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Signs of safety: An investigation of how OHS professionals interpret injury metrics

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ABSTRACT

Introduction: Injury metrics are traditional indicators of safety performance widely used by organizations, industry bodies, and regulatory agencies. In this paper we contend that they are semiotic signs leading to a variety of interpretations beyond their traditionally held meaning as a representation of an organization's safety performance. We argue that injury metrics are semiotic signs where different organizational uses and signals lead to a variety of interpretations amongst internal and external stakeholders. *Method:* This exploratory study reveals these different uses and meanings through semi-structured interviews with 20 experienced occupational health and safety professionals from around the world. Through the uses of injury metrics that they described, we identified 17 separate and distinct meanings that signify four different objects of the injury metric, namely management control, image management, risk measurement, and trust in leadership. *Results:* The findings demonstrate that the meaning of injury metrics is not singular but is contingent and contextually determined. With multiple meanings, a decreasing injury metric is not necessarily a sign of improving safety. It is suggested that injury metrics may support 'safety work' by OHS professionals and that they may have unintended consequences that are antithetical to safety in the workplace. *Practical applications:* Given the role of injury metrics in indicating the safety of an organization, these findings have practical implications for the reliance placed on them and the inferred meanings.

1. Introduction

Indicators are integral to the performance management systems of an organization. They highlight specific aspects of the organizational system (Dahler-Larsen, 2014), providing information to decision-makers both within and beyond the organization (Reiman & Pietikäinen, 2012) that shapes the discourse between these actors and drives action in particular directions. Indicators of safety performance are one example, which according to the OECD (2008, p.5) are 'observable measures that provide insights into a concept (i.e. safety) that is difficult to measure directly.' This definition raises questions concerning the nature and consistency of the insights and interpretations these indicators provide, especially if the measures are indirect. Since there appears to be no research that considers the variety of interpretations attributable to safety performance indicators, this paper provides a first empirical investigation of these interpretations.

1.1. Safety performance indicators

Injury metrics are the cornerstone of occupational health and safety (OHS) reporting that are used by both internal and external stakeholders to evaluate the performance of an organization's safety program (Bottomley, 2002). Traditional safety performance measures focus on injury or fatality rates (Erkal et al., 2023) and are reactive or lagging measures (Øien, et al., 2011) that monitor whether performance goals or outcomes have been achieved (Tang et al., 2018). Characteristically, they capture the frequency and severity of different categories of injury and illness, normalizing the number of injury incidents to the hours worked. Two of the most common measures are the Total Recordable Injury Rates (TRIR) and the Lost Time Injury Frequency Rates (LTIFR) (Swuste et al., 2016). With history dating back to 1916 (Geddert, 2025; BLS, 2012), injury metrics have become the *de facto* global indicator for OHS, ostensibly providing an empirical representation of the safety of an organization (Bowers, 2021). This supports a conventional view of

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safety in organizations, namely that it is improved by preventing as few things as possible from going wrong (Hollnagel, 2014). However, they are applied in other ways too, including in vendor selection processes (Abdul Razak, 2020), individual and firm performance evaluations (Love & Teo, 2017; Lingard, et al., 2013) and sector benchmarking (Venkataraman, 2008). Also, they are used increasingly in environmental, social and governance (ESG) reporting by large corporations to attract investment and satisfy shareholders (Bowers, 2021).

While injury metrics are easy to collect, calculate, comprehend, and compare (Oswald et al., 2018), and consequently are woven into the fabric of OHS practices and safety management systems within organizations across the world, they are not without their limitations. Several academic critiques have been levelled against them focusing on their validity as an accurate measure of safety (Hallowell et al., 2021), their retrospective focus (Lingard et al., 2017), the fact that they measure the absence of safety not its presence (Dekker, 2017) and are not an accurate predictor of future events (Sinelnikov et al., 2015). They are often under-reported (Probst et al., 2008; Rosenman et al., 2006) particularly when performance, as indicated by changes in the measure is incentivized (Bitar et al., 2022). Moreover, they can be easily manipulated (Xu et al., 2021). Some argue that they are a poor representation of serious incidents and fatalities (Martin & Black, 2015), because all injuries are treated as numerically equal, even though severities may differ (Hallowell et al., 2019). This raises an ethical issue of whether the concern is for the number or for the person(s) who has been harmed, particularly if the metrics are targets and these are incentivized (Bitar et al., 2022). There are also statistical limitations. The metrics track high frequency low impact events (Hopkins, 2009) and according to Hallowell et al. (2021) their measurement is statistically insignificant to provide any meaningful or reliable insight. Furthermore, by reducing a complex phenomenon like safety to a single number, they can provide a false sense of assurance to leaders diverting their attention from significant risks (Krause & Bell, 2015). A final difficulty draws on the Regulator Paradox (Weinberg, 1979), where an indicator that is used to measure and guide improvement is also targeted for reduction. With every performance improvement, the variability that directs positive change is reduced, making it more difficult to direct further change, as noted by Amalberti (2001) for safety systems.

As a remedy to these limitations of injury metrics, leading metrics are now often proposed. They focus on events that precede an incident by measuring preventative safety activities and conditions (Lingard, Hallowell, Salas, & Pirzadeh, 2017). Rather than measure outcomes, they provide an indication of weaknesses in the system (Swuste et al., 2016; Grabowski et al., 2007). Despite their promise, however, a recent review of the literature (Bayramova et al., 2024), concludes that leading indicators are inconsistently defined and characterized and, like the aforementioned lagging indicators, may also serve multiple functions.

While lagging and leading indicators are necessary for managing safety, the existing research on different types of OHS metrics broadly focuses on their empiricism and validity rather than on their different uses within organizations. As an exception to this broad focus, Hayes et al. (2023) in their study of safety metrics as boundary objects, note that the meaning attributed to these indicators is sometimes controversial and contested, suggesting that they are interpreted differently by different stakeholders, and serve different purposes within organizations.

1.2. Users of safety metrics – Safety professionals

Although there is limited empirical evidence into the specific practices and role of OHS practitioners in organizations (Provan et al., 2017), what is clear is that they have very varied backgrounds in terms of education and experience (Carroll et al., 2022; Swuste et al., 2014) and perform a wide range of duties that are heavily dependent on the particular context in which they work (Guennoc et al., 2019). Moreover, it is likely that injury metrics will have particular salience for these safety-oriented professionals.

Two longitudinal studies in large organizations in France (Guennoc et al., 2019; Daudigeos, 2013) demonstrate that OHS practitioners need to be relational, working with and through others both inside and outside of the organization. In part this is because sitting outside of the organizational hierarchy they typically lack any formal authority. Daudigeos (2013) argues that to achieve their goals, OHS practitioners are obliged to use unobtrusive influence tactics such as framing safety issues adaptively and using organizational processes and programs instrumentally. We suggest that these may require the use of injury metrics in different ways that permit different interpretations to achieve desired outcomes.

An ethnographic study of 12 OHS practitioners (Provan et al., 2019) indicated how they: (a) worked with line managers to demonstrate the importance of safety to senior management and regulators, (b) promoted the importance of safety to ensure commitment, (c) developed administrative processes to monitor safety performances to indicate compliance, and (d) engaged in technical activities to improve the safety of operational work. While it is likely that these four different types of activities of OHS practitioners each make use of injury metrics to assure others both within and beyond the organization that safety in the workplace is satisfactory, it is unclear how these metrics are used and the meanings that they and others attach to them. Following the previously noted observations from Hayes et al. (2023) these may be different.

