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Nurses' Perception of Introducing Single-Use Gastroscopes in an Operating Theatre

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Abstract

Background: Introducing new medical technologies in clinical settings affects workflows and staff experiences. Nurses, as stakeholders, are often impacted by changes in equipment and processes. Understanding these effects is important in the context of global nurse shortages, where improving working conditions may be essential for retention. This study aimed to assess how transitioning from a reusable-only gastroscope setup to a hybrid setup implementing single-use gastroscopes impacts nurses' perceived organizational conditions.

Methods: A cross-sectional survey was conducted among nurses working in gastrointestinal operating theatre at Copenhagen University Hospital Hvidovre, Denmark. Eligible participants had experience handling both reusable and single-use gastroscopes. The survey, based on the organizational impact framework by Roussel et al., included closed-ended questions across nine domains such as workflow, training, communication, safety, and logistics. Responses were scored on a 0–10 scale and converted to percentages. Paired t-tests were used to compare perceptions between reusable-only and hybrid setups, with significance set at $p<0.05$.

Results: Of the 30 nurses invited, 27 (90%) initiated the survey, and 25 completed it and were included in the final analysis. Across all assessed domains, the single-use gastroscope/hybrid setup was rated more favorably compared to the reusable-only endoscope/setup. Work processes (77% vs. 43%, $p<0.0001$), Cooperation and Communication (80% vs. 53%, $p<0.0001$), Vigilance and Monitoring (90% vs. 45%, $p<0.0001$), Logistics (85% vs. 37%, $p<0.0001$), Training Requirements (60% vs. 45%, $p=0.0037$), Working Conditions and Safety (73% vs. 37%), and Patient Flow (52% vs. 47%, $p = 0.0437$).

Conclusions: Nurses perceived the introduction of single-use gastroscopes as a supplement to the reusable gastroscopes as offering substantial organizational advantages. These findings underscore the importance of evaluating medical devices beyond clinical performance, incorporating organizational and workforce perspectives to support sustainable healthcare delivery. Hybrid implementation models may contribute to improved working conditions and nurse satisfaction, which are critical in addressing workforce challenges.

Abbreviations

HY: Hybrid
GI: Gastrointestinal
OI: Organizational impact
RE: Reusable
SU: Single-use

Background

Integration of new technologies in clinical settings often leads to changes in the existing workflow and clinical settings. In gastrointestinal (GI) surgical units, the choice between reusable and single-use endoscopes extends beyond clinical efficacy and cost considerations; it also affects staff workload and has broader organizational implications.

Nurses, as key stakeholders in the healthcare sector, are particularly affected by such changes. In OECD countries, 17% of nurses are expected to retire by 2030, and in some countries, nurses approaching retirement outnumber that of early career nurses [1]. In Denmark, a national report shows that many nurses have left the healthcare sector due to working conditions and pay. However, two in five would consider returning if workplace conditions improved, highlighting the importance of understanding how organizational changes are affecting nurses [2]. A recent study found that nurses in the surgical department spend a median time of 37 minutes handling a reusable gastro- or colonoscope compared to less than 10 minutes expected of a single-use counterpart [3]. Despite growing interest in the clinical and economic aspects of endoscopic equipment, limited research has explored the organizational and workforce implications particularly for nurses.

At the GI surgical theatre at Hvidovre Hospital in Denmark, single-use gastroscopes (Ambu® aScope™ Gastro) were initially introduced on a trial basis alongside the existing reusable gastroscopes. Following a period of evaluation, positive feedback from clinical staff led to the decision to continue using single-use gastroscopes as a permanent complement to the reusable ones. The aim of this study was to investigate how this shift in

endoscopic setup - from reusable-only gastroscopes to a hybrid setup including both reusable and single-use gastroscopes - affects the organizational impact on nurses working in GI surgical theatre.

Methods

Design: This single-center study employed a cross-sectional online survey design with closed-ended and rating scale questions.

