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RESEARCH ARTICLE

Promoting urinary continence in people suffering a stroke: Effectiveness of a complex intervention—An intervention study

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Abstract

Aim: The study aimed to implement and measure effectiveness of a systematic continence management intervention in people suffering a stroke in undertaking rehabilitation.

Design: An intervention study was conducted.

Methods: In the first part of the study, patients were included in the control group and observed. After the training of the nursing staff, participants were assigned to the intervention group. The intervention consisted of screening, assessment, treatment, communication and evaluation.

Results: Forty-six patients took part in the study, of which 35 were in the control and 11 in the intervention groups. Within the two groups, significant improvements in outcomes were mostly seen during the study. For the Incontinence Quality of Life Social Embarrassment scale, a significantly higher increase was observed for the intervention group. The improvement between admission and discharge in the intervention group was notably larger for the outcome's incontinence and quality of life.

KEYWORDS
cost-effectiveness, intervention study, neurological rehabilitation, nurses, stroke, urinary incontinence

1 | INTRODUCTION

According to Béjot et al. (2016), stroke is a devastating disease and approximately 1.1 million Europeans suffered a stroke each year. More than 80% of stroke survivors report one or more abnormal urinary symptoms at 3 or 12 months, with nocturia being the most frequent (Williams et al., 2012). Further, more than 50% of stroke survivors suffer from urinary incontinence in the acute stage; this value is reduced to 33% after 1 year (Kolominsky-Rabas et al., 2003). Urinary incontinence is defined as the complaint of any involuntary leakage of urine (Abrams et al., 2002). Urinary frequency, urgency and urge incontinence are the predominant symptoms in stroke survivors (Marinkovic & Badlani, 2001). Incontinence negatively affects the course of the disease; incontinent patients showed a worse functional outcome compared to continent patients (Pizzi et al., 2014). Urinary incontinence is a prognostic factor in the subacute phase after stroke for daily living activities (Meijer et al., 2003). Stroke survivors who are incontinent in the acute stage have a fourfold higher risk of institutionalization after a year, and urinary incontinence as initial presentation in acute stroke is associated with a high mortality rate (Kolominsky-Rabas et al., 2003; Marinkovic & Badlani, 2001). Urinary incontinence further negatively impacts the quality of life in persons with underlying neurologic conditions (Tapia et al., 2013). According to Akkoç et al. (2019), lower urinary tract dysfunction is

associated with poorer cognitive and functional status and a lower quality of life in these persons.

Recovery from urinary incontinence was shown as an important prognostic indicator, as evidenced by a significant association between continence at discharge from an inpatient rehabilitation centre with cognition and transfer skills measured by the functional independence measure (Kushner & Johnson-Greene, 2018). Improvement of urinary incontinence to minimal assistance at an independent level upon discharge was associated with a greater likelihood that these patients would also be at the minimal assistance to independent level with cognition and transfer, and the discharge disposition would most likely be the home and/or community rather than an institutional care centre or the requirement of acute care (Kushner & Johnson-Greene, 2018).

2 | BACKGROUND

The treatment of urinary incontinence is challenging. A study conducted by John et al. (2018) urges caution in the use of indwelling urinary catheters after a new-onset stroke, especially for urinary incontinence treatment. It further stresses the need for specific urinary incontinence management after a stroke because indwelling urinary catheters in the post-stroke period are associated with death, particularly among incontinent patients. Following the recommendation of Holroyd (2019), careful assessment and management of incontinence from the earliest opportunity is a key component for rehabilitation and improved quality of life. The timing of appropriate interventions is also essential for successful rehabilitation and can lead to a reduction in the psychological issues associated with both stroke and incontinence. However, it seems to be clear that nurses play an important role in promoting continence in stroke survivors but they reactively manage urinary incontinence, adopting a routinized approach based on local custom and practice. The promotion of urinary continence is not a priority area of stroke rehabilitation for nurses (Booth et al., 2009; Cave, 2017).

Treatment of urinary incontinence is complex; according to Brady et al. (2016), complex packages of care are likely to be required, involving individualized care plans based on the personalized assessments and comprehensive screenings of admissions. These are facilitated through excellent communication skills at the staff level and good communication strategies between staff and patients, and staff training appears to be a core component in facilitating a shift in the approaches to continence care. Gibson et al. (2018) concur with that; they also concluded in their study that the effectiveness of a systematic voiding programme may partly lie in its educational component and individual adaptation of the programme and the ability to incorporate it alongside other aspects of care are likely to be key factors influencing implementation. According to the current Cochrane review by Thomas et al. (2019), there is insufficient evidence to guide the continence care of adults in the rehabilitative phase after stroke. The authors conclude that methods of managing continuing urinary incontinence, such as behavioural interventions (e.g. bladder training, prompted voiding and pelvic floor muscle training), require testing with the stroke population, both in hospitals and in the community post-discharge. Interestingly, only four studies could be found in this Cochrane review examining behavioural interventions, of which three were studies about pelvic floor muscle training (Shin et al., 2016; Tibaek et al., 2005, 2017) and one study compared timed voiding versus void on request (Gelber & Swords, 1997).

Against this background, there seems to be a gap in knowledge about interventions to promote urinary continence in stroke survivors. In general, non-pharmacological interventions should be preferred and according to the literature, a comprehensive assessment with individually adapted measures is recommended. Therefore, the current study aimed to implement systematic continence management in people suffering a stroke and test its effectiveness regarding the patients' urinary continence, quality of life and self-care ability during rehabilitation. Additionally, a process evaluation according to the cost-effectiveness of the intervention and the knowledge enhancement of the nursing staff was carried out, and the acceptance of the intervention was investigated.

