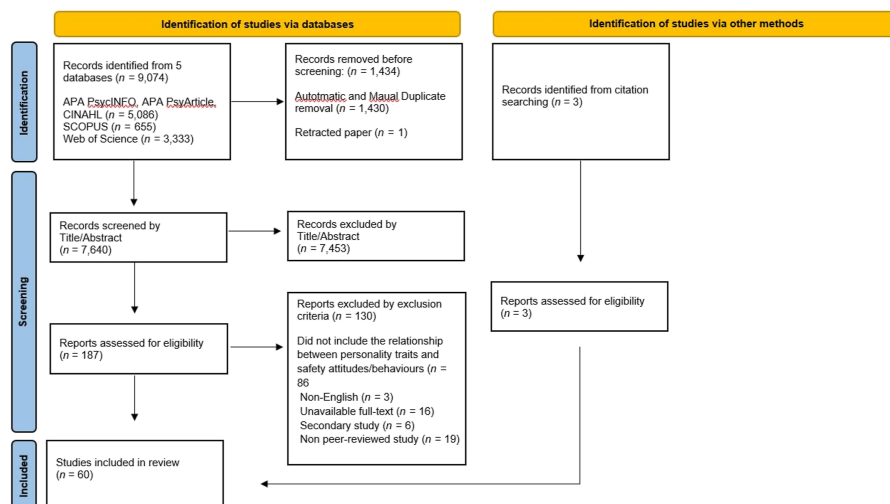
Source(s): Authors work

Table 2.
Eligibility criteria

was initially carried out by the first author and was reviewed by the other two authors. This spreadsheet is included as a [supplementary file](#) titled: *Descriptions of the included studies*.

2.5 Data synthesis

Results were synthesized based on the review questions. The full text of each article was reviewed, and then the data was extracted and subsequently categorized into the following subheadings: Correlations between personality traits and safety attitudes/behaviours, Demographic factors, Personality traits in the context of driving/traffic and workplace safety, and Studies in Healthcare. In addition, a comprehensive analysis of each personality trait was carried out with the frequency of its mention within the respective articles. Particularly, the association of personality traits on safety attitude/behaviours and identified personality traits in each article were presented in this spreadsheet is included as a [supplementary file](#) titled: Synthesis of association on the relationship between personality traits and safety attitudes/behaviours.



Source(s): Authors' work

Figure 1.
Study's PRISMA
flowchart

3. Results

The majority of studies included in this review were conducted in China ($N = 14$), followed by the United States of America ($N = 10$). Interestingly, one study was conducted in three countries at the same time (i.e. China, Japan, and Vietnam) showing different results depending on nationality (Hussain *et al.*, 2020). Similarly, one more study was carried out in Turkey and Iran (2014). Turkey is situated across Asia and Europe, with most of its landmass located in the Asian part of the country (Dewdney and Yapp, 2023). For this reason, Turkey was geographically categorized in Asia for this study.

Although the majority of studies were found to have been conducted in Asia ($N = 27$), all regions presented are research active on this topic (Table 3). The number of studies from each continent appeared consistent with their rough population distribution. From 2001 to 2023, the frequency of published papers augments with the years; most studies were published in 2020 ($N = 9$) (Table 4).

The revealed categories, depending on the context of the included 60 articles, were driving/traffic and industrial safety (Table 5). Most of the studies ($N = 37$) focused on a variety of types of road users such as car drivers and cyclists. Within this group, six studies specifically targeted occupational drivers. The remaining twenty-three articles involved a sample of workers in various industrial fields. The majority of studies were conducted on construction site workers ($N = 7$), and various other occupations were included (i.e. factory workers, flight attendants, elevator workers, metal workers, mining workers, nurses, and nuclear and/or chemical plant workers). Four studies were conducted with undergraduate/graduate students to investigate their perspectives on occupational safety. One study was conducted on various workers from various backgrounds using online methods. The size of samples in the included studies varied from 23 to 5,362.