1.3. Interpreting injury metrics – semiotics

Semiotics is “the study of the social production of meaning through signs” (Scollon & Wong Scollon, 2003, p. 15). It examines how meaning is created, represented, communicated and interpreted through signs (Peirce, 1898). A sign is anything that conveys meaning to someone whether intentional or not. This includes natural and artificial signs, such as words, images, sounds and numbers (Curtis & Curtis, 2011). Peirce established three types of a sign: an icon, an index, or a symbol. An icon has a physical resemblance to the signified, the thing being represented (i.e., a photograph resembles whatever it depicts). An index shows evidence of what is being represented, and there is a real, observable link between the sign and its object. For example, smoke indicates fire, and a speedometer indicates vehicle speed. Conversely, with symbols there is no resemblance between the signifier and the signified. It is conditional and is socially learnt (e.g., language, numbers, and traffic lights). Similarly, a performance metric is another example of a sign that, in its conventional meaning, is used to measure, monitor and forecast a specific condition (Solomon & Tătărâm, 1998). The philosopher CS Peirce developed a form of semiotics where the meaning of a sign is not fixed to its conventional meaning, but contingent and dependent on a consideration of the whole situation, notably its use (Lorino, 2014). For Peirce, signs are central to all human inquiry where meaning and the truth of signs can only be judged in terms of the consequences they make to action. Peircean semiotics is situated, dialogical, and interpreted through mediation and inquiry (Houser, 2010). It extends the boundaries of what a sign represents, notably its intended and conventional meaning, so that the interpretation includes a consideration of the broader cultural, temporal and social context in which the sign is situated and its social consequences (Nöth, 2011). Thus, the meaning of an injury metric is not deterministic and thus solely limited to represent the level of harm within an organization, but has multiple meanings related to the social context of its use. Semiotics changes the focus from what a sign is intended to represent and broadens the focus to consider the use and surrounding context. We believe this notion of the sign as a dynamic process rather than fixed meaning is a potentially useful foundation to elicit a greater understanding of the use of injury metrics and their effects.

The triadic model of a sign is central to Peircean semiotics and consists of the object, the representamen, and the interpretant. The

object is the subject matter being represented and communicated by the sign (i.e., what the sign refers to). This could be a physical or an abstract concept, for example, a red traffic light represents a requirement to stop, a wedding ring signifies marriage, and falling leaves are a sign of autumn. The representamen is the physical form a sign takes and how a concept is represented, such as using a visual, audible, numerical, or linguistic medium. The representamen are those critical elements of the sign that are essential for its functioning as a sign. The interpretant is the mental conception and understanding of a sign's meaning. In other words, how a sign is understood, and the meaning an individual assigns to it in response to its use and their knowledge, experience, and cultural context. This is demonstrated in Fig. 1, where in the conventional interpretation of the injury metric, the object is the safety performance of the organization referred to by the representamen (i.e. the metric) and the interpretant is the meaning assigned to the indicator.

Another feature of Peircean semiotics is how an interpretation of one sign can establish another sign, creating a semiotic chain in a process called semiosis. For example, an increase in the number of injuries could be interpreted as an increase in risk, which may be further interpreted as a sign about safety leadership or a change in the safety climate. This explains why a sign can trigger a stream of connotations that the semiotician Eco (1976) referred to as 'unlimited semiosis.'

Peirce distinguishes our response to signs into three dimensions: the emotional interpretant, the feelings and emotions produced by it; the energetic interpretant, relating to actions or events; and the logical interpretant, referring to thought and deeper understanding (Atkins, 2023). These three dimensions provide greater nuance when examining the understanding of signs and their effect. For example, an increase in the frequency of occupational incidents (the sign) might evoke a logical understanding of a cause of the rise (logical), a sense of unease amongst managers (emotional), and requirement for corrective action (energetic).

A sign can be understood in different ways dependent upon an individual's understanding of the relationship between representamen and object, and its consequences for them. This means that a sign is not static but dynamic and both shapes and is shaped by its user. Analyzing injury metrics through semiotics reveals their sociocultural operation. For example, an injury metric can simultaneously be interpreted as a representation of injuries (its conventional meaning as defined by norms, rules, etc.) and a situated interpretation that is socially constructed based on its use, such as the inclusion of the metric within contract tendering criteria as a measure of an organization's capability. Lorino (2018; 2011) demonstrated how the meaning of injury metrics within a construction organization were understood very differently according to their conventional and contextual meaning. Through a conventional interpretation of the metric, construction site managers were evaluated for the rate of injuries on their sites, but when the contribution of design in the cause of accidents was considered, the understanding of causation and what the metric represented was significantly modified. This led to a very different organizational understanding and consequences for the individuals held accountable for it. Because of its grounding in the philosophy of pragmatism, where concepts, meaning, belief and truth are viewed in terms of their practical consequences, the value of semiotics lies in its ability to reveal the different uses of a metrics and the meanings assigned to them.

1.4. Study objective

The foregoing brief review of the pertinent literature indicates that despite their several limitations, injury metrics continue to be widely used in organizations globally to represent safety performance. Nevertheless, it remains unclear how else injury metrics are used within organizations and the different meanings they have that may be inferred from these other uses. This suggests the need to adopt an emic approach to this study rather than the more conventional etic approaches (Morris et al., 1999) used in previous investigations of injury metrics. OHS professionals are a principal group of organizational actors who can shed light on these different uses and meanings, given their likely use of injury metrics in their role, however their experiences have not been investigated. Semiotics offers a novel lens with which to examine injury metrics providing greater insight into the practical uses of the indicator (i.e., the representamen) and the corresponding meanings (i.e., interpretant). Our objective is to identify the different uses made of injury metrics in organizations and the different meanings that may be attributed to them. This was achieved by interviews with OHS professionals discussing the use of metrics within their organizations and how interpretation was shaped by application. By adopting an emic rather than an etic approach, the study contributes to the literature by broadening the understanding of injury metrics beyond their empiricism and validity to consider how they function as signs through

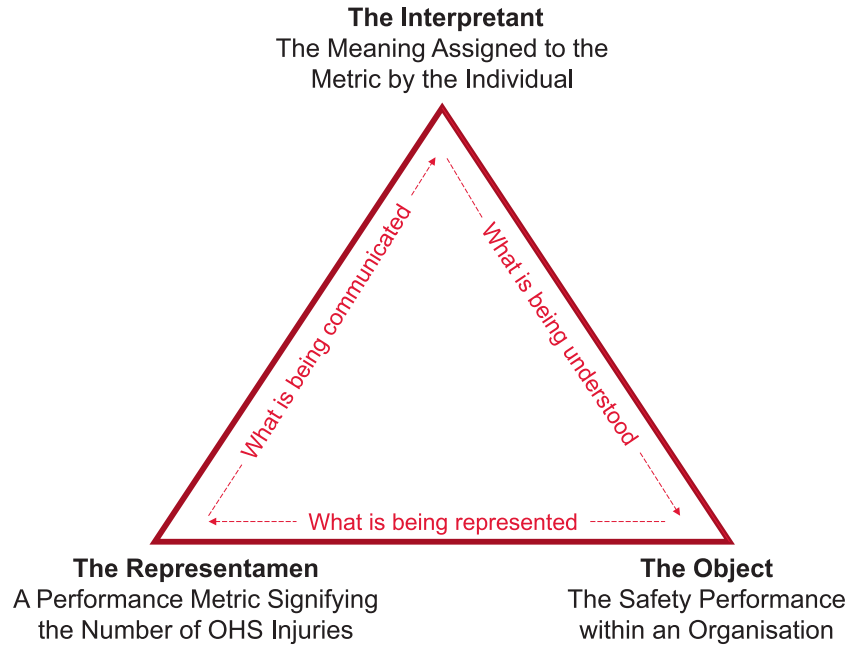

Fig. 1. The Injury Metric as a Semiotic Sign.

identification of the meanings they signify. Practically, this enables a more critical perspective on the ways injury metrics are used by organizations.

The following research questions are relevant in the light of this objective:

1. What uses of injury metrics within organizations are reported by OHS professionals?

2. What meanings may be attributed to the different uses of injury metrics?

The remainder of the paper comprises of four sections. First, the methodology describes the research design and approach to data collection and analysis. This is followed by the results, which report the different uses of the metric and the meanings attributed to them. The findings answer the first research question. The discussion considers the aggregate meanings and implications. This answers the second research question. This discussion also draws out some of the practical implications of the findings. Limitations and suggestions for future research are presented, ending with the conclusions, which indicate our contribution to the literature.

2. Methods

2.1. Research design

A qualitative methodology was selected because it is more suitable for the exploratory nature of this research, where there is a scarcity of extant empirical studies of the topic (Silverman, 2006). Thematic analysis (Braun & Clarke, 2006) provides a rigorous and systematic method for deriving meaning inductively from interview transcripts.

The study focused on two performance measures that are most commonly used in OHS practice, the Total Recordable Incident Frequency Rate (TRIFR) and the Lost Time Incident Frequency Rate (LTIFR). Collectively, these are referred to as injury metrics that lag an incident (Lingard, Hallowell, Salas, & Pirzadeh, 2017). Lagging, rather than leading, indicators were selected for this study because lagging indicators are interwoven widely into the fabric of OHS practices and organizations report regularly upon them externally. Most ESG reporting frameworks stipulate lagging metrics as the required performance measures for safety.

