

Review Paper ■

## A Comparison of Nursing Minimal Data Sets

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**Abstract** It is often argued that Nursing Minimal Data Sets (NMDSs) have advantages for the nursing profession. The NMDSs that have been developed and applied in some countries have many features in common, but there are differences in purpose, content, sampling, collection approach, and developmental stage as well. This paper examines the advantages and disadvantages of data sets of nursing practice, and the differences and similarities of five national and international NMDS systems. The purpose is to apply this information toward an NMDS initiative in the Netherlands. Future initiatives in NMDS development should include international coordination.

■ JAMIA. 1998;5:152–163.

Although many systematic collections of health care data exist around the world, nursing data are usually absent from these systems.<sup>1,2</sup> Clark and Lang<sup>3</sup> argue that it is becoming important for professional nurses all over the world to make visible what nurses contribute to health care. A powerful yet limited set of nursing data, often promoted as a nursing minimal data set (NMDS),<sup>2–6</sup> could be useful in making delivered nursing care visible. An NMDS has been defined by Werley and others as<sup>4–5</sup> “a minimum data set of items of information with uniform definitions and categories concerning the specific dimension of nursing, which meets the information needs of multiple data users in the health care system. The NMDS includes those specific items of information that are used on a regular basis by the majority of nurses across all types of settings in the delivery of care.” Thus, an NMDS would add specific information to existing minimal data sets (MDSs) and statistics in health care.

Five aspects are important with respect to an NMDS. First, pertinent data items need to be identified as the

variables we want information about. Second, each variable needs to be defined accurately—what is it and what is it not. Third, the universe of possible values for each variable or data item must be determined; in nursing these can be lists of agreed terminology, for example. Fourth, the actual patient data can be documented in the patient record with use of the appropriate terminology for particular variables. Finally, these patient data from individual records can be aggregated and coded into databases for different purposes of health care management, research, and policy.

The possibility of an NMDS for the Netherlands has not been investigated. Several health care organizations in this country have, however, expressed an interest in a database that includes nursing data. The purpose of this paper is, therefore, to compare several NMDS systems to see what can be learned from them and applied to the successful development and implementation of an NMDS in the Netherlands. The questions addressed in this selected review are: 1) What are advantages and disadvantages of NMDSs, and is there empirical evidence for these? 2) What are the nursing data currently included in the different NMDS systems; how are the data collected, stored, and analyzed; and what feedback information is aggregated and used?

To answer these questions we first describe developments toward national and international NMDS systems. Next, we examine the benefits and limitations of existing NMDSs. We then compare the data ele-

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Received for publication: 9/11/97; accepted for publication: 11/6/97.

ments, the purpose and scope of the data sets, and the methods of data management, analysis, and feedback of five NMDSs. Finally, we discuss future developments in the area of NMDS systems and a possible strategy for implementation in the Netherlands.

## Nursing Minimal Data Sets

### The Purpose and Development of NMDS Systems

Within health care, there is an urgent need for the systematic collection of nursing care data in order to "make visible what nurses do" and to facilitate comparison, quality assurance, management, research, and funding of nursing care.<sup>1-10</sup> Delaney and Moorhead<sup>11</sup> discuss the advantages for the health care community and for patients of the inclusion of nursing data into health care statistics. They argue that nursing information provides insight into patient care that has never been available before, including information about health problems as they relate to patients' life processes. These extend beyond the disease and the costs of providing medical and surgical services to include the costs of nursing care directed toward health problems. They also extend beyond morbidity and mortality outcomes measurement to include details about functional status.<sup>11</sup>

Two countries that have NMDS systems in use are the United States and Belgium. The initiative for an NMDS started in the U.S., and different uses of the U.S. NMDS have been reported.<sup>4,5,10</sup> Since January 1, 1988, all Belgian general hospitals are required by law to collect data for an NMDS four times a year (the "Minimale Verpleegkundige Gegevens (MVG)/Résumé Infirmier Minimum (RIM)").<sup>6</sup> In addition, an MDS for Belgian psychiatric hospitals—the Minimale Psychiatrische Gegevens (MPG)—has recently been established. This is a multidisciplinary data set that includes patient problems and nursing care.<sup>12</sup>

Other countries are also developing NMDS systems. In Australia, the objective of the Community Nursing Minimum Data Set Australia (CNMDSA)<sup>13</sup> is to introduce standardization and comparability into the collection of a minimal set of data to describe community nursing. No actual data collection has yet been reported from there. Anderson and Hannah<sup>2</sup> assert the need for an NMDS in Canada. The Alberta Association of Registered Nurses suggested the inclusion of nursing components into the Hospital Medical Records Institute (HMRI) database, which are addressed as Health Information: Nursing Components.<sup>14</sup> In Switzerland, the need for an NMDS is recognized, as is the need to first standardize nursing terminology.<sup>15,16</sup> A Swiss NMDS is under development.

