

Paper I

Perceived decisional responsibility for mechanical ventilation and weaning: a Norwegian survey

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ABSTRACT

Aim: To explore variability in perceptions of nurse managers and physician directors regarding roles, responsibilities and clinical-decision making related to mechanical ventilator weaning in Norwegian intensive care units (ICUs).

Background: Effective teamwork is crucial for providing optimal patient care in ICU. More knowledge on nurses' and physicians' perceptions of responsibility in clinical decision-making for mechanical ventilation is needed.

Methods: Self-administered survey of mechanical ventilation and weaning responsibilities was sent to nurse managers and physician directors of Norwegian adult ICUs. Nurses' decisional influence and autonomy were estimated on a numeric rating scale (NRS) from 0 to 10 (least to most).

Results: Response rate was 38/60 (63%) nurses and 38/52 (73%) physicians. On the NRS nurse managers perceived the autonomy and influence of nurses' ventilator decisions higher than physician directors: median of 7 (IQR 5–8) (nurses) versus 5 (3–6) (physicians), ($p < 0.01$), and 8 (7–9) (nurses) versus 7 (5–8) (physicians), ($p < 0.01$) respectively. Respondents agreed that nurses collaborated in assessment of patient response to ventilator changes and titrating ventilator settings: 92% of nurses and 87% of physicians, ($p = 0.46$), and recognizing weaning failure 84% of nurses and 84% of physicians, ($p = 0.96$). Physician directors perceived significantly less collaborative decision-making on weaning method ($p = 0.01$), weaning readiness ($p = 0.04$) and readiness to extubate ($p < 0.01$) than nurse managers. Both groups acknowledged the importance of 'knowing the patient' for weaning success, and agreed that the assessment of work of breathing, well-being, and clinical deterioration were important for determining weaning tolerance.

Conclusions: Nurse managers perceived nurses to have greater autonomy, influence and collaborative interaction regarding decisions on mechanical ventilation than physician directors. Greater awareness and acknowledgment of nurses' role may promote interprofessional collaboration and improve patient care.

Key words: Critical care • Mechanical ventilation • Nursing • Role of health care professionals • Weaning from mechanical ventilation

INTRODUCTION

Surveys have demonstrated variable practice in management of mechanical ventilation in intensive care units (ICUs). Critically ill patients need consistent

and evidence-based treatment and care. In order to improve practice in Norwegian ICUs, we needed baseline information on role responsibilities among nurses and physicians. This article presents data from a survey exploring nurse managers' and physician directors' perceptions of responsibility in clinical decision-making for mechanical ventilation and weaning.

BACKGROUND

Effective teamwork among nurses and physicians is crucial for providing optimal patient care in the ICU (Reader *et al.*, 2009) and might improve patient outcome (Martin *et al.*, 2010). The concept of collaboration can be defined by five underlying concepts: sharing, partnership, power, interdependency and process (D'Amour *et al.*, 2005). A recent European survey of 586 ICUs in eight countries found that interprofessional

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collaboration was the predominant model for decisions about mechanical ventilation and weaning (Rose *et al.*, 2011). A European survey of decisions related to sedation of mechanically ventilated patients in 22 countries demonstrated nurse-physician collaboration in 76% of nurse respondents (Egerod *et al.*, 2013). Studies, however, show that perceptions of nurse-physician collaboration are variable (Reeves and Lewin, 2004; Martin *et al.*, 2010; Reeves *et al.*, 2013). One study found that when nurses perceived collaboration as inadequate, the physicians were satisfied with the level of collaboration (Nathanson *et al.*, 2011).

