Information retrieval strategy in functional gastrointestinal disorders with emphasis on the sensitivity and precision

Farideh Osareh, Roghayeh Ghazavi, Peyman Adibi

Abstract:
BACKGROUND: To determine functional gastrointestinal disorder (FGID) aspects, there should be a guideline to retrieve documents in this area for researchers with different levels of knowledge about these disorders. The objective of this study was conducted in order to compile different terms related to different categories of these disorders and to determine the sensitivity of them.

MATERIALS AND METHODS: To set a proper search, some strategies were used to enhance the precision and sensitivity. After preparing the list of terms according to some sources such as thesauruses, Rome classification, related review articles, and so on, they were divided into seven categories and the queries in each of them were searched on the Scopus.

RESULTS: The sensitivity for each of the terms in categories were calculated, and the highest values were as follows: FGIDs with 189 queries (“digestive* system* function* disorder*”), irritable bowel syndrome with 142 queries (“irritable colon*”), functional constipation with 13 queries (“function* disorder*” and constipation), functional diarrhea with 16 queries (“function* disorder*” and diarrhea), functional bloating with 29 queries (“function* disorder*” and bloat*), Functional Dyspepsia with 29 queries (“functional dyspep*”), and neurogenic bowel with 7 queries (“neurogenic bowel*”).

CONCLUSION: Given the values calculated for sensitivity, and considering the type of study, in order to retrieve documents in this area, it is necessary to apply all or part of the proposed queries to the search strategy.

Keywords: Functional gastrointestinal disorders, information retrieval, precision, sensitivity (recall)

Introduction

Functional gastrointestinal disorders (FGIDs) are common disorders in gastrointestinal (GI) sciences, which can be seen in any part of the GI tract from the esophagus to the rectum. Today’s laboratory and anatomic findings have not yet fully justified the cause of these disorders.[1] This is despite the fact that a lot of research has been carried out in this regard. Although FGIDs are not associated with mortality, they impose high costs on society due to the absence of a definitive diagnosis or treatment. In the meantime, patients with irritable bowel syndrome (IBS) consume a large amount of financial resources of health-care systems, and yet, this disease reduces the daily performance of these patients.[2]

IBS is one of the functional GI disorders associated with chronic abdominal recurrent pain, diarrhea, constipation, and bloating (or distension). Like other functional disorders, IBS can be influenced by cultural, social,
osareh, et al.: information retrieval strategy in fgid

environmental, and behavioral factors.[3] for the first time in 1892, osler called this disease “mucous colitis”. characteristics that he described about this disease were mucorrhea and abdominal colic, which had most commonly been seen in patients with psychopathological symptoms. since then, the said syndrome has been referred to by different terms including spastic, irritable, and nervous colon.[4]

dyspepsia is another gi disease, which encompasses 30%–40% of cases going to gastroenterologists, out of whom 50%–60% suffer from functional or nonulcer dyspepsia.[3] therefore, dyspepsia falls in a different category of functional diseases, which imposes high costs on patients and on the health-care system. this disease, which causes upper abdominal pain and discomfort, is associated with symptoms such as early satiety, feeling full after eating, belching, bloating, and feeling nauseous.[3]

many efforts have so far been made to achieve a unique yet efficient method to diagnose fgid. one of them is the classifications of these disorders in the rome questionnaire, whose latest version, i.e., the rome iv questionnaire, presented in 2016, is currently the main tool for diagnosing and categorizing different types of fgid. the early version of it was developed by a group of scientists in 1989 through a questionnaire using the delphi decision-making method and has been revised several times since then. diagnosis and classification in this questionnaire are carried out based on a variety of symptoms associated with fgid.[2]

depending on different editions of this classification, fgids are divided into seven general categories, each of which consists of several disorders:[6-8]

1. category a: esophageal disorders
2. category b: gastroduodenal disorders
3. category c: bowel disorders
4. category d: centrally mediated disorders of gi pain
5. category e: gallbladder and sphincter of oddi disorders
6. category f: anorectal disorders
7. category g: childhood functional gi disorders.

when conducting a comprehensive review of the literature in this area, it is worth noting that the area of fgid has been studied and investigated from different perspectives, and the role of psychology, neurology, nutrition sciences, traditional and herbal medicine, and most importantly gi sciences can be seen in it. hence, given that this group of disorders is studied and investigated in different areas in order to determine their aspects, it seems necessary that there should be a guideline to retrieve documents in this area at various stages of these studies and for researchers with different levels of knowledge about these disorders. based on the searches made, and given the absence of such a guideline in the literature of this area, even in incomplete search strategies seen in review articles, this study was conducted in order to compile different terms related to different categories of these disorders and to determine the sensitivity (recall) of each of them in order to retrieve relevant documents in databases. so that using these terms, an appropriate search strategy can be set to retrieve documents related to the entire area and/or to each of its subsets in databases. the recovery of information has always been known as one of the most basic needs of specialists for development and progress.[9]

hence, this can be useful for different aims such as writing a review article, enhancing advanced knowledge in this field, conducting a scientometric study, and so on. given that fgids are mainly associated with symptoms related to the middle and lower gi tract including irritable bowel syndrome, functional constipation, functional bloating, functional diarrhea, and unspecified functional bowel disorders,[10] this study puts emphasis on the terms of these two categories.

