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Original research

The impact of an enhanced recovery pathway on nursing workload: A retrospective cohort study ☆

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HIGHLIGHTS

- The success of enhanced recovery (ERAS) programs depends on fulfilment of the protocol.
- Nurses play a key role especially in the work-intensive early postoperative period.
- In this study, nursing workload per patient was decreased after introduction of ERAS.
- Increasing compliance with the ERAS protocol correlated to decreasing nursing workload.

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ABSTRACT

Background & aims: The importance of nursing for surgical patients has been frequently underestimated. The success of enhanced recovery programs after surgery (ERAS) depends on preferably complete fulfilment of the protocol and nurses are an important part of it. Due to the additional nursing action required, such protocols are suspected to increase the nursing workload. The aim of the present study was to observe and measure objectively nursing workload before, during and after systematic implementation of a comprehensive enhanced recovery pathway in colorectal surgery.

Methods: The program ERAS was introduced systematically in our tertiary academic centre 2011, since then our experience is based on more than 1500 ERAS patients. Nursing workload was prospectively assessed for all patients on a routine basis by means of a standardized and validated point system (PRN). In a retrospective cohort study, we compared nursing workload based on prospective data before, during and after ERAS implementation and correlated nursing workload to the compliance with the ERAS protocol.

Results: The study cohort included 50 patients before ERAS implementation (2010) and 69 (2011) and 148 (2012) consecutive patients after implementation; the baseline characteristics of the 3 groups were similar. Mean PRN values were 61.2 ± 19.7 per day in 2010 and decreased to 52.3 ± 13.7 ($P = 0.005$) and 51.6 ± 18.6 ($P < 0.002$) in 2011 and 2012, respectively. Increasing compliance with the ERAS protocol was significantly correlated to decreasing nursing workload ($\rho = -0.42$; $P < 0.001$).

Conclusions: Nursing workload is – against a common belief – decreased by systematic implementation of enhance recovery protocol. The higher the compliance with the pathway, the lower the burden for the nurses!

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1. Introduction

The importance of nursing for surgical patients has been frequently underestimated and nursing workload is almost never assessed in surgical studies. In fact nursing staff is playing a key role on surgical wards in general, and in Enhanced Recovery After Surgery programs (ERAS) in particular.

Enhanced recovery after surgery pathways have proven to reduce complications, hospital length of stay and costs in colorectal surgery [1–3]. The *Enhanced Recovery After Surgery* (ERAS) guidelines have been updated recently and include more than 20 individual items [4,5]. Compliance with those items however is very important, as it is correlated significantly with good clinical outcome [6]. Implementation of enhanced recovery protocols should therefore aim for possibly complete fulfilment of the individual items. However, any changes of practice with the addition of new specific measures are generally difficult to integrate into daily routine; this applies especially to the postoperative period [3,6,7]. It is obvious that nursing staff play a key role in the postoperative patient care [7,8] and increased nursing tasks are required during shorter hospital stays. Systematic ERAS implementation entails therefore radical changes in the structured working day of nursing staff and may be perceived as extra-work [8]. For these reasons, it is to be emphasized that successful implementation of enhanced recovery programs depends on acceptance of the new care pathway by the nursing staff and its collaboration with anaesthetists and surgeons.

The aim of the present study was to assess and compare nursing workload before, during and after implementation of an enhanced recovery program in colorectal surgery, and to correlate nursing workload with the adherence to our ERAS pathway.

2. Material and methods

The enhanced recovery after surgery program was systematically introduced for colorectal surgery in our tertiary academic centre in May 2011 [3]. Prospective documentation of compliance with the ERAS pathway and systematic audit of clinical outcome is a key component and was performed for all patients on a routine basis. Detailed comparison with 50 patients before implementation was mandatory to guide implementation and those 50 patients served as baseline prior to ERAS implementation in our hospital. Nursing workload was prospectively assessed for all patients routinely in order to assure sufficient nursing work-force for the patients. Based on prospective data, the present retrospective study analyzed nursing workload before, during and after ERAS implementation and correlated nursing workload with the compliance with our ERAS pathway. The Institutional Review Board approved the study and all patients provided written consent before surgery. The study was conducted in accordance with the STROBE criteria (http://strobe-statement.org/) and registered under www.researchregistry.com (UIN: 363).

