

RESEARCH ARTICLE

Multifaceted intervention including Facebook-groups to improve guideline-adherence in ICU: A quasi-experimental interrupted time series study

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Abstract

Background: The impact of social media, with its speed, reach and accessibility, in interventions aimed to improve adherence to guidelines such as assessment of Pain, Agitation/Sedation and Delirium (PAD) in intensive care is not described. Therefore, the primary objective of this quality improvement study was to evaluate the impact of a multifaceted intervention including audit and feedback of quality indicators (QI) via Facebook-groups, educational events and engagement of opinion leaders on adherence to PAD-guidelines in four ICUs.

Methods: A quasi-experimental interrupted time series study with eight monthly data points in the two phases Before and Intervention was designed. Proportion of nursing shifts with documented PAD-assessment (PAD-QIs) were retrieved from the electronic medical chart from included adult ICU patient-stays in four participating ICUs. Difference between the two time periods was assessed using generalised mixed model for repeated measures with unstructured covariance matrix, and presented as Beta (B) with 95% confidence interval (CI).

Results: Finally, 1049 ICU patient-stays were analysed; 534 in Before and 515 in Intervention. All three PAD-QIs significantly increased in Intervention by 31% (B = 30.7, 95%CI [25.7 to 35.8]), 26% (B = 25.8, 95%CI [19.4 to 32.2]) and 34% (B = 33.9, 95%CI [28.4 to 39.4]) in pain, agitation/sedation and delirium, respectively.

Conclusion: A multifaceted intervention including use of Facebook-groups was associated with improved guideline-adherence in four ICUs, as measured with process PAD-QIs of PAD assessment. Further research on use of social media to improve guideline adherence is warranted, particularly as social distancing impacts clinical education and training and new approaches are needed.

KEYWORDS

agitation/sedation, delirium, facebook, guideline adherence, intensive care unit, interrupted time series, multifaceted intervention, pain, quality improvement, quasi experimental, social media, social networking sites

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1 | INTRODUCTION

Health status of critically ill patients depends significantly on quality of care in the intensive care unit (ICU).^{1,2} Optimisation of provided critical care according to evidence-based guidelines is of utmost importance.^{1,2} Quality should be monitored and measured, and action must be taken if quality is found to be suboptimal.^{2,3} Current practice for providing information and feedback about quality of care is mainly based on traditional communication methods such as international, national and local meetings, e-mails, web-pages and posters in the ICU. The effects of single components or multifaceted interventions targeting common barriers such as lack of knowledge, awareness or motivation on improved adherence vary.⁴⁻¹⁰ An overview of systematic reviews from 2011 showed that multifaceted interventions are more likely to improve practice than single interventions.⁹

We use social media (SoMe) as a daily way of communication. SoMe can improve communication and information sharing,¹¹ and provide an educational medium for improving health care personnel (HCP) knowledge, research evidence adherence and clinical behaviour.¹² However, use of SoMe in an integrated approach aimed to communicate with HCPs to improve ICU guideline-adherence has not been studied.¹³⁻¹⁵ SoMe can be an alternative communication method with its speed, reach and accessibility via their smartphones.^{12,16,17} In a recent Norwegian survey, 93% of ICU nurses and physicians reported having a SoMe profile, with Facebook being the most popular.¹⁸ In particular, ICU nurses reported a positive attitude towards receiving content on critical care topics in work-related closed Facebook-groups.¹⁸ To our knowledge, no study has tested use of Facebook-groups to improve HCP's adherence to ICU guidelines.

Assessment of guideline-adherence can be measured through quality indicators (QIs).¹⁹ QIs are defined as 'measures to assess a particular health care structure, process or outcome',^{1,20,21} and may be used as screening tools to flag potential health care quality problems needing further investigation.²² Process indicators describe the process of care itself; whether what is known as good clinical practice has been applied.^{1,20} ICU staff deal with several care processes, and pain, agitation/sedation and delirium (PAD) are typical examples.^{23,24} Routines of systematic assessment of PAD with validated tools are strongly recommended in evidence-based international guidelines.^{23,24} In a large study, adherence to a bundle including PAD assessment and management was associated with a clear dose-response relationship between higher bundle-adherence and improved patient outcomes.²⁵ In addition, significant pain was more frequently reported as bundle performance proportionally increased.²⁵ HCPs need both knowledge and clinical competency in understanding the complexity of PAD elements and overcome barriers to improve treatment based on PAD assessment. Therefore, a multifaceted approach would be more likely to facilitate adherence to PAD assessment, also considering that people respond differently to varying types of interventions.^{9,26}

The primary objective of the present quality improvement study was to evaluate the impact of a multifaceted intervention including

Editorial Comment

Use of social media may play a role in the dissemination and implementation of clinical practice guidelines in the ICU.

audit and feedback of QIs via Facebook-groups and email, educational events and engagement of opinion leaders to ensure adherence to the recommended PAD-guidelines.²³ We hypothesised that process PAD-QIs would increase in the intervention period compared to the period before. In addition, we aimed to perform an exploratory process evaluation of the Facebook-intervention.

