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# Delayed Antibiotic Prescriptions in a Primary Care Clinic

**Wasim Alsamah** ( waalsamah@salud.unm.edu )
University of New Mexico https://orcid.org/0000-0001-5139-8416

**Kristi Acker** ( kaacker@ua.edu )
University of Alabama

**Rober Fritch** ( rfritch@salud.unm.edu )
University of New Mexico

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**Data Note**

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## Abstract

# Purpose

Unnecessary Antibiotic Prescription remains an ongoing problem for countries around the world, including United States. One of the most successful methods was implementing delayed prescription (DAP). DAP is providing the patient with a prescription and a recommendation to fill out only if the initial symptoms worsen. However, many primary care providers are either unaware of DAP or reluctant to implement it. The purpose of this study is to increase providers' knowledge of antibiotic resistance in the community and to determine the barriers of primary care providers to starting patients on DAP.

# Methods

This quality improvement study was conducted with a pretest-intervention-posttest strategy. A questionnaire was administered to participants to determine participants' knowledge of and barriers to initiating DAP. Following the pretest, a 30-minute educational intervention was presented on DAP, then providers were given one month to integrate the DAP program when applicable, followed by administration of the questionnaire as a posttest. The results of both questionnaires were compared with descriptive statistics and a paired-sample *t* test.

# Results

Paired t tests demonstrate that 6 items indicated significant improvements from pretest: providers' view of DAP in reducing scheduled visits, inappropriate use of antibiotics, emergency visits, optimizing resources in clinic, providers' knowledge about DAP, and changing patients' perceptions to antibiotics. Further analysis revealed insignificant differences in 2 items; providers' willingness to discuss DAP with their patients, and their readiness to initiate it.

## Introduction

The United Nations General Assembly described antibiotic resistance as the most urgent global risk.[1] Some bacterial strains, such as carbapenem-resistant klebsiella pneumoniae, have few treatment choices. Infections with this bacterium are associated with a 40%-70% mortality rate.[2] Moreover, some bacteria are considered not only difficult to treat but untreatable with established antibiotics.

There are statements of antimicrobial resistance (AMR) for every approved antibiotic available.[3] Fewer antibiotic choices are available not only because of increased resistance to known therapies but also because fewer antibiotics are being developed. Bacteria can achieve prompt resistance, decreasing profitable interest in the development of new antibiotics. For example, from 1983 to 1987, 16 new

antibiotics were permitted by the U.S. Food and Drug Administration (FDA). However, only six new antibiotics were permitted from 2010 to 2016.[4]

Healthcare providers usually choose among two different modalities – providing the patient with a prescription and a recommendation to fill out later or leaving the prescription in the clinic and asking the patient to pick it up if their state deteriorates.[5] Either way, the patient has full power over the decisions affecting their health. Provider-patient relationship is the key variable in this question. Therefore, that can become the first line solution for physician and primary care providers because it reduces patients' reliance on an antibiotic while maintaining their satisfaction.[6]

Review of the Literature

The review meant to provide an update on the evidence on the effectiveness of the existing interventions in the reduction of antibiotic prescription in adults with URIs. Accordingly, this comprehensive review was a multistep process. Particularly, it involved the identification of the databases with the relevant data sources, assessment of the articles' abstracts, and the tabulation of the results.

### *Literature Search Strategy*

The search strategy was based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Accordingly, a systematic review was performed searching in the databases EBSCO, MEDLINE, PubMed, and CINAHL. These databases served as valuable sources of data because they contain a large plethora of scholarly articles. Several key terms were used to carry out the search in the selected databases. These search terms were antibiotic, prescription, interventions, respiratory tract infections, acute respiratory infections, reduction, and methods. The search process also encompassed assessing the bibliographies of the selected trial studies, which was instrumental in collecting additional relevant information on the interventions.

The screening process entailed the identification of citations that potentially met the inclusion criteria though the search of the databases. This step was followed by scanning the citations and removing duplicates. After screening the titles and abstracts of the remaining articles, sources that did not meet the inclusion criteria and did not bear relevance to the topic were excluded. The final step was the assessment of the articles' full text to determine the final articles for the literature review.

