

University of Groningen

Assessing the quality of interdisciplinary rounds in the intensive care unit

Ten Have, Elsbeth C. M.; Hagedoorn, Mettje; Holman, Nicole D.; Nap, Raoul E.; Sanderman, Robbert; Tulleken, Jaap E.

Published in:
Journal of Critical Care

DOI:
[10.1016/j.jcrc.2012.12.007](https://doi.org/10.1016/j.jcrc.2012.12.007)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2013

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Ten Have, E. C. M., Hagedoorn, M., Holman, N. D., Nap, R. E., Sanderman, R., & Tulleken, J. E. (2013). Assessing the quality of interdisciplinary rounds in the intensive care unit. *Journal of Critical Care*, 28(4), 476-482. DOI: 10.1016/j.jcrc.2012.12.007

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.



Assessing the quality of interdisciplinary rounds in the intensive care unit[☆]

Elsbeth C.M. Ten Have^{a,*}, Mariet Hagedoorn PhD^b, Nicole D. Holman MD^c,
Raoul E. Nap MD, PhD^a, Robbert Sanderman PhD^b, Jaap E. Tulleken MD, PhD^d

^aDirectorate Medical Affairs, Quality and Safety, University Medical Center Groningen, Groningen, The Netherlands

^bDepartment of Health Psychology, University of Groningen, Groningen, The Netherlands

^cDepartment of Intensive Care, Martini Hospital, Groningen, The Netherlands

^dDepartment of Critical Care, University Medical Center Groningen, Groningen, The Netherlands

Keywords:

Critical care;
Process assessment;
Videotape recording;
Quality indicators;
Interdisciplinary
communication

Abstract

Purpose: Interdisciplinary rounds (IDRs) in the intensive care unit (ICU) are increasingly recommended to support quality improvement, but uncertainty exists about assessing the quality of IDRs. We developed, tested, and applied an instrument to assess the quality of IDRs in ICUs.

Materials and Methods: Delphi rounds were done to analyze videotaped patient presentations and elaborated together with previous literature search. The IDR Assessment Scale was developed, statistically tested, and applied to 98 videotaped patient presentations during 22 IDRs in 3 ICUs for adults in 2 hospitals in Groningen, The Netherlands.

Results: The IDR Assessment Scale had 19 quality indicators, subdivided in 2 domains: “patient plan of care” and “process.” Indicators were “essential” or “supportive.” The interrater reliability of 9 videotaped patient presentations among at least 3 raters was satisfactory ($\kappa = 0.85$). The overall item score correlations between 3 raters were excellent ($r = 0.80-0.94$). Internal consistency in 98 videotaped patient presentations was acceptable ($\alpha = .78$). Application to IDRs demonstrated that indicators could be unambiguously rated.

Conclusions: The quality of IDRs in the ICU can be reliably assessed for patient plan of care and process with the IDR Assessment Scale.

© 2013 Elsevier Inc. All rights reserved.

1. Introduction

Interdisciplinary rounds (IDRs) are meetings in which health care professionals from different disciplines collaborate to develop an integrated plan of care for the individual patient [1]. The goal is to increase the quality of patient care by sharing information, addressing patient problems, and planning and evaluating treatment [1]. In the intensive care unit (ICU), IDRs are recommended to

[☆] Competing interests: The authors have no commercial association or financial involvement that might pose a conflict of interest connected with this article.

* Corresponding author. Directorate Medical Affairs, Quality and Safety, University Medical Center Groningen, P.O. Box 30.001, 9700 RB Groningen, The Netherlands. Tel.: +31 50 3617044; fax: +31 50 3614357.

E-mail addresses: e.c.m.ten.have@umcg.nl, ecmtenhave@gmail.com (E.C.M. Ten Have).

support quality improvement and to reduce preventable patient harm and conflicts [1,2]. This recommendation was initiated by evidence that ineffective interdisciplinary communication among medical teams is a leading cause of preventable patient harm and a source of severe conflicts within ICUs [3–5].

