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Public Knowledge of Emergency Department Triage and its Association with Patient Satisfaction in Macau During the COVID-19 Era: A Cross-Sectional Study

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Abstract

Background *Emergency Department (ED) overcrowding is a global health challenge, intensified by the COVID-19 pandemic. Public understanding of ED triage is essential for optimizing service utilization and aligning patient expectations. This study aimed to assess public knowledge of the ED triage process in Macau during the pandemic and to examine its association with patient-reported wait times and overall satisfaction.*

Methods *A cross-sectional study was conducted from JunetoOct 2021 among adult Macau residents. A proportionate quota sampling strategy aligned with Macau's seven parishes recruited 480 participants. A validated 28-item questionnaire assessed sociodemographic characteristics, knowledge and perceptions of the ED triage system, and patient satisfaction. Data was analyzed using descriptive statistics, chi-square tests, and Spearman's correlation. Statistical significance was set at $p < 0.05$.*

Results*A total of 446 valid questionnaires was analyzed (response rate: 92.9%). A significant knowledge deficit was identified, with 66.4% (n=296) of participants being unaware of the existence of an ED triage system. Knowledge of triage was significantly associated with a greater acceptance of triage procedures ($\chi^2 = 43.842$, $p < 0.001$) and the principle of prioritization by urgency ($\chi^2 = 7.459$, $p = 0.028$). Spearman's correlation revealed a moderate negative relationship between triage knowledge and self-reported wait time ($rs = -0.438$, $p < 0.001$) and a strong negative correlation between reported wait time and overall satisfaction ($rs = -0.557$, $p < 0.001$).*

Conclusion*A pervasive lack of public knowledge regarding ED triage exists in Macau, a situation likely amplified by the complexities of healthcare navigation during the COVID-19 pandemic. This knowledge gap is significantly associated with unrealistic wait time expectations and lower patient satisfaction. Findings underscore the urgent need for targeted public health education and system-level interventions to improve emergency service utilization and patient experience in a post-pandemic world.*

Keywords: *emergency department, triage, health literacy, patient satisfaction, wait times, COVID-19, Macau*

INTRODUCTION

Emergency Department (ED) overcrowding is a prevalent global health challengecompromising patient safety, increasing mortality, and diminishing the quality of care [1]. The COVID-19 pandemic exacerbated this crisis by overwhelming healthcare resources and exposing systemic vulnerabilities [2]. Contributing factors include aging populations, rising prevalence of chronic diseases, and high rates of non-urgent ED visits [3]. Prolonged ED stays are associated with elevated adverse event rates, delayed delivery of critical medications, and increased mortality [4]. These issues are particularly acute in densely populated Asian settings, where patients with complex comorbidities heavily utilize emergency services [5].

To manage patient flow, EDs utilize triage systems to ensure patients with the most urgent, life-threatening conditions receive immediate intervention, irrespective of arrival time [6]. The pandemic placed immense pressure on triage, as it became a crucial tool for not only assessing clinical urgency but also for identifying and isolating

potentially infectious patients [7]. However, the system's efficacy is often compromised by "inappropriate attendance"—the use of the ED for non-urgent issues—which strains finite resources and disrupts care for critically ill patients [8].

Recent evidence indicates that low public health literacy regarding triage is a primary driver of ED misuse [9]. This knowledge deficit fosters unrealistic expectations about wait times, leading to perceptions of unfairness and patient dissatisfaction [10]. The pandemic likely compounded this issue, with public anxiety and uncertainty about symptoms potentially leading to increased ED visits for mild conditions [11]. Improving patient knowledge is a crucial non-clinical intervention to align patient expectations with the operational realities of emergency care, mitigating frustration and improving the patient experience [9].

While these trends provide a global context, local data for Macau are conspicuously absent. ED attendance in Macau reached 321,877 visits in 2019 [12], and the pandemic has since reshaped healthcare-seeking behaviors. This study, conducted during the COVID-19 pandemic (January-April 2022), was designed to address this critical evidence gap. The primary objectives were: (1) to quantify the level of public knowledge regarding the ED triage system in Macau; (2) to identify key sociodemographic determinants of this knowledge; and (3) to generate evidence-based recommendations for public health initiatives in a post-pandemic healthcare landscape.

