

Burnout Syndrome Prevention Measures among Nursing Staff

Implementing a Mobile Application based on MIT's App Inventor Tool using the Scratch Programming Code

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Abstract—This research study serves, on the one hand, to assess the prevalence of burnout among the nursing staff. On the other hand, to determine the socio-demographic and professional characteristics associated with burnout. The aim is to propose an interactive tool to cope with burnout. This is an observational study of a cross-sectional type, conducted among a population of 30 nurses over 4 months. A self-administered survey was used to determine the sociodemographic and professional characteristics. The Copenhagen Burnout Inventory to evaluate burnout. In total, 17% of nurses display a high level of burnout in both its dimensions and that more than 50% are highly susceptible to it. Moreover, 83% of participants agreed to use the technology as a solution. The proposed prevention solution to cope with burnout was developed by the scratch programming code using the app inventor tool, it consists of three online services (Training, Assessment, Support).

Keywords—Burnout, prevention tool, mobile technology, App Inventor Tool, Scratch Programming Code

1 Introduction

Occupational health has an important role to play in the development of societies. It is crucial to improving occupational health in the face of different economic, demographic, and social challenges [1]. The French National Authority for Health states that active healthcare professionals are a population that is increasingly exposed to burnout [2].

There is a particularly high prevalence of burnout in the nursing profession. It is a profession in which social interactions are many [3], and where the role requires considerable commitment and numerous sacrifices [4].

In today's world, information and communication technologies play an important part in simplifying our personal and professional lives, in particular in the field of public health. Interactive eHealth and mHealth services online allow individuals to consult their medical records themselves [5] using the web or mobile interfaces on a computer or smartphone. They also facilitate immediate communication and information-sharing between different health actors through dynamic social interactions via information systems. Such systems are set up on the internet or an intranet and serve primarily to support the patient and meet his biopsychosocial needs.

The main purpose of this study is to assess the prevalence of burnout among nursing staff at the Hassan II Oncology Centre in Oujda (Morocco). It also seeks to highlight the sociodemographic, personal, and professional characteristics of those reporting burnout to propose an interactive tool for training assesses and supporting those most susceptible to burnout so that they can cope with it by using information and communication technologies. Our stated hypothesis is that sociodemographic, personal, and professional characteristics could give rise to burnout among healthcare professionals.

This article consists of four main sections:

- In the first section, we have defined the key concepts of this research (Burnout, Scratch, and App inventor tool) and also highlighted related work.
- In the second section, we present the research methodology adopted to evaluate burnout using the Copenhagen burnout inventory.
- In the third section, we reveal the results of the survey.
- In the fourth section, we present the three services of the online information and communication platform: Training, assessment, support. We present also how the digital tool will work (Code of a digital tool, Running of the digital tool).

2 Concepts and Related Works

2.1 Burnout syndrome

Burnout is defining as a syndrome involving physical, emotional, and mental exhaustion stemming from work situations that are emotionally demanding [6]. According to the biological model, Cannon has defined burnout as a neuro-vegetative re-

sponse to external attacks that break the normal physiological state and bring about a disruption of homeostasis [7]. It is known to be responsible for the emergence of several non-specific somatic, mental and behavioral conditions, such as cardiovascular, digestive, and musculoskeletal risks, or even isolation and conflict situations [8].

2.2 Scratch programming code

Scratch is a free programming language that allows you to create interactive applications. Scratch is a media-rich open source-programming environment. It also allows us to create and develop programs related to animations, interfaces, and presentations that can broaden the understanding of concepts and practices in terms of training. This visual environment allows an intuitive drag and drops method of programming. Scratch is a project of the Lifelong Kindergarten Group at the MIT Media Lab [9]. It is provided free of charge, it's the programming language used in the App Inventor's platform.

2.3 App inventor tool

MIT App Inventor is an intuitive, visual programming environment, it's based on drag-and-drop programming in a graphical environment, both during dialog design and application coding [10]. the platform requires authentication with a google account. The platform dashboard shown in figure 1 contains all the main features of the app inventor tool.