Although there is no ambiguity about the goal of the IDR, the execution varies because IDRs are complicated by factors including limited time, multiple targets, patient instability, highly technical therapies, and varied responsibilities of different providers [6–8]. However, there are neither uniform methods nor published reports to assess the quality of IDRs. Well qualified IDRs are considered to be rounds in which the appropriate plan of care is agreed to, understood, and executed as planned by all care providers [8,9]. Studies that have investigated IDRs have emphasized that several attributes (ie, the use of checklists, understanding daily patient goals) and key behaviors (ie, effective coordination to support task and information management, strong leadership behavior focused on an open atmosphere, and support for team members by defining boundaries and expectations) are essential to execute well qualified IDRs in the ICU [8,10–12]. The synthesis of these studies may provide valuable information but does not provide a validated assessment instrument. An assessment instrument aimed at the quality of the IDR would be consistent with patient safety measurements that provide a more comprehensive measure of the safety and quality within the ICU [2,13–15]. The purpose of this study is to develop, test, and apply an assessment instrument to measure the quality of IDRs in ICUs.

2. Materials and methods

2.1. Tool development

Tool development was established in 4 consecutive steps, namely, (1) criteria for assessments instruments, (2) Delphi rounds combined with previous literature search, (3) application of the instrument, and (4) data and statistical analysis. These steps are discussed in the sections below.

2.2. Criteria for assessment instruments

A literature search was done that identified 2 different types of criteria for instruments about assessing team processes in the ICU. The first type of criteria referred to investigations about patient safety, such as reducing the incidence of central line infections by using checklists for catheter insertion and maintenance [16]. Instruments to improve patient safety in the ICU were based on findings from the aviation industry and Formula 1 racing teams because of the long history of measuring and improving teamwork to prevent and mitigate errors [17,18]. The second

type of criteria referred to team and patient care processes in ICUs, such as the social-professional structure of complex interdisciplinary organizations [19]. Eight criteria revealed by this second type were used to develop the assessment instrument for evaluating the quality of IDRs (Table 1) [13,20–23].

The first criterion was satisfied by including 2 domains in the instrument: (1) “patient plan of care,” to reflect the technical performance from the initial identification of a goal to the evaluative phase, and (2) “process,” to reflect the team processes that are important to ensure that the appropriate plan of care is agreed, understood, and executed as planned by all care providers (Table 2). The second criterion (“based on literature review and associated with improved outcomes”) was satisfied by the literature review. For the third criterion (“measuring multiple patients with multiple conditions”), choices were made to score the quality of each discussed patient plan of care during the IDR because the execution and team compositions of IDRs may differ between ICUs [6–8,11]. Therefore, the assessment was concentrated on the patient level. It was possible to score the leading intensivist while discussing several patient plans of care to assess the IDRs by several intensivists at a time.

To satisfy the fourth criterion (“fosters an interdisciplinary approach”), quality indicators to assess different professions were included. The construction of this assessment instrument allowed enlargement for additional specialist consultants. The fifth criterion (“describes each quality indicator in terms of observable behavior”) was processed in the description of the quality indicators. Observable behaviors were defined as observable, nontechnical behaviors that contributed to performance within the work environment. To evaluate the sixth criterion (“capable of measuring the effectiveness of different aims and approaches of the IDR in the ICU”), the instrument was tested in 3 ICUs for adults in 2 different hospitals that used different procedures for IDRs; all indicators could be unambiguously

Table 1 Criteria for assessment instruments identified in a literature search

1. Measures both the patient plan of care (technical performance) and team processes [18]
2. Based on literature review and associated with improved outcomes [22]
3. Capable of measuring multiple patients with multiple conditions [8]
4. Fosters an interdisciplinary approach [8]
5. Describes each quality indicator in terms of observable behavior [17]
6. Capable of measuring the effectiveness of different aims and approaches of the IDR in the ICU [21]
7. Capable of measuring interventions for improvement related to the IDR (before and after test) [18]
8. Indicators are statistically tested [22]

References for each criterion are noted.

Table 2 Application of the interdisciplinary round assessment scale in clinical scenarios in 3 intensive care units