MATERIALS AND METHODS

Study Design and Sampling

A cross-sectional survey was conducted among adult residents across Macau's seven parishes. A target sample of 480 participants was recruited using a proportional quota sampling strategy based on parish population distribution, a pragmatic approach for achieving representation when true random sampling is not feasible [13].

Participants

Inclusion criteria were age ≥ 18 years, ability to comprehend written Chinese, and providing written informed consent.

Data Collection Instrument

Data were collected using a structured questionnaire adapted from a previously validated instrument [14] to suit the Macao healthcare context. The final 28-item instrument comprised sections on sociodemographic characteristics, knowledge and perceptions of the ED triage system, and overall patient satisfaction. The instrument's content validity was affirmed by a panel of three ED experts, yielding a Content Validity Index (CVI) of 0.90, which exceeds the recommended threshold for excellence [15]. A pilot test with 30 residents was then conducted to assess reliability. The final instrument demonstrated excellent internal consistency with a Cronbach's alpha coefficient of 0.821.

Data Analysis

Trained research assistants administered the anonymous surveys in person. Data were analyzed using SPSS (v.26). Descriptive statistics, chi-square tests, and Spearman's correlation analyses were performed, with statistical significance set at $p < 0.05$.

Ethical Considerations

The study received full ethical approval from theresearch review board from the Faculty of Health Sciences and Sports, Macao Polytechnic University.All participants provided written informed consent prior to participation.

Results

Of the 480 questionnaires distributed, 446 were returned with complete data, yielding a valid response rate of 92.9%. The demographic characteristics of the participants are detailed in Table 1.

Table 1 Sociodemographic Characteristics of Participants (N=446)

Characteristic	Category	Frequency (n)	Percentage (%)
Age (years)	18-25	77	17.26
	26-35	112	25.13

	36-45	86	19.28
	46-55	69	15.47
	56-65	53	11.88
	≥66	49	10.98
Gender	Male	226	50.67
	Female	220	49.33
Education	Primary School	64	14.35
	Junior High School	108	24.22
	Senior High School	93	20.85
	University (Bachelor's)	144	32.29
	Postgraduate	37	8.29
Occupation	Public/Corporate Manager	35	7.85
	Professional (e.g., Lawyer, Doctor)	15	3.36
	Technician (e.g., Nurse, Teacher)	21	4.71
	Clerical Staff	41	9.19
	Service/Sales Staff	57	12.78
	Fishery/Agricultural Worker	31	6.95
	Craft/Manual Worker	42	9.42
	Machine Operator	40	8.97
	Unskilled Laborer	50	11.21
	Part-time Worker	46	10.31
	Retired	44	9.87
	Other	24	5.38
Monthly Income (MOP)*	10,001 - 20,000	105	23.54
	20,001 - 30,000	181	40.58
	30,001 - 40,000	89	19.96
	≥40,001	71	15.92

*MOP = Macanese Pataca, $8.00 to $1.00 US

The primary reasons for choosing the ED over outpatient clinics were the perception of faster investigations (24.2%) and having no time to visit a clinic during daytime hours (22.8%) (Table 2). Although 74.4% of respondents reported seeing informational signage about patient flow, a majority of those (50.9% of the total sample) stated they did not understand the information.

Table 2 Participant Perceptions of ED Processes and Environment (N=446)