2.1. Patients

The patient population included a consecutive cohort of elective patients operated in 2010 *before* implementation and all elective patients from May 2011 when the process started. Systematic implementation took about six months [3,7], and ERAS patients were therefore separately analyzed as being operated *during* (2011) or *after* (2012) implementation. All consecutive patients were included, and there were no exclusion criterias.

2.2. ERAS protocol and compliance (Table 1)

Our institutional enhanced recovery pathway was published recently [3] and is in accordance with the ERAS recommendations updated 2013 [4,5]. Table 1 provides a comprehensive overview with emphasis on nursing-related care measures. The change in practice induced by ERAS implementation is described in a semi-quantitative way (–, +, ++, +++) for every single item.

Compliance with the ERAS protocol was prospectively assessed for the different phases of perioperative care (pre-, intra- and post-operative; total) as previously published [9]. Briefly, enhanced recovery items were handled as dichotomous variables. Individual compliance was calculated as percentage of compliant patients/total patients (Fig. 2). The number of fulfilled items divided by the total number of the 21 enhanced recovery measures (%) is presented as overall compliance with the pathway (Fig. 1).

2.3. Measuring nursing workload

In our institution, nursing workload is assessed daily for all patients in order to plan the nursing resource needs for the next following 24 h. The anticipated work burden is quantified by means of a standardized and validated point system called *Projet de Recherche en Nursing* (PRN) [10]. Based on the nursing care plan, the PRN tool measures the nursing tasks that need to be achieved during the next 24 h. PRN is based on a list of 249 actions of care, called factors. The selection of factors is determined by the nurse for every patient based on an institutional standard protocol. The addition of the points of every factor determines the time of care required by each patient over 24 h; 1 point represents 5 min of nursing time. To the required times are added the predetermined times which take into account activities not included in the direct care (communication about the patient, administrative activities and interview, internal and external movements in and outside the ward). The data are handled electronically with dedicated software that allows following the load of care of an individual patient throughout the stay in different sectors or care units. PRN is a validated tool and used routinely in the entire hospital since 1992. The list of factors was elaborated by nurses in several countries using the PRN method (Canada, France, Italy, Spain, Switzerland) and the list of factors is regularly revised and updated [11] (http://www.erosinfo.com/).

2.4. Data collection

Nursing workload was documented prospectively by the nurses in charge of the patients as part of their clinical daily routine. They were unaware of the present scientific analysis. The same documentation based on the same factors was performed for the 3 study periods (before, during and after ERAS implementation).

A dedicated and specially trained enhanced recovery nurse was in charge of completing the prospective database, *ERAS Interactive Audit System*. Demographic and surgical details of all patients in the enhanced recovery pathway were captured along with detailed information on compliance with the protocol and audit of clinical outcome until a minimum of 30 days after surgery. Return of bowel function (flatus/stool) was recorded, and postoperative complications were graded according to the Clavien classification of complication [12]. Length of stay was counted from day of surgery until discharge. Discharge was performed on pre-established discharge criteria. Total hospital stay included preoperative days and early readmissions within 30 days after surgery.

Table 1
The institutional enhanced recovery pathway by perioperative phase from the nursing perspective.