2 | METHODS

This study is part of a larger quality improvement initiative through a multifaceted intervention. In addition to PAD, four other QIs were included: multi-professional ward rounds, early mobilisation, early enteral nutrition and pressure ulcers (Figure 1, Appendix 1). Only the impact on PAD are included within the scope of this study, because PAD-QIs are applicable to all patients, less influenced by specific diagnoses and circumstances, thereby clearly reflecting the impact of the intervention on adherence.

2.1 | Design

A quasi-experimental interrupted time series study with two phases was designed, including eight monthly data points before (January'17–August'17, Before) and after initiation of the multifaceted intervention (October'17–May'18, Intervention) (Figure 1). Intervention onset was in September 2017 (Figure 1). Data on PAD-QIs were collected from the electronic medical chart of ICU patients admitted in these time periods. Adult (>18 years) patients' ICU-stays with a minimum ICU-length of stay (LOS) of 48 h were included retrospectively (before 11 June 2017) and thereafter prospectively.

Prior to Intervention, the ICUs had regular focus on PAD with traditional educational events and various types of reminders by opinion leaders (OL). Existing closed Facebook-groups were mainly used for social content and shift-swapping and not for quality improvement purposes.

2.2 | Setting and participation

The study was conducted in four ICUs at Oslo University Hospital (OUH). In 2017, OUH had 3390 ICU patient-stays from 11 ICUs registered in the national Norwegian ICU Registry (NIR), of which 1378 (41%) represented the four study ICUs.²⁷ These ICUs are organised within the same department, with two physically located at OUH

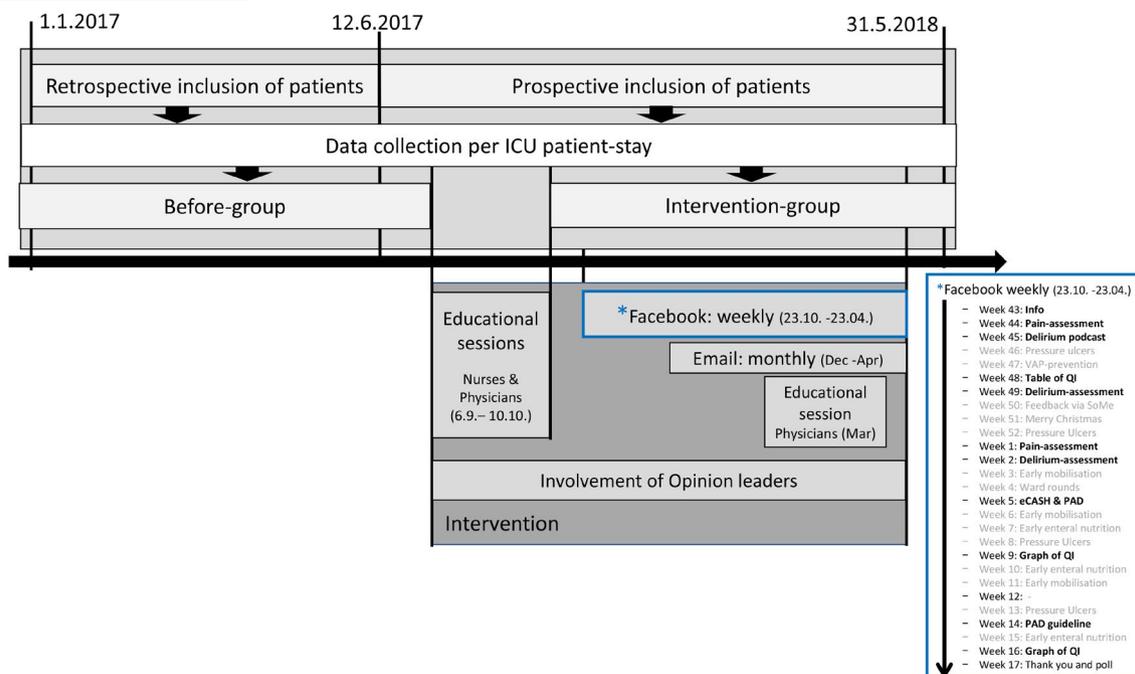


FIGURE 1 Study design [Colour figure can be viewed at wileyonlinelibrary.com]

Rikshospitalet and two at OUH Ullevål. Each ICU has 8–12 beds (see structures in Table 1).

2.3 | Multifaceted intervention

The multifaceted intervention included educational events, audit and feedback of QIs via Facebook and email, and engagement with OL (Figure 1).

Educational events were provided to all ICU nurses in September–October'17. The nine sessions included a three-hour interactive classroom lecture with group discussion. All lectures included definition of quality in health care, quality measurements, overview of the selected critical care topics, discussions around adherence to guideline recommendations and feedback on baseline performance in each ICU. ICU-physicians were offered two one-hour meetings, with presentations, feedback and discussion about the different critical care topics.

Audit and feedback of QIs were provided via weekly Facebook-posts in the closed Facebook-groups between 23.10.17.–23.04.18., and monthly emails to relevant department heads and local OLs. The audited QIs were compared to previous QI-levels within each participating ICUs and to the other ICUs. Twenty-six different Facebook-posts (including 11 images, 11 videos, 3 weblinks and one podcast) were posted simultaneously in all four Facebook-groups (altogether 104 posts), of which 10 consisted of PAD-QI content (Appendix 2). The posts were posted at all weekdays except Sundays, and all times except between midnight and 6.00 am. To increase distribution, visibility and interest, they included emojis, questions and a call to action to gain comments and/or 'likes', including offering gifts to one of those who liked/ commented. The

last Facebook-post was a poll asking Facebook-members to vote for their future preferred place to receive information on critical care topics. All options known to members were available, and multiple options could be voted for.

