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Room 903, Building D, Ocean International Center,
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BRIEF ARTICLE

Factors influencing teamwork and collaboration within a tertiary medical center

Shu Feng Chien, Thomas TH Wan, Yu-Chih Chen

Shu Feng Chien, Technician of Medical Research and Education Department, Veterans General Hospital-Taipei, No.201, Sec. 2, Shipai Rd., Beitou District, Taipei City, Taiwan 11217, China
Thomas TH Wan, Public Affairs, Health Management and Informatics, and Medicine, Associate Dean for Research, College of Health and Public Affair, University of Central Florida, PO Box 163680, Orlando, FL 32816-3680, United States
Yu-Chih Chen, Department of Nursing, Veterans General Hospital-Taipei, No.201, Sec. 2, Shipai Rd., Beitou District, Taipei City, Taiwan 11217, China
Author contributions: Chien SF designed and conducted the survey; Wan TTH performed path analysis of the data; Chen YC reviewed the literature and supported the survey. All authors prepared the final paper.
Supported by the Taipei Veterans General Hospital
Correspondence to: Thomas TH Wan, PhD, MHS, Professor, Public Affairs, Health Management and Informatics, and Medicine Associate Dean for Research, College of Health and Public Affairs, University of Central Florida, Box 163680, Orlando, FL 32168-3680, United States. twan@mail.ucf.edu
Telephone: +1-407-8233678 Fax: +1-407-8230822
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Abstract

AIM: To understand how work climate and related factors influence teamwork and collaboration in a large medical center.

METHODS: A survey of 3462 employees was conducted to generate responses to Sexton's Safety Attitudes Questionnaire (SAQ) to assess perceptions of work environment via a series of five-point, Likert-scaled questions. Path analysis was performed, using teamwork (TW) and collaboration (CO) as endogenous variables. The exogenous variables are effective communication (EC), safety culture (SC), job satisfaction (JS), work pressure (PR), and work climate (WC). The measurement instruments for the variables or summated subscales are presented. Reliability of each sub-scale are calculated. Alpha Cronbach coefficients are relatively strong: TW (0.81), CO (0.76), EC (0.70), SC (0.83), JS (0.91), WP (0.85), and WC (0.78). Confirmatory factor analysis was performed for each of these constructs.

RESULTS: Path analysis enables to identify statistically significant predictors of two endogenous variables, teamwork and intra-organizational collaboration. Significant amounts of variance in perceived teamwork (R^2 = 0.59) and in collaboration (R^2 = 0.75) are accounted for by the predictor variables. In the initial model, safety culture is the most important predictor of perceived teamwork, with a β weight of 0.51, and work climate is the most significant predictor of collaboration, with a β weight of 0.84. After eliminating statistically insignificant causal paths and allowing correlated predictors1, the revised model shows that work climate is the only predictor positively influencing both teamwork (β = 0.26) and collaboration (β = 0.88). A relatively weak positive (β = 0.14) but statistically significant relationship exists between teamwork and collaboration when the effects of other predictors are simultaneously controlled.

CONCLUSION: Hospital executives who are interested in improving collaboration should assess the work climate to ensure that employees are operating in a setting conducive to intra-organizational collaboration.

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Key words: Teamwork; Intra-organizational collaboration; Safety culture; Work climate in a hospital

Peer reviewer: Léon C van Kempen, PhD, Associate Professor, Department of Pathology, McGill University and Lady Davis Institute for Medical Research, Jewish General Hospital, LDI - E447, 3755 Cote Ste-Catherine, Montreal QC H3T 1E2, Canada

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INTRODUCTION

Change efforts such as total quality management and continuous quality improvement reveal the importance of teamwork and collaboration to organizational success. In health care, teamwork has consistently been shown to improve the quality of health care and reduce medical errors[1,2]. In addition, Hoegl and Gemuenden[2] demonstrated that the quality of the teamwork is significantly associated with team performance on innovative projects, which indicates that teamwork is crucial to organizational growth and development. Both of these studies showed that communication is of the utmost importance for determining teamwork and collaboration. This paper uses path analysis to construct a causal path model which helps identify intra-organizational factors influencing the variation in perceived teamwork and collaboration within a large medical center.

