Public health — in search of a knowledge domain and expert reference advisory system

By Lillian L. Chan, M.A.L.S.
Head, Science Division

Robert J. Carande, M.L.S.
Science Reference Librarian

University Library
San Diego State University
San Diego, California 92182-0511

The rationale, development, and implementation of a computer-based reference advisory system (RAS) in public health called Public Health Librarian (PHL) are described. The general purpose of RAS is to provide reference tool suggestions to students in the highly diversified studies of public health in San Diego State University's Graduate School of Public Health. The multidisciplinary nature of public health lends itself to the design of RAS, which brings together key resources across the boundaries of social and medical sciences.

KNOWLEDGE DOMAIN OF PUBLIC HEALTH

Meeting the information needs of students, faculty, and researchers in the diversified field of public health remains a challenge to librarians. In the 1976 report of the Milbank Memorial Fund Commission on Higher Education for Public Health, the following statement summarized the situation:

> Public health is not a single scientific field organized in a uniform way. It is, rather, a configuration of objectives, policies, resources, and activities that is socially determined by a community, state, or nation. The nature of the organization and programs is pluralistic, and the knowledge base from which it functions is complex, multidisciplinary, and interacting [1].

A closer look at the development of higher education programs in public health in the United States reveals the evolution of a multifaceted field. The United States is a pioneer in establishing public health as a field of higher education [2]. Over the past seventy years, schools of public health have grown to twenty-four in number [3]. Among the accredited graduate schools, the major components of the public health program have included the traditional specialties such as preventive medicine, epidemiology, community health, industrial health, environmental health, and maternal and child health. In the mid-1930s, the administration and organization of medical care services became important public issues which were then gradually integrated into the public health curriculum [4]. A 1986 survey of the twenty-three CEPH (Council on Education for Public Health) accredited schools of public health in the United States concluded that the broad range of subject specialties in public health programs makes it essential for students to use resources often outside the special public health libraries [5]. Government publication libraries; major health sciences libraries; management sciences collections; physical, social, and behavioral sciences collections; and extensive interlibrary loan services are all essential supports for public health researchers and students.

The major components of the public health program have included the traditional specialties such as preventive medicine, epidemiology, community health, industrial health, environmental health, and maternal and child health.

The diversity of these subject disciplines helps to explain the complexity of introducing library resources to students in public health. At San Diego State University (SDSU), an expert reference advisory system (RAS) named Public Health Librarian (PHL) was designed to bring together, under one umbrella, key reference tools giving information sources of the main components of the public health program. In addition to covering the constituent subject disciplines within public health, attention was given to material suitable for graduate level students as well

as for practicing public health administrators, epidemiologists, biostatisticians, research scientists, and educators. A review of the library and medical literature was conducted revealing a sizeable body of work on using expert systems for clinical diagnosis* [6]. The use of expert systems for the provision of reference advice in libraries has been a more recent development†. Up to this point, however, there appears to have been no application of expert system techniques to the delivery of reference services in public health.

PUBLIC HEALTH LIBRARIAN

PHL is written in Turbo-Prolog®‡; it is one of several reference advisory systems available at the SDSU Library Science Division running on a stand-alone IBM PC clone. In creating the PHL-user-interface the programmer endeavored to adhere to the design principles discussed in Dumas' "Designing User Interfaces for Software" [7].

The program is composed of a menu tree, a dynamic database of selected menu choices, a permanent knowledge base, and a string manipulator. (A menu tree is simply the series of possible menus through which a user navigates; a string manipulator is that part of the program which compares menu choices to knowledge-base entry attributes that identify the entry's subject and format.) PHL's menu tree is a simple one consisting of a subject menu and a format menu. In determining subject options one theoretically aims at creating a menu whose sum total of options is equivalent to all the components of the discipline with minimal overlap [8]. This ideal is rarely achieved, especially when dealing with a discipline as multifaceted and multidirectional as public health. The method of developing subject options was primarily based on an analysis of the SDSU Graduate School of Public Health curriculum catalog and on a nationwide empirical study of public health library collection emphases [9].

The user traverses the menu tree creating a description of an information need which is stored in a dynamic database and then compared to entries in the knowledge base. A typical knowledge base entry consists of title, location (usually a call number), a brief description of the resource's strengths, and subject and format attributes. The stored information need is cross-referenced to these subject and format attributes by the string manipulator. Those entries that share the same subject domain and format as the patron's information need are then displayed.

