

**Uncovering coal mining accident coverups  
An alternative perspective on China's new safety narrative**

Yang, Xiuyun; Krul, Kees; Sims, David

**DOI**

[10.1016/j.ssci.2021.105637](https://doi.org/10.1016/j.ssci.2021.105637)

**Publication date**

2022

**Document Version**

Final published version

**Published in**

Safety Science

**Citation (APA)**

Yang, X., Krul, K., & Sims, D. (2022). Uncovering coal mining accident coverups: An alternative perspective on China's new safety narrative. *Safety Science*, 148, Article 105637. <https://doi.org/10.1016/j.ssci.2021.105637>

**Important note**

To cite this publication, please use the final published version (if applicable). Please check the document version above.

**Copyright**

Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

**Takedown policy**

Please contact us and provide details if you believe this document breaches copyrights. We will remove access to the work immediately and investigate your claim.

***Green Open Access added to TU Delft Institutional Repository***

***'You share, we take care!' - Taverne project***

**<https://www.openaccess.nl/en/you-share-we-take-care>**

Otherwise as indicated in the copyright section: the publisher is the copyright holder of this work and the author uses the Dutch legislation to make this work public.



# Uncovering coal mining accident coverups: An alternative perspective on China's new safety narrative

Xiuyun Yang<sup>a,\*</sup>, Kees Krul<sup>b,\*</sup>, David Sims<sup>c</sup>

<sup>a</sup> School of Public Affairs, Xiamen University, Xiamen, Fujian, PR China

<sup>b</sup> Faculty of Technology, Policy and Management, Delft University of Technology, Netherlands

<sup>c</sup> Cranfield University, UK

## ARTICLE INFO

### Keywords:

Safety measures  
Coal mining  
Accident coverup  
Underreporting  
China

## ABSTRACT

China has taken on a series of comprehensive institutional measures to improve the safety of its coal mining industry and workers. Official figures indicate similar reductions to both accidents and fatalities, from which a “new safety narrative” has emerged in official discourses. However, this view neglects the fact that many accidents are concealed or underreported in China's mining sector. This study critically examines China's safety measures with a novel dataset of 180 mining accident coverup cases derived from official, judicial, and media sources. The study's findings support three observations: (i) despite the imposition of stricter regulations and the closure of many informal and small-scale mines, accident coverups have continued at both legal and large-scale mines; (ii) despite increased monitoring including the implementation of a fatality indicator system, accident reporting is consistently manipulated by mine owners, local authorities, and even victims' families; and (iii) although new stiffer penalties specifically sanction accident coverups, they are rarely imposed. Our results cast doubt on the conceived success of China's new safety narrative and demonstrate how industrial safety measures are deliberately and structurally compromised.

## 1. Introduction

Globally, the mining industry has long been considered to be one of the most hazardous industries with substantial health and safety risks for its workers (Löow and Nygren, 2019; Saleh and Cummings, 2011). China's coal mining sector is no exception to this (Homer, 2009; Tu, 2007). Coal accounts for approximately two-thirds of China's primary energy consumption, meaning that mineral resource exploitation is frequently prioritised over environmental or safety concerns (Yang et al., 2017; Yang and Ho, 2020). Nonetheless, over the last two decades, China has adopted a series of comprehensive measures to improve the safety of the industry and its workers. Many informal and small-scale coal mines have been closed, new and stricter regulations have been imposed, and safety monitoring has increased along with the introduction of stricter penalties (Andrews-Speed et al., 2005; Liu et al., 2019a; Shi, 2013; Song and Mu, 2013; Yang, 2022).

Due to such measures, China's coal production safety conditions have improved significantly (He and Song, 2012). Most notably, official figures present annual decreases in the absolute numbers of both accidents and fatalities since 2002, despite China's mining output doubling

over the same period. It thus appears, as aptly worded by Geng and Saleh (2015, p. 37), that

“[a] new safety narrative has emerged ... significant safety improvements have taken place in Chinese coal mines, and that these improvements are the results of the effectiveness of government policy, regulatory efforts, and actions to improve mining safety.”

However, the “new safety narrative” must be interpreted with caution. Observers have expressed concerns over the validity of administrative Chinese mining safety data, particularly concerning the reporting of mining-related accidents and fatalities (Fisman and Wang, 2017; Geng and Saleh, 2015). For instance, subcontracted workers are frequently excluded from official statistics while incidents in small mines are often not reported and concealed. In other instances, mining accidents are purposely mislabelled as outcomes of “natural disasters” rather than safety accidents (Geng and Saleh, 2015). Meanwhile, Fisman and Wang (2017) indicated a downward manipulation of reported deaths by local governments, while other studies provide anecdotal evidence of how mining accidents are underreported and concealed

\* Corresponding authors.

E-mail addresses: [yangxiuyun@xmu.edu.cn](mailto:yangxiuyun@xmu.edu.cn) (X. Yang), [k.krul-1@tudelft.nl](mailto:k.krul-1@tudelft.nl) (K. Krul).

<https://doi.org/10.1016/j.ssci.2021.105637>

Received 26 June 2020; Received in revised form 26 April 2021; Accepted 16 December 2021

Available online 4 January 2022

0925-7535/© 2021 Elsevier Ltd. All rights reserved.

(Chan and Gao, 2012; Wang, 2006). Official figures concerning China's mining safety may thus depict an unreliable picture since they neglect the fact that many accidents are deliberately concealed or underreported.

This study aims to systematically assess China's new safety regulations – measures that pertain to regulating, monitoring, and sanctioning of the mining industry – and examines how these regulations may be compromised, deconstructed, or manipulated. This endeavour immediately poses an epistemological problem because little data are available besides official sources. Furthermore, most studies on Chinese mining safety are derived from emblematic and anecdotal evidence, resulting in a lack of quantitative insights. To address these gaps, the authors constructed a descriptive dataset with 180 mining accident coverup cases derived from official, judicial, and media sources.

The dataset is primarily used to identify the *structural patterns* that underlie accident coverups and underreporting. Specifically, we adopt an institutional perspective to examine how standard institutional solutions to improve safety standards (i.e., stricter regulations, intensified monitoring, and more severe sanctions) are neglected and deconstructed in a multi-actor environment. In addition to presenting China's new safety narrative in a more critical light, this also contributes to the broader literature on coverups and underreporting as witnessed in traffic accidents (e.g., Alsop and Langley, 2001; Amoros et al., 2006; Couto et al., 2016; Psaros et al., 2010; Sciortino et al., 2005) and occupational accidents (e.g., Green et al., 2019; Probst and Estrada, 2010; Tucker et al., 2014).

The paper is structured as follows. The next section introduces China's new safety narrative in further detail by outlining the main institutional measures that have been introduced to improve mining safety. Section 3 then describes the methodology and dataset in greater detail. After that, Section 4 presents the empirical results and Section 5 then concludes the key findings and implications of this study.

## 2. Breaking down China's new safety narrative

### 2.1. Three categories of institutional improvement

In line with China's transition towards becoming a society based on formal and legal institutions, the country's mining industry has been the target of new safety laws, acts, and regulations (Liu et al., 2019a; Shen et al., 2012; Song and Mu, 2013). These measures can be categorised as follows: (i) *regulating* the mining industry by closing small-scale mines and imposing stricter legal requirements on operating mines; (ii) *monitoring* mining safety by implementing new indicator and reporting systems; and (iii) *sanctioning* misconduct by introducing criminal penalties specifically designed to address the issue of accident coverups. Each category is discussed in more detail below.

#### 2.1.1. Regulating the mining industry

It is widely held that small mines are responsible for the majority of accidents and fatalities in China's mining industry. For example, the fatality rates observed at small-scale mines operated by township and village enterprises (TVE) have been reported to be almost ten times greater than those for larger state-owned mines (Wang, 2006). Since the late 1990s, the Chinese state has subsequently launched several rounds of mine closure campaigns (Andrews-Speed et al., 2005; Song and Mu, 2013). Moreover, in 2006 China launched a mine consolidation policy designed to allow large state-owned mines to annex small mines, establish joint ventures of small- and state-owned mines, or merge small mines into larger ones (Shi, 2013). Despite resistance from local government, mine owners, and mining workers (Wright, 2007), the number of small-scale mines has diminished considerably.

Meanwhile, new and stricter regulations have been imposed on mine operations. Coal mines must currently obtain six different licences that concern production, safety, and mine management from various local government departments or local branches of the national Coal Mine

Safety Administration (CMSA).<sup>1</sup> If any licence is missing, the mine is considered illegal, and production is permitted only if all six licences have been obtained (Song and Mu, 2013).

After a mine commences production, the local coal mining safety bureau conducts periodic inspections to monitor the mine's compliance with safety regulations. Upon encountering a violation, the bureau can issue a range of penalties, ranging from the issuance of a correction or citation for minor offences, suspending production for major offences, or ordering the evacuation of mineworkers for imminent hazards. For serious violations, the coal mining safety bureau can temporarily withdraw the safety licence until corrections are made.

