

## User Experience (UX) of the Fall Risk Assessment Tool (FRAT-up)

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**Abstract**— Fall risk assessment is important for fall prediction and fall prevention among older adults. In order to be applied in clinical practice, a fall risk assessment tool need to be regarded useful. The aim of this study was to evaluate healthcare professionals’ user experience (UX) of the Fall Risk Assessment Tool (FRAT-up). Eight health care professionals working in a geriatric hospital department or in the primary health care system participated in a focus group and evaluated the tool. The healthcare professionals considered the FRAT-up tool to be novel and considered it useful in clinical practice. The tool can be used to get an extended knowledge and understanding of how to individually tailor a fall prevention intervention. It is suggested that for a better experience, the scale should be simplified and the tool should be integrated with the patient’s medical record.

**Keywords**—component; Falls; Fall Risk Factors, Risk Assessment; User Experience; Aged; Healthcare Systems

### I. INTRODUCTION

Falls and fall-related injuries are a major public health concern, leading to increased morbidity, mortality, and health care costs [1]. Fall-related injuries are the most common accidents among the elderly, with about 10 percent leading to a fracture, of which 1-3 % are hip fractures [2]. Therefore, it is important to use the medical history of the subjects for clinical decision and timely intervention to reduce the risk of falling.

Numerous fall risk factors have been reported in the literature [1], and different subgroups of older people have different risk factors for falls. However, it is challenging to interpret the different information and use it for clinical decision-making. In this study, we assessed the user experience of a newly developed fall risk assessment tool, the FRAT-up, which calculates the future probability of fall risk.

#### A. UX and Usability Evaluation of Healthcare Systems

Usability is a qualitative attribute that indicates how easy devices are to use. User Experience (UX) is a broader concept than usability, and is defined as a person’s perception and responses that result from the use or anticipated use of a product, system or service [3, 11]. UX problems are barriers for implementation of systems into

healthcare practice. Approximately 30% of electronic medical record (EMR) systems fail because physicians cannot use the systems efficiently. These include loss of productivity and difficulty in learning new systems [4].

The ultimate success of a system depends on whether potential users find the system useful and thus satisfactory. For fall risk assessment tools, this means that the systems should focus on critical aspects of fall risk assessment and stakeholders should feel they improve practice by using the system.

#### B. Fall Risk Assessment Tool (FRAT-up)

FRAT-up is a fall risk analysis tool developed under EU project FARSEEING<sup>1</sup>. The project aims to promote better prediction, identification and prevention of falls with a focus on ICT devices, tools and systems. The tool evaluates the fall risk of a subject within a year time span. Starting from a light ontology of risk factors collected from previous published studies on fall risk, a set of probabilistic rules is generated [5, 12]. In FRAT-up, the health profile of the subject is collected, and an overall fall probability of the subject computed. Figure 1 illustrates fall risk probability after information regarding individual’s fall risk factors is added into the tool.



Figure 1. Illustration of probability of fall in FRAT-up<sup>2</sup>

The background for selection of fall risk factors and calculation mechanisms are reported in 27th IEEE

<sup>1</sup> <http://farseeingresearch.eu/>

<sup>2</sup> Frat-up online: <http://ffrat.farseeingresearch.eu/>

International Symposium on Computer-Based Medical Systems. [5]. The algorithm was tested on a total of 2319 observations from 977 subjects aged 65 or more, using data collected in the four waves of the InCHIANTI study [6].

The main objective of this study is to assess the UX and usability of FRAT-up, for use in clinical practice, to make decisions about future fall risk and to support clinical decision-making. To address this, we invited healthcare professionals to evaluate the tool and to provide their feedback and recommendations for further development of the tool. The study was conducted in June 2014.

