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Journal of Biomedical Informatics 41 (2008) 1041–1049

Journal of
Biomedical
Informaticswww.elsevier.com/locate/yjbin

Development of an instrument for measuring clinicians' power perceptions in the workplace

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Received 15 November 2007

Available online 4 March 2008

Abstract

We report on the development of an instrument to measure clinicians' perceptions of their personal power in the workplace in relation to resistance to computerized physician order entry (CPOE). The instrument is based on French and Raven's six bases of social power and uses a semantic differential methodology. A measurement study was conducted to determine the reliability and validity of the survey. The survey was administered online and distributed via a URL by email to 19 physicians, nurses, and health unit coordinators from a university hospital. Acceptable reliability was achieved by removing or moving some semantic differential word pairs used to represent the six power bases (alpha range from 0.76 to 0.89). The Semantic Differential Power Perception (SDPP) survey validity was tested against an already validated instrument and found to be acceptable (correlation range from 0.51 to 0.81). The SDPP survey instrument was determined to be both reliable and valid.

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Keywords: Power; Resistance; Measurement; Questionnaire; Electronic health records; Clinical informatics; Socio-technical; Human factors; Hospital information systems; Computerized provider order entry

1. Introduction

Electronic health record implementations have approximately a 30% failure rate [1] and the introduction of computerized physician order entry (CPOE) is often the process that precipitates the system failure [2–8]. One consequence of CPOE that contributes to this failure is a perception by clinicians that CPOE alters their power status [9]. Because resistance is a factor in the failure of CPOE deployment, and changes in power have been identified as an unintended consequence of CPOE, we are investigating how changes in perceptions of power relate to resistance to CPOE [10].

Personal power is a reflection of a person's sense of dignity and work satisfaction which are an ongoing result of what occurs in his/her workplace [11]. Previous work with management information systems has indicated that there is a relationship between resistance to information technology and power changes in the workplace [12]. In health-care, Ash identified three patterns of power shifts resulting from CPOE that can result in resistance. They are: (1) forced work redistribution and mandated clinical practice guidelines, (2) shifts in control away from clinicians, and (3) loss of autonomy and formation of coalitions [13]. By determining after implementation of CPOE what types of power change and to what degree power perceptions change, system developers and administrators may be able to accommodate these differences before encountering organized resistance resulting in CPOE system failure.

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A significant barrier to researchers in this field is the absence of an appropriate measurement instrument for power perception in healthcare. Previous instruments used to measure perceptions of power have been structured to analyze superior/subordinate relationships, not an individual's perceptions of his/her own power [14–23]. There are strong theoretical and practical arguments against the use of superior/subordinate instruments in healthcare environments. Therefore, we developed the Semantic Differential Power Perception (SDPP) survey instrument to measure an individual's perception of his/her own power in the healthcare workplace. The semantic differential methodology [24] measures people's reactions to stimulus words presented in pairs that are on opposite ends of a spectrum (e.g. good/bad, happy/sad). These "word pairs" are separated by a series of dots that represent a numeric scale between the two words.

In this manuscript, we describe the SDPP survey instrument and its theoretical foundations. We report on a measurement study conducted to determine if the survey is reliable and valid for measuring power perceptions. The SDPP survey is available to researchers who wish to study aspects of or changes to personal power on a large scale within healthcare organizations.

2. Background

The implementation of computerized provider order entry (CPOE) across the health care system has been slow and fraught with significant difficulty. Less than 20% of hospitals across the United States have implemented CPOE, and only slightly more than that have implemented an electronic health record (EHR) [25]. One cause of this delay is clinicians' resistance [26–30]. An important factor related to this resistance is the clinician's perception of the power that they have within their work domain and the belief that their power situation changes when CPOE is implemented [10,31,32].

This power/resistance relationship has been studied in psychology, sociology, and business organizations for more than 50 years [14,33–36]. The effects of power on social relationships and organizational change were the motivators for these studies, primarily as they relate to leadership and hierarchical relationships within an organization. More than 20 years ago, businesses were able to identify that information technology had the capacity to change an organization's power structure and that resistance to such power changes was actually sufficient to cause the failure of that information technology [6,12,15,30,37]. This work has important implications for the implementation of technologies such as CPOE.