#### 2.1.2. Monitoring mining safety and reporting accidents

The next set of measures relates to the monitoring and reporting of mining accidents. Notably, a national "fatality indicator" (*siwang zhibiao*) system has been introduced that records two types of indicators. The first type considers the *absolute* reduction of all mining-related fatalities while the second type is a *relative* indicator and measures intensity-based standards such as the declining fatality rate per ton of coal produced. Accordingly, local officials are held accountable for indicator performance in their administration, which are linked to career advancements and salaries. Chan and Gao (2012) associated the fatality indicator system with work safety standard improvements, such as declining work-related fatalities. Specifically, they found that the system provides a tool to evaluate local government performance beyond local GDP figures alone and that it promotes compliance among local officials with the central government's work safety targets (Chan and Gao, 2012).

A related measure is the national classified safety management and reporting system which was introduced in 2007.<sup>2</sup> In this system, all work-related accidents are classified into four classes of accidents based on the number of fatalities, injuries, or total economic losses incurred. As shown in Table 1, the four classes range between "normal", "major", "serious", and "special serious" accidents.

According to specific stipulations, the on-site manager must report mining safety accidents to the county's Coal Mine Safety Administration (CMSA) within one hour. The county-level CMSA then disseminates the information of the accident both horizontally (to the county government) and vertically (to higher levels of the CMSA). Vertical reporting depends on the severity of the accident. While accidents with three to nine deaths are reported to the provincial level CMSA, accidents with ten or more deaths should be reported to the national CMSA. The safety bureaus are also responsible for informing other relevant agencies including the Public Security Bureau, the Labour Security Office, and labour unions. Accidents of different levels of severity are also subject to investigation by different hierarchical levels of government, with the most severe level of accidents being investigated by the State Council.

#### 2.1.3. Sanctioning coverups

The third set of measures concerns sanctions that can be imposed. After an accident, the mine must halt mining operations and await investigation. If the investigation finds that safety measures were not correctly in place, mining activities will be suspended until safety has been improved and the mine owner's licences may even be revoked. The

<sup>1</sup> The six licences include the following: (i) *mining licence* from the Department of Land and Resources; (ii) *production licence* from the local department of coal (annulled after 2013); (iii) *safety licence* from the NCMSA; (iv) *safety eligibility licence* of the mine manager from the NCMSA; (v) *mine manager licence* of the mine management from the NCMSA; and a (vi) *general business licence* from the local department of the industry and commerce administration (Song and Mu, 2013).

<sup>2</sup> As promulgated by the *Regulation on the Reporting, Investigation and Disposition of Work Safety Accidents* by the State Council in April 2007. [http://www.gov.cn/zw/gk/2007-04/19/content\\_588577.htm](http://www.gov.cn/zw/gk/2007-04/19/content_588577.htm) (accessed 20 October 2020).

sanctions are specifically designed with attempted underreporting or accident coverups in mind. In the 2006 amendment to the Criminal Law, it is explicitly stipulated that

“[a]fter the event of any safety accident, if the responsible person fails to report the accident or makes a false report ... he shall be sentenced to a fixed-term imprisonment of not more than three years or detention” (Article 139-I).

In extreme circumstances, for instance an accident involving many fatalities, fixed-term imprisonment is extended to seven years. A document released by the State Administration of Work Safety further stipulates that the responsible persons are subjected to fine penalties between 60 and 80 percent of the individual's annual income,<sup>3</sup> which further increased to 100 percent in a 2015 revision. Moreover, mining companies are also subject to stiffer fines when found guilty of underreporting or coverups, ranging between 0.5 million yuan for “normal” accidents and up to 20 million yuan for “especially serious” accidents.<sup>4</sup>

#### 2.1.4. China's new safety narrative

With the above-described institutional measures, considerable progress has been made in terms of Chinese mining safety standards and regulations (He and Song, 2012, p. 897; Shen et al., 2012). Indeed, official figures indicate that in the 16 consecutive years since 2002, both the number of accidents and the number of deaths decreased (Fig. 1), which has also been referred to as a “double drop” (*shuang jiang*).<sup>5</sup> The double drop appears even more impressive since China's mining output increased over five percent annually in the same period. For instance, in 2001 there was an average of 3.85 deaths per million tons of output, but by 2019 this figure dropped almost 50 times to just 0.08 deaths per million tons of output.

## 2.2. Decentralisation and information asymmetries in China's mining sector

There are several reasons why China's new safety narrative could be misleading. Most clearly, the narrative neglects that many accidents may be concealed or underreported.<sup>6</sup> Fundamentally, this can be ascribed to China's decentralised governance structure, which dates back to Mao who envisaged the policy of “walking on two feet” that promoted the development of national and local industries (Qian and

<sup>3</sup> The Provisions on Fine Penalties for Work Safety, State Administration of Work Safety, 2007. [http://www.gov.cn/ziliao/flfg/2007-07/17/content\\_687455.htm](http://www.gov.cn/ziliao/flfg/2007-07/17/content_687455.htm) (accessed 20 October 2020).

<sup>4</sup> The Provisions on Fine Penalties for Work Safety, State Administration of Work Safety, 2015. [https://www.mem.gov.cn/fw/flfgbz/gz/200708/t20070801\\_233405.shtml](https://www.mem.gov.cn/fw/flfgbz/gz/200708/t20070801_233405.shtml) (accessed 20 October 2020).

<sup>5</sup> ChinaNews, “Number of accidents and total fatalities have ‘double drop’ in 16 consecutive years in China,” <http://www.chinanews.com/sh/2019/09-18/8958968.shtml> (accessed 1 June 2020).

<sup>6</sup> For instance, a gas explosion on the 2nd of July 2005 at the Jiabiabao coal mine killed 36 mine workers, and the mine owner transported the corpses of 17 victims from the accident to neighbouring Inner Mongolia and hid them there. The act was jointly planned by the director of the coal industry bureau, the mine's chief engineer, and the deputy-director of the mine rescue team. The action was approved by both the deputy secretary of the county party committee and deputy head of the county (China Labour Bulletin, 2008, p. 15). A total of 34 miners and a rescuer died after a blast at Lijiawa mine on the 14th of July 2008. The mine officials helped to relocate the bodies, destroyed evidence, and paid journalists 2.6 million yuan to cover up the disaster, keeping the tragedy out of the public eye for 85 days. In November 2008, 10 journalists and 48 officials were charged with taking bribes to cover up the accidents (Wang, 2010). More recently, it was found that in just one week of 2019, at least four major accidents that killed a total of 21 people were falsely reported or covered up.

Xu, 1993). Decentralisation continued and intensified during the post-Maoist reform period, which brought forward fiscal, management, and administrative reforms (Caulfield, 2006). Consequently, while financial support from the central government was reduced, local governments were granted greater financial autonomy, decision-making powers, and responsibility (Caulfield, 2006). While decentralisation accordingly led to innovative solutions for local development, it also resulted in pervasive principal-agent problems such as information asymmetries and opportunistic behaviour (Chan and Gao, 2012; Jia and Nie, 2017; Minzner, 2009). A small body of literature has shown how this is also relevant for China's national mining safety measures, indicating that accidents are concealed or underreported by different local actors, including mine owners, government officials, and local branches of the CMSA.

First, assigning the national CMSA the sole and specific responsibility of mining safety resolved the issue of overlapping and fragmented bureaucracy in which multiple departments were involved in the administration of mine safety.<sup>7</sup> However, local branches of the administration have continued to rely on local government funding. Similar to other Chinese agencies with a dual leadership matrix structure (*shuangchong guanli*), such as environmental protection bureaus, courts, and statistical agencies (Cai, 2000; Van Rooij et al., 2017), this puts local administrations in a vulnerable position. Local agencies are consequently inclined to respond only to local governments rather than to authorities at higher levels.

Similarly, faced with multiple interests, local authorities may opt to collude to conceal or underreport real death tolls that exceed the fatality indicators (Jia and Nie, 2017; Zhou, 2010). The fatality indicator and classified safety management and reporting system establishes a hierarchical accountability system under which government officials at different ranks and levels are held responsible for work-related accidents depending on the severity of the accident (Chan and Gao, 2012). However, this system may be counterproductive by incentivising higher-level officials to tolerate or even compel dishonest reporting since they are also held accountable if fatality numbers reach a certain threshold.

Moreover, mine owners may opt to conceal accidents after meticulous calculation of the expected utility analysis (Liu and Liu, 2007; Mao and Ma, 2017). For instance, Liu et al. (2019b) found that the introduction of stiffer penalties has controlled the illegal behaviours of coalmines in the short term, yet increased costs related to safety inspections can result in the safety regulator gradually loosening their inspection and sanction practices which in turn can lead to a re-emergence of illegal behaviours and a further round of severe sanctions. Therefore, the new policies induce repeated fluctuations of safety performance and accident concealment. There is also evidence that the levels of punishment are significantly influenced by other factors such as media attention and the type of enterprise ownership (Wei and Lu, 2015). Moreover, media representations of mining coverups as standard practice could potentially encourage mine owners to believe they are unlikely to be exposed (Yang and Wang, 2021).