materials and methods

this is an applied study, which was conducted using a descriptive method and through providing a protocol for retrieving documents from databases. in order to set a proper search strategy, it is necessary to consider two measures or indicators: sensitivity (recall) and precision, which are decision-making criteria for achieving the best search strategy at different stages.

sensitivity means a system’s capability of retrieving relevant documents, and precision means the system’s capability of excluding irrelevant documents. these are both used to describe a system’s capability of purifying information, and through that, we evaluate the system’s capability of retrieving what we want and exclude what is not compatible with our needs. table 1 shows these measures.[11]

hence, the sensitivity (recall) and precision ratios are as follows:

the number of relevant retrieved documents/the total number of relevant documents available in a set = the sensitivity (recall) ratio (a/[a + c]).

the number of relevant retrieved documents/the total number of retrieved documents = the precision (relevance) ratio (a/[a + b]).

| Documents | Relevant | Irrelevant | All |
|-----------|----------|------------|-----|
| retrieved | a        | b          | a+b |
| unretrieved | c      | d          | c+d |
| all       | a+c      | b+d        | a+b+c+d |

Table 1: information retrieval performance measures
The two measures, sensitivity and precision, have opposite effects on the exploration process, which means that any attempt to increase the sensitivity inevitably leads to reduced precision, and the closer the precision is brought to a desirable level, the more the sensitivity decreases.\(^\text{[11]}\)

When setting a subject search strategy, the following can lead to increased precision: customizing a search field (subject or title), nonuse of general topic concepts, hybrid searches and optimal use of Boolean operators, and use of phrase searching. The following can lead to increased sensitivity: use of wildcard or truncation operators and use of different synonyms for topics in both keyword searching and controlled searching.

According to what was presented, and considering the purpose of the study, in order to increase the search precision, the subject field (title, abstract, and keywords) was considered for searching for the set terms. Phrase searches within the quotation marks were used for phrases. In order to limit some words in the intended domain, combined searches were carried out using relevant words and the AND operator. General or wide terms or terms with dual meanings were not included in the searches. In order to increase the sensitivity, terms written in different ways were searched for both in full and using truncation operators. Furthermore, synonyms available for each term were extracted as far as possible using the following four steps:

**Step 1: Use of controlled words in thesaurus, Medical Subject Headings, and Emtree**

In addition to using controlled vocabularies (at databases where this is possible), the two functions or advantages of using thesauri in detecting terms related to the subject (FGID) are as follows: (a) use of the unselected synonyms (Entry Terms), and (b) the retrieval of articles allocated to the desired heading, and the review of retrieved articles in order to extract keywords related to this subject in previous years.

In Medical Subject Headings (MeSH), there is no independent category for FGID, but part of relevant instances can be sporadically seen in the subheading “Gastrointestinal Disease” under the main heading “Disease > Digestive System Diseases”, which is related to this type of disorders. For example, under the subheading (qualifier) “Colonic Disease”, the subheading “Colon Diseases, Functional” is about functional disorders related to the colon, which itself includes the following subheadings:

**All MeSH categories**

Disease categories
  - Digestive system diseases

Gastrointestinal diseases
  - Intestinal diseases
  - Colonic diseases
  - Colonic diseases, functional
  - Colonic pseudo-obstruction
  - Irritable bowel syndrome
  - Neurogenic bowel.

The synonyms related to each of the above subject headings can be retrieved in the Entry Terms section of their catalogs, such that the following are listed for this section under IBS:

- Irritable bowel syndromes
- Syndrome, irritable bowel
- Syndromes, irritable bowel
- Colon, irritable
- Irritable colon
- Colitis, mucous
- Colitides, mucous
- Mucous colitides
- Mucous colitis.

In addition to MeSH, terms related to this type of disorders and their synonyms can also be retrieved in Emtree (related to the EMBASE database). The main category of these disorders is digestive system function disorder, which falls under the following subject hierarchy:

**Emtree**

Diseases
  - Physical disease
  - Physical disease by anatomical structure
    - Digestive system disease
    - Digestive system function disorder.

Synonyms corresponding to the subject are presented under the two subheadings of this category: Intestinal Function Disorder and Stomach Function Disorder. For instance, synonyms corresponding to the main heading are presented as follows: digestion disorder, digestive disorder, digestive disturbance, digestive insufficiency, FGID, GI dysfunction, GI function disorder, GI tract function disorder, and maldigestion.

**Step 2: Using different editions of the Rome classification (the Rome foundation’s classification for functional gastrointestinal disorders)**

This classification, whose details and related sections were presented in the introduction, has so far had four different editions. The information provided in each of the four editions can be used as a guideline to determine the intended terms.

As mentioned before, given that FGIDs are mainly associated with symptoms related to the middle and
lower GI tract including irritable bowel syndrome, functional constipation, functional bloating, functional diarrhea, and unspecified functional bowel disorders.[10] Categories B and C (related to the small intestine, large intestine [colon], and anus) are more prevalent than other categories,[2] and this study puts emphasis on the terms of these two categories [Figure 1].

Step 3: Searching for review articles related to this area and retrieving the words used in it
At this stage, given the high precision of meta-analysis articles in strategy setting, we searched for related articles in PubMed according to the known terms in studied field retrieved from previous steps and limited the types of articles to the aforesaid type. After reviewing the titles of retrieved articles and choosing articles with general subjects in the intended area, we investigated the proposed strategy in a number of these articles and extracted the appropriate terms.

