

Structural Relationships among Service Quality, Systemic Characteristics, Customer Trust, Perceived Risk, Customer Satisfaction and Intention of Continuous Use in Mobile Payment Service

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Abstract. Mobile payment is to enter your credit card information only once on your mobile device, and then make a convenient payment using either your ID and password or mobile phone number and SNS. It is a convenient service that makes payment simply by check-in of identifiable personal information. Therefore, this study aims to verify the structural relationship between service quality, system characteristics, customer trust, customer satisfaction, and continuous use intention of mobile payment service for Chinese people with experience in using mobile payment service. In detail, it intends to examine how convenience, promptness, and efficiency as mobile payment service quality affect customer satisfaction and intention of continuous use. In addition, it intends to investigate how characteristics of mobile payment service such as security, responsiveness, and compatibility affect customer satisfaction and continuous use intentions. And, in this process, we want to empirically test whether customer trust and perceived risk can play a role as a mediator variable. Summarizing the results of the empirical analyses, it is confirmed that the service quality and systemic characteristics of the mobile payment service have a significant effect on the customer's trust. Also, it is structurally confirmed that customer trust and perceived risk have a significant effect on customer satisfaction. Furthermore, customer satisfaction also has a significant effect on customer's intention of continuous use. However, it is confirmed that the systemic characteristics of the mobile payment service do not affect the perceived risk.

Keywords: Mobile payments service, service quality, system characteristics, customer trust, perceived risk, customer satisfaction, continuous use intention.

1. Introduction

As the internet technology develops, the e-commerce sector has also been growing rapidly. In China, the development of internet technology in the early 2000s not only led to the revolution of information technology but also affected various fields. Especially, e-commerce continues to grow rapidly by integrating with Internet and mobile technology. Early e-commerce was mainly used as a credit card, a non-cash payment method, in the online environment, which was difficult to be seen as an optimal payment method because users were limited in terms of cost. In addition, in China, it was difficult to generally commercialize credit cards due to security and technical problems. To solve this problem, Alibaba first launched a mobile electronic payment service called Ali-pay in 2003. As soon as mobile payment service was launched in China, it started to attract consumers and it is growing rapidly until now. The launch of mobile payment service has been a breakthrough in the transformation of existing payment methods, which was common in online payment.

In addition, smartphone technology as well as the internet is rapidly developing. As the online shopping market expands, e-commerce is rapidly spreading worldwide, not limited to the domestic market. In particular, mobile payment services are rapidly eroding existing markets because they have various and excellent services. Mobile payment service has emerged as a third-party mobile payment service considering the trust between consumers and suppliers. Therefore, as we mainly pay in invisible virtual space, interest in trust and security between each other was considered more important.

In this context, this study was conducted to verify the structural relationship among service quality, system characteristics, consumer trust, customer satisfaction and intention of continuous use mobile payment service for Chinese people who have experience using mobile payment service. In detail, this study tried to investigate how the service quality of mobile payment (convenience, speed, economical efficiency) and systemic characteristics (security, responsiveness, compatibility) affect customer satisfaction and intention of continuous use. In the process, it empirically verified whether customer trust and perceived risk play a role as parameters.

For this study, theoretical research and empirical research were conducted in parallel and the following research processes were conducted. First, the theoretical research was conducted to review the preceding studies related to mobile payment service. Specifically, the contents were composed of the previous studies that examined the structural relationship between the variables such as service quality, system characteristics, customer trust, perceived risk, customer satisfaction and intention of continuous use.

Second, based on the theoretical background and previous studies, the empirical study was composed of establishing the structural relationship of each variable set

as a research model and verifying the research hypothesis.

Third, the empirical study was conducted based on the collected data by conducting a survey on Chinese users who have experience using mobile payment services.

Fourth, based on the results of the survey, the empirical study conducted general analysis of the current status (frequency analysis), validity and reliability verification (exploratory factor analysis, reliability analysis), confirmatory factor analysis (concentration validity test), correlation analysis (discrimination validity test). Finally it verified the research hypothesis and derived implications.

2. Theoretical Background

2.1. Service Quality

The importance of service quality is put on emphasis as it determines the intention to reuse according to the degree of satisfaction when customers enjoy the service.

