Institut für wirtschaftliche Pflege und Gesundheitswesen

Technology
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Process optimisation in nursing with VENDLET V5 in Germany, Great Britain and Denmark

Reduction of cost and strain when moving and handling patients

Authors:	Prof. Dr. Hans-Günter Lindner, TH Köln Dipl.-Kauffrau Michaela M. Tittmann, IwP
Telephone:	+49 163 799 8503
E-mail:	hans-guenter.lindner@th-koeln.de michaela.tittmann@iw-pflege.de
Address:	von-Loe-Str. 24, 53840 Troisdorf

Management Summary

In this study the IwP Institute for Economic Nursing and Health Care examines the use of VENDLET V5 for the nursing and health care market in Germany, Great Britain and Denmark.

VENDLET V5 is an automatic patient turning system which supports the moving and handling of bedridden patients in nursing beds. For the study, four moving and handling processes were recorded and analysed in detail in several series of trials. One series of trials examined the procedure with VENDLET V5, the others respectively the usual scenarios in Germany, Great Britain and Denmark. The series of trials were used for modelling and simulation of repeatable observations and analyses of the processes. Measurements and key performance curves can be found in direct comparison during the simulation.

The study shows that VENDLET V5 helps to move the patient more economically and more gently physically. At the same time, it also frees up more time for the nursing staff, that can be used to focus more intensely on the patient. The estimated financial savings are significantly different in the individual countries. They are influenced by the very different procedures for moving and handling. and the usual full costs per working hour in the respective countries

In Germany, the estimated savings are about €4,025 per patient per year at a full cost of €50/hr for an expert nursing attendant. This means that VENDLET V5 is already amortised with the selected scenarios in approx. one year.

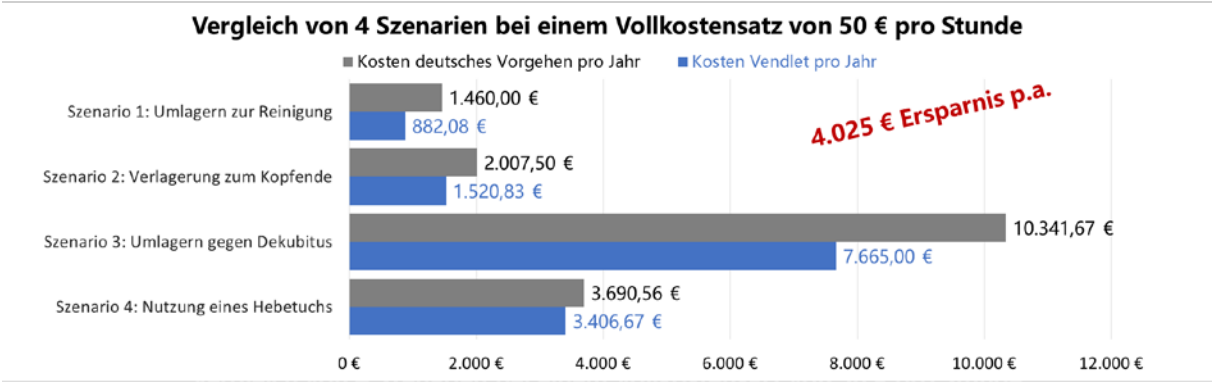


Figure 1: Comparison of German practice with VENDLET V5

The usual practice in Great Britain leads to even higher savings. It is about £7,012 per patient per year at a full cost of £20/hr for an expert nursing attendant. This means that VENDLET V5 is already amortised with 4 scenarios in approx. half a year.