3 | METHODS

3.1 | Design

In the current study, an intervention for continence promotion after stroke in rehabilitation was evaluated. This intervention needed to be comprised several dependent and independent interacting components since incontinence after a stroke is multifactorial, and therefore, a complex intervention is necessary to achieve optimal improvement and influence several different outcomes (Campbell et al., 2000; Ludvigsen et al., 2013; Mühlhauser et al., 2011). The interventions used individually in promoting continence must be adapted to each person suffering a stroke. This high degree of flexibility in the individual implementation of the intervention contributes to the intervention's high complexity. Besides, an interdisciplinary approach in the care of patients is essential in rehabilitation; therefore, a wide variety of professional groups are affected by this intervention. Complex interventions are necessary if a complex problem such as urinary incontinence must be treated. Individual interventions generally have a lesser effect on such challenges (Polit & Beck, 2012). Moreover, there is evidence that the effectiveness of complex interventions can be increased if the interventions are adapted to a particular setting (Campbell et al., 2007).

The entire project concerning the development, evaluation and implementation of a continence-promoting intervention for people after a stroke is based on the MRC framework (Skivington et al., 2021). As described below, we have gone through the first two phases of the framework (Develop Intervention, Feasibility) and are now in the evaluation phase. However, after this first evaluation, the programme theory will have to be revised and aspects of the first two phases will have to be taken into account again. Against

this background, a complex intervention concerning a programme theory was developed and represented by a logic model (Kohler et al., 2020). In accordance with the model by Corry et al. (2013), a synthesis of existing empirical evidence, a needs analysis and a practice analysis were conducted to form the basis on which to develop a programme theory. Taking into account all resources which are described in detail in the article of Kohler et al. (2020), it was subsequently developed a "theory of change logic model" following the recommendations of the W.K. Kellogg Foundation (2004). Firstly, we defined problems, needs, influential factors, strategies and assumptions, subsequently we developed the outcome chains. Finally, the logic model consists of six parts with three outcome chains on interconnected levels which are oriented towards patients and nurses. Important aspects of the strategies within this programme theory are communication, individually adopted measures and defining interdisciplinary objectives. In the chapter "intervention phase" within this section, the strategies are described in detail.

This logic model cannot be regarded as definitive but serves as a preliminary model that must be continually revised and adapted. It is important to evaluate the effectiveness of these complex interventions. However, this alone is not enough for the further development of the programme theory. A formative evaluation, that is, a qualitative process evaluation of the programme theory is also very important (Atkins et al., 2015; Höhmann & Bartholomeyczik, 2013).

To reduce external influences as much as possible, the study was conducted in a single rehabilitation centre. In the first part of the study before the implementation of the intervention, patients were included in the control group and observed. After the training of the nursing staff, participants were assigned to the intervention group. This ensured that the same structural and personnel conditions existed during the control and intervention phase. The TREND Checklist was used to report this study (Des Jarlais et al., 2004).

3.2 | Setting and sample

The study was conducted in a neurological rehabilitation clinic in the German-speaking part of Switzerland from July 2016 to October 2019. Clear inclusion and exclusion criteria were used to select the participating patients.

The inclusion criteria for patients included the following:

- Stroke diagnosis
- Urinary incontinence (as defined by the International Continence Society)
- First inpatient rehabilitation after a stroke
- Signed informed consent

The exclusion criteria for patients included the following:

- Transurethral catheter (inclusion possible as soon as the catheter is removed)
- Suprapubic catheter
- Pronounced agitation or delirium
- Inability to read and speak German

The participating patients were recruited by the nursing staff of the wards. An incontinence screening was carried out by the functional independence measure during the routine nursing assessment at admission. Potential participating patients were informed about the study by the management team of the ward, asked to participate in the study and if they agreed to do so, informed consent was obtained. The nursing staff was supported in the recruitment process by the head of nursing development.

All nursing staff members of the neurological wards who provided signed informed consent were included. Information about the study was given by the study director before the study commenced.

A sample size calculation was carried out in advance and it was estimated that 44 participants were needed per group (with an assumed effect size of 3 for the primary outcome ICIC, a standard deviation of 5, power 0.8 and type I error rate of 0.05).

3.3 | Control and intervention

3.3.1 | Control phase

During the control phase, participants received the usual care from the nursing staff and the entire supervising interdisciplinary rehabilitation team. A superficial incontinence assessment was routinely carried out, followed by the unsystematic application of incontinence management measures, which are usually not discussed in the interdisciplinary team.

3.3.2 | Intervention phase

Systematic continence management was introduced through training. The training took place in two groups, namely, nursing professionals (including those in training) and nursing assistants and health professionals (including trainees). In-depth training was conducted for the management teams (ward management and clinical nurse specialists) of the wards to ensure continuity in the implementation of continence management. The training was led by the first and last authors of this paper (MK and SS). The most important points of the training were summarized in a leaflet and served as support for the implementation of the intervention in the direct patient situation.

The newly implemented intervention followed a structured process. This was intended to guide the nursing staff and the entire interdisciplinary treatment team in continence care. The intervention consisted of screening, assessment, treatment, communication and evaluation.

Based on the detailed assessment, suitable individually tailored measures were derived. The treatment of incontinence involves various measures and not all of them are suitable for every person.

The choice of individual measures was guided by an algorithm (Figure S1). The nursing plan included the nursing diagnosis, nursing goal and measures derived from it. The nursing plan was discussed with the patient. The nursing diagnosis and nursing goal selections in the algorithm were made from the several interventions based on the assessment (Appendix 1).