	ICU 1 (medical ICU) 46 patients, 5 rounds, 5 intensivists	ICU 2 (surgical ICU) 23 patients, 3 rounds, 3 intensivists	ICU 3 (general ICU) 29 patients, 14 rounds, 6 intensivists
	n (%)	n (%)	n (%)
Patient plan of care			
1. Main problem discussed	24 (52)	17 (74)	29 (100)
2. Diagnostic plan discussed	31 (67)	22 (96)	29 (100)
3. The (provisional) goal formulated	18 (39)	18 (78)	29 (100)
4. Long-term interventions (≥ 16 h) discussed	16 (35)	8 (35)	7 (24)
5. Patient greatest risk discussed	23 (50)	5 (22)	22 (75)
6. Secondary problems discussed	44 (96)	22 (96)	25 (86)
7. Plan of care for secondary problems discussed	36 (78)	22 (96)	23 (79)
8. Short-term (<16 h) interventions discussed	45 (98)	22 (96)	28 (97)
Process			
9. Expectations made clear by consultants	41 (89)	23 (100)	27 (93)
10. Input of junior physicians encouraged	19 (41)	16 (70)	21 (72)
11. Are there questions for junior physicians?	29 (63)	15 (65)	22 (76)
12. Junior physician asks for advice/information	4 (9)	3 (13)	2 (7)
13. Leader checks whether junior physician knows what to do according to patient plan of care	1 (2)	3 (13)	4 (14)
14. Input of nurses encouraged	39 (85)	23 (100)	22 (76)
15. Are there questions for nurse?	42 (91)	23 (100)	23 (79)
16. ICU nurse acts proactively and assertively about patient plan of care	31 (67)	12 (52)	4 (14)
17. Leader checks whether the nurse knows what to do according to patient plan of care	31 (67)	12 (52)	4 (14)
18. Summary given	16 (35)	15 (65)	26 (90)
19. It is clear who is responsible for performing tasks	10 (22)	2 (9)	14 (48)

The sum of ICU 1, 2, and 3 is 98 patient presentations. Interdisciplinary Rounds Assessment Scale: each item was answered with 1 (no), 2 (doubt), or 3 (yes). Some indicators had the “not applicable option”; however, this did not apply to scale items 1, 3, 18, and 19. Data are reported as “number (%) of the yes-rating” (responses of no, doubt, and not applicable are not shown). Essential indicators revealed by factor analysis are in bold text.

rated. To satisfy the seventh criterion (“capable of measuring interventions for improvement related to the IDR [before and after test]”), an intervention was conducted with before and after measurement. This nonrandomized intervention study measured control and intervention groups after a leadership training with this instrument and was reported in detail elsewhere [28]. Statistical testing was applied to satisfy the eighth criterion.

2.3. Delphi rounds

To develop quality indicators for assessing IDRs, Delphi rounds were organized, which consisted of 2 intensivists, 2 psychologists, 1 ICU manager, 2 ICU nurses, and the first author (ETH). Delphi rounds have been used in initial research about topics with little or no previous research, may help build a theoretical foundation for the issue being studied, and may provide the details for developing instruments [18].

During the Delphi rounds, 10 patient presentations were carefully analyzed that were videotaped during IDRs led by different intensivists in 2 ICUs for adults in a university medical center. Appropriate and inappropriate behaviors were highlighted. These findings were compared with

previous literature search in which attributes and key behaviors were extracted if the text provided empirical information on improved outcomes to patients or ICU professionals, which were related to or able to be applied to an IDR in the ICU [8,10–12]. These attributes and key behaviors were already described in the Introduction section.

Synthesis of this review showed 4 common themes: technical performance (including goals), communication with caregivers in different disciplines, coordination of the different disciplines, and the division into essential and supporting indicators. Further analysis identified descriptive elements for each indicator. During 3 consecutive sessions, indicators and their descriptive elements were revised during the analysis of the 10 different videotaped presentations and prepared for use in the IDR Assessment Scale instrument.

2.4. The application of the instrument

To test the application of the IDR Assessment Scale, this instrument was applied to 98 videotaped patient presentations during 22 IDRs in 3 ICUs for adults, led by 14 different intensivists during June 2009 and December 2010. Two ICUs (1 medical and 1 surgical) were located in a university medical center for intensive care and had combined

approximately 1500 patients admitted per year. The other general ICU, located in a university-affiliated teaching hospital, had approximately 600 patients admitted per year. In both hospitals, daily IDRs were organized separate from morning rounds and reports at changes of shifts. During these IDRs, the intensivists led the sessions; junior physicians gave clinical patient presentations; and bedside nurses and consultants gave additional relevant and current information.

In all 3 ICUs, IDRs started at 11 AM. Before the IDR started, the video camera was placed in the corner of the meeting room to enable rating of all participants. At the end of the IDR, the video camera was removed. One of the raters stayed during the IDR in the same meeting room to rate the performance of each participant. The planning of videotaping the IDRs was tailored to the shifts of the leading intensivists to enable the rating of different participants.