Participants and setting: The survey was distributed to all nurses working in the GI operating theatre at Copenhagen University Hospital Hvidovre, Denmark. Inclusion criteria required participants to confirm that they had been involved in the handling of both single-use and reusable endoscopes, as indicated by a positive response to the screening question: "Have you been involved in the preparation of both single-use and reusable endoscopes?".

Data collection + Measures: The survey was designed based on the organizational impact (OI) assessment framework by Roussel et al. [4], aiming to systematically capture how implementation of medical devices influences healthcare delivery beyond clinical and economic dimensions. To ensure content validity each question was mapped to the appropriate OI type identified in the framework. Nine of the 12 types of OI (Table 1) was found to be relevant for the aim of this study, which was; work processes or health care production; patient pathways; patient flows; training requirement and skills needed from health care professionals; cooperation and communication modes; vigilance and monitoring method; working conditions and safety; accessibility; and logistics. Depending on the nature of the question, it was phrased either according to the type of endoscope (reusable vs single-use) or clinical setup (only reusable gastroscopes available at the department vs. hybrid setup with both reusable and single-use gastroscopes available). The survey included questions designed to capture both perceived advantages and disadvantages of each endoscope type/setup. Where appropriate, identical questions were asked about both counterparts to minimize the risk of response bias due to differences in phrasing.

To enhance face validity, the survey underwent two rounds of review by nurses from the department. Reviewers assessed the clarity and contextual relevance of each question, ensuring that the language used was unambiguous and appropriate for clinical practice. Feedback from both rounds was incorporated to refine phrasing and improve interpretability.

All nurses in the department were introduced to the study during a team meeting, where the study's purpose, methodology, and ethical considerations were presented. Participants were informed of their right to withdraw at any time without explanation or consequence and informed about data handling and usage. The survey was conducted using SurveyXact and began with a written introduction explaining the study's purpose, the anonymity of responses, and participants' rights. All questions were to be answered on a numeric scale from 0 to 10, with clear indications of what was meant by low, average, and high values (0, 5, and 10). For questions where participants lacked sufficient knowledge or experience, they had the option to select "Don't know." All responses were subsequently converted to percentages for comparison. A link to the survey was distributed to all the participants by a department nurse, and each nurse completed the survey independently. Data was collected from November 2024 to January 2025.

Data analysis: Data was exported from SurveyXact to Excel and response frequencies were calculated as percentages for each question and then visualized using a spider plot to illustrate the distribution of perceived OIs across the selected types of OI, following the framework by Roussel et al. To assess whether there were statistically significant differences in perceptions or outcomes between the counterparts paired t-test was conducted. This approach was chosen to account for within-subject comparisons, as the same participants had experience with both types. A significance level of $p < 0.05$ was used to determine statistical significance.

Table 1: The 12 types of organizational impact by the framework of Roussel et al. (2015) for assessment of medical devices

List of the 12 types of organizational impact		
Type	**Description**	**Included in study**
Work processes or health care production	Changes in how care is delivered.	X
Patient pathways	Alterations in the sequence of care steps.	X
Patient flows	Effects on volume and timing of patient movement.	X
Type and level of involvement of the patient/carer	Shifts in roles or responsibilities.	
Training requirement and skills needed from health care professionals	New skills or education required.	X
Cooperation and communication modes	Changes in team dynamics or networks.	X
Vigilance and monitoring method	New safety or oversight mechanisms.	X
Working conditions and safety	Impact on staff safety or workload.	X
Accessibility	Effects on service availability or equity.	X
Budget allocation	Redistribution of financial resources.	
Architectural and infrastructural design	Need for physical or architectural changes.	
Logistics	Implications for supply and distribution systems.	X

Results

Out of 27 nurses responding to the survey, 25 (93%) completed it and were included in the final analysis. Two were excluded due to incompletion of the survey. Across all assessed OI parameters, the hybrid/single-use setup was rated more favorably (Table 2). The responses showed consistent differences in perceived OI between hybrid setup/single-use gastroscopes and reusable-only/reusable gastroscopes (Figure 1).