Item	Category	Frequency (n)	Percentage (%)
Payment Method for Medical Care	Self-pay	103	23.02
	Billed to Account	47	10.47
	Medical Insurance	195	43.68
	Free Medical Care	87	19.49
	Other	14	3.34
Reasons for Choosing ED (Multiple responses allowed) *	No time for clinic during the day	193	22.8
	Faster investigations in ED	232	24.2
	Higher skill level of ED doctors	125	11.2
	Unsure which specialty to see	146	12.8
	Shorter wait time in ED	99	10.3
	Acute/sudden onset of illness	146	12.8
	Better quality of care in ED	99	10.3
Presence of ED Patient Flow Signage	Yes	332	74.44
	No	85	19.05
	Don't know	29	6.51
Understanding of Signage (if present, n=332)	Looked and understood	135	30.27
	Looked but did not understand	227	50.89
	Did not look	84	18.84
Perceived Necessity of Signage	Very necessary	72	16.15
	Necessary	67	15.02
	Indifferent / Neutral	203	45.52
	Not very necessary	67	15.02
	Unnecessary	37	8.29
Awareness of Priority for Critical Patients	Yes	92	20.63
	No	70	15.69
	Don't know	284	63.68
Areas That Should Prioritize Critical Patients (Multiple responses allowed)*	ED Registration	259	58.07

	Billing/Cashier	207	46.41
	Laboratory/Investigations	314	70.40
	Radiology	226	50.67
	CT Scan	253	56.73
	Hospital Admission	196	43.94

*Percentages for multiple-response questions are based on the total number of responses for that item, not the total number of participants.

A core finding was the significant deficit in public knowledge regarding the ED triage system (Table 3). Two-thirds of participants (n=296, 66.4%) reported they did not know their hospital's ED had a triage system.

Table 3 Participant Knowledge of the Triage System (N=446)

Item	Category	Frequency (n)	Percentage (%)
13. Awareness of ED Triage System	Yes, from hospital signage	70	15.69
	Yes, from multiple visits	45	10.08
	Yes, from media/friends	35	7.86
	No, do not know	296	66.37
14. Attitude Towards Vital Signs Measurement at Triage	Unnecessary, wastes time	134	30.05
	Approve	36	8.07
	Indifferent	276	61.88
15. Attitude Towards Preliminary Diagnostic Tests at Triage	Unnecessary, wastes time	67	15.02
	Approve	87	19.51
	Indifferent	292	65.47
16. Belief About Triage Procedures Shortening Wait Times	Yes, they shorten time	87	19.51
	No, they do not	73	16.36
	Unsure	250	56.05
	They make it more troublesome	36	8.08

Furthermore, participants' understanding of the fundamental principle of triage that is the prioritization by urgency was limited (Table 4). A majority (n=299, 67.0%) were unsure how the queueing order was determined, and only 14.3% (n=64) correctly identified that patients are seen based on the severity of their condition.

Table 4 Participant Perceptions of Triage Priority and Fairness (N=446)

Item	Category	Frequency (n)	Percentage (%)
17. Belief About Patient Order Principle	Should be "first-come, first-served"	83	18.62
	Should be based on urgency	64	14.34
	Don't know	299	67.04
18. Willingness to Yield Turn to an Urgent Patient	No	172	38.56

	Yes	274	61.44
19. Reason for Not Yielding (if No to Q18, n=172)	Other doctors can handle it	26	15.12
	Wait time is already too long	43	25.01
	My own condition feels worse	89	51.74
	Other	14	8.13
20. Who Should Decide Priority (if Yes to Q18, n=274)	The nurse	50	18.25
	The doctor	154	56.21
	The triage system	70	25.54

A significant disparity was observed between experienced ED wait times and patient expectations (Table 5). A majority (n=246, 55.2%) reported waiting more than two hours, whereas the largest group of respondents (n=274, 61.4%) desired a wait of 10 to 30 minutes. This expectation, reality gap, was reflected in satisfaction levels, with a combined 45.8% of the sample reporting being "dissatisfied" or "very dissatisfied."

Table 5 Participant-Reported Wait Times and Overall Satisfaction (N=446)

Item	**Category**	**Frequency (n)**	**Percentage (%)**
25. Reported Wait Time on Last ED Visit	< 30 minutes	30	6.73
	30 minutes - 1 hour	74	16.58
	1 - 2 hours	96	21.52
	> 2 hours	246	55.17
26. Ideal/Most Reasonable Wait Time	Immediately	30	6.72
	< 10 minutes	87	19.52
	10 - 30 minutes	274	61.43
	> 30 minutes	55	12.33
27. Overall Satisfaction with Last ED Visit	Very Dissatisfied	41	9.19
	Dissatisfied	163	36.57
	Neutral	128	28.69
	Satisfied	77	17.26
	Very Satisfied	37	8.29

Spearman's correlation analysis identified statistically significant relationships between key variables (Table 5). There was a moderate negative correlation between triage knowledge and reported ED wait time ($r_s = -0.438$, $p < 0.001$). Furthermore, a significant and strong negative correlation was found between the length of the wait time and overall satisfaction ($r_s = -0.557$, $p < 0.001$).