Other initiatives in the systematic collection of data about nursing do not include nursing care items at this stage. Germain<sup>17</sup> describes the Programme de Médicalisation due Système d'Information (PMSI), an experiment in the collection of data about the intensity of nursing care in France. This French system does not include data that describe nursing care with respect to patient problems, nursing interventions, and patient outcomes. The National Health Service (NHS) in England has established an Information Management and Technology Strategy in which clinical data about nursing care are included.<sup>18</sup> There is no explicit description of an NMDS in this strategy, however. Wheeller<sup>19,20</sup> provides more detail on MDS in the UK, but essential nursing care description items seem to be absent at this stage.

Another development in the area of nursing data includes multidisciplinary databases and health information strategies. In the UK, the Core Community Minimum Data Set Scotland (EPPIC/CCMDS) includes nursing data in a multidisciplinary data set for use in automated records.<sup>21</sup> Modern database and information technology offer possibilities to collect nursing data once and use them for the different purposes, which were identified earlier.<sup>7</sup> Also, the Information Management and Technology Strategy of the NHS in England focuses on data use from clinical systems without the need for other systems to capture information specifically for management purposes.<sup>18</sup> Epping et al.<sup>22</sup> suggest a similar approach for the development of a nursing information strategy for the Netherlands.

Two other projects with a broader, international scope are ongoing: the first is the TELENURSE project and the second is the international development of the Resident Assessment Instrument (RAI). The TELENURSE project, funded by the European Union, contains components for: 1) the development of nursing vocabulary and classifications; 2) an NMDS; 3) clinical systems to record nursing data (as nursing diagnoses, interventions, and outcomes); 4) information systems to collect and aggregate these data; and 5) systems to analyze data, produce information, and provide feedback about nursing care for decision making on different levels.<sup>23</sup> Individual institutions in the following countries participate in the TELENURSE project: Belgium, Denmark, Finland, Greece, Iceland, Italy, Portugal, Switzerland, Great Britain, and The Netherlands. Other institutions and countries have expressed their interest.

The RAI is a multidisciplinary data set that contains nursing care data about patients and clients in nursing homes, among others.<sup>24</sup> The RAI provides a structure and language for understanding long-term care and

design care plans, evaluating quality, and describing the nursing facility population for planning and policy efforts.<sup>24</sup> This RAI data set is currently used in nursing homes internationally, including in the Netherlands.<sup>25</sup>

### Nursing Data in the Netherlands

In the Netherlands, different professional organizations have expressed an interest in developing an NMDS. Goossen and Epping<sup>26</sup> proposed the development of a Dutch NMDS system that could be used for the purposes identified by Werley et al.<sup>4,5</sup>—e.g., budgeting, determining the effectiveness of care, presenting epidemiologic data on nursing problems, and supporting policy making.<sup>22,26</sup> In the Dutch situation it is not possible, however, to test all the possible benefits and uses of an NMDS in a single project. A current project develops an initial version of an NMDS that can be used by acute-care hospitals in the Netherlands for resource planning. In future projects other uses and sectors can be addressed.<sup>22,26</sup>

There is a rationale for this approach. The National Organization for Nursing and Care in the Netherlands investigated the possibility of developing a system to compare nursing care data for policy development, funding, budgeting, and staff allocation in the Dutch health-care system.<sup>27</sup> The current way of determining budgets for nursing care in the Netherlands includes the many different systems and methods in use among different health sectors, different institutions in each sector, and different types of wards in each institution. This situation shows various results on the actual allocation of nursing staff.<sup>27</sup> Thus, there is an urgent need for Dutch nurses to adopt comparable data to influence policymaking and financing of nursing care.<sup>28</sup> The development of a single national budget parameter for nursing care in the Netherlands is considered unfeasible, however, since the Dutch government allows consumers and insurance companies to influence the costs and quality of health care in local and regional markets.<sup>27</sup>

Furthermore, one hospital in the Netherlands is participating in the TELENURSE project to test the nursing interventions terms from the International Classification for Nursing Practice (ICNP).<sup>\*</sup> The TELENURSE pilot will thus gain experience that could be relevant for further work on a Dutch NMDS. Since there are no results available at this stage, it is not possible to tell whether the TELENURSE initiative can be adopted in

the Netherlands. On the other hand, international cooperation and comparison is one of the goals of an NMDS and is of interest for Dutch nurses.

