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Use of Game Theory to model patient engagement after surgery: a qualitative analysis

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Stephen A. Castellanos, BA,[a] Gerardo Buentello, MD,[a]
Diana Gutierrez-Meza, MPH,[b] Angela Forgues, MSPH MS,[b]
Lisa Haubert, MD,[a] Avo Artinyan, MD,[a] Cameron L. Macdonald, PhD,[b]
and James W. Suliburk, MD[a,*]

[a] Baylor College of Medicine, Michael E. Debakey Department of Surgery, Houston, Texas
[b] Qualitative Health Research Consultants, Madison, Wisconsin

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ABSTRACT

Background: Patient engagement is challenging to define and operationalize. Qualitative analysis allows us to explore patient perspectives on this topic and establish themes. A game theoretic signaling model also provides a framework through which to further explore engagement.

Methods: Over a 6-mo period, thirty-eight interviews were conducted within 6 wk of discharge in patients undergoing thyroid, parathyroid, or colorectal surgery. Interviews were transcribed, anonymized, and analyzed using the NVivo 11 platform. A signaling model was then developed depicting the doctor-patient interaction surrounding the patient's choice to reach out to their physician with postoperative concerns based upon the patient's perspective of the doctor's availability. This was defined as "engagement". We applied the model to the qualitative data to determine possible causations for a patient's engagement or lack thereof. A private hospital's and a safety net hospital's populations were contrasted.

Results: The private patient population was more likely to engage than their safety-net counterparts. Using our model in conjunction with patient data, we determined possible etiologies for this engagement to be due to the private patient's perceived probability of dealing with an available doctor and apparent signals from the doctor indicating so. For the safety-net population, decreased access to care caused them to be less willing to engage with a doctor perceived as possibly unavailable.

Conclusions: A physician who understands these Game Theory concepts may be able to alter their interactions with their patients, tailoring responses and demeanor to fit the patient's circumstances and possible barriers to engagement.

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Introduction

Patient engagement is considered an important goal of clinical care, education, and discharge planning. An engaged patient is generally thought of as someone willing to reach out to his caregivers with questions or concerns and is intent on understanding their condition to actively benefit the outcome.[1,2] Without engagement, patient-physician communication is impaired, patient activation fails, and the quality of care, patient adherence, and patient outcomes worsen.[3,4] In addition, lack of engagement in patients can lead to higher health care costs due to preventable complications.[5] With so many personal, subtle, and even subconscious factors, patient engagement remains difficult to define and operationalize. This is especially the case when it comes to considering the needs of different patient populations.[1]

We undertook this research to characterize and compare the nature of physician-patient interaction and its impact on engagement in the context of both private hospital and safety net hospital patient populations. To understand the impact of engagement on postsurgical recovery, we interviewed respondents who underwent either thyroid or colorectal operations. We evaluated the patient's expectations of the patient-physician relationship to inductively model processes of patient engagement in self-care following surgery. We then followed this by presenting an explanation for this interaction, using a signaling model from Game Theory.

Game Theory originated in the 1944 book "*Theory of Games and Economic Behavior*" by John Von Neumann and Oskar Morgenstern.[6] It can be broadly defined as the study of strategic interactions between two parties where the decisions made by each party are interdependent and assumed to be rational.[6] In Game Theory, this strategic interaction is a "game". A famous example is known as the Prisoner's Dilemma and describes the hypothetical situation involving the interaction of two prisoners. In this scenario, the two people involved in a crime are separated during their interrogation. Without the cooperation of the accused, the police do not have enough evidence to convict and it is best if neither confesses, yet communication tendencies ingrained in human behavior patterns often lead to both parties confessing. Understanding intrinsic motivation and decision-making that underlie social interactions between two individuals allows us to develop a framework for optimization of communication.

While game theory has recently been seen more frequently in the health care literature, there have been relatively few examples of signaling games. Here, we have focused on the relationship between patient and physician in communication and the implications this has for modeling a pragmatic clinical encounter. The model (a signaling game) presented is compared to qualitative evidence of real-world interactions between patient and provider from semistructured interviews conducted at both a safety net hospital and a private hospital. The purpose of the study was to examine the hypothetical signaling game against the communication patterns that were noted in the interviews to understand what conditions and behaviors may be optimized to enhance engagement. We hypothesized that each distinct patient population would have specific behavioral tendencies toward engagement in self-care following surgery.

Methods

The study team chose a semistructured qualitative interview approach as it offered insight into patients' lived experiences and gave respondents the opportunity to raise their own questions or concerns. A total of 38 respondents who had received thyroid or colorectal surgery were recruited from both safety net hospital and a private hospital during 6 mo from January 2016 through June 2016 (Table 1). Inclusion criteria included surgery for thyroid or parathyroid or colon Cancer, Crohn's disease, metastases, age 18-70, and Spanish or English as primary language. Potential participants were excluded in cases where there was a concurrent secondary active malignancy, need for multivisceral resection, a preexisting vocal cord paralysis, a chronic neurological condition affecting voice or swallow, pregnancy, or if the patient was a prisoner. These patient groups were excluded as a result of standard policy of the institutional review board for protection of vulnerable human subjects (prisoners and pregnancy) or because of the relatively few number but significantly more complicated multivisceral resection or prior voice/swallowing comorbid condition the patient groups would not be able to adequately participate and enroll to thematic saturation these subgroups of patients separate from standard patient experience for thyroid and colorectal surgery.

The Baylor College of Medicine Institutional Review Board reviewed and approved this study. Verbal consent was obtained before each interview was conducted. Participants were free to decline to answer any question and to end each interview at any time with no justification required. Each participant was paid $25 in consideration for his or her time in the interview. Interviews were scheduled at the respondents' convenience to correspond with their usual clinical care.

Data were collected based on a semistructured interview guide developed in consultation with clinical staff and piloted with three respondents undergoing postdischarge surgical recovery. Interview guides were revised based on their

Table 1 − Demographics.

Category	Thyroid surgery	Colorectal surgery
Safety net hospital	11	8
Private hospital	9	10
Male/female	2/17	9/9
Mean age	53	52
No complications	15	11
Complications	6	6
Spanish speaker[*]	7	4
English speaker[*]	13	14

[*] Primary language of choice.