A Nursing Virtual Intervention :
Real-Time Support for Managing Antiretrovrial Therapy

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The advent of a powerful antiretroviral therapy in 1996 and the subsequent availability of adequate prophylaxis against opportunistic infections have brought about a substantial reduction in morbidity and mortality among people infected with HIV. Formerly considered to be a fatal illness, HIV infection is now classed as a chronic disease [1, 2] and a satisfying and productive life is now possible for persons living with HIV (PLHIV) [3]. In contrast, the chronic condition provoked by the infection makes demands on the individuals to manage their daily care by themselves [4]. For the majority of PLHIV this therapeutic step forward involves managing both the treatment and its allied symptoms (e.g., undesirable side-effects). Unfortunately, PLHIV have difficulty attaining optimal adherence to treatment over an extended period [5]. Currently there is no one intervention approach that is superior to others in enabling therapy adherence to be optimized [6].

According to the systematic review by Rueda and colleagues [7] the most germane interventions are ones most focused on self-management skills and that can be individually tailored. In view of the complexity of antiretroviral therapies and the difficulties in taking them on a prolonged daily basis, providing support for individuals taking the therapy is imperative, as is finding new ways of making it less problematic to comply regularly. Information and communication technology (IT) offers many possibilities and should be emphasized because of its prospective benefits to the clientele [8-10]. IT can play a major role in addressing the issues of accessibility and continuity of care and services that the Canadian health care system must deal with. The Internet is frequently used by persons living with HIV and, as such, it offers new avenues

for delivery of HIV interventions [11]. Accordingly, we have developed a virtual intervention called HIV – Treatment, Virtual Nursing Assistance and Education (VIH-TAVIE[1]) to equip PLHIV for coping with their antiretroviral therapies. The project itself was carried out in three phases: 1) development of the intervention's clinical content, 2) generation of a multimedia scenario and 3) implementation of a Web application via computer interface. In this article we describe the VIH-TAVIE project and how we developed it.

Clinical development of the intervention

Our framework for developing the VIH-TAVIE was Intervention Mapping [12, 13], the planning model for interventions to promote health care. That approach permitted us to integrate theories, empirical data from the literature, results of research and field observations, all pertaining to preventative actions developed at the primary, secondary and tertiary levels. In essence, it was from the results of a longitudinal study on adherence [5], reviews of the literature [14, 15] and validations performed in the field by health professionals and PLHIV that we defined the objectives of the intervention and the means of implementing it were chosen and validated [16].

To optimize adherence to antiretroviral therapy, our intervention focuses on developing and reinforcing the skills required to manage antiretroviral therapy. In so doing, our intent is that the PLHIV's sense of personal efficacy about taking the medication routinely should increase. We have based that component of the intervention on Bandura's [17] theory of self-efficacy. The intervention is composed of different sessions in which the

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[1] VIH-TAVIE It is the french appellation : Virus de l'immunodéficience humaine – traitement assistance virtuelle infirmière et éducation.

ultimate objective is to make it possible for the PLHIV to consolidate proficiencies for self-motivation, self-observation, problem-solving, controlling emotions and interacting socially. Together, these enable the PLHIV to work the therapeutic regimen into daily routine, to cope with side effects from the medication, to handle situations or circumstances that may interfere with taking the medication, to interact with health professionals and mobilizing social support. The sessions integrate various sources of personal self-efficacy, such skills mastery, modeling, verbal persuasion and positive physiological response [17]. In addition, positive persuasion helps to reinforce constructive attitudes [18, 19] Also rooted in the scheme of tailoring [20] the interventions are adjusted according to the specificities of the therapy, the side-effects that arise and difficulties encountered. In addition to PLHIV, content of the intervention was validated by a variety of experts: a nurse, a physician, a nutritionist, a psychologist and a pharmacist.

Description of the virtual nursing intervention: VIH-TAVIE

The VIH-TAVIE intervention is a new health vehicle that is intended to help and support PLHIV to manage taking antiretroviral treatment daily by using information technology as a means of access and of learning. The desired outcome of the intervention is to optimize therapy adherence behaviour, in the belief that optimal adherence can lead to a diminution of the viral load and a reinforcement of the immune system.

