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Developing the injury prevention and safety promotion thesaurus, international English edition: An interdisciplinary tool for indexing and searching for research literature. Progress report 1

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Abstract

Introduction: Research relevant to injury prevention and safety promotion (IPSP) is conducted within more than 30 disciplines. A thesaurus under development identifies and clarifies important IPSP concepts from these disciplines and standardizes their corresponding terms.

The primary function of the IPSP thesaurus will be as an indexing and search tool so that users can conduct online searches with satisfactory completeness but with a minimum amount of irrelevant material. Without this cross-disciplinary thesaurus, researchers may miss relevant information in parallel or disparate fields, which in turn may lead them to recreate information already developed or to miss important connections that could advance each discipline.

Methods: The five-year development process involves (1) gathering candidate concepts and their terms by examining existing thesauri and glossaries, reviewing the archives of 30 professional

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journals, and analyzing search terms used by visitors to the SafetyLit website; (2) compiling the terms for IPSP-related concepts into a list with a categorical hierarchy; (3) convening panels of experts to advise the process and (4) publishing the final print and electronic versions of the thesaurus.

Progress: This paper describes the overall project and its progress so far. We are currently working on compiling the structured list (step 2). To date, more than 8800 IPSP-related terms have been selected for inclusion. These terms are being defined and placed into a suitable taxonomic hierarchy created for this project.

The paper also calls for additional expert panel member volunteers to provide their input.

Keywords: Safety concepts; Terminology; Online databases; Literature searches; Multidisciplinary research; Thesaurus construction

1. Introduction: Why the IPSP field needs a thesaurus

Professionals in many distinct disciplines publish reports relevant to the field of injury prevention and safety promotion (IPSP). These disciplines include: agriculture, anthropology, codes and standards development, consumer product testing and safety, demography, dentistry, economics, education, engineering specialties, ergonomics, fire suppression and prevention, geography, geology, industrial design, interior design, law, management and administration, media studies, medicine, meteorology, nursing, occupational safety and hygiene, oceanography, pharmacology, physiology, political science and policy, psychology, public health, public safety, social work, sociology, sports and kinematics, toxicology, transportation safety, urban planning, and other fields (Appendix A). Although many of the concepts may be similar, professionals from different specialties (Murphy, 2003) and from the many areas where English is spoken often use different words to describe the same concept. Further, concepts and the terms used to label them evolve over time. Finding relevant research literature requires knowing the right terms to use when searching numerous electronic and print abstracting services. The task of learning to use unfamiliar search terms and literature databases is large (Gore, 2003)—so great, in fact, that many professionals may not invest the time and effort necessary to find and read material outside their own discipline (Forsetlund and Bjørndal, 2001; Palmer, 1996; Pezeshki-Raad et al., 2004; Tenopir et al., 2004). However, a systematic search must be thorough and complete (Oxman et al., 1991; Oxman and Guyatt, 1991). Conducting a less-than-comprehensive literature search will result in a biased interpretation of research findings (Szklo, 1991). Thus, researchers may miss relevant, even critical, information in parallel or disparate fields, which in turn may lead them to recreate information already developed or to miss important connections that could advance each discipline. Practitioners and policymakers risk making unsound decisions—decisions that result in bad policies or useless activities.

In technical disciplines, important concepts are represented by the terms used to describe them (Condamines, 1995; Kageura, 1995). It is the use of these terms that distinguishes experts in a field from non-experts (McCray, 1998). Thus, experts in one discipline are unlikely to have sufficient fluency in the concepts and terminologies of other disciplines to be successful in finding reports by authors in other fields that are related to their area of interest. Specialized glossaries exist for most of these fields, but these glossaries focus upon the interests of each discipline, with IPSP issues comprising only a small portion of the concepts included.

A concept may be referred to by more than one term (synonyms) and the same term may refer to multiple concepts (homograph). Thus, a useful list of potential indexing and search terms (keywords) should include all of the terms for relevant concepts, including all synonyms and homographs. Before this list can become useful for indexing and searching for documents within a database, it must be transformed into a thesaurus (Box 1). All synonyms for each concept must be identified and, to facilitate indexing, one term selected as the preferred term from among the synonyms for each concept. (Once the preferred term and its synonyms are incorporated into an online database, anyone searching the database may use the preferred term or any of its synonyms to find material.) Each preferred term must then be sensibly placed into a taxonomy. Taxonomy is the set of preferred terms, each assigned within a hierarchical structure. Each preferred term in a taxonomy must fit into at least one hierarchical structure but may be assigned to more than one hierarchical structure. A search using a broader term (higher in the structure) will find all material indexed using narrower terms that are lower in the structure.