The basis of the research was 20 semi-structured interviews with experienced OHS practitioners, a number consistent with the norm for expert interviews in wider organization and workplace research (Saunders & Townsend, 2016). The interviews were transcribed and thematically analyzed. Thematic analysis is regarded as particularly suitable for analyzing underexplored research areas in which pre-established knowledge is scarce or unavailable (Castleberry & Nolen, 2018). An approach to thematic analysis proposed by Gioia et al. (2013) was used to elicit meanings of the injury metric inductively from the data. The method enables themes to be identified and theory to be built from qualitive data in a structured, rigorous and incremental way (Lima, Brochado, & Marques, 2021; Petit & Lux, 2020). The output of the analysis was a detailed and data-driven conceptual framework formed of first-order concepts, second-order themes, and aggregate dimensions. By interpreting the data within its conceptual framework, we provide an understanding of the use and meaning of injury metrics as semiotic objects.

In accordance with standard ethical procedures, the research design was approved by the university ethics committee (ref: CURES/15214/2022) prior to commencing the study.

2.2. Participants

The study cohort involved 20 experienced OHS practitioners that were leading regional or global safety programs. OHS practitioners were chosen as research key informants because they are commonly seen as responsible for safety in organizations and therefore closest to the function of a safety management system, invariably using injury metrics. The study participants were identified and recruited by the lead author because they had first-hand experience of the different ways that safety metrics are deployed within large and multi-site organizations, and across different geographies. The use of OHS practitioners within the research also gave voice to those who have most experience and authority on the different use, meanings, and practical effects of OHS indicators within their work. Because safety practices differ between geographies (Chen et al., 2020) and sectors (Pilbeam et al., 2016), interviewees were drawn from a variety of industries and countries, operating nationally (in UK, US or Canada – 45%), regionally (in Europe or Asia – 25%) or globally (30%) (Table 1). All interviewees were experienced and qualified OHS practitioners averaging 21.85 (SD 6) years of experience with 437 years of cumulative practice (see Table 1 where individuals were given a unique identifier P1-P20), and therefore knowledgeable informants. Fifteen participants held post-graduate qualifications, while two held undergraduate degrees and three had diplomas. A majority of participants (80%) held membership of an OHS professional body that required a minimum level of training and continuing professional development. The breadth and variety of experience of interviewees was deemed sufficient for exploratory research and adequate to capture an extensive, although not necessarily exhaustive, range of different interpretations of injury metrics, how they and others might use them, and the factors that may influence it.

2.3. Data collection

Twenty in-depth semi-structured interviews were conducted to establish participants' experiences of injury metrics, their different uses, interpretations, and the practical effects. In line with the methodological criteria for conducting semi-structured interviews (Corbetta, 2003), a list of themes, rather than structured questions, was used to design the interview protocol. The interview protocol, shown in Appendix A, drew on prior research on injury metrics and the broader literature on the effect of performance measurement from organizational science and sociology. Open questions were organized around certain pre-established thematic areas, maintaining flexibility and enabling informants to introduce new topics and broaden their responses. Each participant was interviewed individually using video software.

Interviews were conducted by the first author and ranged in length from 40 to 70 min using the interview protocol. The interviewer (an experienced OHS professional himself) encouraged interviewees to expand upon their answers, particularly when uses and interpretations not heard in previous interviews were offered. The audio recordings were transcribed by the first author using audio transcription software. All transcripts were manually validated to the audio recordings, correcting for spelling, homophones, homonyms, enunciation and punctuation errors as recommended by McMullin (2023).

2.4. Data analysis

Data analysis involves a detailed examination of texts to discover underlying patterns, themes, and dimensions. Through four phases (see Fig. 2), we systematically identified, coded, and analyzed the qualitative data. In line with guidance by Lee (1999), the first phase involved reviewing the interview transcripts several times, in this case three, to gain familiarity with the data and to identify recurring similarities or obvious differences between interviews and notable patterns across the interviews. The observations were then incorporated into interview summaries, ensuring they were grounded in the participants' experience and perspective using their language (Hannah & Lautsch, 2011).

During the second phase, the transcripts were systematically analyzed to identify first-order concepts. According to Van Maanen, first-order concepts explain "what is going on" (1979, p. 540). This part of the analysis was completed using NVivo 13 software and involved reviewing each textual unit and assigning it a descriptive label. To

Table 1
Demographic profiles of OHS professionals interviewed in this study.

Participant Identifier	Gender	Years in OHS	Level of OHS Education	Professional Membership	Location	Sector	Geographical Scope	Participation in Focus Group
P 01	M	19	Dip	Yes	UK	Construction	UK	FG1
P 02	F	13	PG	Yes	UK	Rail	UK	No
P 03	F	14	UG	No	Australia	Construction	Asia	FG2
P 04	F	14	PG	No	Netherlands	Maritime	Global	No
P 05	M	14	PG	Yes	UK	Construction	UK	No
P 06	M	15	PG	Yes	Norway	Logistics	Europe	FG2
P 07	F	23	PG	Yes	Ireland	Pharma	Europe	No
P 08	M	16	PG	Yes	UK	Construction	UK	FG1
P 09	F	26	PG	Yes	UK	Retail	Europe	No
P 10	M	19	UG	No	Canada	Nuclear	Canada	No
P 11	F	22	PG	Yes	Singapore	Manufacturing	Global	FG2
P 12	M	23	PG	Yes	US	Retail	Global	No
P 13	M	27	PG	Yes	Australia	Mining	Global	FG1
P 14	M	25	PG	Yes	UK	Public Sector	UK	No
P 15	M	23	PG	Yes	Australia	Property	Asia	No
P 16	F	25	PG	Yes	UK	Oil and Gas	UK	FG2
P 17	M	28	PG	Yes	UK	Construction	Europe	No
P 18	M	28	Dip	Yes	Canada	Manufacturing	US	No
P 19	F	31	PG	No	UK	Oil and Gas	Global	No
P 20	M	32	Dip	Yes	UK	Engineering	Global	FG1

UG: Undergraduate | PG: Post Graduate | Dip: H&S Diploma | FG1: Focus Group 1 | FG2: Focus Group 2

ensure the descriptors represented the participants' voices as accurately as possible phrasal descriptors based on informant-centric terms and experiences were created and used. After all the transcript data had been coded, a compendium of first-order concepts was created. In accordance with Gioia et al.'s (2013) approach, consistency checks were then performed to detect any discrepancies, revising, enriching and editing the coding. This process was repeated five times, where the first-order concepts were scrutinized, compared and revised to establish similarities, trends and deviations, refining them accordingly. For example, the observation by interviewee P20 that *"Managers are accountable for their numbers. Poor injury stats create a real anxiety and a sense of trepidation amongst line managers"* was coded to a first order concept of anxiety. Using Strauss and Corbin's (2015) axial and selective coding procedures, the focus was on concepts that appeared more frequently and were thus more representative of the data (Chandra & Shang, 2019), which in this study meant being reported by at least three respondents. According to Nag (2007), representativeness ensures the reliability of the data, and that subsequent abstraction more accurately reflects the collective experience of the cohort. The draft first-order concepts were then discussed between the authors, scrutinized, and compared and revised accordingly. This led to 17 first-order concepts each representing the different ways that the injury metric was being interpreted. Each of these first-order concepts are semiotic interpretants, in other words, the different meanings that the metric signifies to individuals. These were based on consensus amongst the researchers. In the third phase, the seventeen first-order concepts were organized into second-order theory-centric themes. This involved conceptualizing the informant-centric first-order descriptors into categories based on theoretical observations. The second-order themes were developed through a process of abduction, iterating between phrasal descriptors and academic literature. They are the semiotic representamens and explain how the meanings established in the first-order concepts were influenced by the practical applications of the injury metrics within the organizations. For example, whether the metric was used as a motivation, or a control, or to indicate status influenced the meanings identified in the first-order concepts.

