

The NAS System: Nursing Activities Score in mobile technology

SISTEMA NAS: NURSING ACTIVITIES SCORE EM TECNOLOGIA MÓVEL

SISTEMAS NAS: NURSING ACTIVITIES SCORE (NAS) EN TECNOLOGÍA MÓVIL

Vanessa Menezes Catalan¹, Denise Tolfo Silveira², Agnes Ludwig Neutzling³, Luísa Helena Machado Martinato⁴, Gilberto Cabral de Mello Borges⁵

ABSTRACT

The objective of this study was to present the computerized structure that enables the use of the Nursing Activities Score (NAS) in mobile technology. It is a project for the development of technology production based on software engineering, founded on the theory of systems development life cycle. The NAS system was built in two modules: the search module, which is accessed using a personal computer (PC), and Data Collection module, which is accessed through a mobile device (Smartphone). The NAS system was constructed to allow other forms, in addition to the NAS tool, to be included in the future. Thus, it is understood that the development of the NAS will bring nurses closer to mobile technology and facilitate their accessibility to the data of the instrument relating to patients, thus assisting in decision-making and in staffing to provide nursing care.

DESCRIPTORS

Nursing informatics
Information Systems
Nursing staff
Workload

RESUMO

Este estudo objetivou apresentar a estrutura informatizada que viabiliza a utilização do Nursing Activities Score (NAS) em tecnologia móvel. Trata-se de um projeto de desenvolvimento de produção tecnológica baseado na engenharia de software, fundamentada na teoria do ciclo de vida de desenvolvimento de sistema. O Sistema NAS foi construído em dois módulos: módulo de pesquisa, cujo acesso é realizado através de computador pessoal (PC) e módulo de coleta de dados, acessado por meio de dispositivo móvel (smartphone). O Sistema NAS foi construído de modo a permitir que outros formulários, além do instrumento NAS, sejam incluídos futuramente. Assim, entende-se que o desenvolvimento do Sistema NAS permitirá a aproximação entre os enfermeiros e a tecnologia móvel facilitando o acesso imediato aos dados do instrumento referentes aos pacientes, auxiliando na tomada de decisão e na adequação do quantitativo de pessoal de enfermagem para prestação da assistência.

DESCRIPTORIOS

Informática em enfermagem
Sistemas de Informação
Recursos humanos de enfermagem
Carga de trabalho

RESUMEN

Estudio que objetivó presentar la estructura informatizada que viabiliza la utilización del Nursing Activities Score (NAS) en tecnología móvil. Se trata de un proyecto de desarrollo de producción tecnológica basado en ingeniería de software, fundamentada en la teoría del ciclo de vida de desarrollo de sistema. El sistema NAS se construyó en dos módulos: módulo de Investigación, con acceso a través de computadora personal (PC) y módulo de Recolección de Datos, donde se utiliza un dispositivo móvil (Smartphone). El sistema NAS se desarrolló de modo que permita que otros formularios, además del instrumento NAS, se incluyan a futuro. Se entiende que el desarrollo del Sistema NAS permitirá la aproximación entre los enfermeros y la tecnología móvil, facilitando el acceso inmediato a los datos del instrumento referentes a los pacientes, auxiliando en la toma de decisiones y en la adecuación de cantidad de personal de enfermería necesario para brindar la asistencia.

DESCRIPTORIOS

Informática aplicada a la enfermería
Sistemas de Información
Personal de enfermería
Carga de trabajo

¹RN. Master's student, Graduate Program, School of Nursing, Universidade Federal do Rio Grande do Sul. Porto Alegre, RS, Brazil. nescacatalan@yahoo.com.br ²Ph.D. in Sciences, Universidade Federal de São Paulo. Adjunct Professor, Universidade Federal do Rio Grande do Sul. Porto Alegre, RS, Brazil. dtolfo@enf.ufrgs.br ³RN, Universidade Federal do Rio Grande do Sul. Porto Alegre, RS, Brazil. agnes.ludwig@gmail.com ⁴Seventh-term undergraduate student in Physical Therapy, Universidade Federal do Rio Grande do Sul. Porto Alegre, RS, Brazil. lu.martinato@gmail.com ⁵B.Sc. in Business Administration, Universidade Federal do Rio Grande do Sul. Technical Director Mobisys Wireless Solutions. Porto Alegre, RS, Brazil. gilberto@mobisys.com.br