More recently, studies on power/resistance in healthcare have been conducted [10,38–42]. The motivation for these studies is to encourage the acceptance of clinical information systems, or to determine perceptions of empowerment. These power studies use either (1) healthcare specific ques-

tionnaires using qualitative measures [38,40,41] or (2) quantitative questionnaires designed for business practices [39,42].

Although qualitative studies provide important insights and richness of understanding, there are also some significant limitations [43]. Because power is such a sensitive topic and can have negative associations, beliefs and attitudes expressed may be slanted to appear more positive than they really are [44]. People may self-censor their responses for fear that answers indicating any negative perceptions relating to power may get back to co-workers or superiors. Also, a qualitative study does not provide a measurable means of comparison across individuals or over time. A tool to obtain less biased, measurable data about clinicians' power was needed.

We determined that existing measurement instruments developed for business organizations would not be adequate for research in healthcare organizations because they are based on superior/subordinate relationships. Power measurement instruments for use in business organizations measure leadership, job satisfaction, and management abilities as well as how managers are perceived by their subordinates [14,16–23]. Although, there are some similarities between business and healthcare organizations, the social and working relationships are typically very different. In healthcare, clinician work relationships are often more complex with both peer-to-peer and hierarchical structures. For example, a physician may be an independent practitioner at a hospital, which means he/she has no employment status in that hospital. However, the same physician has the authority to direct the work activity of employees of the hospital, to influence decisions made by that hospital, and to directly impact the financial well being of that hospital. In healthcare, power relationships are not always based on a person's formal position as a "boss" or supervisor, but on responsibilities, knowledge, and respect. Therefore, perceptions of power within a healthcare organization cannot be adequately measured using the established superior/subordinate based instruments developed for standard business practices.

Perceptions of one's own power in the workplace can be affected by many factors, such as autonomy, control of resources, authority to make decisions, and respect of co-workers [13,19,45]. For example, a resident physician under the watchful eye of an attending physician may feel powerless, while an experienced health unit coordinator who effectively manages the information flow on a patient unit may feel quite powerful. In order to measure self-perception of power, an instrument was needed to measure a person's perceptions of their own power in an indirect and non-threatening manner. A requirement for the instrument was that it must translate perceptions into measurable values and encompass as well as differentiate factors that affect power. Since there were no instruments of this type, we developed the SDPP survey instrument (see Fig. 1).

ent, informational, reward and coercive and are described in detail in Table 1. A review of other theories of power [37,47] relating to healthcare organizations shows that they can map back to these same six power bases, but they do not specifically identify the unique power relationships between various members of the healthcare team.

In healthcare, the power bases can be interpreted in a slightly different manner than in a business environment. French and Raven identify *legitimate power* predominately as one's formal position in an organization. Legitimate power is often perceived as power granted to the person hired to be the boss, but in healthcare legitimate power structures are typically more complex and multifaceted. Legitimate power can be derived from formal credentialing as well as organizational structure. For example, the physician's legitimate power arises from being the person who is legally authorized to coordinate and prescribe care based on her/his licensure rather than being hired into the role of manager.

French and Raven define *expert power* as knowledge or expertise, which in most situations is based on experience, education or credentials. Expert power crosses all positions in healthcare. Knowledge and experience are particularly highly regarded in healthcare.

According to French and Raven, *referent power* is a function of charisma and identification with some aspect of a person. However, referent power in healthcare has multiple aspects and associations. It is an important power base in health care because of the clinician's role as a mentor to more junior clinicians. Referent power is also critical for instilling trust and confidence in patients.

Informational power is the ability to persuade or to provide information (good or bad) to enable decision-making. In healthcare, informational power comes from gathering and providing the information on which life-altering decisions are made. Communicating information for these decisions is a critical and powerful role for a clinician. From the patient's perspective, the expert and referent power of the clinician providing the information can impact how

trustworthy they believe the information to be, and how persuasive the information is determined to be.