For the parameter Work processes and healthcare production, the average perceived benefit score was 77% for the hybrid/single-use setup compared to 43% for the reusable-only setup ($p<0,0001$). Patient pathways were rated at 71% for the hybrid/single-use setup and 48% for reusable-only ($p=0.0016$). The parameter Patient flows showed the smallest difference, with scores of 52% and 47%, respectively, ($p=0,0437$). Training requirements and skills needed from healthcare professionals had an average perceived benefit score of 60% for hybrid/single-use compared to 45% for reusable-only ($p=0,0037$), while the parameter Cooperation and

communication modes received scores of 80% and 53%, respectively, (p<0,0001). Vigilance and monitoring methods were rated highest among all parameters, with 90% of the hybrid/single-use and 45% of the reusable-only setup, and Working conditions and safety followed a similar pattern, with scores of 73% and 37%, respectively. Accessibility was rated at 68% and 39%, respectively, and Logistics showed average perceived benefit score of 85% for hybrid/single-use and 37% for reusable-only.

Table 2: *Percentage-based average perceived benefit, where 100% is ideal and 0% is completely unsatisfactory. (SU/HY: single-use gastroscopes or hybrid setting. RE: reusable gastroscopes or reusable-only setting.)

Organizational Impact Parameter		Criteria		Average perceived benefit/satisfaction score*	
		No.	Description	SU/HY	RE
1	Work process or healthcare production (n=299)	1.1.1	Scope wear		38%
		1.1.2	Scope availability		63%
		1.1.3	Impact of broken scope		46%
		1.1.4	Work process and time consumption	84%	
		1.1.5	Handling work processes of two systems	55%	
		1.2.1 1.2.2	Operating room reset post-endoscopy	78%	43%
		1.2.3 1.2.4	Cleaning room organization and maintenance	87%	31%
		1.2.5 1.2.6	Storage area organization and maintenance	80%	36%
		1.3.1	Implementation of single-use gastroscopes	73%	
		1.3.2	Single-use scope implementation	83%	
Average perceived benefit rating				77%	43%
2	Patient pathways (n= 50)	2.1.1 2.1.2	Transport of scope and equipment	48%	71%
Average perceived benefit rating				71%	48%
3	Patient flows (n=150)	3.1.1 3.1.2	Patient throughput	54%	40%
		3.1.3 3.1.4	Impact of shift workload	51%	54%
		3.2.1 3.2.2	Patient waiting time	51%	46%
Average perceived benefit rating					
4	Type and level of involvement of the patient/carer		NA	-	-
Average perceived benefit rating				-	-
5	Training requirements and skills needed from health care professionals (n=75)	5.1.1 5.1.2	Scope handling training	60%	28%
		5.1.3	Microbiological sampling training		62%
Average perceived benefit rating				60%	45%

6	Cooperation and communication modes (n=150)	6.1.1 6.1.2	Communication and coordination for scope readiness	79%	55%
		6.1.3 6.1.4	Internal communication for scope readiness	77%	56%
		6.1.5 6.1.6	Inter-nurse collaboration for scope readiness	83%	49%
Average perceived benefit rating				80%	53%
7	Vigilance and monitoring method (n=183)	7.1.1 7.1.2	Scope breakage handling	94%	62%
		7.1.3 7.1.4	Scope repair process	89%	30%
		7.1.5 7.1.6	Documentation load	92%	60%
		7.1.7 7.1.8	Scope cleaning diligence	86%	26%
Average perceived benefit rating				90%	45%
8	Working conditions and safety (n=300)	8.1.1 8.1.2	Type of scope at disposal (in general)	64%	37%
		8.1.3 8.1.4	Type of scope at disposal during shifts	83%	32%
		8.1.5 8.1.6	Cleaning chemical exposure	83%	33%
		8.1.7 8.1.8	Transport-related physical impact	75%	44%
		8.1.9	Availability of SU scopes and stress level	66%	
		8.1.10	Availability of SU scopes and job satisfaction	76%	
		8.1.11	Implementation of single-use scopes and job attractiveness	68%	
		8.11.12	Implementation of single-use scopes and job satisfaction and retention	67%	
Average perceived benefit rating				73%	37%
9	Accessibility (n=49)	9.1.1 9.1.2	Scope availability	68%	39%
Average perceived benefit rating				68%	39%
10	Budget allocation		NA	-	-
Average perceived benefit rating				-	-
11	Architectural and infrastructural design		NA	-	-
Average perceived benefit rating				-	-
12	Logistics (n=147)	12.1.1	Scope cleaning logistics		34%
		12.1.2 12.1.3	Logistics to ensure scopes are ready	78%	37%