## 2.3. Accident underreporting beyond China

The issues of accident concealment and underreporting are not exclusive to the Chinese mining industry. Underreporting of fatalities and injuries has been consistently noted in the academic literature. For instance, in the case of traffic accidents, it has been estimated that

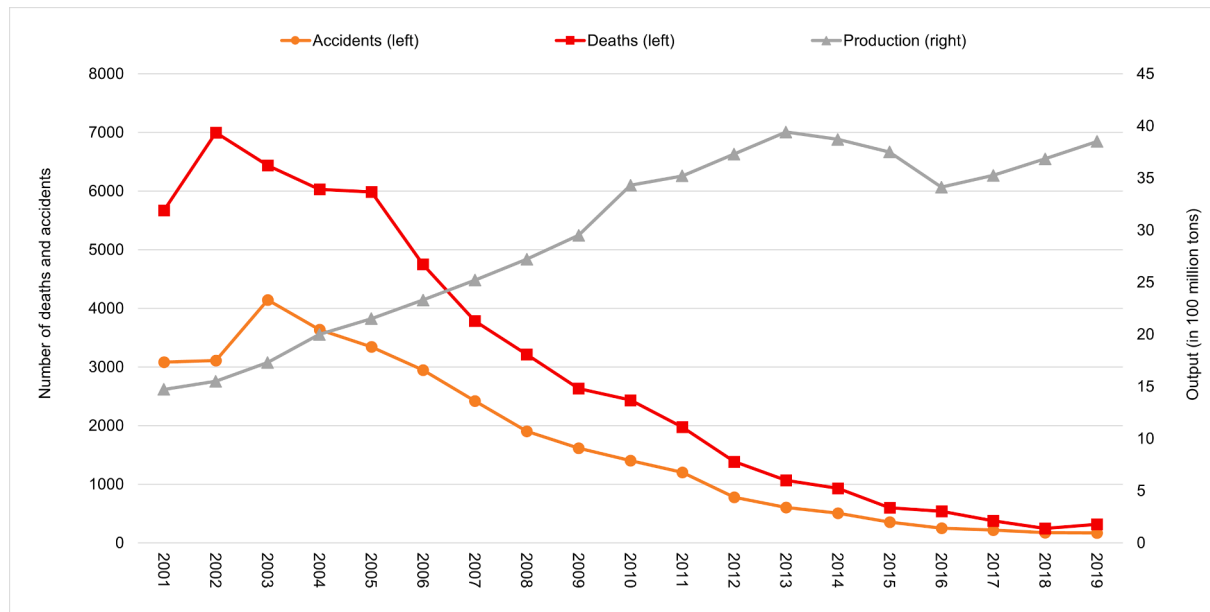
<sup>7</sup> As noted by Wang (2006, p. 19), before the NCMSA, the mining safety administration was fragmented in the 1990s. At the national level, the Ministry of Coal Industry, Ministry of Agriculture, Ministry of Labour, Ministry of Geology, Ministry of Public Security, and the Ministry of Public Health had certain jurisdiction over the administration of safety at TVE mines. Other types of work safety administrations also suffer from similar multi-headed management (Chan and Gao, 2012, p. 359).

**Table 1**  
Classification criteria and reporting requirements for accidents in China.

Level	Class	Criteria*			Reported to	Investigated by
		Deaths	Injuries	Economic damage		
I	Special serious	30+	100+	100 + million yuan	National CMSA	State Council
II	Serious	10–29	50–99	50–99 million yuan	National CMSA	Provincial government
III	Major	3–9	10–49	10–49 million yuan	Provincial CMSA	Prefecture government
IV	Normal	0–3	0–9	<10 million yuan	Prefecture CMSA	County government

Source: Compiled by authors.

\* Accident will be classified if at least one of the three criteria is met.



**Fig. 1.** Overview of coal mine production and safety in China, 2001–2019 (source: China Work Safety Yearbooks, various years).

between 11% and 65% of all road crashes in different contexts are underreported (e.g., [Alsop and Langley, 2001](#); [Amoros et al., 2006](#); [Couto et al., 2016](#); [Psarros et al., 2010](#); [Sciortino et al., 2005](#)). Coverups and underreporting are also prevailing causes of occupational fatalities ([Green et al., 2019](#); [Probst et al., 2017](#); [Tucker et al., 2014](#); [van der Westhuizen and Stanz, 2017](#)). [Tucker et al. \(2014\)](#) summarised prior studies and found that between 29% and 81% of work-related injuries and illnesses go unreported by employees.

Several factors have been identified that influence accident underreporting. The first are accident characteristics and the number of actors involved. For example, underreporting is more prominent for accidents with fewer injuries and injuries of lesser severity ([Alsop and Langley, 2001](#)). Gender and age also account for discrepancies in the reporting of work-related injuries, with young male workers being less likely to report injuries than young female workers ([Tucker et al., 2014](#)). Meanwhile, the availability and actors’ awareness of reporting procedures also influence accident reporting. For instance, a recent study found that the majority of janitors in the United States lacked awareness of reporting procedures and had little knowledge about compensation standards, preventing many janitors from reporting injuries, while others feared negative consequences of reporting ([Green et al., 2019](#)). Culture and ethics could also influence reporting behaviour. [Oswald et al. \(2018\)](#) identified a growing “compensation culture” in the United Kingdom where unjustified, frivolous, or fraudulent legal claims are made after safety accidents. In response to the increased number compensation claims, excessive paperwork and complicated reporting processes have been implemented which have in turn led to an

underreporting of accidents.

In response to the issues outlined above, some general recommendations have been made. These include recommendations to establish clear reporting procedures, increasing rights awareness among actors, and eliminating organisational and societal incentives that result in misreporting ([Green et al., 2019](#); [Oswald et al., 2018](#); [Tucker et al., 2014](#); [van der Westhuizen and Stanz, 2017](#)). Nonetheless, these suggestions are seldom systematically examined or empirically explored, meaning that there is little systematic knowledge about the effects of the institutional measures that are designed to improve safety and mitigate false reporting. The next section explains how this paper attempts to address this gap.

### 3. Methodology

#### 3.1. Data collection

Chinese mining safety data are incomplete and fragmented between different administrations. Official mining safety statistics are published by the National Coal Mine Safety Administration and China Work Safety Yearbooks. There are currently no specific government agencies or non-governmental organisations that collect statistics about mine accident coverage in China.

This study constructs an original dataset from a variety of sources on the basis that data triangulation presents a more reliable figure than official figures in isolation (Yin, 2014, pp. 97–99). Three different sources are accessed: *official*, *judicial*, and *media* sources.<sup>8</sup> First, the study considers the official source of the National Coal Mine Safety Administration and its provincial bureaus.<sup>9</sup> The database offers a non-exhaustive collection of mining accident investigation reports. The second source is the China Online Judgements Database which is maintained by China's Supreme People's Court.<sup>10</sup> This dataset includes documented adjudications from which the researchers selected those specifically pertaining to mining accident coverups. The third source includes cases from WiseNews, a digital news archive that includes articles from the main Chinese news agencies. Although Chinese media are strictly monitored and controlled by authorities, there is a limit to the extent that local authorities can exert control over local media, especially when such media are based outside their own administration.

Repeated searches using the above database search engines were conducted to retrieve relevant reports until the point of saturation occurred. Relevant search terms included mining accidents (*kuangnan*), coverups (*manbao*), and false reporting (*huangbao*). Each case was manually inspected and reviewed, with relevant information extracted with regard to mine name, production capacity, date, accident fatalities, official status of the mine (legal or illegal), and actors' involvement.

### 3.2. Data description

The sample includes 180 unique cases of accident coverups, of which 70 cases were verified by at least two different sources (Fig. 2). This section describes some of the sample's basic characteristics.

Fig. 3 illustrates the temporal distribution of the study sample, which is compared with official figures from the State Administration for Coal Mine Safety. The figure shows a higher ratio of coverup cases since 2010. However, it is believed that the issue of underreporting and concealment was also widespread before 2010 due to the existence of many unlicensed TVE mines (Wang, 2006). For instance, the NCMSA indicated that at least 16 coverups with 41 deaths were revealed in 2005, while in 2006 as many as 89 concealed accidents involving 204 deaths were reported (China Labour Bulletin, 2008, p. 15). Nevertheless, available sources including media news articles covering the period before 2010 often lack critical details and were therefore not included in our sample. Moreover, judicial data were only made available from 2013, so the sample's robustness and reliability are significantly stronger in the period after 2010. Fig. 3 also illustrates that the ratio of deaths is higher than the ratio of accidents, indicating that the cases in the sample have a relatively high number of fatalities.

Fig. 4 presents the spatial distribution of cases in each province. From the figure, it is evident that accident concealment and underreporting are widespread throughout the country in 26 of China's 34 provincial-level regions. Resource-abundant provinces such as Shanxi and Heilongjiang are included in the group of provinces with the highest number of accident concealment and underreporting.

### 3.3. Limitations

The sources accessed in the sample only contain cases that have been revealed, resulting in a clear epistemological limitation since the sample excludes "successfully" concealed cases, meaning that the sample is non-

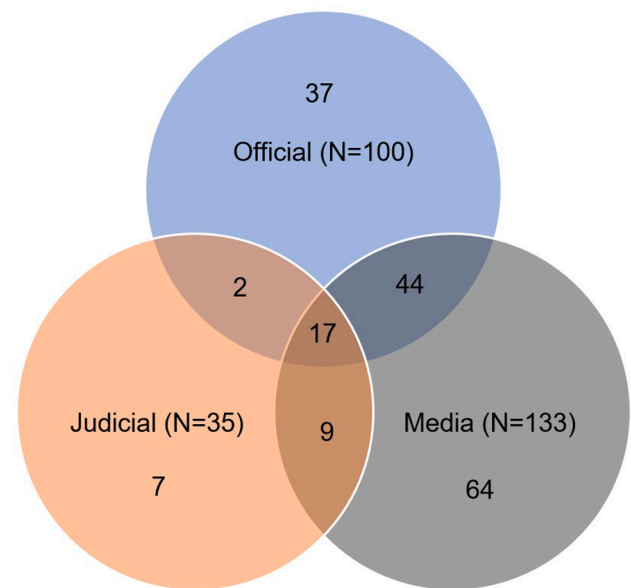


Fig. 2. Sample and case overlaps between the three data sources.

representative because the total number of coverups is unknown. Although we are unable to estimate the pervasiveness of the issue of mining accident coverups, the novel dataset offers important insights into how national mining safety regulations might become systematically and structurally compromised. Our preliminary findings encourage further research that makes use of a broader range of data sources and other methods to gather information and construct a more comprehensive casualty database.