All 60 studies used quantitative approaches for data collection. The predominant approach was a survey ($N = 58$), with four of these studies collecting data through experiments, and two studies used the crash records of participants. One study obtained data by conducting interviews and referencing participants' driving records. Another study conducted a mega-analysis using existing quantitative data. Diverse personality traits that influence individuals' safety attitudes/behaviours were identified, and the results included both positive and negative correlations. Demographic factors including age, work experience, and gender were identified to have a significant correlation with safety attitudes/behaviours. Only two studies were found in the healthcare sector (Mustika and Jackson, 2016; Lo *et al.*, 2018).

Table 3.
Regions of the studies

Continents	Country/number of studies
Asia ($N = 27$)	China ($N = 14$), China, Japan, and Vietnam ($N = 1$), Iran ($N = 2$), Oman ($N = 1$), Republic of Korea ($N = 2$), Saudi Arabia ($N = 1$), Taiwan ($N = 3$), Thailand ($N = 1$), Turkey ($N = 1$), Turkey and Iran ($N = 1$)
Africa ($N = 2$)	Ghana ($N = 1$), Nigeria ($N = 1$)
America ($N = 11$)	Argentina ($N = 1$), United States of America ($N = 10$)
Europe ($N = 13$)	Italy ($N = 6$), Lithuania ($N = 1$), Norway ($N = 2$), Poland ($N = 1$), Romania ($N = 1$), Serbia ($N = 1$), UK ($N = 1$)
Oceania ($N = 7$)	Australia ($N = 6$), New Zealand ($N = 1$)
Source(s): Authors work	

Year of publication	Number of studies
2001	(<i>N</i> = 1)
2002	(<i>N</i> = 1)
2003	(<i>N</i> = 2)
2005	(<i>N</i> = 1)
2006	(<i>N</i> = 1)
2008	(<i>N</i> = 1)
2009	(<i>N</i> = 1)
2010	(<i>N</i> = 2)
2012	(<i>N</i> = 2)
2013	(<i>N</i> = 3)
2014	(<i>N</i> = 2)
2015	(<i>N</i> = 4)
2016	(<i>N</i> = 4)
2017	(<i>N</i> = 5)
2018	(<i>N</i> = 3)
2019	(<i>N</i> = 6)
2020	(<i>N</i> = 9)
2021	(<i>N</i> = 5)
2022	(<i>N</i> = 5)
2023	(<i>N</i> = 2)

Source(s): Authors work

Table 4.
Year of publication and
article output

	Types	Number of studies
Driving/traffic safety (<i>N</i> = 37)	Drivers	(<i>N</i> = 28)
	Cyclists and motorcyclists	(<i>N</i> = 5)
	Railway Train drivers	(<i>N</i> = 2)
	All types of road-users	(<i>N</i> = 2)
Industrial safety (<i>N</i> = 23)	Construction site workers	(<i>N</i> = 7)
	Flight attendants	(<i>N</i> = 1)
	Nurses	(<i>N</i> = 1)
	Factory workers	(<i>N</i> = 1)
	Undergraduate/graduate students	(<i>N</i> = 4)
	General workers	(<i>N</i> = 1)
	Nuclear and/or chemical plant workers	(<i>N</i> = 3)
	Elevator workers	(<i>N</i> = 1)
	Managerial positions	(<i>N</i> = 2)
	Metal industrial workers	(<i>N</i> = 1)
	Mining workers	(<i>N</i> = 1)

Source(s): Authors work

Table 5.
Categories and
individual study types

3.1 Correlation between personality traits and safety attitudes/behaviours

Personality traits have been regarded as predictors of safety attitudes/behaviours with both positive and negative relationships (Chen, 2009; Nordfjærn *et al.*, 2014, 2015; Ji *et al.*, 2019). Safety behaviours are the most studied, and other safety-related factors like safety attitudes, safety climate, and risk perception have been studied together. The mediating role of safety attitudes in the relationship between personality traits and safety behaviour has been identified (Patil *et al.*, 2006; Lucidi *et al.*, 2014; Nordfjaern *et al.*, 2015; Zheng *et al.*, 2019a; Tao *et al.*, 2021, 2023). While personality traits tend to be stable and not easily malleable (Tao *et al.*, 2021), attitudes tend to be flexible to change (Lucidi *et al.*, 2014, 2019a, b; Mallia *et al.*,

