

BMJ Open Prehospital delay and its associated psychosocial factors in patients presenting with acute appendicitis in a southwestern city in China: a single-centre prospective observational study

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ABSTRACT

Objective Prehospital delay is common among patients with acute appendicitis. The aim of this study was to measure the association of a wide range of psychosocial factors with the prehospital delay among adult patients with acute appendicitis in a southwestern city in China.

Methods Sociodemographic, clinical, cognitive and psychosocial factors were collected from 421 adult patients with acute appendicitis from November 2016 to December 2017. In addition, factors associated with prehospital delay were determined by binary logistic regression, after adjusting for selected potentially confounding factors.

Results Only 179 (42.5%) of the 421 patients were transferred to the hospital within 24 hours; the mean prehospital delay was 27.68 hours with a median of 26 hours, while the mean in-hospital delay was 5.16 hours with a median of 5 hours. In the logistic regression analyses, eight variables or subvariables were found to be associated with prehospital delay >24 hours.

Conclusion Delayed presentation for acute appendicitis was associated with older age, living alone, a lack of knowledge of the disease, low social support, an unstable introvert personality trait and negative coping style, intensity of the pain and the symptoms occurring on a workday. A better understanding of the association between psychosocial factors and prehospital delay can help identify patients with acute appendicitis at risk of prehospital delay and lead to the establishment of an effective campaign to promote hospital visits when the symptoms are noticed.

BACKGROUND

Acute appendicitis has been one of the most common intra-abdominal conditions with a 9.0% lifetime cumulative incidence rate, and appendectomy is the most frequently performed emergency operation by general surgeons worldwide.¹ Despite significant advancements in diagnosis and treatment, the incidence of complicated acute appendicitis, including gangrenous or perforated appendicitis, remains considerably

Strengths and limitations of this study

- We were the first to test the association between psychosocial factors and prehospital delay in patients with acute appendicitis.
- Numerous factors may affect prehospital delay among patients with acute appendicitis, and the factors can confound each other; therefore, we considered sociodemographic characteristics, clinical factors, cognitive factors and psychosocial factors.
- We used a questionnaire to determine the psychosocial factors; participants' answers were subject to mistakes in recollection and other errors.
- The present study was conducted in a single centre; whether the present findings apply to other populations with different economic and cultural conditions is unknown.

high (28%–29%),^{2 3} and the postoperative morbidity rates remain between 9% and 18%.⁴

A time-honoured notion that the 'goal should be to accelerate diagnosis and to operate before perforation occurs' was based on the assumption that over time an inflamed appendix will likely progress to perforation.^{5 6} However, the notion has been challenged for both children and adults by many studies in recent years. To avoid disrupting operating room schedules and to reduce technical errors associated with sleep deprivation and fatigue, for uncomplicated acute appendicitis cases that present after hours, it was shown to be safe to delay operations until the next morning.^{7 8} Moreover, other reports suggested that spontaneous resolution was common in patients with low-grade appendicitis and that acute appendicitis could be managed with a semielective strategy after antibiotics therapy has been initiated; therefore, operation may

not be the first choice in these instances, which further confused the issue.^{9–13}

However, there are some pitfalls in these studies that limit the applicability of their results; an obvious error is to compare differences in the proportions with perforation or morbidity between groups with short and long delays regardless of bias in the characteristics of patients.¹⁴ In addition, conservative treatment may result in a high risk of recurrence, which may be problematic in elderly patients or pregnant women, and an increased financial burden results from repeated treatment. On the other hand, many studies have found a positive association between the time interval and the risk of perforation; a long delay until the operation results in complicated appendicitis, and as a consequence, also results in high postoperative morbidity.^{15–19}

In fact, there are no essential differences between the two conclusions. The former studies focused on ‘uncomplicated’ acute appendicitis cases and their hospital-related delay, and the latter studies were mainly concerned with the total delay or prehospital delay. It seems that the prehospital delay played a more important role in the course of appendicitis. Therefore, we argue that there is no benefit to determining how long a delay before appendectomy is safe, but it would be useful to determine and avoid the contributors that can cause prehospital delay in patients with acute appendicitis. Therefore, the aim of this study was to measure the association of a wide range of psychosocial factors with the prehospital delay among adult patients with acute appendicitis in a southwestern city in China.

