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# Fall Risk Assessment Through a Self-Service Terminal in the Outpatient Setting

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### Abstract

Health organizations aim to identify patients with high fall risk in the different attention scenarios in order to provide safety and quality care. In order to address this issue, we designed an assessment tool that surveys fall risk through three questions in self-service terminals in the outpatient setting. Our objectives in this article are to describe the implementation process. A cross sectional design was used for the pilot (between October and November 2018). The issued tickets rate with high fall risk (defined as <sup>3</sup>/<sub>3</sub> positive responses) was 34.3%. Some adjustments needed to be done because some patients did not have true risk criteria due to self-report. We conclude that this tool will allow quicker identification of patients with true high risk. Effective prevention strategies will be necessary to improve safety after risk fall identification.

#### Keywords:

Information systems; Risk assessment; Self-management,

## Introduction

Health professionals and decision makers in health organizations are aware of the need to provide quality and safe care. Patient safety is usually an institutional policy and is considered part of healthcare quality. Unwanted side effects in healthcare represent a considerable cause of morbidity and mortality in health systems.

The American Geriatrics Society and the British Geriatrics Society have published a clinical practice guideline on detection, evaluation and management of fall risk where it is recommended to annually evaluate all adults over 65 years of fall risk. This test involves asking patients if they have fallen two or more times in the past year, received medical attention for a fall, or experienced unsteadiness or loss of balance when standing or walking. It has been shown that patients who respond positively to any of these questions have an increased risk of falls and should receive an additional evaluation [1].

Patient assessment and identification of characteristics that can increase the probability of falls are fundamental for planning effective prevention strategies [2]. Using a specific tool to identify patients with greater susceptibility to fall can assist in preventing injuries [3]. There are investigations related to falls in different areas [4,5], which have provided insights into fall incidence related to the ambulatory care setting and evaluation of fall risk through validated instruments [6].

Nurses in primary care use the Morse scale for assessing the risk of falling but may not be transferrable to an outpatient setting. For that, evidence-based tools that define the risk of falls in non-hospitalized patients are promising [7].

If the fall rates are not reduced in an immediate future, it is projected that the number of injuries caused by falls will double by 2030 [8]. In our institution fall risk prevention for nonhospitalized patients is part of the 6th objective of the Joint Commission International (JCI), warning that fall risk methods should be appropriate for patient, taking into account risk differences (diversity of populations: pregnant, post-surgical or elderly) [9].To date, we have found no reports related to falls in outpatient settings, or assessments of preventive fall interventions.

The assessment of the Fall Risk Scale is normally performed at the time of the medical consultation or nursing intervention. However, there are no early identification of the risk until admission to the institution. This does not ensure patients receive preventive intervention and are informed about safe practices for patients at fall risk. Thus, the objectives of our paper is to describe the design of an assessment tool for fall risk through self-service terminals in the outpatient setting and to report the results of use in the pilot test.

## Methods

#### Setting

Hospital Italiano de Buenos Aires (HIBA) is a non-profit organization with 165 years of history in Argentina. Its healthcare network includes a university hospital of high complexity that covers health care for outpatient, inpatients, emergencies, critical care, home care, chronic care and medical and surgical specialties. It has its own medical insurance service (health maintenance organization), with more than 160,000 affiliates, and provides health services to 1,500,000 people with other health insurances. Annually, more than 45,000 patients are admitted to HIBA hospitals, and 45,000 surgical procedures and 3,000,000 outpatient visits occur. Since 1998, the HIBA has its own health information system (in-house) that includes the management of clinical and administrative information. Its electronic health record (EHR) is an integrated, modular, problem-oriented and patient-centered system, used in the different clinical scenarios (ambulatory, hospitalization, emergency center and home care) [10,11].

Since 2009, self-service terminals have been implemented into the HIBA, and are currently distributed in all ambulatory care areas. It is a standing self-service touch screen cabinet (Fig 1), with multiple features, developed and manufactured in Argentina. The main features of this tool are: appointment scheduling, ticket printing, as well as data recording. The main function for the outpatient is self-reception when attending a scheduled appointment. It has a modern and ergonomic design, with great versatility and robustness. The self-service terminals are recommended for high-concurrency spaces, to support smooth to flow of outpatients in our hospital.



Figure 1: Self-service Terminal

## Design

In order to assess fall risk fall and identify of patients at risk in the ambulatory area, we decided to incorporate a new functionality in the pre-existing self-service terminal in the ambulatory area at the Hospital. We used a cross-sectional analysis to analyze and report the assessment tool use during the pilot test performed during the period between October 18 and November 7, 2018 at Hospital Italiano de Buenos Aires.

Relative and absolute frequencies included were:

- All patients with potential risk of falls (defined as those requiring priority attention by self-report: pregnant, reduced mobility and / or disability);
- Rate of tickets issued (defined as those patients with high risk: at least 2 out of 3 affirmative responses);
- Number of patients attended and intervened by nursing.