2015). Thus, multiple studies suggested that it would be effective to change one's attitude rather than changing one's personality traits to enhance safety (Lucidi *et al.*, 2014; Tao *et al.*, 2021).

The included studies emphasized the effect of personality traits on safety and underlined the importance of adopting personality traits. Studies on workplace safety suggested the importance of hiring an employee who has personality traits that are positively related to safety attitudes/behaviours (Cellar *et al.*, 2001; Ucho and Gbande, 2012; Seo *et al.*, 2015; Jong-Hyun *et al.*, 2018; Hasanzadeh *et al.*, 2019; Doerr, 2020; Gao *et al.*, 2020; Rau *et al.*, 2020; Ghasemi *et al.*, 2021; Nini *et al.*, 2021; Tao *et al.*, 2021, 2023; Aroke *et al.*, 2022; Yang *et al.*, 2022; Mo *et al.*, 2023). Personality characteristics of workers can be considered when assigning tasks (Gao *et al.*, 2020; Aroke *et al.*, 2022; Yang *et al.*, 2022; Mo *et al.*, 2023). For instance, relatively complicated tasks can be delegated to workers exhibiting higher levels of agreeableness and conscientiousness, while those with greater neuroticism may be better suited for tasks of minimal risk (Mo *et al.*, 2023).

The importance of designing and developing training programs tailored to each personality characteristic was suggested (Seo *et al.*, 2015; Hasanzadeh *et al.*, 2019; Gao *et al.*, 2020; Tao *et al.*, 2021, 2023). Furthermore, adopting personality trait models could minimize unsafe behaviours or human errors (Cellar *et al.*, 2001; Ucho and Gbande, 2012; Seo *et al.*, 2015; Jong-Hyun *et al.*, 2018; Hasanzadeh *et al.*, 2019; Doerr, 2020; Gao *et al.*, 2020; Rau *et al.*, 2020; Ghasemi *et al.*, 2021; Nini *et al.*, 2021; Tao *et al.*, 2021; Aroke *et al.*, 2022).

Studies regarding driving/traffic safety showed an association between personality traits and risky behaviours. This association has been discussed by highlighting the following four practical implications: policy-making (Nordfjærn *et al.*, 2014; Al-Tit, 2020; Hussain *et al.*, 2020; Niranjani *et al.*, 2022); designing interventions (Ulleberg and Rundmo, 2003; Patil *et al.*, 2006; Chen, 2009; Wong *et al.*, 2010; Nordfjærn and Rundmo, 2013; Lucidi *et al.*, 2014, 2019a, b; Nordfjærn *et al.*, 2014; Mallia *et al.*, 2015; Herrero-Fernández *et al.*, 2016; Liu *et al.*, 2022; Niranjani *et al.*, 2022); developing educational programs for drivers or pedestrians (Machin and Sankey, 2008; Chen, 2009; Falco *et al.*, 2013; Nordfjærn and Rundmo, 2013; Yang *et al.*, 2013; Zivkovic *et al.*, 2015; Guo *et al.*, 2016; Mustika and Jackson, 2016; Tao *et al.*, 2017; Wishart *et al.*, 2017b; O'Hern *et al.*, 2020; Liu *et al.*, 2022); and recruitment (Seibokaite and Endriulaitiene, 2012; Zivkovic *et al.*, 2015; Wishart *et al.*, 2017a; Zheng *et al.*, 2019b; Niranjani *et al.*, 2022).

