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Transforming Health Care Service Delivery and Provider Selection

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Abstract Commoditization pressures in medicine have risked transforming service provider selection from "survival of the fittest" to "survival of the cheapest." Quality- and safety-oriented mandates by the Institute of Medicine have led to the creation of a number of data-driven quality-centric initiatives including Pay for Performance and Evidence-Based Medicine. A synergistic approach to creating quantitative accountability in medical service delivery is through the creation of consumer-oriented performance metrics which provide patients with objective data related to individual service provider quality, safety, cost-efficacy, efficiency, and customer service. These performance metrics could in turn be customized to the individual preferences and health care needs of each individual patient, thereby providing an objective methodology for service provider selection while empowering health care consumers.

Keywords Patient empowerment · Quality performance · Data mining

Introduction

New technology development in e-commerce has transformed the manner in which consumers shop. Not long ago, a customer wishing to purchase a television set or computer would physically travel to a retail store, review available options, interact with a salesperson, and make a selection based upon their individual preference, product availability, and cost.

Using new technology, like smart phones, consumers can now perform real-time, comparative analysis on products of interest. This has redefined commercial sales and led to a new era of consumer empowerment. A prospective customer is no longer tied to geographic boundaries, provider sales tactics, product availability, and cost. The principle reason why this new technology is practical is that the products being analyzed are commodities; with a finite and well-defined number of standardized data requirements. If one was to attempt to apply the same technology to comparative analysis for the service industries, they would be limited by the lack of standardized data, large number of confounding variables, and inherent subjectivity in analysis. If the consumer empowerment trend currently transforming e-commerce is to be adapted to health care, new technology and data initiatives are required to provide an objective and reproducible means with which health care consumers can intelligently compare and analyze service providers. It is not beyond the realm of possibility that such a technology could be created in the near future, resulting in a dramatic transformation in the way health care is practiced, analyzed, and purchased.

Current Practice Paradigm and Limitations

The primary consumer group of radiology services is the collective patient population, which commonly rely upon either "word of mouth" or "directed" referrals for imaging service provider selection. Word of mouth referrals are

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often provided by friends, colleagues, or family members, who rely upon individual experience, which is impacted by individual bias, subjective perceptions, and a small sample size. Direct referrals are typically provider driven, including physicians, institutions, and third-party payers. In these circumstances, the providers often generate the provider referral based upon contractual obligations, professional relationships, or convenience.

While often unstated, the current model of "directed" provider selection has the potential for conflict of interest on the part of the referring party. This can take the form of physician "quid pro quo" referrals, self-referrals, or third party payer referrals to "in network" providers. In the absence of complete disclosure, the consumer commonly accepts the recommendation, without informed knowledge of alternative service provider options. In a minority of cases, patients may elect to proactively engage in provider selection through their own due diligence. While the Internet has created a tool for patient empowerment through medical education, it is currently limited in its availability of standardized data and comparative service analysis [1, 2]. In addition, the data which are currently available cannot be easily extrapolated to the unique characteristics and health care needs of each individual patient.

The ideal scenario for health care service provider selection would be to replace the current model, which is largely subjective in nature, with one predicated upon objective data analysis. Rather than rely upon the perceptions and potential biases of a third party, the proposed alternative would pool standardized data from a multitude of informational sources, present this data to consumers in an unbiased and objective manner, while factoring in the individual health care needs and preferences of the individual consumer.

Innovation Opportunity

The creation of standardized databases for objective assessment of quality and safety in medical imaging has been previously described [3–6]. These can serve as models for the collection, storage, validation, analysis, and dissemination of the standardized metrics used for analyzing health care performance deliverables.

The primary categories of performance analysis are listed in Table 1 and include quality, safety, cost-efficacy, operational efficiency, and customer service. With the exception of customer service, these analyses can all be predicated upon objective data and can be continuously updated to provide both static and trending analyses. In a dynamic field such as medicine, trending analyses are particularly important as practice standards and supporting technologies are constantly changing.