MATERIALS AND METHODS

Literature review

Teamwork is viewed as group members working together to accomplish a common goal. The key insight is that team members must possess a mutual awareness (i.e., shared perceptions about communication, safety culture, work climate and work pressure), which enables them to interact, anticipate each other's actions and needs, and carry out team processes like coordination. In recent years, organizational collaboration has begun to emerge as a distinct focus of scholarly and empirical research[3]. Understanding employees' perceptions of an organization has become increasingly important in recent years. Collaboration is defined as "to work jointly with others or together especially in an intellectual endeavor"[4]. Thomas *et al*[3] defined inter-organizational collaboration as a term used by scholars and practitioners to describe a process that can emerge as organizations interact with one another to create new organizational and social structures. The amount of research on inter-organizational collaboration could fill many volumes[5]. However, the amount of research on its counterpart, intra-organizational collaboration, pales by comparison. The discrepancy may reflect the longstanding precedence of the inter-organizational view in organizational research[3]. However, in recent years, intra-organizational views begun to gain attention[5]. These views focus more on the organizational relationships within a specific organization rather than on those that form outside the organization[5]. In particular, the collaboration among employees within an organization can be just as important as, if not more important than the collaboration between organizations. This paper will pursuit the former view and quantitatively assesses a path analysis model of predictors of intra-organizational collaboration.

With respect to demographics, research has indicated the women tend to be more collaborative than men, which is why women who work in environments requiring high levels of teamwork often excel in leadership positions[6]. Gellers and Kuipert[7] demonstrated that age also is positively related to teamwork; as the average age of team members increases, so too does the quality of the group's work.

Research questions and hypotheses

Given the obvious importance of teamwork and collaboration in organizations, the central question in this study is to what degree work climate, work pressure, perceptions of safety, job satisfaction, and communication are significant determinants of teamwork and collaboration. Various organizational research articles have provided the basis for the theoretical framework used to develop the study hypotheses[8-15]. The exogenous variables in this study are Effective Communication (EC), Safety Culture (SC), Job Satisfaction (JS), Work Pressure (PR), and Work Climate (WC). The endogenous variables are teamwork (TW) and collaboration (CO). Each of the five exogenous variables is hypothesized to exert influence independently on the two endogenous variables. The study assumes that teamwork predicts collaboration.

Methodology

Data were gathered from a sample selected in 2008 that consists of 3462 employees working for the same tertiary medical center in Taipei, Taiwan. Participants were asked to respond to Sexton's[16-18] Safety Attitudes Questionnaire (SAQ) to assess perceptions of work environment via a series of five-point, Likert-scaled questions. This questionnaire was translated and piloted tested as part of the large survey conducted in the facility.

The exogenous variables are effective communication (EC), safety culture (SC), job satisfaction (JS), work pressure (PR), and work climate (WC). The endogenous variables are teamwork (TW) and collaboration (CO). Teamwork is measured by responses from six related questions in regard to employees' perceived acceptance of any suggestions, opportunities for expressing concerns with care problems, ability to solve clinical problems together, provision of patient support collectively, ability to engender collegial responses, and partnership between physicians and nurses as a well-coordinated team. Collaboration is operationally defined as physicians, nurses, and other clinical staff who work collaboratively within the medical center. The measurement instruments for the variables or summated subscales are presented in Table 1. Reliability of each sub-scale was calculated. Alpha Cronbach coefficients are relatively strong: TW (0.81), CO (0.76), EC (0.70), SC (0.83), JS (0.91), WP (0.85), and WC (0.78).