Seibokaite and Endriulaitiene (2012) stated that personality traits are essential in the work environment in predicting work motivation, perceived safety climate in an organization, and work performance. In particular, some studies proposed specific personality traits that should be considered for practical implications such as designing interventions to cope with emotional road-related responses and development of educational programs (e.g. for drivers), tailored to their personality traits (Ulleberg and Rundmo, 2003; Wong *et al.*, 2010; Nordfjærn and Rundmo, 2013; Nordfjærn *et al.*, 2014; Mustika and Jackson, 2016; Lucidi *et al.*, 2019b; Zheng *et al.*, 2019b; Liu *et al.*, 2022).

3.2 Demographic factors

The impact of demographic factors on safety attitudes/behaviours was also explored. Firstly, the relationship between age and safety was identified (Nordfjærn and Rundmo, 2013; O'Hern *et al.*, 2020; Tao *et al.*, 2021; Liu *et al.*, 2022). Studies on driving/traffic safety showed a positive association (Nordfjærn and Rundmo, 2013; O'Hern *et al.*, 2020; Liu *et al.*, 2022), indicating that younger people tend to pursue more risky behaviours. A negative correlation between age and human error was identified in industrial safety (Tao *et al.*, 2021).

Additionally, the impact of gender has been investigated (Nicholson *et al.*, 2005; Ucho and Gbande, 2012; Nordfjærn and Rundmo, 2013; Hussain *et al.*, 2020). Studies on road safety

suggested that males are more likely to not comply with safety regulations (Nordfjærn and Rundmo, 2013; Hussain *et al.*, 2020). In contrast, Ucho and Gbande (2012) found that male workers are more likely to comply with safety behaviours. Furthermore, the relationships between other demographic factors and safety attitudes/behaviours have been studied: Driving experience (Al Azri *et al.*, 2017; Tao *et al.*, 2017; Shen *et al.*, 2018; Liu *et al.*, 2022), educational level (Nordfjærn and Rundmo, 2013; Guo *et al.*, 2016), work experience (Tao *et al.*, 2021), and working days (Tanglai *et al.*, 2022).

3.3 Personality traits and their corresponding safety attitudes/behaviours

Included studies examined the association between a variety of personality traits and their corresponding safety attitudes/behaviours. Particularly, conscientiousness was the most cited personality trait followed by sensation-seeking, agreeableness, extraversion, normlessness, neuroticism, and openness. Such personality traits and their relationships with safety attitudes/behaviours are summarised in Figure 2.

3.3.1 Conscientiousness. Conscientiousness usually showed a positive relationship with safety attitudes/behaviours, especially in the context of industrial safety. This trait was related to a lower number of work-related accidents (Cellar *et al.*, 2001; Thoms and Venkataraman, 2002), decreased exposure to fall hazards (Hasanzadeh *et al.*, 2019), improved safety behaviour (Gao *et al.*, 2020; Rau *et al.*, 2020; Yang *et al.*, 2022), and lower unsafe behaviour intention and risk propensity (Nicholson *et al.*, 2005; Zhang *et al.*, 2020; Tao *et al.*, 2023).

A similar trend has been shown in studies of driving/traffic safety. Drivers with higher conscientiousness were related to less risky driving (Seibokaite and Endriulaitiene, 2012; Guo *et al.*, 2016; O'Hern *et al.*, 2020; Zhang *et al.*, 2020) and pedestrian (Herrero-Fernández *et al.*, 2016) behaviours. Hussain *et al.* (2020) reported positive correlations between higher conscientiousness and less commitment to violations by female drivers in Japan and Vietnam. Meanwhile, Parr *et al.* (2016) found that adolescents possessing higher levels of conscientiousness were engaged in distracted driving behaviours.

3.3.2 Sensation-seeking. Sensation-seeking has been identified in the literature with the following interchangeable terms: excitement-seeking, fun-seeking, and adventure-seeking. Interestingly, none of the studies found a positive correlation between sensation-seeking and safety attitudes/behaviours. Mustika and Jackson (2016) studied nurses in a private hospital, reporting that sensation-seeking nurses were more likely to blame external factors for unsafe behaviours. Likewise, Ucho and Gbande (2012) found negative correlations between sensation-seeking and safety behaviour compliance among factory workers. Nicholson *et al.* (2005) also suggested that sensation-seeking is related to risk-taking propensity.