## II. METHOD

### A. Focus group and Interviews

A focus group session was conducted for 90 minutes. In the focus group health professionals explored the use of the FRAT-up. Healthcare professionals were presented with the online version of the FRAT-up ([ffrat.farseeingresearch.eu](http://ffrat.farseeingresearch.eu)). They were asked to freely explore the system and after that discuss how the tool worked and give their inputs and feedback on experience of use.

### B. Participants

We included physiotherapists and physicians in the focus group. Participants were recruited from St. Olav hospital, Department of geriatrics and from the primary health care system in Trondheim, Norway. All had working experience with elderly people. Eight healthcare professionals (7 female, 1 male), six physiotherapists and two general practitioners, with average age 42 years ( $SD \pm 10.1$ ), participated. The participants had on average 13.5 years ( $SD \pm 5.5$ ) of working experience with elderly people and on average 9.7 years ( $SD \pm 3.1$ ) of experience in addressing fall related issues concerning elderly people. Three of the participants had between 1 to 4 years of experience of using fall prevention technologies.

### C. Procedure

Approval to run the study was obtained from the Norwegian Social Science Data Services (NSD - Norsk samfunnsvitenskapelig datatjeneste). A researcher, who is a healthcare professional with experience working with older persons at risk of falling, led the focus group discussions, while a Human-computer interaction (HCI) researcher handled practical matters such as completing the consent form and UX questionnaire. The focus group was conducted in Norwegian language. The discussions were carried on in a group setting, and finally participants individually completed the UX questionnaires after observing and using the FRAT-up tool. All participants were asked to sign a written consent form. The focus group was videotaped and transcribed in full text from Norwegian into English.

### D. Assessment and Data Analysis

The 26-item user experience questionnaire (UEQ) [7], [10] covers a comprehensive impression of UX, i.e. measure of both classical usability aspects (efficiency, perspicuity,

dependability) and of UX aspects (originality, stimulation). UEQ covered six factors: Attractiveness, Perspicuity, Efficiency, Dependability, Stimulation, and Novelty.

The questionnaire helped us to assess the comprehensive impression of user experience. The questionnaire consisted of bipolar contrasting attributes on a seven-scale ranking. The order of items in the questionnaire is randomly presented. The participants expressed their agreement with the attributes by ticking the circle that most closely reflected their impression. Laugwitz [7] defines these six factors comprising the UX as:

- Attractiveness: What is general impression of users towards the likes or dislike of the product?
- Efficiency: Is it possible to use the product quickly and efficiently? Does interface looks organized?
- Perspicuity: Is it easy to understand and use system? Is it easy to get familiar with the system?
- Dependability: Does the user feel in control of the interaction? Is the interaction with the product secure and predicable?
- Stimulation: Is it interesting and exciting to use the product? Does the user feel motivated to further use the product?
- Novelty: Is the design of the product innovative and creative? Does the product grab users attention?

The seven-scale ranking was converted into a positive and a negative scale, where +3 represented the most positive and the -3 represented the most negative value. Values between -0.8 and 0.8 represent a neutral evaluation of the corresponding dimension, values  $> 0.8$  represent a positive, while values  $< -0.8$  represent a negative evaluation.

All statements and exclamations expressed during the focus group interview were transcribed from Norwegian into English. For qualitative assessment of user experience, the coding was done in in ATLAS.ti [8].

### E. Measure of Scale Consistency

In order to check the internal consistency of the measure, we calculated the Cronbachs alpha-Coefficient. A coefficient  $> 0.7$  is generally considered as sufficiently consistent. However, from methodological standpoint such a use of a cut-off criterion is not really well-founded. The consistency of the UEQ factors was assessed using coefficient alpha [9].

The alpha-Coefficient was used and scale was sufficiently consistent ( $\alpha > 0.8$ .) for three factors, Attractiveness, Stimulation and Novelty. The consistency of the scale was slightly low for Perspicuity, and Efficiency ( $\alpha = 0.51$ ). The consistency of dependability was very low ( $\alpha = 0.13$ ). The results of the scale's validity indicate that we can reliably use the results of all factors. However, the results for Dependability need to be interpreted carefully.

