

# Personal and Situational Determinants of Patients' Adoption of Robotic Surgery

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**Abstract**—The global market for surgical robots is expected to experience rapid growth in the next decade, primarily attributed to the increasing demand for healthcare services driven by population aging and improved living standards. Although robotic surgery offers many advantages compared to traditional methods, lack of public awareness of these benefits poses challenges to its widespread adoption, necessitating an understanding of factors that influence patients' choice of robotic surgery. Many studies in the literature examine the facilitators and barriers to adopting robotic surgery, focusing on surgical techniques and surgeons' perspectives. However, limited research explores patients' perceptions and reactions, mostly emphasizing personal characteristics. Drawing on the unified theory of acceptance and use of technology (UTAUT) model, this study investigates two situational determinants and three personal determinants of patients' robotic surgery adoption. Analyses of Japanese data reveal that patients' interest in cutting-edge tech, trust in AI, and surgery hospital access improve their attitude toward robotic surgery and, thereby, stimulate their robotic surgery adoption. The availability of a trusted surgeon influences robotic surgery adoption only when patients are interested in cutting-edge technology. In addition, the need for social connections directly impedes the choice of robotic surgery. These findings extend scholars' understanding of the UTAUT model to the robotic surgery context, and they guide both surgical robotics firms in market segmentation and hospitals in decisions on the adoption of robotic surgery equipment.

**Keywords**—*medical informatics, intelligent assistants, human-machine interaction*

## I. INTRODUCTION

The global market for surgical robots is projected to achieve an annual growth of 19.3% from 2022 to 2030 [1]. As the reason for such growth, the global trend of population aging, coupled with rising standards of living, has created a pressing need for healthcare services. Surgical robots have emerged as a promising solution to bridge the gap between the shortage of healthcare workers and the rising demand for medical care. By offering advantages such as enhanced precision, reduced pain and blood loss, and faster recovery, robotic surgery outperforms traditional surgical methods [1]. However, the general awareness regarding these benefits remains limited, impeding the widespread adoption of robotic surgery [2]. To accelerate its diffusion and effectively segment the surgical robots market, it is crucial to understand the factors that influence a patient's decision to choose robotic

surgery over conventional surgical procedures, and the underlying mechanisms.

## II. THEORETICAL BACKGROUND AND HYPOTHESES

Extant research in the literature focuses on the facilitators and barriers to robotic surgery adoption from the perspectives of surgical techniques and surgeons' perceptions [3, 4]. Although a surgical procedure requires patient consent, only limited research explores how patients perceive and react to robotic surgery, mostly focusing on their personal characteristics [5]. To better understand the mechanisms underlying patients' adoption of robotic surgery and guide marketers in effective market segmentation and targeting, this research investigates both situational and personal predictors of robotic surgery adoption.

Based on a version of the unified theory of acceptance and use of technology (UTAUT) model extended for the context of disruptive technology adoption [6], this research develops hypotheses about the effects of two situational determinants (availability of a trusted surgeon, surgery hospital access) and three personal determinants (need for social connections, interest in cutting-edge tech, trust in AI) on patients' attitude toward robotic surgery and their choice of robotic surgery over traditional surgery (see Fig. 1). Here, need for social connections represents the UTAUT social influence construct, interest in cutting-edge tech and trust in AI represent performance expectancy, availability of a trusted surgeon represents facilitating conditions, surgery hospital access represents effort expectancy, attitude toward robotic surgery represents comparative economic value (i.e., perceived benefits and importance of an innovative product/service), and choice of robotic surgery over traditional surgery represents the intent to switch to a disruptive technology product (i.e., a product/service based on an innovation that significantly changes the way users, industries, or firms operate).

## III. METHODOLOGY

To test our hypotheses (see Fig. 1), we designed a questionnaire measuring all constructs of our conceptual model, control variables, and personal information (e.g., gender, age). We conducted the survey in a fictitious setting where the participant had a serious heart disease and needed surgery. We selected Japan as our target population due to its status as the world's oldest society, with a significant proportion of over 65s reaching 29.1% in 2022 [7]. This

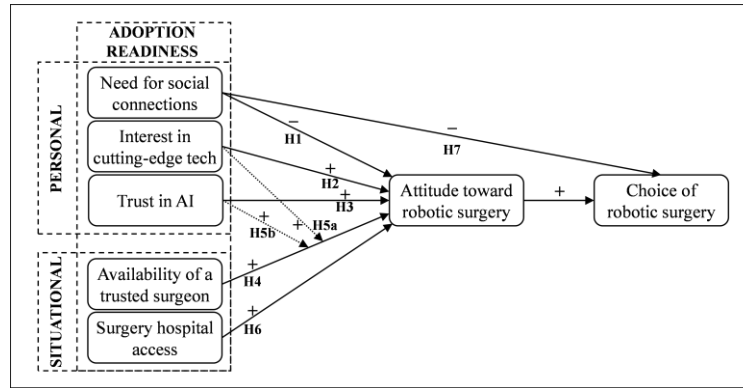


Fig. 1. Conceptual model and hypotheses.

demographic characteristic presents substantial potential demand for surgical surgery. We recruited 250 participants, who provided complete and valid responses. Our sample exhibits a balanced gender distribution and encompasses individuals aged from their 20s to 60s.

We used structural equation modeling for our data analysis. All the main constructs satisfy the standard criteria for both convergent and discriminant validity, and the confirmatory factor analysis (CFA) of all reflective multi-item scales confirms a high goodness-of-fit of our model.

#### IV. RESULTS

Based on linear and logistic regression analyses, our hypothesis tests support a majority of the hypotheses shown in Fig. 1. Regarding personal determinants, the need for social connections does not influence the attitude toward robotic surgery (H1 rejected), but it has a negative direct effect on the choice of robotic surgery (H7 supported). Interest in cutting-edge technology and trust in AI positively influence the attitude toward robotic surgery (H2, H3 supported). Regarding situational determinants, surgery hospital access has a positive influence on the attitude toward robotic surgery (H6 supported). While the availability of a trusted surgeon does not have an overall influence on the attitude toward robotic surgery (H4 rejected), it has a positive effect when the interest in cutting-edge technology is high (H5a supported). In addition, trust in AI does not alter the influence of the availability of a trusted surgeon on the attitude toward robotic surgery (H5b rejected).

#### V. DISCUSSION

The results indicate that patients with greater interest in cutting-edge technology, greater trust in AI, and convenient access to a nearby large hospital that offers surgery have a more positive attitude toward robotic surgery and are thus more likely to choose it. The presence of a trusted surgeon improves patients' attitudes toward robotic surgery only if they are interested in cutting-edge technology. In addition, patients with a strong need for social connections tend to avoid robotic surgery, possibly due to reduced human contact.

These findings deepen the understanding of the UTAUT model in the context of robotic surgery in two key aspects. First, the effect of social influence becomes negative as AI-based services replace human-based services, resulting in

reduced human interaction. Second, a positive interaction is observed between performance expectancy (interest in high tech) and human facilitating conditions (availability of a trusted surgeon). Specifically, human facilitating conditions, as operators of AI-based services, are effective only when users are highly engaged with high tech; otherwise, they prefer human-based services.

These findings provide valuable managerial insights for surgical robotics firms to enhance their market segmentation and targeting strategies. Managers can effectively target patients with a strong interest in high tech and a high level of trust in AI, as well as those residing near large hospitals. In addition, managers may benefit from fostering greater interest in advanced technology among surgeons' patients.

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