### *Data Extraction*

The list of terms that were identified was applied in conducting a trial search, which enabled narrowing down the number of search terms to include only those that resulted in the generation of the most relevant articles. It is essential to point out that the original search strategy was developed using the Medical Subject Headings (MeSH) terminology. The search process was undertaken across all the selected databases with the assistance from the librarian.

The references of the articles identified via the search were compiled using EndNote X7. Articles published prior to 2011 were removed from the study. Thus, a total of 1,973 articles were retrieved for further screening (See Figure 1), then a full revision of the titles and abstracts of the articles took place. Any abstracts that appeared to be questionable were discussed and the decisions on their selection or disregard were made based on the quality and the significance of the results. The articles were then identified and downloaded for the analysis of their full text. Overall, 386 scholarly articles were reviewed (See Figure 1). After the execution of the eligibility phase, five articles that were the most relevant to the topic were included in this review (See Figure 1).

The information extracted from the articles included references, study design, sample/setting, variables, instruments, interventions/comparisons, results, implications, and limitations. Extraction of the limitations mentioned in the articles was instrumental in measuring their quality. This step was critical given that the differences in the study design made it difficult to utilize a formal quality assessment tool for the articles. It was vital to cross-check the information derived from the article to ensure consistency and quality in the data extraction process.

Evidence-Based Practice: Verification of Chosen Option

All interventions were categorized into two major categories: delayed prescriptions, and patient/public information and education. Two studies compared different types of delayed prescription.[6]-[8] Patient education was provided through brochures, or videotapes.[7],[9] Included studies reported a broad spectrum of outcomes. The most common outcomes were the use of antibiotics, prescription of antibiotics, filling of prescriptions by patients, and satisfaction with the treatment. Some studies focused on general practitioner views on delayed antibiotics methods and their confidence using such method.[10],[11]

### *Delayed Antibiotic Prescription and Provider's Education*

The delayed prescription was given to the patients at the time of the initial visit, and patients were given directions to fill the prescription after a given time. Post-dated prescription: the delayed prescription was given at the time of the visit; however, it was post-dated. Delayed collection: the delayed prescription was not provided to patients at the time of the visit, but rather was lodged at the practice's reception or pharmacy, and patients were invited to collect or fill their prescription if their symptoms had not improved or worsened after a few days.[7],[8],[12] Worrall et al.[13] reported the filling of the prescriptions by patients.

Almost all studies with delayed prescription significantly reduced the use of antibiotics for URIs. Overall, the participants in the delayed prescription cluster were less likely than participants in the immediate prescription group to use antibiotics. 32% of individuals given delayed prescriptions fill it compared to 93% of those given immediate prescriptions, which shows huge reduction of antibiotic use according to Sargent et al. [14]

Moreover, most of the studies emphasized on multidimensional interventions. Thus, studies by Kotwani and Holloway[15] and May et al.[16] examined two or more forms of interventions to address the issue of antibiotics over prescription to patients suffering from URIs. A recommended approach was classic providers education through holding collaborating seminars. The intervention involved the distribution of printed materials on the problem of antibiotic over prescription to facilitate education of the healthcare professionals.[17]

The major themes that were discussed in the education materials included the diagnosis and therapy for URIs.[15],[16],[18] Another significant theme that was covered in the use of education material was increasing bacterial resistance because of the unnecessary prescription of antibiotics for URIs treatment.

Effective communication is another significant intervention strategy highlighted in the studies. The purpose of this intervention is to address the pressure that providers face when prescribing antibiotics to their patients.[15] Thus, providers learn about the best way of communicating with patients concerning their expectations on prescribing antibiotics to adequately respond to the concerns voiced by the patients.[12] This intervention was illustrated in a few studies, in which the physicians were trained in seminars on effective communication techniques in the course of prescribing antibiotics.[19],[20]

Raft et al. [21] reported in his study less than 10% of the physicians used delayed prescriptions to children with symptoms of URI, However, 46% were convinced that delayed prescription could reduce antibiotic use. The physicians' opinions on delayed antibiotic prescription were considerably associated with their number of years working in general practice. Physicians with fewer years of practice had a positive outlook for delayed antibiotic prescriptions.