METHODS

Settings and sampling

This study was conducted on 421 adult patients with acute appendicitis from November 2016 to December 2017. The participants were newly diagnosed at the Third Hospital of Mianyang, which provides medical services for approximately 560 thousand people in a southwestern city in China. An initial interview was conducted with each patient to determine whether he/she met the inclusion criteria. A priori sample size calculation was performed with a level at 0.05 of $\alpha_{2\text{-tailed}}$ and 0.20 of $\beta_{2\text{-tailed}}$.

Inclusion and exclusion criteria

We selected patients older than 18 years of age who sought the first medical assistance at our hospital, and the patients themselves or their caregivers agreed to participate in the study and completed the questionnaire. Patients who underwent an elective appendectomy after conservative treatment because of acute appendicitis or a sudden appendectomy during other intra-abdominal operations, whose diagnosis was confirmed by another hospital and who could not give sufficient information, were excluded.

Data collection

All investigators were trained before they were assigned to collect data. The data were obtained from the patients’

hospital records and from a face-to-face survey, which was completed during the study period while the patients were visiting the hospital. Before the start of each interview, we confirmed that this would not interfere with the examination and treatment of patients.

Demographic characteristics

Data for age, sex, marital status, education level, occupation, monthly income, place of residence, living alone or with others, distance from home to hospital, insurance status and history of appendicitis among acquaintances were obtained during an interview using a questionnaire that was pretested and modified prior to final data collection was done. Age was categorised as 18–39, 40–59 and ≥ 60 years of age. Marital status was categorised as unmarried, married and divorced/widowed. Educational level was classified as no formal schooling, primary or junior/middle school, and high school and above. Occupation was classified as unemployed, physical labour and non-physical labour. Monthly income was categorised as $<¥2000$, $¥2000–5000$ and $>¥5000$. Place of residence was classified as rural, town and city. History of appendicitis among acquaintances required that the patient had experienced the process of diagnosis and treatment of acute appendicitis in one or more acquaintances.

Clinical information

Clinical information, including migrating pain, fever, vomiting, diarrhoea, right lower quadrant (RLQ) rebound tenderness, white blood cell count, neutrophil percentage, C-reactive protein, type of appendicitis, incarcerated by faecal stone, time of symptom onset and hospital arrival, time of operation room arrival, symptoms occurred on a workday or weekend (including a national legal holiday), and night-time or daytime symptom onset were obtained from the electronic medical records. Type of appendicitis was divided into two groups: complicated appendicitis (including gangrenous or perforated appendicitis, periappendiceal abscess) and uncomplicated appendicitis (including simple or suppurative/phlegmonous appendicitis). The intensity of pain was rated by patients at the time of admission using the Numerical Rating Scale, with values between 0 and 10²⁰; we categorised scores of 1–3 as ‘mild pain’, 4–6 as ‘moderate pain’ and 7–10 as ‘severe pain’.

Eysenck personality questionnaire-revised short scale for Chinese

Personality traits were measured using the neuroticism scale (EPQ-N) and the extroversion scale (EPQ-E) of the Eysenck Personality Questionnaire-Revised Short Scale for Chinese (EPQ-RSC).²¹ The EPQ-RSC has been used in early studies, and its reliability and validity as a measure of personality traits in China have been well documented.^{22 23} The total score for the extraversion subscale indicates introversion when it is less than 43.3, intermediate when it is from 43.3 to 56.7 and extraversion when it is greater than 56.7. For the neuroticism subscale, a total score of less than 43.3 defines emotional stability, whereas a total

score from 43.3 to 56.7 defines intermediate and a total score greater than 56.7 defines emotional instability.²³ In this study, we classified five personality traits as follows: stable introverts (both EPQ-N and EPQ-E scores <43.2), stable extroverts (EPQ-N scores <43.2, EPQ-E scores >56.7), unstable extroverts (both EPQ-N and EPQ-E scores >56.7), unstable introverts (EPQ-N scores >56.7, EPQ-E scores <43.2) and transitional personality (others not captured in the above four categories).²⁴ In this study, Cronbach's α was 0.812 and 0.797 for the extraversion and neuroticism subscales, respectively.