<u>Characteristics and properties</u>
VIH-TAVIE consists of four interactive sessions at the computer, animated by a virtual nurse that takes the individual through the learning process about the capabilities necessary for taking the treatment. The virtual nurse acts as a vocal assistant and is at the heart of this application. In the course of the sessions, approximately 140 videoclips

of the virtual nurse are presented: they last between 10 and 90 seconds. One unique facet of the application is the interaction between the virtual nurse and the participant. This permits the virtual nurse to personalize (tailor) the information and strategies imparted according to the answers the participant provides.

Content

Each interactive session is distinct from the others (message, strategies, skills, question, data entry). The sessions follow a pre-defined sequence, in order to maintain the gradual conveyance of abilities. The table 1 below presents the elements addressed in the course of each session. The first session focuses on taking the medication, in keeping with the specifications of the therapy, and on developing self-assessment skills. It also concentrates on the development and reinforcement of motivational skills such as associating a positive image with the treatment and being able to handle undesirable side-effects. The second session deals with emotional managing: this is accomplished by being able to identify negative sentiments, recognizing their effect on behaviour and learning strategies for managing them. Also, the problem-solving process for dealing with situations in which it is awkward to take the medications is reviewed. In the third session, establishing, maintaining and strengthening social relations and interaction with health professionals are tackled. In the final session all the skills so far worked on are consolidated.

The nurse's role in "custom-made/made-to-order" interventions

Although, in this case, it is a virtual nurse animating the interactive sessions with the participant, the VIH-TAVIE was designed and developed by bona fide nurses to reach the clientele living with HIV. The medium used is different from traditional professional consultations, but the role of the nurse remains paramount. However, the application

takes a more user-friendly format because the virtual nurse offers the PLHIV the prospect of taking charge of his or own health from the comfort of home. In this way, the individual can play an active learning role in the course of modifying and adopting behaviour and, thereby, managing the treatment more effectively.

The role of the virtual nurse is to furnish training and strategies that enable the PLHIV to integrate taking the medications into the daily routine, to assume a positive attitude to treatment, to cope with the unwanted side-effects brought on by the antiretroviral medication, to discover solutions for difficult situations that may arise and to build and maintain social relations. We know that, when it come to a change in behaviour, it is not enough to know how to do it, but it is also necessary to put the new forms of behaviour to use in order to adjust to them and integrate them into daily routine. Furthermore, knowledge is a component in the framework of this intervention and it is necessary to expand existing awareness to move towards sustainable new behaviour. For the new information to be fully processed, it is necessary to carry out the recommended exercises diligently, day by day. As such, an interval of at least 10 days between sessions is recommended to allow the individual to gain experience with the proposed skills. To assist with this, we developed tools, such as an on-going journal to make note of undesired consequences, to support the individual as he or she becomes familiar with the new skills. During the sessions the virtual nurse provides feedback and reinforcement on the individual's progress and about the abilities being gained. The nurse normalizes the difficulties encountered ("You know it's natural to be forgetful at times") and avoids moralizing or inducing self-reproach.

To sum up, this method of computer-assisted teaching is not only aimed at supplying new information, it also emphasizes the specific personal skills and strategies that will

allow the PLHIV to develop new habits. The new behaviour will furnish the individual with a sense of confidence, efficacy and competence about taking the treatment and to improve his or her quality of life.

Personalized training or tailoring education

To be able to provide 'custom-made' assistance, personal information must be collected directly from the participant and the recommendations can be tailored to his or her explicit needs. A 'virtual' nurse is a guarantee of confidentiality about personal information, such as the specifications of the therapy, the level of adherence, side effects experienced and other difficulties encountered. For example:

- The individual must select the medications that constitute his or her treatment. Written instructions are furnished for taking each of the medications and for storing each (e.g., store between 15 and 30º, away from light; take on an empty stomach).

- From an itemized list of 22 side effects, the individual is able to select those that have caused more discomfort and he or she would like to receive information on (maximum of three per session).

- The individual identifies one or more of the situations in which taking the medications proves to be difficult. For instance, when there are changes to his or her daily routine; when in the company of people who are not aware of the condition; or when alcohol or drugs have recently been consumed. For each problematic situation reported, the means of resolving are proposed.

Table 2 shows the kind of information requested by the virtual nurse in various scenarios. The table also demonstrates ways in which the virtual nurse tailors the feedback according to the PLHIV's level of adherence to treatment.