Nurses and physicians may perceive the concept of collaboration differently; as equal or subordinate team-players respectively. A retrospective study of ventilator decision making demonstrated that Norwegian ICU nurses often initiated weaning without physicians' orders and disregarded orders if they considered them detrimental to the patient (Hansen *et al.*, 2008). A related study on the same population found that the weaning process was dependent on the individual nurses and physicians on duty (Hansen and Severinsson, 2009). A similar observation was reported in a Danish study of nurse decisions and interventions related to mechanical ventilator weaning (Egerod, 2003). Norwegian ICUs are managed predominantly by anaesthesiologists. An 18-month postgraduate ICU-nursing certification programme is offered at universities and university colleges. The number of ICU beds is approximately five to six per 100 000 inhabitants (Strand *et al.*, 2010). Most small non-university hospitals in Norway have combined medical surgical ICUs. In 2009, 15 459 patients received ICU care with a mean length of stay of 4.4 days, mean SAPS II score 35.8, ICU mortality 12.3%, and hospital mortality 18.5%. The average duration of ventilation was 4.4 days (Norwegian Intensive Care Registry, 2010).

The aim of our survey was to compare perceptions of nurse managers and physician directors regarding roles, responsibilities and clinical-decision making related to mechanical ventilator weaning in Norwegian ICUs. Secondary aims included analysis of nurses' and physicians' narrative responses regarding nurse autonomy and clinical influence and exploration of the association of patient experience of work of breathing (WOB), well-being and clinical worsening in relation to nurses' knowledge of the patient. We hypothesized that: (i) perceptions would vary between nurses and physicians regarding nurse responsibilities related to mechanical ventilation; (ii) successful weaning would be dependent on 'knowing the patient'; and (iii) successful weaning would be associated with assessment of WOB, well-being, and clinical deterioration.

METHODS

Study design and sampling frame

This study was part of a European survey of nurses' perceptions of decisional responsibility for mechanical ventilation and weaning conducted in 2009 (Rose *et al.*, 2011). In addition to adapting the questionnaire to the Norwegian context and distributing to nurse managers, we sent the same questionnaire, with the omission of questions on ICU organizational data, to physician directors at the same units. We included all Norwegian ICUs providing mechanical ventilation to critically ill adults ($n = 60$) identified through the Norwegian Directorate of Health and validated against the Norwegian Intensive Care Registry (NIR).

Study participants

We invited 60 nurse managers and 52 physician directors of adult ICUs in November 2009 to participate. More nurses than physicians were eligible to participate as some hospitals with multiple ICUs had only one physician director. Respondents were encouraged to discuss the survey with bedside staff to obtain the most accurate information on mechanical ventilation and weaning management in their unit. Paediatric and neonatal ICUs or units not routinely providing mechanical ventilation such as coronary care and high dependency units were excluded.

Survey development and testing

The questionnaire, originally used in Australia and New Zealand (Rose *et al.*, 2008) and further refined in the European survey (Rose *et al.*, 2011), was contextually adapted to the Norwegian setting (ICU demographics and staffing) based on input from senior nurses and physicians. The adapted questionnaire was forward and back translated into Norwegian by the authors and inconsistencies in the two English versions (initial version and back-translated) were resolved.

The original questionnaire included: (1) professional responsibility for six key ventilator decisions; (2) frequency of 10 ventilation decisions implemented independently by nurses; and (3) nurses' autonomy and influence in decisions regarding ventilation practices. Further details are explained elsewhere (Rose *et al.*, 2008). On the basis of expert feedback and current literature, we added five questions regarding clinical judgment in relation to knowing the patient (Crocker and Scholes, 2009), increased WOB (Frutos-Vivar *et al.*, 2011), well-being (Beeby, 2000) and clinical deterioration (Caroleo *et al.*, 2007). We defined clinical judgment as: interpretation of patient need and the decision to take action, use or modify standard approaches, or to improvise new ones as deemed