French and Raven identify *reward* and *coercive power* as separate and individual power bases, but we consider them to be related elements of social power and combined them into one concept. In business, good behavior usually entitles one to a monetary reward while poor behavior can result in punishment or withdrawal of some benefit. In healthcare, reward and coercion can be expressed by pay raises/cuts, better/poorer work schedules, access to/denial of resources or positive/negative recognition from co-workers as in any hierarchical organization. However, altruistic reward may also be found in appreciation from patients and their families and coercion may be demonstrated by criticism and mistrust, resistance to ideas, or even threats of legal retribution.

As is evident from the preceding discussion, in healthcare organizations, the formal administrative authority structure is not the sole, or even necessarily the primary basis for power. Power is intertwined between the various power bases, and certain types of power may be higher or lower for any specific individual. Taking these differences into consideration, it was necessary to develop a different method for determining the clinician's perception of their own power that (1) is less prone to biases and (2) separates power into the different types, which each person holds in varying degrees. We identified semantic differential questions as the methodology best suited to this task.

3.2. Semantic differential questions

The SDPP survey uses a semantic differential methodology developed by Osgood in 1957 [16]. This method uses bipolar, paired adjectives (i.e. word pairs) to map identification and localization of attitudes in a subject's thought processes [16,24,48]. The survey measures each subject's perception of their power based on the connotative meaning of pairs of words related to the six bases of social power. The stimulus word pairs are representative of

Table 1
Definitions of French and Raven's six bases of social power [46] and their relationship in healthcare

Six power bases	Definition of the power bases	Power relationship in healthcare
Informational	Power based on the ability to persuade or provide information to allow someone to make a decision	Clinicians as the source of information for patient care and patient-made decisions
Expert	Power based on one's knowledge and/or experience	Clinicians as holders of specialized knowledge and experience regardless of position
Referent	Power based on people's sense of identification or desire for identification with the influencing person	Clinicians as mentors, exemplars and confidants
Legitimate	Power based on one's formal position within an organization, reciprocity for favors performed, equity for suffering incurred, or dependence on someone else for help	Clinicians with legal authority to order and plan care, but not with organizational authority over other healthcare providers
Reward/ Coercive	Power based on the ability to provide acceptance, approval or tangible rewards Power based on the ability to provide rejection, disapproval or threats	Clinicians as benefactors of respect and positive recognition Clinicians as detractors to co-workers, or impediments to ideas or practice

extremes (positive and negative). The subject identifies where on the continuum between those extremes their perceptions lie (see Fig. 1). It provides the opportunity for a subject to express a degree of attitude toward separate aspects of a concept rather than a single belief or judgment about it. Because the issue of power can be sensitive, the semantic differential methodology was used because it is non-reactive in nature [48] and does not promote responses that may be biased to be socially acceptable. Also, because the semantic differential questions look at individual aspects of a concept, they can isolate and measure the degree of different types of power instead of overall power.

A major issue in developing the word pairs is to ensure that the selected words have the same meaning for the subject as they do for the researcher. Establishing that the stimuli are interpreted consistently was an important consideration for performing a measurement study of the instrument.

3.3. The SDPP survey

On the SDPP survey, two questions regarding perceptions of power were presented. They are:

1. “At my work, I have...”
2. “At my work, I feel...”

Word pairs representing each power base were randomly intermixed under each question and varied according to whether the positive or negative word was presented first in order to manage central tendency bias. The scores obtained from the SDPP instrument were evaluated relative to a midpoint of zero (0), with five points on one side indicating incremental positive values and five points on the other side indicating incremental negative values. No values were presented on the survey itself to reduce bias toward positive or negative responses (see Fig. 1).

The word pairs used in the survey were based on concepts identified in writings about French and Raven’s power bases [36,49–52], and the opposites of the words were identified as antonyms from Roget’s Thesaurus [53]. The readability of the words used in the survey score were set at approximately a 10th grade level using the Dale–Chall Word List for readability of words [54]. For example, the French and Raven concept for informational power means the power agent shares information or reasoning for a change so that the receiving agent can then make a decision [55]. “The imparting or interchange of thoughts, opinions, or information by speech, writing, or signs” is the definition of “communication”. So one aspect of informational power is communication. Using a thesaurus, the antonym or opposite of communication is “secret”. This leads to the word pair of “Secrets (–) and Communication (+)” representing informational power.