All participants gave formal approval for the videotaping of IDRs. The Medical Ethical Testing Committee of the University of Groningen waived institutional research board approval for videotaping IDRs in the ICUs.

The usability and face validity of the instrument were examined by determining the amount of training time necessary to instruct another intensivist and ICU nurse about the appropriate use of the instrument. Both ICU professionals volunteered for this study. An instrument manual was prepared, and it was explained to the intensivist and nurse by trainers with both a communication and medical background; 1 videotaped patient presentation was rated to check whether definitions were applied uniformly. Then, another 2 patient presentations were randomly selected and rated separately. The results were compared, and the training was defined as adequate when κ is greater than 70%. The amount of training time necessary to instruct another intensivist and ICU nurse to use this instrument adequately was approximately 1.5 hours.

2.5. Statistical analysis

Of the 108 videotaped patient presentations, 10 patient presentations were used during the Delphi rounds to determine the quality indicators and were excluded from further statistical analysis. Of the remaining 98 patient presentations, 9 randomly selected videotaped patient presentations were used to test the interrater reliability of the quality indicators by 3 raters. These 3 raters included 1 intensivist, 1 ICU nurse, and 1 author (ETH). An online multirater Cohen κ calculator was used to assess outcomes per quality indicator for the 3 raters of each patient presentation [24]. Adequate interrater agreement was defined by κ of 0.70 or higher [25,26]. Because the interrater agreement was more than adequate, the remaining 89 patient presentations were further tested by 1 of these 3 raters. To diminish bias due to the fact that the developed methods created a shared understanding, another 26 of the in total 98 patient presentations were corroborated by an additional independent nonmedical rater.

The intraclass correlation was examined by measuring the average score correlation between pairs of raters (1 intensivist [rater 1], 1 author [ETH, rater 2], and 1 ICU nurse [rater 3]). Pearson correlation coefficients (r) were determined.

Internal consistency was measured for 98 videotaped patient presentations with Cronbach α . Internal consistency ranged from 0 to 1. Acceptable reliability was defined by $\alpha = .6$ to $.7$, and good reliability was defined by $\alpha \geq .8$ [25].

A confirmatory factor analysis was conducted on the indicators using principal components extraction with varimax rotation to confirm the subdividing into essential and supportive indicators by the Delphi rounds [27]. As a criterion, a cutoff point of 0.6 was used for indicators in the rotated factor loading matrix.

The application of the instrument was tested by measuring the presence of quality indicators during IDRs in 3 ICUs.

3. Results

3.1. Interdisciplinary round assessment scale

To assess the quality of the IDRs, the IDR Assessment Scale was constructed with 19 quality indicators that were based on literature review and Delphi rounds (Table 2). The scale was subdivided into the 2 domains: "patient plan of care" and "process." The first domain included 8 quality indicators, and the main and secondary problems were distinguished by Delphi rounds. The ICU patient may have multiple secondary problems, so it was deemed relevant to assess whether the discussion about secondary problems does not adversely affect the discussion of the main problem. Of these 8 indicators, 5 were qualified as essential indicators by both Delphi rounds and factor analysis (Table 2).

The "process" domain had 11 quality indicators, including 3 that were added by Delphi rounds. The indicator "junior physician asks for advice" was added because IDRs may be important learning opportunities. The indicator "ICU nurse acts proactively and assertively" was added because the nurse's performance was important in influencing the discussion of the patient plan of care. The indicator "summary given" was necessary because of the complexity of the discussed plans of care. Of these 11 indicators, another 5 were qualified as essential indicators by both Delphi rounds and factor analysis (Table 2). The assessment of leadership behavior was included implicitly and not as a separate item because leadership behavior may be important to interdisciplinary teams in providing coordinated and safe patient care.

All 19 quality indicators were described in terms of observable behavior that was explained in the manual, which was necessary for use of this assessment instrument.

The raters qualified their observations with the definition of the quality indicator using a 3-point scale indicating whether the behavior occurred during each individual patient presentation [29]:

1. No. The behavior was not observed.
2. Doubt/inconsistent. Verbalizations or behaviors were inconsistent with the quality indicator.
3. Yes. The behavior was clearly observed and consistent with the quality indicator.

Some items had a “not applicable” option if the indicator could not be rated. For an optimally executed IDR, all 10 essential indicators were rated with “yes” or “not applicable” (Table 2).