Role models an intervention tool

The role model is highly effective as a part of any learning process, and we have made use of this feature in the VIH-TAVIE intervention. We did so not only to give a more personal touch to some of the narratives in the virtual intervention, but also to make the consultation process more dynamic. If a particular model character appeals to the participant, he or she will be more likely to be influenced by the content. The examples we used were developed from case histories (stories). These role models portray situations in which other people, having gone through similar experiences, have overcome the difficulties related to taking their medications by using successful strategies, and the PLHIV can identify with some or all of the situations.

Take the role model example of Mark. The young man has enjoyed an evening with friends when he realizes he has forgotten to take his Combivir and Sustiva tablets. Checking with the VIH-TAVIE intervention, he learns some strategies to forestall forgetting again. Thereafter, he decides that he will always have an emergency container with him in which he will keep some tablets to ensure that he always has a supply with him in unforeseen cases.

The story of Andrew and Sebastian is also apposite. Andrew finds it extremely difficult to inform (disclose) his partner that he is seropositive. He decides to discuss it with his friend Sebastian, who has been through a similar experience. One of the communication tactics Sebastian suggests is that of active listening. This is useful in this situation in

which the two people will have to: 1) reformulate the idea of each other, 2) provide

feedback and 3) pose questions.

Consolidation tools

Beyond simply providing information, it's necessary to ensure that the participant can

consolidate what he or she has learned. This intervention makes different tools available

that will help with remembering the new information or having specifically tailored advice

readily at hand. For this, the tools, or documents, of interest to the participant can be

printed as PDF files. They are intended to be support for using the newly-acquired skills

and, if desired, to keep track of progress. Some of the various documents offer

counselling about side effects that the participant may feel, while others are intended to

facilitate taking the medications. The latter tools recommend making use of positive

image association and a journal in which to register undesirable effects, and provide

guidance about negative emotions, communication strategies and social support. Finally,

many of the other information documents can also be accessed under 'frequently asked

questions' on the application Web.

Customizing or personalizing

We know that a contextualized learning framework can greatly influence knowledge

assimilation. New realizations are qualified by the awareness that the participant has

already acquired. It is, therefore, basic that the information in the Web application be

connected to situations in which PLHIV feel caught up. The case histories used as

learning vehicles in the videoclips and narratives in the Web application must make

sense to the users or, at the very least, be recognized as realities with which they may

have to face. Therefore, we created different fictitious alter-egos, avatars that may be

adopted by anyone who enrols in the VIH-TAVIE project.

An avatar is a virtual user's alter-ego: it can be a three-dimensional model that symbolizes the embodiment of the user. In our Web application, there are seven avatars, each representing a different profile of a person living with HIV. Our objective was not to stereotype or make light of PLHIV, but to offer choices to the participants for them to associate with a fictitious character having the largest number of significant characteristics in common with themselves. The criteria for choosing these avatars reside in the features of the general population: gender, age groups, different life skills, dress conventions, etc.

Because no nominative data is requested from the participant, for the purpose of identification he or she must select a pseudonym at the very beginning of the process. Next participants select one of the avatars as a representation of themselves or an 'alter-ego'. That icon or model should possess characteristics that most align with those of the participant. The more the model resembles the participant, the more its influence on the learning process. The avatars were designed by a professional illustrator and have been validated by a group of experts in the area of HIV and by individuals living with HIV.

The figure 1 below depicts all of the avatars followed by the figure 2 that represent a type page of the VIH-TAVIE.

The video of the virtual nurse: At the beginning of a new Web page a video of a virtual nurse is booted up. The image of the nurse has been placed strategically in the middle of the screen to promote a close contact with the user. The idea is to give the user a sense of an exchange in an interview or a consultation, and is at the heart of this

interaction. The example below is of a *question* type of participatory video sequence, in which the participant is asked to respond if he or she is interested getting to learn more.

The Web application does not show a video on every page. There are also narrative audio recordings and text messages that invite the individual to key in some personal data, such as which medications he or she is on and how many tablets are neglected.

Various visual perspectives have been chosen by the audio-visual team to fit the image of the virtual nurse to the content of our intervention and make the Web consultation more dynamic. The videos were customized to the specific objective for each interactive session. For example, in the case of helping users perfecting their newly-acquired skills, a close-up view of the virtual nurse's face is used to focus the participant's attention. The virtual nurse smiles and congratulates the participant on undertaking the process or succeeding in it, thereby emphasizing the importance of the message. This is particularly effective in situations where personal positive reinforcement is necessary. More distant video staging is used primarily to present of general information or at the start of a new session. The more close-up settings, in which the video frame shows the nurse from the shoulders up, are used more frequently. They are better in contexts of putting forward questions, reinforcement or exchanging more specific information. This technique lends an impression of reality to the simulation.