Road safety-related studies have dealt more with the sensation-seeking personality and indicated that this trait was associated with risky driving behaviour (Wong *et al.*, 2010; Falco *et al.*, 2013; Nordfjærn and Rundmo, 2013; Yang *et al.*, 2013; Lucidi *et al.*, 2014, 2019a, b;

Conscientiousness	▲▼	Extraversion	▲▼
Sensation-seeking	▼	Normlessness	▼
Agreeableness	▲	Neuroticism	▼
Openness	▲▼		

▲ Positive relationship with safety ▼ Negative relationship with safety

Source(s): Authors' work

Figure 2.
Most studied
personality traits and
their relationships with
safety attitudes/
behaviours

Nordfjærn *et al.*, 2015; Wishart *et al.*, 2017a, b; Zheng *et al.*, 2019a; Al-Tit, 2020), unsafe attitudes (Chen, 2009), issues with traffic safety (Ulleberg and Rundmo, 2003; Machin and Sankey, 2008; Mallia *et al.*, 2015), speeding (Machin and Sankey, 2008), and accident involvement (Yang *et al.*, 2013).

3.3.3 Extraversion. Extraversion was found to exhibit both positive and negative correlations with safety attitudes/behaviours. Regarding workplace safety, extraversion was negatively associated with workers' safety attitudes/behaviours. Specifically, extrovert construction workers were associated with fall hazards, unsafe behavioural intentions, and risk (Hasanzadeh *et al.*, 2019; Zhang *et al.*, 2020). That is, workers with greater extraversion were more likely to have unsafe behaviours (Thoms and Venkataraman, 2002; Nicholson *et al.*, 2005; Ucho and Gbande, 2012; Gao *et al.*, 2020).

Studies on road safety have also shown that extraversion is related to risky driving behaviour (Zivkovic *et al.*, 2015; Niranjana *et al.*, 2022). In contrast, a positive relationship between extraversion and safety, such as less accident involvement, less risky driving, and positive driver behaviour was also reported (Seibokaite and Endriulaitiene, 2012; Guo *et al.*, 2016; Shen *et al.*, 2018).

3.3.4 Agreeableness. None of the studies identified a negative relationship between agreeableness and safety attitudes/behaviours. Workers possessing greater agreeableness were likely to engage in safety behaviours (Gao *et al.*, 2020; Rau *et al.*, 2020; Nini *et al.*, 2021; Tao *et al.*, 2021, 2023; Yang *et al.*, 2022), lower number of accidents (Cellar *et al.*, 2001), and less risk-taking propensity (Nicholson *et al.*, 2005). Particularly, medical students with higher agreeableness were likely to have positive attitudes towards avoiding medical errors (Lo *et al.*, 2018). Moreover, this trait has been linked with less risky driving behaviours and less commitment towards violations (Seibokaite and Endriulaitiene, 2012; Guo *et al.*, 2016; Shen *et al.*, 2018; Hussain *et al.*, 2020; O'Hern *et al.*, 2020). Likewise, Parr *et al.* (2016) suggested that lower levels of agreeableness are engaged in distracted driving behaviours.

3.3.5 Normlessness. Normlessness was mostly investigated for road users in various traffic environments, and a negative correlation has been highlighted. Lucidi *et al.* (2010) stated that normlessness is an outstanding personality trait among drivers in the high-risk group. Mallia *et al.* (2015) suggested that normlessness is systematically related to drivers' attitudes towards traffic safety. Additionally, a negative association with drivers' risky behaviours was also found (Chen, 2009; Falco *et al.*, 2013; Nordfjærn and Rundmo, 2013; Yang *et al.*, 2013; Nordfjærn *et al.*, 2014, 2015; Zheng *et al.*, 2019a, b; Al-Tit, 2020; Tanglai *et al.*, 2022). Meanwhile, no studies were conducted on this trait concerning occupational safety.