3.2. Application of the instrument

Applying the IDR Assessment Scale to 98 ICU patient presentations showed that the frequency of discussing the main problem, diagnostic plan, and (provisional) goal differed per ICU (Table 2). The quality indicators as the expectations by the consultant were made clear and input of nurses was encouraged were often affirmatively rated in most IDRs in all 3 ICUs. The quality indicators such as long-term intervention discussed, it is clear who is responsible for performing tasks, and indicators about the junior physicians were less discussed. All indicators could be unambiguously rated.

3.3. Statistical analysis

The interrater reliability of the IDR Assessment Scale among the 3 raters showed adequate agreement ($\kappa = 0.85$). The interrater reliability among the fourth rater who rated at random 26 of the 98 patient presentations also showed adequate agreement ($\kappa = 0.82$). The variable number of raters did not affect the interrater values.

Intraclass correlation coefficient (0.72) showed fair reproducibility between the observers. The overall item score correlations between 3 raters were excellent. There was a significant correlation between rater 1 (intensivist) and rater 2 (first author) ($r = 0.83$; $P < .0001$), rater 1 (intensivist) and rater 3 (ICU nurse) ($r = 0.8$; $P < .000$), and rater 2 (first author) and rater 3 (ICU nurse) ($r = 0.94$; $P < .0001$). Internal consistency was acceptable ($\alpha = .78$).

Factor analysis confirmed the solution by the Delphi rounds of the essential indicators within the first domain on a cutoff point of 0.6 for indicators in the rotated factor loading matrix (Table 3). The instrument demonstrated face validity.

4. Discussion

Interdisciplinary rounds are important to support quality improvement in patient care. However, IDRs are time and cost consuming, and no instrument is available in previous research to assess their quality. The present study describes the development and application of an IDR Assessment Scale with 19 quality indicators, subdivided in 10 essential and 9 supportive indicators and in 2 domains (“patient plan of care” and “process”), important to assess the quality of an IDR.

Our assessment instrument provides feedback on the process and aim of the IDRs, namely, to increase the quality of patient care by sharing information, addressing patient problems, and planning and evaluating treatment. Furthermore, the evaluation of this feedback may depend on the IDR goals as determined by the ICU staff.

Our study with videotaped patient presentations focused on observable behavior during the IDRs, in contrast with other studies that had been predominantly done with self-report surveys. A strength of the use of an assessment instrument is the identification of issues that are not immediately obvious to participating ICU staff. Issues such as “goal formulated,” “summary given,” or “clarity in coordination” may not be easily detected by self-report studies. A second strength of the IDR Assessment Scale is that it integrates both technical performance (“patient plan of care” domain) and the communication and coordination aspects (“process” domain), whereas previous studies considered these domains separately. Finally, this assessment scale may evaluate the use of checklists aimed to structure the IDRs because if these checklists contained elements that pose risks or that exclude important elements, they may be neither effective nor efficient at improving patient care [30].

Limitations of the present study include the absence of any assessment of the scores for predictive value for any type of patient outcomes, such as length of stay or prevalence of catheter related bloodstream infections. A second limitation includes the awareness of being videotaped, and this may have affected the discourse in IDR that was being evaluated.

Table 3 Factor analysis results: essential indicators for which criteria with a rating of “Yes” would be expected

Criteria	First domain of the factor analysis (factor loadings)
1. Main problem discussed	0.917
2. Diagnostic plan discussed	0.897
3. Provisional goal formulated	0.897
4. Long-term therapeutic items (≥ 16 h) discussed	0.797
5. Patient greatest risk discussed	0.668
9. Expectations made clear by consultants	0.762
10. Input of junior physicians encouraged	0.710
14. Input of nurses encouraged	0.732
18. Summary given	0.867
19. It is clear who is responsible for performing tasks	0.710

Comprised by the first domain of the factor analysis from the IDR Assessment Scale.

A second limitation includes the awareness of being videotaped, and this may have affected the discourse in IDR that was being evaluated. However, participants were strictly informed about the purpose of this rating, and their videotaped IDRs were not used for demonstration of any behavior. Participants declared, in personal communication with the author, to forget being videotaped after 1 patient presentation.