Fig. 1. The MIT App Inventor main panel

The app inventor interface consists of five configuration panels blocks:

1. Palette – Toolbox: Here one can choose what elements want to use in the project and then drag them to the preview screen.
2. Viewer – Application preview screen.
3. Components – Tree used items: One can rename or remove the buttons at the bottom.
4. Properties – Property screen: It is used to customize the appearance of selected items.
5. Media – Media management: This block allows uploading images, music, or video in the application.

Also, there is another block in the header of the platform, it allows saving, exporting, or deleting the work done.

MIT's App Inventor, allows you to create your Android applications that are adapted to mobile devices such as smartphones and tablets. Using of MIT App Inventor application, a very practical application has been developed to assess burnout in nursing staff with a numerical method that can be useful to support them suffering from burnout and help them cope with it.

2.4 Related works

The findings show that 17% of nurses display a high level of burnout in both its dimensions and that more than 50% are highly susceptible to it (see Fig. 2). A predominance of the female sex can be observed, which can be explained by the fact that the nursing profession tends to be female-dominated. These figures are close to those found in the international literature [8], [11] since little data on this subject exist in Morocco. Recently, a Moroccan survey [12] carried out in the private sector showed that 17.35% of healthcare professionals suffered a high level of burnout, which shows that burnout exists in the private sector and not just in the public sector.

An analysis has been carried out of any association between the score for burnout and the sociodemographic, personal and professional variables: "gender"; "family situation"; "several children"; "professional profile"; "professional experience"; "work schedule"; "diet"; "sporting activities". Analyses using the Fisher Exact Test have not revealed any significant link between the score for burnout and the other variables at the threshold of ($p=0.05$) (see Tab. 2).

In this study, we noted that the majority of the nurses agreed with the idea of setting up a platform for training, assessment, and support to prevent burnout. Various studies have shown that information and communication technologies allow organizations to reduce the involvement of management [13], maximize productivity, and renew the skills of employees so that they can develop professionally and perform better [14]. Thus, given the literature and the needs of professionals for an IT solution, we have proposed a digital tool to help to prevent burnout and psychosocial risks with its three main services - "training", "assessment" and "support" - and whose principal aim is to guarantee the well-being and personal and professional development of employees.

3 Methods

3.1 Participants

This is a preliminary observational study of a cross-sectional type [15], carried out among nurses at the Hassan II Oncology Centre in Oujda (Morocco) with a response rate of 100% among those included. Recruits, nurses performing administrative tasks, and nurses on leave were excluded from the study.

3.2 Data collection

The data were collected with the help of a self-administered questionnaire made up of two sections:

- The sociodemographic, professional, and personal characteristics (gender, age, family situation, place of training, length of service, grade, medical record, habits).
- Burnout was measured using a score according to the Copenhagen Burnout Inventory– CBI [8], [16]–[18]. This is a validated instrument for measuring burnout and has been used in numerous scientific research studies, in particular in surveys carried out among healthcare professionals. The validated French version examines 12 items which ascertain two dimensions: the first dimension is the extent to which a sense of burnout is experienced, it is defined as the extent of intense fatigue and physical and psychological exhaustion experienced by the individual. The second dimension measures the extent to which the sense of burnout is linked to the work of caring for patients. This is the result of physical and psychological exhaustion perceived by the individual as being linked to working with others [19]. The CBI result is a score expressed as low: 1 to 2.4; medium: 2.5 to 3.5; or high: 3.6 to 5 which allows the two levels of burnout to be assessed.

3.3 Statistical analysis

The data were verified, then imported to the computer, and processed using IPM-SPSS 23 software. The Fisher Exact Test has been used to identify any potential associations between the sociodemographic, personal, and professional conditions and burnout syndrome. This test is used for small samples, in particular when one of the conditions applies to fewer than five members of staff.

4 Findings of the Survey

4.1 Sociodemographic characteristics

The present study involved 30 nurses out of a total nursing staff of 53 at the Hassan II Oncology Centre – Oujda, Morocco. The population is made up of 17 women and 13 men. Nurses are mostly single with a proportion of 63.3%. The mean age is 29

years with a standard deviation of 5.85. The oldest nurse was aged 51 and the youngest was aged 21.