Perceived social support scale

Social support from family, friends and significant others was evaluated using the Perceived Social Support Scale (PSSS), which consists of 12 items²⁵; it has good reliability and validity in various samples and has been used in China.^{26 27} A higher score of 61–84 was defined as good social support, 37–60 as moderate social support and 12–36 as poor social support.²⁸ The Cronbach's α for PSSS was 0.823 in this study.

Trait coping style questionnaire

Coping strategy was measured with the Chinese version of the Trait Coping Style Questionnaire (TCSQ), which has been widely used to measure patients' style of coping with life events.²⁹ It is a 20-item questionnaire designed to assess two types of coping strategies: positive coping refers to individuals who tend to deal with problems in a positive way and are able to quickly forget unpleasant aspects; negative coping refers to the tendency to use negative coping methods to deal with problems and vent frustrations to other people. Response scores for each question range from 1 to 5. Higher total scores for each dimension indicated frequent usage of this type of coping. Previous studies have found TCSQ to have high reliability and validity as a measure of coping style in China.³⁰ In this study, the internal consistency coefficients of the subscales were $\alpha=0.845$ (positive coping) and $\alpha=0.871$ (negative coping).

Definition of delay

Prehospital delay was defined as the time interval from when the first symptom was noticed until hospital arrival. In-hospital delay was defined as the time interval from hospital arrival to operating room arrival. Total delay was the sum of the former two times. For patients who did not undergo appendectomy, total delay was equal to prehospital delay. According to the recommendation of the World Emergency Surgery Association and the research results of Saar *et al*,^{31 32} the patients were classified into two groups on the basis of prehospital delay: ≤ 24 hours (no delay group) and >24 hours (delay group).

Patient and public involvement

Patients and the public were not involved in the design of the study. A summary of the main results will be made available to study participants on request. Participants will

be acknowledged and thanked for their contributions during the publication and distribution of the results.

Statistical analysis

To ensure accuracy, the data were entered into an Excel database by two trained researchers after all the surveys were completed. Percentages (%) or numbers (n) were provided for categorical variables; means and standard deviations (means \pm SD) were provided for continuous variables following a normal distribution, while medians and the IQRs were provided for continuous variables that did not follow a normal distribution. The normal distributions of the continuous variables were verified using K-S tests. As an initial step, significant differences between groups among all variables were determined using the Pearson χ^2 test, Mann-Whitney U test or independent samples t-test. Then, a binary logistic regression was performed to identify factors associated with the odds of a delay of longer than 24 hours in seeking medical assistance. Given the high number of variables under investigation and to balance the risk for type I and type II errors, only the variables in the initial step that were significantly different between the two groups at an alpha level of 0.05 could be entered into the binary logistic regression model. All statistical calculations were performed using IBM SPSS Statistics V.19.0 (IBM, Armonk, New York, USA). For all statistical analyses, a significance level of two-sided $p<0.05$ was assumed.

RESULTS

From November 2016 to December 2017, a total of 562 patients received a diagnosis of acute appendicitis in the Third Hospital of Mianyang, of whom 421 patients met the inclusion criteria; 42 patients were younger than 18 years, 52 patients were diagnosed in other hospitals before presentation to our emergency department and 47 patients refused to participate or could not give sufficient information were excluded. The patients studied had a mean age of 47.41 years (SD=18.89) and a median age of 44 years, and the peak age category was 31–65 years. The majority, 242 (57.5 %) patients, were delayed by more than 24 hours, while only 179 (42.5%) patients sought attention within 24 hours of noticing symptoms of acute appendicitis.