## Benefits and Pitfalls of NMDS

### Advantages of Systematic Collection of Nursing Data

Werley et al.<sup>4,5</sup> describe a number of benefits that an NMDS for nursing might provide:

- An NMDS would make it possible to describe patient problems across settings, clinical populations, geographic areas, and time; identify nursing diagnoses; determine what nursing interventions or nursing actions are taken; observe nurse-sensitive patient outcomes; and assess what nurse resources are used in the provision of nursing care.
- If the data were part of ongoing nurse documentation and were computerized in such a way that they could be readily retrieved, nursing professionals for the first time would be in an excellent position to compare and contrast nursing practice at different levels; offer testimony on critical nursing and health care issues; develop databases needed to conduct clinical research; assess the cost-effectiveness of nursing interventions for different nursing diagnoses; and assess the costs of nurse resources and provide data to influence health policymaking.
- Through the linkages between nursing and other professional databases, nurses could share data with various health providers and researchers and at the same time have access to their own data.<sup>4,5</sup>

Besides these expectations, there is empirical evidence of the benefits of an NMDS<sup>10</sup>:

- In Belgium it is possible to make nursing data visible in figures and graphic representations; base staff allocation; partly on the MVG/RIM data; perform clinical, quality assurance, and epidemiologic studies<sup>5</sup>; allocate resources based on MVG/RIM in general hospitals<sup>29</sup>; and, since 1994, base financing of nursing care at the national level on MVG/RIM data.<sup>6</sup>
- Saba and Zuckerman<sup>30</sup> found that medical diagnoses in nursing homes did not sufficiently predict the intensity of nursing care and the necessary allocation of staff. The NMDS elements in the Home Health Care Classification System could do this.
- Delaney et al.<sup>31</sup> established the research value of an NMDS, which proved to be: 1) a cost-effective data

\*In a joint effort with the International Council of Nurses in Geneva, the ICNP *alpha* version is established in the TELENURSE project.

abstraction tool, which reduced the costs of record retrieval from \$20.20–\$82.50 per patient record for manual retrieval to \$0.05–\$0.50 per patient record for electronic retrieval; 2) a valuable instrument for producing patient profiles by nursing diagnosis group; 3) a tool for establishing retrospective validation of the defining characteristics of nursing diagnoses; 4) a useful means of determining the costs of direct nursing care; and 5) a means of forecasting frequency and trends in nursing diagnoses.

- Ryan et al.<sup>32</sup> compared the prevalence of nursing diagnoses for several medical diagnoses and surgical procedures by analyzing a sample from 13,135 hospital admissions during 1991. The five most frequent nursing diagnoses for each medical diagnosis and surgical procedure—of which pain and injury potential were most prevalent—suggest that only specific nursing diagnoses were used for each medical diagnosis and procedure.

### Problems and Limitations of an NMDS

Although NMDS systems have many advantages, they are not always beneficial. Identified problems in the areas of comparability and systematic collection of health care data are as follows:

- Sometimes the concepts of MDS data items (variables) match, but the definitions of the MDS elements (in data dictionaries, for example) differ. Wheeler<sup>19,20</sup> presents examples, such as the concept of “date of admission.” Possible definitions for this concept are the date of first contact with a health care provider, the date of entering an emergency room, and the date on which a patient is admitted to a ward in a hospital. Those differences can cause problems when actual patient data from different sources are collected and compared. An actual value for patient G could be admission to ward X in Hospital L on December 6, 1997, whereas patient H is admitted to the emergency room of hospital M on December 6, 1997. The data are equivalent on a conceptual level, but the instantiations are not perfectly comparable. Furthermore, MDSs in one country can differ.<sup>19</sup>
- A unified and standardized nursing vocabulary and terminology system for nursing diagnoses, interventions, and outcomes is a prerequisite for an NMDS.<sup>10,11</sup> Although such material is currently available for inclusion in nursing databases and information systems,<sup>33</sup> there are still problems to be addressed, such as the lack of defined relationships between nursing diagnoses, interventions, and outcomes.<sup>10,33</sup>

- Vocabularies differ in specificity and detail. For example, a very fine grained vocabulary has been derived from patient care records and represents the terms nurses actually use, whereas a much less detailed vocabulary has been incorporated into an elaborate nursing classification.<sup>34–36</sup> It has been suggested that the Metathesaurus of the Unified Medical Language System (UMLS) could map linkages between the specific terms and the classification system.<sup>37</sup>

- A single vocabulary that fits all purposes, or links all terms, is considered a myth, and we need to look carefully at the purpose of the data we need and the vocabulary useful for those data.<sup>38</sup>

- The issue of ownership may be a problem. The CNMDSA project showed that developers often are not eager to “throw away” their “own” definitions and codes.<sup>39</sup> To adhere to national and international standards, it might be necessary to change the existing consensus on the nursing care items.<sup>13</sup>

- Architects of an NMDS must create mechanisms that address informed consent issues and take measures to protect privacy.<sup>10,40</sup> Ryan and Delaney<sup>10</sup> argue that approval from committees for the protection of human subjects should be obtained prior to abstraction of nursing minimum data from patient records.