Step 4: A search using a high-sensitivity strategy for articles and a review of them
At this stage, in order to increase the sensitivity of the retrieval process, and to complete the list of relevant terms, we conducted a search based on more general subjects, and by reviewing the retrieved articles, we determined other specialized terms related to the area of FGID used in the articles and added them to the list. We also added to this list possible combinations of words.

After preparing the list of terms related to the studied area, we divided these terms (or queries) into seven general categories as follows:
- FGIDs
- Irritable bowel syndrome
- Functional constipation
- Functional diarrhea
- Functional bloating
- Functional dyspepsia
- Neurogenic bowel.

In each of the above categories, we carried out the searching of documents on the Scopus database. Scopus is covered all subject areas, and because of the subject diversity of the studied field, it helps us to retrieve the documents in all these subject areas. Furthermore, this database is covered documents in most languages, and the coverage of the journals in this database is more than the Web of Science database. As mentioned before, we considered some tips in search strategy to enhance the sensitivity and precision, such as customizing a search field, nonuse of general topic concepts, hybrid searches and optimal use of Boolean operators, use of phrase searching, use of wildcard or truncation operators, and use of different synonyms for topics in both keyword searching and controlled searching. Maximum precision was applied while taking account of the intended limitations. Hence, we calculated the sensitivity of each of the terms in this study. In each of these categories, we considered the number of instances, retrieved based on the total number of synonyms, equivalent to all relevant documents in the database, and the number of instances, retrieved for each of the terms, equal to the number of relevant retrieved documents, and then calculated the sensitivity percentage for each of the terms based on these two values. Hence, the value obtained for each of the terms represents its sensitivity and proportionality to the search for documents in that subject.

Results
The results of queries set in each of the seven categories related to FGID as well as the number of retrieved documents and their sensitivities are presented in this section.

Table 2 separately presents all results retrieved through all queries of the seven categories after removing the overlaps, and the last row provides the total number of results related to the area of FGIDs in a pure form after removing the overlaps.

The 189 are instances that were generally related to the entire domain of FGIDs, and which could not be included in any of the other six categories. The highest value (40.75%) was related to the query “digestive*

### Table 2: The total number of the results of subcategories related to functional gastrointestinal disorders

| Category number | Category name   | Number of queries | Number of documents |
|-----------------|-----------------|-------------------|---------------------|
| 1               | FGID            | 189               | 11,046              |
| 2               | IBS             | 142               | 21,781              |
| 3               | Functional constipation | 13 | 2683 |
| 4               | Functional diarrhea | 16 | 1647 |
| 5               | Functional bloating | 29 | 751 |
| 6               | Functional dyspepsia | 29 | 5375 |
| 7               | Neurogenic bowel | 7 | 535 |
| Sum             |                 | 425               | 35,521              |

IBS=Irritable bowel syndrome, FGID=Functional gastrointestinal disorders

### Figure 1: Functional gastrointestinal disorders – Groups B and C

B. Gastroesophageal Disorders
- E1. Functional dysphagia
- E1a. Postprandial distress syndrome (PDS)
- E1b. Dysphagia

B.2. Gastroesophageal reflux disease
- B2.1. Nonerosive reflux disease (NERD)
- B2.2. Erosive esophagitis
- B2.3. Barrett’s esophagus
- B2.4. Esophageal motility disorders
- B2.5. Esophageal neoplasms

B.3. Oesophageal motor disorders
- B3.1. Achalasia
- B3.2. Pseudoachalasia
- B3.3. Eosinophilic esophagitis
- B3.4. Non-erosive reflux disease
- B3.5. Esophageal motility disorders
- B3.6. Esophageal neoplasms

C. Bowel Disorders
- C1. Irritable bowel syndrome (IBS)
- C1a. Irritable bowel syndrome (IBS-C)
- C1b. Irritable bowel syndrome (IBS-D)
- C1c. Irritable bowel syndrome (IBS-M)
- C1d. Functional bloating
- C1e. Functional constipation
- C1f. Functional diarrhea
- C2. Functional constipation
- C3. Functional diarrhea
- C4. Functional bloating/diarrhea
- C5. Unspecified functional bowel disorder
- C6. Obstructive defecation
- C7. Retained stool
- C8. Obstetric trauma
- C9. Celiac disease
- C10. Inflammatory bowel disease
- C11. Colon cancer
- C12. Rectal cancer

D. Anal and Perianal Disorders
- D1. Anorectal disorders
- D1a. Hemorrhoids
- D1b. Anal fissures
- D1c. Anorectal abscess
- D1d. Anorectal fistula
- D1e. Anal incontinence

E. Anorectal Disorders
- E1. Anorectal disorders
- E1a. Hemorrhoids
- E1b. Anal fissures
- E1c. Anorectal abscess
- E1d. Anorectal fistula
- E1e. Anal incontinence

F. Gastroenteritis
- F1. Acute gastroenteritis
- F2. Chronic gastroenteritis
- F3. Infectious gastroenteritis
- F4. Noninfectious gastroenteritis

G. Gastrointestinal Motility Disorders
- G1. Gastrointestinal motility disorders
- G1a. Gastroesophageal reflux disease
- G1b. Gastrointestinal dysmotility
- G1c. Gastrointestinal neuropathy
- G1d. Gastrointestinal myopathy
- G1e. Gastrointestinal endocrine disorders
- G1f. Gastrointestinal metabolic disorders
- G1g. Gastrointestinal neoplasms
system* function* disorder*”, through which 4502 documents out of 11,046 relevant documents of this category were retrieved. Eighty-six queries set in this category did not match any of the documents of this database and/or have not been presented in any of the articles. The queries which have any result are presented in Table 3.