## 4. Results

Recalling from Section 2, China has implemented a comprehensive set of measures to improve mining industry safety. Below we examine the extent to which each set of measures, including regulating, monitoring, and sanctioning, has been successful at improving China's mining safety and mitigating the issue of accident coverups.

### 4.1. Regulating China's mines

To regulate the mining industry, the central Chinese government has ordered the closure of numerous small-scale and informal mines. As shown in Table 2, most cases involve small-scale mines, in both the number of accidents (71.7% of all cases) and related deaths (75.0%). Moreover, the average deaths per accident in small mines (6.1) are higher than those in medium (5.5) or large (5.0) mines, which can be explained by large mines tending to have higher safety standards than small mines. This is also shown in the distribution of accident levels. Fig. 5 shows that the largest proportion of cases concealed by large mines are small accidents. In contrast, small mines tend to conceal larger accidents. To date, this finding is in line with existing knowledge that most coverups occur in small-scale mines (Wang, 2006). This justifies the actions of the central government targeted at small-scale mines. However, it should be emphasised that our results still show that the issue of accident concealment and underreporting is also pervasive at large-scale mines (19.4% of all cases). This shows that such issue is a phenomenon that is encountered by both small mines and larger state-owned mines alike.

In addition to closures of small mines, new regulations have been

<sup>8</sup> Over reliability concerns, we deliberately abstained from using other online sources such as blogs, internet discussion groups, and bulletin board systems (BBSs).

<sup>9</sup> National Coal Mine Safety Administration, [www.chinacoal-safety.gov.cn](http://www.chinacoal-safety.gov.cn) (accessed January to May 2020).

<sup>10</sup> China Judgements Online (*Zhongguo Caipan Wenshu Wang*), [wenshu.court.gov.cn](http://wenshu.court.gov.cn) (accessed January to May 2020).

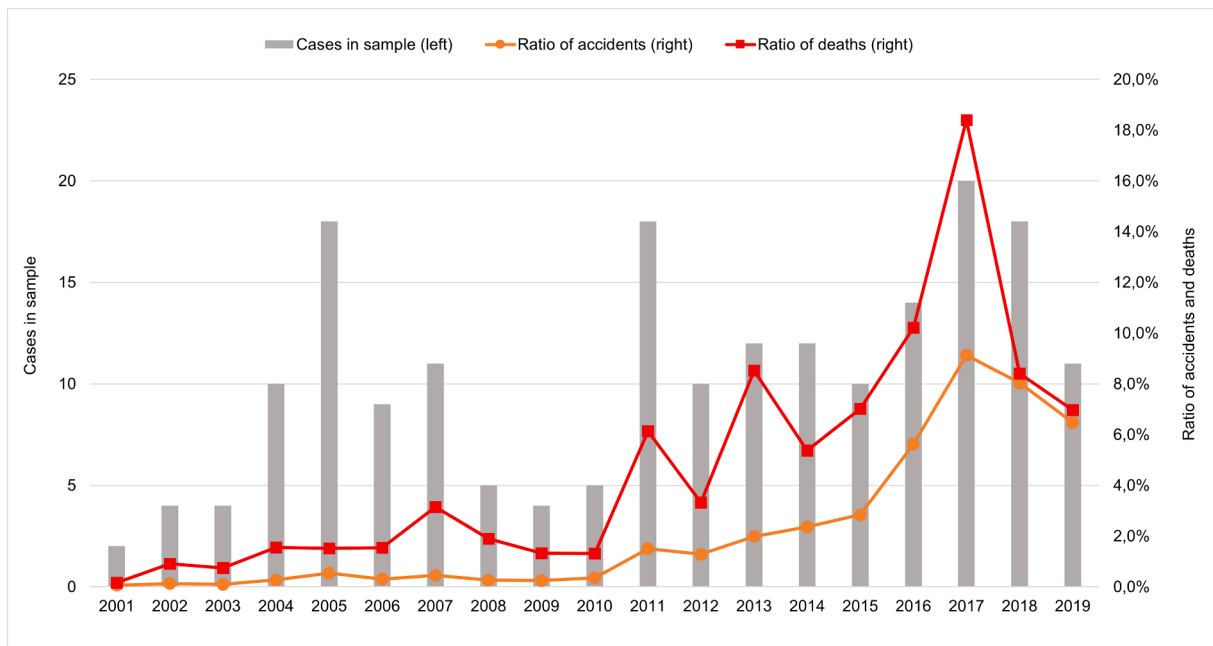


Fig. 3. Temporal distribution of the sample (source: the dataset).

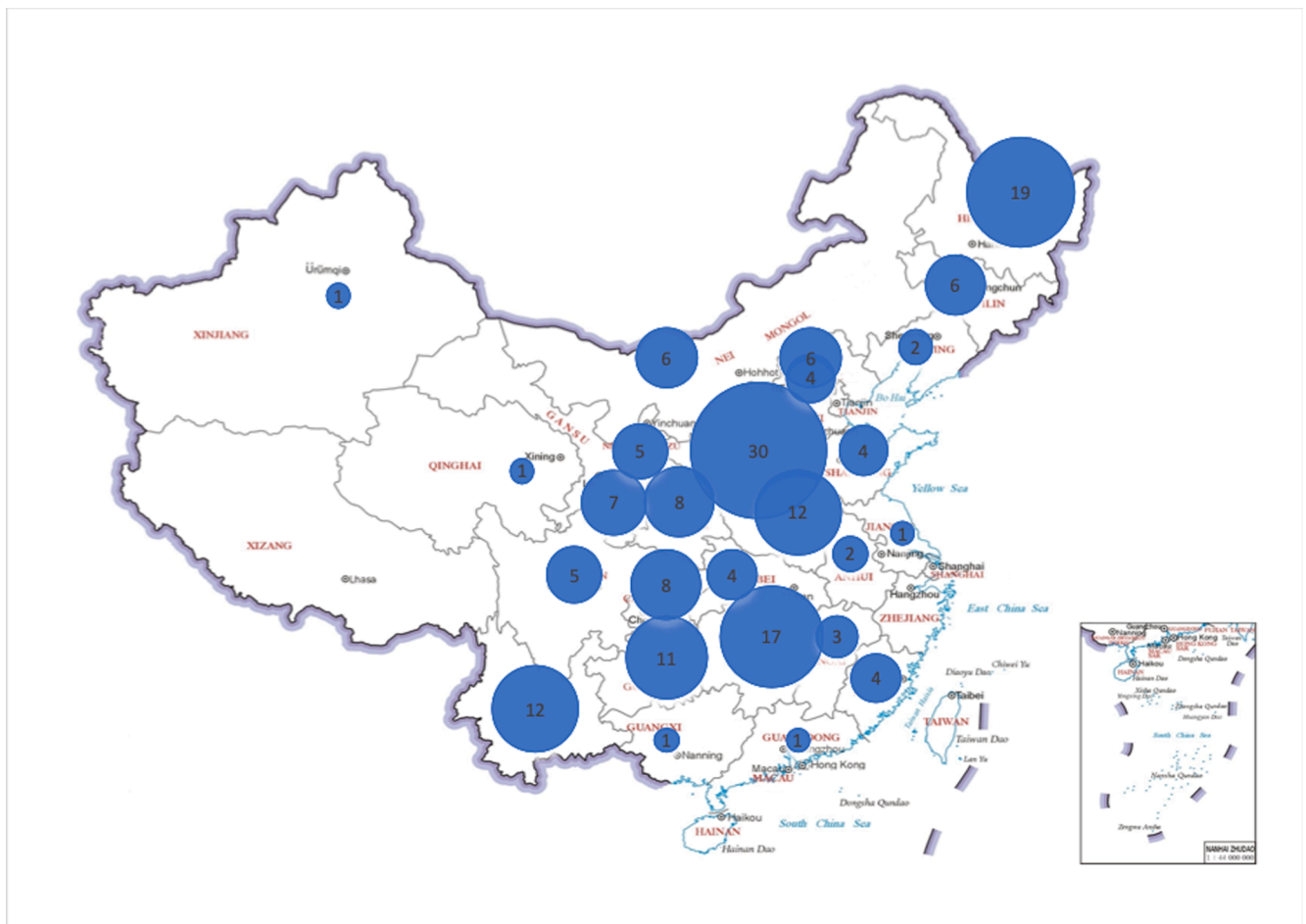


Fig. 4. Spatial distribution of the sample based on the number of cases.

