

Service Failure and Consumers' Satisfaction with the Healthcare Industry: Moderating Role of Recommendation

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Abstract

This study explores the effects of service failure on different service attributes related to patients' satisfaction (i.e., therapeutic effect and service attitude). We consider patients' recommendation-seeking behavior, and examine the moderating effects of recommendation before medical consultation and its differences between the online and offline word-of-mouth (WOM) recommendations. We collected over 3,000,000 reviews from a leading Chinese online health community to facilitate the empirical analysis. We use two ordinal logit models as bases and, find that service failure exerts a negative effect on patients' both therapeutic effect satisfaction and service attitude satisfaction. Moreover, the effect of service failure will be attenuated if patients seek recommendations on doctors before consulting them. Moreover, the moderating effects of online WOM recommendations is demonstrated to be lower than those of the offline ones. Our findings provide important perspectives for the literature and managerial suggestions for stakeholders.

1. Introduction

The rapid growth of healthcare science and technology has been unable to eliminate service failure, which generally coexists with patients' negative feelings, subsequent costs, and sufferings [1]. Thus, practitioners and researchers have highlighted the consequences of patients' dissatisfaction because of service failure in the form of tense doctor-patient relationship and conflicts [2]. To the best of our knowledge, only a few studies have focused on the widespread belief (particularly on the identification of service attributes) that the patients will be dissatisfied when a service failure occurs.

The long-existed information asymmetry between medical service providers and receivers has resulted in the latter's tendency to seek recommendations from family and friends or online word-of-mouth (WOM) on

doctors to ensure the quality of physicians and avoid deceptions [3, 4]. Given that interactions with friends and the crowd will influence patients' decisions because of social influence [5, 6], we suspect that seeking recommendations before medical consultation may affect patients' feelings and perceived service satisfaction, particularly when facing service failure. The exploration of the underlying mechanism of this topic will enable the academic field to understand ex ante the determinants' influence on the ex post perceived value. Moreover, practitioners will be able to seek means to improve the doctor-patient relationship. Thus, the current research topic is significant but a research void remains as well.

We specify two important research gaps of the extant studies. First, research on service failure has mainly focused on the product market and limited attention has been provided to expert service. Many studies and theories have claimed the importance of service quality on influencing consumers' satisfaction and continuance purchasing behavior [7-9] and underscored the consequences of service failure in terms of losing consumers and negative WOM [10]. In common product markets, consumers can seek for redress from companies after experiencing service failure [11]. However, recovery can hardly be introduced into healthcare service, for which is a type of credence goods [12]. Moreover, healthcare service failure is related to patients' health quality and safety, in which the consequences may be more severe than common products [1]. Meanwhile, limited attention has been provided to exploring the influence of service failure in the healthcare industry.

Second, previous studies have failed to address the role of recommendation on influencing patients' perceived value when encountering service failures. Although many studies have demonstrated the significant effect of online and offline WOM recommendations on influencing consumers' decisions [5, 13], the influence of recommendations on consumers' perceived value has received scarce attention while encountering service failure. Moreover, prior research has suggested the differences between consumers' online and offline behaviors [14]. Hence, consumers' decision toward online and

offline recommendation sources may differ but remain a research void. Several studies have also underscored the need to examine differences in terms of affecting consumers' decision [5, 15]. To fill in this research gap, this study will examine the influence of recommendation on consumers' satisfaction when meeting service failure and the differences between recommendation sources, as well as explore the underlying mechanisms.

We crawled public data from *Good Doctor* (haodf.com) using a Python program and built a unique dataset. This study uses patients' ratings of their treatment experience to measure their service satisfaction. In particular, we focus on two service attributes, namely, therapeutic effect and service attitude, because they are the most important and salient indicators for patients when judging their perceived value and satisfaction [1]. We also use text recognition to construct a series of key independent variables to facilitate the empirical analysis. Our results are as follows: (1) service failure would exert negative effects on patients' therapeutic effect satisfaction (TES) and service attitude satisfaction (SAS), (2) recommendations before medical consultation would improve patients' TES and SAS when facing service failure, and (3) the effect magnitude of online WOM recommendation is less than that of the offline WOM on improving patients' perceived service value after experiencing service failure.