3.4 | Data collection

Data collection took place at fixed times during the control and intervention phases. Data were collected from each participating patient at the time of admission, time of discharge and 3 months after discharge. Data on demography, continence, quality of life and self-care ability were collected. Data were collected using questionnaires and the electronic hospital information system. During the stay in the clinic, the nursing staff were responsible for collecting data from the patients and helping them to fill in the questionnaires. The nursing staff were supported in data collection by the project team and trained in advance. The project team took over the data collection after the patients had left the clinic. For this purpose, questionnaires were sent to the participants by post and contact was made over the telephone as a reminder.

Besides, data on the cost-effectiveness of the intervention and nurses' knowledge of incontinence were collected. For cost-effectiveness, the time spent on incontinence care and consumption of incontinence material by the respective patients during the entire stay was recorded. The knowledge of the nursing staff was recorded at the start of the study, before training in systematic continence management (at the end of the control phase) and at the end of the intervention phase.

3.5 | Outcomes

Urinary continence was assessed using the International Consultation on Incontinence Modular Questionnaire – Short Form (ICIQ-SF). The ICIQ-SF consists of four questions and measures the frequency of involuntary urine loss, amount of involuntary urine lost, impairment in daily life due to incontinence and time of urine loss (Avery et al., 2004). The questionnaire is recommended by the International Consultation on Incontinence Symptoms and Quality of Life Committee and has now been translated into 50 languages. A cumulative score is calculated from the item's frequency and amount of urine loss as well as impairment in everyday life. The total score ranges from 0–21 points and the lower the calculated score, the lower the stress is. Validation of the International Consultation on Incontinence Modular Questionnaire – Short Form by Avery et al. (2004) showed good construct validity through interviews with experts, acceptable convergence validity with moderate to strong agreement with other questionnaires, moderate to very good stability in test–retest analysis and internal consistency with a Cronbach's alpha of 0.95. L. Thomas et al. (2014) reviewed the use of the questionnaire in people after a stroke and concluded that it is suitable.

The quality of life was measured by the Incontinence Quality of Life Instrument. This contains 22 items and focuses on the patients' perspective (Wagner et al., 1996). An overall result of 100 points is possible and partial evaluations are often used (Martin & Brazg, 2010). The instrument was developed in the English language and has been translated into French, Spanish, Swedish and German. It is highly reliable: The internal consistency measured by Cronbach's alpha in all languages is between 0.87–0.93 for the overall assessment and the reproducibility using interclass correlation is between 0.92–0.95 (Patrick et al., 1999).

The Extended Barthel Index (Prosiegel et al., 1996) was used to measure self-care ability. The Extended Barthel Index contains additional items to the original Barthel Index. It consists of 16 items and covers the activities of daily life (Quinn et al., 2011). The items are rated with points from 0–4. If a person is completely independent, they score a maximum of 64 points. According to Schädler (2006), the Extended Barthel index is a widely used measure. The instrument is suitable for the acute and rehabilitation phases. It is primarily intended for interdisciplinary rehabilitation teams that use it to plan rehabilitation goals and monitor the success of rehabilitation. It has high reliability, Cronbach's alpha is between 0.96–0.99 when used for neurological patients (Prosiegel et al., 1996; Schädler, 2006). In a study by Jansa et al. (2004), it was shown to be a valid and reliable instrument in persons suffering a stroke. The original English language Barthel Index was translated into German and validated by Heuschmann et al. (2005). The German version showed good validity with a kappa coefficient of 0.93. Furthermore, they concluded that the application of the Barthel Index is suitable for persons with cerebral stroke (Heuschmann et al., 2005).

To assess cost-effectiveness, the time spent on incontinence care was recorded. The electronic hospital information system was used to calculate the time expenditure, which was recorded routinely by the nurses. The time the nursing staff spent on assessment and interventions to promote continence was explicitly recorded. Measures were reported electronically and the time was stored. This information was transferred to a form when the patient left the hospital.

The nurses' knowledge of incontinence was measured using the questionnaire developed and validated by Saxer et al. (2008). The questionnaire was originally developed for nursing staff who care for dependent persons in nursing homes. It consists of 18 items related to urinary incontinence, risk factors and treatment options. The given answer options are "Yes", "No" and "Don't know". In 2012, this questionnaire was adapted for neurological patients by Harder and Saxer (2013). To specifically investigate the knowledge about incontinence after a stroke, the questionnaire was further developed and tested in practice in terms of its comprehensibility and practicability before the commencement of the study.

During the evaluation of the newly introduced complex intervention, a focus group interview was conducted with the caregivers of the wards at the end of the study. This guideline-based interview aimed to evaluate the experiences and acceptance of the nursing staff regarding the implementation of the new intervention. The interview was conducted by the last author (SS), recorded on tape and transcribed verbatim. The analysis took place after the content-structuring qualitative content analysis, according to Mayring (2015). An inductive approach was used. A descriptive presentation of the category system, and a combination with the elaboration of correlations, was carried out.