In 1999, with the intent of standardizing its search term vocabulary, the staff of SafetyLit (a free, online database of IPSP research) began recording and organizing the words and phrases used by SafetyLit website (http://www.SafetyLit.org) visitors to query the archives for published research articles. SafetyLit searches are performed by entering *textwords* (words from the title or abstract of each report) into an electronic Web-form. Each search is automatically recorded into an electronic log. Examinations of this log and of archived research abstracts demonstrated that there are many terms used to label the same concept. For example, there were twelve terms used to seek material on baby bath seats (Box 2), and each of the search terms was found to have been used in at least one published report. While a few user-query searches were conducted using two or three of these synonyms, essentially no searches were conducted using all the textwords necessary to find every report on the topic contained in the archive. When a well-constructed electronic thesaurus with assigned keywords is used to index the documents and facilitate searches, those seeking information need only use a single familiar term since any of the synonyms will retrieve the same list of reports.

The thesauri connected to most existing online literature databases are limited in scope to the interests of their intended audience. The EMTREE thesaurus for use with EMBASE and MeSH for use with MEDLINE-PubMed contain terms and structures designed primarily to be useful to researchers in the biomedical sciences (Elsevier, 2004; US National Library of Medicine, 2005). Similarly, the PsycINFO thesaurus is designed for use by researchers from the field of psychology (Gallagher, 2005). These are unsatisfactory for IPSP work because they each (1) lack the specificity necessary to index or research many injury problems; (2) do not contain many of the common terms for important concepts; (3) omit some important concepts altogether and (4) require the use of separate textword searches with each term for a concept to achieve a comprehensive result.

In 2003, the SMARTRISK organization in Canada published its Thesaurus of Injury Prevention Terminology (Chang et al., 2003). It provides a structured vocabulary of 1250 terms related to selected intentional and unintentional injuries. Its authors recognized its purpose and limitations: it was developed for use in Canada and it was not intended to encompass terms and concepts from every discipline involved in IPSP. The document is, however, the first known published thesaurus of injury prevention terms and demonstrates that a structured vocabulary can be useful in indexing and retrieving safety-related material.

Box 1. Thesaurus: a system of vocabulary control

A thesaurus contains a set of descriptors to be used in indexing and retrieving documents. This set of descriptors is called the classification scheme or system vocabulary. In the many cases where there are several terms that designate a single concept, it is necessary to control the system vocabulary such that an indexer can label the concepts appropriately and a searcher is led to the proper material. The system vocabulary includes all terms, morphological variants, synonyms, relationships between terms, and a structured hierarchy. Each synonym and morphological variant should contain a referral to the authorized or ''preferred'' term. The following example uses geo-political names and their adjectival forms to illustrate thesaurus hierarchical structure and term preference.

If searches are, in the absence of a structured vocabulary, performed using everyday natural language or using the jargon of the many disciplines that publish research in the injury prevention field, several issues pose problems.

Several terms (synonyms) may designate the same concept (e.g., grill guards = roo bars = bull bars; freeway = expressway). Often a thesaurus user, whether an indexer or a searcher, is looking for a certain concept and has in mind a particular term designating that concept. The term may be the preferred term or one of a number of synonyms. For the indexer, synonyms should contain notations that refer to the preferred term. Seekers of information may use the preferred term or any of its listed synonyms and obtain the same search result.

Morphological or orthological variants of terms (e.g., program = programme, tires = tyres, behavior = behaviour) are common. The preferred term must be selected and notations must be provided with the non-preferred variants that refer to the preferred term.

Homographs are words that, although spelled the same, designate different concepts (e.g., lift = elevator, lift = fork lift; traffic = road transportation, traffic = sale of narcotics). For instance, the word ''football'' has a very different meaning to people in the United States than it does in most of the rest of the world. Thus, when a researcher searches the published literature, he or she will need to distinguish whether any report concerns American football, Association Football (soccer), or Australian-Rules football before determining its usefulness. Depending upon the author, a report on ''lift-related injuries'' may refer to ''an enclosed platform for conveying goods or persons from one level to another'', or to ''a vehicle with a power-operated pronged platform that can be maneuvered under heavy loads and then raised to allow the load to be moved or stacked.'' The thesaurus must contain information to distinguish between these homographs. This vital guidance is contained in thesaurus fields called ''Scope notes''.

Abbreviations

USE The term that follows this prefix is the preferred term for indexing when a choice of synonyms exists.

UF (Used for) The term that follows this prefix is a non-preferred synonym. Searches conducted using a ''smart'' electronic thesaurus may be performed using the preferred term or any of its synonyms.