*Involvement of local OL*⁷ included staff leadership and especially professional development nurses who were involved in planning, patient-inclusion and bedside follow-up. QIs were presented to OLs at two meetings during the intervention period in addition to an ongoing dialog. The importance of their involvement to optimise care was emphasised.

2.4 | Data collection

Data from each ICU patient-stay related to PAD-QI calculations, were retrieved retrospectively from the electronic patient chart system (MetaVision, iMDsoft, Israel). To describe included stays, data were retrieved from NIR, including demographic data, primary reason for ICU admission, treatment-interventions, Nursing Activities Scores (NAS), LOS, time on invasive mechanical ventilation and ICU mortality.

We intended to collect data on engagement from the closed Facebook-groups on each Facebook-post 24 h after posting. Data from the poll was summarised when there was no more activity.

2.5 | Variables and outcomes

Primary outcome was adherence to PAD guidelines, measured by the level of the three PAD-QIs in Before and Intervention. The PAD-QIs were calculated per ICU patient-stay and defined as number of

TABLE 1 The study ICUs structure

	Hospital 1		Hospital 2	
	ICU 1 No. (%)	ICU 2 No. (%)	ICU 3 No. (%)	ICU 4 No. (%)
Actual ICU beds	12	8	11	9
Staffed ICU beds	10	6	10	6
No. of regular ICU physicians (persons)	10		6	
Total nursing FTEs with planned use of temporary staff ^a	98.8	62.4	100.8	61.9
Regular nursing FTEs ^a	90 (91)	55 (88)	92 (91)	53 (86)
ICU specialised nurses (FTEs) ^a (% of regular FTEs)	76 (84)	31 (56)	84 (83)	45 (84)
No. of regular nurses (persons) ^b	107	68	113	70
Gender of nursing staff (female) ^b	90 (84)	55 (81)	99 (88)	56 (80)
Age of nursing staff ^b (mean (SD))	47.1 (9.3)	40.6 (10.3)	46.7 (11.4)	41.9 (10.2)

Abbreviations: FTEs, Full time equivalents; ICU, Intensive Care Unit; No, number; SD, Standard deviation.

^aBudget numbers for 2017.

^bData extracted from the database for Personnel rotation planning (MinGat, Visma).

nursing shifts with a minimum of one documented assessment of pain, agitation/sedation and delirium per number of nursing shifts (minimum duration 2 h) during the complete ICU patient-stay.

Process evaluation of the Facebook-intervention was counted by actual number of closed Facebook-group members and numbers of 'seen', 'likes' and 'comments'.

2.6 | Ethics

Study approval was obtained from the Regional Ethics Committee (2016/2281/REK sør-øst A), and the data protection officer at OUH. Permission was obtained to connect NIR data with data from MetaVision. Data were safely stored on the hospital research server.

All patients included received standard care. Written informed consent was obtained prospectively by the patient or a relative. Consent from retrospectively included patients was achieved by a letter with a request to use a defined set of their ICU data with the possibility to withdraw their study participation.

Permission was obtained from department heads. ICU nurses and physicians were informed during educational sessions and through Facebook in the four closed Facebook-groups.

2.7 | Statistical analysis

Categorical data are presented as counts and percentages. Continuous variables are described with mean and standard deviation (SD) or median and interquartile range (IQR) depending on the

distribution. Crude differences between Before and Intervention for continuous variables were assessed by independent samples t-test or non-parametric independent samples Mann-Whitney U test, when appropriate. Pairs of categorical data were compared using Pearson's chi-square test or Fisher's exact test, as appropriate.

For the ITS analysis, time was measured in months. Data from each ICU patient-stay was allocated to the appropriate month based on date of discharge. Data are depicted graphically using estimates of aggregated monthly averages with 95% confidence intervals (CI). Differences between Before and Intervention were assessed using generalised mixed model for repeated measures with unstructured covariance matrix, and results are presented as estimated means at given time points (separately for each ICU) and overall estimated change (Intervention–Before) quantified as regression coefficient Beta (B) with 95% CI. *p* values ≤ 0.05 were considered significant. The study is considered exploratory so no correction for multiple testing was performed.

Statistical analyses were performed with IBM Statistical Packages for Social Sciences (SPSS version 26.0). Figures are created using the software MATLAB by MathWorks, Inc.

3 | RESULTS

Of 1413 eligible ICU patient-stays, 1108 (78%) in 978 patients were included. Finally, 1049 ICU patient-stays were analysed; 534 in Before and 515 in Intervention, after excluding 59 ICU stays overlapping with the two time periods (Figure 2). Details from the two cohorts are shown in Table 2.