INTRODUCTION

Intensive Care Units (ICU) concentrate highly specialized human and technological resources and complex, sophisticated care is delivered, at a high cost for the health system⁽¹⁻²⁾. In that context, for nurses to deliver ICU care, they need a broad scientific knowledge base and specializations allied with their technical and intellectual skills, linked with their daily care and administration practice⁽³⁾.

At most health institutions, the nursing team represents the most significant percentage in quantitative and budgetary terms, which makes nurses the most targeted professionals when it comes to cost reduction⁽⁴⁾. In that sense, nursing has been working to provide evidence-based proof that the numerical and qualitative inadequacy of nursing resources impairs the clients' rights for risk-free health care.

In the search to improve the cost-benefit relation in health care, it becomes fundamental to use indicators that objectively assess patients' clinical condition and care needs. Such care indicators are increasingly necessary for actual staff dimensioning at different hospital units⁽¹⁾.

One instrument constructed for patient classification and nursing workload assessment in intensive care is the NAS (Nursing Activities Score)⁽⁵⁾. Specialists developed the NAS based on the TISS-28 (Therapeutic Intervention Scoring System), with a view to modifying it more specifically for ICU nursing activities⁽⁵⁾. The authors found that the NAS is three times more precise and representative in comparison with the TISS-28 to measure the ICU nursing workload⁽⁵⁾. Thus, studies⁽⁶⁾ appoint that the NAS is interesting and valuable for care management, as the number of nursing professionals its score suggests very closely approximates the reality found.

Using any assessment instrument demands adequate data collection though, and information is both the main element in decision making and essential for care quality and nursing management. Access to information on their practice provides nurses with evidence for supporting Nursing's contribution to client outcomes. In that context, nursing's main effort is to specify the requirements of the information system and the inclusion of nursing needs with a view to sustaining their professional practice⁽⁷⁾.

Ideally, data should be collected directly at the care point, as if records are made after care has been accomplished, like at the end of the shift for example, much information can be lost, which could both compromise quality and duplicate efforts⁽⁸⁾. In that sense, the PDA (Personal Digital Assistant) is suggested as a possible nursing approach to care delivery at the client's bedside⁽⁹⁾.

Besides the PDA, other mobile technology devices exist that can also be adapted for use at the bedside. Smartphones, for example, are increasingly conquering users. These devices are mobile phones with different resources, including internet on an open platform to install different applications according to the type of use and the ability to read and/or edit different files, such as the Microsoft Office package (Word, Excel, PowerPoint). Hence, Smartphones can be useful for people who use mobile phones as a work tool⁽¹⁰⁾.

Data collected through a validated instrument like the NAS can be computerized to describe practice and facilitate actions and decision making in critical patient care. Besides, the use of the NAS can serve not only to support nursing professionals' actions in care delivery to critical patients, but also to respond to information production for client/patient care quality and outcome assessment purposes. It is known that all assessment activities depend on the availability of appropriate and precise information⁽¹¹⁾.

In that perspective, this study aimed to present a computerized structure that makes it possible to use the NAS through mobile technology. Thus, the researchers hope to contribute with information and propositions that enhance reflections on nursing knowledge construction in the field of information systems.

METHOD

This technological production development project was based on software engineering, in the framework of the systems development life cycle theory, which comprises seven phases (Problem Acknowledgement, Feasibility Study, Analysis, Project, Testing and Maintenance), which can often overlap⁽¹²⁾.

The study was developed at the Hospital de Clínicas de Porto Alegre (HCPA), which is a member of the Ministry of Education's teaching hospital network and is academically affiliated with the Universidade Federal do Rio Grande do Sul (UFRGS). The selected sector was the Intensive Care Center (ICC), located in the North wing of the hospital, on the 13th floor. The feasibility of the project was analyzed together with the Information Technology Management Coordination Office (CGTI) and the head of the Intensive Care Nursing Service (SETI) at the HCPA. In addition, budgets were requested from mobile technology software development companies to rent the mobile devices. The devices used are mobile devices (Smartphones with MS Windows Mobile, a mobile phone with an HTML browser), the latter with Wi-Fi for access to the wireless network.