Box 1 (*continued*)

BT (Broader term) The term that follows this prefix represents a concept having a wider meaning. A search using this term will find documents under the Narrower Term(s) and documents under other Narrower Terms if they exist.
NT (Narrower term) The term that follows this prefix refers to a concept with a more specific meaning.
SN (Scope note) The information that follows this prefix consists of the term's definition and may contain additional guidance to the indexer.

The example uses selected (but not all) geopolitical terms associated with Australia.

Aborigine
SN: dfn—One of the original or earliest known inhabitants of a region. In common use, this term is not a label exclusively for indigenous Australians
USE: Indigenous populations

Adelaide
BT: South Australia

Aussie
USE: Australia

Australia
SN: The nation-continent south-east of Asia and between the Indian and Pacific Oceans
UF: *Commonwealth of Australia*
UF: *Australian*
UF: *Aussie*
BT: Oceania
BT: Australasia
NT: Australian Capital Territory
NT: New South Wales
NT: Northern Territory
NT: Queensland
NT: South Australia
NT: Tasmania
NT: Victoria
NT: Western Australia

Australian
USE: Australia

Australian Capital Territory
BT: Australia
NT: Canberra

Brisbane
BT: Queensland

(*continued on next page*)

Box 1 (*continued*)

Canberra
BT: Australian Capital Territory

Commonwealth of Australia
USE: Australia

Darwin
BT: Northern Territory

Hobert
BT: Tasmania

Indigenous populations
SN: One of the original or earliest known inhabitants of a region. This term should always be accompanied by one or more geo-political place terms

Koori
SN: dfn—Certain indigenous peoples of southern New South Wales and Victoria in Australia. Sometimes inappropriately used as a label for all indigenous Australians
USE: Indigenous populations

Melbourne
BT: Victoria

Newcastle
USE: Newcastle County Down
USE: Newcastle NSW
USE: Newcastle Upon Tyne

Newcastle NSW
BT: New South Wales

New South Wales
BT: Australia
NT: Sydney
NT: Newcastle NSW

Northern Territory
BT: Australia
NT: Darwin

Perth
BT: Western Australia

Queensland
BT: Australia
NT: Brisbane

South Australia
BT: Australia
NT: Adelaide

Box 1 (*continued*)

Sydney
BT: New South Wales

Tasmania
BT: Australia
NT: Hobert

Victoria
BT: Australia
NT: Melbourne

Western Australia
BT: Australia
NT: Perth

Sydney is a city within the Australian state of New South Wales and a search using the term "New South Wales" or the term "Australia" should return all documents indexed with the terms "Sydney". A search using the term "Newcastle NSW" should not retrieve documents concerning Sydney unless the document also concerns that city and has been indexed to include both of the city terms. However, a search using the terms "New South Wales OR Australia" would return all information indexed using either of the two city terms.

The term "Australia" is preferred over the terms, Commonwealth of Australia, Aussie, or Australian. In the alphabetical display of the thesaurus, this is indicated three ways:

Non-preferred terms (sometimes called "entry words") are displayed using italics in a printed thesaurus.

With the terms "Commonwealth of Australia" and the adjectival forms "Aussie" and "Australian" are the indicator USE meaning that the preferred term is "Australia".

With the term "Australia" are indicators (UF) for the words "Aussie", "Australian", and "Commonwealth of Australia" indicating that they are non-preferred terms.

A working example of a thesaurus connected to an online literature database is the MeSH system that supports searches of the US National Library of Medicine—PubMed interface to Medline. Information about the contents of MeSH and tutorials explaining how to use the MeSH thesaurus may be viewed at: http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=mesh.

Because the primary goal of a system of storage, indexing, and retrieval is to make relevant information readily available to the seeker, the selection of terms to represent sought-after concepts and the relationships between these concepts must be well-described. The process of creating a thesaurus of terms should include interested persons from all areas where English is spoken and from as many of the involved disciplines as possible. To this end, we held preliminary meetings in early 2004 with safety promotion practice experts attending the 13th Annual International Safe Communities Conference and with research experts at the 7th World Conference on Injury Prevention and Safety Promotion.

Box 2

Baby bath seats
Baby bath chairs
Baby bath rings
Baby bath supports
Baby bathtub seats
Bathing rings
Infant bath chairs
Infant bath rings
Infant bath seats
Infant bath support seats
Infant bathing rings
Infant bathtub seats

It was agreed that a multidisciplinary, multinational thesaurus for the field of injury prevention and safety promotion would be a valuable document, and plans were made to hold ancillary meetings at future conferences to work on its development.

Developing the first edition of the IPSP thesaurus is expected to take three to five years. Thereafter, the thesaurus will be updated regularly to accommodate changes in vocabulary and to incorporate new concepts and terms.