This study contributes to the research stream in several ways. First, we extend the research on consumers' perceived service value by considering the pressure of service failure and social interactions. Second, we explore patients' satisfaction from the two service attributes (i.e., therapeutic effect and service attitude). Third, we contribute to the research on recommendation to understand the differences between with-recommendations and without-recommendations and offline WOM recommendation and online WOM recommendation on consumers' perceived value when service failure occurs.

The remainder of this paper is organized as follows. First, we review the extant studies and develop the hypotheses. Second, we introduce our research context. Third, we construct the variables and empirical models. Fourth, we present and discuss the results. Lastly, we argue the implications and limitations of this study.

2. Literature Review

2.1. Service Failure

Service failure indicates that customers' perceived service performance falls below their expectations or "zone of tolerance" [16], such as abnormally slow service and service unavailability [17]. Prior research has mainly considered service failure from three dimensions, namely, timing, frequency and severity [18]. The extant

studies have indicated that service failure generally results in organizations' substantial costs, particularly in terms of loss of consumers and negative online WOM [10]. After experiencing service failure, the consumers' dissatisfaction with a service will negatively affect their attitude toward the service providers [19], although such an effect could also be affected by the consumer–organization relationship [18]. A well-built consumer–organization relationship would shield the service provider from the negative effects of service failure [11].

Service failure also coexists with consumers' complaints and triggers their service recovery expectation, which increases with the severity of failure [11], while repeated service failures will weaken such expectations [11]. To resolve consumers' complaints and decrease tangible and intangible losses, service providers would endeavor to recover (to prevent losing customers) in the form of offering explanations and switching products [20]. Hess et al. compared customers' attributions after experiencing service failure and recovery and found a significant change [11]. However, services in an expert service market cannot be returned even though consumers encounter dissatisfying experiences [3]. Thus, service failure in an expert service field may cause considerably severe outcomes because consumers need to vent their negative feelings [21], such as the conflicts between the service providers and receivers [2]. The current study uses the healthcare industry as a research example to understand the consequences of expert service failure and the mechanisms of such effects.

2.2. Recommendation

Recommendations from consumers are positive WOM per se and generally treated as valuable references on experiencing a product or service attributes [5]. "Tie strength" between recommenders and decision makers is used as basis to categorize recommendation source into strong-tie (i.e., close relationship) and weak-tie (i.e., distant or no relationship) sources [4]. Strong-tie recommendation sources can offer necessary information for decision makers and analysis from the decision makers' perspective and customized suggestions. Weak-tie recommendation sources can help decision makers to obtain additional information without the limitation of their social circles. Dhan et al. used the face-to-face healthcare service scenario and suggested that consumers' choice on recommendation sources depends on the task difficulty and their prior knowledge [4].

The extensive use of the Internet has provided a source to navigate online WOM [21] and several studies have underscored the differences between the traditional and online WOM recommendations [5, 15]. In this case, recommendation sources can also be further categorized as offline and online WOM recommendations by the

recommendation channel. Online and offline WOM recommendations have been demonstrated to be related to each other, thereby affecting other consumers' subsequent decisions and sales [5, 13].

3. Hypotheses Development

Many studies have illustrated the determinant roles of service quality [22] and service climate [23–25] on patients' satisfaction. The current study treats TES as a patient satisfaction because the tangibility and outcome of service quality can be reflected as a therapeutic effect. Moreover, the service climate mostly depends on doctors, such as the interaction frequency [25], whether they respect the patients and their preferences [23, 24] and whether they take the patients' illness seriously [26]. From the patients' perspectives, these factors could be concluded as the doctors' service attitude, thereby leading to another of our choice on patients' satisfaction dimension (i.e., SAS). Thereafter, we will develop the hypothesis on the effect of service failure on patients' TES and SAS.

3.1. Effect of Service Failure on TES

Healthcare service is a type of credence goods [12] provided by medical institutions and requires a series of interactions between patients and doctors, such as interrogation, medical testing (e.g., laboratory/radiology tests), diagnosis, and treatment [12]. This service industry is distinct from others because patients' diseases are complex and diverse from their conditions, thereby making healthcare service highly customized [1].