Parasuraman et al. (1985) argued that the service quality was a difference which appears when the service level that customers expect and the service results actually performed are compared (Park et al., 2015). Grönroos (1984) presented a service quality model that evaluates service quality by comparing the service expected by consumers with the service provided. In order to distinguish between service quality and objective quality, service quality is considered subjective, but consumers define subjective quality as perceived service quality.

Therefore, based on the previous studies on mobile payment service quality (Han et al., 2015), this study derives three factors such as convenience, economical efficiency, and speed. And then it verifies how the service quality of mobile payment affects customer satisfaction and his or her intention of continuous use.

2.2. Systemic Characteristic

Systemic characteristics can be defined by the quality and performance of the system that delivers data (DeLone and McLean, 2015) Systemic characteristics are being studied at various levels. Systemic characteristic refers to the degree to which the system can be used stably and efficiently by evaluating the quality of general information systems. It also means the degree of personal perception of system performance.

No matter how high quality information services users use, they will have unstable awareness of the website if it failed to deliver data smoothly, such as slow page conversation speed or frequent disconnection. In such cases, users will stop using the website and leave to find other useful websites to replace the thing they use (Mc Kinney and Yoon, 2002).

Therefore, this study views systemic characteristics as a way of using the system stably and efficiently in the process of mobile payment. Based on such viewpoint, this study derives three factors security, responsiveness and compatibility from

previous studies and verifies how these mobile service characteristics affect customer satisfaction and intention of continuous use.

2.3. Consumer Trust

Trust is a very complex concept that includes integrity, reliability, and belief in one group in another Morgan and Hunt, Mayer et al. (1995) defined trust as a sign that it can take damages according to the behavior of the other party, and Gefen (2000) defined trust as an expectation that the other party will not act in a wait-and-see policy to take his own interests in a certain situation.

Choi and Choi (2016) stated that the usefulness and trust perceived in the study on simple payment service have a significant effect on the loyalty of simple payment service, and the greater the belief in service provider, the more the continuous use of simple payment service as a payment method, and the more positive word-of-mouth will tend to the people around them.

This study defines customer trust as the level of trust felt by customers in the process of receiving mobile payment service based on precedent studies, derives factors such as corporate trust and trust in the service process presented in previous studies, and verifies whether these trust factors play a role as a mediating variable in customer satisfaction and intention of continuous use in the mobile payment service process.

2.4. Perceived Risk

Early studies of perceived risk were proposed by Bauer (1960), Cunningham (1967) and others. Consumers can produce unpredictable results in the process of purchasing and consumer behavior, resulting in uncertainty and risk. In particular, mobile payment is highly uncertain due to the limitation of checking the other transaction party online, and the perceived risk of the user will increase for this reason. Also, the perceived risk is a subjective variable, so the degree of risk felt by individuals may vary depending on the consumer's tendency to risk and product involvement. Recently, the interest in security is increasing under various information technology environments (Khalilzadeh and Bilgihan, 2017). Because of the vulnerability of sharing and openness of information, mobile payment can be dangerous in that payment information and personal information can be easily exposed in mobile payment.

Therefore, this study sees the perceived risk as a variety of anxiety perceived in the process of receiving the risk and service due to the system characteristics of mobile payment service. In addition, after this study derives three factors such as anxiety about personal information leakage and financial risk about physical risk such as privacy infringement, it finally verifies what structure these perceived risk factors play as a mediating role in customer satisfaction and intention of continuous use.

2.5. Customer Satisfaction

Oliver (1999) defined customer satisfaction as a judgment on whether the product or service satisfaction state is provided or was provided at a pleasant level from an emotional point of view under the cognitive judgment of the customer. This customer satisfaction has a great influence on the growth and profit of the business and plays an important role in management. Therefore, it provides benefits such as improved profitability, consumer maintenance, positive word of mouth, and marketing cost reduction in the service sector (Park and Lee, 2010).

In Korea, customer satisfaction management has emerged as a key topic of the company since the 1990s, and it has been considered as a necessity task to date. In addition to corporations, public institutions, universities, and hospitals, customer satisfaction management has been introduced and customer-oriented innovation has been carried out throughout society (Yi, 2016). In addition, Many researchers such as (Jin et al. 2017) conducted studies on the satisfaction of mobile simple payment service.