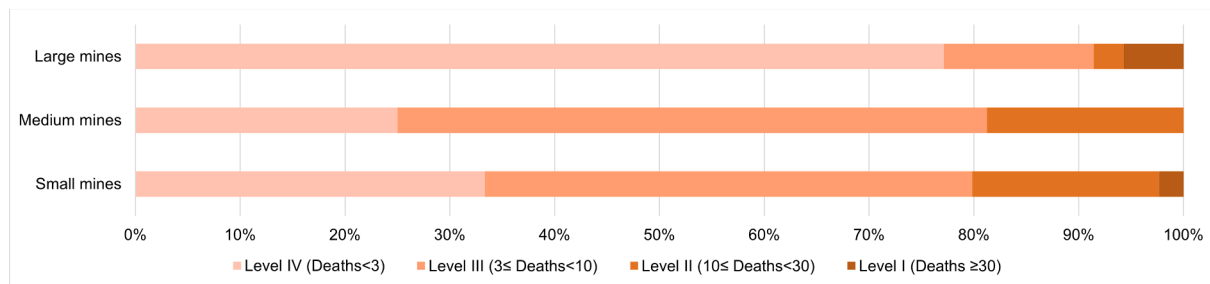


**Table 2**  
Distribution of accidents and deaths by size of mines.

Mine size*	Accidents		Deaths		Average deaths per accident
	N	%	N	%	
Large	35	19.4%	175	16.6%	5.0
Medium	16	8.9%	88	8.4%	5.5
Small	129	71.7%	790	75.0%	6.1
<b>Total</b>	<b>180</b>	<b>100%</b>	<b>1053</b>	<b>100%</b>	<b>5.9</b>

Source: the dataset.

\* Size based on annual production capacity in million tons coal: small (<0.3); medium (0.3–0.9); large (>0.9).



**Fig. 5.** Level of accidents for each size of mine.

introduced relating to mine operations. At present, a mine must obtain six licences before it can begin operations. For the cases in our sample, we categorised the mines into legal and illegal mines.<sup>11</sup> While it is widely believed that coverups are pervasive among many unlicensed mines operated privately or by TVEs (Wang, 2006; Wang et al., 2011), the sample’s findings show that the majority of coverups occur at legal mines. In 68.3% of the sample in this study, coverups occurred at mines that held all required licences, indicating that coverups occur regardless of a mine’s legal status.

#### 4.2. Reporting and monitoring mining safety

A second measure implemented in China’s coal mining industry addresses the monitoring of mining safety and particularly how mining incidents are reported. Our sample identifies two ways of determining how the severity, reporting, and response levels of mining incidents are manipulated. In most cases (85.0%), an attempt was made to cover up the accident entirely, while the number of fatalities was deliberately underreported in the remaining cases (15.0%).

Table 3 shows that underreporting occurred for accidents with relatively high numbers of fatalities (on average 13.3 deaths per accident). Similarly, Fig. 6 shows a clear trend whereby underreporting is more prevalent as the number of fatalities increases. One explanation is that for small accidents with few fatalities, it is relatively easier for mine managers to conceal the accident entirely. Conversely, accidents with more fatalities are arguably more difficult to hide from the public and authorities. In these instances, mine managers may opt to underreport the accident so that it falls within a lower level under the classified

<sup>11</sup> This was not a straightforward task due to data availability. In the official post-accident investigation reports, it was explicitly noted whether mines had the required licences. We applied a strict criterion: if one of the licences was outdated and not renewed on time, the mine is categorized as an illegal operation. For the cases from media and judicial sources, two methods were utilised to check a mine’s licencing status: first, if the media explicitly claimed that the mine was illegal, it is categorized as illegal; second, the National Energy Administration regularly publishes a list of coalmine production capacity including the name of the coal mine, production capacity, and the number of safety licences. If the coal mine is on the list, it is categorized as legal.

safety management and reporting system. By further comparing the reported deaths versus deaths in actuality of the underreported cases, it is found that in the majority of cases (92.6%), the number of deaths were intentionally underreported so that the accidents would be classified one level lower than they otherwise would be. In two exceptional cases, attempts were made to lower the severity level by two levels.

Two of the exposed cases illustrate the issue of underreporting. On the March 29, 2013 in Jilin Province, an explosion killed 36 workers at the Babao coalmine, which was operated by a state-owned enterprise (SOE).<sup>12</sup> However, in the aftermath of the event, the original report only counted 29 deaths were reported with an additional seven deaths hidden

so that the accident would not be classified as a “special serious” accident, which would require investigation from higher authorities and incur greater penalties. Similarly, in a gas explosion accident in 2017 in Lianyuan County (Hunan Province), only nine deaths were reported, despite there actually being 10 casualties.<sup>13</sup> Needless to say, limited transparency and underreporting of accidents complicate rescue operations.

Coverups and underreporting are not exclusively carried out by mine managers. Previous studies suggest that local officials, concerned for their reputation or to avoid risking penalties, may also be involved in coverups (Chan and Gao, 2012; Homer, 2009). Our sample also indicates government collusion. In total, 16.7% of all cases exhibited clear involvement of local authorities in concealing mining accidents.<sup>14</sup> As Table 4 shows, the involvement of authorities appears greater in cases with a high number of fatalities. Strikingly, government officials were

**Table 3**  
Characteristics of coverups and underreporting.

Types	Cases		Deaths		Average deaths per case
	N	%	N	%	
Coverup ( <i>manbao</i> )	153	85.0%	693	67.6%	4.5
Underreporting ( <i>huangbao</i> )	27	15.0%	360	34.8%	13.3
<b>Total</b>	<b>180</b>		<b>1053</b>		<b>5.9</b>

Source: the dataset.

<sup>12</sup> China Daily (8 April 2013), “Deaths ‘concealed’ in coal mine,” [http://usa.chinadaily.com.cn/china/2013-04/08/content\\_16381495.htm](http://usa.chinadaily.com.cn/china/2013-04/08/content_16381495.htm) (accessed 10th of April 2020).

<sup>13</sup> China Daily (20 February 2017), “Punish officials for falsifying accident’s death toll,” [http://www.chinadaily.com.cn/kindle/2017-02/20/content\\_28271320.htm](http://www.chinadaily.com.cn/kindle/2017-02/20/content_28271320.htm) (accessed 10th of April 2020).

<sup>14</sup> Official and judicial sources often contain the administrative and legal punishment of corrupt officials. Additionally, the media covers similar information. Media coverage of the dark side of Chinese society is usually more reliable than reports that extol the state because journalists can lose their jobs or even face prosecution if critical stories turn out to be inaccurate.

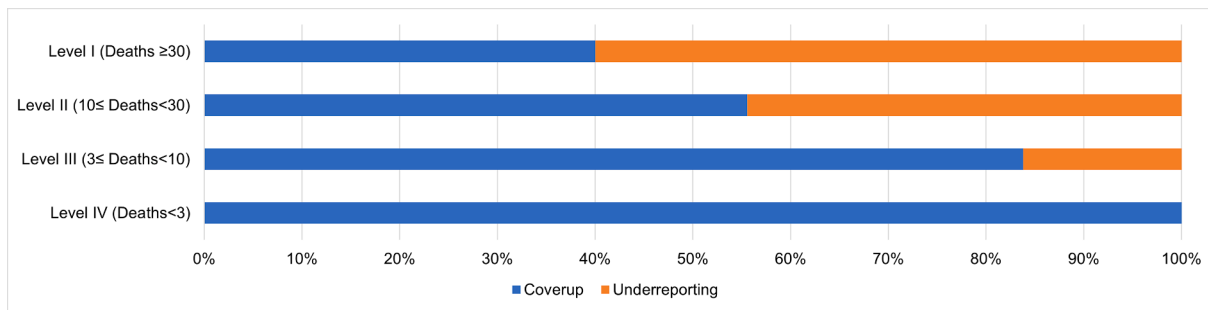


Fig. 6. Ratio of coverups/underreporting per accident level (source: the dataset).

involved in four of the five “special serious” accidents with over thirty deaths (summarised in Table 5). In addition to incurring the risk of higher sanctions, larger accidents also entail the involvement of higher-level authorities. Subsequently, officials at different levels are more likely to collude and to conceal true death tolls.

Finally, mine managers and state officials are not the only groups involved in coverups, with the sample indicating that family members of the deceased are often involved. This becomes clear when considering the compensation received by victims’ families. National compensation standards have steadily increased. Before 2004, compensation was based on direct negotiation between mine owners and victims’ families, averaging approximately 20,000 yuan (2,500 USD) per fatality, while in 2004, national regulations required mine owners to pay at least 200,000 yuan (25,000 USD) for each worker killed in an accident, a figure that was later raised to approximately 620,000 yuan (77,500 USD) in 2012, equivalent to 20 times the average per capita disposal income of urban residents. By calculating mean compensation in our sample, we find that compensation in the observed cases is generally two to three times higher than those of the national standards (Fig. 7).<sup>15</sup>

This indicates that despite increased national compensation standards, mine owners appear willing to pay far higher compensation than the official standards to conceal accidents. For instance in the Baiyun coal mining accident (Hunan Province) which killed three mine workers

Table 4

Cases with government collusion as a percentage of total cases per accident level.