3.6 | Data analysis

For descriptive analysis, the frequencies, mean values and standard deviations were calculated. For items with the possibility of multiple answers, the frequencies were visualized by Pareto diagrams with superimposed 95% confidence intervals. Before aggregation, the outcome items for the control and intervention groups were visualized by line charts with overlaid 95% confidence intervals. Differences in the results of the knowledge tests of the personnel through the intervention were checked by paired *t*-tests. Differences between the intervention and control groups were investigated by Chi-squared tests (for qualitative characteristics), *t*-tests (for quantitative characteristics) or, if necessary, Wilcoxon tests. Differences in International Consultation on Incontinence Modular Questionnaire – Short Form, Extended Barthel Index, Incontinence Quality of Life (sum-score and constructs) and time expenditure for incontinence care between the control and intervention groups at the individual measurement points were investigated by *t*-tests. The time-dependent differences of the above-mentioned scores within the groups were analysed by repeated measurement ANOVA (in case of violation of sphericity in the modification of Greenhouse–Geisser). Group-specific differences over time were investigated by linear mixed models. The relationship between changes in incontinence, independence and quality of life, depending on grouping and age, was investigated using multiple regressions. Correlation coefficients, according to Pearson, were calculated for bivariate correlations of those variables at individual points in time. Model assumptions (e.g. normality, equality of variances and sphericity) were tested appropriately. Evaluations were performed in IBM SPSS 25 assuming a 0.05 level of significance.

3.7 | Ethical approval and trial registration

This study was performed according to the ethical guidelines of the Declaration of Helsinki and approved by the Eastern Switzerland Ethics Committee (2016-00530) responsible for the same. All participants or their representatives provided oral and written informed consent. The study was registered in the German Clinical Trials Register (DRKS00010558).

4 | RESULTS

4.1 | Characteristics of the participants

In total, 46 patients took part in the study, of which 35 (14 women and 21 men) were in the control group and 11 (seven women and four men) in the intervention group. The mean age was 73.7 years in the intervention group and 78.5 years in the control group. Three participants from the intervention group suffered from incontinence before the stroke, whereas in the control group, 16 participants did so. There were no significant differences in the participants' characteristics between the intervention and control groups.

The level of knowledge before and after the intervention was tested in 39 nurses.

4.2 | Patient outcomes

Except for the total Incontinence Quality of Life and Incontinence Quality of Life Social Embarrassment values, no statistically significant differences between the intervention and control groups were found in the zero measurement. Incontinence was more pronounced in the intervention group compared to the control group. Similarly, the Incontinence Quality of Life Social Embarrassment value was statistically significantly lower in the intervention group compared to the control group. Within the two groups, mostly, statistically significant improvements in outcomes were seen during the study.

The linear mixed models confirm the effects found with ANOVA. A group-specific improvement over time was only observed for the Incontinence Quality of Life Social Embarrassment value. This was seen through a significantly stronger increase in the intervention group values between admission and discharge (significant interaction, $p = .044$, Table 1). Upon comparing the differences between the intervention and control groups from admission to discharge, it was seen that the difference in the intervention group was significantly larger for the outcomes of incontinence ($p = .034$), Incontinence Quality of Life total ($p = .016$), Incontinence Quality of Life—Psychosocial Impacts ($p = .014$) and Incontinence Quality of Life—Social Embarrassment ($p = .028$). The increased time requirement could, therefore, be justified by the fact that significantly greater improvements were achieved in the intervention group (Table 2).

The study of the change in Extended Barthel Index between the admission and discharge times as a function of changes in the incontinence construct, quality of life and grouping (intervention and control), indicated that this was significantly improved by changes in the construct urinary incontinence ($R^2 = 0.172$, $b = -0.819$, $p = .006$). The change in the quality of life had no significant additional explanatory power in this model. There was no difference between the intervention and control groups. According to International Consultation on Incontinence Modular Questionnaire – Short Form, this result meant that upon reducing incontinence, independence in everyday life could be increased significantly.

TABLE 1 Patient-related Outcomes

		Measurements										
		T0 (Admission)			T1 (Discharge)			T2 (Home)			p^a	p^b	
		N	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*		Time	IA
ICIQ Q 1–3	CG	35	11.14	3.73	28	7.00	5.55	23	6.00	6.19	.002	.000	.191
	IG	11	14.09	4.57	10	5.90	4.63	4	7.75	5.90	.005		
	p^c		0.036			0.579			0.604				
EBI	CG	35	30.54	14.31	33	41.61	15.88	–	–		.000	.000	.197
	IG	11	31.27	1.35	10	49.40	10.44	–	–		.003		
	p^c		0.878			0.154			–				
IQOL Total score	CG	34	80.91	15.12	27	90.30	16.38	22	82.27	28.90	.058[d]	.007[d]	.107[d]
	IG	11	67.45	26.65	10	92.00	16.26	3	70.00	26.96	0.101		
	p^c		0.137			0.780			0.495				
IQOL AL	CG	34	27.12	5.36	27	30.56	6.90	22	29.59	9.63	.077[d]	.003	.145
	IG	11	25.64	9.10	10	33.50	5.02	3	21.67	8.50	.169		
	p^c		0.510			0.227			0.190				
IQOL PSI	CG	34	39.76	7.08	27	39.48	6.42	22	34.45	11.90	.034[d]	.006[d]	.066[d]
	IG	11	38.00	6.36	10	39.70	6.40	3	28.33	15.14	.088		
	p^c		0.090			0.927			0.424				
IQOL SE	CG	34	17.62	4.44	27	20.26	4.70	22	18.23	7.98	.044[d]	.013[d]	.044[d]
	IG	11	12.82	6.76	10	18.80	6.07	3	20.0	3.61	.033		
	p^c		0.046			0.433			0.712				

Abbreviations: CG, control group; EBI, Extended Barthel Index; IA, interaction; ICIQ, International Consultation on Incontinence Questionnaire; IG, intervention group; IQOL AL, Incontinence Quality of Life Avoidance and Limiting Behaviour; IQOL PSI, Incontinence Quality of Life Psychosocial Impacts; IQOL SE, Incontinence Quality of Life Social Embarrassment; IQOL, Incontinence Quality of Life; *M*, mean; *N*, number of participants; Q, question; *SD*, standarddeviation.