Table 1 Variables, questions, and constructs for the analysis

Construct	Question or statement[1]
Communication effectiveness (CE)	
	It is easy for personnel here to ask questions when there is something that they do not understand
	I know the proper channels to direct questions regarding problems encountered at work
	I receive appropriate feedback about my performance
	My suggestions about safety issues would be acted upon if I expressed them to management
Teamwork (TW)	
	Staff input is well received in the work area
	If it is difficult to speak up if I perceive a problem in the work setting
	Disagreements in the work setting are resolved appropriately
	I have the support I need from other personnel
	The professional staff here work together as a well-coordinated team
Safety culture (SC)	
	I would feel safe being taken care of in my work area
	Errors or mistakes are handled appropriately in the work area
	It is very difficult to discuss errors or mistakes at work
	I am encouraged by my colleagues to report any concerns I may have
	The culture here makes it easy to learn from the errors of others
Job satisfaction (JS)	
	I like my job
	Working here is like being part of a large family
	This is a good place to work
	I am proud to work in this place
	Morale here is very high
Work pressure (WP)	
	When my workload becomes excessive, my performance is impaired
	I am less effective at work when fatigued
	I am more likely to make errors in tense or hostile situations
	Fatigue impairs my performance during emergency situations
Collaboration (CO)	
	I experience good collaboration with other nurses
	I experience good collaboration with physicians
	I experience good collaboration with other health professionals
Work climate (WC)	
	Problem personnel are dealt with constructively by management
	This hospital does a good job of training new personnel
	All the necessary information for diagnostic and therapeutic decisions is routinely available to me
	Trainees in my discipline are adequately supervised

[1]Likert scale was used for each question: Disagree strongly (1); disagree slightly (2); neutral (3); agree slightly (4); and agree strongly (5). Subscales were constructed by summing the relevant items under the respective constructs.

Table 2 Descriptive statistics for the study variables (n = 3467 employees)

	EC	SC	JS	PR	WC	TW	CO
Mean	3.38	3.69	3.76	3.76	3.55	3.76	3.69
Standard deviation	1	0.66	0.89	0.9	0.62	0.71	0.71

EC: Effective communication; SC: Safety culture; JS; Job satisfaction; PR: Work pressure; WC: Work climate; TW: Perceived teamwork; CO: Collaboration.

Table 3 Correlation matrix for the study variables

	EC	SC	JS	PR	WC	TW	CO[2]
EC	1.00						
SC	0.33[1]	1.00					
JS	0.26[1]	0.66[1]	1.00				
PR	-0.13[1]	-0.04[1]	-0.13[1]	1.00			
WC	0.47[1]	0.68[1]	0.61[1]	-0.06[1]	1.00		
TW	0.37[1]	0.72[1]	0.61[1]	-0.06[1]	0.67[1]	1.00	
CO	0.31[1]	0.58[1]	0.52[1]	-0.03	0.86[1]	0.62[1]	1.00

[1]Statistically significant at 0.01 or less, [2]Endogenous variable. EC: Effective communication; SC: Safety culture; JS; Job satisfaction; PR: Work pressure; WC: Work climate; TW: Perceived teamwork; CO: Collaboration.

Confirmatory factor analysis was performed for each of these constructs. Similar results on psychometric properties as documented in previous studies[19-21] were found. The confirmatory factor analysis results of this study could be obtained from the authors at request.

To analyze the causal relationship among these variables, a path analysis model was developed using the five exogenous variables as predictors and the two endogenous variables as the outcome measures. It is postulated that teamwork positively affect intra-organizational collaboration. Age and gender are considered control variables (Table 1).

RESULTS

Table 2 shows the summary statistics for each of the study variables measured by the average of a summative scale, ranging from 1 (strongly disagree) to 5 (strongly agree). As far as demographics of the hospital employees are concerned, the descriptive analysis showed that 81.4 % of the sample were females and 18.6 % were males. Younger individuals outnumber older individuals (65.1% of the sample was under the age of 40 years). Although all exogenous variables are significantly correlated, no strong multicollinearity exists (Table 3). Thus, no predictor variables were excluded from the analysis. The correlation between teamwork and collaboration is 0.62.