	Level IV (Deaths < 3)	Level III (3 ≤ Deaths < 10)	Level II (10 ≤ Deaths < 30)	Level I (Deaths ≥ 30)	Total
Cases with collusion	5	12	9	4	30
Total cases	74	74	27	5	180
Ratio	6.8%	16.2%	33.3%	80.0%	16.7%

on the 23rd of September 2013, compensation of 1.3 million yuan

<sup>15</sup> It is worth noting that the ostensibly “high” compensation is insufficient to compensate for the traumatic consequences of these disasters for the families of accident victims. A conservative calculation of the financial value of the life of a mine worker in 2008 was approximately 2 million yuan (Qian, 2011), which was almost ten times the “national benchmark” for compensation payments. Victims of mining accidents are usually the sole source of income for their families, which include elderly parents, school-aged children, and spouses lacking paid employment. The compensation is an all-inclusive payment that is supposed to account for the fact that healthy workers in the prime of life could have supported their families for years to come. Otherwise, losing the main breadwinner would condemn the victims’ family to poverty for years or decades in the future (China Labour Bulletin, 2008; Yang, 2020). Discriminatory compensation between local and non-local workers also influences employment strategies in the mining industry (Yang and Ho, 2019).

Table 5

Overview of special serious mining accident coverups.

Name	Date	Province	Reported deaths	Actual deaths	Government collusion
Yangquangou	Dec. 12, 2002	Shanxi	8	30	Yes
Jiajiabao	Jul. 2, 2005	Shanxi	19	36	Yes
Xinjing	May 18, 2006	Shanxi	0*	56	Yes
Lijiawa	Jul. 14, 2008	Hebei	0*	34	Yes
Babao	Mar. 29, 2013	Jilin	29	36	No

Source: compiled by authors.

\* The accident was initially covered up.

(162,500 USD) was offered for each victim as “hush money” (*feng kou fei*) by the mine owner. Furthermore, the victims’ families immediately received an initial payment of one million yuan. If the accident remained concealed, the families were to receive an additional 200,000 yuan after the first month and the remaining 100,000 yuan after five months of successful concealment. The families agreed and declared that the victims had died from gastropathy.

#### 4.3. Sanctioning mining accidents after exposure

The third measure introduced by the central government to improve mining safety is the imposition of stiffer sanctions specifically targeted at the issue of coverups.

It is important to first estimate the duration of the period between the accident and actual exposure. Fig. 8 shows that only approximately one-quarter (27.0%) of accidents were exposed within the first two days of the accident. This figure is concerning given that the first two days are arguably the most critical for rescue operations. In some cases, it could take up to one year before the accident was exposed (22.0%), while in extreme cases (5.0%) it could exceed one year. For instance, the accident in Rongningfeng (Henan Province) which killed 24 mine workers on the 22nd of December 2009 was concealed for over three years.<sup>16</sup>

When coverups are exposed, the next step is to examine how they are sanctioned. As mentioned in Section 2.1, there are four main types of penalties: (i) mine closure or suspension of production; (ii) transfer of responsible parties to the judiciary; (iii) fines imposed on responsible individuals; and (iv) a fine on the company. Different sanctions may apply to a case simultaneously. Based on an overview of all official

<sup>16</sup> Xinhua News (9 September 2014), “Rongningfeng coal mine accident cover-up was severely punished,” [http://www.gov.cn/xinwen/2014-09/09/content\\_2747112.htm](http://www.gov.cn/xinwen/2014-09/09/content_2747112.htm) (accessed 23rd of October 2020).

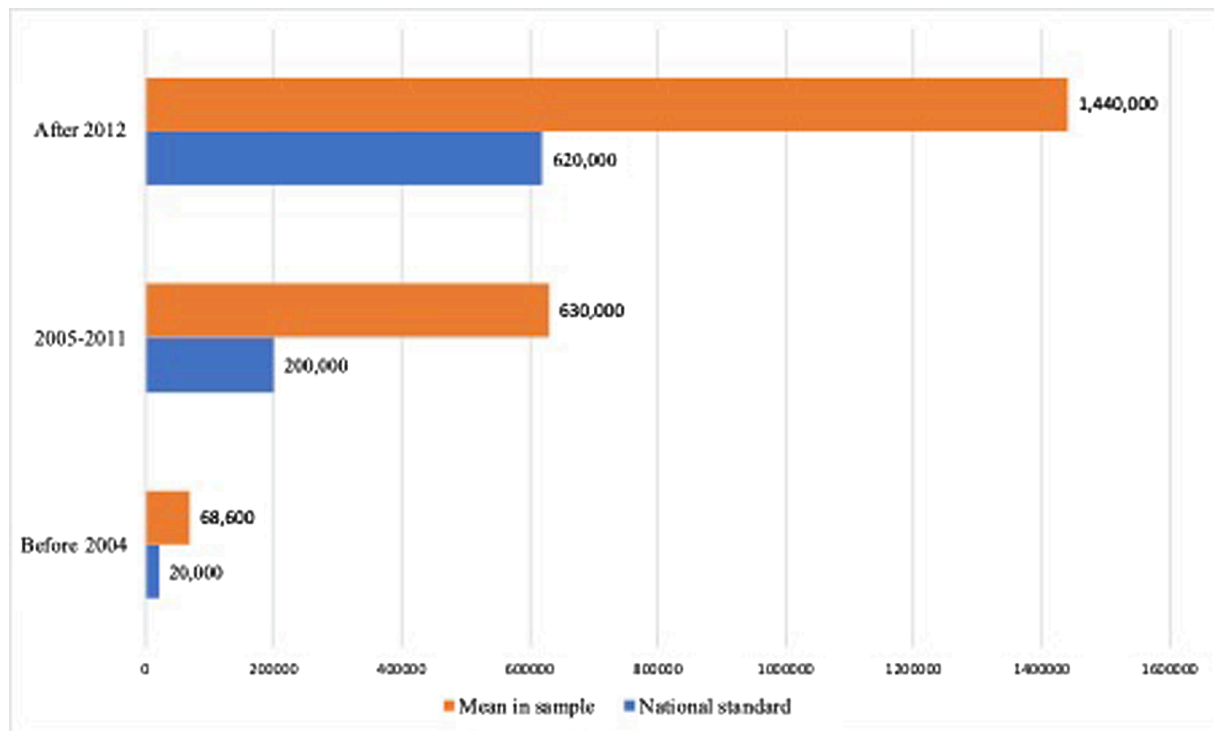


Fig. 7. Compensation in cover-up cases versus national standards in yuan (source: the dataset).

investigative reports ( $N = 80$ ), Fig. 9 shows how often the four types of penalties are applied.

This indicates that the most frequent type of punishment is a fine on the company (83.8% of all cases) or an individual (73.8%). In other instances, the responsible individuals were transferred to the judiciary for further trial (61.3%), while in a few instances (11.3%) the mines were required to be closed or suspended. In general, when a coverup is exposed, punishment is lenient, and mine closure or suspension of mining operations is seldom imposed.<sup>17</sup>

## 5. Conclusions and implications

The Chinese central government has adopted a series of institutional measures to improve the safety of its coal mining industry and workers. Official figures accordingly show a significant reduction in both accidents and fatalities over the last two decades, resulting in the emergence of a new safety narrative. However, this view neglects the fact that many mining accidents are deliberately concealed or underreported. To offer an alternative perspective, this study critically re-assessed the effects of safety measures using a novel dataset of 180 mining accident coverup cases derived from official, judicial, and media sources.

Table 6 summarises our results and indicates how China's institutional mining safety measures have become structurally compromised, and in some instances, have even led to disturbing consequences. While regulatory measures to close informal and small mines and the imposition of stricter legal requirements for mining operations are justified, our dataset shows that accidents and coverups have continued at both legal and large mines that are frequently operated by state-owned enterprises. Similarly, licences also appear to be empty institutions, as explained by

<sup>17</sup> In some investigative reports, there is a section about the coverup process, which typically includes how the involved persons decided to cover up the accident. Reasons that are often mentioned include the fact that production suspension induces higher costs and salary suspension for workers and the proximity of a highly sensitive political event such as a party meeting. Further study is required to understand stakeholders' interests and influence.

Li Yizhong, then director of the Chinese State Administration of Work Safety: despite possessing all six licences, mines continue to violate Chinese laws and regulations in the context of what he described as the "five poisons" of (i) illegal mining, (ii) unsafe operations, (iii) overloading work capacities, (iv) deliberate coverups, and (v) negligence of management.<sup>18</sup> To improve the monitoring of safety measures, new fatality indicators and reporting systems have been introduced to address pervasive principal-agent problems. Government officials and mine managers have also been held accountable for work-related accidents (Chan and Gao, 2012; Minzner, 2009). However, our results indicate that this has not stopped structural manipulation of data concerning the underreporting of fatality numbers or the concealment of accidents altogether, often paired with high compensation to victims' families in exchange for their silence. Finally, our results also show that despite the establishment of new sanctions, severe penalties such as mine closures are rarely imposed.

The failing regulatory, monitoring, and sanctioning measures observed in this study result in unreliable estimates of the total number of accidents in China's coal mining industry, which casts doubts on the acclaimed safety narrative. However, our observed outcomes also have immediate implications for rescue operations. Accurate and swift provision of information is crucial for rescue efforts since rescuers must decide what to do and how to save those still trapped. If key information is withheld from rescuers, they may make incorrect decisions that could result in further casualties. Meanwhile, if an accident is concealed entirely, special state emergency rescue teams will not be deployed which will further increase the number of fatalities.<sup>19</sup> Nonetheless, coverups are likely to continue because actual sanctions have continued to be weakly enforced. Another consequence of the failing measures is

<sup>18</sup> Chinacourt.org, 2007–12-13, "Five poisons and six licences," <https://www.chinacourt.org/article/detail/2007/12/id/279153.shtml> (accessed 18th of June 2020).