Furthermore, we studied only 3 ICUs in 2 hospitals in the same region in The Netherlands, and this may have limited the ability to generalize the present findings. Further testing of the general applicability of the IDR Assessment Scale is necessary because there may be relevant structural differences between ICUs, such as staffing level and open vs closed unit type, units with teaching obligations, and rounds being held in crowded hallways or quiet rooms. The sometimes suboptimal circumstances, in which IDRs can take place, may generate more difficulties in observing behaviors. However, the construction of the IDR Assessment Scale on the patient level may limit the differences in which ICUs evaluate IDRs.

In general, ICU staff's aim for daily optimal quality of care and daily IDR is regarded to be helpful in this process. Indeed, the association between quality of communication and patient outcomes is repeatedly demonstrated by retrospective analyses of incidents and adverse event reports [4]; although the attention of clinicians is claimed by medical choices in diagnostics and therapeutic strategies, other aspects such as determination of short- and long-term goals in care and coordination of activities should also be well run. Attention to the communication process is easily confused with friendliness instead of ensuring that the choices that are made are applied appropriately and uniformly. Therefore, in our point of view, it is relevant to evaluate the quality of IDRs regularly with a quantitative instrument. All 3 ICUs that were rated in this study had considered their IDRs to be adequately performed, and they were surprised by our study results (Table 2).

For example, Table 2 revealed higher scores in ICU 1 and ICU 2 than ICU 3 on secondary problems, short-term interventions, and encouraging input of nurses. At the same time, the main problem, developing explicit patient goals and long-term interventions, was less discussed. The finding that all 3 ICUs rated low on the indicator "It is clear who is responsible for performing tasks" (Table 2) was not surprising to some leading intensivists. They had experienced that appointments made during IDRs frequently needed confirmation or extra explanation to junior physicians and ICU nurses because of different interpretations, and they planned ward rounds immediately after the IDRs. This is an ineffective, inefficient way of discussing daily patient care. Therefore, we feel that our developed instrument may be helpful in improving quality and efficiency of IDR.

The use of the instrument in the ICU includes 2 levels, including the rating of the 10 essential quality indicators or

all 19 indicators that assess both the essential and the supportive indicators. The rating of the essential indicators is appropriate for real-time assessment. To rate all indicators, we feel that it is necessary to use videotaped IDRs. These tapes are helpful in the process of evaluation and feedback.

The IDR Assessment Scale has the benefit of being simple, it is derived from daily practice, and it is easily applicable. However, as with other outcomes scales, there is a trade-off between providing a full description and making the scale simple enough for practical use. Future studies may (1) enable expansion of the scale for predictive value for outcomes such as staff satisfaction, patient and family satisfaction, and clinical outcome; (2) test the IDR Assessment Scale in other ICUs to establish general applicability; and (3) enable expansion of the scale for measuring improvement of the performed IDR after interventions.

In conclusion, this study showed that the quality of IDRs can be reliably assessed for patient plan of care and process. The IDR Assessment Scale had satisfactory interrater reliability, excellent overall item score correlations, and acceptable internal consistency. Our instrument may provide feedback for ICU professionals and managers to develop adjustments in quality of care. Testing the IDR Assessment Scale in other ICUs may be required to establish general applicability.

Acknowledgments

The authors thank all ICU providers who consented to being videotaped for this study. We thank DJ Kleijer for his valuable participation in the Delphi rounds. We thank HEP Bosveld for performing the statistical analysis and RL Brand and Mrs HT Kolkert-Kraanen for rating videotapes.

References

- [1] Manias E, Street A. Nurse-doctor interactions during critical care ward rounds. *J Clin Nurs* 2001;10:442-50.
- [2] Curtis JR, Cook DJ, Wall RJ, et al. Intensive care unit quality improvement: a "how-to" guide for the interdisciplinary team. *Crit Care Med* 2006;34:211-8.
- [3] Azoulay E, Timsit JF, Sprung CL, et al. Prevalence and factors of intensive care unit conflicts: the conflictus study. *Am J Respir Crit Care Med* 2009;180:853-60.
- [4] Salas E, Almeida SA, Salisbury M, et al. What are the critical success factors for team training in health care? *Jt Comm J Qual Patient Saf* 2009;35:398-405.
- [5] Reader T, Flin R, Lauche K, et al. Non-technical skills in the intensive care unit. *Br J Anaesth* 2006;96:551-9.
- [6] Collins SA, Currie LM. Interdisciplinary communication in the ICU. *Stud Health Technol Inform* 2009;146:362-6.
- [7] Ellrodt G, Glasener R, Cadorette B, et al. Multidisciplinary rounds (MDR): an implementation system for sustained improvement in the American Heart Association's Get With The Guidelines program. *Crit Pathw Cardiol* 2007;6:106-16.