The technology chosen to construct the system was the use of WEB pages and JAVA language with the HTTP protocol, which cover the two modules. This technology is characterized as cross-platform (any operating system,

...studies appoint that the NAS is interesting and valuable for care management, as the number of nursing professionals its score suggests very closely approximates the reality found.

Windows-Linux-Mac) and cross-browser (any browser: Internet Explorer, Firefox, Opera, HTML2). JAVA is a programming language that is not linked with a specific operating system, working on any computer independently of the microprocessor and the specific operating system used⁽¹³⁾.

For the entire set of human attitudes and behaviors to facilitate the present study development, procedures and ethical requirements for health research were respected. Therefore, approval for the project was obtained from the Institutional Review Board at UFRGS and at the HCPA (No 08-656).

RESULTS

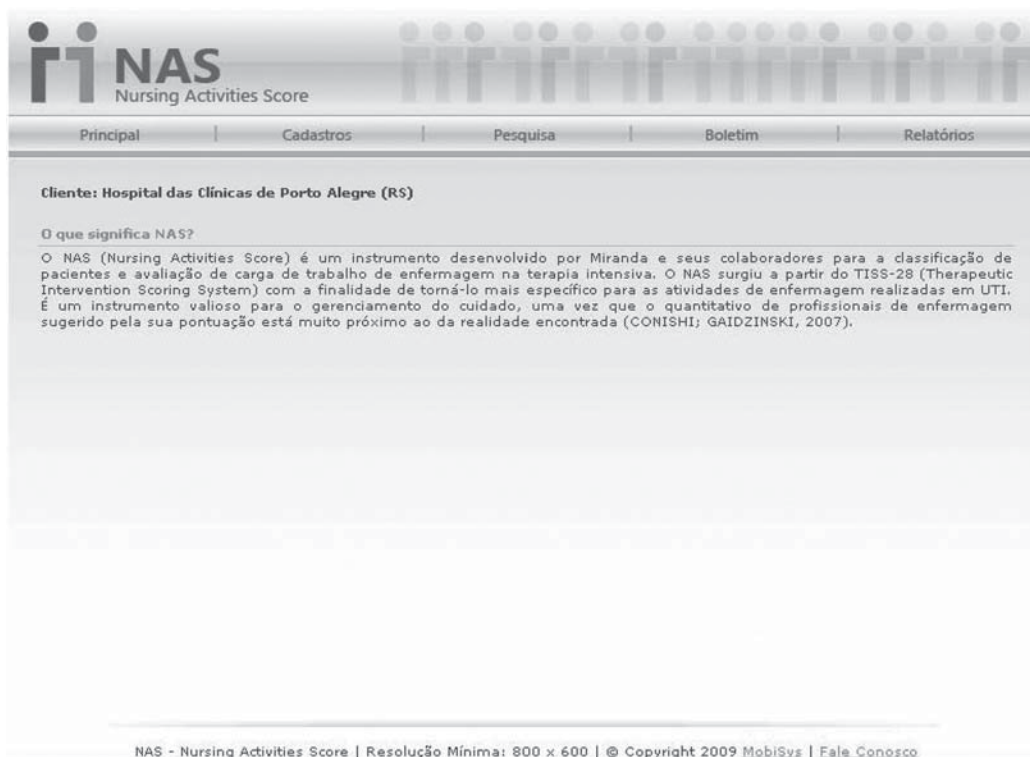
The NAS System was constructed in two modules:

- Research Module: accessed through personal computers (PC).

- Data Collection Module: accessed through the mobile device (Smartphone).

The research module of the NAS System was created for internet access through a desktop or laptop PC. The System site is hosted on a test server of the HCPA and can only be accessed from hospital computers through a login and password the CGTI provides to the research administrator, which makes it safe, as only enabled people can manage the System. The NAS System was constructed to permit the future inclusion of other forms besides the Nursing Activities Score.