The outcomes of service generally influence customers' attributions and expectations toward specific organizations among traditional service industries [11]. The performance of healthcare service, which is reflected as the therapeutic effect, further influences patients' health status, life quality and even life span. Service failure in the healthcare industry indicates that patients' health status is not improved or worsens after undergoing treatment. The outcomes originating from service failures in the context of healthcare are considerably severe and need the patients' subsequent investment to recover. Apart from the additional financial and time factors, healthcare service failure means patients' long-term suffering from diseases (e.g., physical pain, discomfort from the medical testing and treatment) and even death, particularly for the vulnerable population [22]. Such outcomes can trigger patients' dissatisfaction with service performance (i.e., therapeutic effect). Therefore, we propose the following hypothesis:

H1: *Service failure is negatively related to patients' TES.*

3.2. Effect of Service Failure on SAS

Doctors deliver healthcare service to patients. The tangibility of such an intangible expert service can be reflected and measured through the content, duration, and interaction form [27]. In an outpatient service, these factors are controlled by the service providers (i.e., doctors) and the determinants of patients' satisfaction toward the service process [1]. That is, patients' health and recovery depend on doctors' inputs in the form of service attitude toward the former's illness. Hess et al. used equity theory to explain the balance between service providers' input and receivers' outcomes, in which service failure would damage such a balance by attenuating the outcomes or receivers' perception of the providers' inputs [11]. Therefore, service failures can induce patients to question doctors' service attitude and lower the perception of the latter's investment. This scenario leads to patients' dissatisfaction with doctors' service attitude.

From another perspective of service failure, patients would recall the service process to understand the reason for the negative outcomes. The extant studies have clarified the influence of the priming effect on consumers' rating behavior [28]. That is, consumers tend to focus on the most salient attributions when evaluating the service. The extant research has also used the priming effect as basis to emphasize negativity bias in illustrating consumers' rating behavior: they may weigh more on the dissatisfied details than the good ones [21, 29]. Therefore, patients who encounter service failure have a high likelihood of negatively recalling the service process and the doctors' service attitude, thereby prompting the former to post a relatively low rating.

H2: *Service failure is negatively related to patients' SAS.*

3.3. Moderating Effect of Recommendation

Although patients lack professional knowledge and systematic medical training [30], several studies have underscored the information asymmetry between healthcare service providers and receivers [3, 12]. Service providers may capitalize on this information asymmetry and conduct fraud to earn extra profit. To avoid falling victim to fraudulent behaviors, patients seek information and recommendation about doctors who are expert in specific diseases.

Decision makers can seek recommendations from offline social networks. Recommenders themselves or people in their social circles may have suffered from similar illnesses and improved greatly. Through online WOM, patients can navigate others' feedback about the therapeutic effect after treatment. Thus, recommendations likely help patients find doctors who are expert in their specific diseases, and patients may likely believe that the recommended doctor can cure his/her disease.

However, people's health conditions cannot be perfectly identical, so a doctor's treatment may not be suitable for everyone. If the recommended doctor has many cured or improved cases, the patient may blame a service failure (i.e., the health status is not improved or worsening) on personal physical status instead of the doctor's capability and service attitude, thus resulting in less dissatisfaction toward the therapeutic effect.

On the contrary, some patients may choose doctors randomly without seeking. Therefore, they have little knowledge about not only the doctors' service attitude but also whether the doctors' treatment suggestions have contributed to a successfully cured case. Without references and communications with other patients, a service failure can likely lead to patients distrusting the doctors' capability and service attitude, which may cause their high dissatisfaction toward the perceived therapeutic effect and the doctors' service attitude.

In sum, recommendations can help patients form prior knowledge about doctors. With good word-of-mouth from recommenders, patients may treat service failure objectively instead of doubting the doctors' service attitude directly.

H3a: *A service failure will lead to patients' less dissatisfaction toward therapeutic effect if they seek recommendations about doctors.*

H3b: *A service failure will lead to patients' less dissatisfaction toward service attitude if they seek recommendations about doctors.*

3.4. Differences of the Moderating Effect between Recommendation Sources

Prior research has illustrated the differences between the traditional WOM and e-WOM recommendation sources in influencing consumers' decision making [5]. We argue that recommendation sources may also moderate the effect of service failure on patients' satisfaction.

Online WOM, as a weak-tie source, provides more numeric and various cases and references for decision makers than strong-tie sources [4]. In the context of healthcare, patients can analyze doctors' capability and service attitude with the descriptions and consultation experiences from prior reviewers who have consulted about the doctors through online WOM. By contrast, offline WOM recommendation generally provides scarce options and references for patients to make comparison and decisions.