- [8] Pronovost P, Berenholtz S, Dorman T, et al. Improving communication in the ICU using daily goals. *J Crit Care* 2003;18:71-5.
- [9] Dodek PM, Raboud J. Explicit approach to rounds in an ICU improves communication and satisfaction of providers. *Intensive Care Med* 2003;29:1584-8.
- [10] Jain AK, Thompson JM, Chaudry J, et al. High-performance teams for current and future physician leaders: an introduction. *J Surg Educ* 2008;65:145-50.
- [11] Stockwell DC, Slonim AD, Pollack MM. Physician team management affects goal achievement in the intensive care unit. *Pediatr Crit Care Med* 2007;8:540-5.
- [12] Miller A, Scheinkestel C, Joseph M, et al. Coordination and continuity of intensive care unit patient care. *Hum Factors* 2009;51:354-67.
- [13] Reader TW, Flin R, Mearns K, et al. Developing a team performance framework for the intensive care unit. *Crit Care Med* 2009;37:1787-93.
- [14] Pronovost PJ, Berenholtz SM, Needham DM. A framework for health care organizations to develop and evaluate a safety scorecard. *JAMA* 2007;298:2063-5.
- [15] Winters BD, Gurses AP, Lehmann H, et al. Clinical review: checklists —translating evidence into practice. *Crit Care* 2009;13:210.
- [16] Simpson SQ, Peterson DA, O'Brien-Ladner AR. Development and implementation of an ICU quality improvement checklist. *AACN Adv Crit Care* 2007;18:183-9.
- [17] Catchpole KR, de Leval MR, McEwan A, et al. Patient handover from surgery to intensive care: using Formula 1 pit-stop and aviation models to improve safety and quality. *Paediatr Anaesth* 2007;17:470-8.
- [18] Thomas EJ, Sexton JB, Helmreich RL. Translating teamwork behaviours from aviation to healthcare: development of behavioural markers for neonatal resuscitation. *Qual Saf Health Care* 2004;13(Suppl 1): i57-64.
- [19] Garland A. Improving the ICU: part 2. *Chest* 2005;127:2165-79.
- [20] Miller A, Scheinkestel C, Limpus A, et al. Uni- and interdisciplinary effects on round and handover content in intensive care units. *Hum Factors* 2009;51:339-53.
- [21] Shortell SM, Zimmerman JE, Rousseau DM, et al. The performance of intensive care units: does good management make a difference? *Med Care* 1994;32:508-25.
- [22] Pronovost PJ, Goeschel CA, Marsteller JA, et al. Framework for patient safety research and improvement. *Circulation* 2009;119:330-7.
- [23] Pronovost PJ, Berenholtz SM, Ngo K, et al. Developing and pilot testing quality indicators in the intensive care unit. *J Crit Care* 2003;18: 145-55.
- [24] Randolph JJ. Online Kappa Calculator. <http://justusrandolph.net/kappa>. Accessed December 2011.
- [25] Hawthorne G, Richardson J, Osborne R. The Assessment of Quality of Life (AQoL) instrument: a psychometric measure of health-related quality of life. *Qual Life Res* 1999;8:209-24.
- [26] Randolph JJ. Free-marginal multirater kappa: An alternative to Fleiss' fixed-marginal multirater kappa. Joensuu University Learning and Instruction Symposium 2005. ERIC Document Reproduction Service No. ED490661. 14-10-2005.
- [27] Le Blanc PM, Schaufeli WB, Salanova M, et al. Efficacy beliefs predict collaborative practice among intensive care unit nurses. *J Adv Nurs* 2010;66:583-94.
- [28] Ten Have ECM, Nap RE, Tulleken JE. Leadership training and quality improvement of interdisciplinary rounds in the intensive care unit. Submitted for publication.
- [29] Malec JF, Torsher LC, Dunn WF, et al. The mayo high performance teamwork scale: reliability and validity for evaluating key crew resource management skills. *Simul Healthc* 2007;2:4-10.
- [30] Winters BD, Gurses AP, Lehmann H, et al. Clinical review: checklists—translating evidence into practice. *Crit Care* 2009;13:210.