Using the Internet to conduct training was part of the recommended interventions to improve diagnosis.[7] Consideration was given to the feedback that the participants provided [17]. Thus, understanding the challenges that providers faced in the course of making prescriptions for their patients was essential.

Secondary outcomes included patients' satisfaction with the treatment, and patients' views on the effectiveness of antibiotics for URTIs. In the Little et al. [7] study, there was no significant difference in satisfaction between different variants of delayed prescription. de la Poza et al. [8] reported no significant difference in satisfaction between delayed collection, and immediate prescription groups.

### Literature Gap

There is sufficient evidence that delayed prescribing reduces antibiotic use, and the model has been introduced to general practitioners and adopted by the CDC.[1] However, a study found the practice is not consistently used, with many primary providers voicing concerns about its implementation.[14] More studies to identify which behavior-change are needed to target the theoretical framework domains that influence the use of delayed prescribing by primary care practitioners.

Some literature conflicts have been found on the benefits of public education methods. One review reported no or small benefit from printed educational materials [22] whereas McDonagh et al.,[23] agreed that public educational campaigns are not effective in reducing antibiotic use.

All the review studies have been in general outpatients' settings, however, some of them have added step to analyze any hospital admission following delayed antibiotic use.[12],[24],[25] Some studies in the review reported antibiotic prescription as their outcome. However, not all patients used their prescriptions. On the other hand, the studies that reported antibiotic use instead of antibiotic prescription relied on patients' self-reports which may present desirability bias.

## Methods

The setting for this project was in an outpatient clinic. The population was certified primary care providers (medical doctors, nurse practitioners) at the clinic. The project took place over 8 weeks' time frame. A letter of agency support for the study was obtained from the main hospital. Upon approval from the IRB committee, an email was sent to all providers describing the purpose of the project and inviting them to participate. Upon affirmative replies, a consent was sent to contributors with a request for their signature and return. A 14-item questionnaire was available by a link or paper to participants based on their preference. The questionnaire asked for demographic information and their knowledge and views on different barriers to starting patients on DAP (Appendix). Participants had the choice of email or paper copy. Completion took approximately 5 minutes. When the questionnaires were returned, the responses were analyzed to determine the barriers and knowledge about the program identified by each provider. Based on the responses, a planned presentation on Antibiotic Stewardship and Delayed prescriptions took place. Providers instructed to implement delayed antibiotics prescriptions with number of their patients and follow closely with outcome. Then the questionnaire sent again after a month period to the providers as a posttest.

The same survey questionnaire was conducted after giving the participants enough time (4 weeks) to implement delayed prescriptions and have feedback from their patients. The survey sent, via email with option of paper upon request, to participants to determine the difference in knowledge and perceptions of DAP and the level of their barriers to administration. Upon return of the questionnaires, responses were analyzed with the goal of providers beginning patients on the DAP program to decrease unnecessary prescriptions and antibiotic resistance in our community.

# Data Analysis

The data were assessed and analyzed with SPSS statistical software. The results of the pretest and posttest were computed utilizing inferential statistics, a paired-sample *t* test.[26] Analysis was designed for possible statistically significant differences between the pretest and posttest ($p < .05$) and compared in tables. Most of the participants were female 83.3%, (n = 5). Half of the participants (n = 3) reported being in practice for more than five years, as opposed to being in practice for less than five years. In terms

of clinical affiliation, 50% (n = 3) reported being in practice/family medicine while the remaining (n = 3) were in primary care/general. All participants (N = 6) reported seeing an average of 10–19 patients daily. Additionally, half of the participants were nurse practitioners, and the other half were medical doctors.