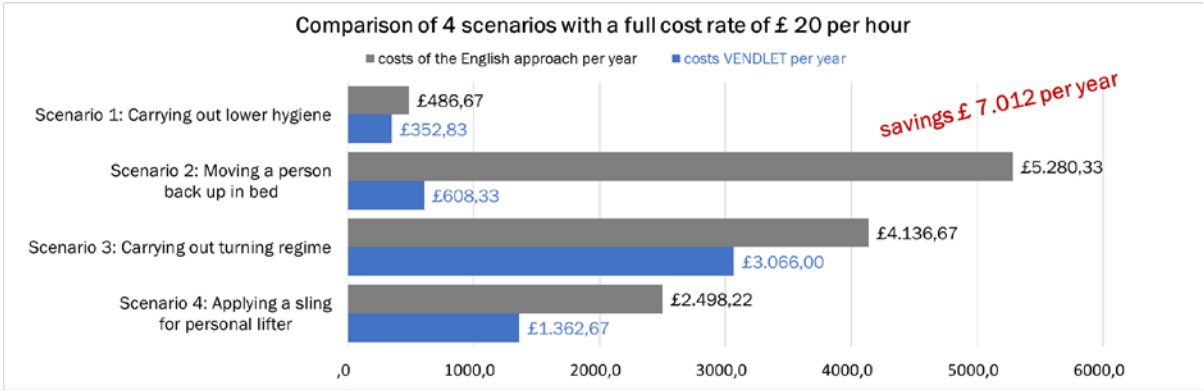


Figure 2: Comparison of British practice with VENDLET V5

In Denmark the moving processes are only carried out by one nursing attendant. There, the estimated saving is about 63,556 DKK per patient per year with a full cost of 225 DKK/hr for an expert nursing attendant. This means that VENDLET V5 is already amortised with 4 scenarios in approx. half a year.

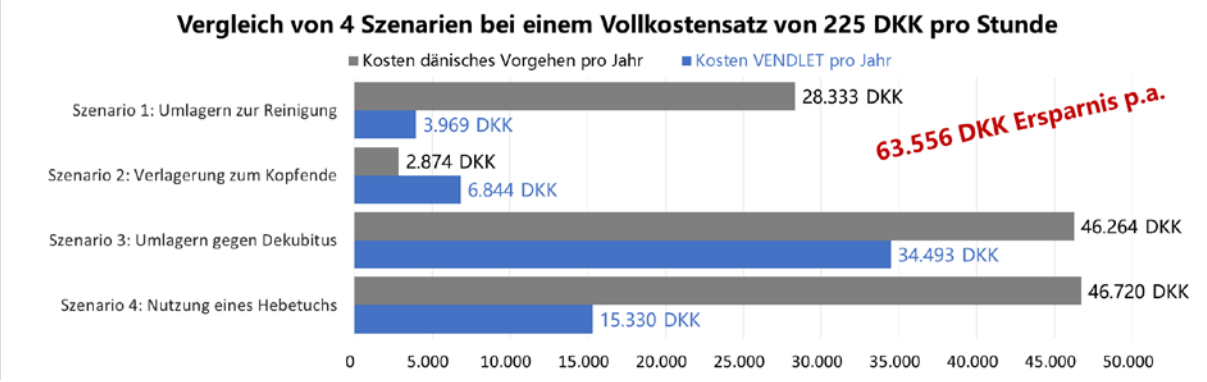


Figure 3: Comparison of Danish practice with VENDLET V5

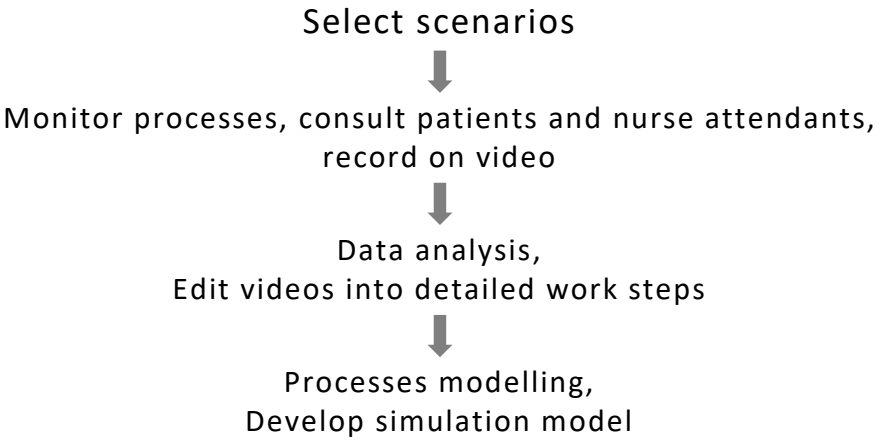
All measured values indicate significantly lowered physical strain. Simultaneously, the study found that using the VENDLET V5 saves time, leading to a reduction in costs. But another, perhaps even more important advantages lie in preventing spinal injuries caused by strain, e.g. severe slipped disks. This also carries a significant economic benefit, as it would lower sick leave.