Measure	Description	Change in practice
Preoperative phase		++
Patient counselling	Preadmission information: oral and written	+++
Bowel preparation	Avoidance of bowel preparation	+
Fasting	Clear fluids until 2 h, solids 6 h pre-OP	+++
Carbohydrate drinks	800 ml the evening before, 400 ml 2 h before surgery	+++
Premedication	No preoperative long-acting sedative premedication	++
Thrombo-prophylaxis	LMW heparin 12 h before surgery, IPC	–
Intraoperative phase		+
Antibiotic prophylaxis	Cefuroxime 1.5g + metronidazole 500 mg 30 min prior to incision	–
Postoperative analgesia	Thoracic epidural analgesia for open surgery. Multimodal opioid-sparing strategies for laparoscopy	+
Hypothermia prevention	Active warming (air blanket)	–
PONV prophylaxis	Droperidol 1 mg at induction, ondansetron 4 mg with or without betamethasone 4 mg at the end of operation[a]	++
Balanced intravenous fluids	Intraoperative crystalloids 500–1000 ml for surgery <3 h, otherwise crystalloids1500 ml, colloïds 500–1000 ml. Postoperative crystalloids 500 ml during the first 24 h, then stop	+++
Nasogastric tubes	No routine postoperative nasogastric tube	+
Abdominal drains	No routine abdominal drainage	+
Postoperative phase		++–+++
Postoperative analgesia	Epidural or PCA removed after 48 h. Paracetamol, Ibuprofen; Oxycodone-Naloxone if needed	++
Mobilisation	Out of bed on day of surgery, >6 h per day thereafter	+++
Nutrition	Free fluids 4 h after surgery. Two oral nutritional supplements per day. Normal diet from day of surgery	+++
Systematic laxatives	Oral magnesium hydroxide ± chewing gum	++
Bladder catheter	Removal on postoperative day 1	++
Systematic audit	Systematic audit. Bi-monthly meeting	++

Nursing-related items are emphasized (**bold**). ERAS implementation required changes in practice labelled as follows.
–. No change at all.
+. Minor changes without implications for daily routine.
++. Important changes with big impact on patient care.
+++. Fundamental change for patients and care providers.
[a] Betamethasone only for women or non-smokers or those with previous history of PONV. LMW, low molecular weight; IPC, intermittent pneumatic compression; PCA, patient-controlled analgesia; PONV, postoperative nausea and vomiting.

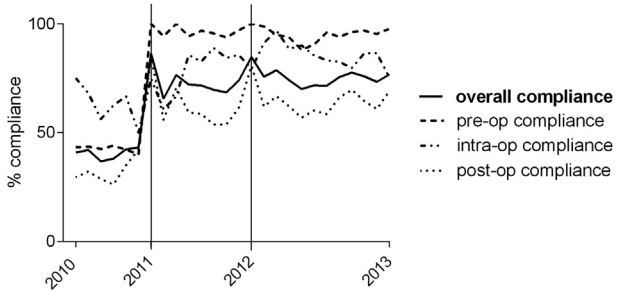

Fig. 1. Compliance with the ERAS protocol by perioperative phase. Vertical lines indicate start and end of the implementation process. Overall compliance with the ERAS protocol is displayed as bold line along with the individual numbers for pre-, intra- and postoperative phase as indicated.

2.5. Statistical analysis

Descriptive statistics for categorical variables were reported as frequency (%), while continuous variables were reported as median (interquartile range). Continuous variables were compared between 2010, 2011, and 2012 with the Kruskal Wallis test. Chi-square was used for comparison of categorical variables. All statistical tests were two-sided and a level of 0.05 was used to indicate statistical significance. Statistical correlation was described by use of Pearson's correlation coefficient. Data analyses were performed using Stata13 statistical software (StataCorp LP, College Station, TX, USA).

3. Results

3.1. Patients

Fifty patients before ERAS implementation (2010) were compared with 69 (2011) during implementation and 148 (2012) consecutive patients after implementation. No patients were lost to follow-up in the observation period until 30 days after surgery. Baseline characteristics were similar between the 3 compared groups (Table 2).

3.2. ERAS implementation and compliance with the protocol

Compliance with the recommended perioperative care pathway increased significantly after systematic implementation and could be sustained in the following year (2012). Compliance with pre- and intraoperative measures was higher than postoperative compliance at any given time point (Fig. 1).

Fig. 2 gives an overview of the application of individual nursing-related items before, during and after implementation. There were highly significant differences for most of the nursing measures indicating that the intended change in practice was actually realized.

3.3. Functional recovery, complications, length of stay (Table 3)

Return of bowel function was significantly faster after introduction of ERAS. Postoperative morbidity did not differ between the comparative groups and is summarized in detail in Table 3. Hospital stay was reduced by more than three days after ERAS and this has been sustained without increasing re-admission rates.