Time of delay among patients with complicated or uncomplicated acute appendicitis

The mean prehospital delay was 27.68 hours with a median of 26 hours, while the mean in-hospital delay was 5.16 hours with a median of 5 hours. Most patients (61.5%; $n=259$) were discharged with a diagnosis of uncomplicated acute appendicitis. Patients with complicated appendicitis had a significantly longer prehospital delay (27 vs 25 hours, $p=0.002$) and total delay (33 vs 30 hours, $p=0.002$). There was no significant difference in time of in-hospital delay between the two groups (table 1).

Table 1 Time of delay among patients with complicated or uncomplicated acute appendicitis

Time of delay (hours)	Uncomplicated (n=259)	Complicated (n=162)	P value
Prehospital, median (IQR)	25 (18–31)	27 (23–32)	0.002
In-hospital, median (IQR)	5 (4–6)	5 (4–6)	0.459
Total, median (IQR)	30 (22–36)	33 (28–38)	0.002

Demographic characteristics of patients

Table 2 shows the demographic characteristics of patients with acute appendicitis in two groups. The patients in the delay group were more likely to be aged ≥ 60 years (40.1% vs 26.8%, $p=0.013$) and to living alone (30.2% vs 18.4%, $p=0.004$) than patients in the no delay group. A history of appendicitis among acquaintances may encourage patients to seek medical help when suffering abdominal pain (36.3% vs 14.0%, $p<0.001$). With respect to sex, marital status, education level, occupation, monthly income, place of residence, distance from home to hospital and insurance status, the differences among the participants with different prehospital delays were not statistically significant ($p>0.05$).

Prehospital delay by clinical variables

The association between clinical status and prehospital delay is presented in **table 3**. Overall, migrating pain, fever, vomiting, diarrhoea, RLQ rebound tenderness, white blood cell count, neutrophil percentage, C-reactive protein, incarcerated by faecal stone, and night-time or daytime symptom onset had no significant association with the visit time of patients. However, those with severe pain were more likely to see the doctor within 24 hours compared with those with mild or moderate pain (32.2% vs 21.8%, $p=0.013$). The symptoms of patients in the delay group were more likely to have occurred on a working day (68.2% vs 55.3%, $p=0.008$).

Psychosocial factors of participants

There was a significant difference in the distribution of EPQ personality traits and social support among patients in the two groups ($p<0.05$); the delayed patients had a larger proportion of unstable introverts and poor social support compared with the no delay patients. The results of the TCSQ showed no significant differences between the two groups on the positive coping dimensions, but the delay group had a significantly higher score on the negative coping dimension ($p<0.05$) (**table 4**).

Factors associated with prehospital delay

In the logistic regression analyses, eight variables or subvariables were associated with prehospital delay >24 hours. As shown in **table 5**, patients ≥ 60 years of age had 2.36 times the odds of delaying compared with patients <40 years of age (95% CI 1.39 to 4.02; $p=0.002$). Additionally, patients who lived alone (OR=1.74, 95% CI 1.02 to

2.97; $p=0.042$) had significantly higher odds of presentation delay than patients who lived with others. Having no history of appendicitis among acquaintances and having symptoms that occurred on a workday may delay patients' seeking medical help when suffering from acute appendicitis (OR=2.72, 95% CI 1.61 to 4.60; $p<0.001$ and OR=1.72, 95% CI 1.08 to 2.73; $p=0.021$, respectively). Those suffering from mild pain were more likely to see the doctor after more than 24 hours compared with those suffering from severe pain (OR=2.51, 95% CI 1.44 to 4.35; $p=0.001$). With respect to EPQ personality traits, the odds for stable extroverts and unstable introverts were 0.51 times (95% CI 0.27 to 0.97; $p=0.041$) and 2.32 times (95% CI 1.20 to 4.48; $p=0.012$) the odds for transitional personality, respectively. Patients' poor social support and negative coping style were significantly associated with prehospital delay (OR=2.55, 95% CI 1.46 to 4.47; $p=0.001$ and OR=1.04, 95% CI 1.01 to 1.06; $p=0.002$, respectively).