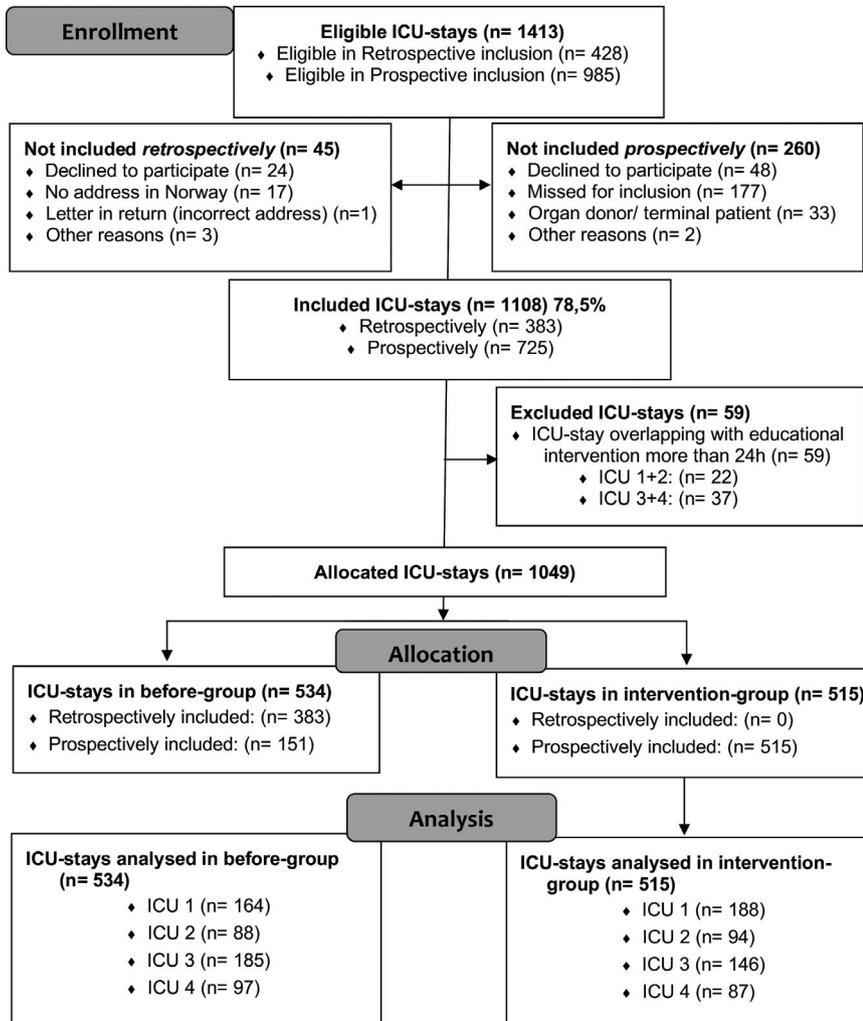


FIGURE 2 ICU patient-stays; Flow chart of enrollment, allocation and analysis

3.1 | Levels of PAD-QIs

The 16 individual monthly data points included PAD-QIs from 53 to 80 ICU patient-stays. ITS-analyses showed a significant increase in all three PAD-QIs in Intervention versus Before (Figure 3). All three PAD-QIs increased significantly in Intervention by 31% ($B = 30.7$, 95%CI [25.7 to 35.8]), 26% ($B = 25.8$, 95%CI [19.4 to 32.2]) and 34% ($B = 33.9$, 95%CI [28.4 to 39.4]) in pain, agitation/sedation and delirium, respectively (Table 3). The size of the change differed between the four ICUs (Table 3). Documentation of pain and agitation/sedation remained unchanged in ICU3 with high pre-existing activity in Before, whereas the other three ICUs improved in Intervention (Table 3). Documentation of delirium improved in all four ICUs (Table 3).

3.2 | ICU personnel's engagement in Facebook-posts

The four closed Facebook-groups had 78–160 members. After 24 h from posting, we had relevant data on 79 of the 104 (76%) posts, which

had been 'seen' by mean 69.6% (SD: 7.4) members, 'liked' by mean 7.1% (SD: 4.0) and commented on by median 2.9% (IQR: 0.0, 4.6).

The top five most 'seen' posts had a contest activity including a gift, were posted in evenings (5:48 PM and 8:55 PM) between Monday and Wednesday, and included a video or an image.

In the poll with 189 votes, closed Facebook-groups (62 votes, 33%) and e-mails (70 votes, 37%) were the two most popular choices on preferred location for critical care topic information (Table 4).

4 | DISCUSSION

The main finding of this study evaluating the impact of a multifaceted intervention including closed Facebook-groups on adherence to current PAD recommendations, was a significant improvement in PAD-QI over time. Delirium was documented significantly more frequently in all four ICUs in Intervention versus Before, while pain and agitation/sedation were documented more frequently in three of the four ICUs. The ICU with no difference in pain and agitation/sedation, had already a high documentation rate in Before. Most