		12.1.4 12.1.5	Logistics linked to scope repair and maintenance	92%	34%
		12.1.6	Logistics of purchase/ restock reprocessing supplies		44%
Average perceived benefit rating				85%	37%

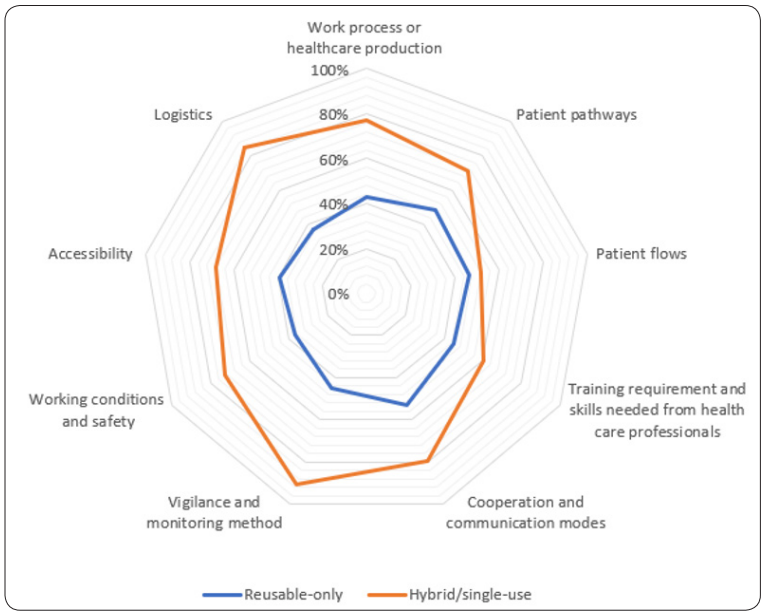

Figure 1: Percentage-based average perceived benefit. 100% represents the optimal/ideal and 0% is completely unsatisfactory. (SU/HY: single-use gastroscopes or hybrid setting. RE: reusable gastroscopes or reusable-only setting.)

Discussion

This study demonstrates that nurses working in gastrointestinal surgical theatre perceive that single-use gastroscopes in a hybrid setup offer organizational advantages over a reusable-only setup. Statistically significant benefits were found suggesting that adoption of single-use gastroscopes as a supplement to the reusable gastroscopes positively influenced nursing workflow, reduced operational complexity, and improved staff satisfaction.

Châteauvieux et al. also applied the OI framework by Roussel et al. to evaluate the OI of implementation of a single-use flexible bronchoscope [4,5]. They found that the single-use process scored better than the reusable process in 9 out of 10 assessed OI parameters. Their study highlighted simplified logistics, reduced exposure to hazardous substances, and improved device availability associated with single-use technologies. These findings are also supported by Gudnadottir et al., who found that single-use rhinolaryngoscopes were significant superior in four OI domains: logistics, cooperation and communication, vigilance and monitoring, and working conditions and safety [6].

Understanding the OI of new medical devices—especially from the perspective of frontline staff—is increasingly recognized as essential in improving healthcare delivery and workforce sustainability [7]. Given the ongoing nurse shortages and high attrition rates in many healthcare systems, including Denmark, improving working conditions through thoughtful device implementation is not only a matter of efficiency but also of workforce sustainability [8-10]. A Danish report have shown that 79% of nurses would consider returning to the healthcare sector if workplace conditions improved and the workload was reasonable compared to working hours [11]. International policy also highlights the value of involving nurses and other staff in planning processes, and the WHO Regional Office for Europe reported that engaging approximately 200 frontline professionals in hospital design led to more effective and contextually relevant outcomes, reinforcing the broader recommendation to integrate staff perspectives into organizational change to enhance satisfaction, retention, and operational sustainability [12,13].