Therefore, this study defines customer satisfaction as the level of satisfaction perceived in the overall mobile payment service process, derives three factors from the definition presented in the previous studies: service satisfaction, system satisfaction and information satisfaction. And finally it verifies the influence relationship between the aforementioned preceding factors and the intention to use continuously.

2.6. Intention of Continuous Use

Oliver (1980), Battacherjee (2001) and others said that the intention to continue to use is the intensity of the intention or plan either to purchase or continue to use the product and service when receiving the product or service (Dorsch et al., 2000). They asserted that the expected benefits formed based on past experiences play an important role in the formation of intention to continuous use, which is a key concept for users and companies to maintain a continuous relationship.

This study defines intention of continuous use as the possibility to use mobile payment service both repeatedly and continuously. After deriving three factors of positive word-of-mouth intention, recommendation intention of others, and intention of continuous use suggested in many previous studies, this study examines the structural relationship between the mobile payment service components.

3. Research Model and Hypothesis

3.1. Research Model

The purpose of this study is to analyze the factors affecting the satisfaction of users using mobile payment service and to analyze how each element works within what kind of structural relationships. The survey was conducted for Chinese people who use mobile payment services and the questionnaire was composed of factors such as

service quality, system characteristics, customer trust, customer satisfaction, and continuous intention to use.

Based on the theoretical background mentioned before and the previous studies of PZB (Parasuraman et al., 1998), Lim and Jing (2018), Park et al. (2015), this study set the service quality and system characteristics of mobile payment services as independent variable, trust and perceived risk as parameters, and customer satisfaction and intention to use to use as independent variables. According to this set-up, it focuses on the structural relationship among the variables. The research model was set up as Fig. 1.

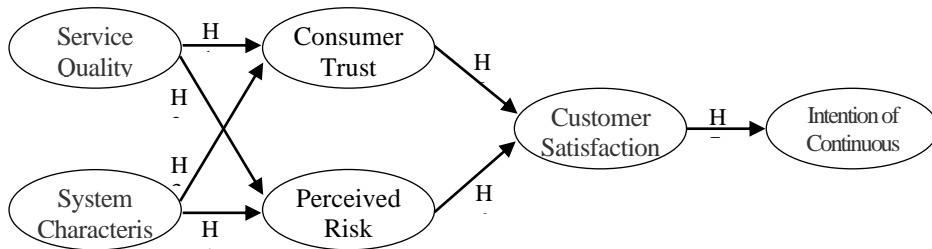


Fig. 1: Research model

3.2. Research Hypothesis

The research hypothesis was set up as follows to test the research model established based on the results of previous studies.

Hypothesis 1: The service quality of mobile simple payment service will have a positive effect on customer trust.

Hypothesis 2: The service quality of mobile simple payment service will have negative (-) effects on perceived risk.

Hypothesis 3: The system characteristics of mobile simple payment service will have a positive effect on customer trust.

Hypothesis 4: The system characteristics of mobile simple payment service will have negative (-) effects on perceived risk.

Hypothesis 5: Customer trust in mobile payment service will have a positive effect on customer satisfaction.

Hypothesis 6: Perceived risk of mobile simple payment service will have negative (-) effect on customer satisfaction.

Hypothesis 7: Customer satisfaction of mobile simple payment service will have a positive effect on intention of continuous use.

4. Empirical Analysis and Results

4.1. Survey Design

The subjects of this study were those who have used mobile payment service among

Chinese people living in Henan, Hubei, Anhui, Hebei, Jilin, and Heilongjiang provinces in China. A total of 372 questionnaires were collected from the survey using online, and a total of 350 questionnaires were used for empirical analysis, excluding 22 questionnaires containing many missing or insincere responses.

The questionnaire used in this study consisted of five Likert scales for service quality (11 items), systemic characteristics (11 items), customer trust (9 items), perceived risk (7 items), customer satisfaction and intention of continuous use (3 items each) presented in the research model. The question about demographic characteristics was composed of nominal scale.

SPSS 26.0 was used for statistical analysis of the data. Frequency analysis was conducted to identify the general characteristics of the subjects, and reliability analysis and exploratory factor analysis were conducted to verify the reliability and validity of the measurement tools used in the empirical study. In addition, structural equation modeling analysis was conducted to confirm the factor analysis and the hypothesis test using AMOS 26.0.

4.2. General Characteristics of Data

The demographic characteristics of the samples are shown in Table 1.

