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Research Article

Side effects and perceptions among young adults in Bangladesh following COVID-19 vaccination: a single center study

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Abstract

Background and objectives: COVID-19, caused by SARS-CoV-2, has led to a global pandemic with severe health, economic, and social impacts. Vaccination has emerged as a crucial mitigation strategy. Despite the pivotal role of COVID-19 vaccines in controlling the pandemic, vaccine hesitancy remains a significant concern globally, particularly among young adults. This study aimed to explore the side effects and perceptions of the young adults in Bangladesh following COVID-19 vaccination.

Materials and methods: The study, conducted in April 2021 among 325 young Bangladeshi adults who received two doses of Sinopharm (BBIBP-CorV) vaccine against SAR-CoV-2. Participants completed a self-administered online questionnaire covering demographics, health history, post-vaccination adverse events, and perceptions about COVID-19 vaccine. A symptom scoring system, based on the interquartile range (IQR), was used to categorize the severity of the side effects. Data analysis utilized SPSS version 26.0, with appropriate tests for significance.

Result: Total 325 participants (male - 64.6%, female - 68.9%) were enrolled. The mean age was 22 ± 1.6 years. Social media (43·1%) was the primary source of information about COVID-19. Vaccine related side effects were experienced by 40.9% and 47.1% participants following 1st and 2nd dose of vaccination respectively. Side effects were more prevalent after the second dose of vaccine, particularly in females (31·3% *vs*. 8·2%, p<0·001). Common side effects included fatigue (41·6%), injection site pain/swelling (36·7%) and headache (32·6%). In over 50% of participants, symptoms appeared within 8 hours following both doses. Symptoms resolved by taking rest at home in majority of participants. Participants with comorbidity reported significantly higher rate of side effects after the first dose (61.8% *vs*. 37·3%, p <0.05). Despite side effects, 69·8% felt reassured post-vaccination, 63·7% believed in its long-term safety, and 98·8% recommended vaccination to others.

Conclusion: The Sinopharm COVID-19 vaccine was well-tolerated among young adults in Bangladesh. Though higher side effects after the second dose were observed in female participants, yet most maintained a positive perception, underscoring its acceptability and recommended vaccination to others.

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Introduction

COVID-19, caused by SARS-CoV-2, was first identified in December 2019 in Wuhan, China [1]. It has since affected millions globally, causing over 3.7 million deaths [2,3] and leading to a global pandemic. The disease spreads primarily through respiratory droplets [4], resulting in widespread lockdowns, travel restrictions, and economic disruptions [5]. Substantial research funding has been directed towards combating COVID-19 [6]. While social distancing and quarantine measures can slow virus spread, they may not completely halt it [7]. Vaccination is considered the best approach to preventing severe complications and deaths [8]. GAVI and WHO, collaborating with other agencies, have expedited the development of effective vaccines [9]. More than eight COVID-19 vaccines have been approved for emergency use, including Sinopharm, Pfizer-BioNTech, AstraZeneca, Moderna, and Johnson & Johnson, each showing varying efficacy [10-12]. These vaccines have undergone multiple clinical trial phases to ensure safety [13] and have been proven to significantly reduce infection transmission [6].The first mass vaccination program began in early December 2020 [14]. As of July 2024, approximately 57% of the world population has received at least one dose of a COVID-19 vaccine, with 8.7 billion doses administered globally [15].

The United Arab Emirates (UAE) leads in vaccination rates, with over 5 million people vaccinated [3]. UAE approved the Sinopharm vaccine in December 2020, initiating mass vaccination campaigns [16]. Bangladesh began its mass vaccination program in January 2021, utilizing seven recommended vaccines: Moderna, Pfizer/BioNTech, Sputnik V, Johnson & Johnson, Oxford/AstraZeneca, Sinopharm, and Sinovac [17]. The Sinopharm COVID-19 vaccine, developed by China National Pharmaceutical Group, is an inactivated virus vaccine [18]. Administered in two doses the vaccine stimulates antibody production against the virus, and prevents potential SARS-CoV-2 infection [19]. Like other vaccines, Sinopharm can cause mild, temporary side effects [20,21], including injection site pain, fatigue, headache, muscle pain, and fever, indicative of the body's immune response [22]. The vaccine is adjuvanted with aluminum hydroxide to enhance immune response [10].Understanding public acceptance of COVID-19 vaccination is crucial for improving vaccine coverage rates [23].