3.4. Nursing workload before, during and after ERAS implementation

Mean PRN values were 61.2 ± 19.7 in 2010 prior to ERAS and decreased during introduction of ERAS significantly to 52.3 ± 13.7 ($P = 0.005$), and to 51.6 ± 18.6 ($P < 0.002$) in the year after implementation. This is consistent with average time savings of 45 min per patient each day in 2011 and 48 min in 2012 compared with the cohort before ERAS implementation in 2010.

Table 2
Baseline characteristics of patients before, during and after systematic ERAS implementation.

	ERAS implementation			*P* value
	2010: *before* (n = 50)	2011: *during* (n = 69)	2012: *after* (n = 148)	
Age (years)[b]	67 (55.5–75.3)	65 (54.5–81)	64.5 (50–74)	0.129
Sex ratio, (M:F)	25:25	39:27	83:69	
Body mass index (kg/m^2)[b]	25.1 (23.0–29.1)	25.1 (22.4–28.7)	24.5 (21.4–27.6)	0.286
ASA grade[a]				0.114
I–II, n (%)	33 (66%)	55 (79.7%)	118 (79.7%)	
III–IV, n (%)	17 (34%)	14 (20.3%)	30 (20.3%)	
Diagnosis[a]				0.084
Neoplasia, n (%)	32 (64%)	49 (71%)	91 (61.5%)	
Diverticular disease, n (%)	12 (24%)	10 (14.5%)	20 (13.5%)	
IBD, n (%)	–	3 (4.3%)	16 (10.8%)	
Others, n (%)	6 (12%)	7 (10.1%)	21 (13.8%)	
Surgical approach[a]				0.028
Laparoscopic, n (%)	20 (40%)	46 (66.7%)	73 (49.3%)	
Open, n (%)	22 (44%)	17 (24.6%)	62 (41.9%)	
Converted, n (%)	8 (16%)	6 (8.7%)	13 (8.8%)	
Procedure[a]				0.069
Right colon, n (%)	11 (22%)	16 (23.2%)	30 (20.3%)	
Left colon, n (%)	21 (42%)	29 (42%)	47 (31.8%)	
(Sub)total colectomy, n (%)	2 (4%)	1 (1.4%)	4 (2.7%)	
Rectum	13 (26%)	20 (29%)	37 (25%)	
Other	3 (6%)	3 (4.3%)	30 (20.3%)	

ASA, American Society of Anaesthesiologists. IBD, inflammatory bowel disease. Right colon: ileocaecal and right colectomy. Left colon: left colectomy, sigmoid resection, and Hartmann's reversal. Rectum: (low) anterior resection, abdominoperineal resection, proctocolectomy.
Values are median (IQR).
[a] Chi-square test.
[b] Kruskal Wallis.

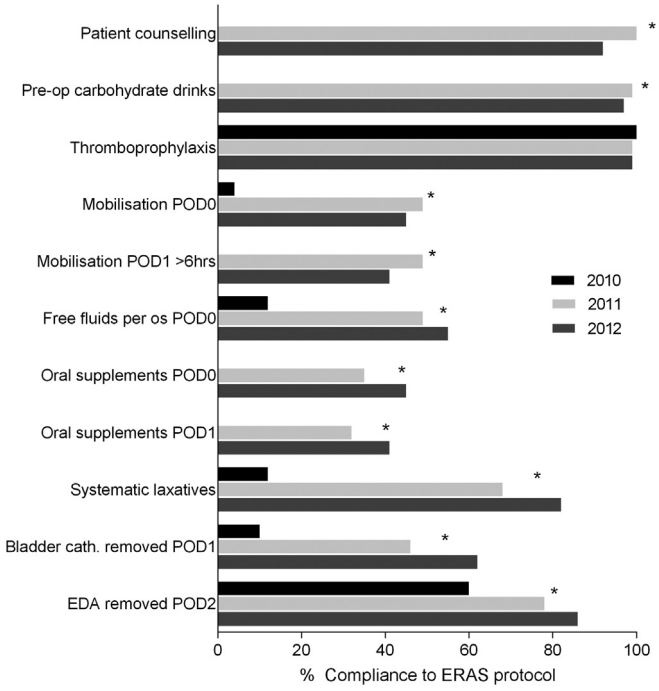

Fig. 2. Compliance with nursing-intensive ERAS measures before during and after implementation. The bars indicate the percentage of patients who adhered to the individual measures of the ERAS protocol. Displayed are only the nursing-related items which are emphasized in Table 1. Results are presented for the three comparative groups before (2010, black), during (2011, light grey) and after (2012, dark grey) implementation. * indicates statistical significance: P < 0.05.