Table 1: Characteristics of samples

Sortation		Frequency	Ratio (%)
Gender	Male	163	46.6
	Female	187	53.4
Age	20s	106	30.3
	30s	164	46.9
	40s	73	20.9
	50s and older	7	2.0
Academic Background	Hige school graduation	96	27.4
	University student	55	15.7
	College graduation	119	34.0
	Graduate studies	80	22.9
Career	Student	55	15.7
	Office work	134	38.3
	Self-employment	70	20.0
	Professional occupation	56	16.0
	Public officer	35	10.0
Monthly Average Income	5,000Yuan less than		
	5,000-10,000Yuan less than	136	38.9
	10,000-20,000Yuan less than	122	34.9
	20,000Yuan and older	88	25.1
		4	1.1
Total Respondent		350	100.0

As a result of analyzing the general characteristics of data, 46.6% of males and 59.2% of females participated in the survey, and 30.3% of males were in their 20s, 46.9% were in their 30s, 20.9% were in their 40s, and 2.0% were in their 50s or

older. The most common educational background was college graduation: 27.4% of high school graduation, 15.7% of university graduation, 34.0% of university graduation, and 22.9% of graduate school graduation.

The professional background was 15.7% of students, 38.3% of office workers, 20.0% of self-employed workers, 16.0% of professionals, and 10.0% of civil servants. It was found that 34.9% of respondents earn 5,000 to 10,000 yuan, 25.1% earn 10,000 to 20,000, and 1.1 % earn 20,000 yuan or more, in which the highest ratio was 5,000 to 10,000 yuan.

4.3. Reliability and Validity of Measurement Variables

In this study, reliability analysis and factor analysis were conducted to verify reliability and validity of the concept of configuration such as service quality, system characteristics, trust, customer satisfaction, and intention of continuous use in mobile payment service. In addition, to verify the validity of composition of the measurement items, the factor analysis was conducted according to the main component extraction and the Varimax Rotation method, and the factor analysis of the eigen value of 1.0 or more was used for analysis.

Table 2: Result of reliability and validity analysis

Theoretical Variable	Factor	Item	Factor Loading	Cronbach α	Eigen Value	Variance (%)	KMO Measurement
simple payment service quality	convenience	both on and off-line possible	.725	.748	2.564	18.023	KMO=.876 $\chi^2=1267.7$, d.f=104, p=.000
		simpler than the existing payment means	.718				
		convenient service offer	.654				
		no hassle	.654				
	speed	real-time service availability	.749	.765	2.387	15.945	
		rapid update	.660				
		Simpler than other payments	.665				
		quick payment	.619				
	economical	useful over existing transactions	.711	.701	2.254	16.207	
		immediate knowledge of the results of use	.656				
		trade commission savings	.651				

simple payment system characteristic	compatibility	available through PC etc.	.742	.704	2.421	16.206	KMO=.835 $\chi^2=817.32$, d.f=65, p=.000		
		many types of devices	.732						
		compatible with bank accounts	.691						
		compatible with other services	.635						
	reactivity	fast processing speed	.726	.694	2.273	16.721			
		fast connection and loading speed	.694						
		a quick cancellation of the deal	.666						
		immediate provision of service	.665						
	security	don't care about the damage	.749	.741	1.913	14.654			
		guarantee of privacy and anonymity	.691						
		privacy protection	.687						
	consumer trust	trust in service	payment becomes more convenient	.746	.669	2.574		27.321	KMO=.867 $\chi^2=667.13$, d.f=35, p=.000
			fully operate the payment service	.735					
payment becomes safer			.729						
technical problem not generated			.722						
achieves efficiency increase and value improvement			.648						
corporate trust		trust in purchased product	.780	.637	1.679	18.564			
		Management	.697						

		without problems with customer information					
		overall trust in mobile payment services	.620				
		trust in company offering mobile payment service	.554				
perceived risk	personal information leakage risk	concern about personal information leakage	.818	.748	2.306	28.824	KMO=.786 $\chi^2=930.38$, d.f=28, p=.000
		concern about transaction information leakage and hacking	.762				
		potentiality of unpredictable risk	.714				
	technical risk	functional error frequent occurrence of error	.930	.880	1.805	22.560	
		service not provided	.925				
	monetary risk	a financial loss	.886	.731	1.581	19.768	
		unjust charge	.855				
	customer satisfaction / intention of continuous use	use intention	positive word of mouth intention	.882	.720	2.265	
intention of continuous use			.866				
recommendation intention			.806				
customer satisfaction		overall satisfaction	.882	.681	1.824	21.347	
		satisfaction of transaction method	.810				
		satisfaction of information provided	.796				