appropriate by the patient response (Tanner, 2006). According to Tanner *et al.* (1993), 'knowing the patient' implies both knowing the patient's typical pattern of responses and knowing the patient as a person (Tanner *et al.*, 1993). The term well-being was added because discomfort and anxiety influence patient responses to therapies, and patients' level of comfort and well-being are critical indicators in most clinical judgments (Coyer *et al.*, 2007; Benner *et al.*, 2011). We added the following five questions: (1) Is the nurse's knowledge of the patient important to predicting weaning success? (2) Is the physician's knowledge of the patient important to predicting weaning success? (3) Is the assessment of increased WOB [defined as respiratory rate >35 breaths/min and/or use of accessory respiratory muscles (Frutos-Vivar *et al.*, 2011)] important to predicting weaning success? (4) Is the assessment of patient well-being (health providers' perspective) important to predicting weaning success? (5) Is the assessment of patient deterioration important to predicting weaning success? Answers were recorded on a numeric rating scale (NRS) of 0–10, where 0 was unimportant and 10 was very important. In addition we provided a section for narrative responses or comments.

Prior to distribution, face validity was assessed by a panel of six experienced ICU nurses and physicians. Surveys were distributed via e-mail and returned to a secure collector maintained by Questback (<http://www.questback.com/>) in 2009. Two reminders to complete the survey were sent via e-mail at two week intervals from initial distribution.

Data analysis

Organizational characteristics such as hospital type, staffing ratio, and use of a weaning protocol were analysed using descriptive statistics. Owing to small numbers in the category nurse input alone we collapsed classification of professional responsibility to create a binary of interprofessional collaboration versus medical input alone. Comparisons of nurse manager and physician director responses were analysed using non-parametric Mann-Whitney *U*-tests and Fishers exact tests or χ^2 tests as appropriate. WOB, well-being and clinical worsening were correlated to nurse's knowledge of the patient and analysed using Spearman's rho. We considered a *p*-value of <0.05 as statistically significant. Analysis was performed using PASW Statistics 18.0 (SPSS 18.0).

To triangulate quantitative findings comments were analysed by deductive content analysis (Elo and Kynas, 2008) on the bases of five underlying concepts of collaboration; sharing, partnership, interdependency,

power and process (D'Amour *et al.*, 2005). Comments were analysed line by line to identify statements mirroring these concepts. We conducted a comparative analysis to assess if certain concepts were more apparent in nurse manager responses compared with physician directors. Further, statements were analysed in terms of hospital type and use of a weaning protocol.

Ethical considerations

Approval was obtained from The Regional Committee for Medical Research Ethics (REK – 2009/840-6). Return of a completed questionnaire was considered indicative of consent. Participants were advised that survey completion was voluntary. To maintain anonymity, no ICU or participant identifiers were collected.

RESULTS

Response rates and unit characteristics

We received responses from 38/60 (63%) nurse managers and 38/52 (73%) physician directors. Responses were from community hospitals (72%) and university hospitals (28%). The nurse-patient ratio was 1:1 for intubated patients at 34/37 (92%) ICUs and for patients receiving non-invasive ventilation (NIV) at 25/36 (69%) ICUs. 5/11 (46%) university hospital ICUs and 16/27 (59%) community hospital ICUs used a weaning protocol. Education on mechanical ventilation was provided to nurses during ICU orientation for new employees at 35/38 (92%) ICUs.

Roles and responsibilities for mechanical ventilation and weaning

Nurse managers rated the autonomy and influence of nurses significantly higher than did physician directors. On a scale of 0–10, nurse autonomy was rated as median of 7 (IQR 5–8) by nurse managers and 5 (3–6) by physician directors ($p < 0.01$). Nurse influence was rated as 8 (7–9) versus 7 (5–8) ($p < 0.01$). There was no association between perceived nurse autonomy and influence and the use of a weaning protocol ($p > 0.29$).