Table 1 Categories of health care service analysis

Primary service analyses
Operational efficiency (e.g., timeliness)
Quality (e.g., clinical outcomes)
Cost-efficacy (e.g., comparative cost)
Customer service (e.g., patient satisfaction)
Safety (e.g., iatrogenic complications)
Secondary provider analyses
Geographic location
Demographics
Availability
Pedigree (experience and training)
Technology
Economic profile

While the primary service analyses could assess higher level provider performance metrics, the secondary analyses could focus on practical measures such as geographic location, demographics, availability, and economic profile. In all circumstances, the prioritization of these categorical analyses could be customized to the specific health care needs and preferences of each individual consumer (i.e., context and user-specific prioritization schema). The derived analytics provide a standardized mechanism for evaluating comparative performance deliverables among competing service providers; with the ability to analyze provide performance on an individual, group, institutional, or network level.

Once the referenceable databases are in place and operational, an authorized end-user could log onto the system using an Internet browser to initiate a provider search. An example of a simple search application can be seen with a patient who is advised by her primary care physician to obtain a screening mammogram. In this particular example, the patient is only interested in identifying nearby service providers who can perform the test as soon as possible. In this example, the sole search criteria are geographic location and availability. Once the starting location and requested service are entered; the database would provide the consumer with a list of qualified service providers within the defined geographic radius of interest, along with available appointment times (arranged in chronological order). The patient could then select the provider of choice, request scheduling, and have a verified appointment confirmation and directions transmitted within seconds.

In addition to manual data input, automated data capture could eliminate several of these steps (geographic location and desired test). In the automated mode of operation, the global positioning device in the computer being used (e.g., iPhone) could use the geographic coordinates to automatically determine the starting geographic location. In addition, at the time of end-user authentication/identification, the patient's electronic medical records could be automatically retrieved including a list of "pending" actions (for example, the recommended mammogram). By simply highlighting the pending mammogram request and requesting "Schedule," the computer could automatically generate a query based upon the user-defined search variables of interest.

For those services which are not typically provided on an appointment basis (e.g., chest radiograph), the proposed technology could also be used to track availability based upon existing workflow demands and backlogs. As an example, a patient seeking to visit an outpatient imaging center or hospital imaging department may want to search the database for immediate provider availability in a defined geographic region. Participating service providers would have the ability to report exam-specific backlogs and waiting times. Once this cursory search has been completed, the patient could elect to expand the search for quality/safety performance data of available providers on both institutional and/or individual levels. In the example of the chest radiograph request, the patient may wish to review quality/safety data among potential institutional providers, as well as individual quality/safety data of the technologist or radiologist currently on duty.

In order to expedite workflow (and reduce input errors), a number of customizable and automated search options could be created, using predictive analytics, based upon historical use of the individual end-user and comparable end-users. This type of automated search utilizes the information within the individual end-user profile (Table 2), medical service being analyzed, and the historical records of prior searches to proactively predict what specific context and user-specific queries would be of relevance.

An example of how predictive analytics could be used to automate medical service provider searches can be illustrated in the case of a patient (Mrs. Smith) who is told she has a mass on her mammogram, which is suspicious for cancer, and requires biopsy for definitive diagnosis. Her gynecologist refers her to a local general surgeon, who recommends to Mrs. Smith that she undergo a surgical biopsy, which can be performed in his outpatient surgical center. Before committing to the recommended service, Mrs. Smith elects to search for service provider options.