2. Value of the completed thesaurus

We are developing a thesaurus that clarifies important IPSP concepts and standardizes their corresponding terms. The primary purpose of the IPSP thesaurus will be to index documents so that users can conduct online searches from a variety of starting points to retrieve IPSP-related information with satisfactory completeness but with a minimum amount of irrelevant material. Other purposes could include providing definitions of terms, describing the scope of the concepts covered by each term, and demonstrating the interrelationships of concepts. All of these purposes will facilitate a greater understanding of the broad area of injury prevention and safety promotion (Aitchison et al., 2000).

Although there are many reasons for creating this thesaurus, it is not intended to impose an "official language" upon practitioners in any field. If the standard vocabulary is to be widely accepted and successfully used, it will need to include all the various terms for each concept, their spelling variants, and words in use by non-experts that refer to the key concepts (McCray, 1998). Such a thesaurus would not only be an indispensable tool for facilitating access to documents but would also provide a multidisciplinary glossary of the many factors related to injury prevention and safety promotion.

3. Methods: the project work plan and rationale for each action

From a list of thousands of terms related to IPSP concepts, it is necessary to identify those that are synonyms, those that are similar yet dissimilar enough to warrant different classification, and those that are clearly discrete. Among all synonym terms, one will be selected as the "preferred term" and listings for all other synonym terms will point to

the ''preferred term'' that will be used for indexing documents related to the concept. With a modern thesaurus tied to an electronic database, although the preferred terms are used for indexing documents, the preferred terms and all their synonyms and spelling variants hold equal status for searching and retrieval (Fayen, 2004). Concepts and terms must be arranged in a structure or taxonomy that establishes their hierarchical and associative relationships with other concepts (Box 1). Terms must be clearly defined so that indexers will have guidance when assigning keywords. These definitions, as well as any additional instructions for indexers, will be added to each term's ''scope note''.

We propose to develop the IPSP thesaurus using a process recommended by the International Organization for Standardization (ISO 2788–1986) (International Organization for Standardization, 2004). Where issues of thesaurus construction and organization are not covered by the ISO standard, we propose to follow the guidelines recommended by the American National Standards Institute (National Information Standards Organization, 1993).

During the process of creating the IPSP thesaurus, we plan to accomplish the following tasks (see Fig. 1):

1. Find concepts and terms that are candidates for inclusion in the thesaurus. The main criterion for the inclusion of a particular term in the thesaurus should be whether the term reflects common usage (International Organization for Standardization, 2004), either in general language or in the language of one of the many specialty fields that address IPSP issues. Thus, terms must be included if they are used in any of the contributing disciplines.

1a. Collect published tools (glossaries, keyword lists, specialist dictionaries, and existing thesauri) from the many disciplines that conduct research related to injury prevention and safety promotion.
These are being mined for concepts and terms relevant to IPSP.

1b. Scan the contents of selected professional journals from related disciplines for concepts and terms.
Thirty journals selected as a representative cross-section of IPSP-related disciplines are being examined (Table 1). Research reports, letters, and editorials from each journal's archives, along with each item's references and citations, are being scanned for relevant concepts and terms, which are then added to a list of potential thesaurus terms using the text editing software TextPad (2005). When the journal scanning process is complete, the list will be sorted into alphabetical order and filtered for duplicates.

1c. Examine SafetyLit server logs to identify users' search terms.
Terms and phrases entered into the SafetyLit search engine during the years 2000–2004 were imported into the TextPad text editor. In 2000, there were regular weekly visitors from at least 150 nations. By the end of 2004, SafetyLit had regular visitors from 184 nations. The international nature of users of the SafetyLit search engine allows identification of a rich variety of search terms.

1d. Request lists of terms from colleagues in the injury prevention and safety promotion field.

1e. Seek lists of terms from experts in other fields.