2.5. Data validation

The interpretation of the interview data and the development of concepts and themes was subsequently validated with the interviewees using two separate focus groups. This process of validation was introduced by the researchers and was additional to the stages of the Gioia methodology. The researchers felt that this additional stage was necessary to counter any etic bias and ensured that the meanings and themes that emerged from the data reflected the interviewees' own language, interpretations, and experiences. Each focus group comprised four of the original interviewees, as indicated in Table 1. During these two 90-minute facilitated workshops, each of the first-order concepts and second-order themes were introduced and explained. Participants were then invited to individually rate each concept and theme according to whether: (a) they recognized them, and (b) the descriptions represented their understanding of the concept. To minimize bias, participants were individually asked to evaluate each code using Mentimeter, a phone voting app. Ratings were on an ordinal 5-point scale, where 1 meant the participants "strongly disagree" with the interpretation and 5 they "strongly agree." All the first-order concepts exceeded 85% (SD 0.098) recognition rate, broadly aligning to 4 and 5 on the scale. This was considered a statistically acceptable validation of the codes, enhancing the reliability of the data and its interpretation (O'Reilly & Parker, 2013). Participants in the focus groups were also asked to provide feedback on the wording of the first-order codes and how they were grouped. This led to refinements to the descriptors. For example, based on the interview transcript code FO7 was initially labelled "rivalry" but this was changed to "envy" in the focus group discussions. Similarly, F11 was modified from "advertising" to "marketing." In addition to challenging the labelling of the categories, the focus groups also considered the groupings, and this led to refinement leading to some subtle changes in the alignment of categories.

The second-order themes were also validated by the focus group using the aforementioned process. Participants scored the codes 76% (SD 0.092), equating to 4 on the scale, that is, "agree." Whilst these scores were lower than those in the first-order concepts, they met the threshold for validity (O'Reilly & Parker, 2013). As with the first-order concepts, participants reviewed the descriptives and grouping of the second-order themes, resulting in minor refinements. This resulted, for example, in "liability" being changed to "risk." In summary, the use of focus group to verify the labels for the first-order codes and second-order themes strengthened the validity of the data and ensured they reflected the interviewee's experience.

The final stage involved analyzing the concepts and themes that had emerged from interviewees' experience and turning these into researcher-centric concepts. This involved aligning the second-order themes with the appropriate academic literature to explain what is

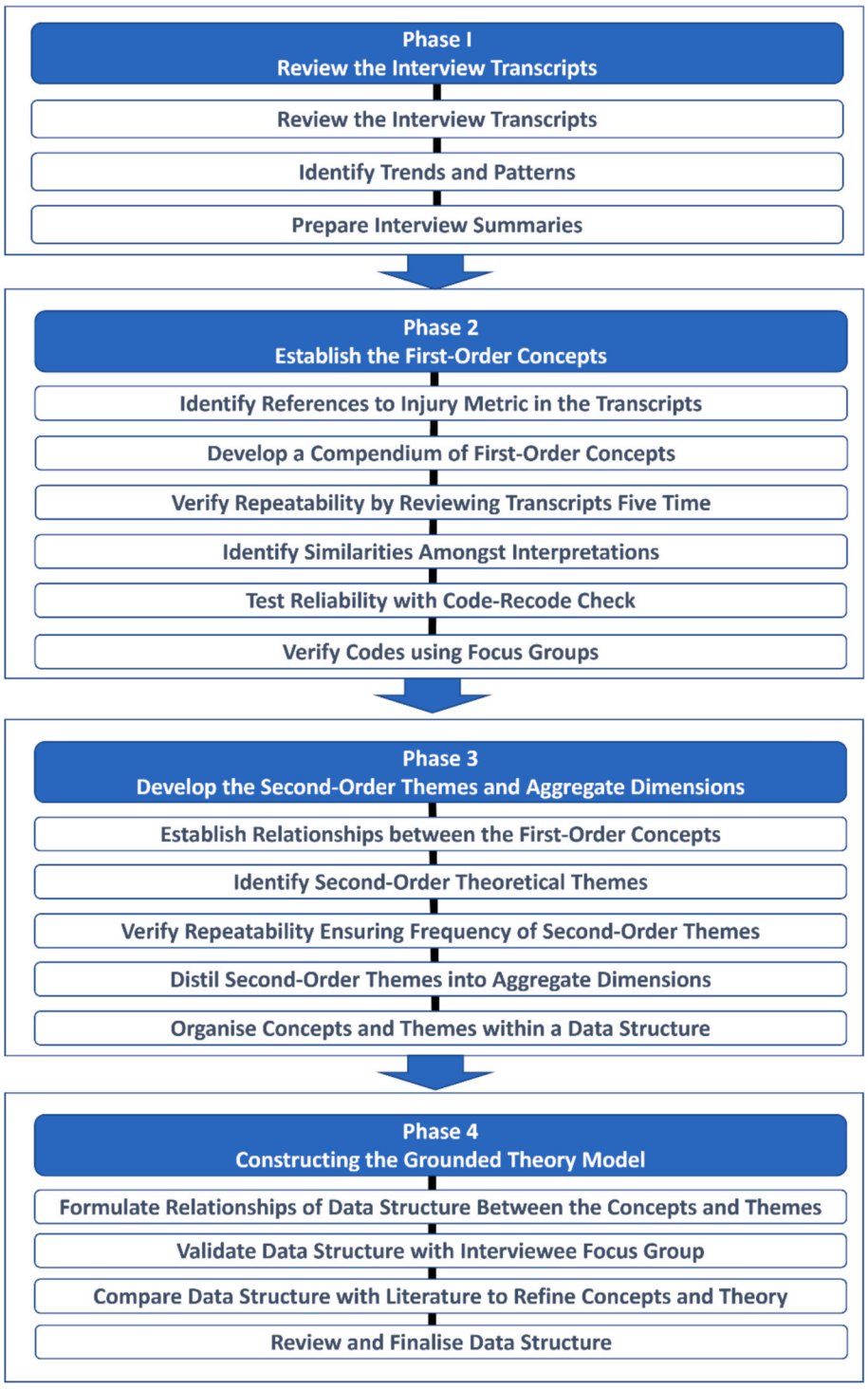

Fig. 2. Stepwise analysis of the interviews of OHS professionals (based on Gioia et al., 2013).

occurring. These aggregate meanings were developed through an iterative process and drew upon the existing body of knowledge. This provided the final data structure (Fig. 3). This parallels the semiotic triangle, where the injury metric is the sign that signifies a particular object (the aggregate dimension). The concepts and themes are progressively clearer articulations of the use and meaning associated with the sign.

2.6. *Presentation of findings*

The first-order concepts and second-order themes are presented within the research findings. These are extracted from the participant-centric terms and answer RQ1 and RQ2. The findings are tabulated and presented according to the second-order themes, with frequent reference to informants' 1st-order quotations. Tables 2-7 shows the relationship between the first-order concepts and second-order themes.