The 142 queries are instances belonging to the “Irritable Bowel Syndrome” category. The highest value (78.8%) was related to the query “irritable colon” and/or “irritable colon*”, through which 17,164 documents out of 21,781 relevant documents of this category were retrieved. Forty-nine queries did not match any of the documents of this database and/or have not been presented in any of the articles. The queries which have any result are presented in Table 4.

In this category, given that IBS is used as an acronym for “Irritable Bowel Syndrome” in articles, it may be possible that this instance will also be taken into consideration in the retrieval of documents in this area. Given that this abbreviation is also applicable to other domains and related terms like integrated Brier score (IBS), it is considered in retrieval processes in combined forms.

Instances retrieved through IBS on the Scopus database included 10,890 documents, and if matched 21,781 retrieved documents in related category [Table 4], there will be 3,177 documents unrelated (in other domains) and 7,713 documents related to Irritable Bowel Syndrome. With the sensitivity formula applied to this amount, its sensitivity will be 70.83%.

The 13 queries are instances belonging to the “Functional Constipation” category. The highest value (48.86%) was related to the query “function* disorder*” and constipation, through which 1,311 documents out of 2,683 relevant documents of this category were retrieved. Five queries did not match any of the documents of this database and/or have not been presented in any of the articles. The queries which have any result are presented in Table 5.

The 16 queries are instances belonging to the “Functional Diarrhea” category. The highest value (77.6%) was related to the query “function* disorder*” and constipation, through which 1,278 documents out of 1,647 relevant documents of this category were retrieved. Nine queries did not match any of the documents of this database and/or have not been presented in any of the articles. As it can be seen in this table, the results retrieved through the term “diarrhea” were completely similar to those retrieved through “diarrhea” which is the other way of writing the term, so it did not mention in final queries.

The queries which have any result are presented in Table 6.

The 29 queries are instances belonging to the “Functional Dyspepsia” category. The highest value (64.18%) was related to the query “Functional dyspep*”, through which 3,450 documents out of 5,375 relevant documents of this category were retrieved. Ten queries did not match any of the documents of this database and/or have not been presented in any of the articles. The queries which have any result are presented in Table 7.

The 7 queries are instances belonging to the “Neurogenic Bowel” category. The highest value (97.38%) was related to the query “Neurogenic Bowel” and/or “Neurogenic Bowel*”, through which 521 documents out of 535 relevant documents of this category were retrieved. One query did not match any of the documents of this database and/or has not been presented in any of the articles. The queries which have any result are presented in Table 8.

The 7 queries are instances belonging to the “Neurogenic Bowel” category. The highest value (64.18%) was related to the query “Functional Dyspepsia” category. The highest value (64.18%) was related to the query “Functional dyspep*”, through which 3,450 documents out of 5,375 relevant documents of this category were retrieved. One query did not match any of the documents of this database and/or has not been presented in any of the articles. The queries which have any result are presented in Table 9.

Discussion

Searching queries based on the seven subject headings, showed that the main terms related to each of the seven subject headings when applying the necessary precision, only retrieved part of the relevant articles. So that in the category “Functional Gastrointestinal Disorders” the search using this exact term only retrieves 21.01% of relevant documents and is located in the fourth place in terms of frequency. In “irritable bowel syndrome/syndromes”, the search for this term falls in row 4 in terms of frequency and retrieves 67.29% of articles in this area. In the heading “Functional Constipation”, this term falls in the second row in terms of frequency and retrieves 48.19% of the relevant articles. The term “Functional Diarrhea/Diarrhea” is the fourth category, where the search for the exact term only retrieves 13.05% of the related documents, and which falls in row 6 in terms of frequency. The search for “Functional Bloating” in the related category only retrieves 9.05% of relevant documents and falls in the seventh row. In the heading “Functional Dyspepsia”, the search for this term, which falls in the second row in terms of frequency, retrieves 63.79% of articles in this heading. The search for “Neurogenic
Table 3: Values for queries related to functional gastrointestinal disorders