A typical knowledge base entry consists of title, location (usually a call number), a brief description of the resource's strengths, and subject and format attributes. The stored information need is cross-referenced to these subject and format attributes by the string manipulator.

While the computer program runs some 800 lines, the relative simplicity of its logic is obvious in the following descriptive pseudocode:

Get menus
Record answers
Create information need profile
Get knowledge base
Compare need profile to knowledge base entries
Display corresponding entries.

PHL is accessible through a friendly front end programmed in PC-based HyperPAD®'s PadTalk®§ language, PHL being just one of several systems available on the RAS board. A session begins when PHL is selected and the compiled program is executed. PHL's first screen is designed to communicate to the user the overall objective, method, and parameters of the system.

The first interaction between the patron and PHL takes place at the subject screen (Figure 1). Specific subject options were determined using the methods described earlier. A nonalphabetical ordering of options was consciously chosen to slow the pace of selection, thus encouraging the user to reflect on possible choices. Selection consists of a single uppercase letter corresponding to the menu choice.

The next screen, the format menu, is divided into two parts. At the top of the screen the profile status identifies the subject chosen from the previous menu. The format menu in the main part of the screen lists nine possible information formats (Figure 2). These formats reflect both the variety of forms in which information can be found and the specific types of information requested by public health students at SDSU.

Once the patron completes the format menu, PHL displays those entries which are likely to satisfy the

* More than 270 articles on the subject "expert systems" have been indexed in *Index Medicus* since 1988.

† A search in *Library and Information Science Abstracts* (LISA) from 1969–1990 revealed sixteen articles on the use of expert systems for reference advice or other public service support; articles appeared mostly after 1987.

‡ Turbo-Prolog is a registered trademark of Borland International Incorporated.

§ HyperPAD and PadTalk are registered trademarks of Brightbill-Roberts Company, Ltd.

Figure 1
Subject menu

PUBLIC HEALTH LIBRARIAN

What is your subject emphasis?
Please use UPPER CASE letter.

A: Health Services Administration
B: Epidemiology
C: Health Promotion/Preventative Medicine
D: Environmental Health
E: Biostatistical Methodology
F: Maternal Child Health
G: Occupational Health/Industrial Hygiene
H: All Public Health
X: Exit Public Health Librarian

SELECT (then press ENTER):

Figure 2
Format menu

PUBLIC HEALTH LIBRARIAN

You chose Health Services Administration.
Please use UPPER CASE letter to choose format.

A: Journal & Report Literature
B: Conference Literature
C: Statistical Data
D: Definitions/Abbreviations/Acronyms
E: Encyclopedic Overviews and Literature Reviews
F: Research Centers/Organizations/Associations
G: Biographies/Directories
H: Writing Papers and Grant Proposals
I: Legislation
X: Exit Public Health Librarian

SELECT (then press ENTER):

subject and format of the request. For instance, a patron requesting journal literature on health services administration is referred to *Hospital Literature Index* and *Abstracts of Health Care Management Studies* among others. Each resource and its annotation are given an entire screen, with patrons working through at their leisure by pressing the ENTER key. A final page, which can be printed, lists the titles and locations of all relevant resources.

Currently the two-menu configuration has an additional screen (following the initial information screen) that asks the patrons to type their information requests using natural English language sentences. The sentences are then stored, along with the patron's selection input from the subsequent menu screens, in a separate file.

PHL BENEFITS

In addition to having a self-help reference system for the students, other benefits of the current configuration of PHL are:

- PHL provides an opportunity to review the comprehensiveness of reference resources in each specialty of public health. Strengths and weaknesses of the collection are identified. As a result, collection development efforts have been redirected to areas needing augmentation. In addition, selecting reference titles for PHL permits assessment of the reference collection in terms of its usefulness and relevance to particular kinds of patron information needs. This focuses attention on the reference collection as a dynamic resource instead of as a simple physical location.
- PHL cites reference tools housed in different locations of the library. Those universities having a separate public health library can take advantage of a RAS to include all appropriate reference titles housed in various libraries on campus.
- New titles can be added easily. Location changes and deletion of outdated materials can be made quickly. The system is also flexible in terms of the amount of information presented. In particular, because the knowledge base is stored in a separate text file, annotations can be quickly enlarged or shortened, depending on the nature of the material or the demands of the student populations.
- The natural language input screen and subsequent storage of search strategies allows comparisons between the actual information need and the menu choices selected. Some important questions can then be answered: How many of these information needs would have been realized by such choices? How well is PHL doing its job? Such data will quickly spotlight ambiguities in the menu options not otherwise immediately apparent. For instance, is the distinction between epidemiology and biostatistical methodology understood, or that between literature reviews and journal literature?