2. Create Web-based forums for receiving comments from professionals and from the public.

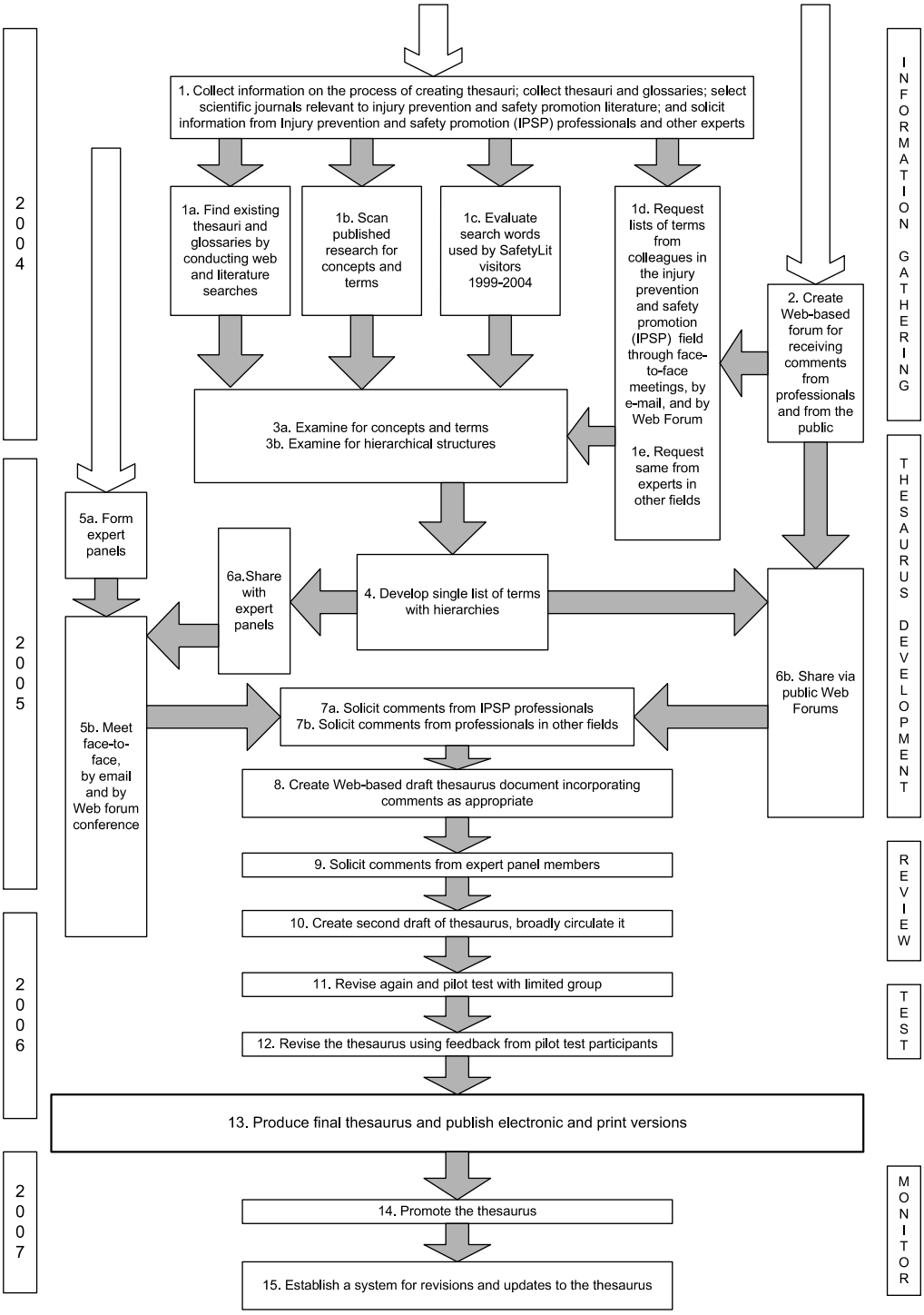

Fig. 1. Work flow safety promotion thesaurus project.

Table 1
List of journals examined for concepts and terms and the volume year scanning began

Accident Analysis and Prevention (1969)
Aggression and Violent Behavior (1996)
American Journal of Drug and Alcohol Abuse (1980)
American Journal of Sports Medicine (1980)
Annals of Emergency Medicine (1980)
Annual Proceedings of the Association for the Advancement of Automotive Medicine (1969)
Aviation, Space, and Environmental Medicine (1975)
British Journal of Sports Medicine (1980)
Community Safety Journal (2002)
Traffic Injury Prevention/Crash Prevention and Injury Control (1999)
Dental Traumatology (1990)
Disasters (1980)
Homicide Studies (1997)
Human Factors (1960)
IATSS Research (1988)
Injury Control and Safety Promotion/International Journal for Consumer and Product Safety (1995)
Injury Prevention (1995)
International Journal of Biometeorology (1970)
International Journal of Crashworthiness (1996)
Journal of Applied Fire Science (1991)
Journal of Fire Protection Engineering (1995)
Journal of Motor Behavior (1980)
Journal of Safety Research (1969)
Journal of Studies on Alcohol (1975)
Journal of Wilderness Medicine/Wilderness and Environmental Medicine (1990)
Perceptual and Motor Skills (1975)
Safety Science/Journal of Occupational Accidents (1976)
Suicide and Life Threatening Behavior (1980)
Toxicology and Applied Pharmacology (1970)
Transportation Research, Part F (1998)

The Internet provides a simple way to hold conferences without the need for attendees to travel. World Wide Web-based meetings may be open to anyone with an Internet connection or limited to those provided with a password. Initially, the Web-based thesaurus meeting participants will be closed to the general Internet community. Later, a system to receive comments from the public will be added.

