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Association between the guardians' educational levels and unintentional injuries in children aged 6–18 in Shenzhen, China

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Abstract

Background Unintentional injuries is the leading cause of death in children aged 6–18 in China. Previous studies on the association between the guardians' educational levels and unintentional injuries in children have been inconclusive, and it remains unclear among the Chinese population. Therefore, this study aimed to identify the association between guardians' educational levels and unintentional injuries in children aged 6–18 in Shenzhen, China.

Methods This cross-sectional study enrolled 9,903 children aged 6–18 in Shenzhen in 2020 using a multistage cluster sampling method. Information on the children and guardians were collected, and unintentional injuries in the past year was examined by using two nested questions. Logistic regression analyses were used to test the association between the guardians' educational levels and unintentional injuries in children aged 6–18, and the crude odds ratios (ORs) and adjusted ORs with 95% confidence intervals (95% CI) were calculated.

Results 275 of the 9,903 children reported experiencing at least one unintentional injuries in the past year, and the weighted incidence of unintentional injuries was 6.3% (95% CI: 5.8–6.8%) in children aged 6–18 in Shenzhen, China. The incidence of unintentional injuries differed significantly in the guardians' education levels ($P < 0.05$). After adjustment for the children's variables, multiple binary logistic regression analysis showed that compared to children whose guardians' educational levels were low, children whose guardians' educational levels were high (adjusted OR = 0.57, 95% CI: 0.37–0.87) and medium (adjusted OR = 0.56, 95% CI: 0.39–0.81) had a lower odds of unintentional injuries. Similar results were also observed when further adjustment for both the children's and guardians' variables.

Conclusion The overall incidence of unintentional injuries in children aged 6–18 in Shenzhen was low, and it was associated with the guardians' educational levels. Children whose guardians' educational levels were low should be given special concern to prevent unintentional injuries, and it is suggested to reduce the incidence of unintentional injuries in children by improving the guardians' educational levels.

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Keywords Unintentional injuries, Educational levels, Cross-sectional study, Shenzhen, Children

Background

Unintentional injuries are defined in terms of a series of external cause codes, such as road traffic injuries, poisoning, falls, fires and burn injuries, and drowning [1]. According to the World Report on Child Injury Prevention, around 950,000 children under the age of 18 die from injuries each year, 90% of which are unintentional [2, 3]. Furthermore, injuries dominated the causes of death in children aged 6–18 in 2020 based on data from the Chinese Center for Disease Control and Prevention [4]. In addition to death, unintentional injuries are the second leading cause of disability worldwide [5], and accidental injuries impose a heavy financial burden and medical stress to the society [6]. For example, a study reviewed the economic cost of unintentional injuries and found that the cost of unintentional injuries in children was enormous, ranging from US $516,938.0 to US $9,550,704.0 per year in the USA [7], and a study on the financial costs of hospitalization for unintentional injuries among 6,215 children aged 0–14 years in Northwest China found that the total cost of hospitalization was US $1,033,876.0, with a median cost of US $90.5 per case; and the total length of stay in the hospital was 106,915.2 days, with a median of 13.0 days per case [8]. Therefore, an attempt to investigate factors associated with unintentional injuries in children is imperative as it can help identify those at high risk and thereby taking appropriate measures to prevent or reduce the incidence of unintentional injuries [9].

Accumulating evidence has shown that factors related to the guardians could affect the incidence of unintentional injuries in children [10–12]. The relationship between the socioeconomic status of guardians and unintentional injuries in children has been well documented [10, 11], and previous studies have linked the parental mental illness with an increased risk of injury in the offspring [12]. Additionally, the role of guardians' educational levels in the occurrence of unintentional injuries has received public attention [13, 14]. For example, a cohort study in Sweden found that children whose guardians' educational levels were lower had a 1.48 times higher risk of death or hospitalization due to unintentional injuries than children whose guardians' educational levels were higher [15], and a population-based retrospective study in South Korea showed similar findings [16]. However, in China, it remains unclear whether the guardians' educational levels could have an impact on the incidence of unintentional injuries in children. Considering the differences in the educational systems and social and cultural background across countries, it is still necessary to investigate the relationship between the guardians' educational levels and unintentional injuries among children in China.