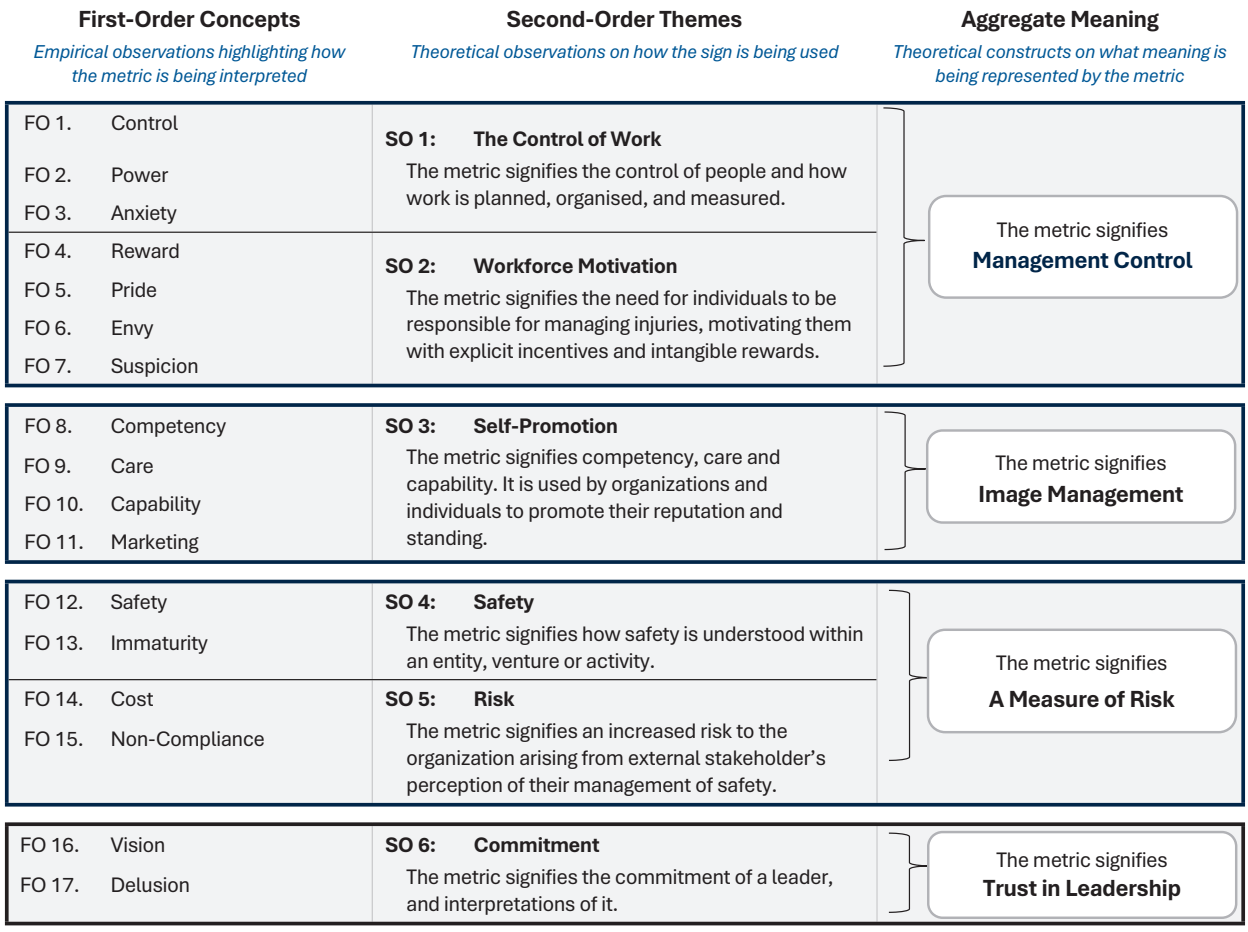

Fig. 3. A data structure for the meaning attributed to injury metrics by OHS professionals.

Table 2
Concepts and themes associating injury metrics with management control.

2nd Order Themes	1st Order Concept	Illustrative quotations, including the source
Controlling	Control The metric signifies management control where it is used to organise work, establish priorities and set goals. Power It signifies the power that the OHS managers have over others in how incidents are categorised. Anxiety Failing to achieve the expected level of performance has consequences. It signifies fear and oppression.	*"The indicator directs business planning across the firm. Every decision is driven by numbers and controlled through targets"* [P12]. *"How I categorise incidents matters to managers. It gives me leverage"* [P07]. *"Managers must answer for their injury numbers. They must report to the managing director. It is not a pleasant experience."* [P20]

Table 3
Concepts and themes associating injury metrics with workforce motivation.

2nd Order Themes	1st Order Concept	Illustrative quotations, including the source
Motivating	Reward The indicator signifies a financial reward for achieving a pre-defined incident rate. Pride When leaders praise incident rates, it signifies excellence, creating pride and inspiring others. Envy When used as a source of competition, the indicator signifies rivalry and envy. Suspicion It represents the concealment of injuries and manipulation of reporting.	*"The indicator is 25% of the annual bonus. It's a big motivator"* [P05]. *"Managers with a low rate of injuries are praised. Being in the top 5 is a big thing. They get respect and recognition"* [P14]. *"KPIs are used competitively. When leaders praise someone for their numbers, it creates rivalry and a toxic culture"* [P16]. *"When injuries are incentivised, people manipulate reporting. When incident rates are celebrated, there is always under-reporting"* [P19].

3. Findings

Through the data analysis seventeen different first-order concepts were identified in the study, each representing a different meaning. These have been grouped into six second-order themes that relate to the uses revealed by the participants. These meanings are reported under the six uses below.

3.1. The control of work

Participants revealed the different ways the injury metric was used to organize and schedule work, define priorities, and manage suppliers. This led to three different meanings.

Firstly, it was integrated within the organization of work, used to establish priorities and set targets. In some cases, it was incorporated into work planning where scheduling algorithms rotated workers between tasks that were physically demanding. It also defined performance expectations that individuals had to meet. This led to the metric being interpreted as a means of control, signifying management oversight: *"Injury rates are just another indicator used to measure performance"*

Table 4
Concepts and themes associating the injury metrics with reputation.

2nd Order Themes	1st Order Concept	Illustrative quotations, including the source
Reputation	Competence For organizations and individuals, it signals the ability to deliver improvements.	*"Many safety professionals define themselves by this number. Big reductions are your market credibility, demonstrating competence"* [P01].
	Care The indicator signifies how well an organization is caring for its workers.	*"ESG investors use metrics to assess us. They view corporate responsibility in this number"* [P17].
	Capability Organizations use it to select, approve and manage their suppliers.	*"Our injury rate has a real impact in our ability to win work. Clients use it to assess our capability and competency in safety"* [P11].
	Marketing Organizations use it to promote their social responsibility and stewardship.	*"Corporate became interested when it became part of the sustainability agenda. It's become marketing spin to promote the firm"* [P15].

Table 5
Concepts and themes associating the injury metrics with safety.

2nd Order Themes	1st Order Concept	Illustrative quotations, including the source
Safeness	Safety It signifies how safe an organization is, so safety can be measured and compared.	*"TRIFR remains the Gold Standard. Everyone views the safety of a business through these rates"* [P05].
	Immaturity It is viewed with scepticism and signifies a misunderstanding of how safety works.	*"Injury rates are misleading. When I see people promoting their success through this number, it tells me that they're in for a nasty shock"* [P13].

Table 6
Concepts and themes associating the injury metrics with increasing risk.

2nd Order Themes	1st Order Concept	Illustrative quotations, including the source
Riskiness	Cost It signifies the increased costs that result from work-related injuries.	*"Our insurance costs are one of the firm's major outgoings and the injury rate impacts this. Insurers use it when pricing our insurance rates"* [P11].
	Non-Compliance It signifies inadequate potential non-compliance and the risk of inspections.	*"When I worked for the regulator, we used it to target enforcement. It highlights where safety is poorly controlled and potential violations"* [P09].

Table 7
Concepts and themes associating the injury metrics with commitment.

2nd Order Themes	1st Order Concept	Illustrative quotations, including the source
Commitment	Vision The metric functions as a symbol of leader's commitment for safety.	*"A low LTIFR tells me leaders are paying attention to safety – they get it"* [P10].
	Delusion Leaders set targets to signify their safety commitments, but this is interpreted as unrealistic and delusional.	*"The leadership team set stretch targets to halve the injury rate in a year. The frontline viewed it as delusional"* [P19].

[P17].

A further example was its inclusion within investment criteria, determining which sites and projects received funding for development and upgrades. This had unintended consequences: "*The metric had to be green for an investment proposal to be considered, but the sites really needing the investment funding are those with the highest injury rates as their equipment is outdated*" [P11]. Another example was the inclusion in the control of suppliers. Participants described how injury metrics were incorporated within the performance management criteria of vendors: "*It's a performance specification in the SLAs of suppliers. There are penalties if they exceed certain rates*" [P03].

When used as an instrument of control, the consequences of failing to achieve the expected level of performance can have significant personal repercussions for individuals, leading to feelings of fear and oppression. Participants stated that an individual's wider capability and professionalism was often evaluated through performance metrics, and this invoked a sense of anxiety: "*Your numbers define you and how you're judged. Managers have been previously let go because it was felt that they were not on-top of their KPIs. They create a palpable sense of failure*" [P08]. The fear and sense of oppression led participants to associate the metric as a sign of anxiety.

Another effect of using injury metrics as a means of control was its effect on the power amongst organizational actors. When indicators were used to determine how managers are evaluated, they had a vested interest in the categorization of incidents, such as which events count toward their personal targets and which did not. Participants described how this gave those responsible for investigating, managing and categorizing incidents significant leverage and influence over others: "*Incidents are often grey and there's a lot of discretion in categorization. Because they impact their bonus, managers are heavily invested in how I define them. So, incidents can be useful, you know, I'll accommodate this if you do that.*" [P17]. The categorization of incidents became a currency; a form of power OHS practitioners held over others. Use of the metric as an instrument of control resulted in three different interpretations, each represented in the first-order concepts summarized in Table 2.

3.2. To motivate and encourage accountability

In contrast to their use as a means of control, the research revealed how the metric was also deployed as a form of motivation, encouraging personal accountability. It was used to stimulate and inspire individuals through incentives and non-tangible benefits such as recognition schemes and reward. These uses led to four different meanings, two positive interpretations and two others leading to negative sentiment.