## III. RESULTS

In the first part of the results we present quantitative result on the basis of UEQ and explain through feedback of healthcare professionals. Then we compare the quantitative result with benchmarking of the UEQ data. In the second

part of the results we derive the themes from the coding of qualitative data.

Table 1 shows mean and 95% confidence interval of six factors covering the UX of FRAT-up tool. Table 1 and figure 2 show that the UX was regarded different for the six factors of FRAT-up tool. The novelty factor scored highest and perspicuity lowest.

TABLE I. UX CONFIDENCE INTERVAL OF FRAT-UP TOOL (N=8)

Scale	Mean	Std. Dev.	95% CI	$\alpha$
Attractiveness	0,929	0,645	[0,48 – 1,38]	0,87
Perspicuity	0,375	0,756	[-0,15 – 0,90]	0,47
Efficiency	0,938	0,704	[0,45 – 1,42]	0,51
Dependability	1,021	0,559	[0,63 – 1,41]	0,13
Stimulation	1,156	0,844	[0,57 – 1,74]	0,83
Novelty	1,313	0,821	[0,74 – 1,88]	0,8.

#### A. Benchmarking

For benchmarking, the mean values are set in relation to existing values from a benchmark data set [7]. This data set contains data from 4818 persons from 163 studies concerning different products (business software, web pages, web shops, social networks). This comparison of the results with the data in the benchmark allowed us to assess the quality of the system and compare it with other products. Figure 2 shows the comparison of current assessment to benchmark data.

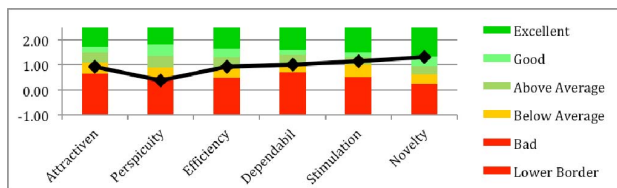


Figure 2. : The result relative to the benchmark

*Attractiveness and dependability scored just below average:* Participants expressed their experience regarding the attractiveness of the scale: enjoyable, good, present, pleasing, friendly and attractive.

Participants rated the dependability of the tool below average. Dependability is related to the users' feelings of control on the outcome and if the results are predictable. Participants wanted to see the calculation method and probability of each construct that adds towards the fall prediction. However co-efficient measure of dependability was low, so it could be the reason that many of the participants interpreted it differently.

*Perspicuity scored very low:* Participants rated the perspicuity of the tool quite low. During the focus group, the participants stated that they were not familiar with all the abbreviations and terms that were used in the assessment tool.

*Efficiency and Stimulation scored above average:* The participants rated the efficiency and the stimulation above average, which means that participants considered that using FRAT-up is an efficient and fast way to calculate the

probability of fall risk in a person. Participants also considered it interesting and exciting to use the FRAT-up for clinical use. The interest of the participants showed that they were motivated to use FRAT-up in clinical use.

*Novelty scored very high:* The Highest sum score was given to the novelty of the fall risk assessment through medical background, which means that the participants considered it a creative and inventive way to assess fall risk.

#### B. FRAT-up Usefulness for Nurses

The FRAT-up, by the participants, was regarded quite useful for nurses who do not have extended knowledge of the area. Furthermore, the participants saw it as an additional aid to get an extended knowledge and understanding of how a better fall prevention intervention can be provided.

One participant stated: "I will, independently of the tool, know if a person has high or low risk of falling, but home-nursing might not have as much knowledge.... If that person had put in [the values] in the tool, the nurses might get a useful tool in everyday [work] life" (participant Nr.6).