Virtual nurse text: On the right of the screen, next to the video, the virtual nurse's narrative is posted. This gives the participant the choice between an auditory or visual transmission.

The menu is made up of the following three items:

1) <u>General information</u> including electronic data PDF files. If the participant prefers a hard copy of the text relating to the skills and aptitudes he or she wants to develop or those that will facilitate taking the medication, these can be printed out. The texts are described in the preceding "Consolidation tools' section.

2) <u>Frequently asked questions</u> (FAQ), and answers. These are listed at the end of each session and address the large variety of uncertainties that often concern PLHIV. For example: *What is the significance of the CD4 cell count number and the viral load? How do I get organized for a trip out of the country? How can ask people I know for help?* PDF files dealing with these various subjects are also available to print.

3) <u>Personal information.</u> This is based on 'descriptive' information provided by the participant: gender, age group, medications constituting the therapy, etc.

Creating the Web application: scripting and programming

We transposed our intervention over to a Web application by making some changes in content presentation and adding audio-visual commentary before the requisite computer programming. To accomplish these production steps, we joined forces with a team of professionals in the fields of information technology and visual arts: a programmer-analyst, a media consultant, an illustrator and audiovisual technicians.

We created the setting by producing a multimedia scenario. This allowed not only for dividing up the clinical content of the intervention, but also for the arrangement of the multimedia units and the generation of algorithms. Splitting up the clinical content was

an essential prerequisite for programming. In this way, we were able to provide sequential access to the content of the intervention on the Web page. Similarly, the different links possible between Web pages are shown with sorting algorithms and tool symbols that graphically represent the logical sequence of operations. As well, for the stage-setting process, we had to plan all the interfaces for navigation, access functionalities, registration, printing of text, electronic transfer of files, links between Web pages, etc. The divers content and functions were entered in highly-detailed form to facilitate programming and to ensure that the text and images presented on screen continued to be comfortable and welcoming to the participant. The overall configuration comprises more than 133 Web pages, 19 algorithms and 45 PDF files.

Making a screen interpretation also involves making general design choices for the application as well as choices specific to the each of the onscreen Web pages. On the general level, we had to decide on a colour (in shades of green) that is different from what is usually to be seen on Web sites and where white is out of place, to create an individual atmosphere for our virtual application. We also decided to use film of a nurse to lend verisimilitude to the virtual assistant and thereby create the impression of a personal clinical consultation. The choice of film perspectives (far-away, near or close-up) was dependent on the information being passed on. All choices were made in order to give the participant the feeling of being conferred with. Each page was particularly designed to enable the participant to undertake a process for taking control of his or her health. For this, many of the elements on view have to meet criteria making them attractive and memorable to maintain the participant's interest. These involve the duration of text and videos, variety of images, language choice, tone of voice of the virtual assistant or speaker, ease of locating functionalities, colour, font and lettering style of the background, etc. This interactive design of our Web application differentiates

its value to the user from that of standard Web information sites in which much of the content is simply reordered and interaction with the participant is at a minimum.

The computer programming phase necessitated contemplating the many features that will guide the setting-up of the VIH-TAVIE project: notably, the type of Web required, the choice of computer hardware, the nature of the program running the application, the scope and diffusion hoped for, security aspects, etc.

The main prerequisites for developing our application were the following.

- The application should be usable with any Web navigation program.
- The application should use of open source code software to reduce costs and make future dissemination easier.
- The application should run on an ordinary computer and does not require any special materials or operating system, and no software other than that selected in the development phase.

The criteria retained for the data processing choices for our VIH-TAVIE intervention were based on gaining access to future users of the Web application; on the quality/price balance, keeping development costs reasonable while still being able to provide free usage to the participant; ease of use, both for the participant and the application manager; the means of giving responses to a wide number of application queries; etc.

The choices we made are listed below.

- The programming language we selected is Java because it is object-oriented, available an almost any platforms, and free of charge.

- We thought the MySQL database, which contains data furnished by the Web application and the users was the most advantageous. It is a free open-code relational database management system that is extremely robust.