3.3.6 Neuroticism. Neuroticism had a negative correlation with safety behaviours (Gao *et al.*, 2020; Yang *et al.*, 2022; Tao *et al.*, 2023), risk-taking propensity (Nicholson *et al.*, 2005), and human error (Tao *et al.*, 2021) from the perspective of industrial safety. Likewise, this trait has been negatively correlated with safe driving behaviours (Seibokaite and Endriulaitiene, 2012; Tao *et al.*, 2017; Shen *et al.*, 2018; Liu *et al.*, 2022; Niranjana *et al.*, 2022). Hussain *et al.* (2020) found a positive relationship between this trait and slips among Japanese drivers and a negative relationship among Chinese drivers.

3.3.7 Openness. Openness has primarily been examined in relation to industrial safety. Whereas the relationship between safety attitudes (Anastasiei *et al.*, 2020), safety behaviours (Tao *et al.*, 2023), and higher attention to hazards (Hasanzadeh *et al.*, 2019) were identified, Nicholson *et al.* (2005) and Zhang *et al.* (2020) found that openness is related to risk-taking propensity. In addition, there was a positive correlation between safe driving behaviour (Shen *et al.*, 2018) and distracted driving behaviour (Parr *et al.*, 2016), respectively.

3.3.8 Proactive. Proactive personality was identified in workplace safety (Ji *et al.*, 2019; Mo *et al.*, 2023). Ji *et al.* (2019) described that a proactive personality indirectly affects flight

attendants' safety behaviours through a safety attitude. Therefore, flight attendants possessing strong safety attitudes tend to be aware of the risks of the flight environment. [Mo et al. \(2023\)](#) also found a positive association between proactive personality and safety behaviour.

3.3.9 Other personality traits. The following personality traits were also identified: Anxiety ([Ulleberg and Rundmo, 2003](#); [Chen, 2009](#); [Lucidi et al., 2010, 2014, 2019a, b](#); [Nordfjærn and Rundmo, 2013](#); [Al Azri et al., 2017](#); [Al-Tit, 2020](#); [Rau et al., 2020](#)), Altruism ([Ulleberg and Rundmo, 2003](#); [Machin and Sankey, 2008](#); [Lucidi et al., 2010, 2019a, b](#); [Yang et al., 2013](#); [Mallia et al., 2015](#); [Zheng et al., 2019a](#); [Al-Tit, 2020](#)), Anger ([Chen, 2009](#); [Lucidi et al., 2010, 2019b](#); [Yang et al., 2013](#); [Zheng et al., 2019a, b](#); [Tanglai et al., 2022](#)), Aggressive ([Al-Tit, 2020](#)), Empathy ([Owsley et al., 2003](#); [Landay et al., 2020](#); [Baran et al., 2021](#)), Impulsiveness ([Owsley et al., 2003](#); [Herrero-Fernández et al., 2016](#); [Zheng et al., 2019b](#); [Baran et al., 2021](#)), Hostility ([Lucidi et al., 2014, 2019a, b](#)), Thrill ([Wishart et al., 2017a, b](#)), Proactive personality ([Ji et al., 2019](#); [Mo et al., 2023](#)), Guilt-prone ([Landay et al., 2020](#)), Exhibitionistic ([Landay et al., 2020](#)), Venturesome ([Owsley et al., 2003](#)), Psychoticism ([Tao et al., 2017](#)), Lie ([Tao et al., 2017](#)), Amiability ([Wong et al., 2010](#)), Impatience ([Wong et al., 2010](#)), and Likeability ([Zivkovic et al., 2015](#)).