#### C. Integration with patient journal

Most of the medical history and information, required in fall risk assessment, can be accessed from the patient journal. The FRAT-up can be integrated with the patient journal so that it can be used regularly. Participants stated:

"What is being filled in here might be filled in by more than one professional" (participant Nr.3), and

"Fall related information should be directly transformed to the patient journal" (participant Nr.6).

#### D. Localization and Scaling Simplification

FRAT-up questionnaire is based on the related work in fall risk factors. Some of the assessment information that describe fall risk in a particular area were not known to the healthcare professionals in the country of assessment.

For example, FRAT-up uses "CESD" with a scale ranging between 0 and 60. However the healthcare professionals did not know this test or the abbreviation. "There are several things that need that [explanation], for example walking sub score, what's that?" (Participant Nr.5).

"The questions are very relevant... but the score system should be...easier" (Healthcare participant Nr.1).

"But I do not understand all the numbers, like 5 and 7? ... Where do they come from?" (Participant Nr.6).

Participants recommended that the scale value should be visible and help should be provided on each scale

"But if you had a question mark [after the scale] that you could click to appear (Participant Nr.8), (Several people nod in agreement).

#### E. Training

In order to get better UX and acceptance of the system, healthcare professionals wanted to know details about the method of calculation of the fall risk score. The participants wanted an explanation of what method was used for calculation.

"If it is a good test we would like an explanation so we could use it" (participant Nr.6).

“It almost has to come with a teaching/training package, so that you know what’s behind all these scores. (Several says yes or mhm) (Participant Nr.7).

#### IV. DISCUSSION

The purpose of this study was to assess UX and usability of the FRAT-up, and to get an extended knowledge about how a better intervention can be provided.

We will discuss the results of from dimensions of UX described by [7] and describe how UX of tool can be improved. Then we will discuss about the methodological concerns of the study.

##### A. UX of FRAT-up and Improvement

###### 1) Attractiveness

The attractive of future tool can be increased if the future system can provide a scale that is easy to understand. The current tool only shows information when a mouse is hovered over the text box and the cursor is kept stationary. Since the weighted scale for questions is different for most of the questions. The attractiveness of tool can be improved if the weighted bipolar scale can be used as default text in the text box, and text hides when value is added in the textbox. This approach will make it easier to read the questions in the system and scale will be shown at the position when users need the details of the scale.

###### 2) Design Quality

Stimulation and novelty of the system are strong points of the system. The system used an intuitive approach of barometer to display results. The systematic change of colors from green to red indicated the increase in fall risks. It made it easy for healthcare professionals to see the future risk.

###### 3) Use Quality

The tool can become efficient in use if healthcare professionals can spend less time to fill-in information. This is possible if data from patient’s journal can be integrated with the tool. This integration can help in using information that is already available in the healthcare system, and only adding information that are not available.

The perspicuity of the tool can be increased by making separate section of information. It will then become easier to understand and get familiar with the different section of the tool such as medication, acute illness, disability etc. This segmentation makes it easy to follow a comprehensive question in the tool. Further, the perspicuity of the tool can be increased if local abbreviations are to be used in the system. Showing the weighted score of each risk factor can provide additional information to the healthcare professional that an also increase the confidence and trust of the tool.

The assessment clearly shows that although the new FRAT-up tool provides the outcome of fall prediction in a simple manner, healthcare professionals did not solely want to depend on new the system. They want to use it as additional help beside conventional assessment.

##### B. Methodological Concerns

There are some methodological concerns regarding this study. In this study only six physiotherapists and two

physicians participated to give their feedback. It would have strengthened the study to include more physicians and also registered nurses who might also be users of such a tool.

#### V. CONCLUSION

The study evaluated UX of the fall risk tool and demonstrated that healthcare professionals considered the use of FRAT-up a useful and novel approach to assess fall risk. However the tool is considered to be used as additional source of information. The study indicates that in order for FRAT-up to be useful locally, it needs to be in line with the local healthcare vocabularies, have a better explanation for the different sub scores and being with patient journal to make use of existing information.

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