# How Well Do Computerised Decision Support Systems Cover Nursing Standards of Practice? A Literature Review

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**Abstract.** The use of computerized decision support systems (DSS) in nursing practice is increasing. However, research about who uses DSS, where are they implemented, and how they are linked with standards of nursing is limited. This paper presents evidence on users and settings of DSS implementation, along with specific nursing standards of practice that are facilitated by such DSS. We searched six bibliographic databases using relevant terms and identified 28 studies, each evaluating a unique DSS. Of these, 24 were used by registered nurses and 19 were implemented in short-term care units. Most of the DSS were found to facilitate nursing standards of assessment and intervention, however, outcome identification and evaluation were the least included standards. These findings not only highlight gaps in systems but also offer opportunities for further research development in this area.

**Keywords.** Computer assisted decision making, nurses' scope of practice, clinical informatics

## 1. Introduction

Decision support systems (DSS) are tools that help clinicians make informed decisions based on existing knowledge and individual patient characteristics. For nurses, such tools can facilitate the dynamic and complex decisions that they make regularly. Nursing is driven by certain standards of practice. The most widely recognised and implemented framework includes six standards of practice: assessment, diagnosis, outcomes identification, planning, implementation, and evaluation. The implementation standard includes four elements: coordination of care, health teaching and health promotion, consultation, and prescriptive authority and treatment [1]. These elements can be unique to users and nursing tasks. Previous reviews have mainly looked at specific nursing tasks performed by DSS such as nursing documentation and medication administration [2]. While DSS have been found to be effective in reducing medication errors and implementing evidence-based practice [3], their roles in supporting nursing standards is understudied. We undertook a systematic review of electronic DSS in nursing. The results of that review have been reported in a separate publication [4]. Here we specifically focus on mapping DSS functions to standards of nursing practice.

## 2. Method

We searched bibliographic databases including PubMed, CINAHL, Cochrane, Embase, Scopus, and Web of Science using variations of the following terms: decision support, nursing, patient outcomes, care delivery, and decision making. Studies published from Jan 2014 to Mar 2020, and those that evaluated electronic DSS used solely by nurses were included. After the initial search, duplicate entries were removed, and titles and abstracts were screened by two independent reviewers. Non-English articles and conference abstracts were excluded. Full length articles were assessed independently against inclusion criteria by two reviewers. Disagreements were resolved by consensus. Interrater agreement was moderate (Cohen's k 0.565, n=69) [5].

### 2.1. Data Extraction and Synthesis

For each included study, descriptive information about study design, DSS users, setting, and nursing standards of practice were extracted. We categorised users into registered nurses, midwives and nurse practitioners [6], and settings into acute care and long term care facilities [7]. We then mapped functions of each DSS to one or more standards of nursing practice.

## 3. Results

The database search retrieved a total of 1,019 articles. Twenty-eight papers, each evaluating a unique DSS, met the inclusion criteria. Eighteen studies were quasi-experimental [8-25], six were randomized controlled trial [26-31], three were descriptive [32-34], and there was one observational study [35].

### 3.1. Settings and Users

The majority of DSS were aimed at registered nurses (n=24) in a variety of clinical settings. The remaining were for nurse practitioners (n=3), or both nurses and midwives (n=1). Nineteen DSS were for short-term care units, including outpatient clinics, ambulance, emergency or urgent care, medical and surgical inpatient units, and critical care areas. Eight were for long term facilities such as nursing homes, community centers, and home healthcare. Only one DSS covered both kinds of settings.

### 3.2. DSS Coverage of Nursing Standards of Practice

As shown in Table 1, the majority of DSS (n=24, 86%), supported the nursing standard of intervention, followed by assessment (n=23, 82%). The least commonly supported standards were outcome identification and evaluation. Examples of DSS functions that support nursing standards of practice are given in Figure 1. Within implementation, 18 DSS supported coordination of care; eight supported teaching and promotion; seven prescription and treatment; and three supported the practice of consultation.