- Ryan and Delaney<sup>10</sup> also assert that the reliability and validity of the database need to be assessed. Often these are confused with the validity and reliability of the classification system, but the authors stress the importance of looking at the actual data. Relevant measures would be to inspect the data and coding and to calculate the frequencies of each element. For computerized data, a few cases should be checked against actual patient records.

- High costs of updating NMDS systems include: upgrading existing data collections; changing the methodology, instruments, or classifications; changing information systems; and educating new users.

- Few electronic patient record systems allow direct retrieval of nursing minimal data.<sup>7,41</sup>

### Comparison of Different NMDS Systems

A comparison of NMDS systems at national and international levels seems feasible so long as differences in stages of development and use are taken into account and made explicit. For this comparison, NMDS systems were selected on the basis of literature searches using Medline, RN-Index, and EMBASE. Using the key words “nursing minimum data set,”

"NMDS," and "nmds," however, these searches identified only a few articles. Some index terms for the subject in the literature appeared very vague—e.g., information systems, nursing process, nursing, nursing research. Therefore, the proceedings of nursing informatics and medical informatics conferences and several journals that are specialized in nursing and health informatics were studied as well. References in selected papers were retrieved. Experts in NMDS projects were asked for supplementary reference material and questioned about the status of national developments. This led to additional documents that describe ongoing projects. Electronic mail proved a good means of communication.

The inclusion criteria for the projects in this review were as follows: 1) The NMDS system must include one or more *nursing care* items, described as nursing diagnoses, interventions, and outcomes or synonyms for these concepts. 2) It must be possible to infer from the publications some details about data elements; the purpose of the system; the vocabularies, terminologies, or classifications used; the method of data collection; the sample size and available database; feedback information; developmental stage of the project; and future directions.

In the next section some existing NMDS systems are compared in terms of these features. The systems in-

cluded here are the U.S. NMDS, the Belgian MVG, the Australian CNMDSA, the Canadian HI:NC, and the European TELENURSE project. The Belgium Psychiatric Data Set, the RAI for nursing homes, and the Scottish EPPIC system are not included, because they focus on multidisciplinary data sets and would require another approach for comparison.

### Comparability of NMDS Systems

In order to compare and interpret actual data, there must be agreement among these features of the NMDS systems: 1) the purpose of data collection, 2) the scope and population of data collection, and 3) the vocabularies used to describe patient needs, nursing care, and patient outcomes.

As shown in Table 1, the scope for most of these projects is national, except for the TELENURSE initiative. This implies that international comparisons based on the national systems will suffer from selection bias and that specific procedures are needed to compare systems adequately at this level. A similar problem exists with differences in the patient populations and the underlying vocabularies of the NMDS systems. As shown in Table 2, some systems use the same vocabularies, and there exist initiatives to map these vocabularies to allow comparison. Further benefits can be achieved when comparison is possible with other data

Table 1 ■

Comparison of Nursing Minimal Data Sets (NDMSs): Purpose and Population

	USA	Belgium	Australia	Canada	Europe
Name of data set	Nursing Minimum Data Set (NMDS)	Minimale Verpleegkundige Gegevens/ Résumé Infirmier Minimum (MVG/ RIM)	Community Nursing Minimum Data Set Australia (CNMDSA)	Health Information: Nursing components (HI:NC)	TELENURSE & International Classification of Nursing Practice (ICNP)
Purpose	Describe and compare nursing care Demonstrate and analyze trends in nursing care Support nursing research Base policy on factual data	Bridge gap between variability of daily nursing practice and policymaking Describe health status Allow for clinical nursing research Determine costs and effectiveness of nursing care Determine intensity of nursing care Determine hospital budgets and staffing	Compare performance of institutions Allocate resources Monitor and compare health status of the population Deliver information	Deliver information about nursing care Demonstrate unique contribution of nurses to the health of Canadians	Determine feasibility of nursing data collection and comparison in Europe Make visible what nurses do Collect nursing data that have been documented with use of the ICNP
Scope	National	National	National	National	Multinational
Population	All settings	General hospitals	Community care	All settings	All settings