TABLE 2 ICU patient-stays characteristics

Variables	Before (n = 534)	Intervention (n = 515)	p-value
Demographics			
Age (mean (SD))	55.6 (16.1)	55.1 (16.6)	0.650
Gender (male) (no (%))	345 (64.6)	341 (66.2)	0.584
Bodyweight ^a (kg) (mean (SD))	82.8 (19.5)	79.7 (18.9)	0.014
SAPS II (mean (SD))	38.4 (16.6)	37.4 (17.2)	0.359
Primary reason for ICU admission			
			0.535
Respiratory failure (no (%))	57 (10.7)	52 (10.1)	
Circulatory/ cardiovascular failure (no (%))	45 (8.4)	37 (7.2)	
Gastroenterological failure (no (%))	99 (18.5)	115 (22.3)	
Neurological failure (no (%))	88 (16.5)	75 (14.6)	
Sepsis (no (%))	24 (4.5)	15 (2.9)	
Injury/trauma (no (%))	146 (27.3)	143 (27.8)	
Other (no (%))	75 (14.0)	78 (15.1)	
Admitted from another ICU (no (%))	203 (38.0)	170 (33.0)	0.090
ICU Treatment			
Mechanical ventilation (no (%))	479 (89.7)	412 (80.0)	<0.001
Tracheostomy (no (%))	154 (28.8)	117 (22.7)	0.024
Intracranial Pressure monitoring (no (%))	74 (13.9)	72 (14.0)	0.954
Vasoactive infusion >6 h (no (%))	467 (87.5)	413 (80.2)	0.001
Extended haemodynamic monitoring ^b (no (%))	58 (10.9)	60 (11.7)	0.686
Targeted temperature management (no (%))	21 (3.9)	19 (3.7)	0.837
Haemodynamic support ^c (no (%))	10 (1.9)	13 (2.5)	0.471
Renal replacement therapy (no (%))	113 (21.2)	94 (18.3)	0.237
NAS per ICU day (mean (SD))	146.2 (92.0)	148.3 (79.4)	0.702
Time on invasive mechanical ventilation (days) (median (IQR))	4.7 (1.9, 10.3)	4.0 (1.0, 9.7)	0.026
LOS ICU (days) (median (IQR))	6.8 (3.7, 12.9)	6.1 (3.7, 10.7)	0.279
ICU Mortality (No (%))	53 (9.9)	33 (6.4)	0.038

Abbreviations: ICU, Intensive Care Unit; IQR, Interquartile Range with 25, 75 percentiles; kg, kilograms; LOS, Length of stay; NAS, Nursing Activities Score; no, number; SAPS, Simplified Acute Physiology Score; SD, Standard Deviation.

^aDue to missing data for Bodyweight; n = 499 in before, n = 438 in after.

^bExtended hemodynamic monitoring includes SwanGanz or PiCCO.

^cHaemodynamic support includes ECMO, IABP or Impella.

Facebook-group members had seen the Facebook-posts 24 h from posting, but numbers of 'likes' and comments were low. Still, closed Facebook-groups received 33% of Facebook-poll votes of preferred location for critical care topic information.

To our knowledge, this is the first study to use closed Facebook-groups as part of an intervention strategy to improve adherence to ICU recommendations. The QIs in Before were relatively low for pain (40%) and especially low for delirium (10%), and these increased by 31% and 34%, respectively. To improve an activity that prior to intervention is low is less challenging and not surprising.^{4,28} For agitation/sedation, the documentation activity was higher (60%) in Before, but still improved by 26%. A scoring frequency of above 70% is considered standard in the German QI-set, with recommended PAD scoring at

least every 8 h.¹⁹ In our study, this standard was only achieved for agitation/sedation overall and in three of the four ICUs. For pain, the standard of 70% was only reached in one of the four ICUs.

Indeed, this was a multifaceted intervention, and we certainly do not know which part of the intervention had an effect on the measured level of PAD QIs. Audit and feedback have the potential to change recipients' awareness and beliefs about current practice, and inherently motivate improvement in care, particularly when compliance is low.^{4,28} The overall improvements in the three PAD-QIs were relatively high and similar to the highest IQR presented in a Cochrane review of audit and feedback.⁴ In addition to low compliance, audit and feedback appears to be most effective when provided several times by a supervisor or colleague, given

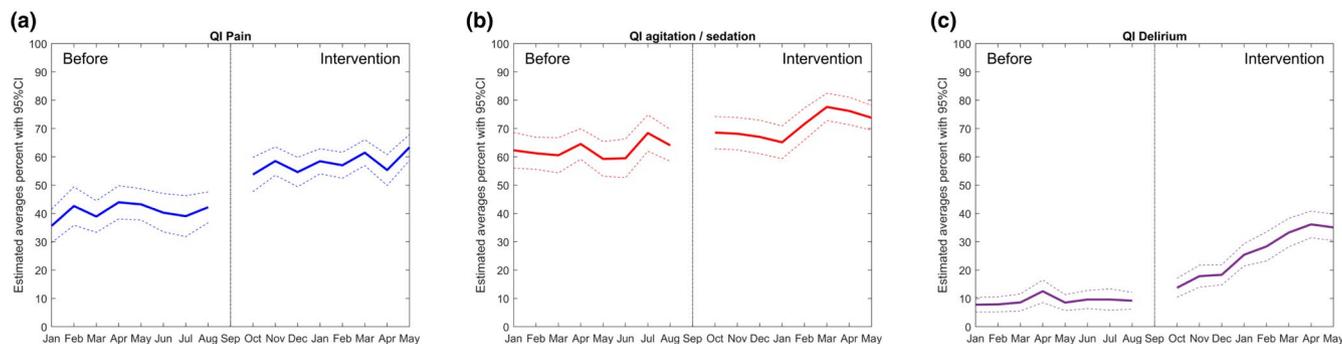


FIGURE 3 Interrupted Time Series charts for the development of quality indicators (QI); pain (a), agitation/sedation (b), delirium (c), in percentage of nursing shifts with documented assessments, in the two time periods: Before (Jan–Aug) and Intervention (Oct–May) [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]