**Table 1.** Functions of computerized DSS by nursing standards of practice (n=28).

| First author, year | Setting | Nursing standards of practice* | | | | | |
|---|---|---|---|---|---|---|---|
| | | **A** | **D** | **O** | **P** | **I** | **E** |
| *User group: Registered Nurses* | | | | | | | |
| McLead, 2020 [20] | Urgent/emergent care | Yes | Yes | | Yes | Yes | |
| Wouters, 2019 [34] | Urgent/emergent care | Yes | Yes | | Yes | Yes | |
| Tang, 2019 [23] | Nursing homes | Yes | | | Yes | Yes | |
| Reynolds, 2019 [22] | ICU | | | | | Yes | |
| Telford, 2018 [35] | ICU | | | | | Yes | Yes |
| Mahabee-Gittens, 2018 [19] | Urgent/emergent care | Yes | Yes | | | Yes | |
| Dehgani-Soufi, 2018 [13] | Urgent/emergent care | Yes | | | Yes | Yes | |
| Chunmei, 2018 [12] | Hospital inpatient | | Yes | | Yes | Yes | |
| Thoma-Lurken, 2018 [31] | Community - Geriatrics | Yes | Yes | | Yes | | |
| Boltin, 2018 [10] | Urgent/emergent care | Yes | | | | Yes | |
| Topaz, 2018 [24] | Home health | Yes | | | | Yes | |
| Barken, 2017 [32] | Telemedicine | Yes | Yes | | | Yes | |
| Geurts, 2017 [29] | Urgent/emergent care | Yes | Yes | | Yes | Yes | Yes |
| Kihlgren, 2016 [17] | Urgent/emergent care | Yes | | | | Yes | |
| Bennett, 2016 [9] | Urgent/emergent care | Yes | Yes | | Yes | Yes | |
| Ajay, 2016 [8] | Community health centers | Yes | Yes | | Yes | Yes | Yes |
| Febretti, 2016 [14] | Community-Palliative care | Yes | Yes | | | Yes | |
| Cortez, 2016 [27] | Outpatient clinics | | | | Yes | Yes | |
| McDonald, 2016 [30] | Home health | Yes | Yes | | | Yes | |
| Lytle, 2015 [18] | Hospital inpatient | Yes | Yes | | Yes | Yes | |
| Dallaire, 2015 [28] | Ambulance | Yes | | | | Yes | |
| Bowles, 2015 [11] | Hospital inpatient | Yes | Yes | | Yes | Yes | |
| Ciqueto-Peres, 2015 [33] | Hospital inpatient | Yes | Yes | Yes | Yes | | |
| Olsho, 2014 [21] | Nursing homes | | Yes | | Yes | | |
| *User group: Nurse Practitioners* | | | | | | | |
| Harless, 2016 [15] | Outpatient clinics | Yes | Yes | | Yes | Yes | |
| Vetter, 2015 [25] | Home health | Yes | Yes | | | | |
| Bakken, 2014 [26] | Various specialties | Yes | Yes | Yes | Yes | Yes | |
| *User group: Registered Nurses and Midwives* | | | | | | | |
| Horner, 2014 [16] | Outpatient clinics | Yes | Yes | | Yes | Yes | |
| **Percentage of studies (n=28) **** | | **82%** | **68%** | **7%** | **61%** | **86%** | **11%** |

*A-assessment, D=diagnosis, O=outcomes identification, P=planning, I=implementation, E=evaluation.
**Categories are not mutually exclusive, DSS could be mapped to multiple standards.

## 4. Discussion

Our review summarises recent evidence on nursing DSS with an aim to establish connections between DSS functions and nursing standards of practice. We found that the application of DSS is widespread, covering all areas of patient-nurse interactions within the healthcare continuum. However, current DSS tend to focus on a sub-set of clinical problems and perform limited clinical tasks like triage recommendations for urgent or emergent care needs; medication dose recommendation reminders to complete assessments; or risk score calculation (Figure 1). Moreover, these DSS do not sufficiently

cover all clinical settings. For instance, only four DSS in our review were applicable to hospital inpatient areas, which employs the highest number of nurses and collects a large amount of health-related data [36].
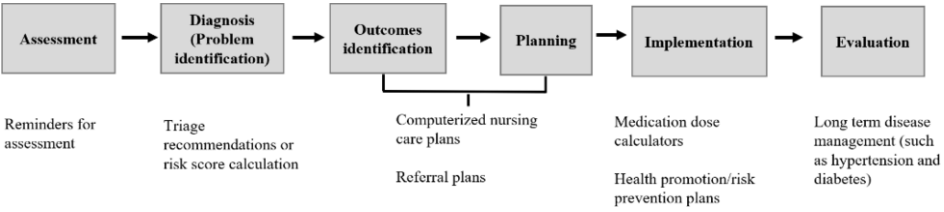


**Figure 1.** Examples of specific DSS functions linked with standards of nursing practice.

While most DSS support multiple nursing functions, the focus on outcome identification and evaluation is minimal. Majority of the DSS facilitate assessment function by a pre- designed series of questions to ensure all relevant information is collected. These systems then generate recommendations about what a nurse should do (implementation), without clearly explaining what the nurses should expect to see as an outcome. This missing piece of information is directly linked with evaluation of efficacy of these actions. Adding components about expected outcomes and evaluation can enhance clinical judgement and uptake of DSS by nurses [37].

## 5. Conclusion

Computerised DSS can facilitate multiple standards of nursing practice, including assessment, diagnosis, outcomes identification, planning, implementation and evaluation. However, their scope is limited in setting and functions. More research is needed to understand how expanding their scope, especially including components of outcomes identification and evaluation, and combining standards of practice within DSS can affect nurses' decision making, and patient outcomes.

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