Nurse managers and physician directors agreed that nurses and physicians collaborated on assessment of patient response to ventilator changes: 35 (92%) versus 33 (87%) ($p = 0.46$) and nurses were able to reliably recognize weaning failure: 31 (84%) versus 32 (84%), ($p = 0.96$). Significantly more nurse managers than physician directors perceived nurses collaborated with physicians on recognizing weaning readiness: 31 (82%) versus 23 (61%), ($p = 0.04$), choosing the weaning method 26 (70%) versus 16 (42%), ($p = 0.01$),

and recognizing extubation readiness 25 (68%) versus 11 (29%), ($p < 0.01$). Managers and physician directors agreed that nurses did not participate in selection of initial ventilator settings 13 (34%) versus 7 (18%), $p = 0.12$, (Table 1). There was agreement on the type of ventilator changes made by nurses without consulting the physician (Figure 1). Titration of FiO_2 was perceived by both groups as the most frequent decision made independently by nurses.

Clinical judgment for determining weaning tolerance

Nurses and physicians alike acknowledged the importance of 'knowing the patient' to determine weaning tolerance (Table 2). They also agreed that clinical judgment comprising assessment of WOB, well-being, and clinical worsening were helpful determinants of weaning tolerance. Nurse managers perceived knowing the patient as important for assessment of WOB ($p = 0.01$), well-being ($p = 0.01$) and clinical deterioration ($p = 0.02$), whereas physician directors perceived knowing the patients was only important for assessment of WOB ($p < 0.05$) (Table 3).

Narrative responses on nurse autonomy and influence

Nurse managers and physician directors each contributed 16 narrative responses regarding nurse autonomy and influence. We identified five subcategories of collaboration: sharing, partnership, power, interdependency and process. Power among team members regarding competency and experience were the most frequent issues reported (Table 4). Organizational factors as hospital type and weaning protocol do not

explain how autonomy and influence are perceived. Both nurses and physicians link autonomy and influence to competency and experience and describe the nurse autonomy within defined limits. However these limits are not necessarily associated to a weaning protocol. Physicians linked nurse autonomy with the underlying theme 'Process' acknowledging the importance of nurse assessment as the basis for decision-making. Interdependency implied mutual dependence as 'Nurses often provide additional information of importance for decisions about extubation, reintubation etc'. [quote by physician]. Interdependency was linked to patient comfort and the need for close collaboration in decisions regarding ventilator settings.

DISCUSSION

The aim of our study was to compare perceptions of nurse managers and physician directors regarding roles, responsibilities and clinical-decision making related to mechanical ventilator weaning in Norwegian ICUs. To the best of our knowledge, this is the first survey describing interprofessional role responsibility for mechanical ventilation in Norway, including both nurses and physicians. Increased knowledge of decisional responsibility may promote interprofessional collaboration and improve patient care. Our main findings were that nurse managers perceived nurses to have greater autonomy, influence and collaborative interaction regarding decisions on mechanical ventilation than perceived by physician directors. The respondents agreed that nurses and physicians often collaborated on assessment of patient response, ventilator setting changes and recognizing weaning failure. Physician directors perceived nurses were less likely to contribute to decisions about recognizing weaning readiness, choosing the weaning method and recognizing extubation readiness. Nurses associated knowing the patient with better assessment of WOB, well-being and clinical deterioration, whereas physicians only linked knowing the patient to better assessment of WOB.

The larger European survey to which our survey contributed nurse manager data demonstrated that interprofessional collaboration varied according to types of decisions (Rose *et al.*, 2011). The study found that physicians were more likely to select the initial ventilator settings while nurses were more involved in the on-going titration of ventilator settings and assessment of extubation readiness. A potential bias in studies based on nurse responses alone is the risk of overestimating the role of nurses (Rose *et al.*, 2008; Jubran, 2012). We overcame this bias by also surveying physicians.