- The content and presentation of the application were separated to facilitate its development and its possible use with different languages and platforms in the future. The data layout was done with a compilation of dedicated graphic elements (widgets) developed for the purpose, and with Cascading Style Sheet (CSS) technology.

- The recommended Web browser is Firefox. This open source code Web navigator is free, light, secure, and conforms to all Web standards.

These choices ensure that the application can be distributed easily, installed on a wide range of platforms and, therefore, have the greatest number of users.

As a result of the requirements and the technical choices for setting up the VIH-TAVIE intervention, our implementation brings a new flexibility to this kind of Web application. Indeed, it includes both a user interface targeting PLHIV and a designing interface to allow nurses to easily create new pages, new scenarios, and new interventions. After reading the manual, this interface is easy to use by a nurse with basic computer skills. He or she can use it to create new pages or new sessions and can modify each according to his or her needs. The designing interface also guarantees that the application always remains up to date. It provides information on demand and makes nurses' responsible by making it possible for them identify their needs and to solve problems in the Web application by themselves. The designing interface is, intrinsically, a page generator. It provides an adaptability that means that models of pages can be added or modified, according to the users' profiles.

Intervention dose issues

This nursing intervention involves four interactive computer sessions, each lasting between 20 and 30 minutes. The sessions take place every two weeks, over a period of two months (i.e., a total of four sessions). This is a real-time application for accommodating the needs of the user. The every-two-weeks for two months frequency is advised to give the participant time to put the strategies that have been recommended into practice. This learning stage is essential because the PLHIV has received new information formulated by the virtual nurse. Therefore, the user has to have a chance to use the new information in a familiar context. The interval is suitable for consolidating it, mainly because it will occasion a change of habits in the user's daily life. This gradual, regulated training is more meaningful if the challenge that the user sets, or his or her level of commitment, is met with a result that is up to his or her expectations. If, on the other hand, the pre-set objectives are not met, users are encouraged to keep at it by going back to earlier training exercises. With a fresh start they try once again to rectify the situation or to explore different avenues of solution. Successfully assimilating new training enables the participant to apply the newly-acquired aptitudes judiciously in a variety of contexts. After finishing the four sessions, the participant should have complete recourse to the VIH-TAVIE intervention.

Evaluation contexts

From the point of research, evaluation of the intervention is carried out on two levels: in the clinical milieu and in a community setting. In the clinical milieu, the intervention is used as a supplementary tool in the on-site follow-up by a nurse. As a part of the Web

application evaluation process, the research nurse meets with the participant following the regular encounter with the interdisciplinary team looking after him or her. There, the nurse provides whatever guidance is necessary in using a computer to 'navigate' through the VIH-TAVIE application. Users do not need to own their own computer because the health care centre can provide them; that way a wide range of participants can be reached. Moreover, the individuals are accompanied at each stage throughout the Web application evaluation process.

The other operational context takes place in the community. The appeal of the application in this setting is to be able to evaluate the effectiveness of using the VIH-TAVIE intervention in real time, at the time and place convenient to the individual and according to the extent of his or her needs. While start-up usage is programmed, in terms of usage trajectory (gradual competence), availability is unlimited over the subsequent remainder of the intervention.

Discussion and conclusion

VIH-TAVIE project has emanated from reviewing studies that describe the difficulties PLHIV encounter in adhering to their antiretroviral treatments. In addition, field observations about full-time access to specialized consultation services for PLHIV led us to develop a new approach: in view of the complexity of antiretroviral therapy and of taking it on a daily basis, PLHIV will be able to make use of a purpose-designed application, tailored to them and at the time that best suits them. This in turn, has given rise to new thinking about behavioural change and the determinants of adherence behaviour amongst this particular clientele.

From the outset, VIH-TAVIE is more than an information tool: it is a virtual nursing intervention, using the pre-eminently information technology. The intervention supports people living with HIV in going through a process of developing and consolidating the skills that will enable them to manage their medical therapy and attain a better quality of life. The PLHIV has an active role in the intervention: he or she is seen as someone who has the strength and potential for change and who, therefore, is expected to make use of the strategies and capabilities that are expressly recommended. As well as dispensing lessons made-to-order for the specific needs of the participant (tailored intervention), the virtual nurse supplies feedback and positive reinforcement on the participant's progress on assimilating the abilities he or she needs. Thus, the virtual nurse becomes a figurative care partner and mentor that help the PLHIV to process the traditionally 'paternalistic' approach that has been widely used in this area of health care, and modify it into a more participatory model. As observed by Demiris and colleagues [21], IT has the potential to empower patients and support transition from a passive role as a recipient of care services to an active role in which the patient, if informed, has options and is involved in the decision-making process.