DISCUSSION

In this investigation, only 179 (42.5%) of the 421 patients with acute appendicitis were transferred to the hospital within 24 hours; the mean prehospital delay was 27.68 hours with a median of 26 hours, while the mean in-hospital delay was 5.16 hours with a median of 5 hours. No previous study had investigated the delay among Chinese patients with acute appendicitis; the present study is the first to reveal that patients in this southwestern city in China are facing a major problem in terms of presentation delays, consistent with the results of reports from abroad.^{12 32 33} Because this research was not focused on the relationship between patient delay and complicated appendicitis, we simply compared the overall differences in delay between patients with complicated and uncomplicated appendicitis without adjusting for other variables that might predict increased odds of complicated appendicitis. However, the present study did find that patients with complicated appendicitis had a significantly longer time of prehospital delay (27 vs 25 hours, $p=0.002$) and total delay (33 vs 30 hours, $p=0.002$) but not in-hospital delay (5 vs 5 hours, $p=0.459$), suggesting that the main factor associated with complicated appendicitis is prehospital presentation time, similar to most studies.^{7 16 34} Therefore, it will be useful to determine and avoid the contributors that can cause prehospital delay in patients with acute appendicitis.

The factors associated with prehospital delay are numerous and include sociodemographic characteristics, clinical factors, cognitive factors and psychosocial factors. For each factor, different associations were found across different studies of different diseases. Sociodemographic characteristics play an important role in prehospital delay, especially in low-income and middle-income countries. Our analysis revealed that patients at more advanced ages (≥ 60 years) were more likely to delay presentation, similar to studies of chronic or emergent diseases such

Table 2 Demographic characteristics of patients (n=421)

Demographic characteristics	Total (n=421)	Delay (n=242)	No delay (n=179)	P value
Age (years), n (%)				0.013
18–39	172 (40.9)	87 (36.0)	85 (47.5)	
40–59	104 (24.7)	58 (23.9)	46 (25.7)	
≥60	145 (34.4)	97 (40.1)	48 (26.8)	
Sex, n (%)				0.921
Male	216 (51.3)	125 (51.7)	91 (50.8)	
Female	205 (48.7)	117 (48.3)	88 (49.2)	
Marital status, n (%)				0.924
Unmarried	57 (13.5)	34 (14.0)	23 (12.8)	
Married	314 (74.6)	180 (74.4)	134 (74.9)	
Divorced/widowed	50 (11.9)	28 (11.6)	22 (12.3)	
Education level, n (%)				0.869
No formal schooling	74 (17.6)	43 (17.8)	31 (17.3)	
Primary or junior/middle school	165 (39.2)	97 (40.1)	68 (38.0)	
High school and above	182 (43.2)	102 (42.1)	80 (44.7)	
Occupation, n (%)				0.400
Unemployed	98 (23.3)	52 (21.5)	46 (25.7)	
Physical labour	170 (40.4)	104 (43.0)	66 (36.9)	
Non-physical labour	153 (36.3)	86 (35.5)	67 (37.4)	
Monthly income, n (%)				0.308
<¥2000	125 (29.7)	65 (26.9)	60 (33.5)	
¥2000–5000	166 (39.4)	101 (41.7)	65 (36.3)	
>¥5000	130 (30.9)	76 (31.4)	54 (30.2)	
Place of residence, n (%)				0.311
Rural	227 (53.9)	125 (51.7)	102 (57.0)	
Town	99 (23.5)	56 (23.1)	43 (24.0)	
City	95 (22.6)	61 (25.2)	34 (19.0)	
Living alone or with others, n (%)				0.004
Living alone	106 (25.2)	73 (30.2)	33 (18.4)	
Living with others	315 (74.8)	169 (69.8)	146 (81.6)	
Distance from home to hospital (km), median (IQR)	6 (5–7)	6 (5–7)	6 (5–7)	0.432
Insurance status, n (%)				0.248
No	19 (4.5)	9 (3.7)	10 (5.6)	
Yes	402 (95.5)	233 (96.3)	169 (94.4)	
History of appendicitis among acquaintances, n (%)				<0.001
No	322 (76.5)	208 (86.0)	114 (63.7)	
Yes	99 (23.5)	34 (14.0)	65 (36.3)	