Chi-square analysis revealed that participants knowledgeable about the triage system held significantly different perceptions of triage processes (Table 6). Knowledgeable participants were more likely to approve of vital signs

checks (χ^2= 43.842, p < 0.001) and preliminary diagnostic tests (χ^2= 57.363, p < 0.001). They were also more likely to reject a "first-come, first-served" principle in favor of prioritization by urgency (χ^2 = 7.459, p = 0.028).

Table 6 Association Between Knowledge of the ED Triage System and Key Perceptions of Triage Processes

Perception / Attitude Item	Response	Knowledge of Triage System: Yes (n=150)	Knowledge of Triage System: No (n=296)	χ2	p-value
Attitude towards vital signs measurement at triage				43.842**	<0.001
	Unnecessary, wastes time	39 (26.0%)	95 (32.1%)		
	Approve	29 (19.3%)	11 (3.7%)		
	Indifferent	82 (54.7%)	190 (64.2%)		
Attitude towards preliminary diagnostic tests at triage				57.363**	<0.001
	Unnecessary, wastes time	18 (12.0%)	58 (19.6%)		
	Approve	62 (41.3%)	27 (9.1%)		
	Indifferent	70 (46.7%)	211 (71.3%)		
Belief about patient order principle				7.459*	0.028
	"First-come, first-served" is correct	21 (14.0%)	66 (22.3%)		
	"Based on urgency" is correct	32 (21.3%)	38 (12.8%)		
	Unsure	97 (64.7%)	192 (64.9%)		
Willingness to yield turn to a more urgent patient				6.193*	0.014
	Yes, would yield	68 (45.3%)	101 (34.1%)		
	No, would not yield	82 (54.7%)	195 (65.9%)		

Data are presented as n (%). P-values < 0.05 were considered statistically significant, *: p < 0.05, **: p < 0.001, ***: p < 0.0001

Spearman's correlation analysis identified statistically significant relationships between key variables (Table 7). There was a moderate negative correlation between triage knowledge and reported ED wait time (rs = -0.438, p < 0.001). Furthermore, a significant and strong negative correlation was found between the length of the wait time and overall satisfaction (rs = -0.557, p < 0.001).

Table 7 Spearman's Correlation Between Reported Wait Time and Overall Satisfaction

Variable Pair	Spearman's rho (rs)	p-value
. Knowledge of Triage System & Reported ED Wait Time	-0.438**	<0.001
2. Reported ED Wait Time & Overall Satisfaction	-0.557**	<0.001

**. Correlation is significant at the 0.01 level (2-tailed)

DISCUSSION

This study provides the first systematic investigation into public perceptions of the ED triage system in Macau. The principal finding is a profound deficit in public understanding. The fact that 66.4% of participants were unaware of the triage system, and 67.0% were unsure how queueing order is determined, highlights a critical gap in health literacy. This corroborates findings from other regions and is a likely driver of ED misuse, unrealistic expectations, and patient dissatisfaction [9, 10].

The finding that two-thirds of the public were unaware of the triage system is particularly concerning. The study's timing (June-Oct 2021) suggests this knowledge gap persisted despite heightened public interaction with and media coverage of the healthcare system during the pandemic [9]. This points to a failure of both proactive, community-based education and in-hospital communication. Effective communication is paramount during a health crisis to build trust and manage public anxiety [16]. The perception that triage procedures are "unnecessary" undermines safe patient prioritization and reveals a lack of trust in the clinical judgment of triage nurses finding consistent with research highlighting that patient acceptance of triage is dependent on trust in the provider [17, 18].