In the initial analysis, effective communication (EC), safety culture (SC), job satisfaction (JS), work pressure (PR) and work climate (WC) were considered as predictors of perceived teamwork and collaboration. The total variance in teamwork accounted for by the five predictors is 40%, whereas the total variance in collaboration

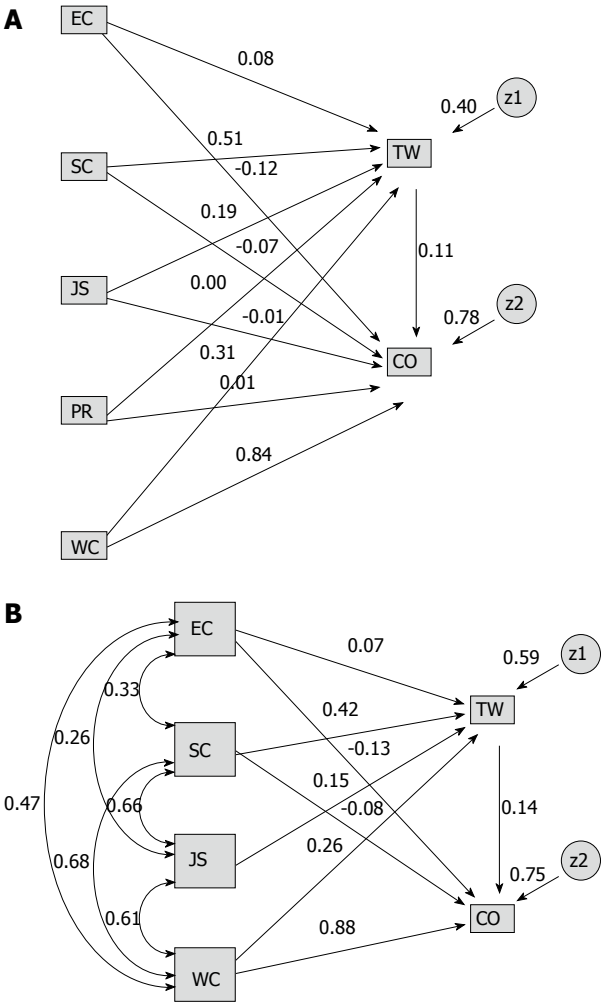

Figure 1 Path analysis and revised path analysis (B) of predictors for perceived teamwork and collaboration. Teamwork (TW); collaboration (CO); effective communication (EC); safety culture (SC); job satisfaction (JS); work pressure (PR); and work climate (WC).

accounted for by five predictors and teamwork is 78% (Figure 1A). However, work pressure is not significantly related to teamwork. Work pressure and job satisfaction are not significantly related to collaboration. Finally, teamwork is significantly but weakly related to collaboration (β = 0.11) when the effects of other predictors are simultaneously controlled.

A revised path analysis that includes only statistically significant predictors of perceived teamwork and collaboration as well as intercorrelations among the predictor variables is presented in Figure 1B. This model accounts for 59% of variance in teamwork and 75% of variance in collaboration. Teamwork remains weakly and positively correlated with collaboration (β = 0.14).

Gender and age were considered as control variables in the primary analysis of perceived teamwork and collaboration. However, gender was found not to be a statistically significant factor to explain the variation in teamwork. Age was found to be negatively correlated with teamwork, in contrast to previous research[6] has demonstrated just the opposite relationship.

Table 4 Regression statistics of the revised path analysis

Predictor variables	Standardized regression coefficients	Unstandardized regression coefficients	Standard errors	Critical values
SC→TW	0.42	0.45	0.02	25.46[1]
JS→TW	0.15	0.12	0.01	9.39[1]
WC→TW	0.29	0.33	0.02	18.47[1]
EC→CO	-0.13	-0.09	0.01	-13.53[1]
TW→CO	0.10	0.10	0.01	8.55[1]
WC→CO	0.85	0.98	0.01	69.04[1]

[1]Statistically significant at 0.01 or less. Goodness of fit (GOF) statistics for the structural equation model: χ^2 = 69.44 with 3 degrees of freedom; CMIN/Γ = 23.15, *P* = 0.001; NFI index = 1.00; CFI index = 0.995; and root mean squares error = 0.08. EC: Effective communication; SC: Safety culture; JS: Job satisfaction; PR: Work pressure; WC: Work climate; TW: Perceived teamwork; CO: Collaboration.