as tumour and stroke.^{35–37} However, contrary to these studies,^{38–40} no associations between prehospital delay and economic factors, sex, marital status, education level, occupation, place of residence, distance from home to hospital or insurance status were found in our study. One way that this can be explained is that with the popularisation of insurance, more convenient transport and

the development of improved diagnosis and treatment technology in hospitals, seeking medical help for acute appendicitis is no longer a complicated, expensive and time-consuming process.

Regarding clinical characteristics, only patients with severe pain were less likely to have a prehospital delay compared with patients with mild or moderate pain. In

Table 3 Clinical characteristics of patients (n=421)

Clinical variables	Total (n=421)	Delay (n=242)	No delay (n=179)	P value
Migrating pain, n (%)				0.368
No	108 (25.7)	58 (24.0)	50 (27.9)	
Yes	313 (74.3)	184 (76.0)	129 (72.1)	
Fever, n (%)				0.417
No	260 (61.8)	145 (59.9)	115 (64.2)	
Yes	161 (38.2)	97 (40.1)	64 (35.8)	
Vomiting, n (%)				0.394
No	129 (30.6)	70 (28.9)	59 (33.0)	
Yes	292 (69.4)	172 (71.1)	120 (67.0)	
Diarrhoea, n (%)				0.425
No	352 (83.6)	199 (82.2)	153 (85.6)	
Yes	69 (16.4)	43 (17.8)	26 (14.5)	
RLQ rebound tenderness, n (%)				0.400
No	209 (49.6)	123 (50.8)	86 (48.0)	
Yes	212 (50.4)	119 (49.2)	93 (52.0)	
White blood cell count ($\times 10^9/L$), median (IQR)	13.5 (11.1–15.9)	13.9 (11.3–15.7)	13.1 (10.4–16.0)	0.224
Neutrophil percentage (%), means \pm SD	81.5 \pm 9.1	81.0 \pm 10.1	82.2 \pm 7.6	0.192
C-reactive protein, median (IQR)	7.32 (5.629.04)	7.22 (5.64–8.85)	7.64 (5.62–9.22)	0.705
Incarcerated by faecal stone, n (%)				0.196
No	326 (77.4)	193 (79.8)	133 (74.3)	
Yes	95 (22.6)	49 (20.2)	46 (25.7)	
Symptoms occurred on a workday or weekend, n (%)				0.008
Workday	264 (62.7)	165 (68.2)	99 (55.3)	
Weekend	157 (37.3)	77 (31.8)	80 (44.7)	
Night-time or daytime symptom onset, n (%)				0.248
Night-time	214 (50.8)	117 (48.3)	97 (54.2)	
Daytime	207 (49.2)	125 (51.7)	82 (45.8)	
Intensity of pain, n (%)				0.013
Mild	220 (52.3)	121 (50.0)	99 (55.3)	
Moderate	84 (20.0)	43 (17.8)	41 (22.9)	
Severe	117 (27.7)	78 (32.2)	39 (21.8)	

RLQ, right lower quadrant.

addition, symptoms occurring on a working day was one of the barriers to seeking medical help among patients with acute appendicitis. Some studies reported a positive association between symptoms and/or signs of disease and patient delay.^{41 42} However, no difference in prehospital delay was found between patients with different clinical characteristics, including migrating pain, fever, vomiting, diarrhoea, RLQ rebound tenderness, white blood cell count, neutrophil percentage, C reactive protein and incarcerated faecal stone in the present study. Although an uncommon clinical presentation may increase the

difficulty of diagnosis for the doctor, which may cause diagnostic delays, it is not an important factor for patients in deciding whether or not to see a doctor.