The clash between the public's perception of fairness (18.6% believed in "first-come, first-served") and the clinical reality of triage (prioritization by urgency) is a key source of tension. The pandemic brought such ethical dilemmas to the forefront globally [7]. Without education to bridge this gap, patients are more likely to perceive the prioritization of others as an injustice, leading to frustration [19]. This is compounded by the finding that over half of those who saw informational signage did not understand it, indicating that current communication methods are ineffective.

The chasm between patient expectations and reality is stark because over half of patients waited more than two hours, where the majority expected to wait less than 30 minutes. The analysis yields a significant finding, revealing a strong negative correlation between wait time and satisfaction ($r_s = -0.557$).Importantly, greater understanding of triage was found to be moderately correlated with shorter self-reported wait times ($r_s = -0.438$).This suggests that knowledge is a powerful mediating factor; educating patients may recalibrate their expectations and improve satisfaction, even when wait times remain long [17, 21].

The analysis revealed no statistically significant relationship between triage knowledge and primary demographic indicators, including age and level of education.This may suggest that the lack of systemic public education in Macau is so pervasive that it affects all demographic groups equally, a situation potentially exacerbated by the universal confusion and information overload of the pandemic era.

Implications for Policy and Practice

The findings from this study have clear and urgent implications for the post-pandemic era. First, a multi-pronged public health education strategy is imperative to explain what triage is, why it is necessary, and what patients should expect. Second, in-hospital communication must be redesigned using digital tools and easy-to-understand graphical flowcharts to empower patients and reduce anxiety [22]. Third, the finding that many use the ED for convenience suggests an underlying issue with access to primary care, a well-established driver of ED overcrowding. Health authorities should explore expanding after-hours primary care services to provide a viable alternative for non-urgent conditions [3].

Strengths and Limitations

This study's strengths include being the first of its kind in Macau, a high response rate, and the use of a validated instrument. However, limitations must be acknowledged. The cross-sectional design precludes establishing causality. Quota sampling may be subject to selection bias. Finally, the data are self-reported and may be influenced by recall bias and the unique psychological context of the COVID-19 pandemic, which could affect perceptions of healthcare experiences. Future mixed-methods research is needed to explore the "why" behind these attitudes in greater depth [23].

CONCLUSION

This study reveals a critical disconnect between public perception and the clinical reality of ED triage in Macau. This knowledge gap, existing within the challenging context of the COVID-19 pandemic, contributes to unrealistic expectations, patient dissatisfaction, and inefficient use of vital emergency resources. The strong link between knowledge, perceived wait times, and satisfaction provides a clear mandate for action. These findings serve as an evidence-based roadmap for developing targeted educational interventions and health policy reforms to empower patients and safeguard the integrity of emergency care in Macau.

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Authors' contributions

SPC and CSUL were responsible for the study's conceptualization and design. CSP conducted data collection and drafted the initial manuscript. CSUL critically reviewed and revised the manuscript for essential intellectual content. All authors (SPC, CSUL, WIPP, and YMCC) have read, edited, and approved the final version of the manuscript for publication.

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Data availability

All data generated or analyzed during this study are included in this published article.

Declarations

The study received ethical approval from the Human Research Ethics Committee at Macao Polytechnic University (approval certificate no. 2024/014.2401). All procedures involving human participants adhered to the ethical principles of the Declaration of Helsinki. Prior to participation, all subjects received comprehensive information regarding the study's objectives, procedures, and their rights, including confidentiality and the right to withdraw without penalty. Informed consent was obtained from all participants using a detailed consent form. Collected data were anonymized and maintained with strict confidentiality, used exclusively for research purposes, thereby safeguarding participants' rights and privacy throughout the study.

Consent for publication

Not applicable

Competing interests

The authors declare no competing interests.

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Ethical Approval and Consent to Participate

Ethical approval was obtained from Macau Polytechnic University's Faculty of Health Sciences and Sports Ethics Review Board. Participants were informed of the study's aims, procedures, confidentiality, and right to withdraw without penalty, and provided written consent. All data were anonymized and kept strictly confidential for research purposes only.

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