Given that each patient's physical status is qualitatively different, the real and perceived therapeutic effect may also vary. Specifically, online WOM recommendations' numerable successfully cured cases can be more persuasive than offline WOM recommendations' few cases. As a result, online WOM recommendations offer accurate information about doctors and lead to patients'

higher expectations than offline WOM recommendations. According to expectation–confirmation theory [7, 8], the perceived performance and disconfirmation are significant determinants of consumers' satisfaction, and the negative disconfirmation exerts higher influence than positive confirmation. When perceived performance is negative and other conditions are equal, a consumer will be more dissatisfied if he/she has higher expectations on a product or service owing to higher negative disconfirmation. Therefore, with online WOM recommendations, service failure will lead to patients' higher dissatisfaction because of higher expectations.

H4a: *A service failure will lead to patients' higher dissatisfaction toward therapeutic effect when they seek online WOM recommendations about the doctors than when they seek offline ones.*

H4b: *A service failure will lead to patients' higher dissatisfaction toward service attitude when they seek online WOM recommendations about the doctors than when they seek offline ones.*

4. Methodology

4.1. Data

Using a web spider, we crawled public data from the Good Doctor (haodf.com) to examine our hypotheses. The Good Doctor allows patients to search health-related information in terms of reading professionally authored articles or initiating online communication toward doctors who have opened expert websites and offered online services. We chose this website as our research sample for two main reasons. First, it is one of the largest and leading Chinese online health communities. Up to December 2017, the Good Doctor included more than 500,000 physicians from 8289 regular hospitals. Second, the Good Doctor is distinct from other OHCs in terms of its unique review function design, which nicely fit our research context. Patients can post ratings and comments for doctors to evaluate their perceived TES and SAS. Moreover, patients can choose to present other relevant information about their treatment experience, such as disease, purpose of consultation (e.g., diagnosis/treatment), reason for consulting the focal doctor (e.g., online WOM/others' recommendation), treatment approach (e.g., medication), and current health status (e.g., better/worse). These patient-reported contents greatly fit our research purpose and provide us a perfect research context. Thus, the platform is an appropriate data source to conduct this research.

We collected data in December 2017 and built the dataset, which contains 3,390,543 reviews for 493,548 physicians. To ensure the reliability of the following empirical analysis, we excluded samples on the basis of

several conditions to fit the research questions. The exclusion process is shown in Table 1. First, we deleted the reviews without full ratings, include both TES and SAS. Then, we excluded doctor samples with less than 10 reviews and disease samples that have been reported less than 10 times in all observations. Finally, we deleted the reviews without key information relating to this study by text analysis. Specially, we identified and preserved three types of reasons for choosing the focal doctor (“random choice,” “online WOM,” and “friends’/other doctors’ recommendation”) and four types of reported health status after treatment (“recovery,” “better,” “no improvement,” and “worse”). Such a process left us 592,515 reviews for further analysis.

Table1. Sample Selection

Process	No. of Reviews
Initial Sample	3,390,543
Less: Reviews without full ratings	(436,667)
Less: Doctors who have less than ten reviews and reviews with diseases reported less than ten times in the sample	(1,120,090)
Less: Reviews with the reported reason of choosing doctors that do not belong to “Random Choice”, “Online WOM” or “Friends/Other Doctors’ Recommendation” (the combinations of these items are also deleted) and reported health status that does not belong to “Recovery”, “Better”, “No Improvement” or “Worse”	(1,241,271)
Sample with data available	<u>592,515</u>

4.2. Variables

By extracting relevant information from our dataset, we constructed a series of variables. The focal dependent variables are the patients’ reported service satisfaction, i.e., TES and SAS. Patients post ratings for the two satisfaction dimensions using a 5-point ordinal categories: “strongly dissatisfied,” “dissatisfied,” “ordinary,” “satisfied,” and “strongly satisfied,” and we diverted them into 1 to 5, respectively.

This study focuses on the consequences of service failure and the moderating effect of recommendations about the focal doctors. Thus, we coded *Failure* as a dummy variable, which equals 1 when patients’ self-reported health status is “No Improvement” or “Worse,” and 0 when that is “Better” or “Recovery.” By filtering the three categories of patients’ reported reasons of choosing the focal doctors, we coded two dummies, in particular, *Recommendation* and *Online Recommendation*. *Recommendation* equals 1 if a patient seeks recommendation about the focal doctor before consultation; 0, if a patient chooses the focal doctor randomly. *Online* equals 1 if a patient seeks recommendation from online WOM; 0, from friends’ or other doctors’ recommendations.