Table 1 Collaborative responsibility for ventilator decision-making

Domains of mechanical ventilator decisions	Nurses ($n = 38$)	Physicians ($n = 38$)	p -value
	n (%)	n (%)	
Evaluating patient response and titrate settings	35 (92)	33 (87)	0.46
Recognizing weaning failure	31 (84)	32 (84)	0.96
Recognizing weaning readiness	31 (82)	23 (61)	0.04*
Selection of weaning method	26 (70)	16 (42)	0.01*
Recognizing extubation readiness	25 (68)	11 (29)	<0.01*
Selecting initial ventilator settings	13 (34)	7 (18)	0.12

Table denotes proportion of respondents who perceived responsibility as collaborative as opposed to medical alone.

* $p < 0.05$ is considered significant.

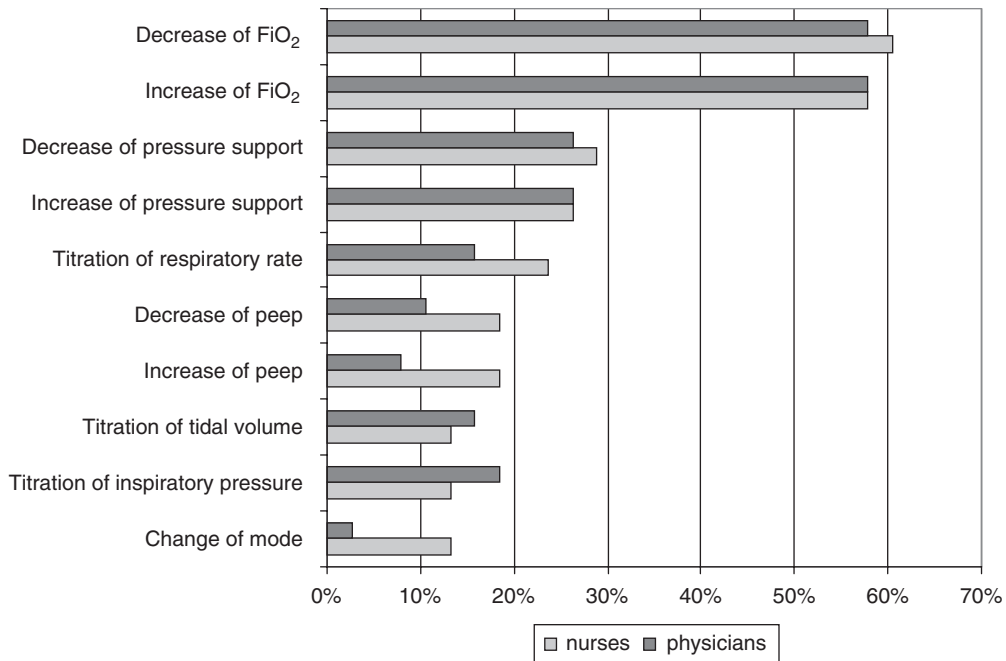


Figure 1 Titration of ventilator settings. Figure indicates proportion of nurses ($n = 38$) and physicians ($n = 38$) who identified that ventilator changes were made and implemented independently by nurses >50% of time.

Table 2 Importance of knowing the patient and clinical judgement on weaning

		Nurses median (IQR)	Physicians median (IQR)	p value*
Knowing the patient	Nurse knows the patient ($n = 76$)	9 (8–10)	8 (7–9)	0.15
	Physician knows the patient ($n = 76$)	8 (7–9)	8 (8–10)	0.11
Clinical judgment	Increased WOB ($n = 74$)	8 (7–9)	8 (7–9)	0.72
	Well-being ($n = 73$)	8 (6–9)	7 (5–8)	0.07
	Clinical worsening ($n = 73$)	9 (8–10)	9 (8–10)	0.25

Numeric rating scale 0–10 (low-high impact).

*Mann-Whitney U -test; $p < 0.05$ is considered significant.

Clinical decisions are difficult to identify because they are not always explicit. In a study of nurses' role in ventilator weaning, it was shown that clinical decisions were an act of continuous experimentation to determine the needs to the patient (Egerod, 2003). This attention to patient response has been described in other studies as 'following the lead of the patient' which combines following the body's lead, with patient preferences (Benner *et al.*, 2011). Following the patient's lead is an important nurse-patient interaction and a vital part of the process of weaning.