Vaccine hesitancy, driven by safety concerns and side effects, poses a significant challenge [2,8]. The WHO has identified vaccine hesitancy as a global threat, emphasizing the need to address vaccine confidence and manage side effect perceptions [6]. Medical students, as young adults, can significantly influence public perception regarding acceptance of COVID-19 vaccine [22]. This study aimed to evaluate side effects and perceptions following Sinopharm COVID-19 vaccination among young adults in Bangladesh.

Materials and Methods

This cross-sectional study involved young adults who received two doses of Sinopharm (BBIBP-CorV) COVID-19 vaccination against SARS-CoV-2 under the routine vaccination program of Government of Bangladesh. Participants completed a self-administered online questionnaire distributed via WhatsApp. The questionnaire, created using Google Forms, was developed following a literature review and insights from sources including the VAERS card (USA), WHO's COVID-19 Vaccine Explainer, and academic databases. It covered demographics, pre-vaccination health, vaccine perceptions, and post-vaccination effects. A pilot study was conducted to validate the questionnaire. A symptom scoring system, based on the interquartile range (IQR), was used to categorize the severity of the side effects of vaccine into mild (scores 1-4, IQR1), moderate (scores 5-10, IQR2) and severe (scores > 11, IQR3). Each reported symptom was assigned a score of 1, with a total possible score of 32. With an assumed 50.0% side effect rate, 95% confidence interval, and 5% margin of error, the target sample size was 384. Data were analyzed using SPSS version 26.0. Descriptive statistics and chi-square tests were used for analysis. The study was approved by the Ibrahim Medical College Institutional Review and Ethic Board.

Result

A total of 325 vaccinated participants were enrolled in the study. Total 203 and 221 participants provided information on vaccine related adverse effects after first and second dose of vaccination

respectively. The majority of participants (60.3%) were aged 22-26 years with a mean age of 22.00 ± 1.58 years (range 19-26 years). Most participants were female (n=224, 68.9%). Regarding health status, 64.6% were healthy, while 35.4% had chronic illnesses, like allergies (20.9%), bronchial asthma (4.6%), and obesity (3.4%). Table-1 shows the detail demographic and health status of the participants.

Table-1: *Demographic and health status of study population (n=325)*

Variable	Number	Percentage
Age*		
18-21 years	129	39.7
22-26 years	196	60.3
Gender		
Male	101	31.1
Female	224	68.9
Health status		
Healthy	210	64.6
Had comorbidity	115	35.4
Allergy	68	20.9
Obesity	11	3.4
Bronchial asthma	15	4.6
Endocrine disorder	8	2.5
Autoimmune diseases	5	1.5
Cardiovascular diseases	3	0.9
Peptic ulcer disease	2	0.6
Neurological diseases	2	0.6
Hematological diseases	1	0.3

*Note: *Mean age: 22.00 ± 1.58 years, Range 19-26 years*

The primary sources of COVID-19 information were social media (43.1%), government-owned media (33.8%), and scientific/medical websites (18.5%). Prior to vaccination, 12.6% had suffered from COVID-19, while 4% infected with SARS-CoV-2 post-vaccination. Pfizer-BioNTech was the preferred vaccine (32.0%), followed by AstraZeneca/Oxford (15.1%) and Moderna (13.8%). Only 16.6% of participants were scared of vaccination, mainly due to concerns about adverse effects (61.1%) and safety/efficacy (16.7%) of the vaccine (Table-2).

Detail of the side effects experienced by the responded is shown in Table-3 and 4. Out of total participants, 203 and 221 individuals responded regarding vaccine related side effects after 1st and 2nd dose of vaccination respectively. No side effect was reported by 59.1% and 52.9% participants while 83 (40.9%) and 104 (47.1%) participants experienced some degree of side effects following 1st and 2nd dose of vaccination respectively (Table-3). But the difference was not significant ($p>0.05$). Both after 1st and 2nd dose of vaccine, the overall occurrence of moderate side effects was significantly ($p < 0.05$) high compared to mild and severe types (first dose: 19.7% *vs*. 11.8% and 9.4%; 2nd dose: 24.9% *vs*. 11.3% and 10.9%). After the second dose, females experienced significantly ($p < 0.05$) higher rate of side effects compared to males (56.3% *vs*. 23%). Following the second dose, females had a higher rate of moderate side effects (31.3%) compared to males (8.2%) and this difference was statistically significant ($p < 0.05$).