3.5. Nursing workload and compliance with the ERAS pathway (Fig. 3)

Increasing compliance to ERAS protocol was related to decreasing nursing workload. An inverse linear correlation between nursing workload and compliance with the ERAS protocol was observed ($\rho = -0.42$; $P < 0.001$).

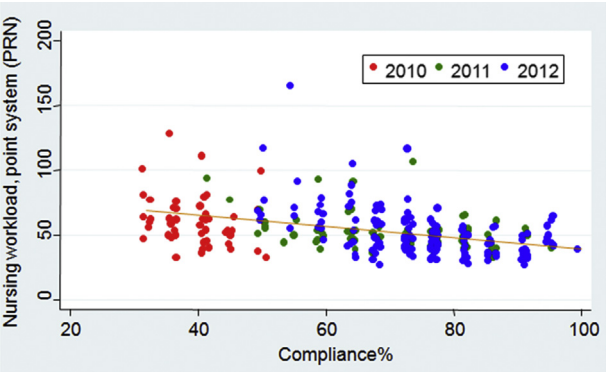

Fig. 3. Correlation of nursing workload with the compliance with the ERAS protocol. Inverse linear correlation between compliance with the ERAS protocol and nursing workload (PRN) ($\rho = -0.42$; $P < 0.001$). PRN – *Project de Recherche en Nursing* [10].

4. Discussion

This study was designed to assess the nursing workload within a formal ERAS® program for colorectal surgery. Systematic implementation of ERAS was associated with decreased nursing workload while the nursing staff was unaware of the observation of the workload. Moreover, it was observed that a higher compliance to the ERAS protocol was associated with lower work burden for the nurses.

Nurses are key to all stages of a successful enhanced recovery programme. A previous study by our group has shown that nurses embrace ERAS philosophy even better than doctors (unpublished data), and are responsible for very few of the deviations from the pathway. In our institutional experience based on more than 1500 ERAS patients, initial scepticism and resistance to adopt the enhanced recovery program faded away rapidly to give way to overt

Table 3
Functional recovery, complications, length of stay.

	ERAS implementation			*P* value
	2010: *before* (n = 50)	2011: *during* (n = 69)	2012: *after* (n = 148)	
First passage of flatus (POD)[b]	2.5 (2–4)	2 (1–2)	2 (1–3)	0.004
First passage of stool (POD)[b]	4.0 (3–5)	3 (2–4)	2 (2–4)	<0.001
30d complications (No. of patients, %)[a]				0.644
overall	26 (52%)	34 (49%)	84 (57%)	
I–II, n (%)	17 (34%)	28 (40.6%)	63 (42.6%)	
III–IV, n (%)	8 (16%)	6 (8.7%)	20 (13.5%)	
V, n (%)	1 (2%)	0 (–)	1 (0.7%)	
Hospital stay (days)[b]	10 (7–18)	7 (5–11)	7 (4–11)	<0.001
30d re-admissions n (%)[a]	2 (5.6%)	2 (3.0%)	7 (5.0%)	0.768

Values are median (IQR).
[a] Chi-square test.
[b] Kruskal Wallis.

enthusiasm. The current study gave potential explanations. Against common belief, nursing workload reduced with introduction of ERAS, due to standardization of patient resulting in improved outcomes. Patients having less (severe) complications are less likely to be work-intensive. But there are probably also other intrinsic explanations as detailed below.