First, the factor analysis of mobile simple payment service quality showed that three factors (convenience, speed, and economical efficiency) were derived, and the explanatory power of the whole factor was 50.175%. In addition, the reliability analysis showed that the Cronbach' α value, which represents internal consistency, was convenience factor $\alpha = .748$, speed factor $\alpha = .765$, and economic factor $\alpha = .701$.

Second, as a result of factor analysis on the systemic characteristics of mobile payment service, three factors (compatibility, responsiveness, security) were derived, and the explanatory power of the whole factor was 47.581%. Also, the reliability analysis showed that Cronbach' α value was compatible factor $\alpha = .704$, responsive factor $\alpha = .694$, and security factor $\alpha = .741$.

Third, as a result of factor analysis of trust in mobile payment service, two factors (service trust, corporate trust) were derived, and the total factor explanatory power was 45.885%. In addition, the reliability analysis showed that Cronbach' α value was $\alpha = .669$ for service trust factor and $\alpha = .637$ for corporate trust factor, which means that the reliability of mobile payment customer was secured.

Fourth, the factor analysis of perceived risk of mobile payment service revealed three factors (personal information leakage risk, technical risk, and financial risk) and the total factor explanatory power was 71.152%. Also, the reliability analysis showed that Cronbach' α value was $\alpha = .748$, technical risk factor $\alpha = .880$, and financial factor $\alpha = .731$, which means that the reliability of mobile payment service perceived risk was secured.

Fifth, as a result of factor analysis on customer satisfaction and continuous intention to use mobile payment service, two factors (intention of continuous use and customer satisfaction) were derived, and the total factor explanatory power was 54.071%. In addition, the reliability analysis results show that Cronbach' α value is customer satisfaction factor $\alpha = .681$, and intention-of-continuous-use factor $\alpha = .720$, which shows that overall, customer satisfaction and intention of continuous use for mobile payment service have been secured.

4.4. Confirmatory Factor Analysis

In this study, confirmatory factor analysis was conducted to test the single dimension of each measurement item using multi-items, and the final result is the same as Table 3.

As shown in the analysis results, the final confirmatory factor analysis results showed that the analysis satisfied the general estimated standard value of recommendation with the fitness index value =113.788($p=.000$), RMR=.018, GFI=.952, AGFI=.911 NFI=.960, CFI=.980, and RMSEA=.057. The value of composite reliability (CR) was measured as more than 0.7 (estimated value) and average variance extracted (AVE) value was more than 0.5 (estimated value), which proves that the convergent validity, or concentration validity is secured.

Table 3: Results of confirmatory factor analysis

Concept Variable	Measured Item	Standard Loadings	Standard Error	t value	C.R.	A.V.E.
service quality	convenience	.831	.*	.*	.780	.542
	speed	.737	.081	10.688		
	economical	.833	.080	11.999		
system characteristic	compatibility	.563	.070	8.062	.755	.514
	reactivity	.870	.*	.*		
	security	.765	.076	11.536		
consumer trust	corporate trust	.876	.*	.*	.780	.641
	trust in service	.747	.086	9.800		
perceived risk	personal information leakage risk	.808	.*	.*	.738	.503
	technical risk	.557	.154	3.223		
	monetary risk	.556	.156	3.261		
customer satisfaction	overall satisfaction	.707	.099	9.045	.754	.515
	satisfaction of information provided	.771	.*	.*		
	satisfaction of transaction method	.743	.103	9.414		
intention of continuous use	intention of continuous use	.815	.088	10.220	.755	.508
	overall satisfaction	.838	.*	.*		
	recommendation intention	.703	.097	9.318		
* Item with initial loadings of 1 $\chi^2=113.788$ (d.f.=57, p=.000), $\chi^2/d.f.=1.996$, RMR=.018, GFI=.952, AGFI=.911, NFI=.960, CFI=.980, RMSEA=.057						

4.5. Correlation Analysis

Correlation analysis was conducted between each factor to verify the discriminant validity between each factor whose concentration validity was proved by the confirmatory factor analysis result. As a result, as shown in the table, the correlation coefficient value is not found to be large compared to the square root value of the diagonal variance extraction index (AVE) value, so it can be seen that the discrimination validity is secured.