These meetings may be held in real-time or, because participants in this project will be from many time zones, via a message/comment system. This will allow participants to provide information, other participants to comment upon it, and for others to respond to the comments.

The software package phpBB (2005) will provide the Web infrastructure for these forums. This software allows a forum leader or moderator to control what messages are posted and thus will reduce the likelihood that unwanted commercial messages interfere with productive dialog.

3a. Examine the lists, logs and specialist tools (items 1a–1e) to identify relevant concepts and the terms that label those concepts.

An early requirement in the development of a thesaurus is establishing the concepts that should be included and selecting the preferred term to designate each concept. When concepts (and the terms that describe them) are selected, it is also necessary

to keep in mind the organizational structure of the thesaurus (see 3b below). Decisions must be reached concerning the concepts that will receive terms of their own and the concepts that may be described by using more than one term. For example, the concept of operating a bicycle while intoxicated could probably be described with a combination of terms such as "alcohol drinking" and "bicycle riding" because there is not a large body of literature on the subject. However, the concept of driving a motor vehicle while intoxicated may benefit from its own term because there is a very large amount of published research on the topic and there will likely be several sub-terms for concepts that will be listed below the term for the concept "driving under the influence".

The list of terms should be extremely inclusive. It is important that terms be selected with the user's point of view in mind (Smith, 1984). Although the primary focus of the IPSP thesaurus is to allow for consistent indexing of materials to enable professionals to conduct topical searches more easily, we recognize that laypersons will also be likely to use it to seek material. Thus, lay terms should also be considered for inclusion.

3b. Gather and evaluate options for organizational structure.

To create a semblance of order out of an alphabetical list of thousands of terms, candidate terms will initially be placed in a temporary ad hoc structure using MultiTes (2004) software. This software facilitates the creation and management of thesauri, taxonomies and other types of controlled vocabularies. It provides automatic creation and deletion of reciprocal entries for standard relationships [i.e., cross-references between synonyms and one or more preferred terms (equivalence relationships); between broader and narrower terms (hierarchical relationships) and between related terms (associative relationships)].

4. Develop a single list of terms organized in an ad hoc hierarchical structure.

The development of a single list is a key step for the successful involvement of expert panel members from disciplines other than those normally considered IPSP related. Among the thousands of terms, busy professionals will need some means of focusing-in on the terms relevant to their area of expertise.

Even in this preliminary phase, constructing the hierarchy of terms must be done with care. A variety of classification schemes already exist for public health surveillance of the nature (WHO Collaborating Centres for Classification of Disease, 1992) and external causes (ICECI Coordination and Maintenance Group, 2004; Nordic Medico-Statistical Committee Working Group for Classification for Accident Monitoring, 2003) of injury; of occupation-related injuries (US Department of Labor—Bureau of Labor Statistics, 2001); of road transport incident data (MMUCC Development Team, 2003) and of behavioral risk-related disorders (Task Force on DSM-IV of the American Psychiatric Association, 2000). Their suitability for their stated purposes notwithstanding, however, these schemes are mostly inappropriate for organizing terms in a way that facilitates the indexing or retrieval of published research. Individually, or even as a group, these classification systems do not encompass all the concepts necessary for organizing research on the occurrence and prevention of injuries and on the science of safety promotion. That said, it is nonetheless necessary for the terms and concepts in the IPSP thesaurus to be, at least, compatible with the terminology used in these other systems.

An issue of growing importance is that of evidenced-based practice. The demand for reports of high methodological standards is increasing as more people recognize the value of evidence-based practice. The labels, if any, used by the authors to describe

these designs will differ across disciplines and through time. Sometimes, the research methods are described in one or more sentences of the narrative without a label (e.g., cross-sectional survey, randomized trial, etc.) that summarizes the research design. Decisions must be made when selecting the terms used to describe evidence-based research and how these terms should be placed in the hierarchical structure. In aiming to incorporate evidence-based terms, we recognize that this can present problems for the indexers who use the completed IPSP thesaurus. While a professional indexer is expected to have some knowledge in a particular field, there should be no expectation that the indexer is an expert in statistics or research design. An indexer must be able to apply evidence-based research terms without having a background in research science and without needing to carefully read and comprehend each paper's methods section before assigning the appropriate term. Thus, great care will be needed when selecting the terms describing research methodology.