Through a user-friendly interface, on the homepage of the NAS System research module (Picture 1), an explanation is displayed about the Nursing Activities Score and the scale concept. The main menu on that page, as well as in all other research modules, also contain buttons that, when clicked on, allow users to navigate inside the system's research platform. These buttons are repeated on all pages, so that users can move across the pages as needed.



Picture 1 – Homepage of the NAS System – research module

When clicking on the button *Register*, the researcher has access to another screen (Picture 2) with five registra-

tion options: for patients, researchers, research groups, research items and the type of response data to be obtained.



Picture 2 – Register page of the NAS System – research module

To give an example, when selecting the *Patients* button, the researcher can register patients at the unit, who are listed in the order of registration. More patients can be included, excluded (by clicking on the X symbol) or help can be requested (? button). The help button is present on different pages in the system. The register addresses information like: file, box (bed), entry date, exit date, death certificate, origin, Mechanical Ventilation (MV) and multi-resistant microbe (if the patient is being treated for some infection this type of agent has caused). It should be highlighted, like on the other screens, that only those items marked with a red asterisk (*) have to be filled out. After finishing the completion, the researcher clicks on the button *Save data* to finish registering patient information in the database and, if (s)he changes his/her mind, merely clicking the *Back* button is enough to return to the previous page. The *Back* option also appears on different pages.

When selecting the *Research items* button on the register page (Picture 2), the user is taken to another screen that displays all NAS scale items already registered, with options to exclude existing items and add new ones. When the user clicks on *Include*, the following fields appear:

- *Description*: the item should be written out (e.g. vital signs, times, calculation and regular weight). This field is mandatory;
- *Type of Response Data*: whether the included data will be decimal, mixed or others. Completion is mandatory;

- *Standard Value*: functions as a kind of default, in which the completed value is always the same;
- *Maximum Value*: the maximum value the item accepts is filled out;
- *Minimum Value*: the minimum value the item accepts is filled out.

After completing these fields, data can be saved, including the new item. The researcher can also return to the previous page or move on to a new one (main menu buttons).

According to the NAS instrument, items should be grouped according to the basic activities suggested, such as: monitoring and control, laboratory tests (biochemical and microbiological), medication (except for vasoactive drugs), hygiene procedures, drain care (nasogastric probe with drainage, EVD), mobilization and positioning, support and care for relatives and patients, administrative and management tasks, ventilation support, cardiovascular support, renal support, metabolic support and specific interventions.

In the sequence for including the NAS scale in the system, on the *Register* screen (Picture 2), the user should click on the *Research Group* button, moving on to the next page that displays all previously registered NAS scale groups, including the option to exclude existing items and add new ones. When selecting the item *Include*, on the next page, the field *Description* appears, where comple-

tion of the item title is mandatory (for example: metabolic support); the option to mark items for exclusion, in case only one of the items related to the group is permitted (for example: items from the hygiene care group). Also, all registered items are presented, so as to include only those items related to the included group.

Going back to the *Register* screen (Picture 2), the *Type of Response Data* button directs the user to the page where all available response data alternatives the database will recognize can be selected, which are: simple choice, text, decimal, full, date and multiple choice.

When returning to the main menu (on the top part of the screen), the *Research* button directs the user to a screen that lists the title of all researches registered in the System. Thus, more than one research can be included. When the user clicks on *Include*, the user is directed to another page that displays the following fields:

- *Description*: including the research title is mandatory;
- *Responsible*: where the user should select the researcher responsible for the research;
- *Creation Date*: where the current date appears as the research creation date;
- *Research Group*: permits selecting the item groups for inclusion;
- *Add button*: the user clicks on this button after choosing all item groups to be added to the research.

Going back to the main menu and clicking on *Bulletin*, the administrator can visualize the same screens the collector accesses through the Smartphone. The *Bulletin* module also permits NAS data collection in the same way as when using the device, but on a PC.

The main menu also contains the button *Reports*. When this is selected, the administrator goes to a page where research reports can be exported as Microsoft Excel worksheets.