| n  | Query                                                                                      | Documents | Sensitivity (%) | n  | Query                                                                                      | Documents | Sensitivity (%) |
|---|-------------------------------------------------------------------------------------------|-----------|-----------------|---|-------------------------------------------------------------------------------------------|-----------|-----------------|
| 1 | “Digestive” system* function* disorder**                                                 | 4502      | 40.757          | 53 | “Digestive functional disorder**”                                                           | 14        | 0.127           |
| 2 | “Functional gastr*”                                                                         | 3142      | 28.445          | 54 | “Functional disorder* of gastrointestinal”                                                 | 14        | 0.127           |
| 3 | “Functional gastrointestinal”                                                                | 2887      | 26.136          | 55 | “Functional disease* of the gastrointestinal”                                              | 13        | 0.118           |
| 4 | “FGID”                                                                                    | 2321      | 21.012          | 56 | “Functional disease* of the stomach”                                                        | 13        | 0.118           |
| 5 | “Functional bowel*”                                                                         | 1261      | 11.416          | 57 | “Functional intestin* disease**”                                                             | 13        | 0.118           |
| 6 | “Intestin* function* disorder**”                                                            | 925       | 8.373           | 58 | “Functional intestinal disease**”                                                            | 13        | 0.118           |
| 7 | “Functional bowel* disorder**”                                                               | 893       | 8.084           | 59 | “Gastr* function* disease**”                                                                | 13        | 0.118           |
| 8 | “Functional abdom*”                                                                         | 717       | 6.491           | 60 | “Functional disease* of the digestive”                                                       | 11        | 0.1             |
| 9 | “Functional abdominal”                                                                      | 715       | 6.473           | 61 | “Bowel* function* disorder**”                                                               | 10        | 0.091           |
| 10 | FGID                                                                                       | 573       | 5.187           | 62 | “Functional disorder* of digestive”                                                          | 9         | 0.081           |
| 11 | “Stomach function* disorder**”                                                               | 478       | 4.327           | 63 | “Functional disorder* of the bowel”                                                         | 9         | 0.081           |
| 12 | “Functional intestin**”                                                                      | 412       | 3.73            | 64 | “Colon* function* disorder**”                                                               | 8         | 0.072           |
| 13 | “Functional intestinal”                                                                     | 389       | 3.522           | 65 | “Functional colon disease**”                                                                 | 8         | 0.072           |
| 14 | “Functional gi”                                                                            | 330       | 2.988           | 66 | “Functional colorect**”                                                                      | 8         | 0.072           |
| 15 | “Functional bowel* disease**”                                                                | 249       | 2.254           | 67 | “Functional disease* of the colon**”                                                         | 8         | 0.072           |
| 16 | “Gastr* functional”                                                                        | 224       | 2.028           | 68 | “Colonic functional disorder”                                                               | 7         | 0.063           |
| 17 | “Functional colon*”                                                                         | 138       | 1.249           | 69 | “Functional colorectal”                                                                     | 7         | 0.063           |
| 18 | “Functional disorder* of the gastr**”                                                       | 125       | 1.132           | 70 | “Functional disease* of gastr**”                                                             | 6         | 0.054           |
| 19 | “Functional disorder of the gastrointestinal”                                               | 116       | 1.05            | 71 | “Gastrointestinal functional disease”                                                        | 6         | 0.054           |
| 20 | “Functional disorders of the gastrointestinal”                                              | 116       | 1.05            | 72 | “Functional disorder* of stomach”                                                            | 5         | 0.045           |
| 21 | “Functional gastric”                                                                        | 115       | 1.041           | 73 | “GI functional disorder**”                                                                  | 5         | 0.045           |
| 22 | “Gastrointestinal functional”                                                               | 115       | 1.041           | 74 | “Functional disease* of gastrointestinal”                                                    | 4         | 0.036           |
| 23 | “Functional intestin* disorder**”                                                            | 101       | 0.914           | 75 | “Functional disorder* of intestin**”                                                          | 4         | 0.036           |
| 24 | “Gastr* function* disorder**”                                                                | 90        | 0.815           | 76 | “Functional gi”                                                                            | 4         | 0.036           |
| 25 | “Functional colonic”                                                                        | 74        | 0.67            | 77 | “Bowel functional disorder**”                                                                | 3         | 0.027           |
| 26 | “Functional dis* of the diges**”                                                             | 68        | 0.616           | 78 | “Digestive functional disease**”                                                              | 3         | 0.027           |
| 27 | “Gastric functional”                                                                        | 57        | 0.516           | 79 | “Functional abdom* disease**”                                                                | 3         | 0.027           |
| 28 | “Functional disorder* of the digestive”                                                      | 53        | 0.48            | 80 | “Functional abdominal disease”                                                               | 3         | 0.027           |
| 29 | “Gastrointestinal functional disorder**”                                                      | 53        | 0.48            | 81 | “Functional colon disorder**”                                                                | 3         | 0.027           |
| 30 | “Functional disorder* of the stomach”                                                        | 45        | 0.407           | 82 | “Functional disorder* of gastric”                                                             | 3         | 0.027           |
| 31 | “Functional megacolon*”                                                                     | 35        | 0.317           | 83 | “Functional disorder* of bowel”                                                              | 3         | 0.027           |
| 32 | “Functional colon* disease**”                                                                 | 34        | 0.308           | 84 | “Gastric functional disease**”                                                                | 3         | 0.027           |
| 33 | “Functional disorder* of the colon**”                                                        | 33        | 0.299           | 85 | “Intestine* functional disorder**”                                                            | 3         | 0.027           |
| 34 | “Functional colon”                                                                          | 29        | 0.263           | 86 | “Colorectal functional disorder**”                                                            | 2         | 0.018           |
| 35 | “Functional colonic disease**”                                                                | 27        | 0.244           | 87 | “Digestive system functional disorder**”                                                      | 2         | 0.018           |
| 36 | “Intestinal functional disorder**”                                                            | 27        | 0.244           | 88 | “Functional disease* of the gi”                                                              | 2         | 0.018           |
| 37 | “Diges* function* dis**”                                                                    | 25        | 0.226           | 89 | “Functional disease* of digestive”                                                            | 2         | 0.018           |
| 38 | “GI functional”                                                                             | 22        | 0.199           | 90 | “Functional disorder* of intestinal”                                                          | 2         | 0.018           |
| 39 | “Nonulcer* colit**”                                                                         | 21        | 0.19            | 91 | “Functional disorder* of intestine**”                                                          | 2         | 0.018           |
| 40 | “Nonulcerative colitis”                                                                     | 21        | 0.19            | 92 | “Functional disorder* of the abdominal”                                                       | 2         | 0.018           |
| 41 | “Functional abdom* disorder**”                                                                | 20        | 0.181           | 93 | “Functional disorder* of the intestinal”                                                      | 2         | 0.018           |
| 42 | “Functional abdominal disorder**”                                                              | 20        | 0.181           | 94 | “Intestinal functional disease**”                                                             | 2         | 0.018           |
| 43 | “Functional colon* disorder**”                                                                | 20        | 0.181           | 95 | “Stomach functional disorder**”                                                               | 2         | 0.018           |
| 44 | “Functional disorder* of gastr*”                                                               | 19        | 0.172           | 96 | “Abdominal functional disorder**”                                                             | 1         | 0.009           |
| 45 | “Functional disorder* of the intestin**”                                                      | 19        | 0.172           | 97 | “Bowel functional disease**”                                                                  | 1         | 0.009           |
| 46 | “Functional intestine**”                                                                     | 19        | 0.172           | 98 | “Colon* function* disease**”                                                                 | 1         | 0.009           |