Fewer patients new touch points and less force applied to the moving and handling also increases the comfort of both patients and careres.

1 The realisation of the study

Vendlet ApS is selling the automatic patient turning system VENDLET V5 worldwide with increasing success. With VENDLET V5, patients are moved by moving the bed sheet. The nursing attendant controls this process via a remote control and, in doing so, touches the patient only softly to give a feeling of security. Moving takes place without the application of force. With the help of the study and the simulation developed for this, the effect the improvements have for the everyday practise should become visible, available and measurable, so that the benefits can be conveyed. This study forms the basis for an international comparison.

The method in overview:



1.1 Select scenarios

The study compares moving patients using VENDLET V5 and the usual procedures currently in practice in Germany, Great Britain and Denmark. Techniques according to the textbook or with special illnesses were not analysed. For this comparison, a bedridden patient type and the following four frequent scenarios were selected for time reasons and cost reasons from many possibilities:

1. Positioning for lower hygiene procedures
2. Turning a patient in bed
3. Repositioning the patient up in bed
4. Applying and removing a sling

In doing this, VENDLET V5 was used for patients up to 200 kg; the version up to 400 kg was not used.

1.2 Observing processes, conferring with patients and nursing attendants and recording on video

Video sequences are the basis for the objective data collection in this study. This allows repeated analysis of times, actions, facial expressions and gestures. The scenarios were filmed up to 3 times with VENDLET V5 and the German practice. For Great Britain, several videos were available, from which those comparable with the other ones were selected.

To receive a sufficiently large amount of empirical data, it would be statistically desirable to be able to consult more than one hundred patients and to film them several times. However, such an analysis could hardly be expected of the patients.

Hence, the following action was selected: for the comparison between the use of VENDLET V5 and the German practice, one patient in each case was initially observed and interviewed. Afterwards, the analysed moving processes were carried out with a test person and were recorded on video. Before the video recordings, the participants were briefed without influencing them about the contents. The goal was for the actors to intuitively to show accustomed ways of acting. The comparison between the use of VENDLET V5 and the usual practice in Great Britain and Denmark were based on video recordings created by third parties, which were also analysed as follows.

1.3 Analysing data, editing videos into detailed work steps

The analysis of the video recordings is explained below with the help of the process "repositioning for lower hygiene". For the analysis, coherent movement patterns were summarised into sections related to the contents, for example "turn patient" and "centre patient". These sections correspond to so-called activities in the process models and include start, end and designation. They were defined as marks and then transferred into a spreadsheet. The following indicators were also determined from the video, which have an influence on the wellbeing of the nurse and the patient: the number of touches per patient, the carers diffraction angle and the applied and lumbal force.

Figure 4: Management of the scenarios in Adobe Premiere CC

The analysis of the moving and handling of the actual patients served as a reference for the activities with the test person. In doing this, the times for individual actions, applied and lumbal force and carers diffraction angle were compared

1.4 Modelling the processes, developing the simulation model

It is necessary for the required simulation to transfer the observed scenarios into a model. The different moving and handling processes are complicated and require different methods of modelling,

which must be united into a uniform overall model. With the help of the simulation tool AnyLogic, a simulation environment was created especially for the study, in order to objectively compare the scenarios using the VENDLET V5 with the scenarios in the different countries.

The activities were mapped using the discrete event-oriented Process Modelling Library. The components nursing attendant, patient, VENDLET V5, pillow and sling are agents with their own state models (State Chart Models). Thus, each simulated patient and nurse can assume different states in a scenario.

After modelling the individual process steps in the simulation model, incl. movements, diffractions and touches, specific figures were added. These were determined during the analysis of the videos.

The times of the individual activities were mapped in normal distribution; in this, the averages are the times measured in the videos. Thus, the simulation can occur, and the individual steps can run successively according to the observed times within the statistical distributions.

The computer-aided simulation of the scenarios makes it possible to observe them repeatedly and to carry out different analyses with changed parameters. The results vary because the times within the activities are assigned random values and are distributed normally around the average; i.e. the repetition of the simulation with the same parameters can lead to different results.