Table 4: Result of correlation analysis

Sortation	Service Quality	System Characteristic	Consumer Trust	Perceived Risk	Customer Satisfaction	Intention of Continuous Use
Service Quality	.542					
System Characteristic	.623***	.514				
Consumer Trust	.680***	.655***	.641			
Perceived Risk	-.305***	-.283***	-.286***	.503		
Customer Satisfaction	.695***	.634***	.695***	-.302***	.515	
Intention of Continuous Use	.523***	.590***	.500***	-.384**	.517***	.508

The value of the diagonal line is the average variance index (AVE) value
 ** p<.05, *** p<.01

4.6. Results of Research Hypothesis Verification

This study investigates the structural relationship among service quality, system characteristics, customer trust, perceived risk, customer satisfaction, and intention of continuous use of mobile payment service. The results of verifying each hypothesis are as follows in Table 5.

Table 5: Result of hypothesis test

Hypothesis	Path		Parametric Estimation	Coefficient of Standardization	S. E.	t	p	Adoption Status	
H1	service quality	→	perceived risk	-.332	-.321	.086	-3.843	.000***	adoption
H2	service quality	→	consumer trust	.608	.840	.066	9.228	.000***	adoption
H3	system characteristic	→	consumer trust	.156	.198	.050	3.108	.002***	adoption
H4	system characteristic	→	perceived risk	-.017	-.015	.065	-.253	.800	reject
H5	perceived risk	→	customer satisfaction	-.166	-.163	.067	-2.160	.024**	adoption
H6	consumer trust	→	customer satisfaction	1.261	.847	.144	8.730	.000***	adoption
H7	customer satisfaction	→	ontinuous use	.645	.654	.084	7.705	.000***	adoption

** p<.05, *** p<.01

As a result of the research hypothesis, the t value of hypothesis 1 was -3.843, $p=.000(p<.01)$, which was statistically significant, so hypothesis 1 was adopted. The t value of hypothesis 2 was 9.228, $p=.000(p<.01)$, which was statistically significant and hypothesis 2 was adopted.

The t value of hypothesis 3 was 3.108, $p=.002(p<.01)$, which was statistically significant, so hypothesis 3 was adopted. However, the t value of hypothesis 4 was -.253, $p=.800(p>.05)$, which was out of the significance level and hypothesis 4 was rejected.

In addition, the t value of hypothesis 5 was -2.160, $p=.024(p<.05)$, which was statistically significant, so hypothesis 5 was adopted, and the t value of hypothesis 6 was statistically significant as 8.730, $p=.000(p<.01)$. Hypothesis 7 was also adopted because the t value of hypothesis 7 was statistically significant at 7.705 and $p=.000(p<.01)$.

5. Conclusion

The above results showed that the service quality and systemic characteristics of mobile simple payment service had a positive effect on customer trust, and the service quality of simple payment service had a negative effect on perceived risk. Furthermore, the service quality and systemic characteristics of simple payment service have a positive effect on customer trust and reduce the perceived risk, which has a significant effect both on customer satisfaction and on intention of continuous use. However, the systemic characteristics of simple payment service did not have a significant effect on the perceived risk, which showed a difference.

Therefore, in order to improve the satisfaction and intention of continuous use to mobile payment service users, it is foremost necessary to make payment service convenient, economical and quick. Furthermore, there is a need to improve the quality of mobile payment service and to strengthen compatibility, responsiveness and security while considering the system characteristics.

In addition, this study confirmed that trust factors related to mobile payment service play a mediating role in customer satisfaction and intention of continuous use. Therefore, efforts should be made from the perspective of the whole company to improve customer trust, and another effort should be in line with reducing personal information leakage or other physical and financial risks that may occur during the service delivery process.

This study made a positive contribution to deriving academic and practical implications by examining the structural relationships among relevant factors which affect customer satisfaction and intention of continuous use related to the mobile payment service in China. However, given the limitations relevant to the regions and the age group, more study should be carried out by diversifying the survey area and the survey subjects in the future.

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