In addition to questions related to power, the SDPP instrument asked for individual characteristic information,

such as gender, age, position, education, employment status, patient unit specialty, previous experience with CPOE, and patient unit structure. Semantic differential questions related to attitudes toward CPOE were also included.

4. Methods

Because the SDPP survey was developed as a tool to be used in a much larger study evaluating perceptions of power, it was necessary to pilot the instrument and its administration. The results of the pilot study are the basis for this measurement study. The SDPP survey instrument and the research study in which it will be used were approved by the University of Pittsburgh’s Institutional Review Board (IRB protocol #0610080).

4.1. Setting and sample

The measurement study was conducted in a large, tertiary care medical center on four patient units. The units were selected based on the principle investigator’s previous association with the Unit Directors and the diversity of the medical environments (Rehabilitation Medicine, Orthopedics, and Cardiology). The Unit Directors gave permission for us to approach their staff for the study, but did not encourage or discourage participation. All resident physicians, nurses, and health unit coordinators (total of 96 possible subjects) on those units were recruited to participate in the pilot study by asking them to provide their email address on a sign-up sheet.

4.2. Measurement study process

We sent each subject an email containing a URL link to two web-based surveys. The surveys were the SDPP survey and the validated Sources of Power (SOP) Audit developed by Slevin and Velthouse [15]. The SOP Audit was used to establish criterion validity for the SDPP even though it focuses on perceptions of why subjects think *others* comply with an individual’s influence, not what the individual perceives their own power to be. Because the SOP Audit is not strictly superior/subordinate based and deals with the same six power bases, we believed that it would be an acceptable instrument to use to measure criterion validity for the SDPP survey. The total time to take both surveys online was approximately 10–15 min and could be done from any computer from which the subject could access the World Wide Web. All subjects received a \$5 gift card for agreeing to participate.

4.3. Statistical analysis

As indicated in the Instrument Development section, the responses were scored on a scale of 5, 4, 3, 2, 1 (positive values), 0 (neutral value), –1, –2, –3, –4, –5 (negative values) based on which radio button along the continuum

the subject selected. Statistical analyses were performed using SPSS[®].

4.3.1. Reliability measures

Reliability is the degree to which a measurement is consistent or reproducible [56]. For the SDPP instrument, we wished to determine that the word pairs used to represent each power base did indeed measure the same power base. For example, if a subject scored very positively for one word pair representing expert power, they should also score very positively for the other word pairs representing expert power. Reliability for each group of word pairs was computed using Cronbach's Alpha (using SPSS 14.0 [57]), and based on commonly accepted practice, 0.70 was used as the threshold for an acceptable value for evaluation of these reliability scores [56].

4.3.2. Validity measures

Validity is the degree to which the factor that the researcher wants to study is actually what is being measured [56]. For the intended study, it was necessary to know that each group of word pairs was measuring the appropriate power base. This could be determined by correlating the score for each power base from the SDPP with the score for each power base from the SOP Audit. For example, if a person had an overall high score for expert power in the SDPP survey, one would expect that they would have a high score for expert power in the SOP Audit. Pearson correlations between the scores of the two instruments were calculated using SPSS 14.0 [57]. A value greater than 0.40 was determined to be an acceptable, but low correlation strength [56], while a strength between 0.50 and 0.69 was considered moderate, between 0.70 and 0.89 was considered strong, and between 0.90 and 1.00 was considered very strong [58].

Content or face validity of the instrument was provided with examination by faculty and clinicians prior to administration in the pilot study. Feedback on the word pairs from the pilot subjects was also requested. Faculty indicated that the words should be chosen to be at the level of understanding of the health unit coordinator. Clinicians provided input as to what their perceptions of the word pairs represented and adjustments were made to the word pairs until a mutual understanding of what the word pairs

represented was achieved. Feedback was received from only one subject, who stated that the instrument was easy to follow.

5. Results

Of the 96 possible subjects, 19 completed the SDPP survey, and 13 completed both the SDPP and SOP Audit (response rate = 20%). Six subjects closed their web browser after completing the SDPP survey and before they completed the SOP Audit and could only be included in the reliability study. Reliability was calculated on all 19 of the respondents, and validity was calculated on the 13 that completed both the SDPP and SOP Audit.