Contd...
Table 3: Contd...

| n  | Query                                          | Documents | Sensitivity (%) | n  | Query                                          | Documents | Sensitivity (%) |
|----|-----------------------------------------------|-----------|-----------------|----|-----------------------------------------------|-----------|-----------------|
| 47 | “Functional disease* of the gastro*”          | 18        | 0.163           | 99 | “Functional disease* of the bowel”            | 1         | 0.009           |
| 48 | “Functional dis* of diges”*”                 | 17        | 0.154           | 100| “Functional disease* of the intestin*”         | 1         | 0.009           |
| 49 | “Functional disorder of the intestin*”        | 17        | 0.154           | 101| “Functional disorder* of colon*”              | 1         | 0.009           |
| 50 | “Functional disorders of the intestin*”       | 17        | 0.154           | 102| “Functional disorder* of the colorect*”       | 1         | 0.009           |
| 51 | “Functional colonic disorder*”               | 16        | 0.145           | 103| “Gl function* disease*”                       | 1         | 0.009           |
| 52 | “Gastric functional disorder**”              | 16        | 0.145           |    |                                               |           |                 |
|    | Sum                                           |           |                 |    |                                               |           | 11,046          |

FGID=Functional gastrointestinal disorders

Table 4: Values for queries related to irritable bowel syndrome

| n  | Query                                          | Documents | Sensitivity (%) | n  | Query                                          | Documents | Sensitivity (%) |
|----|-----------------------------------------------|-----------|-----------------|----|-----------------------------------------------|-----------|-----------------|
| 1  | “Irritable colon*”                            | 17164     | 78.803          | 48 | “Spast* colit*”                               | 34        | 0.156           |
| 2  | “Irritable bowel*”                            | 15075     | 69.212          | 49 | “Spastic colitis”                             | 33        | 0.152           |
| 3  | “Irritable bowel”                             | 15071     | 69.193          | 50 | “Irritable intestin*”                          | 23        | 0.106           |
| 4  | “IBS**”                                      | 14658     | 67.297          | 51 | IBS-u                                        | 22        | 0.101           |
| 5  | IBS and (gastric* OR gastro*)                 | 7172      | 32.928          | 52 | “Irritable intestine*”                         | 20        | 0.092           |
| 6  | IBS and bowel*                                | 7146      | 32.808          | 53 | “Irritable bowel disorder**”                  | 17        | 0.078           |
| 7  | IBS and bowel*                                | 7145      | 32.804          | 54 | “Irritable bowel”                             | 17        | 0.078           |
| 8  | IBS and colon*                                | 6474      | 29.723          | 55 | “Bowel” irritating                            | 13        | 0.06            |
| 9  | IBS and colon*                                | 6322      | 29.025          | 56 | “Bowel irritating”                            | 12        | 0.055           |
| 10 | IBS and all (gastric OR gastrointestinal)     | 6304      | 28.943          | 57 | “Bowel irritation”                            | 12        | 0.055           |
| 11 | IBS and gastr*                                | 4285      | 19.673          | 58 | “Colon* spast*”                               | 11        | 0.051           |
| 12 | IBS and gastrointestinal                      | 3517      | 16.147          | 59 | “Irritable digestive*”                         | 11        | 0.051           |
| 13 | IBS and abdom*                                | 2810      | 12.901          | 60 | “Colon spasm”                                 | 8         | 0.037           |
| 14 | IBS and abdominal                             | 2789      | 12.805          | 61 | “Irritative bowel*”                           | 8         | 0.037           |
| 15 | IBS and intestin*                             | 2729      | 12.529          | 62 | “Colit* spast*”                               | 7         | 0.032           |
| 16 | IBS and diarrhea                              | 2516      | 11.551          | 63 | “Spasm* intestin*”                             | 7         | 0.032           |
| 17 | IBS and constipation                          | 2090      | 9.596           | 64 | “Intestine* irritation”                        | 5         | 0.023           |
| 18 | IBS and intestine*                            | 2026      | 9.302           | 65 | “Spasm* colon*”                               | 5         | 0.023           |
| 19 | IBS and intestinal                            | 1646      | 7.557           | 66 | “Colit” spasm**                               | 4         | 0.018           |
| 20 | IBS and colonic                               | 1587      | 7.286           | 67 | “Fibs”                                       | 4         | 0.018           |