[a]Repeated measurement ANOVA or *t*-test for paired samples (for EBI).

[b]Mixed linear model (time and grouping as independent variables): Test of internal subject effects.

[c]*t*-Test independent sample.

[d]Correction according to Greenhouse–Geisser for violation of sphericity.

TABLE 2 Differences between patient-related admission and discharge outcomes

		Measurements			
		N	*M*	*SD*	*p*[a]
ICIQ	CG	28	−3.79	5.58	.034
	IG	10	−8.50	6.49	
EBI	CG	33	12.24	10.66	.197
	IG	10	17.70	14.22	
IQOL—total	CG	27	9.81	14.49	.016
	IG	10	27.60	28.06	
IQOL—Avoidance and Limiting Behaviour	CG	27	3.63	5.85	.065
	IG	10	8.80	10.52	
IQOL—Psychosocial Impacts	CG	27	3.30	7.57	.014
	IG	10	12.10	12.73	
IQOL—Social Embarrassment	CG	27	2.89	3.43	.028
	IG	10	6.70	6.63	

Abbreviations: CG, control group; EBI, Extended Barthel Index; ICIQ, International Consultation on Incontinence Questionnaire; IG, intervention group; IQOL, Incontinence Quality of Life; *M*, mean; *N*, number of participants; *SD*, standard deviation.

[a]*t*-Test independent sample.

The higher the incontinence at entry, the lower the quality of life at entry ($r = -.698$). This was also seen in the measurement taken 3 months after leaving rehabilitation; the higher the incontinence, the lower the quality of life ($r = -.802$). The higher the independence in everyday life at the time of discharge, the higher the quality of life at this time of measurement ($r = .348$) (Table 3).

4.3 | Nurse outcomes

The time spent by nurses on continence management did not differ significantly between the intervention and control groups in the zero measurement ($p = .204$). However, concerning the descriptive parameters, the time expenditure in the intervention group was higher across all measurement points. Within the groups, the time expenditure decreased statistically significantly in both the control ($p = .003$) and intervention groups ($p = .036$). The linear mixed model confirmed the effects found using ANOVA. A group-specific (control group versus intervention group) difference in the time course (significant interaction) was not observed (Table 4).

The level of knowledge increased by 1.94 points (*SD* 2.40) (*t*-test, $p = .000$). The greatest increase was among persons in training (+4.75), while the smallest increase was among Registered nurses (+1.15). For other professionals, the increase amounted to approximately 2 points, which, due to the small sample size, did not represent a statistically significant increase apart from the professional group of nursing assistants. Across all occupational groups, the difference between the second control measurement and "post-intervention" compared with the difference between the first control measurement and the second control measurement was statistically significant ($N = 26$; $p = .039$, CI = −2.84 to −0.08). This meant that the increase in knowledge among all nurses was greater in the second phase of the study than in the first phase.

4.4 | Acceptance of the intervention

The analysis of the focus group interview revealed the two main categories of facilitators and barriers to the implementation of the intervention, which are shown in Figure 1 along with their subcategories.

Above all, the structure and design of the intervention were conducive to its implementation. The intervention provided a clear structure, which the nurses could use for orientation. For example, the algorithm showed suitable individual measures for existing problems. On the other hand, the structure of the intervention supported a uniform procedure in the team, which was usually not given without the intervention. The contact persons and persons responsible for the intervention, who were clearly identifiable for the nurses, were perceived positively. The focus group also confirmed the comprehensibility of the intervention. Independent familiarization was possible based on the existing documents. In particular, the explanation of the assessment and algorithm was perceived as helpful. The intervention addressed the shameful, often avoided and, in the case of healthcare professionals, seldom prioritized topic of incontinence.

The nurses actively asked the patients about their continence situation and, through this first step, broke the taboo on the topic in a two-person constellation. The included screening and assessment led to the fact that "one had to deal with the patient and with incontinence, what exactly incontinence is and where the problem lies". This enabled a differentiated illumination of the phenomenon, including the causes, symptoms and resources. By dealing with incontinence and the patient in detail, the carers experienced a sensitization for the different symptoms, available resources and

TABLE 3 Correlations between patient outcomes

		ICIQ-A	ICIQ-D	ICIQ-H	EBI-A	EBI-D	IQOL-A	IQOL-D	IQOL-H
ICIQ-A	r^a	1	.198	.072	−.215	−.203	−.698[b]	−.357[c]	.048
	P		.234	.721	.152	.193	.000	.030	.819
	N	46	38	27	46	43	45	37	25
ICIQ-D	r^a	.198	1	.645[b]	−.186	−.502[b]	−.052	−.555[b]	−.385
	p	.234		.001	.264	.001	.758	.000	.077
	N	38	38	22	38	38	37	37	22
ICIQ-H	r^a	.072	.645[b]	1	−.145	−.261	−.280	−.641[b]	−.802[b]
	p	.721	.001		.470	.207	.157	.001	.000
	N	27	22	27	27	25	27	22	24
EBI-A	r^a	−.215	−.186	−.145	1	.667[b]	.166	.253	.398[c]
	p	.152	.264	.470		.000	.276	.130	.049
	N	46	38	27	46	43	45	37	25
EBI-D	r^a	−.203	−.502[b]	−.261	.667[b]	1	−.040	.348[c]	.354
	p	.193	.001	.207	.000		.801	.035	.090
	N	43	38	25	43	43	42	37	24
IQOL-A	r^a	−.698[b]	−.052	−.280	.166	−.040	1	.372[c]	.140
	p	.000	.758	.157	.276	.801		.024	.506
	N	45	37	27	45	42	45	37	25
IQOL-D	r^a	−.357[c]	−.555[b]	−.641[b]	.253	.348[c]	.372[c]	1	.509[c]
	p	.030	.000	.001	.130	.035	.024		.016
	N	37	37	22	37	37	37	37	22
IQOL-H	r^a	.048	−.385	−.802[b]	.398[c]	.354	.140	.509[c]	1
	p	.819	.077	.000	.049	.090	.506	.016	
	N	25	22	24	25	24	25	22	25