Patients' interpretation of symptoms and knowledge of the disease have been shown to be strongly associated with patient delays in other quantitative studies of cancer and stroke.^{43–45} In the present study, the patients who had experienced the process of diagnosis and treatment of acute appendicitis in their acquaintances often arrived at the emergency department or hospital earlier than other patients. Knowledge of acute appendicitis gleaned

Table 4 Psychosocial factors of patients (n=421)

Psychosocial factors	Total (n=421)	Delay (n=242)	No delay (n=179)	P value
EPQ personality traits, n (%)				<0.001
Transitional personality	99 (23.5)	56 (23.1)	43 (24.0)	
Stable introverts	77 (18.3)	42 (17.4)	35 (19.6)	
Stable extroverts	95 (22.5)	40 (16.5)	55 (30.7)	
Unstable extroverts	44 (10.5)	24 (9.9)	20 (11.2)	
Unstable introverts	106 (25.2)	80 (33.1)	26 (14.5)	
Perceived social support scale, n (%)				0.002
Good	180 (42.8)	91 (37.6)	89 (49.7)	
Moderate	118 (28.0)	64 (26.4)	54 (30.2)	
Poor	123 (29.2)	87 (36.0)	36 (20.1)	
Trait coping style, median (IQR)				
Positive coping	38 (28–41)	38 (28–41)	38 (24–41)	0.134
Negative coping	28 (21–39)	34 (22–39)	24 (19–38)	<0.001

EPQ, Eysenck Personality Questionnaire .

from this experience increased patients' awareness that they had an acute appendicitis rather than acute gastroenteritis when the initial symptoms occurred.

Previous studies found that the personality traits of extraversion and neuroticism were significantly associated with cancer screening attendance.^{46–48} This study demonstrates that personality traits influence prehospital delay. The 'unstable introvert' group waited the longest waiting before deciding to see a doctor. Neurotic personalities have lower levels of self-efficacy that are likely to be unhelpful and lead to avoidance behaviour when facing trouble. Extroverts have higher self-efficacy and may be more motivated to participate in therapy. On the other hand, introverts may be more unwilling to participate due to lack of motivation.⁴⁹ Extroversion has also been demonstrated to be associated with a higher pain tolerance, greater use of active coping mechanisms and lower perceived intensity of pain.⁵⁰

Coping refers to one's ability to change cognitive and behavioural efforts constantly, to manage specific external or internal demands that are appraised as taxing or exceeding the resources of the person; this concept originated from theories of self-defence.⁵¹ In this study, there were no significant differences between the two groups in the positive coping dimensions of the TCSQ; however, the delay group had scores on the negative coping dimension that were higher than the scores of the no delay group, indicating that these patients tended to adopt a negative and immature avoidant coping mode after noticing symptoms of acute appendicitis.

Regarding social support, we found that patients in the delay group had significantly lower social support and were likely to live alone compared with patients in the no delay group. A study reported that patients with breast cancer who lacked social support from family members and spouses were more likely to delay.⁴³ Another study

conducted in Mexico in 2011 reported that social support is crucial for materialisation of the initial contact as well as for community care.⁵² Social support was defined as the perception and actuality that one is cared for, has assistance available from other people (spouse, relatives and friends) and that one is part of a supportive social network.⁵³ Social support is considered to promote biological or behavioural adaptations under conditions of stress. This may result in better treatment compliance and the adoption of better health behaviours, which will generally exert positive effects on overall physical condition.⁵⁴ Several studies have also described how the patient's concealment of symptoms may influence the delay in seeking medical, while discussing them with friends and family can facilitate the decision to seek medical advice.⁵⁵

Our study had some advantages. Even though there were many studies of the relationship between delay and clinical outcomes, we were the first to test the association between psychosocial factors and prehospital delay in patients with acute appendicitis. Numerous factors may affect the decision of patients to see doctor, and the factors can confound each other; therefore, we considered socio-demographic characteristics, clinical factors, cognitive factors and psychosocial factors. We entered into the binary logistics model variables that, in the initial analyses, were significantly different between the two groups at an alpha level of 0.05. After adjusting for other variables, the variables retained in the model can predict the increased odds of prehospital delay. This line of thinking may also be useful to extend to other emergency surgery conditions indirectly, because in the absence of surgical care, case-fatality rates are high for common, easily treatable conditions; this may result not only from economic problems, especially in low-income and middle-income countries,⁵⁶ but also from psychosocial factors that are confronted globally.