**Knowledge About Delayed Antibiotic Prescription**

***DAP Reduces Scheduled Visits:***

For this item, participants indicated that they were more likely to agree with the statement following the intervention ($M$ = 4.50, $SD$ = .84) compared to before the intervention ($M$ = 3.50, $SD$ = .84). The paired sample t-test indicated that this observed difference was significant $t$ (5) = -2.24, $p$ <.05.

***DAP Reduced Emergency Visits:***

For this question, participants were more likely to agree with the statement that DAP reduces emergency visits after the intervention ($M$ = 4.67, $SD$ = .52) than prior to the intervention ($M$ = 3.67, $SD$ = .82). The analysis by paired sample t-test showed that the observed difference was significant, t (5) = -2.74, $p$<.05.

***DAP Reduces Inappropriate Antibiotic Use:***

The results from the survey showed that participants were more likely to agree that DAP minimizes inappropriate antibiotic use after the intervention ($M$ = 4.50, $SD$ = .84) when compared to before the intervention ($M$ = 3.50, $SD$ = 1.05). A paired sample-test showed that the observed difference was significant statistically, $t$ (5) = -2.74, $p$<.05. This finding indicates that the educational intervention was useful in increasing participant's knowledge regarding the beneficial impact of DAP in preventing inappropriate use of antibiotic medications.

***Implementing DAP is a Good Strategy to Optimize Resources:***

For this question, the findings indicated that after the intervention, participants were more likely to agree that DAP optimizes resources ($M$ = 4.83, $SD$ = 0.41) compared to before the intervention ($M$ = 3.50, $SD$ = 1.05). Analysis by a paired sample t-test revealed that this difference was significant, $t$(5) = -2.70, $p$<.05. This finding demonstrates that the educational intervention for primary care givers was effective in increasing their knowledge regarding the value of implementing DAP as a strategy for achieving optimal utilization of healthcare resources.

***Patients will be Satisfied with DAP:***

For this item, the findings from the survey indicated that participants were more likely to agree that DAP leads to patient satisfaction at post-intervention ($M$ = 5.00, $SD$ = .00) compared to pre-intervention ($M$ = 3.83, $SD$ = 1.33). Analysis using paired sample t-test revealed that this difference was significant statistically, $t$ (5) = -2.15, $p$<.05). Therefore, this finding suggests that the educational intervention delivered to primary caregivers was potentially effective in increasing their knowledge regarding the beneficial impact of DAP on the satisfaction of patients.

### *DAP will Change Patients' Perceptions to Antibiotics:*

The results show that, at post-intervention, participants were more likely to agree with this statement ($M$ = 4.33, $SD$ = 0.82) than before the intervention ($M$ = 3.17, $SD$ = .75). This observed difference was found to be significant by a paired sample t-test, $t$ (5) = -2.91, $p$<.05.

### *Providers' Willingness/Readiness:*

The results showed that participants less likely to agree to practice DAP after the intervention ($M$ = 2.67, $SD$ = 1.86) compared to before the intervention ($M$ = 3.67, $SD$ = 1.51); however, the analysis by paired samples t-test showed that the difference was not significant, $t$ (5) = 1.46, $p$=.10. This result suggests that the intervention did not improve participants' readiness to adopt DAP.

### *Providers' Willingness to Discuss Antibiotic Stewardship with Patients:*

After the intervention, participants were less likely to agree to discuss antibiotic stewardship ($M$ = 2.83, $SD$ = 2.04) compared to pre-intervention. An analysis by a paired sample t-test showed that the difference was not significant, $t$ (5) = 1.47, $p$=.10.

### *Providers Willingness to Prescribe Delayed Prescriptions:*

For this question, the findings showed that providers were less likely to be willing to prescribe DAP at post-intervention ($M$ = 2.5, $SD$ = 1.97) in comparison to pre-intervention ($M$ = 3.5, $SD$ = 1.64); nevertheless, this difference was not found to be significant by a paired samples t-test, t(5) = 1.46, $p$=.10. This finding shows that the educational intervention for primary care providers did not influence their willingness to practice DAP.