Because it is necessary to have reliability before one can have validity [56], calculations of reliability for the 19 subjects were performed on all of the original word pairs used in the SDPP survey. Then, in order to achieve optimum reliability, word pairs that did not contribute positively to the reliability of the power base to which they were assigned were removed from the survey, or in one case, a word pair's assignment was changed from one power base to another. The original word pairs used to represent each power base and those that were removed are shown in Table 2. We did not change any of the individual words used in the word pairs as this would require re-piloting the instrument. Once the inadequate word pairs were removed, all the power bases achieved an acceptable reliability value with a range of 0.76–0.89.

5.1. Reliability results

We first calculated reliability for all of the original word pairs for each power base. The reliability for three of the power bases (Informational, Referent, and Legitimate) was not greater than 0.70 and therefore unacceptable (range of 0.50–0.68). Removing one word pair at a time from the group of word pairs used for a particular power base, Cronbach's Alpha was calculated for all combinations of the word pairs to determine which subset of word pairs provided the highest reliability.

In this process, it was discovered that a word pair used to represent Reward/Coercive (i.e. "Restricted/Permitted") actually represented the Legitimate power base better.

Table 2

Word pairs that reliably identify each power base and word pairs (italicized) that were removed to improve reliability

Word pairs	Informational	Expert	Referent	Legitimate	Reward/Coercive
Reliable	Secrets/communication arguments/discussions ignored/asked	Inexperience/experience no education/education ignorance/knowledge a student/a teacher	Dishonesty/honesty no say/influence resistance/cooperation looked down on /respected criticized/complimented	No authority/authority disorder/goals supervised/in control restricted/permitted*	Nowhere to go/opportunities uncertainty/security punished/rewarded discouraged/encouraged
Removed	<i>Rules/ideas</i>	<i>Self doubt/confidence</i>	<i>Conflict/agreement a follower/a leader</i>	<i>Dependent/independent obedient/in charge</i>	<i>Restricted/permitted*</i>

The word representing the negative extreme is on the left and the word representing the positive extreme is on the right.

* Moved this word pair from the Reward/Coercive Power Base to the Legitimate Power Base to improve the reliability of the Legitimate Power Base.

Moving the word pair from Reward/Coercive did not cause that power base's reliability to drop below the acceptable level and greatly improved the reliability of the Legitimate power base. Cronbach's alpha using the original word pairs and then after removing the unreliable word pairs is shown in Table 3. Once the reliable word pairs were determined, all the power bases achieved an acceptable reliability value (range of 0.76–0.89).

5.2. Validity results

For criterion validity, all power base scores from the SDPP were correlated with the power base scores from the Sources of Power Audit using SPSS 14.0 [57]. Validity was acceptable (correlation threshold greater than 0.40) for all the power bases using the original word pairs (range of 0.63–0.81, moderate to strong correlation). Correlations were then calculated using only the word pairs that represented an acceptable reliability. Validity for all power bases was still acceptable (range of 0.51–0.81, moderate to strong correlation). The correlation value for each power base and the strength of those correlations between the SDPP survey and the SOP Audit are shown in Table 4.

6. Discussion

CPOE success is critical to minimizing medical errors and improving the quality of patient care [59,60]. Understanding the implications of changes in power relationships in healthcare can greatly assist in successful CPOE implementations. For this reason, we created the Semantic Differential Power Perception (SDPP) survey instrument.

In this measurement study, we determined that the instrument is both reliable and valid for quantitatively reporting power levels based on French and Raven's six bases of power. This instrument will be used in a study of CPOE resistance and can also be used by other researchers to study power perceptions in the healthcare workplace.

The quantitative survey instrument that we have developed may capture information about power relationships in healthcare that qualitative studies alone cannot capture. Qualitative studies of power in a healthcare environment provide interpretations of perceptions across a limited number of subjects. The degree of change in those perceptions over time or circumstance cannot be determined. A reliable and valid quantitative instrument, such as the SDPP, can be administered to a much larger population and can reveal measurable changes in the different bases of power over time. With further studies of power and resistance in CPOE implementation, researchers may one day be able to predict organizational power changes and take appropriate steps to manage resistance. A variety of interventions could be tested for bolstering waning power bases and supporting already positive power bases by adjusting workflows, improving reporting structures, and providing individual recognition. In this way, CPOE resultant power changes could be an intended intervention rather than an unintended consequence.