4.2 Professional characteristics

More than 60% are multi-purpose nurses, 23.3% are radiology technicians and the remainder have a variety of specialties. 90% of them had fewer than 10 years of professional experience. Moreover, 50% have normal working hours, 13% work on-call and 27% work combine normal hours and on-call work.

4.3 Personal characteristics (Habits and medical records)

16.7% of participants were following a diet and almost half of them did sport regularly. More than 80% took no vitamins or food supplements and only 16.7% self-medicated, in general for headaches, pain, or fatigue. None of the participating nurses suffered from cardiovascular disease or diabetes.

4.4 Burnout: Prevalence

The CBI revealed that more than 16% of the participating nurses had a high general burnout score (63.3% medium, 20% low), and 23% had a high patient-related burnout score (34% medium, 43% low) (see Table 1).

Table 1. Distribution of the population according to results of each dimension of the CBI

CBI	General burnout score	Patient-related burnout score
Low	(n=06) 20 %	(n=13) 43 %
Medium	(n=19) 63.3 %	(n=10) 34 %
High	(n=05) 16.7%	(n=07) 23%

Figure 2 shows that 17% of nurses display a high level of burnout in both its dimensions (General burnout and Patient-related burnout) and that more than 50% are highly susceptible to it.

The analyses using the Fisher Exact Test have not revealed any significant link between the score for burnout and the other variables (Gender, marital status, number of children, profile, years of experience, work schedule, diet, food supplements, sport) at the threshold of ($p=0.05$) (see Table 2).

Table 2. Comparative analysis between the CBI result and the sociodemographic, personal and professional variables

	Low	Medium	High	P
	n (%)	n (%)	n (%)	
Gender: Woman Man	03(17.65) 05(38.46)	10(58.82) 07(53.85)	04(23.53) 01(7.69)	0.310
Marital status: Single Married Divorced	03(16) 05(50) 0	11(58) 05(50) 01(100)	05 (26) 0 0	0.126
Number of children: 0 <=2 >2	05(20) 01(33) 02(100)	15(60) 02(67) 0	05(20) 0 0	0.145
Profile: Multi- purpose nurse Radiology techni- cian Anesthesia nurse Other	05(26.32) 01(14.29) 01(33.33) 01(100)	10(52.63) 06(85.71) 1(33.33) 0	04(21.05) 0 01(33.33) 0	0.354
Years of experience: <1 year 1-5 years 6-10 years >10 years	01(100) 03(13.04) 01(33.33) 03(100)	0 15(65.22) 02(66.66) 0	0 05(21.74) 0 0	0.293
Work schedule: Normal Normal + on-call On-call Other	04(26.66) 02(25) 01(25) 01(100)	08 (53.34) 05(62.5) 2(50) 0	03(20) 01(12.5) 01(25) 0	0.99
On diet: No Yes	07(28) 01(20)	13(52) 04(80)	05(20) 0	0.809
Takes food supple- ments:No Yes	08(32) 0	12(48) 05(100)	05(20) 0	0.08
Does sport: No Yes	05(31.25) 03(21.43)	08(50) 09(64.29)	03(18.75) 02(14.28)	0.883

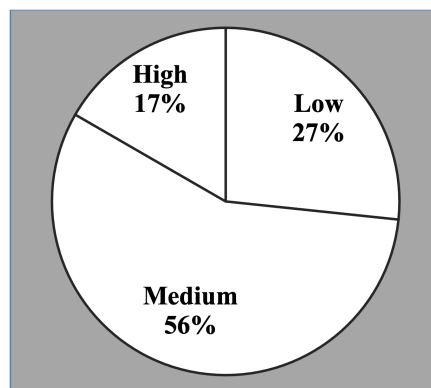


Fig. 2. Distribution of the population according to results of both dimensions of CBI

4.5 Use of ICTs

This survey (see Tab. 3) revealed that 25 of the participants (83%) agreed that a platform should be set up to train, assess, and support those most susceptible to burnout. The same number regularly used smartphones, computers, and online training platforms to find information.