The data collection module of the NAS System was created for access through a mobile device (Smartphone). Access is obtained through the Smartphone browser, typing the address of the system's collection page, which is recorded in the device's history of pages visited, so as to facilitate future collections.

Picture 3 below is the first page that appears, with a list of bulletins. Each line contains the number of the patient's file, the respective NAS collection date and the same patient's total NAS score on that date. On the same page, collections can be excluded by clicking on the X symbol.



Picture 3 – List of Bulletins page of NAS System – data collection module

By clicking on *Include*, the user is taken to the following page (Picture 4), where the fields below are displayed:



Picture 4 – Bulletin Cover Page of the NAS System – data collection module

- *Research*: where the user should select the title of the research (s)he is participating in;
- *Patient*: where the number of the patient's file should be selected;
- *Researcher*: where the name of the researcher who is collecting the data should be selected.

The date and time of data collection automatically appear as the standard value according to the device's operating system.

Under these fields, the current date and collection time is displayed.

When clicking on *Next*, the user moves to another page (Picture 5), which is actually the computerized version of the NAS form.



Picture 5 – *Completion* Page of the NAS System – data collection module

The form is completed by touching the screen, a resource frequently used in data collection. The collector selects the quadrants of each NAS item corresponding to the care the patient received during the last 24h. When clicking on the selection field, the score of the respective NAS item already appears. When finishing the completion, the collector selects the *Save* button, so as to save data in the system database and visualize the final NAS score.

The Creation of the System: one obstacle, one lesson

One of the first obstacles after defining what device to use in the research was the purchasing of the apparatus (Smartphone). Besides the price of this type of technology (high cost), technical specifications had to be observed

with a view to compatibility with the project and its use in the HCPA system. The responsible researchers sought different models and brands of these devices on websites and specialized mobile telephony stores. The following items were observed for the purchase:

- Being a mobile phone with an HTML browser;
- Being a Smartphone with a Windows Mobile™ operating system;
- Having Wi-Fi access;
- Having Touch Screen technology to facilitate form completion;
- Larger screen sizes with better resolution to facilitate visualization;
- Device memory, which interferes in the connection speed;
- Battery duration and useful life;
- Price compatible with the researchers' budget;
- Unblocked device for any telephone operator to use.

After many searches and different meetings, the researchers found the model Smartmaxx Gold, brand Nav City, the most compatible at the time. It was mainly used during tests with the hospital's wireless network. While constructing the system, a Smartphone, model SGH i710, brand Samsung, owned by one of the researchers, was also used. Internet access with this Smartphone was obtained through a connection cable between the device and a PC, as it did not possess Wi-Fi technology. Thus, it was only used in the layout creation and system adaption phases before migrating to the HCPA intranet. It should be highlighted that the use of two different models and brands in the system construction was important to verify that there were no differences in NAS system access depending on the browser.

When using Wi-Fi and even other networks, users need to be aware that network signals may not work, receive interference or even be weak at certain access points, mainly when far from the wireless network antenna. Besides, the device model can interfere when capturing the network with good or weaker signals, as some models can capture this signal better. At different times during tests at the CTI, the Internet signal was either interrupted or very weak or the network's safety configurations blocked the system pages. The network support team little by little solved all of these problems by configuring the device and migrating the system to the HCPA intranet.

During the system construction, various obstacles were met. Many meetings were held with the CGTI, during which configurations, access mode, type of programming language were discussed, besides various encounter to configure the device so as to permit its network access. One of the most discussed aspects during these meetings was undoubtedly research data traffic safety, that is, that patient data could not be accessed from outside the hos-

pital or by unauthorized people. Intranet use was a very important point that partially solved this issue. It should be highlighted that it was agreed upon with the CGTI that, after setting up this system at the HCPA, the existent integration of corporate computer system data with Hospital Management Applications (HMA) with NAS system data would again be discussed.