To encourage personal accountability, organizations incorporated the metric within financial bonuses. Aligning injury metrics with financial compensation led to a range of reactions amongst individuals. Firstly, participants highlighted how incentivization led individuals to separate the metric from the human impact it represents: "*The injury rate has become a budgetary line … it's treated like any other target we have to meet … hitting the target and achieving the bonus is the overriding goal*" [P13]. Linking the metric with compensation led individuals to interpret a measurement of workplace injuries as a sign of financial reward.

Another form of motivation involved deploying the metric to stimulate internal competition through benchmarking, praise, and award schemes. Participants reported that a supervisor with low injuries rates gained respect and recognition across the organization. They were viewed as achievers, seen to deliver and make an impact. Similarly, when leaders praise and publicly recognize teams with low injuries this resulted in the metric being interpreted as a sign of excellence and achievement: *"Leadership praises the team with the best quarterly performance. It creates healthy competition and a sense of recognition. Management use it to inspire others to go further"* [P05]. Using the metric as an instrument of motivation led to it being viewed as a sign of pride. It signified achievement.

Whilst rewarding and praising performance may motivate some, others interpreted this very differently, pointing to the negative impacts and associating it with an unhealthy culture. Participants provided examples of the consequences of using the metric to drive internal

competition. It contributed to a sense of rivalry and enmity amongst leadership teams: *"The monthly league table for the key metrics creates a toxic culture of secrecy… competition is a blocker to collaboration"* [P16]. Organizational learning and sharing are often viewed as central to safety, but using the metric to create internal competition had the unintended effect of leaders withholding knowledge and not collaborating. Success became a source of intellectual knowledge that created competitive differentiation: *"Teams wouldn't share their best practices and were reluctant to discuss the full lessons of incidents"* [P02]. Internal competition had the effect of creating rivalry amongst teams and led to the metric being interpreted as a sign of envy.

Some participants went further viewing the linking of metrics with bonuses and praise as an overt sign of manipulation. It signified the concealment of injuries: "*When I see incident rates being celebrated and rewarded, I immediately know there is under-reporting. It tells me there is no trust – people are hiding stuff*" [P02]. Another interviewee provided a similar example: "*Managers often call-out site managers with good rates, but everyone knows they're the ones hiding information and suppressing incidents. They use creative accounting to avoid incidents being included in the performance scorecard*" [P14]. Doubts over the veracity of data and concern over institutionalized manipulation resulted in the metric signifying suspicion.

Applying the metric as a means of motivation led participants to identify four different meanings, as demonstrated in Table 3. It signified a form of reward, a badge of pride, alongside a sign of envy and suspicion.

3.3. Self-promotion

A third group of uses related to how the metric was deployed to promote a positive impression. OHS practitioners signified their capability to deliver and promote their achievements through the metric: "*Recruiters often see it as evidence of my impact … it provides credibility and evidence of what I would bring to their business*" [P09]. It held a similar meaning at an organizational-level where businesses use it to market their competency to their investors and clients: "*The investor relations team use it to promote our capabilities to our shareholders… marginal movements on a graph in the wrong direction carry great weight to leadership, often beyond the reality on the ground*" [P11]. Similarly: *"Reductions demonstrate the effectiveness of our program to the market"* [P13]. At an organizational and individual-level, the metric signified competency and the capability to deliver. It was similarly used to project an impression to external stakeholders, providing numerical evidence of social responsibility and signifying care: *"It shows how we're looking after our workforce"* [P16].

The metric was found to also be incorporated within the vendor procurement and selection processes. When the metric was above the benchmark this prompted concerns amongst clients. Its inclusion had very practical implications: "*We're a contracting business and these vetting processes can make or break our ability to win work. If our rates are not above industry benchmark, it affects how the market views us*" [P17]. The incorporation of the metric within supplier vetting and accreditation schemes led to it being interpreted as a sign of organizational capability.

Demonstrating how a sign can have multiple meanings, whilst some participants viewed the indicator a sign of an organization's care and capability, others interpreted such uses with skepticism. When used to promote an organization's social responsibility it was interpreted as a sign of advertising, even signifying corporate spin. For example: *"One of the significant users of TRIFR is the business development teams. They use it as marketing and the slightest improvements get spun … it has become a like greenwash"* [P02]. Table 4 summarizes these four 1st order concepts.

3.4. Safety

The metric has long functioned as a proxy for the level of safety across an organization where the absence of incidents signifies the safeness of an entity (NOSHC, 1999). This use was evident within the sample where the metric was viewed as objective evidence of safety in several organizations. Participants provided examples of this use: "*For all its limitations, my senior leadership team like its simplicity… it enables us to measure and compare ourselves in ways other indicators don't*" [P05]. Acknowledging its limitations several participants treated this use with caution and skepticism: "*When the rate rises, there is a palpable sense of nervousness amongst managers. A few minor incidents can trigger anxiety that safety is out of control*" [P18]. Demonstrating how one interpretant can form another interpretant, the use of the metric as an empirical measure of safety by some individuals signified the immaturity of practice in others; this led them to view their approach as outdated thinking: "*When people measure success or celebrate injury-free periods, it tells me they don't really understand safety*" [P19]. Participants disclosed frustration with how the continued use of injury metrics by external stakeholders sustained historic interpretations and understandings of safety: "*I've been trying to introduce a different idea about what safety is, but our clients and insurers fixate on this number*" [P12]. This may explain why many participants interpreted the continued use of the metric as a valid measure of safety with skepticism. For them it signified immaturity. These two contrasting interpretations of safety are presented in Table 5.

3.5. Risk

An alternative interpretation to safety was risk, indicating how the organization's management of safety was perceived by external stakeholders, and the increased costs and regulatory scrutiny that may result from a deteriorating performance. Emanating from the relationship between workplace injuries and financial losses, the metric signified the potential insurance costs arising from an increased rate of injuries: "*We have a claims culture in some sites and injuries are a big driver of our insurance costs*" [P09]. In other cases, the meaning derived from an organization's measurement and reporting processes: "*The metric is one of finance's KPIs, so managers associate injuries with losses*" [P20]. In a further example of how context shapes meaning, participants described how regulatory agencies prioritize their inspection program based on the metric. Increases in an organization's rate of injuries and specific reportable incident types were interpreted by the regulator as a sign of increased risk and potential non-compliance within the reporting organization. The regulator's interpretation and their expected action led organizations to modify what they communicated: "*The regulator targets organizations with high injury rates. So, after each incident there's a big focus on ensuring incidents don't trigger regulatory inspections*" [P06]. In a semiotic chain of interpretants, the expected interpretation of the injury metric by a regulator directly influenced organizational behavior, which in practical terms leads to under-reporting. These two interpretations of risk are presented in Table 6.

3.6. Commitment

The final group involved incorporating the metric within leadership messaging to demonstrate personal commitment to safety. Participants provided examples where the metric was incorporated within leader's communications as visible evidence of their commitment to safety: "*Injury-free vision gets integrated into the exec's messaging. Often, it'll be described as something they're personally committed to… but more aspiration than a hard target, like being customer-focused or the employer of choice*" [P05]. For some, the intended meaning resonated and reducing the rate of injuries signified a responsible leader who was demonstrating their care for workers. This interpretation was summarized by an interviewee: "*Leaders that are serious about safety talk about its importance regularly. They discuss safety as a value, something that matters to them personally*" [P10]. Leaders used the metric in supporting an aspirational vision for safety.

While some interpreted it as a sign of a leader's commitment, others held an opposite view, interpreting the leader's belief and reliance on

the metric as unrealistic. Aspirational commitments signified delusion and were viewed as misguided: "*I've worked for a number of leaders that set hugely ambitious targets for injury metrics … they are treated with suspicion and skepticism by the shopfloor*" [P3]. Similarly: "*Leaders love setting zero goals because it feels ambitious, even visionary. But I've seen how zero is weaponized and has massive ramifications across organizations, so I now question their motives and judgement*" [P12]. These two contrasting interpretations of the metric as a sign of commitment are demonstrated in Table 7.

4. Discussion

The findings demonstrate that injury metrics are deployed by organizations and individuals in different ways to achieve specific outcomes. We identified six uses: as a form of control, a means of motivation, a tool of self-promotion, as a tool for measuring safety, risk and non-compliance, and as a sign of a leader's commitment. Identifying these different uses broadens our understanding of these metrics revealing that they serve epistemic, pragmatic and political functions, aligning with Chiapello and Gilbert's (2019) three functions of management tools. When used as a means of measuring risk or the level of safety, the metrics functioned as epistemic tools, enabling understanding and facilitating processes of veridiction and valuation. Used as a means of management control and motivation, they had a pragmatic effect, enabling and framing individual behavior and actions. Viewed through a political lens, injury metrics served as instruments of power, legitimizing claims and enabling organizations and individuals to promote their reputation. Furthermore, and perhaps unsurprisingly, some of these different uses of injury metrics were also reported to have unintended consequences, which in some cases were antithetical to workplace safety. For example, when the metric was used as a target creating anxiety or leading to under-reporting of incidents. These are considered further below.