Table-2: *Response of study population regarding COVID-19 and its vaccine (n=325)*

Variable	Number (%)
Source of information on COVID-19	
I have no information	5 (1.5)
Friends and relatives	10 (3.1)
Government-owned media platforms	110 (33.8)
Social media platforms	140 (43.1)
Scientific and medical websites	60 (18.5)
History of Covid-19 infection	
Had Covid-19 before vaccination	41 (12.6)
Had Covid-19 after vaccination	13 (4)
Choice of COVID-19 vaccine	
No preference	78 (24)
Pfizer-BioNTech	104 (32)
AstraZeneca/Oxford	49 (15.1)
Moderna	45 (13.8)
Sinopharm	42 (12.9)
Johnson & Johnson	2 (0.6)
Sputnik V	5 (1.5)
Scared of COVID-19 vaccination	54 (16.6)
Reason of sacredness (n=54)	
Adverse effects	33 (61.1)
Doubt about safety and efficacy	9 (16.7)
Needle phobia	4 (7.4)
Poor health condition	5 (9.3)
Post vaccination problems	3 (5.6)

Detail clinical features of the side effects recorded among the participants following vaccination are shown in Table-5. In over 50% of participants, symptoms appeared within 8 hours following both doses, and the symptoms of the majority vaccine recipients were relieved by taking rest at home. Out of 115 participants having comorbid conditions,

Table-3: *Side effect experienced by the recipients of first and second doses of Sinopharm vaccine*

Side effects	After first dose (n=203)	After second dose (n=221)	p-value
	Number (%)	Number (%)	
No	120 (59.1)	117 (52.9)	
Yes	83 (40.9)	104 (47.1)	
Mild	24 (11.8)	25 (11.3)	>0.05
Moderate	40 (19.7)	55 (24.9)	
Severe	19 (9.4)	24 (10.9)	

Note: p <0.05, moderate *vs*. mild and severe; p > 0.05, mild *vs*. severe both after 1st and 2nd dose.

Table-4: *Side effects after first and second dose of Sinopharm vaccine according to the gender*

	After first dose (n=203)			After second dose (n=221)		
Side Effects	Male (n=67) Number (%)	Female (n=136) Number (%)	p-value	Male (n=61) Number (%)	Female (n=160) Number (%)	p-value
No	46 (68.7)	74 (54.4)		47 (77)	70 (43.7)	-
Yes	21 (31.3)	62 (45.6)		14 (23)	90 (56.3)	<0.05
Mild	9 (13.4)	15 (11)	>0.05	5 (8.2)	20 (12.5)	> 0.05
Moderate	8 (11.9)	32 (23.5)		5 (8.2)	50 (31.3)	<0.05
Severe	4 (6)	15 (11)		4 (6.6)	20 (12.5)	> 0.05

Note: Both after 1st and 2nd dose: For male - p > 0.05, mild vs. moderate vs. severe; for female - p <0.05, moderate vs. mild and severe; p > 0.05, mild vs. severe.

Table-5: *Clinical features of side effects after receiving 1st and 2nd dose of Sinopharm vaccine*

Variables	Cases with side effects after	
	1st dose (n=83) Number (%)	2nd dose (n=104) Number (%)
Symptoms appeared		
Within 8 hours	49 (59)	63 (60.6)
By 9 to 16 hours	19 (22.9)	27 (26)
By 17 to 24 hours	15 (18.1)	14 (13.5)
Duration of symptoms		
Less than 1 day	17 (20.5)	16 (15.4)
1-3 days	47 (56.6)	58 (55.8)
4-7 days	11 (13.3)	18 (17.3)
More than 7 days	8 (9.6)	12 (11.5)
Symptoms relieved by		
Rest at home	62 (69.7)	67 (68.4)
Analgesic and antipyretic at home	25 (28.1)	29 (29.6)
Consultation at OPD	2 (2.2)	2 (2)