### *Asking Patients About their Perceptions of Antibiotics:*

The findings indicated that participants had the same likelihood of asking patients their perceptions of antibiotics at post-intervention ($M$ = 3.67, $SD$ = 1.37) and pre-intervention ($M$ = 3.67, $SD$ = 1.03). A paired sample t-test showed no significant difference, $t$ (5) = 0.00, $p$=.5.

### *Offer Options like Educations, Reach Out to Office in Case Symptoms Worsen:*

For this question, the results indicated that after the intervention, participants were more likely to adopt the practice of offering options like education and reaching out to the office ($M$ = 4.67, $SD$ = .82) compared to pre-intervention ($M$ = 4.33, $SD$ = .82). Nevertheless, a paired sample t-test showed that the difference was not significant, $t$ (5) = -.79, $p$=.23, which suggests that the intervention did not have an impact on the adoption of this practice.

Table 1: Mean Difference in Pre-intervention and post-intervention comparison of DAP Knowledge

| | Mean Baseline (M±SD) | Mean Post-intervention (M±SD) | Difference | Significance |
|---|---|---|---|---|
| **DAP will reduce scheduled visits** | 3.5±0.84 | 4.5±0.84 | Increase | Significant |
| **DAP will reduce emergency visits** | 3.67±0.82 | 4.67±0.52 | Increase | Significant |
| **DAP will reduce inappropriate antibiotics use** | 3.5±1.05 | 4.5±0.84 | Increase | Significant |
| **Implementing DAP will be a good strategy to optimize resources** | 4.83±0.41 | 3.5±1.05 | Increase | Significant |
| **Patients will be satisfied with DAP** | 3.83±1.33 | 5.0±0.0 | Increase | Significant |
| **DAP will change patient's perceptions to antibiotics** | 4.33±0.82 | 3.17±0.75 | Increase | Significant |

Rated on 5-point scale (1: never, 5: strongly agree)

# Discussion On Dap Result

Project findings suggest that the educational intervention for primary care providers was effective in increasing their knowledge regarding the benefits of DAP in terms of reducing scheduled visits (66.6%), optimizing resources (100%), and changing patients' perception of antibiotics (83%). These results align with previous findings in Spain.[6]

In terms of barriers to initiate DAP, findings suggests that educational session with providers didn't improve their willingness to adopt DAP, nor to discuss DAP with their patients which align with previous study by Sargent et al.[14] Their study concluded that although General Practitioners (GPs) knew about delayed prescribing, they did not use it constantly, favoring to bring patients back for review and chose to only use it with patients in a highly selective way.

### Limitations

Limitations recognized with this project include the small number of participants (n=6). The survey was completed in a limited geographic area with all providers located in the same clinic, so it is uncertain if the study results are generalizable to antibiotic prescribing habits in other clinics or geographic populations. The study sample lacked ethnic and gender diversity (majority females); therefore, it is uncertain if the study results are generalizable to other populations. Another limitation of this study is the short time frame the providers were given to apply the DAP method to their practice. Lastly, the reliance on self-reported implementation from questionnaire respondents may have led to recall bias. Due to the

anonymity of the survey, the investigator was unable to accurately verify the history of prior antibiotic use among participants.

### Implication for Future Research

Future research is necessary to establish most effective outpatient stewardship interventions in the outpatient settings. One recommendation to accomplish this would be to use community pharmacies to quantify antibiotic prescribing habits before and after the antibiotic stewardship outreach program is implemented. Another area of interest would be to survey the patients before and after the implementation of outpatient antibiotic stewardship programs to develop policies to overcome potential barriers identified. Additionally, qualitative research on a large scale is essential to better understand the barriers that we can find for its implementation by both professionals and patients.

## Conclusion

Antibiotic resistance is one of the major global health emergencies and kills hundreds of thousands of people every year. Delayed antibiotic prescription has promising effect on reducing the unnecessary use of antibiotics. The findings from this project suggested that the educational intervention was effective in increasing knowledge regarding DAP among primary care providers. DAP could have considerable effects if became part of daily practice of outpatient providers.

## Declarations

No conflicts of interest have been identified by any of the authors

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# Appendix

An appendix is not available with this version.