<sup>19</sup> Note that state emergency rescue teams are already very limited relative to the number of coal mines. As of 2013, there were 397 specialized mine rescue teams in China, serving over 12,000 coal mines nationwide (He et al., 2019).

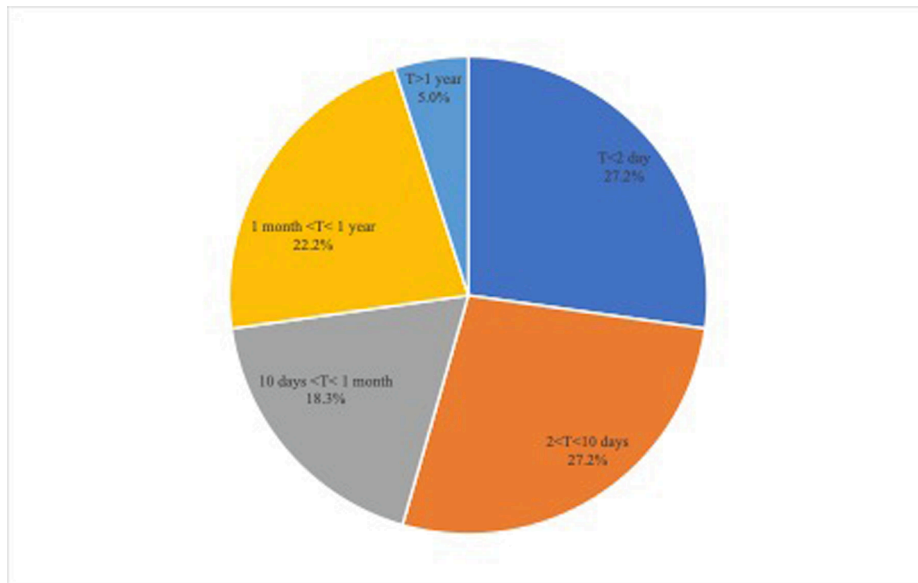


Fig. 8. Duration between accident to exposure (source: the dataset).

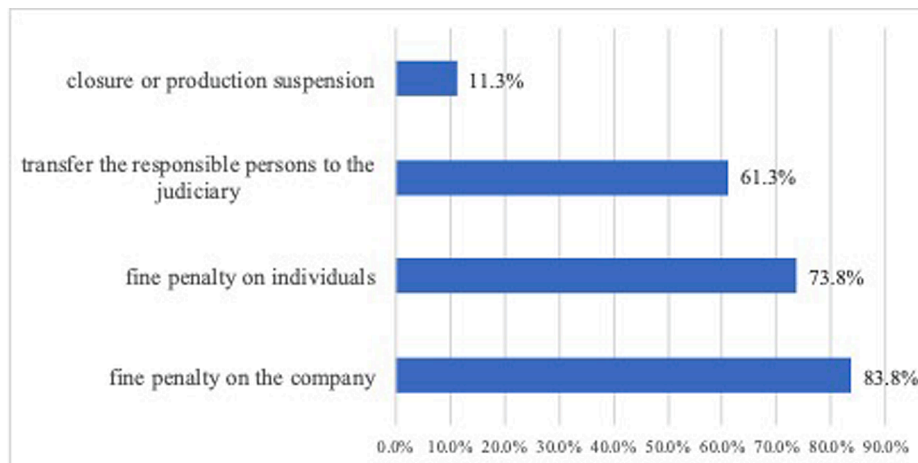


Fig. 9. Punishment for coverups (as a percentage of all cases, N = 80) (source: the dataset).

**Table 6**  
Compromising effects on mining safety measures.

Institutional mining safety measures	Findings
Closure of informal and small mines and new legal requirements for mine operations	Accidents and coverups have continued at both legal and larger mines
New fatality indicator and classified safety reporting systems	Downward manipulation of reported figures by mine operators, government officials, and victims' families
Increased sanctions and stiffer penalties against coverups	More severe penalties are rarely imposed

Source: Drawn by authors.

the emergence of so-called “blind shaft” murders<sup>20</sup> in which miners kill a co-worker, and attempt to make the death look like an accident in order to extort compensation from the mine owner to keep the incident concealed. At least 144 such cases have been covered in news reports during

<sup>20</sup> The term is related to the movie ‘Blind Shaft’, the Berlin Movie Festival’s 2003 Silver Prize winner.

the last two decades (Yang, 2020). Finally, with the pervasiveness of coverups and underreporting unchanged, official figures come to be viewed with increased suspicion from the public.<sup>21</sup>

Regulating, monitoring, and sanctioning are standard institutional solutions to improve safety. Beyond China’s coal mining sector, similar solutions have been introduced for road or occupational safety. Our study is a textbook example that demonstrates how institutional measures introduced by central authorities are subject to deliberate manipulation and structural deconstruction by actors at the local level, which can even result in contradictory behaviour and outcomes. Most clearly, measures designed for safety and transparency may instead result in reduced transparency or a blame culture where “the way safety was managed was to not problem solve to avoid reoccurrence, but to instead blame others for failings” (Oswald et al., 2018, p. 301).

Finally, we second the point put forth by Saleh and Cummings (2011) that the most essential resource that leaves the mine every day is the miner, not the coal. Mine owners and responsible agencies are obligated

<sup>21</sup> Similar suspicions appeared in the high-speed train collision in Wenzhou on the 23rd of July 2011, where netizens doubted the officially reported number of victims (Liu and Chang, 2018).

to provide a safe workplace for mineworkers. Since the current measures are still inadequate, it is imperative to adopt new strategies to improve safety and reporting. To address the issue of accident coverups and underreporting, it is critical to empower safety bureaus with inspection and enforcement rights. Moreover, it is necessary to establish an accident reporting system that directly disseminates accident information at all hierarchical levels instead of moving from one level to the next. More actors should also be involved in accident reporting and the government should seek assistance from labour unions, the media, and other relevant actors to combat the issue of coverups and underreporting. Until such improvements are introduced, the position of China's new safety narrative remains precarious.

### CRedit authorship contribution statement

**Xiuyun Yang:** Conceptualization, Methodology, Validation, Formal analysis, Data curation, Writing – original draft, Writing – review & editing, Visualization, Funding acquisition. **Kees Krul:** Conceptualization, Methodology, Validation, Formal analysis, Writing – original draft, Writing – review & editing, Visualization. **David Sims:** Writing – review & editing.

### 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.

### Acknowledgement

This work was supported by the Humanities and Social Sciences Project of the Ministry of Education in China (No. 20YJCZH208), and the Fundamental Research Funds for the Central Universities (No. 20720191002). We are grateful to Chenhao Guan, Yanmin Li, and Wenyu Ye for data collection.