Table 2 Variables contained within Individual profile

Demographics
Socioeconomic
Education
Geography
Risk factors
Genetics
Medical/surgical history
Pharmacology
Personal preferences
Insurance

As different options are presented to her, Mrs. Smith generates a query to determine the comparative quality measures of surgeons in her local geographic area for the diagnosis of breast cancer (Fig. 1). In addition to providing Mrs. Smith with this list of quality ratings, the computer identifies several other search parameters which have been used in high frequency for end-users with similar individual profiles and clinical context. In the course of presenting this search data, the computer presents the frequency with which these search variables have been used:

Based upon comparative search statistics of similar end-users for the same search context, the computer database identifies those search variables of highest frequency (highlighted) and offers to incorporate these into the current search, if desired. By simply clicking on the option for "Extend Search," the search is now modified in keeping with the search characteristics of comparable end-users. The analysis performed creates a hierarchical list of potential providers within the defined geographic area and insurance network, based upon their combined quality, safety, and customer service scores for the specific procedure and diagnosis of interest.

Additional Applications

In addition to the quantitative analysis of service performance, a number of other applications could be derived

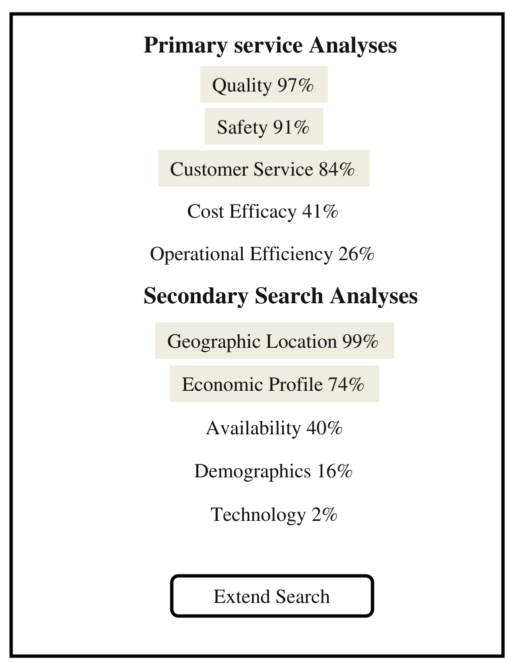

Fig. 1 An example of an expanded search for customizable search criteria

from the proposed technology including education and training, credentialing and licensing, research, hiring and promotion, technology assessment, and automated feedback and alerts.

In addition to providing consumer education, the technology could also provide education and training for health care providers. An institutional provider could use the performance analytics to identify individual and departmental performance outliers in order to facilitate remedial education and additional staff training. As an example, if the medical imaging department within a given hospital is receiving poor performance scores (relative to its peers), the data could be used to help identify the sources of the problems and offer opportunities for improvement. The data could identify the specific performance metric of concern (e.g., CT image quality), along with the causative factors (e.g., technology in use, performing technologist, or specific exam type). The administrator could intervene by upgrading technology, offering the technologist in question additional training or providing staff with clinical in-services targeting the specific exam type of concern.

Another application for the technology is credentialing and licensing of medical service providers, which could be individual or institutional. If the data contained within the database are standardized, meta-analysis could be performed which provides for large sample size statistical analysis, taking into account the unique profile characteristics of the provider. This allows for difference in physician education/training, practice type, institutional demographics, and geographic location to be factored into the analysis.

As an example, an interventional radiologist requesting privileges to perform a new procedure could have his/her performance metrics compared to peers with a similar profile and have privileges granted or denied based upon objective performance data. In the event that the privileges were denied, the provider would be given specific data as to the deficiency and have ample opportunity for targeted improvement, part of which could be based upon trending analysis and part on continuing education. This same approach could arguably be a significant improvement to the existing procedure for institutional credentialing, such as the Joint Commission on Accreditation of Health Care Organizations. The current model of individual state licensing could eventually be replaced by a national model utilizing the performance metrics for standardized analysis.

These objective performance metrics could also be used to assist in hiring and professional advancement of health care providers, replacing the existing model which is largely subjective in nature. Using the standardized data analytics, a prospective employer could reliably compare and contrast multiple job applicants, taking into account profile differences of each individual and the institutions in which they practiced. In addition, the employer could apply differential weighting to the categories of analysis, in keeping with the specific job requirements. As an example, a hospital administrator is looking to hire a new administrative director of imaging services. The previous director has been dismissed due to problems with low employee morale and multiple complaints from patients and physicians. In the course of seeking a new director, the hospital administrator wants to find a qualified outside candidate, who is particularly strong in their interpersonal skills and consumer advocacy. As a result, the administrator preferentially places a high weighting to the customer service category of analysis.