The findings also demonstrate that interpretation of injury metrics is not singular, predetermined or fixed. They are not simply an indicator of how frequently an injury has occurred and therefore how safe the organization is, they are more than that. The injury metrics signified different meanings (elaborated in the next section) based on how they were utilized suggesting that meanings are dynamic (Houser, 2010) and supporting the view that they may function as boundary objects (Hayes et al., 2023).

4.1. Four representations

In comparing the six uses identified in the research with the literature, four aggregate meanings are evident. These broader interpretations enhance the understanding of what is being signified by these injury metrics through their different uses.

The first relates to management control where the metric was used in a process Gioia and Corley describe as "conforming and performing" (2002, p. 110). Whether the injury metric was applied in a prescriptive manner to define how work was organized or as a tool to motivate and incentivize worker behavior through reward or competition, these are two forms of management control systems which organizations deploy to achieve their objectives (Malmi & Brown, 2008). Using the metric as a means of control enables leaders to "govern others at a distance" (Espeland & Stevens, 2008, p. 415) through the practice of measured accountability (Muller, 2018). When used as part of a management control system, the metric is being used to ensure that the required safety processes and practices are being adhered to and that work is being effectively monitored and controlled to ensure compliance. Rae and Provan (2019) describe this as administrative safety.

The meaning of semiotic signs is not deterministic but contextually situated. For example, when used to create internal competition through league tables and awards, this led some to interpret the metric with pride and achievement, supporting previous research on incentive programs (Yeow & Goomas, 2014). Conversely, this competition led others to interpret the metric as a sign of envy, supporting Mau's argument that indicators can turn "colleagues to competitors" (2022, p. 48). The consequences of failing to achieve the expected levels of performance resulted in others viewing it as sign of fear and anxiety, supporting the claim by Bevan and Hood (2006, p. 518) that targets can led to "regimes of targets and terror." Similarly, incentivizing the metric resulted in a representation of the number of workers injured being interpreted as a sign of financial reward. This not only supports the claim that performance indicators can contribute to the depersonalization of work (Hur, Lee, Schroeder, & Zhong, 2017), but also previous research on the ethical challenges arising from commensuration (Islam, 2022; Espeland & Stevens, 1998). Another form of control emerges from the consequences of measurement and the power this provides to those classifying incidents. OHS practitioners were found to utilize the classification process as a source of power, demonstrating the role of power and conflict in the management and administration of safety within organizations (Reiman & Pietikainen, 2014; Antonsen, 2009). OHS practitioners interpreting injury metrics as a sign of power reminds us that performance indicators can turn 'knights to knaves' (Le Grand, 2003, p. 21).

In contrast to an instrument of control, the second aggregate meaning arises from the use of the metric to create an impression and promote organizational and individual reputations. It was used by organizations to promote specific attributes to external stakeholders. Within contracting businesses, the metric signifies an organization's capabilities to others, where a low level of injuries is interpreted as a sign of safe operations, allowing them to compete for and win work. Similarly, publicly traded firms used the metric to promote how they were caring for their employees and being a responsible employer. This aligns with previous research that found metrics are commonly deployed as tools of image management, used to signify competency and portray a positive corporate image (Yusoff & Lehman, 2009; Thøger Christensen & Askegaard, 2010). The objectivity of metrics more generally supports corporate storytelling and helps advance a firm's claim of social legitimacy (Crowther, 2017; Di Tullio et al., 2020). O' Neill argued similarly that injury metrics are used within corporate reporting to "attenuate stakeholder perceptions of risk" (O' Neill, et al., 2016, p125). This use of the metric forms part of what Rae and Provan (2019) describe as 'demonstrated safety', where the focus is on providing assurance to external stakeholders, showing that the organization is fulfilling its safety obligations. Signifying competence also occurs at an individual level where the metric supports OHS practitioners' career progression. Numbers enhance the trust within resumés and the plausibility of an individual's claims (Waung, McAuslan, DiMambro, & Mięgoć, 2017). Several of the participants who described using the metric to signify their competency to hiring organizations were themselves critical of its empiricism and how it was applied within their organization. This demonstrates that the same sign may be interpreted very differently (even by the same person) when the context changes, illustrating how the meaning of the injury metric is socially situated.

One of the most conventional and long-standing uses of the injury metric is as a measure of an organization's safety performance (Geddert, 2025). This formed part of the third aggregate meaning, a sign of risk. Participants revealed how marginal increases in the metric were often interpreted as literal reductions in the level of safety and an increased risk of major accidents. This interpretation is despite the known limitations of the metric as an empirical and statistically valid measure of safety within an organization (Hallowell et al., 2021). The interpretations provided by interviewees, such as signifying cost or non-compliance, reflect its use by external stakeholders that have practical consequences for the organization, such as the reassessment of insurance premiums.

Trust is the fourth aggregate meaning and involves leaders using the metric to signify their commitment to safety. Its role was principally symbolic where it was integrated within leadership communications as a

means of building trust and confidence in their leadership capabilities. Participants described how the metric's objectivity lent credibility to the leader's aspirations for safety (i.e., injury free, goal zero) and, alongside other metrics, built confidence in their ability to ability to deliver. How leaders talk about safety matters, their rhetoric contributes to shared beliefs and values that accentuate the value organizations places on safety (Lyubykh et al., 2022; Lingard et al., 2019). Amernic and Craig argue that the words leaders use are "potentially a central formative element in developing a safety culture" (2017, p 66). This is supported by studies of high-profile disasters where the language leaders used was found to be a contributory factor shaping the organizational culture (Craig & Amernic, 2023; Ocasio, 2005;). Ocasio (2005, p. 110) describes a "vocabulary of safety leadership" where leaders influence the cognitive content (i.e., what we think) and cultural processes (i.e., how we think). One participant stated that their leader always began their monthly communications with safety and the metric acted as an anchor for this. Regular inclusion of the metric in communications aligns with the suggestion that a leader's safety communication should be "persistent, repeated and rigorously factual" (Craig & Amernic, 2023, p 47), thereby engendering confidence and trust in the leader's concern for safety in the organization.

Whilst some participants interpreted the metric as a sign of a leader's commitment to safety building trust, others held a contrasting interpretation. They viewed its inclusion within leadership communication as a sign of delusion, contributing to mistrust. They pointed to the paradox that while the metric was promoted as a means of building trust, its measurement and use as a target resulted in the opposite effect, contributing to mistrust and suspicion. Other studies (Sherratt & Dainty, 2017; Dekker, Long, & Wybo, 2016) have indicated the negative impacts of establishing targets for zero incidents. For these participants meaning is anchored in their practical experience, as Peirce noted in the notion of the "material qualities of the sign" (Peirce, 1908, p 287).

4.2. Semiotic analysis

One way of considering the variety of practical uses of the injury metric evident in this study is through the three categories of sign Peirce introduced: icon, index and symbol. Although there were limited examples of the use of injury metrics as iconic signs, there were several examples of injury metrics operating as indexical signs where their use was connected to observable, objective criteria and where changes in the rate had a causal effect. Examples include using the metric to signify cost or risk (increased insurance premiums), non-compliance (inspections would result), and safety (the rate affects the ability to win work). Similarly, when used as a means of management control, the application of the metric was causally connected with consequences for individuals. In other uses, the connection between the metric and what was represented was symbolic and had to be socially learnt. When leaders integrated the metric within their safety messaging, it was a symbolic sign because the relationship between the role of the leader and the injury metric was indirect and must be culturally learned. Similarly, use of the metric by organizations and individuals to signify reputation (i.e., care and competency) is established through convention.