In a test phase, the simulation was shown to nurses and other experts from the health service and was checked for validity and found to be correct.

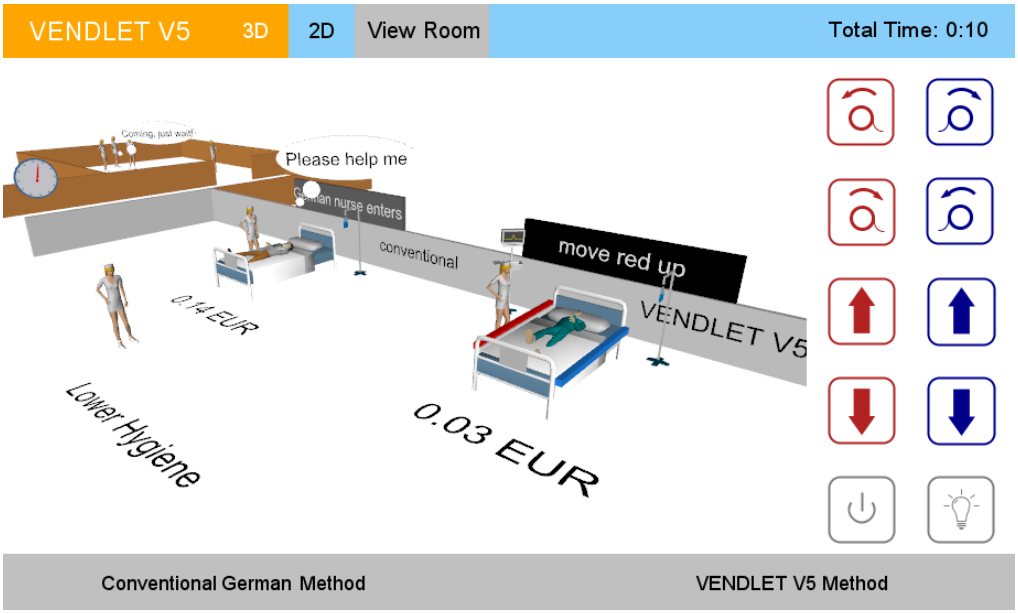


Figure 5: The VENDLET V5 Simulation window

The simulator for VENDLET V5 is an independent program that can be used to carry out different scenarios. In this case, the following parameters can be defined for the simulation:

- the respective repetitions per day,
- the delay until the second nurse starts to support the first nurse in the German and British scenarios (in Denmark the processes are carried out by only one nursing attendant),
- and the hourly rate of the nursing attendant (including pension, sick leave, training and seminars, etc.)

2 The results of the simulator

The results of the simulation are explained below, using the scenario "repositioning for lower hygiene" as an example. The German traditional method is being compared to the VENDLET V5. In the simulation window, the values shown on the left represents the German scenario, and the values shown on the left represents the VENDLET V5.

Before the beginning the simulation, the parameters are set for this process as follows: 6 repetitions per day, full costs of € 50 per hour and no waiting period for the second nursing attendant (0 seconds); these are indicated in the bottom row (Figure 6: Measured data "Repositioning for lower hygiene" ①).