	Before	Intervention		
	Mean (95% CI)	Mean (95% CI)	Coefficient Beta (95% CI)	
QI Pain (Total)			30.7	(25.7, 35.8)
ICU 1 (n = 164; n = 188)	26.1 (23.4, 28.7)	55.1 (52.5, 57.6)		
ICU 2 (n = 88; n = 94)	23.8 (20.1, 27.4)	42.1 (38.6, 45.6)		
ICU 3 (n = 185; n = 146)	63.5 (61.0, 66.1)	64.2 (61.4, 67.1)		
ICU 4 (n = 97; n = 87)	39.3 (35.8, 42.8)	70.0 (66.3, 73.7)		
QI Agitation/ Sedation (Total)			25.8	(19.4, 32.2)
ICU 1 (n = 164; n = 188)	69.6 (66.2, 73.0)	76.4 (73.2, 79.6)		
ICU 2 (n = 88; n = 94)	35.5 (30.9, 40.1)	51.5 (46.9, 56.0)		
ICU 3 (n = 185; n = 146)	76.4 (73.2, 79.6)	77.4 (73.8, 81.1)		
ICU 4 (n = 97; n = 87)	45.8 (41.4, 50.2)	71.7 (67.0, 76.3)		
QI Delirium (Total)			33.9	(28.4, 39.4)
ICU 1 (n = 164; n = 188)	3.0 (0.1, 5.9)	21.3 (18.5, 24.1)		
ICU 2 (n = 88; n = 94)	1.0 (−2.9, 4.8)	15.3 (11.4, 19.2)		
ICU 3 (n = 185; n = 146)	22.3 (19.6, 25.1)	34.0 (30.8, 37.2)		
ICU 4 (n = 97; n = 87)	3.1 (−0.7, 6.9)	37.0 (33.0, 41.1)		

Abbreviations: CI, Confidence interval; ICU, intensive care unit; n, number.

both verbally and in writing, including clear objectives and an action plan.^{4,28} Inclusion of most of these aspects were achieved with the present Facebook-posts, with feedback of monthly, audited QIs from the main investigator (AP) to ICU colleagues. In addition, educational events and OLs were also included. In two Cochrane reviews, median-adjusted risk difference in adherence to desired practice was 6% with educational events⁵ and 10.8% improvements in adherence to evidence-based practice with OL interventions.⁷

The impact of Facebook on the observed changes in PAD-QIs in this study is unclear, and studies of Facebook-use to improve adherence to patient care are lacking. In a study, communicating evidence-based practice points via Facebook and Twitter, 70% of respondents reported that SoMe had changed their practice.¹² We found that a large proportion of Facebook-group members saw the posts indicating that the intervention was adopted. However, we do not know whether 'seen' actually means that they read the content or just

scrolled over it. Further, we do not know whether this affected their PAD documentation practice, since we collected data on included patients rather than on individual HCP. Positive predictors of SoMe use for professional purposes are younger age and fewer years of professional experience,¹¹ indicating that SoMe could become more effective in the future. Furthermore, SoMe is an important platform for disseminating information and remote learning during the COVID-19 pandemic, as social distancing affects clinical training and didactic education and new approaches to enhance education of HCP are needed.^{29–31}

The magnitude of improvements and the settings prior to Intervention varied across the four ICUs. ICU 3 had the lowest improvement in PAD-QIs, with no significant improvement in pain- and agitation/sedation-assessment, which were relatively high in Before. ICU 4 had the largest improvements in all three PAD-QIs, but in addition the lowest proportion of 'seen' and

TABLE 3 Quality indicators of pain, agitation/ sedation and delirium before and Intervention. Estimated means for the ICUs and results of the generalised mixed model for repeated measures with unstructured covariance matrix for total difference

TABLE 4 Engagement in Facebook-post by members in the closed Facebook-groups and votes from the last post of where they in the future wanted to receive critical care content

	Total	ICU 1	ICU 2	ICU 3	ICU 4
No of Facebook-group members (Median (min-max))	122 (78–160)	155 (150–157)	82 (78–85)	130 (127–160)	112 (109–117)
Engagement in posts after 24 h					
No of posts ^a	n = 79	n = 20	n = 19	n = 20	n = 20
Seen in % of no of group-members (mean (SD))	69.6 (7.4)	68.6 (5.5)	73.5 (8.4)	72.0 (7.0)	64.4 (5.5)
Likes in % of no of group-members (median (IQR))	6.2 (4.3, 9.4)	8.5 (5.3, 12.3)	6.0 (3.5, 8.3)	5.2 (3.3, 10.8)	6.1 (5.3, 7.3)
Comments in % of no of group-members (median (IQR))	2.3 (0.0, 4.6)	2.0 (0.8, 4.0)	4.7 (2.5, 6.3)	2.3 (0.8, 3.8)	0.4 (0.0, 2.4)
Facebook Poll: Votes of preferred source for receiving information on critical care topics					
No of votes	n = 189	n = 67	n = 39	n = 48	n = 36
	n (%)	n (%)	n (%)	n (%)	n (%)
Closed-Facebook group	62 (33)	21 (31)	17 (44)	17 (35)	7 (19)
E-mail	70 (37)	22 (33)	4 (10)	21 (44)	23 (64)
Hospital Intranet	41 (22)	18 (27)	11 (28)	6 (13)	6 (17)
Posters in ICU	14 (7)	6 (9)	6 (15)	2 (4)	0 (0)
Paper in mail-shelf	2 (1)	0 (0)	1 (3)	2 (4)	0 (0)