To capture the effect of confounding factors, we also set several control variables. According to prior research, online ratings and review volume are the key factors capturing social influence [6, 31]. We calculated the prior average ratings for both satisfaction dimensions as key control variables, i.e., *PriorTES* and *PriorSAS*. In addition, the increase on the number of reviews leads to reviewers’ strategic behavior on grabbing attention in terms of posting ratings diverse from the crowd [32]. Studies have also indicated a negative rating trend as the volume increases [33]. Thus, we employed *PriorVol* as another control variable, which is the count of prior reviews. Table 2 presents the measures and summary statistics of the aforementioned variables.

Table 2. Variables description and summary statistics

Variables	Description	Mean	S.D.	Min	Max
<i>TES</i>	Patients’ reported TES for doctor i	4.885	0.492	1	5
<i>SAS</i>	Patients’ reported SAS for doctor i	4.940	0.358	1	5
<i>Failure</i>	Dummy for patients’ self-reported health status after treatment (No Improvement or Worse = 1, Better or Recovery = 0)	0.026	0.160	0	1
<i>Recommendation</i>	Dummy for whether patients seek recommendations about doctors before consultation (Seek knowledge = 1, Random Choice = 0)	0.952	0.213	0	1
<i>Online</i>	Dummy for patients’ recommendation source (Online = 1, Offline = 0)	0.410	0.492	0	1
Control Variables					
<i>PriorTES</i>	Average prior reported TES by other patients for doctor i	4.795	0.221	1	5
<i>PriorSAS</i>	Average prior reported SAS by other patients for doctor i	4.918	0.144	1	5
<i>PriorVol</i>	Number of prior reviews of other patients for doctor i	150.304	216.778	0	1984

4.3. Empirical Model

As the data of dependent variables are ordinal in nature, we leveraged an ordinal logistic model to perform the empirical analysis [34], which can keep the levels' order while ignoring possibly unequal differences between levels. To capture the nonlinear relationship between the focal variables, we used a latent dependent variable U_{ijt} to reflect a patient's evaluation on doctor i 's service reported in j -th review in period t and then built the models on patients' review level. The models are presented as follows:

$$\begin{aligned}
 U_{ijt} &= \beta_1 \text{Failure}_{ijt} + \beta_2 \text{Recommendation}_{ijt} \\
 &+ \beta_3 \text{Failure}_{ijt} \times \text{Recommendation}_{ijt} \\
 &+ \beta_4 \text{PriorRating}_{ijt} + \beta_5 \log(\text{PriorVol}_{ijt} + 1) \quad (1) \\
 &+ \theta'_1 \text{Disease}_{ij} + \theta'_2 \text{Doctor}_i + \theta'_3 \text{Month}_t + \varepsilon_{ijt} \\
 U_{ijt} &= \beta_1 \text{Failure}_{ijt} + \beta_2 \text{Online}_{ijt} + \beta_3 \text{Failure}_{ijt} \times \text{Online}_{ijt} \\
 &+ \beta_4 \text{PriorRating}_{ijt} + \beta_5 \log(\text{PriorVol}_{ijt} + 1) \quad (2) \\
 &+ \theta'_1 \text{Disease}_{ij} + \theta'_2 \text{Doctor}_i + \theta'_3 \text{Month}_t + \varepsilon_{ijt}
 \end{aligned}$$

We employed model (1) to examine the main effect of service failure on patients' evaluation and the moderating effect of recommendation. Then, we used model (2) to explore the differences of the main effect between different recommendation sources, and we estimated it with a subset of our dataset, where the "Random Choice" part is deleted. In both models, i and j indicate doctor and review, respectively, and t is the time stamp. β_1 , β_2 and β_3 capture the main effect of service failure on patients' TES and SAS and the moderating effect of recommendation and recommendation sources, respectively. PriorRating_{ijt} refers to PriorTES_{ijt} or PriorSAS_{ijt} , which accommodates the dependent variable, and β_4 captures its effect. To control the scale of prior review volume, we transformed PriorVol_{ijt} into log format and plus one to avoid zeros. In addition, θ_k are vectors capturing the fixed effects on disease, doctor, and time level. Moreover, we assumed ε_{ij} follows a logistic distribution, and the ordinal responses Rating_{ijt} (i.e. TES_{ijt} and SAS_{ijt}) are determined by the following rules:

$$\text{Rating}_{ijt} = \begin{cases} 1, & \text{if } U_{ijt} \leq \lambda_1; \\ 2, & \text{if } \lambda_1 < U_{ijt} \leq \lambda_2; \\ 3, & \text{if } \lambda_2 < U_{ijt} \leq \lambda_3; \\ 4, & \text{if } \lambda_3 < U_{ijt} \leq \lambda_4; \\ 5, & \text{if } \lambda_4 < U_{ijt}. \end{cases} \quad (3)$$

where λ_1 to λ_4 are the cutoff points indicating the intervals of each rating level. From these assumptions, the conditional distribution of rating is calculated as:

$$\Pr(\text{Rating}_{ijt} = k | x) = \begin{cases} \Pr(U_{ijt} \leq \lambda_1 | x), & k = 1; \\ \Pr(\lambda_{k-1} \leq U_{ijt} \leq \lambda_k | x), & k = 2, 3, 4; \\ 1 - \Pr(U_{ijt} \leq \lambda_4 | x), & k = 5. \end{cases}$$

$$= \begin{cases} \Pr(U_{ijt} \leq \lambda_1 | x), & k = 1; \\ \Pr(U_{ijt} \leq \lambda_k | x) - \Pr(U_{ijt} \leq \lambda_{k-1} | x), & k = 2, 3, 4; \\ 1 - \Pr(U_{ijt} \leq \lambda_4 | x), & k = 5. \end{cases} \quad (4)$$

where,

$$\Pr(U_{ijt} \leq \lambda_l | x) = \frac{\exp(\lambda_l - U_{ijt})}{1 + \exp(\lambda_l - U_{ijt})}, l = 1, 2, 3, 4 \quad (5)$$

We then performed the following empirical analysis based on the ordinal logit model.

5. Results

5.1. Hypotheses testing

As seen in Table 3, Models (1-1) and (1-2) are the baseline models indicating the main effect of service failure on patients' TES and SAS, and the rest of the columns are full models.

We first test H1 and H2. The estimates of β_1 in all models are negative and significant, suggesting that service failure exerts negative effect on patients' TES and SAS. Service attitude and therapeutic effect are different rating attributes; however, with service failure, patients are more likely to post lower ratings on therapeutic effect and service attitude of doctors. Consumers will post ratings more objectively with the support of multi-dimensional rating systems [29], which remain unable to eliminate the negativity bias [21]. Simply put, consumers will choose to focus more on the negative attributes and omit the positive ones of a product or service. Thus, H1 and H2 are supported.

From the estimates of the interaction terms, we observe significant moderating effect on the negative main effect of service failure. Given that the estimates of interactions between service failure and recommendation are positive and significant (Model 2-1, $\beta_3 = 0.5006$, $p < 0.001$; Model 2-2, $\beta_3 = 0.5221$, $p < 0.001$), the negative effect of service failure will be attenuated for patients who seek recommendation ($\text{Recommendation} = 1$) about the doctors before consultation. In other words, seeking recommendation may facilitate patients to post relatively higher ratings on their reported TES and SAS when a service failure appears. Thus, H3a and H3b are supported.

When considering the recommendation source, our results provide evidence for H4a and H4b (Model 3-1, $\beta_3 = -0.3317$, $p < 0.001$; Model 3-2, $\beta_3 = -0.4166$, $p < 0.001$). The negative and significant estimates of the interactions between service failure and online WOM indicate the difference between recommendation sources on the negative effect of service failure. That is, seeking knowledge about the doctors online before consultation ($\text{Online} = 1$) exacerbates the negative effect of service failure on patients' self-reported satisfaction. In line with our hypothesis, patients who seek knowledge about

doctors from online WOM are stricter, and they post lower ratings for doctors than those who obtain prior

recommendations offline (i.e., friends or other doctors) when facing to service failure.