The remaining traits were studied in the context of road safety, showing significant positive and negative associations with safety attitudes/behaviours. Some studies have not specified the types of traits despite the indirect or direct impact of personality traits on safety attitudes/behaviours ([Seo et al., 2015](#); [Jong-Hyun et al., 2018](#); [Ghasemi et al., 2021](#); [Hasaninasab et al., 2021](#)).

3.4 Studies in healthcare

Two studies were conducted in the healthcare sector on the relationship between personality traits and safety attitudes/behaviours ([Mustika and Jackson, 2016](#); [Lo et al., 2018](#)). [Lo et al. \(2018\)](#) conducted a study on medical students with internship experience. They found significant relationships between two personality traits (i.e. agreeableness and conscientiousness) and medical students' attitudes towards medical errors. Students with higher agreeableness were likely to have positive attitudes towards dealing with medical errors. In addition, students with higher conscientiousness tended to be confident in avoiding errors and were reluctant to disclose their errors. Furthermore, [Mustika and Jackson \(2016\)](#) focused on qualified nurses who worked in private hospitals. In this study, the nurses' personality traits (i.e. openness and sensation-seeking) and risk-taking propensity were examined. They suggested that nurses with a higher level of sensation-seeking and reward-oriented risk-taking tendencies are likely to blame external factors to justify their risk-taking behaviours. The identified personality traits in healthcare and their relationships with safety attitudes/behaviours are presented in [Figure 3](#).

Participants	Medical Students	Nurses
Personality Traits	Agreeableness ▲	Sensation-seeking ▼
	Conscientiousness ▲	

▲ Positive relationship with safety ▼ Negative relationship with safety

Source(s): Authors' work

Figure 3.
Safety in healthcare

4. Discussion

In this study, available evidence on the relationship between personality traits and safety attitudes/behaviours has been examined. A scoping review of the literature, without excluding any field of practice/industry, enabled the exploration of healthcare's relevant exposure concerning the other fields of practice/industry.

Researchers have been investigating this topic from the early 2000s until today, on various samples and geographical regions. If we combine industrial and driving/traffic safety as having similar results, the results of the relationship between personality traits and safety were consistent regardless of the studies' dates, samples' characteristics, and/or geography. However, when treating industrial and driving/traffic safety as different, their qualitative characteristics highlight their different nature. In principle, healthcare would be closer to the industrial safety, and especially to areas that require teamwork, working in shifts, with highly qualified specialised personnel working within critical and highly complex environments. By exploring healthcare further, in comparison to other, relevant industries, it would augment our understanding in healthcare professionals' safety behaviours/attitudes. Safety attitudes have been studied along with safety behaviours. Attitude denotes a persistent tendency towards favouring or disfavouring certain behaviours (Wong *et al.*, 2010). Although risky attitudes could lead to risky behaviours (Lucidi *et al.*, 2019b; Zhang *et al.*, 2020; Tao *et al.*, 2021), Ulleberg and Rundmo (2003) suggest that attitudes cannot necessarily predict future behaviour. An individual's risky attitude exerts an influence on the assessment of whether they opt to engage in risk (Zhang *et al.*, 2020). Thus, safety attitudes can be considered a predisposition to safety behaviours.

Despite the difference in the meaning of safety attitudes and safety behaviours, the two terms have been used interchangeably in some studies (Thoms and Venkataraman, 2002; Zivkovic *et al.*, 2015; Guo *et al.*, 2016; Al Azri *et al.*, 2017; Landay *et al.*, 2020; Baran *et al.*, 2021). Henning *et al.* (2009) pointed out that safety attitudes have been mistakenly addressed with a definition of safety climate or an indicator of safety climate. Likewise, Ucho and Gbande (2012) stated that safety attitude involves assessing thoughts and evaluations related to an individual's behaviours that could affect others' well-being rather than an individual's feelings about a specific job aspect. Hence, it is important to investigate safety attitudes as a single factor influencing employees' behaviours to promote organizational safety.