This study showed that about half of the Norwegian ICUs used weaning protocols, but there was no association between nurse autonomy and units using protocols. We found that many decisions were collaborative in the absence of protocols and that nurse input played an important role in management of ventilated patients. Some studies have recommended that weaning should be considered as early as possible in the patient trajectory, and that spontaneous breathing trials (SBTs) should be attempted to determine extubation readiness (Boles *et al.*, 2007). Several studies suggest that standardized protocolized approach may promote the weaning process (Blackwood *et al.*, 2010) and improve decision-making in difficult to wean patients (Teixeira *et al.*, 2012). Protocols might enable nurses to act more independently within the limits of the instrument, but may also limit autonomy attributed to the individual skill and experience of the nurse and the ICU culture of collaboration (Rose and Nelson, 2006).

In our study nurses and physicians disagreed on the nurses' role in determining weaning and extubation readiness. The decision of 'ready to extubate' is complex, as either delayed or failed extubation is associated with an increased duration of ventilation and higher mortality (Epstein, 2002). Some studies have shown that physicians might overlook patient readiness for extubation (Boles *et al.*, 2007). The narrative responses in our study, however, suggest that

Table 3 Nurses' and physicians' perceptions of the influence of 'nurse knowing the patient' on judgment of work of breathing, well-being and clinical worsening

	Work of breathing		Well-being		Clinical worsening	
	Nurse (n = 36)	Physician (n = 38)	Nurse (n = 35)	Physician (n = 38)	Nurse (n = 35)	Physician (n = 38)
Spearman's rho	0.412	0.325	0.423	0.208	0.389	0.264
p-value	0.01*	<0.05*	0.01*	0.21	0.02*	0.11

* $p < 0.05$ indicates significant difference.

Table 4 Deductive content analysis of statements concerning nursing autonomy and influence

Concept	Nurses	Physicians
Shared responsibility (5/4)*	At night, the nurses run the department, because the anaesthesiologists are on call. LH, non-WP	At our hospital we have both an anaesthesiologist in training and a senior anaesthesiologist on duty at the same time. Determination of ventilator settings and weaning are done by the physicians, but it naturally happens in close cooperation with the nurse at the patient's bedside who can evaluate treatment. LH, non-WP
Collaboration (4/9)*	Nurses are independent within defined limits related to each patient (this gives us the opportunity to titrate settings according to guidelines, if we understand what we are doing). LH, WP	ICU nurses contribute regularly in all intensive care treatment decisions. Procedures are continuously evaluated. LH, WP
Interdependency (3/5)*	Nurses adjust pressure and oxygen levels according to predetermined values and patient response. LH, WP	Nurses often provide additional information of importance for decisions about extubation, reintubation etc. UH, WP
Power (9/10)*	It depends on competency and experience. We do not always have patients on mechanical ventilation and for this reason, some of the nurses lack practice. LH, non-WP	Nurses' experience and feed-back always plays a role for the physician making decisions. LH, non-WP
Process (2/4)*	There are only ICU certified nurses at our department. We do not have a protocol to determine weaning readiness. Nurses work independently, but most decisions are made by the physician on duty. The decision-making process is collaborative. UH, non-WP	ICU nurses perform a number of assessments regarding ventilator settings and ventilator treatment, which are often the basis of physicians' decisions. All decisions are made by the physician. LH, WP

UH, university hospital; LH, local hospital; WP, weaning protocol.

*Number of times the underlying concept is expressed by nurse managers and physician directors respectively.

nurses are in a good position to detect early changes in patient response and recognize readiness to wean due to their continuous proximity to the patient.