#### **Phase 1: Situation Diagnosis**

The 6th version of the JCI Manual recommends having a tool to identify risk of fall in the ambulatory area from the moment patients enter the institution, which allows them to be correctly identified and to establish a secure circuit. The scope is to detect patients at risk of falling, as well as identify risk factors. The educational intervention carried out by the nursing staff must be recorded in the EHR.

#### Phase 2: Development of the Prototype

This stage is based on the already implemented features design of the self-service terminals (see Figure 2), which includes the incorporation of the fall risk assessment.



Figure 2: Self-service Terminal - Initial Screen Translation: Welcome to the self-service terminal. Which transaction do you wish to perform? Confirm I'm Present (I already have an appointment). Book an appointment. Register (It's my first time at Hospital Italiano). Other tasks.

In the prototype, three questions of assessment are aligned to the left and the possible answers (YES / NO) on the right side of the screen (See Figure 3).

Volver	🕗 Autopestión	
Para su seguridad dentro del Hospital es importa Riesgo de Caídas	nte saber si	usted tiene
¿Se ha caído en el último año?	Si	No
¿Utiliza alguna ayuda para caminar (andador) o se le ha sugerido que lo haga?	Si	No
¿Siente temor para caminar?	Si	No
	Continuar	

Figure 3: Self-service Terminal - Risk Fall Assessment Screen Translation: For your safety at Hospital Italiano it is important to know your falling risk. Have you fallen the last year? (Yes/No). Do you use any walking assistance, or have you been suggested to do so? (Yes/No). Are you afraid when walking? (Yes/No).

Listed below the questions, is a 'CONTINUE' option that the patient should select and is disabled until the three questions mentioned above are answered. In order to ensure completeness of the scale, all three data fields are mandatory.

For those patients with high risk (defined as two of three affirmative answers), a ticket is printed with the letter C as shown in Figure 4.



Figure 4: Emisión de ticket con Riesgo de caída. Translation: Please take your printed ticket and wait to be attended, thank you.

For the development of the software, we decided to build a web application. Java<sup>TM</sup> language was used to program all the functionalities of the back-end, with HTML and JavaScript for the front-end. The final set of the application was deployed on web servers and accessed using a Chrome<sup>TM</sup> browser installed in each self-service terminal, under Windows 7<sup>TM</sup> or Windows 10<sup>TM</sup>, configured to be used from a touch screen. Eventually the application will also be able to run under Linux<sup>TM</sup> (Red Hat<sup>TM</sup>, Ubuntu<sup>TM</sup>, Debian<sup>TM</sup>, etc.).

### **Phase 3: Implementation**

The pilot test of the printing ticket feature and process was implemented during the month of October. The care circuit for patients with potential risk fall was established. The administrative staff and nurses were involved in the process. The process begins with the printing of a ticket identify with the letter C (possible patient with risk fall detected), which is generated by answering affirmatively two of the questions, in the self-service terminal. Once the ticket has been issued, the patient waits for his call by the administrative staff, then the patient is identified with a green bracelet in the wrist and is oriented towards a safe place. The nursing staff is informed to locate the patient in a safe place. In addition, the nurse performs Morse scale assessment of falls risk, provides educational materia, and records the intervention in the EHR.

#### Results

Based on the prototype, the following modifications were made: the size of the letter was increased, and the color was improved and adapted to improve user experience of older adults. The necessary adjustments were made until arriving at the final version, which is currently being used in a pilot test (See Figure 5).



Figure 5: Self-service Terminal - Risk Fall Assessment Screen Adapted from the Original Ddesign. Translation: For your safety at Hospital Italiano it is important to know your falling risk. Have you fallen the last year? (Yes/No). Do you use any walking assistance, or have you been suggested to do so? (Yes/No). Are you afraid when walking? (Yes/No).

During the study period, there were a total of 1784 patients with potential risk of falls who responded to the assessment, of which the rate of issued tickets was 34.3% (95% CI 32.10-36.56).Figure 6 shows the frequency distribution of patients that carried out the survey and the generation of ticket with fall risk according to the dates. The red line indicates completed surveys that did not generate a ticket, and the blue line indicates the surveys completed that resulted in generation of a ticket.



Figure 6: Frequency Distribution of Patients who Completed the Survey that Resulted in Generation of a Fall Risk Ticket

The number of patients who received nursing care each day of the pilot is shown in Figure 7.



Figure 7: Total Patients Attended by Nursing

An important finding in the validation of patient conditions with potential falling risk was that many of them did not meet a true risk criterion. Table 1 shows the details of this findings.