Note: OPD –out patient department

34 and 27 responded regarding the post vaccination side effects after 1st and 2nd dose of vaccine (Table-6). After the 1st dose, the overall side effects was significantly ($p < 0.05$) higher in participants with comorbid condition compared to healthy individuals (61.8% *vs*.37.3%). Following the first and second dose, participants with more mild side effects (50% and 63%) compared to healthy individuals (32.0% and 40.2%). After the second dose, participants with comorbidity though had a higher rate of overall side effects (63%) compared to healthy (45.4%), but the difference was not

Table-6: *Comparison of side effect after first and second doses of Sinopharm vaccine, according to comorbidity status of the study population*

Side effects	First dose in participant with			Second dose in participant with		
	No Comorbidity (n=169)	Comorbidity (n=34)	p-value	No Comorbidity (n=194)	Comorbidity (n=27)	p-value
No	106 (62.7)	13 (38.2)	< 0.05	106 (54.6)	10 (37)	> 0.05
Yes	63 (37.3)	21 (61.8)		88 (45.4)	17 (63)	
Mild side effects	54 (32)	17 (50)		78 (40.2)	17 (63)	< 0.05
Moderate side effects	7 (4.1)	3 (8.8)	> 0.05	8 (4.1)	0	--
Severe side effects	2 (1.2)	1 (2.9)		2 (1.1)	0	

Table-7: *Prevalence of side effects after first (n=203) and second (n=221) doses of Sinopharm vaccine among the study participants*

Side effects	First dose n (%)	Second dose n (%)	p-value
Fatigue	68 (33.5)	92 (41.6)	0.084
Pain/swelling at injection site	57 (28.1)	81 (36.7)	0.060
Nausea	15 (7.4)	24 (10.9)	0.217
Change in blood pressure	12 (5.9)	21 (9.5)	0.162
Headache	48 (23.6)	72 (32.6)	0.033
Myalgia	43 (21.2)	60 (27.1)	0.152
Clogged/runny nose/dyspnea	30 (14.8)	30 (13.6)	0.354
Joint pain	28 (13.8)	39 (17.6)	0.277
Fever	27 (13.3)	33 (14.9)	0.630
Sore throat	12 (5.9)	20 (9)	0.222
Cough	14 (6.9)	12 (5.4)	0.529
Menstrual abnormality	17 (8.4)	15 (6.8)	0.537
Numbness/Tingling/Dizzy	39 (19.2)	60 (27.1)	0.767
Disturbance in sleep quality	17 (8.4)	26 (11.8)	0.195
Haziness in vision	17 (8.4)	22 (10)	0.474
Skin allergy	13 (6.4)	21 (9.5)	0.241
Hair fall	12 (5.9)	18 (8.1)	0.370
Chills	18 (8.9)	19 (8.6)	0.922
Diarrhea	5 (2.5)	6 (2.7)	0.871
Vomiting	2 (1)	7 (3.2)	0.119
Bruise	5 (2.5)	6 (2.7)	0.871
Excessive sweating	13 (6.4)	18 (8.1)	0.492
Drowsiness	57 (28.1)	76 (34.4)	0.162
Palpitation	11 (5.4)	22 (10)	0.082

statistically significant (p > 0.05). Table-7 shows that the prevalence of side effects generally increased after the second dose of the vaccine, although the differences did not reach statistical significance. The most common side effects were fatigue (33.5% *vs.* 41.6%, p=0.084), pain/swelling at the injection site (28.1% *vs.* 36.7%, p=0.060), and headache (23.6% *vs.* 32.6%, p=0.033) for the first and second doses, respectively. Other notable side effects included myalgia (21.2% *vs.* 27.1%, p=0.152) and drowsiness (2 8.1% *vs.* 34.4%, p=0.162). Various other side effects, such as nausea, change in blood pressure, and numbness/tingling/dizziness were reported with varying prevalence but did not show statistically significant differences between the doses.