### References

- Alsop, J., Langley, J., 2001. Under-reporting of motor vehicle traffic crash victims in New Zealand. *Accid. Anal. Prev.* 33 (3), 353–359. [https://doi.org/10.1016/S0001-4575\(00\)00049-X](https://doi.org/10.1016/S0001-4575(00)00049-X).
- Amoros, E., Martin, J.-L., Laumon, B., 2006. Under-reporting of road crash casualties in France. *Accid. Anal. Prev.* 38 (4), 627–635. <https://doi.org/10.1016/j.aap.2005.11.006>.
- Andrews-Speed, P., Ma, G., Shao, B., Liao, C., 2005. Economic responses to the closure of small-scale coal mines in Chongqing, China. *Resour. Policy* 30 (1), 39–54.
- Cai, Y., 2000. Between state and peasant: local cadres and statistical reporting in rural China. *China Q.* 163, 783–805. <https://doi.org/10.1017/S0305741000014661>.
- Caulfield, J.L., 2006. Local government reform in China: a rational actor perspective. *Int. Rev. Adm. Sci.* 72 (2), 253–267. <https://doi.org/10.1177/0020852306064613>.
- Chan, H.S., Gao, J., 2012. Death versus GDP! Decoding the fatality indicators on Work Safety Regulation in Post-Deng China. *China Q.* 210, 355–377. <https://doi.org/10.1017/S0305741012000379>.
- China Labour Bulletin, 2008. Bone and Blood: The Price of Coal in China. Hong Kong.
- Couto, A., Amorim, M., Ferreira, S., 2016. Reporting road victims: assessing and correcting data issues through distinct injury scales. *J. Safety Res.* 57, 39–45. <https://doi.org/10.1016/j.jsr.2016.03.008>.
- Fisman, R., Wang, Y., 2017. The distortionary effects of incentives in government: evidence from China's "death ceiling" program. *Am. Econ. J. Appl. Econ.* 9 (2), 202–218. <https://doi.org/10.1257/app.20160008>.
- Geng, F., Saleh, J.H., 2015. Challenging the emerging narrative: critical examination of coalmining safety in China, and recommendations for tackling mining hazards. *Saf. Sci.* 75, 36–48. <https://doi.org/10.1016/j.ssci.2015.01.007>.
- Green, D.R., Gerberich, S.G., Kim, H., Ryan, A.D., McGovern, P.M., Church, T.R., Schwartz, A., Arauz, R.F., 2019. Knowledge of work-related injury reporting and perceived barriers among janitors. *J. Safety Res.* 69, 1–10. <https://doi.org/10.1016/j.jsr.2019.01.003>.
- He, X., Song, L.I., 2012. Status and future tasks of coal mining safety in China. *Saf. Sci.* 50 (4), 894–898. <https://doi.org/10.1016/j.ssci.2011.08.012>.
- He, Z., Wu, Q., Wen, L., Fu, G., 2019. A process mining approach to improve emergency rescue processes of fatal gas explosion accidents in Chinese coal mines. *Saf. Sci.* 111, 154–166. <https://doi.org/10.1016/j.ssci.2018.07.006>.
- Homer, A.W., 2009. Coal mine safety regulation in China and the USA. *J. Contemp. Asia* 39 (3), 424–439. <https://doi.org/10.1080/00472330902944511>.
- Jia, R., Nie, H., 2017. Decentralization, collusion and coalmine deaths in China. *Rev. Econ. Stat.* 99 (1), 105–118. [https://doi.org/10.1162/REST\\_a\\_00563](https://doi.org/10.1162/REST_a_00563).
- Liu, S.N., Chang, T.-K., 2018. One disaster, three institutional responses: legitimation crisis and competing discourses in China. *J. Stud.* 19 (3), 392–414. <https://doi.org/10.1080/1461670X.2016.1190666>.
- Liu, Q., Li, X., Hassall, M., 2019a. Regulatory regime on coal Mine Safety in China and Australia: Comparative analysis and overall findings. *Resour. Policy* 101454. <https://doi.org/10.1016/j.resourpol.2019.101454>.
- Liu, Q., Li, X., Meng, X., 2019b. Effectiveness research on the multi-player evolutionary game of coal-mine safety regulation in China based on system dynamics. *Saf. Sci.* 111, 224–233. <https://doi.org/10.1016/j.ssci.2018.07.014>.
- Liu, X., Liu, Y., 2007. Expected utility analysis of accident coverups by private coal mines. *Coal Mine Saf.* 72–74.
- Lööv, J., Nygren, M., 2019. Initiatives for increased safety in the Swedish mining industry: studying 30 years of improved accident rates. *Saf. Sci.* 117, 437–446. <https://doi.org/10.1016/j.ssci.2019.04.043>.
- Mao, Q., Ma, B., 2017. Explanation of behaviors in coal mine accident cover-up: from the perspective of "systematic-stakeholders". *China Public Adm.* 114–121. <https://doi.org/10.3782/j.issn.1006-0863.2017.01.20>.
- Minzner, C.F., 2009. Riots and cover-ups: counterproductive control of local agents in China. *Univ. Pennsylvania J. Int. Econ. Law* 31, 53–123.
- Oswald, D., Sherratt, F., Smith, S., Dainty, A., 2018. An exploration into the implications of the 'compensation culture' on construction safety. *Saf. Sci.* 109, 294–302. <https://doi.org/10.1016/j.ssci.2018.06.009>.
- Probst, T.M., Estrada, A.X., 2010. Accident under-reporting among employees: testing the moderating influence of psychological safety climate and supervisor enforcement of safety practices. *Accid. Anal. Prev.* 42 (5), 1438–1444. <https://doi.org/10.1016/j.aap.2009.06.027>.
- Probst, T.M., Petitta, L., Barbaranelli, C., 2017. Comparing recall vs. recognition measures of accident under-reporting: a two-country examination. *Accid. Anal. Prev.* 106, 1–9. <https://doi.org/10.1016/j.aap.2017.05.006>.
- Psarros, G., Skjong, R., Eide, M.S., 2010. Under-reporting of maritime accidents. *Accid. Anal. Prev.* 42 (2), 619–625. <https://doi.org/10.1016/j.aap.2009.10.008>.
- Qian, Y., 2011. The statistical value of coal miners' lives. *Stat. Res.* 28, 89–92.
- Qian, Y., Xu, C., 1993. Why China's economic reforms differ: the M-form hierarchy and entry/expansion of the non-state sector. *Econ. Transit.* 1 (2), 135–170. <https://doi.org/10.1111/j.1468-0351.1993.tb00077.x>.
- Saleh, J.H., Cummings, A.M., 2011. Safety in the mining industry and the unfinished legacy of mining accidents: safety levers and defense-in-depth for addressing mining hazards. *Saf. Sci.* 49 (6), 764–777. <https://doi.org/10.1016/j.ssci.2011.02.017>.
- Sciortino, S., Vassar, M., Radetsky, M., Knudson, M.M., 2005. San Francisco pedestrian injury surveillance: mapping, under-reporting, and injury severity in police and hospital records. *Accid. Anal. Prev.* 37 (6), 1102–1113. <https://doi.org/10.1016/j.aap.2005.06.010>.
- Shen, L., Gao, T., Cheng, X., 2012. China's coal policy since 1979: a brief overview. *Energy Policy* 40, 274–281. <https://doi.org/10.1016/j.enpol.2011.10.001>.
- Shi, X., 2013. China's small coal mine policy in the 2000s: a case study of trusteeship and consolidation. *Resour. Policy* 38 (4), 598–604. <https://doi.org/10.1016/j.resourpol.2013.09.009>.
- Song, X., Mu, X., 2013. The safety regulation of small-scale coal mines in China: analysing the interests and influences of stakeholders. *Energy Policy* 52, 472–481. <https://doi.org/10.1016/j.enpol.2012.09.069>.
- Tu, J., 2007. Coal mining safety: China's Achilles' heel. *China Secur.* 3, 36–53.
- Tucker, S., Diekrager, D., Turner, N., Kelloway, E.K., 2014. Work-related injury underreporting among young workers: prevalence, gender differences, and explanations for underreporting. *J. Safety Res.* 50, 67–73. <https://doi.org/10.1016/j.jsr.2014.04.001>.
- van der Westhuizen, J., Stanz, K., 2017. Critical incident reporting systems: a necessary multilevel understanding. *Saf. Sci.* 96, 198–208. <https://doi.org/10.1016/j.ssci.2017.04.004>.
- Van Rooij, B., Zhu, Q., Li, N., Wang, Q., 2017. Centralizing trends and pollution law enforcement in China. *China Q.* 231, 583–606. <https://doi.org/10.1017/S0305741017000935>.
- Wang, S., 2006. Regulating death at coalmines: changing mode of governance in China. *J. Contemp. China* 15 (46), 1–30. <https://doi.org/10.1080/10670560500331658>.
- Wang, X., Wu, S., Song, Q., Tse, L.-A., Yu, I.T.S., Wong, T.-W., Griffiths, S., 2011. Occupational health and safety challenges in China-focusing on township-village enterprises. *Arch. Environ. Occup. Heal.* 66 (1), 3–11. <https://doi.org/10.1080/19338244.2010.486424>.
- Wang, Q., 2010. Scribe gets 16 years in mine accident coverup [WWW Document]. *China Dly.* Available from: <[http://www.chinadaily.com.cn/china/2010-01/06/content\\_9270859.htm](http://www.chinadaily.com.cn/china/2010-01/06/content_9270859.htm)> (accessed 2.22.16).
- Wei, J., Lu, S., 2015. Investigation and penalty on major industrial accidents in China: the influence of environmental pressures. *Saf. Sci.* 76, 32–41. <https://doi.org/10.1016/j.ssci.2015.02.006>.
- Wright, T., 2007. State Capacity in Contemporary China: 'closing the pits and reducing coal production'. *J. Contemp. China* 16 (51), 173–194. <https://doi.org/10.1080/10670560701194392>.
- Yang, X., 2020. An assessment of the media's portrayal of murders at Chinese mines. *Extr. Ind. Soc.* 7 (3), 1066–1076. <https://doi.org/10.1016/j.exis.2020.07.014>.
- Yang, X., 2022. Worshipping colliery gods in China: Religious view of resource extraction and mining safety. *Extr. Ind. Soc.* 9, 101041. <https://doi.org/10.1016/j.exis.2021.101041>.
- Yang, X., Ho, P., 2019. Is mining harmful or beneficial? A survey of local community perspectives in China. *Extr. Ind. Soc.* 6 (2), 584–592. <https://doi.org/10.1016/j.exis.2019.02.006>.

- Yang, X., Ho, P., 2020. Mining institutions, contention and credibility: applying the conflict analysis model to court cases in China. *Extr. Ind. Soc.* 7 (3), 1011–1021. <https://doi.org/10.1016/j.exis.2019.11.012>.
- Yang, X., Wang, B., 2021. Framing and blaming: media coverage of coal mining accident coverups in China. *Extr. Ind. Soc.* 8 (2), 100895. <https://doi.org/10.1016/j.exis.2021.100895>.
- Yang, X., Zhao, H., Ho, P., 2017. Mining-induced displacement and resettlement in China: a study covering 27 villages in 6 provinces. *Resour. Policy* 53, 408–418. <https://doi.org/10.1016/j.resourpol.2017.07.001>.
- Yin, R., 2014. *Case Study Research: Design and Methods*. Sage Publications.
- Zhou, X., 2010. The institutional logic of collusion among local governments in China. *Mod. China* 36 (1), 47–78. <https://doi.org/10.1177/0097700409347970>.