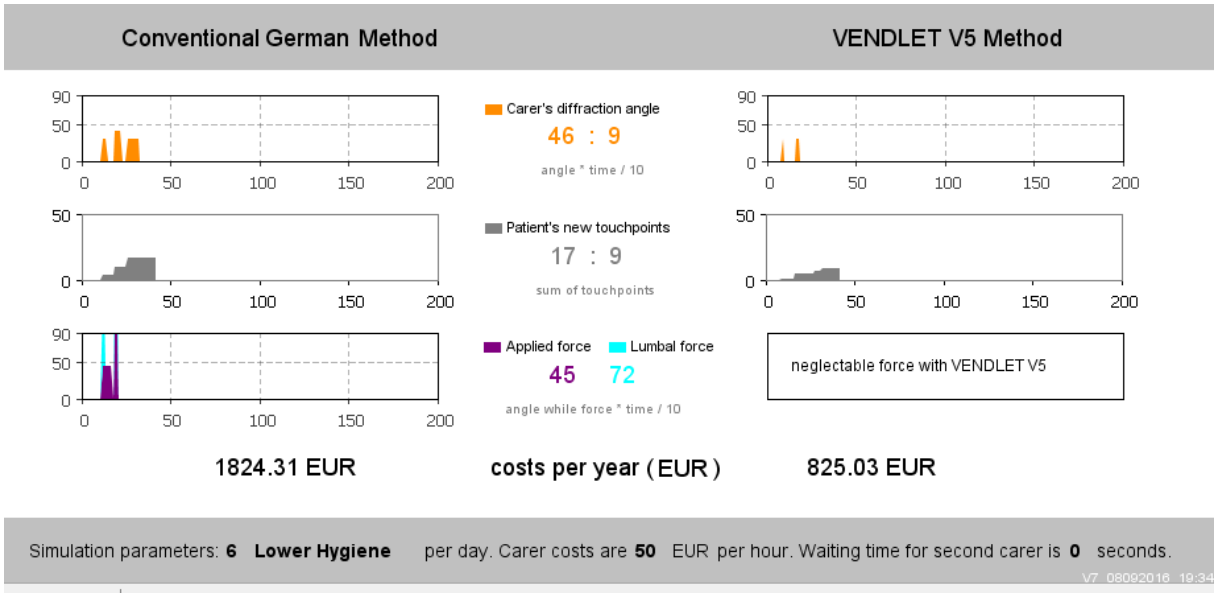


Figure 6: Measured data "Repositioning for lower hygiene"

The simulation represents a real-time scenario. In the traditional German scenario, the second nursing attendant sets off directly in the selected case when the first nursing attendant steps near the bed. About 6 seconds pass until the arrival of the second nursing attendant, i.e. altogether 12 seconds (precisely 12.567 seconds from the simulation) until both nursing attendants can begin the moving and handling process. The two nursing attendants then need 24 seconds respectively for this, so that the German practice lasts a total of 61 seconds. These costs are rounded to €0.84 per process.

With the use of VENDLET V5, a nursing attendant needs 26 seconds for moving, which corresponds to a cost of €0.40; this is less than half of the personnel cost in the comparison. The values are multiplied by the number of executions per day and 365. This results in costs of €1842.26 per year for the German practice and of €882.08 for the use of Vendlet②. The duration of the cleaning is independent of the procedure for moving and handling, and therefore does not factor into the calculation.

In addition to the financial aspects, the overview of results shows the evaluation of qualitative criteria as indicators of the strain and wellbeing of the nursing attendants and the patients. The Y axis shows the diffraction angles, or the patients new touch points and the X axis shows the time sequence. As a result, the intensity and duration of the loads can be read.

The diffraction angle of the back of the nursing attendants without the application of force, is an indicator of the strain imposed on the spine, and and thus the probability of pain in this part of the body③. It shows how strongly the back is bent and for how long work goes on with this deflection. During the conversion into a numerical representation, the angle of the body deflection is multiplied

by the duration of the deflection: angle * time. This corresponds to the indicator of the area. To make the results clearer, this value was divided by ten. Then the ratio of the deflection angle of the back in this scenario amounts to 46:9. I.e. when using VENDLET V5 the back is significantly less deflected; the strain is when using VENDLET V5 is only 20% of the traditional German method.

The patient's new touchpoints correspond to external mechanical impulses which must be processed sensitively, cognitively and affectively by the patient④. Each process means energy that the patient must use for it. The higher a patient's pain sensitivity is, the more disturbing touching is. The touches per patient are added as they occur. The graph thus shows the cumulative touches per patient. The nursing attendants touch the patient together almost twice as much according to the German practice. The ratio is 17:9.

The carers applied force is another indicator of strain. The effect of the forces increases with increasing carers diffraction angle. The more frequently strain occur in this area, the higher the risk of damage and possible incapacity for work. The beginning and the end of the application of force can be determined by the observation of the muscle tone in the arms of the carer. No value can be determined for VENDLET V5, since there is no force applied during moving and handling. Only the hands are used for guidance or a reassuring touch.

In addition, strain from shear forces in the lumbar spine (lumbal force)⑥, occurring when pulling and from strain when deflecting, are shown. No value can be determined for VENDLET V5, since there is no force applied.