Following Sinopharm vaccination, females experienced significantly higher rates of several side effects (Table-8). For the first dose, side effects reported by females include fatigue (38.2%, p=0.042), pain/swelling at the injection site (33.8%, p=0.009), disturbance in sleep quality (11.8%, p=0.013), haziness in vision (12.5%, p=0.003), and excessive sweating (8.8%, p=0.045). Following the second dose of vaccination, significant side effects in female participants were fatigue (50.6%, p<0.001), pain/swelling at the injection site (43.1%, p=0.001), headache (42.5%, p<0.001), myalgia (33.1%, p=0.001), numbness/tingling/dizziness (49%, p=0.001), drowsiness (40.6%, p=0.002), nausea (13.8%, p=0.028), changes in blood pressure (12.5%, p=0.014), joint pain (21.3%, p=0.023), and palpitations (12.5%, p=0.041).

Table-8: *Gender-specific prevalence of side effects after first and second doses of Sinopharm vaccine among the study participants*

Side effects	After first dose (n=203)			After second dose (n=221)		
	Male (n=67) Number (%)	Female (n=136) Number (%)	p-value	Male (n=61) Number (%)	Female (n=160) Number (%)	p-value
Fatigue	16 (23.9)	52 (38.2)	0.042	11 (18)	81 (50.6)	0.001
Pain/swelling at inj. site	11 (16.4)	46 (33.8)	0.009	12 (19.7)	69 (43.1)	0.001
Nausea	2 (3)	13 (9.6)	0.092	2 (3.3)	22 (13.8)	0.028
Changes blood pressure	3 (4.5)	9 (6.6)	0.543	1 (1.6)	20 (12.5)	0.014
Headache	13 (19.4)	35 (25.7)	0.830	5 (8.2)	67 (42.5)	0.001
Myalgia	9 (13.4)	34 (25)	0.058	7 (11.5)	53 (33.1)	0.001
Dyspnea	8 (11.9)	22 (16.2)	0.425	6 (9.8)	24 (15)	0.208
Joint pain	7 (10.4)	21 (15.4)	0.332	5 (8.2)	34 (21.3)	0.023
Fever	8 (11.9)	19 (14)	0.689	6 (9.8)	27 (16.9)	0.189
Sore throat	4 (6)	8 (5.9)	0.980	4 (6.6)	16 (10)	0.425
Cough	5 (7.5)	9 (6.6)	0.823	2 (3.3)	10 (6.3)	0.384
Menstrual abnormality	-	17 (12.5)	-	-	15 (9.4)	-
Numbness/Tingling/Dizzy	10 (14.9)	29 (21.3)	0.094	8 (13.1)	52 (49)	0.001
Disturbance in sleep	1 (1.5)	16 (11.8)	0.013	1 (6.7)	25 (28.1)	0.076
Haziness in vision	0	17 (12.5)	0.003	3 (4.9)	19 (12.5)	0.099
Skin allergy	3 (4.5)	10 (7.4)	0.431	5 (8.2)	16 (10)	0.801
Hair fall	2 (3)	10 (7.4)	0.215	3 (4.9)	15 (9.4)	0.279
Chills	4 (6)	14 (10.3)	0.308	2 (3.3)	17 (10.6)	0.082
Diarrhoea	2 (3)	3 (2.2)	0.736	0	6 (3.8)	0.125
Vomiting	1 (1.5)	1 (0.7)	0.607	0	7 (4.4)	0.097
Bruise	1 (1.5)	4 (2.9)	0.531	0	6 (3.8)	0.125
Excessive sweating	1 (1.5)	12 (8.8)	0.045	3 (4.9)	15 (9.4)	0.279
Drowsiness	14 (20.9)	43 (31.6)	0.110	11 (18)	65 (40.6)	0.002
Palpitation	3 (4.5)	8 (5.9)	0.678	2 (3.3)	20 (12.5)	0.041

Regarding participants' perceptions of the Sinopharm vaccine, most participants (69.8%) felt more reassured after vaccination, 63.7% believed in its long-term safety, 98.8% recognized the need to continue preventive measures, 46.8% reported increased vital sign monitoring, and 98.8% recommended COVID-19 vaccination to others (Table-9).