In China, educational inequalities remain high [17]. Shenzhen, the Chinese city that has the largest share of internal migrant population due to its development as a Special Economic Zone, is representative in terms of the guardians' educational levels in China. Therefore, this cross-sectional study aimed to identify the association between the guardians' educational levels and unintentional injuries in children aged 6–18 in Shenzhen, China.

Methods

Study design

As a part of the "2016–2020 Child Injury Prevention Program Child Injury Special Survey Plan" by the National Center for Chronic and Noncommunicable Disease Control and Prevention of the Chinese Center for Disease Control and Prevention in China [18], this cross-sectional study was conducted in Shenzhen, China. A multistage cluster sampling method was used to select the participants. There were 9 districts and 785 schools in Shenzhen (including 347 primary schools and 435 high schools) in 2020. First, Longhua District was randomly selected from the 9 districts in Shenzhen. Then, Guanhu Street was selected from the 6 streets. Finally, four schools (including one primary school, two combined primary and junior high schools, and one combined primary and high school school) in Guanhu Street were chosen randomly, and a total of 9,903 children aged 6–18 in these 4 schools were included in this study. According to the sample size formula for categorical outcome in cross-sectional studies "$N=deff^{*}Z^{2}p(1\text{-}p)/d^{2}$" [19], a minimum sample size of 9,720 was determined based on the following assumptions: def=1.5, $Z_{1-\alpha/2}$=1.96, p=16.5% [20], q=1-p=83.5%, and d=0.20p. Therefore, the sample size of this study was sufficient.

Data collection

Data on the information of children and guardians were collected using a questionnaire, which was developed by the National Center for Chronic and Noncommunicable Disease Control and Prevention. Well-qualified investigators, who underwent unified training before the survey, explained the purpose and the items of the questionnaire to the children via face to face. After that, children with at least fourth grade of primary school were asked to complete the questionnaire by themselves, while those below fourth grade of primary school were asked to bring the questionnaire home and complete the questionnaire under the guidance of their guardians. The completeness of the questionnaire was checked by the investigators and

the data were finally imputed to the Excel spreadsheet for further analyses.

Study variable

Guardian's education level

The guardian was defined as the person who was responsible for the child's daily needs, including food and shelter, and spent the most time with the child in this study, and the guardian's educational levels was divided into three groups: low (≤primary school), medium (junior or senior high school), and high (≥college).

Covariates

Variables for children Variables for children included sex, grade, Shenzhen household **registration**, accommodation, and parents working outside.

Shenzhen household registration Household registration refers to the location of the household registration, which is the place where the household registration book of Chinese residents is registered, and the Shenzhen household registration refers to the location of household registration in Shenzhen.

Accommodation It refers to the child's accommodation during the school day, with the option of "home" referring to that the children stay at home during the night of school day and the option of "school" referring to that the children live at school.

Parents working outside Parents working outside are a form of labor that involves leaving their children's hometown or village to engage in production, business, service, and other non-agricultural production activities in foreign countries or cities to receive remuneration. The option of "both outside" means that both the parents are working outside, the option of "either outside" means that one of the parents is working outside, and the option of "neither outside" means that neither the father nor the mother of the child is working outside.

Variables for guardians

Variables for guardians included the relationship between the children and guardians, guardian's age, communication time, communication attitude, and communication content.

Relationship between the children and guardians It refers to the relationship between the guardians and children, and is divided into three groups including parents (including stepparents), grandparents, and other relatives (such as uncles, aunts, and others).

Communication time It refers to the actual amount of time a guardian spends communicating with the child per day, and is divided into three groups including<10 min, 10–60 min, and >60 min.

Communication attitude It refers to the guardian's attitude towards communicating with the child, and is divided into three groups including guardian passive (defined as the guardian does not actively ask the child for communication), guardian active (defined as the guardian actively asks the child for communication), and both active (defined as both the guardian and the child actively ask each other for communication).