Table 1: Patients without True Criteria for Falling Risk		
Other reasons for consultation (not related to programmed ambulatory appointments)	<ul> <li>Registration application</li> <li>Request for laboratory</li> <li>printing</li> <li>Appointment scheduling</li> <li>Others arrangements</li> </ul>	
Technical failures in ommunication	Patient who wanted priority attention	

## Discussion

The design of this tool aimed at assessing and detect patients who were at high fall risk within the outpatient setting, in order to plan effective prevention strategies. This process could improve the waiting conditions, adapt specific needs of high fall risk populations, improve patient safety, and potentially reduce the risk of falls within the institution. The rate of tickets issued was 34.3%, higher than expected, due to the logistics and necessary resources required for the implementation of effective prevention strategies, and the coordination of all the actors involved. However, this rate could be overestimated, given that patients reported untrue data, and thus further validation is required. We believe that the step of validation is important, because many patients reported having high risk to avoid the system waiting times, in order to be treated with priority. The process of self-report generates the need to validate the true positive cases of patients with a high risk of falling, and in some cases the answer of the generated ticket.

The full patient population may also not have been represented, as there were a small number of terminals in which the survey was implemented (not enough for the number of patients), connectivity issues (which sometimes prevented the use of the terminal), and difficulties with the touch screen.

This is our first experience of implementing a technological tool to improve the quality and safety of patients in the outpatient setting. Although, it is a novel tool with great potential and in consistency with JCI priority lines, diffusion, institutional communication and training are needed. For this, it requires more communication and teamwork (security, administrative, nursing, among others).

Furthermore, standard strategies for continuity of care are needed, focused on addressing the diversity of patients with potential risk fall, integrating all the necessary staff of the process with a single objective. At the same time, it highlights the importance of indicators.

As future pending lines of work, we propose: re-design to overcome some of the aforementioned technical difficulties, improving usability and adapting new functionalities to the user needs (incorporation of patient identification through QR or through Personal Health Record).

### Conclusions

The design of this tool will allow the rapid identification of patient with true positive high risk of fall in the outpatient setting, and effective prevention strategies will be necessary to guarantee a safe course of action for patients. This could support improving waiting conditions, adapting to the specific needs of the population at high risk, and potentially decreasing the risk of falls within the institution.

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#### References

- E.A. Phelan, J.E. Mahoney, J.C. Voit, and J.A. Stevens, Assessment and management of fall risk in primary care settings, *Med Clin North Am* **99** (2015), 281–293.
- [2] M. de F. Luzia, M.A. de G. Victor, and A. de F. Lucena, Nursing diagnosis risk for falls: Prevalence and clinical profile of hospitalized patients, *Rev Lat Am Enfermagem* 22 (2014), 262–268.
- [3] B. O'Rourke, R. Upchurch, J. Bain, L. Tirey, S. Vrchota, and K. Watson, Identification of Fall Risk Factors Through Self-report and Physical Performance, *Topics in Geriatric Rehabilitation.* 34 (2018), 194–199. doi:10.1097/tgr.00000000000194.
- [4] G.P. Forrest, E. Chen, S. Huss, and A. Giesler, A comparison of the Functional Independence Measure and Morse Fall Scale as tools to assess risk of fall on an inpatient rehabilitation, *Rehabil Nurs* 38 (2013), 186–192.
- [5] G.F. Del Duca, D.L. Antes, and P.C. Hallal, Quedas e fraturas entre residentes de instituições de longa permanência para idosos, *Rev Bras Epidemio.* 16 (2013), 68–76.

- [6] L.Z. Rubenstein, R. Vivrette, J.O. Harker, J.A. Stevens, and B. Josea Kramer, Validating an evidence-based, self-rated fall risk questionnaire (FRQ) for older adults, *Journal of Safety Research*.42 (2011), 493–499. doi:10.1016/j.jsr.2011.08.006.
- [7] [No title], (n.d.). http://nursing.uthscsa.edu/onrs/starmodel/institute/su09/doc uments/meador.pdf (accessed October 22, 2018).
- [8] C. Ni Scanaill, C.N. Scanaill, C. Garattini, B.R. Greene, and M.J. McGrath, Technology innovation enabling falls risk assessment in a community setting, *Ageing Int.* 36 (2010), 217–231.
- Website, (n.d.). https://www.jointcommissioninternational.org/6th-editionin-depth-preventing-falls-in-inpatient-and-outpatientsettings/ (accessed October 22, 2018).
- [10] F. Plazzotta, D. Luna, and F. González Bernaldo de Quirós, Health information systems: integrating clinical data in different scenarios and users, *Rev Peru Med Exp Salud Publica*. **32** (2015), 343–351.
- [11] D. Luna, F. Plazzotta, C. Otero, F. González Bernaldo de Quirós, A. Baum, and S. Benítez, Incorporación de tecnologías de la información y de las comunicaciones en el Hospital Italiano de Buenos Aires, (2012). http://hdl.handle.net/11362/3959 (accessed November 23, 2018).

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