Table 4 shows that the Chi-square value (χ^2) is 1.75, with 1 degree of freedom (Γ), which is statistically significant at the 0.186 level; χ^2/Γ is 1.75; the NFI index is 1.00 and the CFI index is 1.00; lastly, the RMSEA is 0.02. These goodness-of-fit statistics show that the final path model fits very well with the data. Of the four statistically significant predictors of teamwork, safety culture (β =0.42) exerts the most influence on the variability in teamwork. Effective communication, job satisfaction and work climate have a positive influence on teamwork. For intra-organizational collaboration, work climate exerts (β = 0.88) more than three times the positive influence on collaboration than on team work. However, a negative and weak relationship of collaboration to effective communication and safety culture was found and reported in Table 4.

DISCUSSION

A relatively parsimonious path model was presented and evaluated. The findings reveal that a significant amount of variance in perceived teamwork (R^2 = 0.59) and in collaboration (R^2 = 0.75) is accounted for by the predictor variables. The most important predictor of perceived teamwork is safety culture, with a β weight of 0.42. The most significant predictor of collaboration is work climate, with a β weight of 0.85. Therefore, it is recommended that health care executives who are interested in improving collaboration should assess the work climate to ensure that employees are operating in a setting conducive to intra-organizational collaboration and cooperation. Considering previous research, a bizarre and surprising finding is that effective communication (β = -0.13) and safety culture (-0.08) are negatively associated with collaboration. It is believed that the measurement of effective communication should be revised to use quality indicators of communication that more accurately reflect how teamwork is facilitated by a favorable work climate.

Because the analysis is based on perceptions of employees in a single large medical center, its generalizability may be limited. It is unknown whether data drawn from

another sample would produce similar results. Future researchers could consider sampling employees from other comparable facilities and other industries to determine whether the findings could extend beyond the medical care organization sampled in this research. A related limitation is that the sample was disproportionately female; future researchers should sample males and females more evenly. Furthermore, including contextual and organizational characteristics for a variety of health care organizations could enhance the explanatory power of the predictor variables for teamwork and collaboration. Future research should therefore consider multilevel modeling of both work-unit and hospital characteristics that might be significant in determining the variability in teamwork and collaboration[22,23].

In conclusion, organizational behavior research needs to choose a proper theoretical framework for specifying the causal paths for validation. Without a proper theoretical framework, the creation of a path analysis model may be fruitless or groundless. Even with a well fitting model, using path analysis models without a theoretical framework is like shooting in the dark. It is the theoretical framework that must guide the researcher in assuming specific causal paths among the study variables.

It is clear that work climate has a large direct effect on intra-organizational collaboration. Safety culture has a moderate impact on teamwork. All of the other variables have a somewhat diminishing role in affecting the two endogenous variables, teamwork and collaboration. Taken together, the revised path analysis model explains a good proportion of the variance in both teamwork and collaboration. This new-found knowledge should be used to foster effective management of employees' safety culture and work climate. Mechanisms that either facilitate or impede effective teamwork should be explored and experimented with, as suggested by the expert panel from the Canadian Health Services Research Foundation[24] and other investigators[25-27]. Furthermore, improvement in work climate alone could substantially influence intra-organizational collaboration.

COMMENTS

Background

Safety culture is essential to the health care delivery system, particularly in a large medical center. The mechanisms for fostering work climate and safety environment are not well understood. Path analysis is an analytic tool to tease out complex causal relationships among many organizational variables that may directly and indirectly affect team work and collaboration within a large hospital.

Research frontiers

Organizational behavior research needs to choose a proper theoretical framework for specifying the causal paths for empirical validation. Path analysis enables to identify important mechanisms influencing team work and intra-organizational collaboration. Thus, patient safety measures could be properly institutionalized under an optimal work climate that stresses team work and collaboration.

Innovations and breakthroughs

The new-found knowledge about a strong and positive relationship of work climate to teamwork and collaboration in the hospital environment should be used to foster effective management of employees' perceptions of work environment and safety culture. Mechanisms that either facilitate or impede effective teamwork should be explored and experimented by health care executives.

Applications

Effective teamwork and collaboration have led the national recognition of exceptional quality of care delivered by the study hospital. This study has shed important light about the benefits of strengthening teamwork and collaboration within a complex organization. Other facilities could adopt similar organizational strategies in implementing mechanisms that could foster a productive environment.

Terminology

Intra-organizational collaboration: Patient safety is based collaborative efforts among health professionals, an essential component of delivering high quality of hospital care. This commonly shared mission by hospital employees has guided the development and implementation of many collaborative safety related programs.