It is likely that the process of selecting the preferred term from a list of synonyms will be simple for most concepts and contentious for a few (e.g., for labels of human qualities and behaviors). For example, consider the terms "wife abuse", "spouse abuse", "domestic violence", "family violence", and "partner violence". Reaching agreement on the preferred terms and hierarchical structure among these will require discussions of controversial social issues (Committee on the Training Needs of Health Professionals to Respond to Family Violence, 2002). Even the proper use of standard terms within the IPSP field (e.g., "accident") can be debated (Pless and Hagel, 2005).

In making a decision about including or excluding a term, it is necessary to determine: (1) if research documents exist that make a distinction between the term in question and terms for similar concepts; (2) if there is a sufficient quantity of documents to warrant the addition of more specific terms; (3) if the distinction would be better made using a completely different term, possibly within a different categorical hierarchy and (4) if searchers are likely to seek documents with these labels even if documents are not in the archive. There will be many such complications among the thousands of possible terms for an injury prevention and safety promotion thesaurus.

It is important to avoid terms which may connote or imply racism, sexism, or a judgment of deviancy or aberration (Elsesser, 1984; Berman, 1984). This is not only an ethical issue. From a purely practical perspective, words that users find offensive are unlikely to be as effective as more neutral, less emotionally laden terms. Identifying these problem words will be complicated by the diversity of pejorative labels in the various English-language dialects incorporated in this thesaurus.

5a. Form panels of experts.

Plans are underway to convene volunteer panels of experts not only from the fields of injury prevention and safety promotion but also from the other listed fields. Ideally, the panels will include representatives of each specialty who have both knowledge of the subject and experience with library science or reference information storage and retrieval.

5b. Hold meetings with expert panel members face-to-face, by email, and by Web forum.

The expert panels will meet at regularly scheduled specialist conferences within each discipline and (because of the cost and the difficulties associated with scheduling telephone conference calls for international panel members) via Internet forums.

6a. Share list created in Step 4 with expert panel members from the IPSP field.

Both electronic and print versions of the list will be made available to panel members.

6b. Share list created in Step 4 with other professionals and the public.
In addition to electronic and print versions of the entire IPSP thesaurus, lists of terms specific to each panel member's own discipline will be made available.

7a. Seek input from injury prevention and safety promotion specialists.
The scope and structure of the IPSP thesaurus must reflect the specific needs, viewpoints, and priorities of the users to be served. By making this process collaborative and multinational, we help assure that the thesaurus will be well-constructed and well-received by IPSP specialists around the globe.
Panel members will be asked to answer the following questions: (1) Have any concepts been omitted? (2) Are all listed concepts discrete, or may some be combined? (3) Have all of the terms that label each concept been included? and (4) Is the structure appropriate for indexing and finding documents?

7b. Seek input from specialists from other fields.
This step requires careful preparation so that these experts are not bothered by trivial issues or imprecise questions (Soergel, 1974). The term list will be segregated into topics so that experts may, if they choose, focus upon only the words and concepts within their specialty area. To make this thesaurus useful, specialists from each discipline, especially those who have some knowledge of indexing and classification, will assess each concept term and its placement in the hierarchy. The experts will be asked to comment upon and provide additions to the terms in their specialty area. They will be given the opportunity to provide comments upon terms and concepts from disciplines other than their own.

8. Produce a Web-based working draft with synonyms grouped together and with a simple categorical structure.
Using input from the expert panels, a working draft of the thesaurus will be produced and placed on the IPSP thesaurus website. This step will allow panel members to examine and comment upon the hierarchical structure more thoroughly. Terms must be placed in a hierarchy such that those that are more specific are listed under those that are more general. Care must be taken to avoid inadvertently linking unrelated concepts. For example, the term "after-market modifications" is used to describe changes made to land vehicles (e.g., addition of grill guards, fog lights, window tinting film, custom vehicle suspension systems). It may be tempting to place that term below land vehicles in the thesaurus structure. However, other products are commonly modified by consumers from the manufacturer's original design. These products may have nothing to do with transportation (mobile phone face plates with flashing lights, special grips added to hand tools, personalization of sports gear, adjustments to firearms, etc.). Thus, although subheadings of the concept aftermarket modifications may be contained under product-specific headings, the main entry must be placed above any product-specific terms and independent of any particular product category. If the thesaurus structure is not properly ordered, searches will deliver irrelevant results.

9. Solicit further comments from expert panel members.
Panel members will be encouraged to provide additional input into the structure and content of the thesaurus before a second draft version is produced and broadly circulated for public comment.

10. Produce a second draft thesaurus and broadly circulate it for comment.
This early draft will be examined not only by injury prevention and safety promotion experts but also by volunteers from the other related fields. It is likely that a subject

expert can provide useful suggestions in fields that are not his or her own—experts in a peripheral discipline are, from the particular viewpoint of their specialty, likely to bring to light aspects that have been overlooked by the experts from the discipline from which the concepts and terms arose (Soergel, 1974). This step has the added advantage of helping to ensure that the terms have the proper meaning to experts regardless of their specialty.