Abbreviations: A, admission; D, discharge; EBI, Extended Barthel Index; H, home; ICIQ, International Consultation on Incontinence Questionnaire; IQOL, Incontinence Quality of Life; *N*, number of participants.

[a]Correlation according to Pearson (significance two-tailed).

[b]Correlation is significant at the level of 0.01 (two-tailed).

[c]Correlation is significant at the level of 0.05 (two-tailed).

TABLE 4 Time expenditure of the nursing staff

	Time of measurements											
	Week 1			Week 4			Week 7				p^b	
	N	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	p^a	Time	IA
CG	35	37.34	34.00	20	16.80	20.20	7	14.14	17.55	.003	.002[c]	.207[c]
IG	11	61.82	57.37	11	36.09	38.87	5	39.00	36.30	.036		
p^d		.204			.148			.143				

Abbreviations: CG, control group; IA, interaction; IG, intervention group; *M*, mean; *N*, number of participants; *SD*, standard deviation.

[a]Repeated Measurement ANOVA or *t*-test for paired samples (for EBI).

[b]Mixed linear model (time and grouping as independent variables): Test of internal subject effects.

[c]Correction according to Greenhouse–Geisser for violation of sphericity.

[d]*t*-Test independent sample.

possible, varying goals. The interview participants reported that the interventions could be successful in promoting incontinence. The differentiated recording and the structured and, above all, detailed documentation sensitized the participants to the characteristics of incontinence and enabled them to make visible, measurable and transparent improvements, even in small steps.

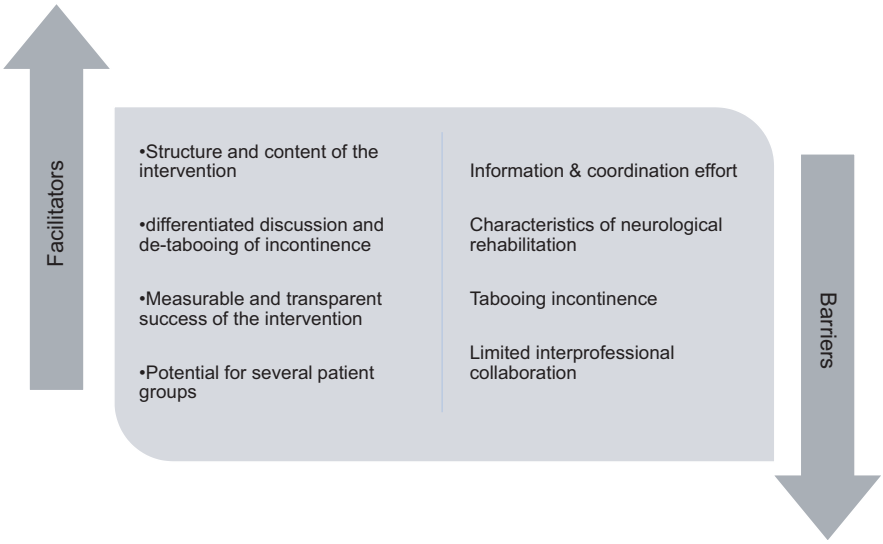

FIGURE 1 Facilitators and barriers in the implementation of systematic continence management

The transparency regarding success increased the acceptance of the nursing staff to continue the intervention with the patient and apply it to other patients. Acceptance of the intervention meant that it was not only carried out based on instructions but also the presence of an intrinsic motivation, which increased the chances that the intervention could be implemented comprehensively in the long term and thus, made accessible to as many patients as possible. A success in continence promotion is a particularly significant outcome for rehabilitation. Participants reported that incontinence and the resulting need for support were often reasons for admission to a nursing home, whereas improved continence could mean that patients could be discharged after all. They also saw the implementation of the intervention as an opportunity to demonstrate the significant share of nursing care in the outcome of rehabilitation.

The focus group participants saw a transferability of the intervention, which had so far only been applied to patients with a stroke, to other groups of people in neurological rehabilitation. Patients with multiple sclerosis, Parkinson's disease and craniocerebral trauma were explicitly mentioned by the participants.

During the focus group interview, participants addressed barriers in the implementation of systematic continence management. These included the information and coordination efforts of the intervention and characteristics of neurological rehabilitation and its patients, as well as incontinence as a taboo subject associated with shame and limited interprofessional cooperation. Overall, the nursing staff assessed systematic incontinence management as an intervention that could be carried out in everyday life, but they perceived the, sometimes, high information and coordination efforts as a barrier or challenge in its implementation.