3 The summary of the results for the four scenarios in the individual countries

An objective of the study is to determine whether there is a financial gain of implementing the VENDLET V5 system. Therefore, the time needed and the resulting costs of the moving and handling procedures in the individual countries will be compared with the time needed for the use of VENDLET V5 for each of the four scenarios (positioning for lower hygiene procedures, turning a patient in bed, repositioning the patient up in bed, applying and removing a sling).

For this demonstration, the following assumptions were made about the frequency of the procedures on a patient per day: each patient is positioned for lower hygiene procedures 6 times daily, is repositioned up in bed 6 times daily, is turned in bed 12 times for decubitus prophylaxis and is moved 4 times with the lift.

3.1 Germany

First, the average times and the time savings are determined for each moving process. Here, it should be taken into account that for the cost comparison in the German procedure, it was assumed that two nursing attendants were standing ready by the bed and so there was no waiting period for a second nursing attendant. The process cost overviews therefore include the pure treatment times and no travel times. In practice, this means that the longer the first nursing attendant must wait for the arrival of the second nursing attendant, the higher the saving using VENDLET V5.

	Zeitersparnis VENDLET V5 je Vorgang in Sek	Häufigkeit am Tag	Zeitersparnis VENDLET V5 am Tag in Min:Sek	Kosten-ersparnis VENDLET V5 am Tag in €	Zeitersparnis VENDLET V5 im Jahr in Std:Min	Kostenersparnis VENDLET V5 im Jahr in €
Umlagern zum Reinigen des Gesäßes	19	6	0:01:54	1,58 €	11:33	577,92 €
Eine im Bett an das Fußende gerutschte Person wieder ans Kopfende verlagern	16	6	0:01:36	1,33 €	09:44	486,67 €
Umlagern zur Dekubitusprophylaxe	44	12	0:08:48	7,33 €	53:32	2.676,67 €
Anlegen und Abnehmen eines Hebetuchs / Netzes für den Patientenlifter	14	4	0:00:56	0,78 €	05:40	283,89 €
Summe			**0:13:14**	**11,03 €**	**80:30**	**4.025,14 €**

Figure 7: Overview of process costs in Germany

To determine the costs, an hourly rate of €50 was assumed for the full costs per nursing attendant. In Germany estimated savings are about €4,025 per patient per year[1]. This means that VENDLET V5 is already amortised with 4 scenarios in approx. one year.

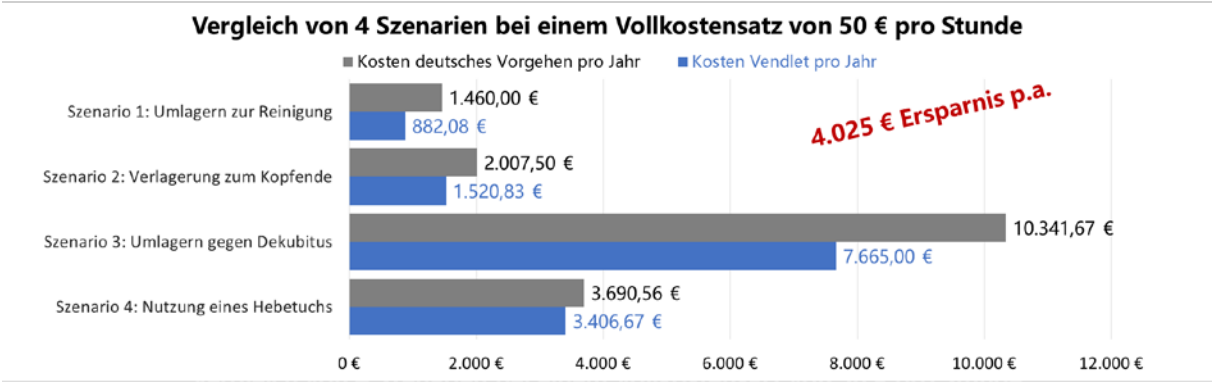


Figure 8: Comparison of the 4 scenarios in Germany

3.2 Great Britain

In Great Britain, the moving and handling processes are also carried out by two nursing attendants. Here, for the cost comparison it was also assumed that two nursing attendants were standing ready by the bed and so there was no waiting period for the second nursing attendant. In Great Britain, the use of VENDLET V5 leads to an even higher saving compared to the usual practice.