Communication content It refers to the topics on which the guardian communicates with the child most frequently, and was divided into five groups including academic performance (defined as the topics on a child's grades and other academic-related performance in school), material living conditions (defined as the topics on the objective conditions under which people survive and develop, including food, clothing, shelter, and means of travel), social activities (defined as the topics on the child's social activities, such as sports, entertainment, and friendships), psychological thought (defined as the topics on the child's psychological thought, such as sadness and distress), and other (defined as the topics that are not directly related to the children themselves, such as social news).

Outcome of interest

The outcome of interest in this study was unintentional injuries. Data on the unintentional injuries among children in the past year were collected by asking two nested questions. The first question was "within the past year, has the child had any unintentional injuries, such as road traffic injuries, falls/falls, blunt force injuries, firearm injuries, knife/sharp object injuries, burns, suffocation, drowning, poisoning, animal injuries, etc.?" Those with "Yes" option to the first question were asked to answer the second question: "has the child received a clinical diagnosis at a hospital or school infirmary due to the unintentional injuries? or has the child rested for one day or more due to the unintentional injuries". Those with "Yes" option to the second question were considered as a case of unintentional injuries, and the detailed information on the unintentional injuries including whether it occurred in Longhua District or not, the location of injury, the activity involved in the injury, the cause of injury, the nature of injury, and the area of injury were recorded.

Table 1 Characteristics of the study participants ($n=9,903$)

Variables			Median (IQR)/*N*	Proportion (%)
Variables for children	Children' age		10.00 (8.00, 12.00)	
	Sex	Boy	5,529	55.8
		Girl	4,374	44.2
	Grade	1–3 in primary school	4,060	41.0
		4–6 in primary school	3,571	36.1
		1–3 in junior high school	1,717	17.3
		1–3 in senior high school	555	5.6
	Shenzhen household registration	Yes	779	7.9
		No	9,124	92.1
	Accommodation	School	1,870	18.9
		Home	8,033	81.1
	Parents working outside	Both outside	1,192	12.0
		Either outside	1,200	12.1
		Neither outside	7,511	75.9
Variables for guardians	Guardian's age		36.00 (33.00, 40.00)	
	Relationship between the children and guardians	Parents	7,411	74.8
		Grandparents	627	6.4
		Others	1,865	18.8
	Guardian's educational levels	Low	794	8.0
		Medium	7,047	71.2
		High	2,062	20.8
	Communication time	< 10 min	933	9.4
		10–60 min	5,599	56.5
		> 60 min	3,371	34.1
	Communication attitude	Guardian passive	968	9.9
		Guardian initiative	678	6.9
		Both sides initiative	8,122	83.1
	Communication content	Academic performance	3,772	38.6
		Material living conditions	1,680	17.2
		Social activities	1,919	19.6
		Psychological thought	1,663	17.0
		Others	734	7.5

IQR: Inter quartile range

Statistical analysis

Continuous variables were described using mean (standard deviation, SD) or median (inter quartile range, IQR) and analyzed using the *t* test or the Wilcoxon rank-sum test as appropriate. Categorical variables were described using frequencies (n) and percentages (%), and analyzed using the χ^2 test or the Fisher exact test as appropriate. The incidence of unintentional injuries was weighted according to the Shenzhen Statistical Yearbook in 2020 [21] to represent the whole population aged 6–18 in Shenzhen, China. Simple binary logistic regression analyses were used to explore the associations of the guardians' educational levels and other covariates with unintentional injuries, and two multiple binary logistic regression were performed to explore the independent relationship between the guardians' educational levels and unintentional injuries. Specifically, model 1 was adjusted for the variables for children, and model 2 was adjusted for both the variables for children and guardians. The odds ratio (OR) and 95% confidence interval (95% CI) for each explanatory variables were calculated by logistic regression analyses. Hosmer-Lemeshow tests were performed to evaluate the goodness-of-fit for models 1 and 2, and a *P* value of >0.05 was considered to be well-fitted [22]. All statistical analyses were performed using SPSS 26.0 (International Business Machines Corporation, New York City, USA) and R software (version 4.2.2) with the level of significance set at $P<0.05$.

