

# Multimedia e-learning in Moodle significantly improves home treatment quality of haemophilia patients.

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## **What is haemophilia?**

Haemophilia is a group of hereditary genetic disorders that impair the body's ability to control blood clotting or coagulation, which is used to stop bleeding when a blood vessel is broken. A haemophiliac does not bleed more intensely than a normal person, but can bleed for a much longer time. Haemophilia is often referred to as The Royal Disease, due to the high number of descendants of Queen Victoria afflicted by it. Haemophilia A (clotting factor VIII deficiency) is the most common form of the disorder, occurring at about 1 in 5,000–10,000 male births. Haemophilia B (factor IX deficiency) occurs at about 1 in about 20,000–34,000 male births. Bleedings are generally located in one (or more) of the major joints: elbows, knees and ankles. Repeated bleedings eventually lead to haemophilic arthropathy, often serious and disabling. A bleeding inside the skull can cause disorientation, loss of consciousness, brain damage and might even be fatal.

## **Haemophilia home treatment**

Although there is no cure for haemophilia, it can be controlled with infusions of the deficient clotting factor. Treatments fall into one of two categories: prophylaxis or on-demand. Prophylaxis involves the infusion of clotting factor on a regular schedule in order to keep clotting levels sufficiently high to prevent spontaneous bleeding. On-demand treatment involves treating bleedings when they arise. In both categories, home treatment plays an important role. Besides of the medical advantages of an alert and thus more effective treatment of bleedings, treatment at home may often lead to more independency and a better quality of life. There may be disadvantages as well: inaccurate diagnosis leading to inappropriate applications, or late arrival of patients in haemophilia-treatment centres when help is needed. Furthermore, it appears that the quantities of clotting factors applied differ from the physician's prescription.

## E-Learning requirements

On request of the Erasmus Medical Centre (EMC) in Rotterdam, a multimedia e-learning program has been designed to improve the quality of home treatment.

The program has two main purposes:

1) improving the daily process of home treatment:

Gradually, incorrect routines may appear in the daily process of preventive home treatment. Examples are risk of contamination caused by neglecting hygienic procedures, not interchanging veins and incorrect administration of treatments or bleedings.

2) improving the knowledge of patients, to be able to deal effectively with unexpected situations:

In case of bleedings or side effects of treatments, the execution of specific procedures is required. Because unexpected situations are rare, patients tend to forget some elements of these procedures.

The content of the e-learning program should be based on an existing handbook for patients.

## Project issues

Besides the requirements stated above, there were several issues that should be taken into account in the design of the e-learning program:

**Limited budget** - despite the promising expectations of the e-learning program, its development was not part of the hospitals budget but sponsored by an external party, i.e. Sanquin.

**Quality** - parallel to the design of the e-learning program a rigid test programme has been set-up to test whether the e-learning programme is an effective instrument in improving the quality of haemophilia home treatment.

**Target group** - The occurrence of haemophilia is spread evenly over people with different levels of education. Therefore the program should - if possible - adhere to the B1 level from the European Language Framework.

**Availability of medical specialists** - Because availability of medical specialists is limited, a mode of communication needs to be designed that takes this into account.

## E-Learning design

The program has been implemented in Moodle. Moodle is an e-learning program with extensive functionality, but a low cost of ownership due to its well designed structure and its Open Source character.

For the e-learning program itself we applied the Moodle Lesson Module. The program has been divided into 6 lessons reflecting the structure of the existing handbook. For communication between project stakeholders, a development forum has been set up. This way, asynchronous communication about the program is possible during development; participants are getting e-mail messages when new contributions are made in the forum and all communication is written down, leaving little or no room for discussion about requirements and project decisions afterwards.

The first 5 lessons consist of rephrased theory from the handbook, open and closed question formats and interactive exercises.

The 6th lesson contains a video, demonstrating all activities required for the infusion of clotting concentrate and open questions about the content of the video.

The matrix below shows how the requirements and project issues are fulfilled by the e-learning design.

	Moodle	Development forum	Theory	Open questions	Interactive exercises	Video
Daily process				√		√
Theoretical knowledge			√	√	√	
Content from handbook			√		√	√
Limited budget	√					
Quality		√				
Target group education level			√	√	√	
Limited availability of doctors		√				

## Test set-up

Because of a possible life threatening situation, the program needs to be thoroughly tested. Two groups of patients have been randomly selected. An e-Learning group (n=16) and a Control group (n=14). The measurements consisted of two aspects: an observation of the intravenous injection of clotting factor by patients and each patient filling out a questionnaire.

Both aspects have been measured in a Pre-Test and a Post-Test.

In Week 1, both the e-Learning group and the Control group took the Pre-Test. Each patient filled out the questionnaire and each patient has been observed in the process of injecting clotting factor.

After the Pre-Test, the e-Learning group took the e-Learning course. Between the two tests, the test results have not been presented to the participants.

In week 5, both groups took the Post-Test.

This approach has been chosen to reduce the effect of external influences in the measurement process. If external influences are present they will likely be similar for both groups.

After the Post-Test, the control group was invited to take the e-learning program as well. All members of the control group were willing to do so.

## Test results

### Knowledge test

The e-learning group starts in the pre-test (week 1) with a median score of 23 points (47%). The minimum score is 8 points (16%) and the maximum score is 31 points (64%).

The results of the post-test show a significant improvement in the knowledge level of the participants in the e-learning group. The median score is 35 (72%) with a minimum of 18 (37%) and a maximum of 42 (87%).

The control group has a median score of 25 (52%) both on the pre-test and on the post-test. This means that this test has a high test-retest reliability level.

	Total group N=30		e-Learning group N=16		Control group N=14	
	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test
Median (%)	24 (50%)	32 (66%)	23 (47%)	35 (73%)	25 (52%)	25 (52%)
Minimum (%)	8 (16%)	18 (37%)	8 (16%)	18 (37%)	15 (31%)	19 (39%)
Maximum (%)	31 (64%)	42 (87%)	31 (64%)	42 (87%)	31 (64%)	32 (66%)
Paired sample t-test significance	< 0.001		< 0.001		0.218	

### Practical test

The e-learning group starts in the pre-test (week 1) with a median score of 12 points (60%). The minimum score is 6 points (30%) and the maximum score is 15 points (75%).

The results of the post-test show a significant improvement in practical abilities of the participants in the e-learning group. The median score is 15 (75%) with a minimum of 10 (50%) and a maximum of 18 points (90%).

The control group has a median score of 11 (55%) on the pre-test and an average of 11,5 (58%) on the post-test.

	Total group N=30		e-Learning group N=16		Control group N=14	
	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test
Median (%)	11 (55%)	13 (65%)	12 (60%)	15 (75%)	11 (55%)	11,5 (58%)
Minimum (%)	6 (30%)	4 (20%)	6 (30%)	10 (50%)	7 (35%)	4 (20%)
Maximum (%)	16 (80%)	18 (90%)	15 (75%)	18 (90%)	16 (80%)	16 (80%)
Paired sample t-test significance	0.018		0.001		0.669	

## Additional result

The open questions in the e-learning program consist both of knowledge testing questions and information gathering question, like "Do you play any kind of sport or intend to do so. If so, what kind of sport? If not, why not?".

It appeared that the answers on these questions are often relevant in doctor-patient discussions.

## What's next?

It has been statistically proven that the e-learning group scores significantly better on both aspects.

This opens the way for making the programme available to all haemophilia patients in the Netherlands and to translate and localize the programme for other languages and countries.

Furthermore, we expect that this setup is applicable to other situations where high (life) risks are at stake, both inside and outside the medical world.

## References

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