| 21 | IBS and bloat*                                | 947       | 4.348           | 68 | “Colitis spastic”                             | 3         | 0.014           |
| 22 | IBS and bloating                              | 942       | 4.325           | 69 | “Colon spastic”                               | 3         | 0.014           |
| 23 | IBS and distension                           | 862       | 3.958           | 70 | “Irritable inflammomat* bowel*”                | 3         | 0.014           |
| 24 | IBS and unclassified                          | 804       | 3.691           | 71 | “Irritable inflammatory bowel”                | 3         | 0.014           |
| 25 | IBS and dyspep*                               | 607       | 2.787           | 72 | “Irritable intestinal”                        | 3         | 0.014           |
| 26 | IBS-D                                        | 602       | 2.764           | 73 | “Spasm* colit*”                               | 3         | 0.014           |
| 27 | IBS and dyspepsia                             | 601       | 2.759           | 74 | “Spasmodic colitis”                           | 3         | 0.014           |
| 28 | IBS-C                                        | 488       | 2.24            | 75 | “Spastic colonic”                             | 3         | 0.014           |
| 29 | IBS and colorec*                              | 277       | 1.272           | 76 | “Bowel irritability”                          | 2         | 0.009           |
| 30 | IBS and colorectal                            | 273       | 1.253           | 77 | “Intestin* irritability”                       | 2         | 0.009           |
| 31 | IBS and gastric                              | 214       | 0.983           | 78 | “intestinal irritability”                      | 2         | 0.009           |
| 32 | “Irritable bowel disease**”                   | 202       | 0.927           | 79 | “Irritable spastic colon**”                    | 2         | 0.009           |
| 33 | “intestin* spasm**”                           | 183       | 0.84           | 80 | “Irritative intestin*”                         | 2         | 0.009           |
| 34 | Pi-ibs                                       | 172       | 0.79           | 81 | “Irritative intestinal”                       | 2         | 0.009           |
| 35 | “Intestinal spasm”                           | 137       | 0.629           | 82 | “Spasm intestinal”                            | 2         | 0.009           |
| 36 | “Spast* colon*”                               | 125       | 0.574           | 83 | “Colit” mucomembran*s**                        | 1         | 0.005           |
| 37 | “Spastic colon”                               | 120       | 0.551           | 84 | “Intestin* spast*”                            | 1         | 0.005           |
| 38 | IBS-m                                        | 92        | 0.422           | 85 | “Intestine* spastic”                          | 1         | 0.005           |
| 39 | IBS and abdomen                              | 75        | 0.344           | 86 | “Irritable digestion”                         | 1         | 0.005           |
| 40 | “Muc*s colit*”                                | 69        | 0.317           | 87 | “Irritative colit*”                           | 1         | 0.005           |
| 41 | “Colon* spasm”                                | 53        | 0.243           | 88 | “Irritative colits”                           | 1         | 0.005           |
| 42 | “Intestin* irritation*”                       | 53        | 0.243           | 89 | “Mucomembran’s colo*”                         | 1         | 0.005           |
Bowel” has a better status in the seventh category than in the others and retrieves 97.38% of the relevant documents. According to the result of similar studies in other medical sciences, fields also approved these results. Wilczynski et al.\cite{12} conducted an analytic survey to comparing hand searches of 55 journals with retrievals from EMBASE for 4843 candidate search terms and 17,004 combinations. The results showed that combinations of search terms reached peak sensitivities of 94.6% with specificity at 63.7%, whereas combinations of search terms to optimize specificity reached peak specificities of 99.3% with sensitivity at 61.4%. Gehanno et al.\cite{13} showed that locating studies from topics with no single MeSH term requires the use of various MeSH and non-MeSH terms in combination to obtain a satisfactory recall. This factor must be taken into consideration by the end-user in order to improve the cost-effectiveness ratio of the search in Medline.\cite{13} Hence, given the values calculated for sensitivity, and considering the type of study, in order to retrieve documents in this area, it is necessary to apply all or part of the proposed queries to the search strategy. So that in the retrieval of articles, in order to conduct a systematic study, it is necessary to apply all proposed queries to enhance the search sensitivity. However, in order to retrieve documents to enhance the knowledge and/or to provide theoretical bases for studies, it is more helpful to consider maximal instances or terms currently used in articles in order to retrieve recent articles.

Acknowledgment
This article is extracted from PhD Thesis supported by Shahid Chamran University of Ahvaz with ethical number 93328.