Results

Characteristics of the study participants

Table 1 shows the characteristics of the study participants. The median age of the children and guardians was 10.00 (8.00, 12.00) and 36.00 (33.00, 40.00), respectively. Among the 9,903 children, 5,529 (55.8%) were boys, 4,060 (41.0%) were in grade 1–3 in primary school, and 779 (7.9%) had Shenzhen household registration. Additionally, the guardians of 7,411 children (74.8%) were parents, and the majority of the guardians (56.5%) spent 10–60 min communicating with their children per day. In terms of the guardian's educational levels, a total of 794 (8.0%), 7,047 (71.2%), and 2,062 (20.8%) guardians were low, medium, and high, respectively.

Incidence of unintentional injuries

Among the 9,903 children, 275 reported having experienced at least one unintentional injuries in the past year. The unweighted incidence of unintentional injuries among the study participant was 2.8% (95% CI: 2.5–3.1%), and the weighted incidence was 6.3% (95% CI: 5.8–6.8%) in Shenzhen, China. The characteristics of the 275 unintentional injuries cases is shown in Table 2. 242 (88.0%) cases occurred in Longhua District, 132 (48.0%) occurred at home, and 143 (52.0%) were caused by fall.

Table 2 Characteristics of the 275 unintentional injuries cases

Variables		*N*	Proportion (%)
Occurred in Longhua District	Yes	242	88.0
	No	33	12.0
Location of injury	Home	132	48.0
	School	71	25.8
	Outside home/school	72	26.2
Activity involved in the injury	Sports	56	20.4
	Entertainment	88	32.0
	Daily life	111	40.4
	Transport	20	7.3
Cause of injury	Traffic injury	21	7.6
	Fall	143	52.0
	Blunt/sharp force injury	48	17.5
	Burns and scalds	13	4.7
	Others	50	18.2
Nature of injury	Fracture	44	16.0
	Sprain/strain	42	15.3
	Open injury	35	12.7
	Contusion/abrasion	95	34.5
	Burn	13	4.7
	Others	46	16.7
Area of injury	Head	57	20.7
	Upper limb	82	29.8
	Lower limb	97	35.3
	Torso	8	2.9
	Multi-area	4	1.5
	Others	27	9.8

Between-group analyses on factors associated with unintentional injuries

Table 3 shows the results of between-group analyses on factors associated with unintentional injuries. The incidence of unintentional injuries differed significantly in the sex of children, grade of children, parents working outside, guardian's age, guardian's educational levels, communication time and communication attitude ($P<0.05$).

Multiple analyses on the association between the guardians' educational levels and unintentional injuries

Table 4 shows the results of multiple binary logistic regression analyses on the association between the guardians' educational levels and unintentional injuries in children. Model 1 showed that compared to the guardians with low educational levels, children whose guardians' educational levels were high (adjusted OR=0.57, 95% CI: 0.37–0.87) and medium (adjusted OR=0.56, 95% CI: 0.39–0.81) had a lower odds of unintentional injuries. Model 2 showed similar results. The results of Hosmer-Lemeshow tests indicated that both Models 1 and 2 were well fitted ($P=0.572$ and 0.963 for Models 1 and 2, respectively.)

Discussion

This study investigated the association between the guardians' educational levels and unintentional injuries in children aged 6–18 in Shenzhen, China. To the best of our knowledge, this was the first study to explore the association between the guardians' educational levels and unintentional injuries in children. The weighted incidence of unintentional injuries in children aged 6–18 in Shenzhen, China was found to be 6.3% in this study, which was lower than the estimates found in Jiangsu Province (19.5%) [23] and among non-left-behind children in mainland China (27.94%) [24]. In comparisons with the estimates found in other countries, such as South Africa (68.2%) [25], Southeast Asia (42.2%) [26], and Japan (10.6%) [27], the incidence found in this study was also lower. The difference in the incidence of unintentional injuries in Children may be explained by the different social economic development levels, cultural backgrounds and geographical environments across countries [28–30]. As one of the first-tier cities in China, Shenzhen is highly developed with a surveillance system for unintentional injuries and thereby reducing the occurrence of unintentional injuries in children [31, 32]. Though the incidence of unintentional injuries in children aged 6–18 in Shenzhen, China was low, efforts were still needed to prevent unintentional injuries considering it may not only cause death and disabilities, but also impose a heavy financial burden and medical stress to the society [33, 34].