Abbreviations: ICU, intensive care unit; IQR, Interquartile Range with 25, 75 percentiles; SD, Standard Deviation, no, number.

^a26 Facebook posts were posted in each of the four ICU closed Facebook-groups, giving altogether 104 posts; N is lower in the table due to missing data.

comments on Facebook. Local circumstances can always contribute to improvements in quality of care, and we know that the OL in ICU 4 was particularly active with additional bedside reminders in Intervention. Different approaches by local OLs in different ICUs may have affected overall engagement in the study, and the extent of forwarding emails, posting audit and feedback from Facebook-posts or bedside support varied across ICUs.

4.1 | Strengths and limitations

Randomisation was not possible due to logistical issues. The ability to attribute the change to the intervention is strengthened with ITS including multiple measurements by reduced uncertainty of unstable measurements at only two time-points.^{32–34} However, we cannot completely exclude that the difference in PAD-QIs could be caused by something else and not the intervention due to the history threat. We are, however, not aware of any structural changes made in Intervention versus Before. Characteristics of included ICU patient-stays were similar in both cohorts. However, mechanical ventilation including tracheostomies and use of vasoactive infusions were more common, in addition to longer time on mechanical ventilation and higher ICU mortality in Before. Whether this is relevant to PAD-documentation is unclear.

Effects of the multifaceted intervention were evaluated during an ongoing intervention period, and we do not know if the effect was sustainable or if it just represented a Hawthorne effect.^{33,35} At what point the effect on improved adherence should be measured is controversial, due to several confounding aspects developing over time.³⁴ Implementation and quality improvement initiatives are ongoing processes for several years, and more follow-up is needed after this study's intervention period both to maintain and further improve practice.

Moreover, since we only evaluated PAD, we do not know if the other QIs could have provided different results. This study focused on PAD assessment, not the clinical sign of less pain and less delirium, which could be more important quality outcomes for patients. However, a clear dose-response relationship has previously been shown between guideline adherence and clinical patient outcomes.²⁵

Typical ITS limitations are autocorrelation and seasonality. Autocorrelation was adjusted for using appropriate statistical methodology, and seasonal changes are not expected in the PAD-QIs except for weekends and holidays with more use of temporary staff. Before included summer holidays, with expected lower guideline adherence, but this was not reflected in the ITS figure. Finally, blinding of ICU personnel and study-investigators was impossible.

5 | CONCLUSION

A multifaceted intervention including use of closed Facebook-groups was associated with an improved guideline-adherence measured with process PAD-QIs of PAD assessment. Further research on the impact of using SoMe to improve guideline adherence is warranted, particularly as social distancing impacts clinical education and training and new approaches to training HCPs are needed.