Financial support and sponsorship
This work was supported by the Shahid Chamran University of Ahvaz.
Table 8: Values for queries related to functional dyspepsia

| n  | Query                                      | Documents | Sensitivity (%) |
|----|--------------------------------------------|-----------|-----------------|
| 1  | “Functional dyspep*”                       | 3450      | 64.186          |
| 2  | “Functional dyspepsia”                     | 3429      | 63.795          |
| 3  | “Non ulcer* dyspep*”                       | 1399      | 26.028          |
| 4  | “Non ulcer dyspepsia”                      | 1294      | 24.074          |
| 5  | “Function* disorder*” and dyspep*          | 933       | 17.358          |
| 6  | “Function disorder*” and dyspepsia         | 718       | 13.358          |
| 7  | “Function* disease*” and dyspep*           | 264       | 4.912           |
| 8  | “Functional disease*” and dyspepsia        | 262       | 4.874           |
| 9  | “Functional disorder*” and dyspepsia       | 235       | 4.372           |
| 10 | “Function disorder*” and dyspeptic         | 60        | 1.116           |
| 11 | “Functional dyspeptic”                     | 52        | 0.967           |
| 12 | “Nonulcerative dyspepsia”                 | 42        | 0.781           |
| 13 | “Nonulcer dyspeptic”                       | 38        | 0.707           |
| 14 | “Functional disorder*” and dyspeptic       | 34        | 0.633           |
| 15 | “Functional disease*” and dyspeptic        | 30        | 0.558           |
| 16 | “Function disease*” and dyspepsia          | 2         | 0.037           |
| 17 | “Functional abdomen dyspepsia”             | 1         | 0.019           |
| 18 | “Functional intestinal dyspepsia”          | 1         | 0.019           |
| 19 | “Nonulcerative dyspeptic”                  | 1         | 0.019           |
|    | Sum                                        | 5375      |                 |

Table 9: Values for queries related to neurogenic bowel

| n  | Query                                      | Documents | Sensitivity (%) |
|----|--------------------------------------------|-----------|-----------------|
| 1  | “Neurogenic bowel*”                        | 521       | 97.383          |
| 2  | “Neurogenic intestin*”                     | 13        | 2.430           |
| 3  | “Neurogenic intestinal”                    | 9         | 1.682           |
| 4  | “Neurogenic intestine*”                    | 4         | 0.748           |
| 5  | “Neurogenic colon*”                        | 2         | 0.374           |
| 6  | “Neurogenic colitis”                       | 1         | 0.187           |
|    | Sum                                        | 535       |                 |

Conflicts of interest
There are no conflicts of interest.

References

1. Borhani M, Khoshzban F, Jadiri B, Naseri M, Kamali-Nejad M, Taleie D. Functional gastrointestinal disorders and traditional medicine in Iran. J Islamic Iran Tradit Med 2014;5:116-23.
2. Jafari-Niaemi M, Isvand F. Clustering of Functional Gastrointestinal Disorders (Dissertation). Isfahan: Isfahan University; 2011. Available from: http://engold.ui.ac.ir/~m.rezaei/research/IsvandJafari.pdf [4/7/2017].
3. Maleki I, Hosseini H, Khalilian A, Taghavi T, Niksolat F. Effects of psycho-education on quality of life in patients with irritable bowel syndrome. J Res Rehabil Sci 2007;5:39-45.
4. Moghadaszadeh M, Fatahi E, Bonyadi M, Shirzadeh M. Effect of food allergen exculsion on symptoms and quality of life in irritable bowel syndrome. J Gorgan Univ Med Sci 2012;14:86-90.
5. Bagherian R, Pourkazem T, Nouri A, Adibi P. The effects of stress management training on symptoms of medical treatment-resistant functional dyspepsia. Govaresh 2009;14:15-22.
6. Drossman DA, Corazziari E, Talley NJ, Thompson WG, Whitehead WE, editors. Rome II: The Functional Gastrointestinal Disorders. USA: McLean: Degnon Associates; 2000.
7. Drossman DA. Rome III diagnostic criteria for functional gastrointestinal disorders. In: Rome III diagnostic criteria for functional gastrointestinal disorders (3rd ed). McLean: Degnon Associates, Inc.; 2006. URL: Available from: http://www.romecriteria.org/assets/pdf. [Last accessed 2018 Jun 01].
8. Drossman DA, Hasler WL. Rome IV-functional GI disorders: Disorders of gut-brain interaction. Gastroenterology 2016;150:1257-61.
9. Abedi M, Ashrafi-Rizi H, Zare-Farashbandi F, Nouri R, Hassanazadeh A. Comparison on information-seeking behavior of postgraduate students in Isfahan University of Medical Sciences and University of Isfahan in writing dissertation based on Kuhlthau model of information search process. J Educ Health Promot 2014;3:98.
10. Ashtari S, Sorouri M, Moghim-Dehkordi B, Pourhoseingholi MA, Safae A, Vahedi M, et al. Prevalence of functional bowel disorders in Tehran province: A pop ulation based study. J Knowled Health 2011;6:31-9.
11. Shiri AA. Recall and Precision. Encyclopedia of Library and Information Sciences. URL: Available from: http://portal.nlai.ir/daka/Wiki. [Last accessed 2018 Jun 01].
12. Wilczynski NL, Haynes RB. Hedges Team. EMBASE search strategies achieved high sensitivity and specificity for retrieving methodologically sound systematic reviews. J Clin Epidemiol 2007;60:29-33.
13. Gehanno JF, Rollin L, Le Jean T, Louvel A, Darmoni S, Shaw W. Precision and recall of search strategies for identifying studies on return-to-work in Medline. J Occup Rehabil 2009;19:223-30.