The next application of the proposed technology is technology assessment which is an important factor affecting health care service performance. If one was to compare different CT scanners in a hospital imaging department, they would find that technology differences may impact a number of performance deliverables including operational efficiency (e.g., scan time), safety (e.g., radiation dose), and quality (e.g., image degradation due to motion). If replacing the technology in question is not a viable option, the database could be searched to identify other service providers using the same technology, with higher performance measures. The supervisory CT technologists in the imaging department with poor performance scores may elect to utilize the database to identify comparable institutional providers, using the same technology, with high performance scores. A query could be generated requesting communication between the two parties for the purpose of consultation, and if agreed upon, the relevant contact information could be provided. The supervisory CT technologists could exchange information regarding practice patterns (e.g., protocols, workflow, image processing) to provide insight as to how CT operations could be modified in the hopes of improving the deficient performance metrics.

Technology vendors could also use the performance data to identify the relative strengths and deficiencies of their own technology relative to that of their competitors. This provides an opportunity for future technology refinement and innovation. If, for example, a CT vendor learns that its technology is consistently providing lower safety scores (due to higher radiation dose), it could use these data to assist in the development of low-dose scanning protocols, filters, and image processing. The incremental success of these technology refinements could in turn be directly measured through "before and after" data analysis.

Another important application of the technology would be the ability to create customizable feedback, alerts, and prompts to consumers. These prompts could take a number of forms and could be the direct result of prior searches instituted by the individual consumer or changes in data of direct relevance to an individual consumer. An example of a targeted alert based upon the individual consumer profile could be seen with a patient receiving a certain medication (e.g., Glucophage) and who may be adversely affected by contrast administration for a scheduled imaging exam (e.g., CT). The computer database searches the patient and institutional databases to identify relevant clinical and technical data (e.g., renal function, historical contrast usage for the exam being performed). Automated alerts could be sent to the patient, referring clinician, technologist, and radiologist, along with technical and clinical recommendations for improved safety.

While the technology is primarily intended as a clinical empowerment tool, the vast array of standardized data and derived analytics provides a rich opportunity to perform medical research on quality, clinical outcomes, safety, and economics. In addition to providing for research, these data could also be used to identify those service providers with the highest clinical outcomes measures and use this information to establish "best practice" evidence-based medicine guidelines.

Conclusion

The proposed technology utilizes a series of objective and subjective data to create standardized databases for the purposes of quantifying performance in the delivery of medical services. The major categories of analysis include quality, safety, operational efficiency, customer service, and economics. These performance analytics could be evaluated on an individual or collective basis (i.e., composite score) to provide the health care consumer with a standardized and reproducible performance measure, relating to their own specific medical needs, subjective preferences, or priorities.

The various search analytics which could be derived from the system can be simple and straightforward (e.g., next available appointment) or extremely complex (e.g., complication rate of a specific surgical procedure in a specific patient population). These analytics could be derived through both manual and automated means, with the computer recording and tracking use patterns of the consumers and combining this with the individual end-user profile to create predictive search analytics. The end goal is for the computer database to identify specific patterns of use, relative to the individual end-user profile, clinical context, and required service deliverables.

In addition to providing health care consumers with real-time and portable search capabilities relating to service performance, this system could also be used for education and training, health care research, credentialing and licensing, comparative technology assessment, trending analysis, and automated (and customized) alerts related to individual health care needs. The goal of the proposed technology is to empower health care consumers, by providing them with data-driven knowledge, in order to improve clinical outcomes. The derived data analytics could also provide health care service providers with data-driven opportunities for education, training, and process improvement. In the end, an educated consumer (and service provider) will promote improved service deliverables and clinical outcomes.

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