The principle finding of this study was that compared to children whose guardians' educational levels were low, children whose guardians' educational levels were high (adjusted OR=0.57, 95% CI: 0.37–0.87) and medium (adjusted OR=0.56, 95% CI: 0.39–0.81) had a lower odds of unintentional injuries after adjustment for variables for children, and similar findings were observed after further adjustment for variables for guardians, which indicated the robustness of the findings. This was consistent with the findings of some previous studies [15, 35, 36]. For example, Beiki et al. reported that the risk of death and hospitalization due to unintentional injuries was significantly higher in children with lower parental educational levels [15], and Salam et al. found that children whose parents' educational level were low were at an increased the risk of injury death [35]. The difference in the incidence pf unintentional injuries in children with different guardians' educational levels may be caused by the different abilities in understanding children's development across the guardians with different educational levels. Specifically, it was more difficult to anticipate a child's rate of development in terms of the ability to

Table 3 Between-group analyses on factors associated with unintentional injuries

Variables			Unintentional injuries cases		χ^2/t	*P*	Logistic regression analyses	
			No	Yes			OR (95% CI)	*P*
Variables for children	Sex	Boy	5,336 (55.3)	193 (70.2)	23.62	< 0.001	1	
		Girl	4,292 (44.7)	82 (29.8)			0.53 (0.41– 0.69)	< 0.001
	Grade	1–3 in primary school	3,993 (41.5)	67 (24.4)	42.27	< 0.001	1	
		4–6 in primary school	3,425 (35.6)	146 (53.1)			2.54 (1.90– 3.41)	< 0.001
		1–3 in junior high school	1,668 (17.3)	49 (17.8)			1.75 (1.21– 2.54)	0.003
		1–3 in senior high school	542 (5.6)	13 (4.7)			1.43 (0.78– 2.61)	0.244
	Shenzhen household registration	Yes	750 (7.8)	29 (10.5)	2.80	0.094	1	
		No	8,878 (92.2)	246 (89.5)			0.72 (0.48– 1.06)	0.096
	Accommodation	School	1,822 (18.9)	48 (17.5)	0.377	0.539	1	
		Home	7,806 (81.1)	227 (82.5)			1.10 (0.81– 1.51)	0.539
	Parents working outside	Both outside	1,148 (11.9)	44 (16.0)	7.21	0.027	1	
		Either outside	1,159 (12.0)	41 (14.9)			0.92 (0.60– 1.42)	0.717
		Neither outside	7,321 (76.1)	190 (69.1)			0.68 (0.49– 0.95)	0.022
Variables for guardians	Guardian's age		9,628 (97.2)	275 (2.8)	-2.762	0.006	1.02 (1.01– 1.04)	0.003
	Guardian's educational levels	Low	756 (7.9)	38 (13.8)	12.91	0.002	1	
		Medium	6,863 (71.3)	184 (66.9)			0.53 (0.37– 0.76)	0.001
		High	2,009 (20.9)	53 (19.3)			0.53 (0.34– 0.80)	0.003
	Relationship between the children and guardians	Parents	7,212 (74.9)	199 (72.4)	1.20	0.550	1	
		Grandparents	606 (6.3)	21 (7.6)			1.26 (0.80– 1.98)	0.329
		Others	1,810 (18.8)	55 (20.0)			1.10 (0.81– 1.49)	0.533
	Communication time	< 10 min	891 (9.3)	42 (15.3)	11.35	0.003	1	
		10–60 min	5,453 (56.6)	146 (53.1)			0.57 (0.40– 0.81)	0.002
		> 60 min	3,284 (34.1)	87 (31.6)			0.56 (0.39– 0.82)	0.003
	Communication attitude	Guardian passive	939 (9.9)	29 (11.2)	19.25	< 0.001	1	
		Guardian initiative	643 (6.7)	35 (13.6)			1.76 (1.07– 2.91)	0.027
		Both sides initiative	7,928 (83.4)	194 (75.2)			0.79 (0.53– 1.18)	0.246
	Communication content	Academic performance	3,667 (38.6)	105 (40.7)	3.12	0.539	1	
		Material living conditions	1,632 (17.2)	48 (18.6)			1.03 (0.73– 1.45)	0.879
		Social activities	1,866 (19.6)	53 (20.5)			0.99 (0.71– 1.39)	0.962
		Psychological thought	1,629 (17.1)	34 (13.2)			0.73 (0.49– 1.08)	0.113
		Others	716 (7.5)	18 (7.0)			0.88 (0.53– 1.46)	0.614