The nursing discipline has taken advantage of information and communication technology (IT) to establish a new means of intervention for interacting with clients and providing them with information. The expanding technology seems to be indispensable in taking up the current challenges of availability and continuity of care. It allows for an unprecedented access to, and exchange of, information that will ultimately transform all realms of nursing practice. Apart from our current use of this technology for monitoring and triage, now is the time for nurses to innovate and take advantage of it to evolve new ways of doing things and to revamp existing conditions and services.

The nursing community, especially that of North America, has already begun to explore the feasibility of dispensing interventions via the Web [22] . Some of these enquiries have been related in the literature: the Online HIP Fracture Prevention Modules developed for preventing hip fractures by Nahm and colleagues [23] ; the Caring Connection Web site [24] , elaborated to support families and maintain relationships over the course of a hospitalization; HeartCare developed by Flatley Brennan, and colleagues [25], which offers changeover care for clients who have had cardiac surgery and the Women to Women project (WTW) from Weinert and colleagues [26] which enables women with a chronic condition but living in a remote area to procure health services and support. The state of knowledge in the domain of computer-tailored health intervention is embryonic. The recent review by Lustria and colleagues [27] reported only 30 interventions and found none for HIV adherence.

The approach of our VIH-TAVIE application is still experimental: it has been developed in the context of reorganizing services and of the scarcity of resources. It is designed to ensure clients living with HIV more information dispensed with a personal touch, while involving them in a user-friendly process to manage their therapy and handle problems they encounter. Obviously, Web support will never replace the quality and intensity of a real nurse-patient relationship, but it has its place in the continuum or trajectory of skilled care and service.

While we anticipate direct positive outcomes among the HIV clientele, it is also highly probable that that this virtual support application will have ramifications among different clienteles who must also contend with the daily challenges of their health conditions.

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Menu

Avatar

Virtual nurse text

Video of the virtual nurse

Question block

Answer buttons

Table

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Table 1
Content of the VIH-TAVIE sessions

Content of each session	Strategies and materials
Session 1	Deciding on a nickname / selecting an avatar / Explanation of the procedure by the nurse / Evaluation of the treatment / Feedback depending on the degree of treatment adherence (< 85% to >95%) / **Motivational capabilities**: association of a positive image with the treatment / reward for successes. Training proposal / **Self-observation** of behaviour / Identification of medications composing the treatment / Identification of undesired side-effects and provision of a logbook / Messages adjusted to deal with the unwanted effects in conjunction with the specifications of the therapy.
Session 2	Review of the skills covered in the first session / Managing emotions: strategies for avoiding non-productive thinking, such as distraction, meditation or yoga, soothing words / Actions for **problem resolution** with the help of DECISION rules and case history models: accounts of PLHIV who used efficacy strategies to contend with difficult situations for taking the therapy.
Session 3	Review of the skills covered in Session 2 / **Social skills**; identification of support sources / Communication strategies: active listening and expressing emotions. Illustration using models (accounts of PLHIV) / Mobilization of resources: catalogue of health care professionals and community organizations and their functions / Strategies for requesting help / strategies for speaking and interacting with professionals.
Session 4	Consolidation of skills from the first three sessions

Table 2
Tailored advice, based on the degree of treatment adherence

adherence > 95%	adherence between 85% and 94%	adherence < 85%
(video of virtual nurse) Excellent! You should congratulate yourself and be proud of your achievement. You should now recognize that you're really able to integrate you medication into your daily life.	*(video of virtual nurse)* Making mistakes is normal, but in order to maximize the benefits of your medications, you have to try to avoid them. Now you're ready and able to do it!	*(video of virtual nurse)* Making mistakes is normal but, by forgetting so many times, you're running the risk of letting the virus get stronger and develop a resistance, which will reduce the effectiveness of the medications. You have to try to identify situations that make it difficult for you to take your treatment and learn to avoid them. Ask you nurse for help. She and you can analyze the difficulties in greater detail, and she can suggests some different alternatives or solutions.

N.B. Calculation of percentages for treatment adherence has been done with computer software. It is a function of the number of tablets and frequency, as well as dosages not taken over the last seven days.