Empirical evidence has demonstrated certain personality traits to be associated with safety evaluation factors. Individuals with certain personality traits are more likely to engage in risky behaviours. In other words, these associations can be considered for proper recruitment, proper human resource allocation, and minimization of human error (Cellar *et al.*, 2001; Ucho and Gbande, 2012; Hasanzadeh *et al.*, 2019; Gao *et al.*, 2020; Rau *et al.*, 2020; Nini *et al.*, 2021; Tao *et al.*, 2021; Aroke *et al.*, 2022).

Most studies have covered common personality traits such as agreeableness and conscientiousness. However, there were differences in personality traits measured by industrial and driving/traffic safety. For instance, normlessness has not been measured in the context of industrial safety, and proactive personality has not been evaluated in road safety. In healthcare the only investigated personality traits, from only two studies, are agreeableness, conscientiousness, openness and sensation-seeking. Therefore, it is suggested that an assessment tool tailored to each category should be adopted.

Age (Nordfjærn and Rundmo, 2013; Tao *et al.*, 2021; Liu *et al.*, 2022), gender (Ucho and Gbande, 2012; Nordfjærn and Rundmo, 2013; Hussain *et al.*, 2020), and other demographic factors were significantly correlated with safety attitudes/behaviours in existing studies. Given their significance on safety, demographic factors should be widely considered in future studies.

The results from the healthcare sector have shown some types of personality traits are appropriate for maintaining safety in healthcare settings. [Lo et al. \(2018\)](#) have described the positive relationship between the levels of conscientiousness and agreeableness among medical students and their approach to medical errors. [Mustika and Jackson \(2016\)](#) have reported a correlation between the level of sensation-seeking and the justification of risk-taking behaviour among nurses.

Based on these findings, recruiting individuals with higher conscientiousness and agreeableness, and lower sensation-seeking traits can be reckoned to enhance safety work practice within healthcare ([Lo et al., 2018](#)). However, the scarcity of the identification of more personality traits among healthcare employees and their correlation to safety attitudes/behaviours, safety education etc. has underscored the imperative need for further research.

4.1 Strengths and limitations

This scoping review provides a comprehensive exploration of the literature that demonstrated the correlation between personality traits and safety attitudes/behaviours. However, there are some limitations. The methodological quality of the literature was not assessed, which could have affected the validity of the results obtained. Furthermore, as the search range was limited to English-language publications, relevant studies published in other languages were excluded. As the grey literature was not included, publications from various industries and organizations may have been missed. Furthermore, there was a lack of research addressing safety attitudes as a single factor.

5. Conclusion

Positive and negative correlations between certain personality traits and workplace and/or road safety were revealed. The main identified issues were:

- (1) The two terms (attitudes/behaviours) were inconsistently used by some studies and
- (2) Inconclusive results were reported for some personality traits regarding their safety attitudes/behaviours

These issues are believed to have impeded the accurate generalization of relevant results to all the fields of practice/industry. For this reason, further targeted research would benefit from the exploration of the relationship between the personality characteristics and the two distinct variables (attitude and behaviour). Of these two, attitude is the trait that is proposed to be more focused on as it has the potential to alter, e.g. through education, to enhance safety. Healthcare should keep up with other highly regulated industry's example and benefit from these recommendations.

The findings of this review illustrated limited evidence of the relationship between personality traits and safety attitudes/behaviours globally, with healthcare having had very limited research output, when compared to other highly complex and regulated industries.

Patient safety is an area that has been highlighted as an area needing immediate attention and action globally. By understanding the relationship between healthcare practitioners' personality types and their safety attitudes/behaviours, this knowledge could be used in making care safer by affecting their attitudes/behaviours through education/training or other healthcare governance structures (recruitment, human resource allocation). Healthcare needs to be investigated further, in comparison to other relevant industries, as healthcare governance structures (education, training, resource allocation, processes etc.) could be developed/updated towards safe patient care.

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Supplementary material

The supplementary material for this article can be found online.

Corresponding author

Anna V. Chatzi can be contacted at: anna.chatzi@ul.ie

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