The researchers and NAS System developer's (Mobisys) efforts should also be mentioned. Various meetings took place with the systems analyst, as well as e-mail exchange and the use of communicators like MSN™ and Skype™. The main difficulty during negotiations was undoubtedly reaching a consensus, mainly on what interface would be presented to the users. The company departed from the perspective of what was most usual and feasible in informatics and the researchers from the care perspective. Both parts did their utmost best for NAS use on the Smartphone to be as easy as possible, with an attractive interface and without many pages, which both the researchers and the company tested several times. Thus, following the system life cycle⁽¹²⁾, the end product of the NAS System was reached.

CONCLUSION

The researchers consider that the goals set for this study were reached, mainly concerning the proposed sys-

tem development. NAS collection through Smartphones is a feasible proposal and allows nurses to collect the data during patient care at the bedside.

The NAS System permits approximation between the nurses and mobile technology, so as to facilitate immediate access to instrument data about the clients, helping with decision making in care management and in the adaption of nursing staff numbers for care delivery.

Consequently, using Smartphones as an NAS completion device represents an alternative for the "time" factor, which health professionals often appoint as a limiting factor for information technology use.

In addition, as the Smartphone is a device with mobile phone functions, nurses who already possess this type of device can also use their own equipment in care. Thus, as a private object, owners would take more care with the device, improving the matter of material safety.

Finally, it is highlighted that this study does not end here. The development project will continue with the implementation and assessment of the NAS system with mobile technology, constructed here, in the computer system of the study institution. This advance can facilitate the structuring of elements that can better respond to the previously appointed needs and benefits.

REFERENCES

1. Queijo AP. Tradução para o português e validação de um instrumento de medida da carga de trabalho de enfermagem em unidade de terapia intensiva: Nursing Activities Score (NAS) [dissertação]. São Paulo: Escola de Enfermagem, Universidade de São Paulo; 2002.
2. Fein A, Fein SL. Utilization and allocation of critical resources. In: Shoemaker WC, editor. Textbook of critical. 4th ed. Philadelphia; 2000. p. 2009-15.
3. Ducci AJ, Krokosz DVC, Bento SCT, Padilha KG, Kimura M, Miyadahira AMK. Produção científica brasileira de enfermagem em terapia intensiva de 1995 a 2004. *Acta Paul Enferm.* 2007;20(2):216-22.
4. Gaidzinski RR. Dimensionamento de pessoal de enfermagem em instituições hospitalares [tese livre-docência]. São Paulo: Escola de Enfermagem, Universidade de São Paulo; 1998.
5. Miranda DR, Raoul N, Rijk A, Schaufeli W, Iapichino G. Nursing Activities Score. *Crit Care Med.* 2003;31(2):374-82.
6. Conishi RMY, Gaidzinski RR. Nursing Activities Score (NAS) como instrumento para medir carga de trabalho de enfermagem em UTI adulto. *Rev Esc Enferm USP.* 2007;41(3):346-54.
7. Évora YDMA. A enfermagem na era da informática [editorial]. *Rev Eletr Enferm [Internet].* 2007 [citado 2010 fev. 12];9(1):14. Disponível em: <http://www.fen.ufg.br/revista/v9/n1/pdf/v9n1a01.pdf>
8. Marin HF. Os componentes de enfermagem do prontuário eletrônico do paciente. In: Massad E, Marin HF, Azevedo Neto RS, editores. O prontuário eletrônico do paciente na assistência, informação e conhecimento médico. São Paulo: FMUSP/ UNIFESP/OPAS; 2003. p. 73-83.
9. Barra DCC. Processo de Enfermagem Informatizado em Terapia Intensiva em Ambiente PDA (Personal Digital Assistant) a partir da Cipe® Versão 1.0 [dissertação]. Florianópolis: Pós-Graduação em Enfermagem, Universidade Federal de Santa Catarina; 2008.
10. Dvorak JC. Que venham os iPhones! *Revista Info.* 2008; (272):32.
11. Donabedian A. La calidad de la asistencia. ¿Cómo podría ser evaluada? *Rev Calidad Asistencial.* 2001;16(1 Supl):80-7.
12. Meilir PJ. Projeto estruturado de sistemas. São Paulo: McGraw-Hill; 1988.
13. Laudon P, Laudon KC. Sistemas de Informação Gerenciais. São Paulo: Pearson Prentice Hall; 2007.