[1] The result for "repositioning for lower hygiene procedure" differs from the German practice in the explanation for the 'results in the simulator', because a delay of 6 seconds was set for visualisation until the arrival of the second nursing attendant. This therefore results in higher costs.

	Zeitersparnis VENDLET V5 je Vorgang in Sek	Häufigkeit am Tag	Zeitersparnis VENDLET V5 am Tag in Min:Sek	Kosten-ersparnis VENDLET V5 am Tag in £	Zeitersparnis VENDLET V5 im Jahr in Std:Min	Kostenersparnis VENDLET V5 im Jahr in £
Umlagern zum Reinigen des Gesäßes	11	6	0:01:06	£0,37	06:41	£133,83
Eine im Bett an das Fußende gerutschte Person wieder ans Kopfende verlagern	384	6	0:38:24	£12,80	233:36	£4.672,00
Umlagern zur Dekubitusprophylaxe	44	12	0:08:48	£2,93	53:32	£1.070,67
Anlegen und Ablegen eines Hebetuchs / Netzes für den Patientenlifter	140	4	0:09:20	£3,11	56:46	£1.135,56
Summe			**0:57:38**	**£19,21**	**350:36**	**£7.012,06**

Figure 9: Overview of process costs in Great Britain

It amounts to about £7,012 per patient per year at a full cost rate of £20/hr for an expert nursing attendant. This means that VENDLET V5 is already amortised with 4 scenarios in approx. half a year.

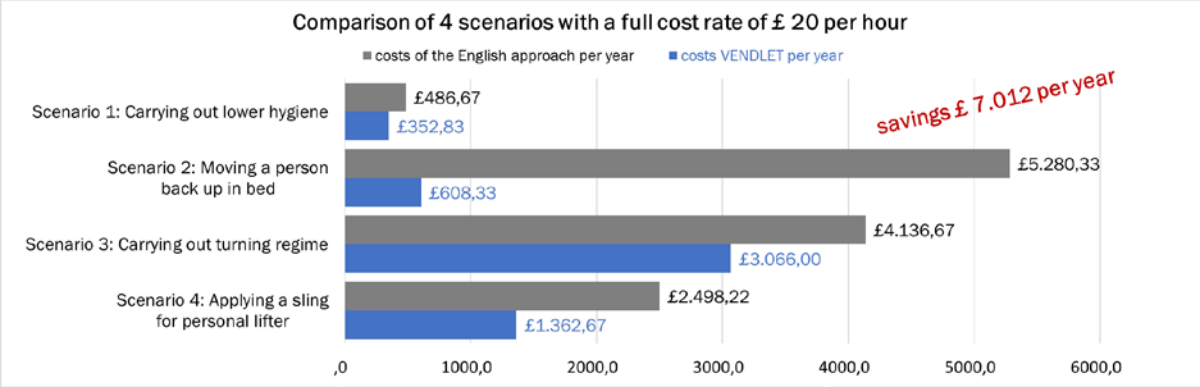


Figure 10: Comparison of the 4 scenarios in Great Britain

3.3 Denmark

In Denmark, the moving processes are carried out by only one nursing attendant. Here, the use of VENDLET V5 also leads to a much higher saving compared to the usual practice in Germany.

	Zeitersparnis VENDLET V5 je Vorgang in Sek	Häufigkeit am Tag	Zeitersparnis VENDLET V5 am Tag in Min:Sek	Kosten-ersparnis VENDLET V5 am Tag in DKK	Zeitersparnis VENDLET V5 im Jahr in Std:Min	Kostenersparnis VENDLET V5 im Jahr in DKK
Umlagern zum Reinigen des Gesäßes	178	6	0:17:48	14,83 DKK	108:17	24.363,75 DKK
Eine im Bett an das Fußende gerutschte Person wieder ans Kopfende verlagern	-29	6	-0:02:54	-2,42 DKK	-17:38	-3.969,38 DKK
Umlagern zur Dekubitusprophylaxe	43	12	0:08:36	7,17 DKK	52:19	11.771,25 DKK
Anlegen und Abnehmen eines Hebetuchs / Netzes für den Patientenlifter	344	4	0:22:56	19,11 DKK	139:30	31.390,00 DKK
Summe			**0:46:26**	**38,69 DKK**	**282:28**	**63.555,63 DKK**