11. After incorporating the comments from Step 10, pilot test the thesaurus by indexing a collection of documents and conducting searches.
    The aim of the pilot test is to obtain feedback that will help highlight inconsistencies or areas of confusion in the thesaurus terms or structure. Skilled volunteers with experience in indexing will be provided with abstracts from journal articles and conference proceedings to index using preferred terms (keywords) from the draft thesaurus. Several indexers will be assigned the same material. Their work will be compared to qualitatively and quantitatively assess consistency in assigning terms.
    Once the documents have been indexed, other volunteers—some skilled in information reference services and others with little information services experience but with expertise in IPSP issues—will be asked to perform searches for selected material from the documents that were indexed. Searchers will be given questions of a very general nature that may be addressed by selecting the appropriate search terms and using them to retrieve material. Given that the thesaurus developers will know the full contents of the database and the keywords that were assigned by the indexers, it will be possible to assess the thesaurus as a tool for retrieving all relevant (and for avoiding irrelevant) documents in the database.
12. Revise the thesaurus using information collected from the pilot test.
    Feedback from pilot test participants will be incorporated into the final draft of the document.
13. Produce the first edition of the thesaurus.
    Following any necessary editorial clean-up work and layout for production of the print version, the IPSP thesaurus will be published in hard copy and online.
14. Promote the thesaurus.
    Panel members, through their organizations, will assist with broadly informing the various disciplines of the IPSP thesaurus' existence, give presentations at conferences, and reference the thesaurus, when appropriate, in reports of their research.
15. Establish a permanent system for updates.
    A thesaurus document or project is never complete. Regular updates are necessary to incorporate new concepts or terms, changes in labels for concepts already included in the thesaurus, and changes in geopolitical place names.

4. Progress to date

At this time, we have collected 142 glossaries, regular and specialist dictionaries, existing thesauri, and classification schemes from the professional disciplines listed in the introduction. We are continuing to seek others for evaluation. Selected terms from these sources are being added to the working list of IPSP thesaurus terms. A current list of the existing resources that have been reviewed is available on the IPSP thesaurus website (http://www.injurypreventionthesaurus.com).

The 471,283 terms collected from SafetyLit search logs were distilled to develop a list of relevant and unique terms. Elimination of duplicates removed 398,552 log entries. Removing terms that were clearly keyboard entry errors eliminated 26,236 items. Removal of obvious outlier phrases (e.g., "persons killed during robberies of elite-class casinos") eliminated 1,837 items. After removing author and place name searches (39,151 names) 5507 unique search terms remained.

Terms are also being gathered from the review of the reports published in the 30 journals listed in Table 1 and are being added to the list of potential thesaurus terms.

More than 8800 injury and safety-related and 1800 geopolitical terms have been added to the list of words under consideration, and a working hierarchical structure has been created. This list is updated frequently and is available online at http://www.injurypreventionthesaurus.com.

5. Comments

The field of information retrieval is constantly evolving. However, new online search systems, such as Google Scholar (Google Labs, 2005), still require that searchers know all of the different words that may apply to a concept in order to conduct a thorough search. These new online search engines have the same limitations as other text word-based retrieval systems. The information seeker must know all of the words that may define each concept of interest. Only after documents are indexed using a thesaurus and controlled vocabulary will the searcher be able to find material containing the jargon of an unfamiliar field.

To our knowledge, this endeavor will create the first English language thesaurus of IPSP that maps concepts across many disciplines at an international level.

In recognition of the efforts of the large number of volunteers necessary to complete this project, the IPSP thesaurus will be made available online to all at no cost. If you would like to participate in one of the panels or offer your comments, please contact David Lawrence at david.lawrence@sdsu.edu.

An immediate application of the IPSP thesaurus will involve its use to index all material available through SafetyLit. Once this tool is incorporated, users will be able to search for abstracts of articles from over 1600 professional journals, reports from scores of government agencies and organizations, and proceedings of relevant conferences in a more comprehensive and systematic fashion. It is also envisioned that this tool will have a much broader application. Specifically, the IPSP thesaurus offers injury prevention resource centers, whether in a physical (e.g., libraries) or electronic (e.g., Web-based) context, a taxonomic structure that facilitates consistent indexing of information resources, ultimately enabling injury prevention professionals to conduct more effective and efficient information searches.

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Appendix A

Visit the thesaurus website (http://www.injurypreventionthesaurus.com) to view the thesaurus resource documents listed by the professional discipline from which each arose. The most recent versions of the IPSP concept term list and the geopolitical term list are also available.

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