OR: odds ratio; 95% CI: 95% confidence interval

Table 4 Multiple binary logistic regression analyses on the association between the guardians' educational levels and unintentional injuries in children

Variables		Model 1			Model 2		
		adjusted OR	95% CI	*P*	adjusted OR	95% CI	*P*
Guardian's educational levels	Low	1			1		
	Medium	0.56	(0.39– 0.81)	0.002	0.58	(0.40– 0.84)	0.004
	High	0.57	(0.37– 0.87)	0.010	0.58	(0.37– 0.90)	0.015

OR: odds ratio; 95% CI: 95% confidence interval

Model 1 was adjusted for the variables for children.

Model 2 was adjusted for both the variables for children and guardians.

climb, open containers or locks, and light fires for guardians who were poorly educated or living in poor areas, and they may tend to overestimate children's ability to remember instructions and underestimate rapid developmental change [37–39]. Additionally, well-educated guardians were more proactive in communicating with their children, and were better equipped to recognize dangers in their environments and put safeguards in place [40].

The higher odds of unintentional injuries in children whose guardians' educational levels were lower indicated that the decision makers should pay more attention to children whose guardians' educational levels was low. On the other hand, given the preventable nature of unintentional injuries among children [41] and the fact that the educational level was modifiable, it is highly recommended for the decision makers to reduce the incidence of unintentional injuries in children by improving the guardians' educational levels in the long run. Additionally, promotion of knowledge and skills regarding child safety to guardians with low educational levels could protect against unintentional injuries in children [42, 43]. Practical ways to achieve this improvement include strengthening the education targeted at the guardians with low educational level through parent-teacher meetings organized by the school, as well as implementing community-based health education by the local Centers for Disease Control and Prevention.

The main strengths of this study included its large sample size and the representativeness of weighted data. However, some limitations should be acknowledged. First, self-reporting bias may exist and the fact that children may differentially understand and seriously respond to questionnaires within a given age bracket may cause information bias. Second, all study participants were recruited from schools in this study. Therefore, whether the findings can be generalized to those unschooled was unclear. Finally, due to the cross-sectional nature of the study design, causal inferences cannot be established. Therefore, future prospective cohort study is still needed to ascertain the causal association between the guardians' educational levels and unintentional injuries in children.

Conclusions

The incidence of unintentional injuries in children aged 6–18 in Shenzhen was low. Compared to children whose guardians' educational levels were low, children whose guardians' educational levels were high and medium had a lower odds of unintentional injuries. Therefore, more attention should be paid to children whose guardians' educational levels was lows, and it is recommended to reduce the incidence of unintentional injuries in children by improving the guardians' educational levels.

Abbreviations

CI Confidence interval
IQR Inter quartile range
OR Odds ratio
SD Standard deviation

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-024-19748-4.

Supplementary Material 1

Acknowledgements

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Author contributions

Y X has made substantial contributions to the conception, design of the work, the analysis, interpretation of data, have drafted the work and substantively revised it. X Y has made substantial contributions to the conception, design of the work, the analysis, interpretation of data, have drafted the work and substantively revised it. X W, W Z, Z F, F X, X D, and S Z has made substantial contributions to the conception, the acquisition, interpretation of data. W D and S Z has made substantial contributions to the conception, the acquisition, have substantively revised it. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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Data availability

The datasets used and/or analyzed during the current study are available from the corresponding authors on reasonable request.

Declarations

Ethics approval and consent to participate

This study protocol had been approved by the Ethics Committee of the Longhua District Chronic Disease Control Center of Shenzhen City (No. 20190321001) and National Center for Chronic and Noncommunicable Disease Control and Prevention of Chinese Center for Disease Control and Prevention (No. 201713). This study was conducted following the Declaration of Helsinki, and informed consent was obtained from all subjects and/or their legal guardian(s).

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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