Table 3. Use of information and communications technologies

Use of ICTs	Yes	More or less	No
Use of ICTs (smartphone, computer, online training platform) to look for information	83%	17%	0%
Opinion regarding setting up a platform for training, assessing, and supporting individuals most susceptible to burnout	83%	14%	3%

5 The Proposed Digital Tool

5.1 Objective

The digital prevention tool that has been proposed is made up of three services integrated into an online information and communication platform (see Fig. 3 and 7):

- Training is the first service offered by the system. Its main objective is to raise the awareness of burnout among healthcare professionals. Furthermore, it defines the causes and possible consequences of burnout using constructivist pedagogical approaches and dynamic, interactive educational tools can help to warn about and fully comprehend the seriousness of, this syndrome.
- Assessment is the service that allows the individual to determine the state of his biopsychological health by filling in a self-administered questionnaire made up of three parts (data on physiological health, psychometric tools).
- Support is the service that allows for the permanent provision of social support by specialists in psychiatry, occupational psychology, and neurolinguistic programming, which is directed at those whose profile reveals problems facing up to professional challenges.



Fig. 3. Digital services provided by prevention tool

5.2 Method and tools used to develop the digital tool

Unified Modelling Language was used to design the digital architecture of the IT tool (see Fig. 5). The App Inventor tool was used to develop the platform with Scratch graphic programming language (see Fig. 6), following Deming's scientific approach

with 4 processes: Plan, Do Check, Act [20]. The algorithm in Fig. 4 represents the operational principle of the application in the simplified form of the Assessment service.