While there is overwhelming evidence for the medical benefits of ERAS [1–3], little has been reported on the impact of enhanced recovery programs on nursing workload. Our findings on a formal ERAS® program are similar to those of Sjetne et al. who reported that introduction of an institutional enhanced recovery pathway in a gynaecological ward was associated with reduced workload [13]. This Norwegian group measured total nursing time for individual patients during their stay; furthermore the authors conducted verbal interviews and personnel surveys indicating high degree of satisfaction with the change in practice. Their results contrast at first sight with a thorough evaluation from Kehlet's "fast track" group [14]. They carefully recorded total nursing time in 25 "fast track" patients and compared the findings with 30 patients receiving conventional care. Although total nursing time was reduced in the interventional group, this was largely outweighed by a 4-day reduction in hospital stay. Therefore nursing time per day increased in the "fast track" group. Interestingly, nursing activities shifted in their study from physical care to verbal tasks including information, motivation and teaching. The results from our present study confirm these changes in activities (Fig. 2). Clearly the work-intensive days fall in the early postoperative period, at least in patients without complications. Therefore, our study helps to confirm a reduction of nursing workload by implementation of enhanced recovery pathways [13,14]. Additionally, increased compliance with the ERAS® protocol was associated with a reduced overall nursing workload. For this reason, initial investments like detailed information, diligent patient preparation, enhanced mobilisation and early nutrition is very important as it reduces other nursing tasks significantly in these patients.

Nursing workload is difficult to define and measure [10] but surgeons should consider this important collaboration with nursing staff. The typical professional activities include medical tasks, physical actions, communication, and administrative duties. It seems impossible to analyze separately those measures because they belong together and are performed by the nursing staff continuously.

Previous studies simply timed the time spent with various activities in an attempt to objectively quantify the work burden per patient [13,14]. Subjective variables such as stress, satisfaction, and mental involvement play certainly an important role as well, and may partially be assessed by questionnaires and interviews [13]. One important limitation of those approaches is however the observer effect (Hawthorne) that can willingly or unwillingly bias the results. In this study, nurses quantified the anticipated nursing workload as part of their clinical routine and were also unaware of the performed analysis. The PRN score takes into account a large variety of nursing tasks and tends to be more objective and observer independent as simple questionnaires. PRN has been shown to be a reliable and useful tool that is used in several countries [10,11]. It is considered as a validated tool to measure nursing workload.

Several limitations of our present study should be addressed. The analysis was performed retrospectively but all assessed data were registered prospectively into professional databases by dedicated data managers. Despite the shortcoming of retrospective analysis, the data may be considered as robust and reliable. Further, the PRN score measures the anticipated workload for the next 24 h and not the actual work done. However, the accuracy of PRN scoring is cross-checked and systematically audited by the nursing management. Of note, PRN assessment shows that both anticipated and actual numbers correlate closely. Moreover, PRN scoring was applied the same way for the three analyzed groups.

Finally, working conditions and staffing criteria differ considerably between units, hospitals and countries. In our Department the working conditions and staffing criteria were homogenous through the entire study period. Nonetheless, our findings are probably reproducible in other hospitals and countries.

We emphasize that workload was reduced despite adding additional measures to the nursing routine. This is because standardisation and improved clinical outcome is generally observed with implementation of enhanced recovery pathways [1]. Similar positive side effects like cost reduction [3] and decreased nursing workload as reported here, are therefore likely to be observed in other hospitals as well, after successful systematic implementation of an enhanced recovery program.

In conclusion, our study suggests that implementation of an enhanced recovery program like ERAS decreases nursing workload per patient against a common belief. Standardisation and adherence to enhanced recovery protocols are keys of success. The higher the compliance with the pathway, the lower the burden for the nurses.

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Conflicts of interest

No conflicts of interest to declare.

Ethical approval

Ethical approval obtained by IRB, university of Lausanne.

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Author contribution

Statement of Authorship.

Martin Hübner: conception and design, analysis and interpretation, drafting.

Valerie Addor: conception, critical revision.

Juliette Slieker: design, analysis and interpretation, critical revision.

Anne-Claude Griesser: conception, interpretation, critical revision.

Estelle Lécureux: conception and design, analysis and interpretation, critical revision.

Catherine Blanc: analysis and interpretation, critical revision.

Nicolas Demartines: conception, interpretation, critical revision.

All authors approved the final version.

Guarantor

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