Table 3. Effect of service failure on patients' satisfaction

Variables	(1-1)	(1-2)	(2-1)	(2-2)	(3-1)	(3-2)
	TES	SAS	TES	SAS	TES	SAS
<i>Failure</i>	-1.9223*** (0.011)	-1.5969*** (0.011)	-2.3783*** (0.038)	-2.0665*** (0.039)	-1.6625*** (0.018)	-1.2750*** (0.020)
<i>Recommendation</i>			0.2603*** (0.011)	0.2144*** (0.014)		
<i>Failure</i> × <i>Recommendation</i>			0.5006*** (0.039)	0.5221*** (0.040)		
<i>Online</i>					-0.0966*** (0.005)	-0.0453*** (0.007)
<i>Failure</i> × <i>Online</i>					-0.3317*** (0.023)	-0.4166*** (0.025)
<i>PriorTES</i>	0.7657*** (0.009)		0.7610*** (0.009)		0.7507*** (0.010)	
<i>PriorSAS</i>		0.8115*** (0.014)		0.7919*** (0.014)		0.7708*** (0.015)
<i>ln(PriorVol)</i>	0.0034 (0.002)	-0.0196*** (0.002)	-0.0018 (0.002)	-0.0244*** (0.002)	0.0077*** (0.002)	-0.0174*** (0.003)
Disease Fixed Effects	YES	YES	YES	YES	YES	YES
Doctor Fixed Effects	YES	YES	YES	YES	YES	YES
Time Fixed Effects	YES	YES	YES	YES	YES	YES
Observations	592514	592514	592514	592514	564154	564154
Pseudo R ²	0.1281	0.1128	0.1309	0.1159	0.1239	0.1043

Note: 1. Robust standard errors are reported in the parenthesis. 2. Significance level: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$. 3. The values of κ_i are omitted because of page limitation.

5.2. Robustness Check

To validate our findings, we conduct a robustness check by discussing potential mechanisms that may influence the reliability of the observed effect. The dependent variables are likely to be related to a certain level, so the error terms of the models are correlated. In that case, we re-estimate the models jointly by seemingly unrelated regression, which allows correlated error terms between different equations. The results provided in Table 4 are in line with our main findings.

6. Discussion

6.1. Key Findings

This study aims to unravel the effects of service failure on patients' satisfaction about different service attributes, i.e., therapeutic effect and service attitude.

Building on the unique dataset and empirical analysis, this research yields three critical findings. First, service failure exerts a negative effect on patients' TES and SAS. Second, seeking online or offline WOM recommendations before medical consultation attenuates the negative effect of service failure. Third, the effect magnitude of online WOM recommendation is higher than that of the offline one on moderating the effect of service failure. These findings underlie several theoretical and managerial implications.

6.2. Theoretical Implications

This study contributes to the literature from several perspectives. First, we contribute to the healthcare management studies by developing two specific attributes on measuring patients' satisfaction and examining the effect of service failure on them. Although Donabedian put forward the measures of service process and outcomes to judge service quality [35], the dimensions to

judge patients' service satisfaction have yet been addressed. Considering that many studies have emphasized the importance of patients' satisfaction [1, 12, 22], we contribute to the literature by identifying two salient dimensions, that is, therapeutic effect and service atti-

tude. Given the obvious effect of service failure on therapeutic effect, we also yield contribution by uncovering the negative effect of service failure on patients' SAS, which means patients will blame negative outcomes on doctors.

Table 4. SUR estimation results

Variables	(1-1)	(1-2)	(2-1)	(2-2)	(3-1)	(3-2)
	TES	SAS	TES	SAS	TES	SAS
<i>Failure</i>	-1.5360*** (0.003)	-0.8952*** (0.003)	-2.4203*** (0.012)	-1.7785*** (0.009)	-1.3756*** (0.005)	-0.7881*** (0.004)
<i>Recommendation</i>			0.0490*** (0.003)	0.0267*** (0.002)		
<i>Failure×Recommendation</i>			0.9670*** (0.012)	0.9649*** (0.009)		
<i>Online</i>					-0.0093*** (0.001)	-0.0017*** (0.001)
<i>Failure×Online</i>					-0.2824*** (0.007)	-0.1894*** (0.005)
<i>PriorTES</i>	0.2305*** (0.002)		0.2211*** (0.002)		0.2295*** (0.002)	
<i>PriorSAS</i>		0.2937*** (0.003)		0.2753*** (0.003)		0.2944*** (0.003)
<i>ln(PriorVol)</i>	0.0047*** (0.000)	0.0018*** (0.000)	0.0031*** (0.002)	0.0007* (0.000)	0.0059*** (0.000)	0.0023*** (0.000)
<i>Constant</i>	3.8158*** (0.012)	3.5285*** (0.013)	3.8179*** (0.012)	3.5966*** (0.013)	3.8186*** (0.012)	3.5237*** (0.013)
Disease Fixed Effects	YES	YES	YES	YES	YES	YES
Doctor Fixed Effects	YES	YES	YES	YES	YES	YES
Time Fixed Effects	YES	YES	YES	YES	YES	YES
Observations	592514	592514	592514	592514	564154	564154
R ²	0.2750	0.1868	0.2841	0.2027	0.2773	0.1887