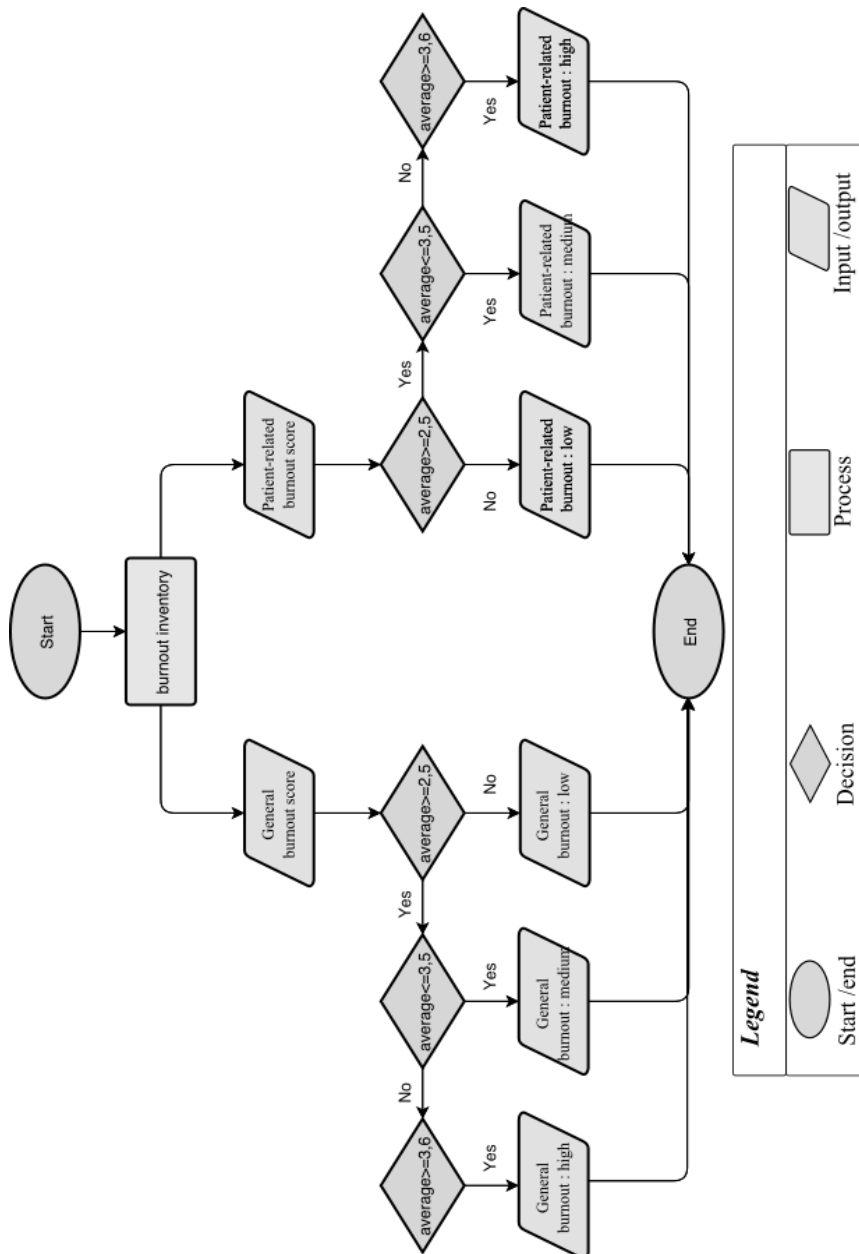


Fig. 4. Flowchart of the algorithm of the Assessment service

5.3 How the digital tool will work

The user can use a smartphone to access the platform and consult the three services provided by the prevention tool. The user can start in the digital training space, which allows him to find out about the concept of burnout and the impact of psychosocial risks on physical and mental health. Next, in the assessment space, he could input data on his physical health and also fill in a questionnaire to ascertain the state of his psychological health. The outcome of the questionnaire is a score expressed as high, medium, or low. If the score is high, the system suggests to the user that he consult an expert in psychiatry or occupational psychology to seek an opinion on the result of the self-assessment and then to send him through the support services recommendations and strategies for adjusting to various professional difficulties (see Fig. 5). Besides, the system contains several smart functions, such as automatic and periodic prompts to do sport regularly, enjoy some leisure time, visit family, or rest in a therapeutic garden to reduce the day-to-day effects of burnout at work. A recent study has shown the burnout is less prevalent in work environments with a garden than without one [21].

Code of digital tool: The programming language used is Scratch. The block if () then, else is a control block used to calculate the score of the CBI, the block checks its Boolean condition; if the condition is true, the code held inside the first block will activate; if the condition is false, the code inside the second block will activate (see Fig. 6):

If the score is between 1 and 2,5 then the result of burnout is a low (green color);

Else if the score is between 2,5 and 3,5 then the result of burnout is a medium (orange color);

Else if the score is between 3,6 and 5 then the result of burnout is high (red color).

Running of digital tool: Figure 7 illustrates how the application works on a mobile phone. The user can access the platform via the authentication page with a login and a password, then he can choose the service he needed (training, assessment, or support), if the result of the assessment was alarming, an alert will be automatically sent to a psychologist specialist to take over the user status, i.e., automatically transfer it to the support service. The digital tool is also adaptable to any display resolution, whether for telephones or tablets.

6 Conclusion and Future Work

This study indicates that burnout among the nursing staff is a reality at the Hassan II Oncology Centre – Oujda. The sociodemographic, personal, and professional variables used in this study have not been shown to have a significant impact on burnout according to the "Copenhagen Burnout Inventory" tool. The use of information and communication technologies is recommended to prevent burnout. It is thus highly desirable to establish interactive services for training or awareness-raising, self-assessment, and support within the professional body.

Our study was conducted on 30 nurses, which is a fairly small population. Therefore, for future research, it would be interesting to look at a larger population. The

continuation of our research work could also focus on the integration of artificial intelligence into our digital tool. Indeed, the development of an algorithm that allows us to send adaptation strategies to people to cope with burnout via notifications on smartphones is our next project. The integration of a scientifically validated recommendation system into our digital tool will enable us to strengthen support for people who suffer in their professional life and also to reduce the prevalence of burnout.