Our findings reinforce the value of including staff-perceived OI before implementing new medical technologies and suggest that a hybrid model in the gastrointestinal surgical unit, with both reusable and single-use gastroscopes available, may contribute to such improvements by reducing physical and cognitive workload, improving job satisfaction, and streamlining communication.

Strengths and Limitations

The findings of this study, should be seen in the light that it was conducted at a single center, which may limit generalizability. Though having responses from 90% of the nurses employed at the surgical unit at the time of data collection (27 out of 30), the sample size was modest, and data were based on self-reported perceptions, which are subject to bias. Additionally, while the survey was designed to minimize phrasing bias and underwent face validity testing, further validation in multi-center settings would strengthen the findings. The study also did not assess long-term outcomes such as staff turnover, absenteeism, or patient throughput, which could provide deeper insights into the organizational effects of device implementation. A key strength of this study is its focus on a hybrid setup - evaluating the OI of introducing single-use gastroscopes alongside reusable ones, rather than comparing a single-use-only setup to a reusable-only setup. This design more accurately reflects the current reality of clinical practice in surgical GI settings, where single-use endoscopes are typically introduced as a supplement rather than a replacement. By capturing the nuances of this hybrid implementation, this study provides relevant and applicable insights for healthcare settings considering similar transitions.

Conclusion

This study highlights the impact adoption of new medical devices has on nurses' daily work and overall working environment. The nurses of this Danish surgical gastrointestinal unit experienced clear organizational advantages across all assessed OI parameters after implementation of single-use gastroscopes as a supplement to their existing reusable gastroscopes.

This study emphasizes the importance of evaluating medical devices through a multidimensional lens that includes organizational and workforce impacts. By integrating frameworks like that of Roussel et al. (4) and drawing on real-world insights, healthcare institutions can make more informed, sustainable decisions that support both clinical excellence, staff workflow and work processes. Even when clinical performance is equivalent, organizational benefits such as reduced training needs, simplified workflows, and improved safety should be considered alongside cost in the selection and implementation of new medical devices.

Supplementary Information

Author Contributions

Conceptualization and design, L.R.R, G.T, K.N, I.M.B and P.B.M; Data curation, L.R.R, G.T, B.B.J, K.N, and I.M.B; Investigation, L.R.R, and I.M.B; Methodology, , L.R.R, G.T, B.B.J, K.N, and I.M.B; Writing—original draft, L.R.R, K.N, and I.M.B; Writing—review and editing, L.R.R, G.T, B.B.J, K.N, I.M.B and P.B.M; All authors have read and agreed to the published version of the manuscript.

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Data Availability

The author confirms that all data generated or analyzed during this study are included in this manuscript.

Supplementary Materials

An English translation of the original questionnaire is included in the supplementary materials.

Declarations

Ethical Approval and Consent to Participate

This study only collected anonymous nurse perception data regarding workflow and organizational impact, without involving patient data, human participants, human tissue, protected health information, or clinical outcomes. Therefore, formal ethics approval was deemed unnecessary according to the IRB guidelines of Copenhagen University Hospital Hvidovre. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

Before accessing the questionnaire, all participating nurses were informed verbally and received written information about the purpose of the study, the anonymity of their responses, their right to withdraw at any time, and that the data collected would be used for research and publication. Completion of the survey was considered as providing informed consent. Therefore, informed consent to participate was obtained from all participants.

Consent for Publication

Consent for publication was not applicable since the manuscript did not contain any identifiable personal information. The participating nurses answering the questionnaire were informed that the data collected would be used for research and publication.

Competing Interests

K.N. is employed as a Global Health Economist at Ambu A/S. All other authors declare no competing interests.

Availability of Data and Materials

Data and materials are available from the corresponding author upon request.

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