In neurological rehabilitation, as in other healthcare system settings, priorities are oriented towards treatment and care. The promotion of continence is not included in the institution where the study is conducted, although the topic of incontinence is omnipresent in nursing care. In the neurological rehabilitation setting, there is no provision for dealing with incontinence, which results in a reactive, unstructured and inconsistent approach. For the implementation of the intervention, this means that awareness of the priority of the topic in nursing care and in the interprofessional team must first be created. The lack of a foundation can be a barrier and result in an increased information effort to promote the employees' acceptance of systematic continence management and motivate them to implement it. Incontinence is a topic that is associated with shame and is not talked about in the family, among healthcare professionals and patients and in the general public. The tabooing of this topic is a barrier to the implementation of systematic incontinence management. Since the people involved are not used to talking about it, they find it difficult to deal with it in a differentiated way. Interprofessional cooperation in the field of incontinence in the institution where the study was conducted appeared to be limited from the perspective of the interview participants. The above-mentioned perceived uneasiness to address the topic seemed to be a hurdle for interprofessional cooperation, which may, however, be overcome with the gradual removal of taboos.

5 | DISCUSSION

A complex intervention consisting of screening, assessment, treatment, communication and evaluation showed positive effects in stroke patients during a rehabilitation stay for urinary continence and the quality of life of the affected person. Nurses must invest more time in the intervention, which decreased during the rehabilitation stay. The knowledge of the nurses increased significantly after implementation of the intervention and the acceptance of the newly developed model could be evaluated as high.

This study confirmed the assumption that a complex intervention with individually adapted measures is needed to promote continence in people after a stroke. A detailed assessment is crucial and was the basis for the whole intervention. These results were in line with the conclusions of the studies of Brady et al. (2016), Gibson et al. (2018) and Holroyd (2019). Evidently, such interventions can only be conducted through nurses that have undergone a training

programme. The current study included behavioural interventions, which were required in the present Cochrane review of Thomas et al. (2019). Promoting continence is recommended in rehabilitation after stroke, but it remains unclear what the most effective behavioural interventions are (Langhorne et al., 2011). As already mentioned, none of the included studies tested individually adapted toilet training or bladder training, although these interventions were recommended. Therefore, the results of the current study cannot be compared with other studies because the newly developed complex intervention differs from studies cited in this paper.

The time spent on continence promotion was significantly higher in the intervention group compared to the control group, which is, of course, associated with higher costs. It was expected that the time required at the beginning of the intervention would be much higher due to the assessment. However, since it was assumed that more participants would become continent in the intervention group, it was also assumed that the time expenditure at the end of the stay in the intervention group would be lower. This assumption could not be confirmed and the time required to discharge did not differ significantly between the groups. This may have been due to the rather small sample size of the intervention group. However, in the present study, the increased time expenditure was justified by the fact that both the continence and quality of life increased significantly in the intervention group than in the control group. Further, the result in the current study that the more significantly incontinence can be reduced, the greater the increase in independence in everyday life was very important for the rehabilitation outcome. This may have a major economic impact as fewer people will need to be referred to a long-term inpatient facility after their rehabilitation stay (Kolominsky-Rabas et al., 2003).

The knowledge of the nurses increased significantly during the intervention phase. It could be assumed that the knowledge improved sustainably as the two measurement dates were rather far apart and otherwise, no training on this topic was carried out. According to the focus group interview, the increased knowledge positively affected the performance of the nurses, indicating that nurses in this study did not have a reactive approach (Booth et al., 2009; Hälleberg Nyman et al., 2017). Rather, the nurses were proactive and knew exactly what they had to do to improve the situation of incontinent stroke survivors.

The acceptance of the intervention could be classified as high from a nursing perspective. These results were in line with the study of Brady et al. (2016), which concluded that nurses described improved continence knowledge, attitudes and confidence alongside a shift from containment to rehabilitative approaches after implementing a continence care intervention. Similar results were also obtained by French et al. (2016); they described that enablers included the guidance provided by the systematic voiding programme, patient and relative involvement, extra staff, improved nursing skill and confidence and experience of success. However, the evidence for this topic is very low; French et al. (2017) concluded in their qualitative evidence synthesis that no studies have evaluated the delivery of behavioural interventions in rehabilitation settings. Therefore, it becomes necessary to take this component into account when implementing such an intervention.

In the development of the programme theory, it was concluded that developing and representing it via a logic model could help clarify the initial intervention and ensure that implementation strategies were well thought out. Further, by employing detailed reflection and using previous research, it was expected that the intervention could be implemented successfully and its effectiveness investigated in more depth (Kohler et al., 2020). It can be stated that the implementation was fully implemented successfully. It was possible to evaluate the first outcome chain (patient outcome: reduced incontinence episodes, improved independence in activities of daily living and quality of life), except the cost-saving aspect. This outcome should be evaluated in a larger sample with additional measurements. The second outcome chain on patients' experiences was not evaluated in this study. Nurses' outcome chain could also be evaluated fully (conducting continence management, improved knowledge about treatment, improved interdisciplinary communication, targeted interdisciplinary care plan, improvement in collaboration and resource efficiency). However, resource efficiency needed to be evaluated in more depth. The question remains whether the higher expenditure of time also has a long-term impact on costs and morbidity. In conclusion, the programme theory should be adapted according to the readiness of the staff to implement the intervention. This means that the considerations of concerns and doubts should receive attention. Further, first, it is important to incorporate a larger sample size in the next evaluation round of the programme theory because it is known that the intervention is probably effective and the outcomes concerning cost-saving and resource efficiency can be observed in greater detail. Second, in the next study, the patients' experiences of the intervention should be evaluated regarding communication opportunities, feelings of being taken seriously and knowledge of incontinence treatment. For this evaluation, a qualitative research design will be suitable.