Table 2 ■

## Comparison of NDMSs: Vocabularies and Comparison with Other Data Sets

	NMDS	MVG/RIM	CNMDSA	HI:NC	TELENURSE & ICNP
Vocabularies used	NANDA, NIC, Omaha, HHCC	ADL list list of 23 interventions (ICNP in future?)	NANDA	NANDA, NIC, Omaha, (HHCC under inves- tigation)	ICNP
Comparison with other health care data sets	Uniform Hospital Discharge Data Set (UHDDS)	Minimal clinical data set, medical inter- vention data set & diagnoses related groups	To be established	Health Medical Record Institute (HMRI)	None

NOTE: NANDA, North American Nursing Diagnoses Association; NIC, Nursing Intervention Classification; HHCC, Home Health Care Classification; ICNP, International Classification for Nursing Practice.

sets. For instance, in Belgium the MVG/RIM is collected simultaneously with the minimal clinical (i.e., medical) data, which can broaden the picture and allow researchers to control for possible confounders.<sup>6</sup>

The five NMDS systems have the shared purpose of describing and comparing nursing care. They also facilitate research and management. Furthermore, the information from NMDS systems can help influence policymaking with respect to nursing care budgets and staff allocation. Such decisions are usually not based on information alone, however, and require political activities alongside.

### NMDS Data Elements

Table 3 summarizes the data elements of the five NMDSs included in this study. It is obvious that the five have several features in common, but there are differences as well. Because it is not possible to discuss each feature here, only the conceptual levels are addressed.

The data items can be seen as the variables or attributes of interest on which a data collection focuses. In other words, in Table 3 the attributes are described, not the possible values. The features these systems have in common are nursing care data items such as nursing diagnosis, nursing intervention, and nursing outcome, and demographic data about the patient, nurse, and institution. Although the Belgium MVG does not include nursing diagnoses and outcomes at this stage, these items may be included in the future.<sup>23</sup>

Compared with the U.S. and Belgium systems, the CNMDSA includes several additional items related to date of first contact, date of referral, and date of first visit, etc. These make it possible to determine the exact episode of care,<sup>13</sup> and can be very important for making comparisons with other health care data sets and for determining the actual costs of care. As stated

before, these data can be compared only when the definition and characteristics of every data item are consistent and when data collection is based on a unified terminology. A difference in dates could result in counting a number of nursing diagnoses in or out of a study. On the other hand, some local definitions—and possibly incomparable data—might be inevitable because of distinct differences among the health care systems of different countries. Thus, either the comparison of actual data must include details about such differences or the terminology must be adequately mapped.

### Collection, Analysis, and Dissemination of NMDS Information

Table 4 compares the processes of data collection, sampling, aggregation, analysis, and feedback in the five NMDS systems. In some NMDS systems the nursing care data are collected electronically, while others use paper-based systems or a combination of both.<sup>10</sup> Many Belgian wards still collect MVG/RIM data using paper-based systems, but the hospitals are required to send in the data electronically.<sup>6</sup> In Australia, the plan is to collect all data electronically.<sup>13</sup> The use of automated nursing documentation systems is thought to improve the possibilities of collecting patient and nursing care data for an NMDS.<sup>4,7,10,23</sup> Such automatic collection of nursing data is one of the goals of the TELENURSE project.<sup>23</sup>

The sample sizes of the five initiatives show the greatest differences. In the United States, random or convenience samples are used most commonly, sometimes in a longitudinal design, whereas in Belgium data from the whole population in hospital at a certain time are collected in a cross-sectional design (over a 15-day period four times a year). In Belgium, the collection of nursing data currently includes more

than 10 million records in a national database, which have been collected on regular basis since 1988. The first TELENURSE pilot (known as the Telenursing Concerted Action project) used only 389 subjects, with a different sampling method in each participating country, which made comparison of nursing care items extremely difficult.

Analysis of the data differs between the USA, where data collection and analysis depend on varying purposes and research projects, and Belgium, where there is one national approach to data collection and data analysis, which is repeated every quarter. These differences are mainly because of variances in the national health systems, although some issues are the

Table 3 ■

Comparison of NDMSs: Data Elements

	NMDS	MVG/RIM	CNMDSA	HI:NC	TELENURSE & ICNP
No. of elements	16	17	28	27 (28 for newborns & infants)	16 (in the pilot test)
Patient demographics	5 items	3 items	5 items	8 items	4 items
Medical care items	None	ICD code Complications	Medical diagnosis	Medical diagnosis Procedures Dates Alive/dead codes	None
Nursing care elements	Nursing diagnosis Nursing intervention Nursing outcome Intensity of nursing care	Nursing interventions (from list of 23) ADL*	Nursing diagnosis Goals of nursing care (7 types) Nursing intervention (8 types) Client dependency Discharge (4 items)	Client status Nursing intervention Client outcomes Nursing intensity	Nursing diagnosis/nursing phenomena Nursing intervention Nursing outcome (future)
Service elements: Agency and provider	Unique service or agency number Unique health record number Unique nurse identifier	Unique hospital code Code specialty Code ward No. of beds	Agency identifier Source of referral	Provincial/institution/chart no. Doctor identifier Consultant identifier Nurse identifier Principal nurse provider	Type of institution
Episode	Episode or encounter date Discharge/termination date	Admission date Length of stay Day of stay Discharge date	Date first contact Date of referral Discharge date from hospital Date first visit Discharge date Date last contact	Admission date & hour Discharge date & hour Length of stay	Moment of stay (admission, stay, discharge)
Resources		No. of nursing hours available No. of nurses available Qualification mix of nursing Qualification mix	Resource utilization		
Other	Disposition point Expected payer of the bills		Other support services	Institution Main point of service Payer	