As is typical of a measurement study, this study was performed with a relatively small number of subjects. However, the finding of acceptable reliability makes it unnecessary to add additional subjects, because reliability will typically increase with additional observations [56,61].

Table 3
Cronbach's alpha calculations for reliability of the Semantic Differential Power Perception (SDPP) Survey

	Informational		Expert		Referent		Legitimate		Reward/Coercive	
	Original	Reliable	Original	Reliable	Original	Reliable	Original	Reliable	Original	Reliable
Number of word pairs	4	3	5	4	7	5	5	4	5	4
Cronbach's alpha	0.62	0.78	0.89	0.89*	0.68	0.89	0.50	0.76	0.85	0.77**

* Even though reliability remained the same for the Expert Power Base, one word pair was dropped to improve the validity.

** Moved a word pair from the Reward/Coercive Power Base to the Legitimate Power Base to improve the reliability of the Legitimate Power Base even though it decreased the reliability and validity of Reward/Coercive. However, Reward/Coercive remained above the acceptable threshold for both reliability and validity.

Table 4
Pearson correlation for validity between the Semantic Differential Power Perception (SDPP) Survey and the Sources of Power (SOP) Audit

	Informational		Expert		Referent		Legitimate		Reward/Coercive	
	Original	Reliable	Original	Reliable	Original	Reliable	Original	Reliable	Original	Reliable
Number of word pairs	4	3	5	4	7	5	5	4	5	4
Pearson correlation	0.79	0.57	0.66	0.68	0.72	0.74	0.63	0.81	0.81	0.51*
Correlation strength	Strong	Moderate	Moderate	Moderate	Strong	Strong	Moderate	Strong	Strong	Moderate

* Moved a word pair from the Reward/Coercive Power Base to the Legitimate Power Base to improve the reliability of the Legitimate Power Base even though it decreased the reliability and validity of Reward/Coercive. However, Reward/Coercive remained above the acceptable threshold for both reliability and validity.

7. Limitations

We have identified two limitations to the study. First, fixed sets of word pairs used in the study was a limitation. Because of time constraints related to implementation schedules, the only changes made were removing word pairs or changing the power bases they measured. The individual words were not changed. Adding and testing different words and word pairs for the Legitimate and Reward/Coercive power bases might improve both their reliability and criterion validity. Also, an exploratory factor analysis prior to the development of the SDPP survey may have been beneficial to assist in determining word pairs to be used for each power base. However, since the resulting correlations from the pilot were strong, a confirmatory factor analysis will be performed from the research study data for which this survey was designed [58]. Second, the survey has not yet been shown to be generalizable across a wide range of environments. It would be beneficial to study this instrument across several different variables such as a community hospital vs. an academic medical center, or institutions with and without electronic clinical systems. This study attempted to provide some diversity by piloting across different types of patient units even though they were within the same healthcare organization. Consistency across multiple variables when measuring clinicians' power perceptions would also indicate generalizability of the SDPP instrument. Despite these limitations, the SDPP survey may provide important benefits to researchers who wish to study and eventually minimize the impact of changes in power structure.

8. Conclusions

The SDPP instrument provides a quantitative, rather than qualitative, evaluation of the various types of power an individual perceives about themselves in their work place, thereby allowing comparisons over time, across individuals and across institutions. With the ability to quantify these perceptions, system implementers can determine changes in particular types of power and attempt to compensate for them.

Acknowledgments

The authors acknowledge the expert programming assistance of Girish Chavan, Systems Programmer IV, in creating the Semantic Differential Power Perception Survey in its electronic form. This study was supported by fellowship Grant #5 T15 LM007059-20 from the National Library of Medicine. The preliminary results of this measurement study were also presented in poster form at the NLM Trainee Conference in Palo Alto, CA at Stanford University in June, 2007.

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