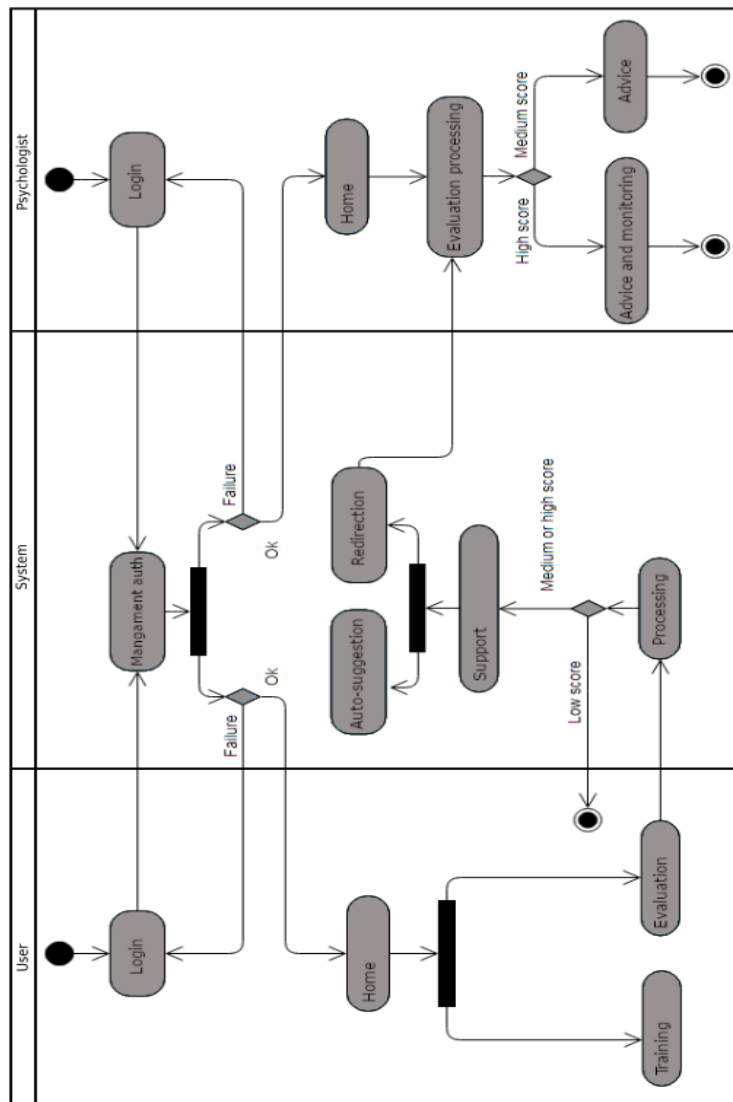


Fig. 5. The sequence of activities for a user on the digital tool from the training service to the support service