Note: Significance level: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Second, we contribute to the healthcare information literature by providing a novel perspective to understand patients' choice of recommendation means. Morey indicated that patients mainly seek information from offline means, and the online one is the second popular choice [36]. We argue that the online means provides patients with considerable choices about doctors and ratings from others, which may help patients make better decisions. A possible downside is that vast online information may raise patients' expectations on the service process and outcomes.

Third, this study contributes to the service failure research by revealing that ex-ante factors can influence the effect of service failure on consumers' ex-post satisfaction and perceived values. Research about service failure focuses mainly on the outcomes, influence, and

strategy of conducting ex-post recovery [11, 20]. This study provides a novel perspective that ex-ante factors (i.e., recommendations) can also exert an influence on the negative effect of service failure.

Finally, we contribute to the recommendation research to understand the differences between online and offline WOM recommendations. Several studies have implied such differences [5, 13]. Although Smith et al. documented the differences between recommendations from online groups [15], the differences between online and offline recommendation sources still warrant in-depth understanding. This study fills these research gaps by finding the differences in attenuating the negative effect of service failure.

6.3. Managerial Implications

This research underlies several important managerial implications. First, a service failure triggers patients' dissatisfaction not only on therapeutic effect but also on service attitude. Although doctors are busy with their daily work, we suggest them to keep a relatively good attitude as much as they can to foster a better service climate, which may alleviate the tense relationship between doctors and patients, especially when service failure appears. As one treatment may show varying outcomes on different patients, we suggest that patients should be objective when their health status has not improved and avoid venting their anger on the doctors.

Second, a service failure leads patients to show higher dissatisfaction when they seek knowledge from online WOM recommendations than when they do from offline ones. Because patients may build up excessive expectations from doctors with good reputation. We suggest that patients should be practical and not overly expect the therapeutic effect. When encountering a service failure, we suggest patients to communicate with doctors timely to seek a better solution.

Third, this study suggests that seeking recommendations about doctors before the consultation attenuates the negative effect of service failure on patients' satisfaction. Thus, Patients can search for related information about their diseases before consultation and find a proper doctor, which can benefit their consultation experience. We also suggest the practitioners build intelligent recommendation systems to match patients with proper doctors. Moreover, disclosure on doctors' consultation history and reviews from other patients may help improve patients' consultation satisfaction, especially when a service failure appears.

6.4. Limitations and Future Research Directions

This study has several limitations, which may imply fruitful research directions. First, we only focus on patients' reported TES and SAS for doctors' service despite the many other attributes for a product or service. Therefore, one future research direction is to consider other attributes related to consumer satisfaction. In addition, we code patients' self-reported health status as service failure, which is a dummy variable, and fail to measure service quality with an objective, continuous variable to extend our findings. Future research can further employ continuous measures to validate our findings. Second, owing to the anonymous mechanism to protect patients' privacy in OHCs, we are limited to identify patients' personal information and online activities, such as their age, gender, duration, and social network in the website. However, previous studies have

documented the potential effect of these factors on reviewers' ratings [13, 31]. Researchers can consider other factors to extend our findings and examine the reliability of this study using other OHCs.

7. Conclusion

This study fills the underlying research gap by exploring the effect of service failure on patients' satisfaction and considering the moderating effect of recommendation and recommendation sources. We contribute to the literature by unravelling that service failure not only influences patients' TES but also their SAS, that the recommendation can attenuate the negative effect of service failure, and that such an effect varies between online and offline WOM recommendation sources. With our findings as basis, related stakeholders can formulate appropriate strategies and policies to improve patients' satisfaction and doctor-patient relationship.

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9. References

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