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REFERENCES

1. Rhodes A, Moreno RP, Azoulay E, et al. Prospectively defined indicators to improve the safety and quality of care for critically ill patients: a report from the Task Force on Safety and Quality of the European Society of Intensive Care Medicine (ESICM). *Intensive Care Med.* 2012;38(4):598-605.
2. Guidet B, Valentin A, Flaatten H. *Quality management in intensive care: a practical guide.* : Cambridge University Press; 2016.
3. Flaatten H. The present use of quality indicators in the intensive care unit. *Acta Anaesthesiol Scand.* 2012;56(9):1078-1083.
4. Ivers N, Jamtvedt G, Flottorp S, et al. Audit and feedback: effects on professional practice and healthcare outcomes. *Cochrane Database Syst Rev.* 2012;6:229.
5. Forsetlund L, Bjørndal A, Rashidian A, et al. Continuing education meetings and workshops: effects on professional practice and health care outcomes. *Cochrane Database Syst Rev.* 2009;2:87. <https://doi.org/10.1002/14651858.CD003030.pub2/abstract>
6. Grimshaw JM, Thomas RE, MacLennan G, et al. Effectiveness and efficiency of guideline dissemination and implementation strategies. *Health Technol Assess.* 2004;8(6):iii-iv, 1-72.
7. Flodgren G, O'Brien MA, Parmelli E, Grimshaw JM. Local opinion leaders: effects on professional practice and healthcare outcomes. *Cochrane Database Syst Rev.* 2019;6:120.
8. Wensing M, Grol R. Single and combined strategies for implementing changes in primary care: a literature review. *Int J Qual Health Care.* 1994;6(2):115-132.
9. Boaz A, Baeza J, Fraser A; the European Implementation Score Collaborative G. Effective implementation of research into practice: an overview of systematic reviews of the health literature. *BMC Res Notes.* 2011;4(1):212.
10. Squires JE, Sullivan K, Eccles MP, Worswick J, Grimshaw JM. Are multifaceted interventions more effective than single-component interventions in changing health-care professionals' behaviours? An overview of systematic reviews. *Implement Sci.* 2014;9(1):152.
11. Chan WS, Leung AY. Use of social network sites for communication among health professionals: systematic review. *J Med Internet Res.* 2018;20(3):e117.
12. Maloney S, Tunnecliff J, Morgan P, et al. Translating evidence into practice via social media: a mixed-methods study. *J Med Internet Res.* 2015;17(10):e242.
13. Narayanaswami P, Gronseth G, Dubinsky R, et al. The impact of social media on dissemination and implementation of clinical practice guidelines: a longitudinal observational study. *J Med Internet Res.* 2015;17(8):e193.
14. Benetoli A, Chen TF, Aslani P. The use of social media in pharmacy practice and education. *Res Soc Adm Pharm.* 2015;11(1):1-46.
15. Barnes SS, Kaul V, Kudchadkar SR. Social media engagement and the critical care medicine community. *J Intensive Care Med.* 2019;34(3):175-182.
16. Maloney S, Moss A, Ilic D. Social media in health professional education: a student perspective on user levels and prospective applications. *Adv Health Sci Educ.* 2014;19(5):687-697.
17. Maloney S, Tunnecliff J, Morgan P, et al. Continuing professional development via social media or conference attendance: a cost analysis. *JMIR Med Education.* 2017;3(1):e5.
18. Petosic A, Sunde K, Beeckman D, Flaatten HK, Woien H. Use of social media for communicating about critical care topics: a Norwegian cross-sectional survey. *Acta Anaesthesiol Scand.* 2019;63(10):1398-1405.
19. Kumpf O, Braun JP, Brinkmann A, et al. Quality indicators in intensive care medicine for Germany - third edition 2017. *Ger Med Sci.* 2017;15:Doc10.
20. Donabedian A. Evaluating the quality of medical care. *Milbank Q.* 2005;83(4):691-729.
21. Donabedian A. The quality of care. How can it be assessed? *JAMA.* 1988;260(12):1743-1748.
22. AHQR. Agency of Healthcare Research and Quality Advancing Excellence in Health Care. Quality Improvement and monitoring at your fingertips. US Department of Health & Human Services;2021. Accessed April 12, 2021. <https://www.qualityindicators.ahrq.gov/>.
23. Barr J, Fraser GL, Puntillo K, et al. Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the intensive care unit. *Crit Care Med.* 2013;41(1):263-306.
24. Devlin JW, Skrobik Y, Gelinas C, et al. Clinical practice guidelines for the prevention and management of pain, agitation/sedation, delirium, immobility, and sleep disruption in adult patients in the ICU. *Crit Care Med.* 2018;46(9):e825-e873.
25. Pun BT, Balas MC, Barnes-Daly MA, et al. Caring for critically ill patients with the ABCDEF bundle: results of the ICU liberation collaborative in over 15,000 adults. *Crit Care Med.* 2019;47(1):3.
26. Pun BT, Balas MC, Davidson J. Implementing the 2013 PAD guidelines: top ten points to consider. *Semin Respir Crit Care Med.* 2013;34(2):223-235.
27. Buanes EA, Kvale R. Norsk intensivregister. Årsrapport for 2017 med plan for forbedringstiltak. Versjon 1.1.: Norsk intensivregister, Helse Bergen.; 2019 25. januar 2019.
28. Ivers NM, Sales A, Colquhoun H, et al. No more 'business as usual' with audit and feedback interventions: towards an agenda for a reinvigorated intervention. *Implement Sci.* 2014;9:14.
29. Chan AK, Nickson CP, Rudolph JW, Lee A, Joynt GM. Social media for rapid knowledge dissemination: early experience from the COVID-19 pandemic. Wiley Online Library. 2020.
30. Merchant RM, Lurie N. Social media and emergency preparedness in response to novel coronavirus. *JAMA.* 2020;323(20):2011-2012.
31. Mohamed-Hussein A, Yassa H, Makhlof H. Impact of social media on knowledge dissemination between physicians during COVID-19 virus outbreak: a cross sectional survey. *medRxiv.* 2020. <https://doi.org/10.1101/2020.05.31.20118232>
32. Hategeka C, Ruton H, Karamouzian M, Lynd LD, Law MR. Use of interrupted time series methods in the evaluation of health system quality improvement interventions: a methodological systematic review. *BMJ Global Health.* 2020;5(10):e003567.
33. Polit DF, Beck CT. *Nursing research: generating and assessing evidence for nursing practice.* Wolters Kluwer Health.; 2012. XIV, 802 s.: ill. p.
34. Shadish WR, Cook TD, Campbell DT. *Experimental and quasi-experimental designs for generalized causal inference/William R. Shadish, Thomas D. Cook, Donald T. Campbell.* Houghton Mifflin; 2002.
35. Grimshaw J, Campbell M, Eccles M, Steen N. Experimental and quasi-experimental designs for evaluating guideline implementation strategies. *Fam Pract.* 2000;17(90001):11S-16.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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