The 17 separate meanings identified by the participants are diverse and varied. Some interpretations were related to an intentional use of the metric, others involved an emotional response to the implications of its use, and still others arose from expertise and specialist knowledge. Pierce differentiated meaning into three interrelated categories, the logical, emotional and energetic interpretant (Curtis & Curtis, 2011). These provide a way to consider the range of meanings reported in this study. A logical interpretation is where the metric was used intentionally to signify specific action or behavior. For example, when it was used as a means of controlling how work was conducted and measured, it was used to motivate or prompt action by the interpreter. When used as a sign of safety, risk or as a form of self-promotion, it was also used in a logical way. Its meaning can be explicitly stated and is some case, even formulated as a proposition. Pierce's second class of interpretant was emotion, referring to the feeling or affective response elicited by the sign, for example when interpreted as a sign of anxiety, envy, and suspicion. When interpreted as a source of power, it prompted the OHS practitioners to leverage the opportunity created. As an energic interpretant, the classification of an incident had a practical effect on the interpreter's actions. Acknowledging that the three categories are not mutually exclusive (Lorino, 2018), nevertheless they provide a way of considering how the meaning individuals infer from signs can be rational and logical as intended or conversely result in an unexpected action or emotion.

4.3. Unintended consequences of injury metrics

Measures and targets are an integral part of performance management systems used to control work in organizations (Smith & Bititci, 2017). However, these measures do not always deliver the desired outcomes. Sometimes, the outcomes may be unintended, even if these might have been anticipated (De Zwart, 2015). In an extensive review of the literature, Franco-Santos and Otley (2018) identified several unintended consequences of performance management. The uses and associated meanings of indicators revealed in this study demonstrate that injury metrics are also susceptible to the same failings in the following ways. Information surrounding injury metrics may be manipulated to meet performance requirements within the organization, especially when the indicators are reviewed in individuals' appraisals and used as evidence to support promotion cases. Perversely, this can undermine the career progression of those who encourage open reporting that enables organizational learning and longer-term improvement in safety performance. Accurate reporting of injury metrics can also be hampered when the performance metric is incentivized (Probst et al., 2019) and when it informs resource allocation decisions. Resources may be allocated to facilities where injury rates are high or conditionally upon achieving a predefined incident rate or when rates are low. The latter may encourage under reporting to gain investment.

Injury metrics may also be selectively reported to external stakeholders, supporting Mariappanadar et al.'s (2022, p.22) assertion that corporate OHS reporting involves the "selective disclosure of sententious, self-serving and vague information." Selective reporting of injury and other safety related metrics enable organizations to portray a positive corporate image, particularly to investors and shareholders, in a practice described as 'safewash' (O'Neill et al., 2016).

Injury metrics can encourage selective attention, where aspects of performance that are measured are given attention and other aspects that are not (or cannot be) measured are overlooked (Hood, 2006; Mannion & Braithwaite, 2012). Where the metrics are incentivized, the focus may turn to the associated financial rewards rather than to the care and concern for the injured individual(s) that the measure represents, thus dehumanizing them. Such ethical challenges are known to result from commensuration (Espeland & Stevens, 1998).

The metric can also provide organizations with the 'illusion of control' (Franco-Santos & Otley, 2018) where they can come to believe that it is an accurate representation of fatality and serious injury risks, or indeed major hazard risk. This can result in organizations developing false assurance (Rae & Alexander, 2017).

A final unintended consequence was the negative effect on social relationships within the organization. Where measures were used to create league tables this created a source of either pride and achievement (Yeow & Goomas, 2014) or envy (Mau, 2022) reducing trust, increasing suspicion and promoting transactional relationships. When the measure was used to control and monitor it became a source of fear and anxiety, supporting the suggestion that targets can establish 'regimes of terror' (Bevan & Hood, 2006, p 518). Such a sense of fear paradoxically turns a measure used ostensibly to improve safety into an instrument that has an adverse effect on psychological safety.

4.4. Managerial implications

The findings have several important practical implications for OHS professionals, senior managers in organizations, and stakeholders external to the organization, including regulators, insurers, and investors. First, when used comparatively and competitively, metrics can provide individuals with a source of power and influence over others. For example, individuals managing commensuration processes that determine which incidents count towards performance targets have power over the way managers and leaders are measured, evaluated, and compensated.

Second, injury metrics are interpreted by external stakeholders. This may lead organizations to modify how they use this information, for example downplaying particular pieces of information (e.g., accidents and injuries) that might be viewed negatively by others, while emphasizing other data, such as reductions in injury rates, which might be viewed more favorably. This is particularly important for larger organizations (and their shareholders) that are increasingly obliged to submit ESG reports for audit, and for those that review these reports and base decisions upon them. Appropriate professional skepticism needs to be deployed when interpreting these metrics.

Third, ethical challenges may also arise as a result of the different ways in which injury metrics are used. Where metrics offer the opportunity to influence others, then corruption is possible. Moreover, where injuries are reduced to a number, and this number has a financial implication, then this may risk depersonalizing the event so that the appropriate care and concern is not given to the injured person. This raises professional ethical challenges.

4.5. Limitations and future research

This exploratory study has a number of limitations that also offer opportunities for further research. First, only 20 OHS professionals were interviewed. While this may limit the generalizability of the findings, these practitioners were highly experienced and came from a range of different sectors in different geographies. Second, the study draws on the experience of OHS professionals working in large global organizations. Their experience might be different to that of OHS professionals in smaller regional companies. A comparative study in these settings could be included in future work. A third concern is the validity of the findings. The analysis is inevitably shaped by the perceptions and experiences of the authors (Bluhm et al., 2011). To mitigate this the findings were validated through two focus group discussions involving some of the original interviewees. However, this too may suffer from confirmation bias. The participants supported and confirmed what had previously been said, although we note that they did challenge our interpretation of the interviews, which necessitated a revision of the initial interpretations.

The study proposed that the components of safety management systems, in this case injury metrics, are semiotic signs. As the reliance on certified safety management systems with their inclusion of numeric and pictorial / visual indicators grows, the meanings actors infer from them, and the actions they subsequently take warrants further study. It is also important to examine how other groups both inside and outside the organization respond to these signs. Here we investigated the interpretation of OHS professionals. Others, such as corporate board members, or regulators and investors, also respond to these signs. Their interpretations may differ from those presented here. Two other contextual factors, national culture and the nature of the hazards present in the organizations, may also affect how these metrics are interpreted and acted upon. This too requires further investigation.

5. Conclusion

By examining their practical use, the study has shown how injury metrics are not simply an empirical representation of safety performance, but are semiotic signs signifying a variety of intentions and expectations to different groups. This study has enlarged the conventional, static understanding of the metric to reveal a diversity of uses of the metric, each occurring within a broad range of cultural, temporal and social interactions. Through the adoption of a semiotic perspective, the study showed that experienced OHS professionals attributed four different meanings to injury metrics, each influenced by the contextual use and its practical implications for them. These reflected their experience of the ways they and others in their organizations made use of them, namely, to hold others to account, to demonstrate their own or their organizations competence to others, to signify risk and to indicate the safety culture of the organization. This variety demonstrates that the meaning of injury metrics is neither fixed nor singular but contingent and contextually determined. While this may have unintended consequences, a common problem with performance measures, it encourages OHS practitioners to pay more attention to their use as this has a major effect on how individuals interpret and respond to them. Finally, it provides a challenge to the comforting assumption that a decreasing injury metric is necessarily a sign of safety in the workplace.

CRediT authorship contribution statement

James Pomeroy: Writing – original draft, Visualization, Validation, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Colin Pilbeam:** Writing – review & editing, Supervision, Project administration, Methodology.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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HYPERLINK "SPS:id::app1" Appendix A

The semi-structured interviews considered the following topics:

Reflections

1) The interviewee's experience of metrics within their current organization.
2) How the metric is used by the interviewee, and the value it brings.
3) How the metric influences their work.

Application

4) The practical ways that the metric is used throughout organizations.
5) How the metric features in an organization's interactions with its external stakeholders.

Meaning

6) How the metric is communicated and discussed within their organizations.
7) The meaning that different actors infer from the metrics.
8) How meaning differs by role, function, or process.

Influences and consequences

9) The consequences of the metric for individuals.
10) The organizational consequences of the metric.

11) Explore the effects of changes in the metric, such as depreciations and improvements.
12) How the metric features in decision-making and management processes.

Scenarios

13) Tell me about what happens when the metric increases or decreases? For example, does it link to any management processes, such as performance goals, targets, or rewards?
14) Tell me a time when the metric highlighted difference in performance between different departments or functions of the organizations – what happened?
15) Does the metric influence the decision-making or how work is planned and done? If so, how?
16) If one team/dept had a higher injury metric than another, how would that be viewed? What would happen?
17) Tell me about how the metric practically impacts people within the organization?

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