\*ADL, activities of daily living.

Table 4 ■

## Comparison of NDMSs: Data Collection, Analysis, and Dissemination

	NMDS	MVG/RIM	CNMDSA	HI:NC	TELENURSE
Means of data collection	From electronic and paper records, based on inclusion criteria	Surveys over 15 days, four times a year Paper, bar codes, or electronic records	Electronic records	No current use	During C/A*: from paper records Future pilots: electronic records from 6 sites
Sample size	Sampling of about 100-15,000 patients per study, and more	All patients $\pm$ 400.00 patients/year, or 1.2 million records/year One national database since 1988	Not reported	N/A	389 patients for first test study
Analysis of data in database	Dependent on every research project Appropriate statistics selected based on research question No national comparison currently	Statistics for ordinal data Multivariate approach; no single indicator can measure all aspects of patient care Cross-sectional approach of many-to-many interactions in nursing care	Not described in literature	No current use	Belgian MVG/RIM approach might be used
Aggregation levels	Patient, unit, institution, several institutions	Patient day, patient stay, patient, unit, hospital, national	Patient, institution, national, international	Clients, employers, province, national	Patient, pilot institutions, European countries
Feedback information	Reported in literature and research reports Reported at local, regional, national, and international conferences	Fingerprints for ward, institution, and nation All wards and specialties Sent back to all hospitals in booklet and on disk	Not described in literature Goes to the institutions that participate and others that have an interest	No current use	Reported at conferences and in project reports

\*C/A is the Telenursing Concerted Action project that preceded TELENURSE.

result of choices in research methods. Ryan and Delaney<sup>10</sup> describe several different research projects in order to test and use the NMDS in the U.S. Specific research projects include studies to: test the availability and retrievability of elements of the NMDS; test the electronic retrieval of NMDS items; report linkages in databases of nursing interventions and outcomes for specific diagnoses; describe nursing practice by use of NMDS items; and show trends in nursing care.<sup>10</sup> Each of these studies used an appropriate but different research design, sampling method, and method of analysis, depending on the research question.

It is clear that, although the idea of an NMDS is supported in several countries, the differences in research designs at this stage do not always allow for national or international comparison of nursing data. Although the Belgian system allows for comparison at

different times and for different settings, the research questions that can be answered by such a specific, one-purpose national database—without nursing diagnoses and patient outcomes—are limited. Some uses of the MVG/RIM for quality and epidemiologic studies have been reported.<sup>6,12</sup>

At first sight, the aggregation levels of current NMDS systems show differences. Nevertheless, most NMDSs intend to meet data needs for all levels, which are those of individual patients, units or wards, institutions or organizations, regions, nations, and groups of nations.

Feedback about nursing care is presented in different ways. Findings in the United States are reported at conferences and in publications, as are the Belgian results.<sup>4-6,11,31,32</sup> In Belgium, however, the feedback is also reported in an annual MVG/RIM booklet and a quarterly diskette, which makes it possible to com-



pare data from the local unit with national data and with data from similar wards at other hospitals. For the feedback information, Belgium uses additional graphical tools to present the data: the fingerprints of individual wards. These make the information easy to read and understand. Furthermore, the data are combined into national maps, which allow for easy comparison of patient categories, wards, and institutions.<sup>6</sup>

## Discussion and Conclusion

Although the idea of an NMDS seems to be unquestioned in nursing, there are many differences among actual NMDS systems and many questions to be addressed. It can be asked whether the development of an NMDS is worth the enormous efforts and costs. Benefits and costs need to be balanced against the results of NMDS use. This selected review has tried to answer two questions that will assist in making such decisions on NMDS development.