Table-9: *Participants' perceptions regarding Sinopharm vaccine after vaccination (N=325)*

Perceptions of Sinopharm vaccine	Number (%)
Feel more reassured after vaccination	227 (69.8)
Believing that COVID-19 vaccines are safe in the long term	207 (63.7)
Believing that the practicing of sterilization and social distance measures, as well as wearing medical face mask is still necessary even after vaccination	321 (98.8)
Monitoring vital signs become more frequent after vaccination	152 (46.8)
Advice others to get vaccinated for COVID-19	321 (98.8)

Discussion

COVID-19 vaccines have significantly impacted the epidemic, preventing widespread loss of life and reducing infections and complications. Despite their effectiveness, concerns about vaccine safety persist globally. This study aimed to explore the short term side effects and perceptions surrounding the COVID-19 vaccine among young adults aged 18-25 years in Bangladesh.

The majority of participants were young adults (mean age 22.00 ± 1.58 years), predominantly female (68.9), with 64.6 being healthy and 35.4 having chronic illnesses. It was observed in the present study that the primary sources of COVID-19 information were social media, government-owned media, and scientific/medical websites. Our study revealed a higher prevalence of side effects following Sinopharm (BBIBP-CorV) COVID-19 vaccination among female participants, particularly after the second dose. Common side effects included fatigue, injection site pain/swelling, headache, and myalgia. Participants with chronic diseases experienced more side effects compared to healthy students, with a statistically significant difference in mild side effects after the first dose. Moderate side effects were more prevalent after the second dose, with symptoms typically appearing within 8 hours and lasting 1-3 days. Female participants experienced significantly higher rates of moderate side effects after the second dose compared to males. They also reported a wider range of side effects, including fatigue, injection site pain/swelling, sleep disturbances, and various systemic symptoms. Despite these side effects, most participants felt reassured after vaccination, believed in its long-term safety, and continued to adhere to preventive measures. The majority recommended COVID-19 vaccination to others, indicating a generally positive perception of the vaccine's benefits.

Several studies indicate common side effects of Sinopharm COVID-19 vaccine as injection site pain and fever [25-28]. Other vaccines like CoronaVac, ChAdOx1, and mRNA-1273 show similar side effects [29-31]. Adenoviral vector vaccines induce higher localized pain than mRNA vaccines and inactivated types, as reported by Rehab Magdy et al [32]. These findings are consistent with our results.

Vaccine injection fears and hesitancy were linked to post-vaccination side effects [22]. Hatmal *et al*. found that almost half of vaccine recipients were initially apprehensive about COVID-19 vaccination [19]. Vaccination rates increase with endorsement by trusted government health authorities, physician recommendations, and effective communication through official channels. Availability of vaccines at multiple sites and free distribution also enhance vaccination rates [3].

Our study found a higher incidence of adverse reactions after the second dose compared to first doses of the Sinopharm COVID-19 vaccine, consistent with previous research [27,28,33,34]. This might be attributed to the immune system's response involving inflammatory cytokine secretion following initial vaccination.

Post-vaccination side effects typically emerged within 24 hours of both doses, subsiding within 72 hours, aligning with prior studies [34]. However, some research reported symptoms persisting for up to 3 days [35], possibly influenced by recipient demographics and sample size [36].

In our study, females exhibited a higher likelihood of experiencing adverse symptoms compared to males. Following the first dose, females showed more systemic, local, and respiratory manifestations, but after both doses, systemic signs, neurological symptoms, and local expressions were more prevalent in females. Similar findings were reported in studies involving the BBIBP-CorV (Sinopharm) vaccine [22,27,35,37] as well as in surveys of other COVID-19 vaccines and various inactivated virus vaccines [30,38,39]. The exact cause is uncertain, but it's speculated that females may have a more robust immune system, leading to increased cytokine and antibody responses [40].

Participants with comorbidity reported more symptoms after the first dose, contrasting with other studies' findings where individuals without comorbidity experienced more adverse effects [22,27,41]. This discrepancy might be related to variations in immune responsiveness among individuals with chronic conditions and warrants further investigation.

The Sinopharm COVID-19 vaccine was generally well-tolerated among young adults in Bangladesh, with side effects more prevalent after the second dose and in female participants. Despite experiencing side effects, most participants maintained a positive perception about the vaccine, indicating its acceptability. The higher prevalence of side effects in females and those with chronic diseases suggests the need for tailored vaccination strategies and communication and counseling with these groups. The reliance on social media for COVID-19 information highlights the importance of utilizing these platforms for disseminating accurate vaccine-related information.

Conflict of interest

No competing interest/conflict of interest.

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