# Figures

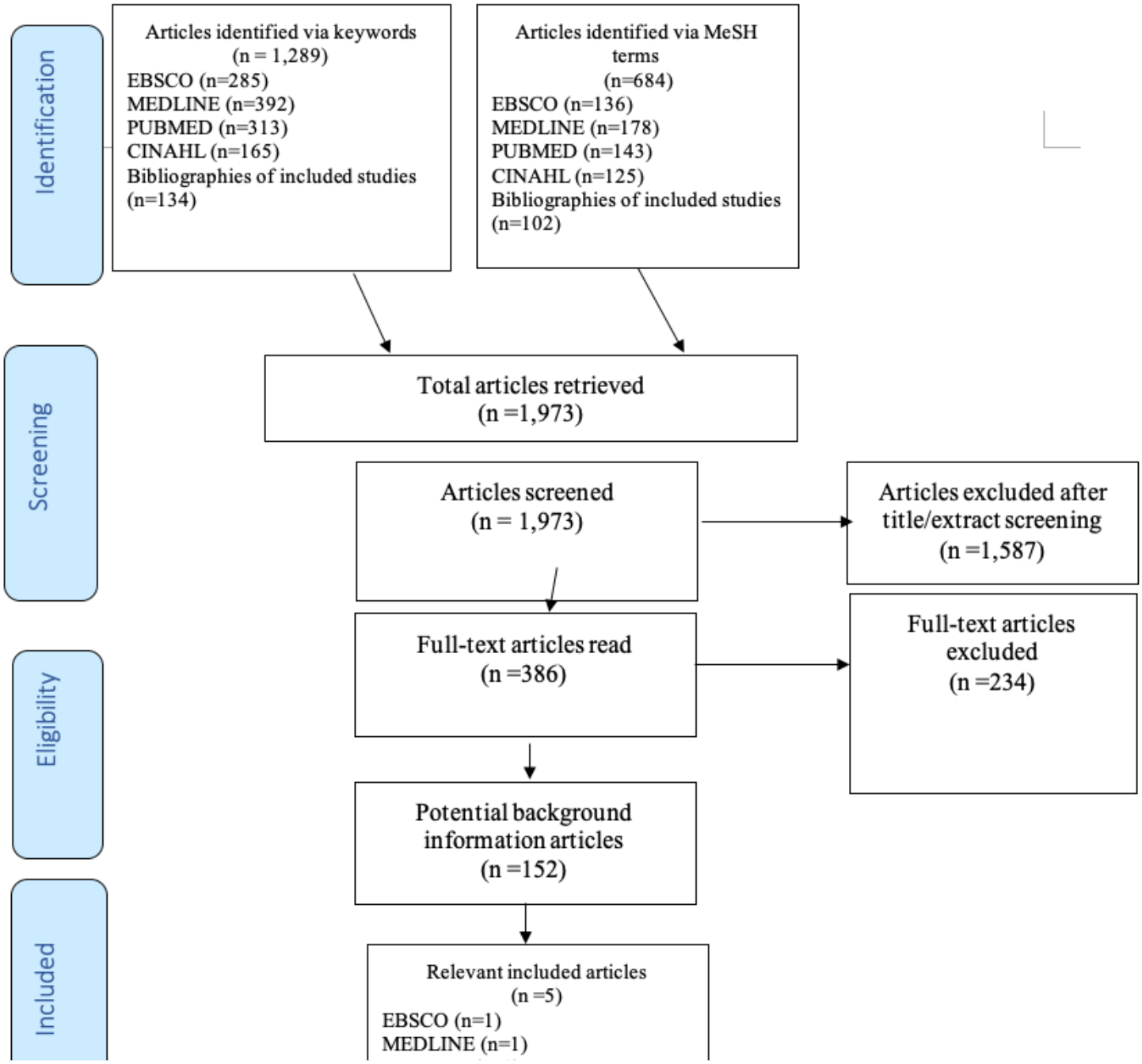


**Figure 1**

*Illustration of the selection process*