Our study showed that both nurses and physicians agreed that 'knowing the patient' was an important aspect to determine the patient's ability to tolerate the weaning process. Knowing the patient has been considered an important basis for clinical judgment and responding to patients' symptoms in nursing in general (Tate *et al.*, 2012). In their seminal work on critical care nursing, Benner *et al.* (1996, 2011) described how expert nurses coached the patient through ventilator weaning by degrees of cheering, nudging and pushing, based on knowing the patient (Benner *et al.*, 2011). Other studies based on field observations suggested that knowing the patient was associated with expert nursing and complex decision-making in relation to ventilator weaning (Egerod, 2003; Haugdahl and Storli, 2012).

It is a noteworthy finding in our study that both nurse managers and physician directors espouse the significance of 'knowing the patient' although the patient is unable to communicate normally because of intubation, sedation, delirium and mechanical ventilation. A recent theory on the dynamics of the nurse-patient relationship from the patient perspective describes a feeling of genuinely being cared for and that becoming connected with a caring and competent nurse gave them (the patient) a sense of hope, and increased their sense of security, health and well-being (Halldorsdottir, 2008). The nurse-patient relationship is by many considered the core of nursing. Further exploration of ways to integrate patients into the health care team are needed as patients are the ultimate justification for providing collaborative care (D'Amour *et al.*, 2005).

Narrative data offered a deeper understanding of the varying views of nurse managers and physician

directors. Comments included important conditions for cooperation, as each statement could be linked to one or more of the underlying concepts of professional collaboration (D'Amour *et al.*, 2005). Educational and experiential differences might account for the uneven perceptions of roles and responsibilities of nurses and physicians, but the main issue is, perhaps, not about nursing autonomy. Benner *et al.* (1996) have suggested that interprofessional collaboration is characterized by a greater degree of interdependence than autonomy (Benner *et al.*, 1996). As stated by Benner *et al.* (1996) intensive care nursing has changed the way physicians make clinical judgments; critical therapies that need instant attention require nurses to work with guidelines rather than direct physician's orders and accordingly the disciplinary boundaries have blurred (Benner *et al.*, 1996). This is corroborated by findings in a recent survey of Norwegian ICUs where nurse-physician collaboration (85%) is well established; despite collaborative practice, the management of pain and sedation did not adhere to international recommendations (Wøien *et al.*, 2012). Further exploration of perceptions of collaboration among nurses and physicians are recommended for future research (Nair *et al.*, 2012).

LIMITATIONS

Our study has several limitations. First, senior nurse managers and physician directors might have different perceptions of clinical practice than bedside clinicians. Second, data were based on self-report and offered

only an estimate of practice. Third, we failed to link nurses and physicians from the same units in our efforts to ensure anonymity. However, we assume the respondents were representative as they were from all parts of the country.

CONCLUSIONS AND CLINICAL IMPLICATIONS

Our main findings were that nurse managers perceived nurses to have greater autonomy, influence and collaborative interaction regarding decisions on mechanical ventilation than perceived by physician directors. The varying perceptions of nurses and physicians on the role of intensive care nurses might impact practice; however professional boundaries in ICU are blurred by interdependence rather than autonomy of professional groups. Both nurses and physicians acknowledge the importance of knowing the patient and tailoring care to the individual. Increasing awareness and acknowledgment of nurse's role and ability may promote interprofessional collaboration and improve patient care.

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WHAT IS KNOWN ABOUT THIS TOPIC

- Effective teamwork among nurses and physicians is crucial for providing optimal patient care in the ICU.
- Perceptions of nurse-physician collaboration are variable.

WHAT THIS PAPER ADDS

- Nurse managers rate nurse autonomy and influence regarding ventilator related decisions higher, compared with physician directors.
- Both groups acknowledge the importance of knowing the patient to determine the patient's ability to tolerate the weaning process.
- Nurse managers and physical directors agree that the assessments of work of breathing, well-being and clinical worsening are important subcategories in clinical judgment for determining weaning tolerance.
- Increasing awareness and acknowledgment of the role of the nurse may promote interprofessional collaboration and improve patient care.

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