Peer review

A limited number of intra-organizational studies on safety culture and work climate were found. This study offers new insight about factors influencing the variation in teamwork and intra-organizational collaboration in a very large medical facility. The results could be generalized to other large hospitals. Path analysis appears to be a parsimonious statistical tool to identify the relative importance of predictor variables in explaining the variability in teamwork and collaboration.

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Hong-Xiang Sun, PhD, Associate Professor, College of Animal Sciences, Zhejiang University, Yuhangtang Road 866, Hangzhou 310053, Zhejiang Province, China

Peter J Quesenberry, MD, Division of Hematology, Oncology, Rhode Island Hospital, 593 Eddy Street, Providence, RI 02903, United States

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Mariana de Andrea Hacker, PhD, Laboratory of Leprosy, Oswaldo Cruz Foundation, Avenida Brasil 4365 –Manguinhos, Rio de Janeiro 21040360, Brazil

Marijeta Kralj, PhD, Senior Scientist, Head of Laboratory of Experimental Therapy, Division of Molecular Medicine, Rudjer Boskovic Institute, Zagreb 10000, Croatia

Wen-Hsiung Chan, PhD, Professor, Department of Bioscience Technology, Chung Yuan Christian University, No. 200, Chung Pei Road, Chung Li 32023, Taiwan, China

William CS Cho, PhD, FHKIMLS, Chartered Scientist (UK), FHKSMDS, FIBMS (UK), Consultant of Registered Chinese Medicine Practitioner Association, Department of Clinical Oncology, Queen Elizabeth Hospital, Room 1305, 13/F, Block R, 30 Gascoigne Road, Kowloon, Hong Kong, China

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Events Calendar 2012

January 20-21, 2012
AGA Clinical Congress of Gastroenterology and Hepatology: Practice, Evidence and Quality in 2012
Miami, FL, United States

January 26, 2012
Symposium of the Swiss Society of Pharmacology and Toxicology, Advances in Pharmacology - Cardiovascular Pharmacology
Bern, Switzerland

January 28 – February 1, 2012
LabAutomation2012
Palm Springs Convention Center, Palm Springs, CA, United States

February 1-4, 2012
3rd International Workshop on Medical Image Analysis and Description for Diagnosis System
Hotel Tivoli Victoria, Algarve, Portugal

February 24, 2012
State Stem Cell Agency Governance Subcommittee
San Francisco, CA, United States

March 11-14, 2012
Thoracic Imaging 2012
Hyatt Regency, Huntington Beach Resort and Spa, Huntington Beach, CA, United States

March 25-30, 2012
44th International Diagnostic Course Davos (IDKD)
Davos, Switzerland

April 26-29, 2012
75th Anniversary of the Canadian Association of Radiologists Annual Scientific Meeting
Le Centre Sheraton, Montreal, Quebec, Canada

April 29 - May 4, 2012
EUCHEM Conference on Stereochemistry
Brunnen, Switzerland

May 4-6, 2012
World Congress on Biotechnology
Hyderabad, India

June 7-9, 2012
ASCI 2012 - 6th Congress of Asian Society of Cardiovascular Imaging
Bangkok, Thailand

June 9-13, 2012
2012 Annual Meeting of the Society of Nuclear Medicine
Miami Beach, FL, United States

August 15-19, 2012
ICE 2012 - International Congress of Endoscopy
Daegu, South Korea

October 28-30, 2012
EANM 2012 - Annual Congress of the European Association of Nuclear Medicine
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Editor-in-Chief
Yicheng Ni, MD, PhD, Professor, Department of Radiology, University Hospitals, KU, Leuven, Herestraat 49, B-3000, Leuven, Belgium

Editorial Office
World Journal of Methodology
Editorial Department: Room 903, Building D,
Ocean International Center,
No. 62 Dongsihuan Zhonglu,
Chaoyang District, Beijing 100025, China
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16 **Pagedas AC**, inventor; Ancel Surgical R&D Inc., assignee. Flexible endoscopic grasping and cutting device and positioning tool assembly. United States patent US 20020103498. 2002 Aug 1

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