RAS AND EXPERT SYSTEMS

The term RAS is used to distinguish this program from a full-blown expert system. PHL is not a complete expert system for two reasons. First, PHL provides no explanation of its selections, an essential component of any expert system [10]. Second, the lack of any feedback loop within the program itself does

not allow immediate modification of reference advice. The program, as presently written, is not able to develop a user profile—important in those instances where the patron returns with the same question, having been unable to find the needed information from the first session's advice. The modification of reference advice in response to patron success/failure in finding information is an important part of the expertise brought to the negotiation by the reference librarian [11]. Without this expertise PHL cannot claim to be a complete expert system.

The modification of reference advice in response to patron success/failure in finding information is an important part of the expertise brought to the negotiation by the reference librarian.

Nevertheless, PHL does embody other, equally important characteristics of reference expertise. PHL provides highly subject-sensitive access to reference resources at SDSU without requiring the presence of a reference librarian. The brevity of the menu tree corresponds to the reference librarian's skill at averting needlessly drawn-out negotiations while maintaining diversity of possible paths (PHL permits over sixty possible routes) [12]. In addition, the choice of reference tools in the knowledge base reflects expertise in the selection of resources to resolve the likely information needs of public health students. This encoded expertise justifies PHL being called an expert RAS as long as its limitations are clearly kept in mind.

CONCLUSION

PHL is one example of the many creative uses for computers in the reference context. Not only does PHL positively impact direct reference services to students—it also provides important data for better identifying the information needs of public health students. The resulting data provide a foundation for collection development more in accordance with those needs. Since PHL is essentially a reference advisory resource using carefully constructed subject and format menus, it creates a coherent conceptual model that can be used to evaluate reference holdings.

Since PHL is essentially a reference advisory resource using carefully constructed subject and format menus, it creates a coherent conceptual model that can be used to evaluate reference holdings.

The storage of natural language input, creating a database of actual natural language requests keyed in by patrons, is an additional benefit. Future plans call for a natural language interface to assist the patron in selecting a "librarian" from among the many available on the RAS board. While there is no dearth of natural language processing models, most are based on human to human dialog. Few empirical data exist in the literature on the actual content of patron questions as these are expressed in front of a computer screen via keyboard. A natural language processor will need to examine this kind of input. Certain common surface features of the natural input will suggest characteristics the parsing algorithm must possess. (A parsing algorithm determines the syntactic structure of a sentence.) It may be that certain prepositions always precede subject identification, or that subject modifiers always correspond to a specific syntax. Additionally, particular conceptual presuppositions patrons bring to the organization of public health information will become apparent. Every use of PHL increases the amount of data available for future use.

The time spent developing this system has paid off not only in the resulting RAS, but in a closer understanding of patron needs and the relative strengths and weaknesses of the SDSU reference collection. The authors look forward to the development and introduction of other "librarians" to the RAS board.

REFERENCES

1. MILBANK MEMORIAL FUND COMMISSION. Higher education for public health, a report of the Milbank Memorial Fund Commission. New York: The Commission, 1976:6.
2. ROEMER MI. Schools of public health and their future role. Public Health Rep 1977 Oct;92(5):407–10.
3. COUNCIL ON EDUCATION FOR PUBLIC HEALTH. US schools of public health and graduate public health programs accredited for 1990. Am J Public Health 1990 Mar;80(3):369.
4. ROEMER, op. cit., 408.
5. CHAN L. Public health libraries: a survey of library support for schools of public health. San Diego State University, 1986. Unpublished report.
6. DE VRIES PH, DE VRIES ROBBE PF. An overview of medical expert systems. Methods Inf Med 1985 Apr;57–64.
7. DUMAS JS. Designing user interfaces for software. Englewood Cliffs, NJ: Prentice Hall, 1988.
8. IBID.
9. CHAN, op. cit.
10. BRACHMAN RJ, AMAREL S, ENGLEMAN C, ENGLEMORE RS ET AL. What are expert systems? In: Hayes-Roth F, Waterman DA, Lenat DB, eds. Building expert systems. Reading, MA: Addison-Wesley, 1983: 31–57.
11. VICKERY A, VICKERY B. Information science in theory and practice. Boston: Butterworths, 1987.
12. IBID.

Received March 1990; accepted October 1990