There are many ways that one can obtain information about medical-term-use behavior by health-information consumers, for example, by using surveys and interviews. However, a transaction-log analysis of queries submitted to a health-information system is more comprehensive, accurate, and reliable. Web-transaction-log analysis, which refers to the study of users' online activities on a given Web site, has attracted the attention of researchers for many years. Web-transaction analysis can reveal first-hand and real-world behavior and interests of users. It enables researchers to better understand Web site user behaviors and the service quality that the Web site provides. It also can be used to optimize the effectiveness of information services. Web-transaction-log analysis of user queries can focus on a traditional online public access catalog (OPAC) system in a library setting (Cooper, 2001), public search engines (Hoelscher, 1998; Silverstein, Marais, Henzinger, & Moricz, 1999; Spink, Jansen, Wolfram, & Saracevic, 2002) or specialized environments such as an academic Web site (Wang, Berry, & Yang, 2003). Yi, Beheshti, Cole, Leide, and Large (2006) provided an overview of the frequency distributions of single terms, term pairs, and multiterm queries submitted to several history and psychology databases. In a health-related log analysis study by Herskovic, Tanaka, Hersh, and Bernstam (in press), the number of queries, number of distinct users, queries per user, words per query, common words, Boolean operator use, common phrases, result set size, MeSH categories, and other data were analyzed based on a one-day transaction log. Similarly, McCray, Ide, Loan, and Tse (2004), examined queries submitted to the ClinicalTrials.gov system to develop techniques to help support consumer health-information seeking. Another approach used on transaction logs is flow analysis, which focuses on users' visitation flows in and out of Web sites (Eick, 2001). These analyses reveal which Web sites direct visitors to a given Web site, and where visitors go to when they leave the site. Such knowledge can be valuable for promoting Web site contents. In a similar vein, transaction logs can provide data for assessing the market share of online health-information systems (Wood, Benson, LaCroix, Siegel, & Fariss, 2005).

Studies reveal that coword analysis is a powerful method for discovering associations among research topics, and for revealing hidden connections that may be not obvious (Callon, 1986; Coulter, Monarch, & Konda, 1998; Courtial & Law, 1989). Cluster density is used to measure the strength of the links that connect the words within a cluster. Cluster density was used as a good indicator of the cluster's capacity to maintain itself (Callon, Courtial, & Laville, 1991). Cluster centrality, which can be defined as the sum of all external link values (Turner, Chartron, Laville, & Michelet, 1988), can be used to assess the strength of a cluster's interaction with other neighboring clusters.

Clustering techniques are widely applied in medical research domains such as medical-image clustering (Masulli & Schenone, 1999), multidimensional heterogeneous microbiological data clustering (Tsymbal, 2005), molecular biology- and biomedicine-literature clustering (Nenadić, Mima, Spasić, Ananiadou, & Tsujii, 2002), and other medical-data clustering (Villmann & Albani, 2001).

Both traditional statistical approaches and information visualization approaches, which were first introduced by Robertson, Card, and Mackinlay (1989), can be applied to transaction-log data to analyze word usage patterns or behavior of health-information consumers. Information-visualization approaches may be more effective for this purpose than tables and values summarizing query characteristics. McCormick, DeFanti, and Brown (1987) define *visualization* as a method of computing that transforms the symbolic into the geometric, enables researchers to observe their simulations and computations, offers a method for seeing the unseen, enriches the process of scientific discovery, and fosters profound and unexpected insights.

Information visualization transcends traditional data analysis. The visual presentation generated by an information-visualization approach enables people to observe multiple perspectives of relationships among objects, which is beyond what a traditional statistical method can reveal. For instance, a clustering algorithm may produce clusters from a dataset, but it may not include how these clusters are related, and how an object in one cluster is related to objects in other clusters. Some clustering application packages may offer a hierarchical structure to reveal clustering relationship outcomes. In such a tree structure, siblings within a category can be easily identified, and adjacent subclusters or objects can be recognized. However, it is possible that if two clusters or objects are relevant to each other, they may be situated far away from each other in the tree structure. This is because in the tree structure, neighboring relations are used to display the closest clusters or objects, but this simple way of using neighboring positions is incapable of illustrating more complicated and multiple relationships among objects. In addition, it does not offer the degree to which any two objects are related to each other. In contrast, a visualization presentation provides a richer information environment, presents an overview of the displayed objects, illustrates the contexts of an interest area or object, and may offer an interactive means for information exploration.

There is a wide spectrum of available information-visualization techniques and applications, the main examples of which are Pathfinder associative networks (Chen, 1999; Fowler, Fowler, & Wilson, 1991; Schvaneveldt, Durso, & Dearholt, 1989;), self-organizing maps (Kohonen, 2001; Kohonen et al., 2000; Lin, Soergel, & Marchionini, 1991), and multidimensional-scaling (MDS) analysis (Kruskal, 1964a, 1964b; Torgerson, 1952; Walter & Ritter; 2002).

Another exploratory statistical technique that has been applied is factor analysis. One advantage of factor analysis is that it can recognize certain properties of correlations between identified variables that multidimensional-scaling and cluster analysis cannot recognize. For example, factor analysis has been used to segment the online user groups of a Web portal based on a transaction-log file (Jiang, Fu, Wang, Lin, & Chen, 2005) and computer user groups (Carson, 1975),

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