Figure 11 : Overview of process costs in Denmark

In Denmark, the estimated savings resulting from the use of VENDLET V5 are about 63,556 DKK per patient per year with a full cost rate of 225 DKK/hr for an expert nursing attendant. This means that VENDLET V5 is already amortised with 4 scenarios in approx. half a year.

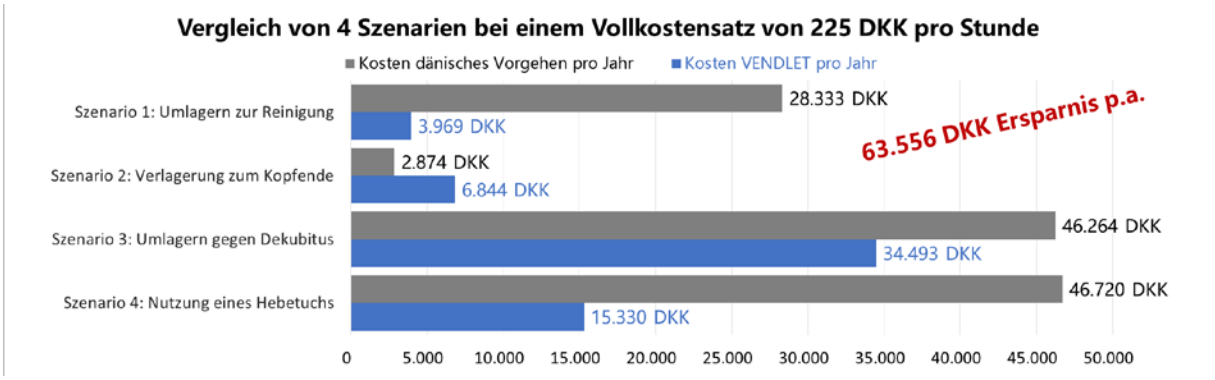


Figure 12 : Comparison of the 4 scenarios in Denmark

3.4 Germany, Great Britain, Denmark

The costs nursing attendants having to take sick leave caused by spine disorders, depends on the nature and severity of the illness and its treatment. An average cost amount cannot be specified for this scientifically. It is nevertheless reasonable to assume that the economic benefits once again will significantly increase in all countries if sick leave caused by spine disorders can be reduced by using VENDLET V5. Long-term illnesses of nursing attendants do not only have a serious impact on the functionality and performance of a facility. It also forces nursing attendants to change occupation as a result of several slipped disks. In this respect, the reduction of severe spine disorders has a strong impact on both costs and the increasing shortage of specialists.

4 The result

The manufacturer Vendlet ApS in Aabenraa, Denmark, had claimed the following benefits of using the VENDLET V5, that this study set out to test:

1. Physical relief for the nursing attendants,
2. Improvement of comfort for patients and nursing attendants, as well as
3. Increased economic use of nursing attendants.

These three hypotheses could be confirmed. Fewer changing touches and force applied improved the comfort for patients and nursing attendants. Also, time savings can be ascertained which leads to a cost saving. For the 4 selected scenarios and the specified number of repetitions per day, as well as the specified full cost rates per working hour, there were annual savings in Germany of €4,025, in Great Britain of £7,012 and in Denmark of 63,556 DKK. It must be mentioned that the usage possibilities of VENDLET V5 go beyond the 4 scenarios selected for the sake of clarity in the study. I.e. the relief of the employees and the working time saved will even be significantly higher in the facilities.

Due to the different practices in the individual countries and the different salaries, the amortisation times for a VENDLET V5 vary greatly with the selected scenarios in the individual countries - from approx. one half up to one full year. However, a far higher human and also economic benefit lies in the avoidance of back injuries caused by strain. If only one loss of six weeks were to be avoided, VENDLET V5 would already have been worthwhile.

The study is a starting point for determining the comprehensive benefits of new health care tools like VENDLET V5.