6 | STRENGTHS AND LIMITATIONS

The strength of this study was the carefully prepared and transparently described intervention. Furthermore, the control and intervention phases took place in the same setting, which was very relevant for the evaluation. Since the implementation was accompanied by the nursing expert (who discussed each case with the nursing team), the correct implementation was guaranteed.

A small sample was deliberately chosen for this first evaluation of the programme theory, but the calculated sample size could not be achieved. On the one hand, recruitment was difficult because the patients were in a poor general condition, spoke a foreign language or their relatives did not have the time or interest to consent to participating in a study in the case of patients with mild cognitive impairment. On the other hand, the referral management in the clinic was changed at the beginning of the study, with the result that fewer potential participants entered the clinic. As already mentioned in the

discussion, the present study lacked the evaluation of the patients' lived experiences; this must be accounted for in the next evaluation of the programme theory.

7 | CONCLUSIONS

This study contributes to increasing the knowledge about continence promotion in people after a stroke. It confirms that the training of nurses, in-depth assessment and individually adapted measures are important. Due to the positive results, the programme theory can now be evaluated with a larger sample. Attention must be paid to the recruitment strategy in advance. The next evaluation must focus on the economic aspects and the patients' experience.

8 | RELEVANCE TO CLINICAL PRACTICE

In practice, it is very important to make the topic of incontinence a recurring theme, so that nurses are active rather than reactive in the context of promoting continence and individual care planning is required. Besides, the nursing staff training must be further developed and it must be considered whether, for example, it could be partially completed in the form of online training.

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CONFLICT OF INTEREST

The authors declare that there is no competing interest.

AUTHOR CONTRIBUTIONS

Kohler: Study concept and design, carried out the intervention, collected and analysed the data and wrote the manuscript. Ott: Study concept and design, and analysed the data. Mullis: carried out the intervention and collected data. Mayer: study concept and design. Kesselring: study concept and design. Saxer: study concept and design, principal investigator. All authors discussed the results and contributed to the final version of the manuscript. All authors read and approved the final manuscript.

ETHICAL APPROVAL

This study was performed according to the ethical guidelines of the Declaration of Helsinki and approved by the Eastern Switzerland Ethics Committee (2016-00530) responsible for the same. All participants or their representatives provided oral and written informed consent.

SPONSOR'S ROLE

Eastern Switzerland University of Applied Sciences was the sponsor of this study, with principal investigator S. Saxer. The sponsor had no role in the study design, data collection, data analysis, data interpretation, writing of the report or the decision to submit for publication.

STUDY REGISTRATION

Registration number: German Clinical Trials Register (DRKS00010558), Date of registration: 05/25/2016; URL: https://www.drks.de/drks_web/navigate.do?navigationId=trial.HTML&TRIAL_ID=DRKS00010558

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on reasonable request from the corresponding author. The data that support the findings of this study are not publicly available due to patient privacy and ethical restrictions reasons.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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APPENDIX 1

DESCRIPTION OF THE INTERVENTION

Screening	Extended Barthel Index	The instrument contains an item that records the control of urine excretion, as soon as the excretion is not assessed as "normal continence", incontinence is present.
Assessment	Detailed nursing anamnesis	Includes elements, such as how the incontinence affects everyday life or which problem-solving strategies have already been applied.
	Physical observation	Include the ability to use a toilet (with a focus on mobility and cognition).
	Micturition protocol	Incontinence episodes can be described in detail
	Residual urine	Bladder scan
	Urinary tract infections	Laboratory test
Treatment	Toilet training	Toilet visits at individually appropriate times were aimed at behavioural habits. starting point was the evaluation of the micturition protocol, including the daily schedule (frequency and timing of therapies) and the assessment based on this evaluation, the toilet visits were integrated into the daily schedule and recorded on the therapy plan. For patients with cognitive limitations, toilet training was carried out at fixed times (e.g. every 3 hr)

	Bladder training	Bladder training is a form of behavioural therapy. The aim is to correct incorrect excretion habits that were manifested by frequent visits to the toilet, increase bladder capacity and improve the ability to displace the urge to urinate, to increase the overall excretion intervals of those affected to 3–4 hr
	Specific interventions at night	Toilet training was not recommended during the night, as it could disturb the sleep rhythm or trigger states of confusion. Therefore, other interventions were recommended, for example, the use of condom urinals or pads, the placement of the urine bottle next to or in bed or the employment of a commode.
	Evaluation of the used incontinence material	The incontinence pad used by the patient was checked. This included clarifying whether the size, shape and type of material were chosen to suit the degree of incontinence and preferences of the person affected.
	Adjustment of drinking behaviour	By carrying out the micturition protocol, disadvantageous drinks were identified, and the affected persons were subsequently instructed to limit or avoid these drinks as far as possible in the future. To reduce incontinent episodes during the night, the reduction of fluid intake in the evening was discussed with the affected persons.
Additional measures		For example, the adaptation of aids, mobility training (e.g. transfer to the toilet), bowel management, weight reduction or pelvic floor training.
Communication	Weekly site discussions were held with the patient to evaluate the measures taken.	The responsible nurse discussed how the patients experienced the measures with them; any necessary adjustments to the measures were jointly determined. Depending on the individual situation, the next of kin was also invited for the discharge interview.
Interdisciplinary communication and evaluation		The nursing goal and its measures were announced at the weekly interdisciplinary meetings and were recorded in writing for all disciplines in the clinical information system and continuously updated. The nursing managers of each ward were the contact persons for the entire interdisciplinary rehabilitation team and were responsible for ensuring that the measures taken were implemented and evaluated. They were in regular contact with the head of nursing development to reflect and discuss the individually selected measures.