The first question is: "What are the advantages and disadvantages of NMDSs, and is there empirical evidence for these?" All NMDS systems have in common the potential to make visible what nurses actually do, why they do it, and with what results. This visibility is necessary to influence policymaking about nursing care, which has been stressed on many occasions.<sup>1-6,16,22</sup> It is clear that an NMDS allows for such an endeavor. Several research projects illustrate advantages for the profession and for health care at large. For instance, an NMDS can offer detailed information about the need for care and about the costs and quality of services. A growing body of evidence supports the assertion that an NMDS provides the profession with substantial benefits with respect to budgeting, financing, quality assurance, and nursing research.

On the other hand, disadvantages need to be taken into account. First, we need to address carefully the issues of whether we are comparing the same entities and of how we will deal with differences in scope, population, sample, actual data, abstraction, and aggregation. The reported results are, except in Belgium, quite small in scale when compared with whole populations. On the other hand, the large national database in Belgium has its own limitations: nursing diagnoses and patient outcomes are not included, which limits the research questions that can be answered with this database. Furthermore, if the underlying structures of the different data sets—locally, nationally, and internationally—are incompatible, there is nothing to compare. We believe it is feasible, however, to describe what patients have and what care is delivered, and to some extent correct these descriptions for

the particular population and size of the data set by using standardized incidence and prevalence estimates on nursing care items.

The issue here is not to critique the many studies that have been undertaken on use of the NMDS<sup>10</sup> but to contribute to the possibility of international comparison of nursing data. For a thorough international comparison, not only the instrument for data collection (i.e., the NMDS) needs to be consistent, but also the research questions, sampling methods and sizes, modes of data collection, and means of data analysis must be compatible. Ryan and Delaney<sup>10</sup> argue for the validity and reliability of the actual patient data collected for an NMDS. We support this view. We also want to add, however, that the external validity and reliability of the comparisons of different data collections from different populations should adhere to epidemiologic standards. This is necessary to achieve the suggested representation of an NMDS at an international level.<sup>10</sup>

Second, the issue of terminology still needs to be addressed. Here we agree with Hoy,<sup>38</sup> who considers it unfeasible to make a "Holy Grail" for the nursing profession—that is, the goal of one terminology and classification system that fits all purposes. The use of comparable descriptions in clinical records needs to be addressed, however, before we can even think of collecting reliable and valid data for higher levels of aggregation. Possible solutions include the use of synonyms with linkages to the coded standardized terminology from classifications<sup>42</sup> and the use of standard vocabulary in clinical records.<sup>43,44</sup> Furthermore, the mapping of terminology systems is feasible, as has been illustrated by recent initiatives in this area, such as that described by Warren,<sup>45</sup> who maps NANDA diagnoses to other health terminology in the SNOMED international system.<sup>45</sup> (NANDA is the North American Nursing Diagnoses Association; SNOMED is the Systematized Nomenclature of Human and Veterinary Medicine).

Third, the use of computerized patient records to provide nursing care data is considered *the* strategic investment for nursing care in the coming years.<sup>1,7,8,16,22</sup> This is the "collect once, use many times" principle, as Epping et al.<sup>22</sup> describe it. It seems, therefore, realistic to promote both the idea of a national and an international NMDS *and* an electronic patient record to "make visible what nurses do."<sup>1,2,22,23</sup>

Fourth, adequate measures need to be taken with respect to confidentiality and privacy. The informed consent procedure of the patient has already been mentioned. But even when there is consent, it is necessary to take measures to protect unauthorized use

of patient, professional, and institutional data. The CNMDSA describes security measures in detail, including transmission protocols, encryption, and passwords.<sup>13</sup>

The second question for this review is: "What are the nursing data currently included in the different NMDS systems; how are they collected, stored and analyzed; and what feedback information is aggregated and used?" There are commonalities between an NMDS and other health data sets. Many data items that are of interest to nurses (see Table 3) are already collected in national health databases and can be shared with other health disciplines.<sup>4,5</sup> These shared items include patient demographics, service data, and medical care elements, among others. On the other hand, it has been argued that specific nursing care items—such as patient problems, nursing interventions, and nurse-sensitive patient outcomes—are of interest to the profession and might be relevant for other disciplines as well.<sup>4,5</sup> From the perspective of efficiency, it is considered important that nurses make use of health data sets that already exist both nationally and internationally. It is also important that nursing data become available in large multidisciplinary databases to support health care management and policy decisions. In fact, this is the third advantage of NMDSs that Werley<sup>4,5</sup> described: that is, sharing data with other health professionals.