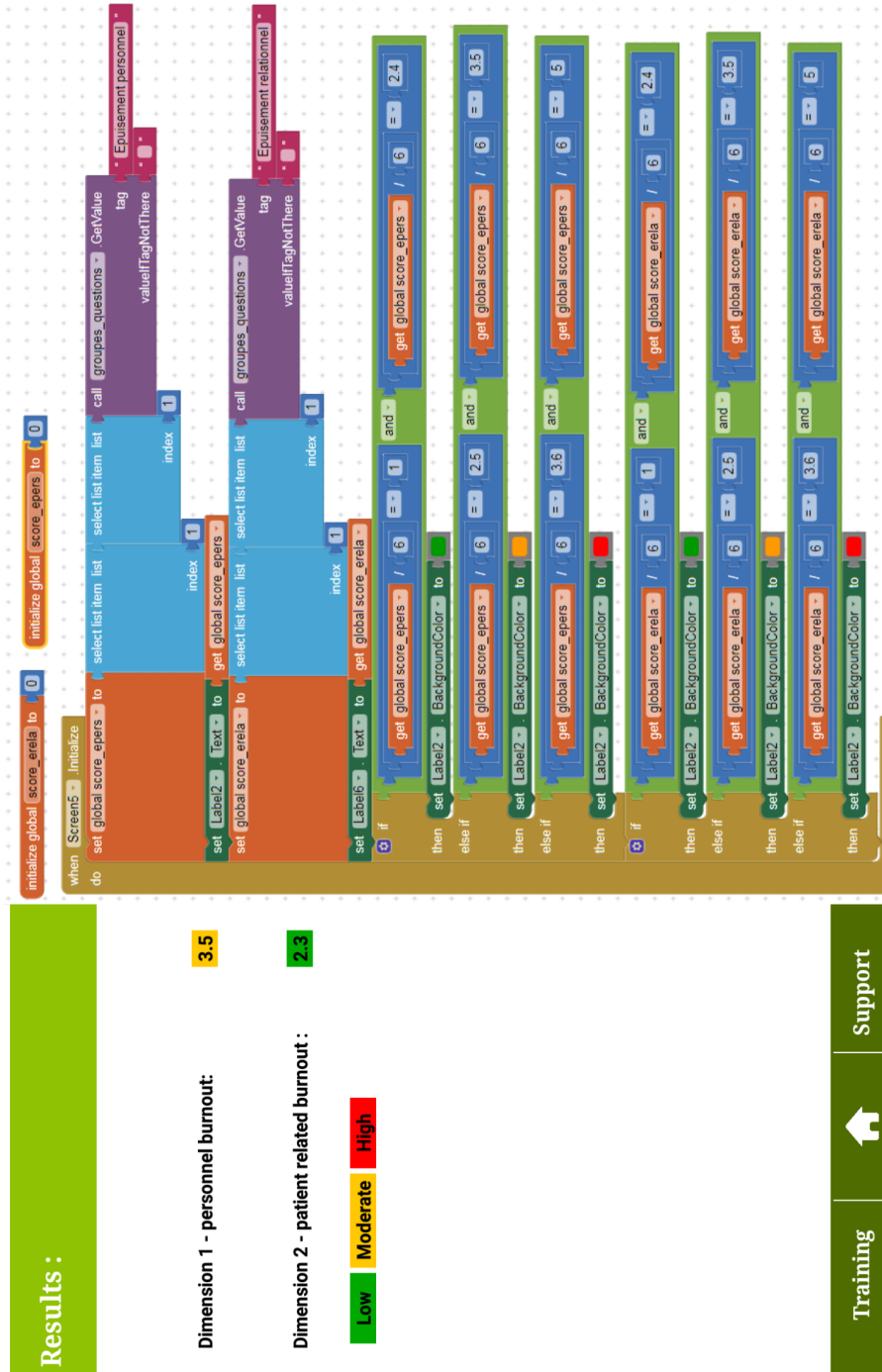


Fig. 6. The Assessment service interface with scratch programming code

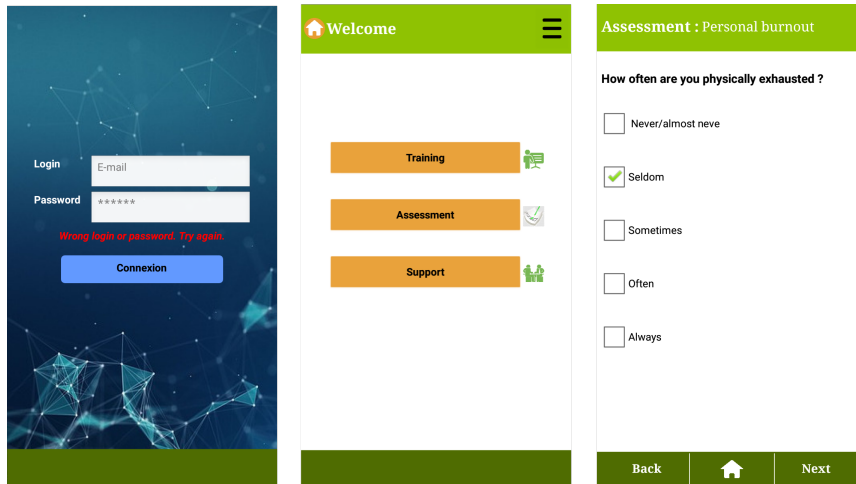


Fig. 7. Graphic interfaces of the digital tool

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