Table 5 The results of logistic regression analysis on prehospital delay

Psychosocial factors	Delay (n=242)	No delay (n=179)	OR (95% CI)	P value
Age (years), n (%)				0.013
18–39	87 (36.0)	85 (47.5)	Reference	
40–59	58 (23.9)	46 (25.7)	1.31 (0.74 to 2.32)	0.359
≥60	97 (40.1)	48 (26.8)	2.36 (1.39 to 4.02)	0.002
Living alone or with others, n (%)				0.004
Living with others	169 (69.8)	146 (81.6)	Reference	
Living alone	73 (30.2)	33 (18.4)	1.74 (1.02 to 2.97)	0.042
History of appendicitis among acquaintances, n (%)				<0.001
Yes	34 (14.0)	65 (36.3)	Reference	
No	208 (86.0)	114 (63.7)	2.72 (1.61 to 4.60)	<0.001
Symptoms occurred on a workday or weekend, n (%)				0.008
Weekend	77 (31.8)	80 (44.7)	Reference	
Workday	165 (68.2)	99 (55.3)	1.72 (1.08 to 2.73)	0.021
Intensity of pain, n (%)				0.013
Severe	78 (32.2)	39 (21.8)	Reference	
Moderate	43 (17.8)	41 (22.9)	0.83 (0.38 to 1.79)	0.631
Mild	121 (50.0)	99 (55.3)	2.51 (1.44 to 4.35)	0.001
EPQ personality traits, n (%)				<0.001
Transitional personality	56 (23.1)	43 (24.0)	Reference	
Stable introverts	42 (17.4)	35 (19.6)	0.92 (0.47 to 1.81)	0.809
Stable extroverts	40 (16.5)	55 (30.7)	0.51 (0.27 to 0.97)	0.041
Unstable extroverts	24 (9.9)	20 (11.2)	0.74 (0.33 to 1.66)	0.466
Unstable introverts	80 (33.1)	26 (14.5)	2.32 (1.20 to 4.48)	0.012
Perceived Social Support Scale, n (%)				0.002
Good	91 (37.6)	89 (49.7)	Reference	
Moderate	64 (26.4)	54 (30.2)	1.54 (0.77 to 3.05)	0.219
Poor	87 (36.0)	36 (20.1)	2.55 (1.46 to 4.47)	0.001
Negative coping style, median (IQR)	34(22–39)	24(19–38)	1.04 (1.01 to 1.06)	0.002

EPQ, Eysenck Personality Questionnaire.

However, several limitations should be considered when interpreting our results. First, we observed only a temporal relationship between psychosocial factors and prehospital delay in patients with acute appendicitis. Second, the number of analysed participants was 421, which was a small proportion of the number of residents in our city. Third, we used a questionnaire to determine the psychosocial factors; participants' answers were subject to mistakes in recollection and other errors. Fourth, the present study was conducted in a single centre; thus, it is not known whether the present findings apply to other populations with different economic and cultural conditions.

CONCLUSION

In summary, prehospital delay for acute appendicitis was common in this southwestern city of China. The results

suggest that the prehospital delay may be attributed to some psychosocial factors such as older age, living alone, a lack of knowledge of the disease, low social support, an unstable introvert personality trait and negative coping style. The intensity of pain and symptoms occurring on a workday are the most important clinical factors affecting delay in presentation of acute appendicitis. We believe that a better understanding of the association between psychosocial factors and prehospital delay can help identify patients with acute appendicitis at risk of prehospital delay and lead to the establishment of an effective campaign to promote hospital visits when symptoms are noticed.

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