Although the purpose of an NMDS is to obtain comparable data about nursing care, it is questionable whether this is currently the case. Belgium is quite advanced with their national system, but the MVG/RIM data cannot be compared with data from other nations. In the U.S., the use of different terminology systems and study designs makes it unfeasible to compare the results from different studies. There is a difference between the retrospective or prospective continuous collection of data in the U.S. projects, on the one hand, and the cross-sectional sampling in Belgium, on the other, which again makes comparisons difficult. To a large extent such differences in national NMDS systems are the result of differences in the health care systems of the countries involved. At the conceptual level, data items do not differ much, with an exception for the Belgian system, which currently does not include nursing diagnoses and outcomes. Other differences among NMDS systems include: electronic versus paper-based data collection; individual research projects versus national health statistics; presentation of feedback via publication in the literature versus a specially developed graphical "language," such as the fingerprints and national graphical map in Belgium; the purposes of data collection (i.e., who exactly is doing what with the results?); and

the involvement of professional groups in the development.

Consequences of data collection, analysis, and dissemination of feedback information should be addressed at an early stage. This is important in order to keep professionals involved in the project and to keep their interest in data collection and use. Reading, analyzing, summarizing, and utilizing research findings is not always an easy task for nurses in practice.<sup>46</sup> Furthermore, for international comparisons of nursing data, inefficient translations might be necessary. Assisting the interpretation of NMDS research with graphical ways of arranging and comparing data can thus be helpful and needs careful investigation in the future. Such an approach is suggested for the TELENURSE project.<sup>1,23</sup> We should also be aware of the continuous change within our profession and in health care generally, which makes necessary the ongoing adjustment of a data set and the methods of its collection, analysis, and feedback.

Nursing clearly needs to address the issue of establishing linkages among the different developments in NMDS systems, vocabulary, and electronic records. In addition, adherence to existing and future standards in health care and nursing is necessary. In fact, every single data element of the NMDS needs a careful concept analysis and definition if it is to be useful in comparisons of nursing care. We need agreement on every variable, its level of aggregation, and its possible and agreed value. Nursing needs to address such standardization efforts. This could be done nationally as part of an NMDS initiative and internationally, perhaps, by those organizations that have an interest in these matters.

Finally, it can be questioned whether a specific nursing MDS still has relevance. More attention needs to be given to the multidisciplinary development of databases at patient and health care levels, instead of discipline-specific developments. For instance, the development of the EPPIC, RAI, and MPG systems shows that it is possible to include nursing care data in multidisciplinary data sets. On the other hand, nursing professionals still need to agree on all the care elements and terminology used in this multidisciplinary data set. We recommend that the multidisciplinary approach be investigated further.

In summary, important issues in the development of an NMDS in the Netherlands include:

- Identification of the purposes of NMDS data. The estimation of resources is used to start the Dutch developments, but other possibilities of an NMDS will have to be addressed as well.

- Clear definitions of the variables of interest, which are the NMDS items. Table 3 shows the relevant items for this, and an appropriate set will be chosen for use in the first Dutch project in the area.
- Use of unified terminologies that constitute the universe of values for each variable of interest and that can be used to document clinical care.
- Test of the data set in practice to document nursing care and calculate nursing resources.
- Integration of nursing data items into electronic patient records and existing health databases. The purpose is to share data and prevent duplication of effort in data collection while meeting legal and privacy regulations at the same time.
- Mechanisms to collect data, aggregate them into large health databases, analyze them, and present feedback information about nursing care. Further development of a universal graphical language that presents the data in an easily interpretable and understandable way is recommended.
- Methods to evaluate the benefits of the system and to continuously update it and enhance the benefits.

In conclusion, we can state that at both national and international levels there is no such thing as a single NMDS, nor are all underlying data elements comparable at this moment. International coordination of NMDS projects would be one approach to solve this problem. In the Netherlands, the development of a Dutch NMDS for resource calculations will be only the start. This data set will try to make visible what nurses do, why they do it, and with what results for patients. These nursing data will be used first to determine the need for nursing resources; the results for this test will be available in late spring 1998. Future projects with the Dutch NMDS may address such other areas as the effectiveness and the quality of nursing care as well as other research issues. We imagine that eventually nursing care items will be part of Dutch national health care statistics to support health policymaking.

The authors acknowledge the contributions of June Clark (ICNP), Amy Coenen and Polly Ryan (NMDS), Heather Clarke (HE:NC), Gunnar Nielsen (TELEURSE), Walter Sermeus (MVG/RIM), Jim Turley (CNMDSA), Patrick VanGele, Patrick Weber and Rudolf Widmer (Switzerland), and Maggie Wheeler (UK) for their materials, suggestions, and comments about the different nursing minimal data sets and developments presented in this review. The authors are grateful to the JAMIA reviewers and editors whose comments helped us make this a scientifically sound, clear, and readable article.

Finalization of this paper was made possible by a grant from the Dutch Organization for Nursing and Care (LCVV) as part

of the development of a first version of the nursing minimal data set for the Netherlands (VMDSN-AIG).

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