

# Supervision, Interprofessional Collaboration, and Patient Safety in Intensive Care Units during the COVID-19 Pandemic

Marije P. Hennis<sup>1</sup>, John Q. Young<sup>2</sup>, Martina Hennessy<sup>3</sup>, Karen A. Friedman<sup>2</sup>, Bas de Vries<sup>1</sup>, Reinier G. Hoff<sup>1</sup>, Enda O'Connor<sup>4</sup>, Aileen Patterson<sup>3</sup>, Gerard Curley<sup>5</sup>, Krma Thakker<sup>2</sup>, Marjel van Dam<sup>1</sup>, Diederik van Dijk<sup>1</sup>, Wilton A. van Klei<sup>1</sup>, and Olle ten Cate<sup>1</sup>

<sup>1</sup>University Medical Center Utrecht, Utrecht, the Netherlands; <sup>2</sup>Donald and Barbara Zucker School of Medicine at Hofstra/Northwell, New York, New York; <sup>3</sup>School of Medicine, Trinity College Dublin, Dublin, Ireland; <sup>4</sup>Department of Anesthesia and Critical Care, St. James's Hospital, Dublin, Ireland; and <sup>5</sup>Department of Anesthesia and Critical Care, Beaumont Hospital, Dublin, Ireland

ORCID IDs: 0000-0003-1508-0456 (M.P.H.); 0000-0003-2219-5657 (J.Q.Y.); 0000-0002-2153-5288 (M.H.); 0000-0003-1980-1839 (K.A.F.); 0000-0002-7432-7087 (R.G.H.); 0000-0003-4315-0917 (A.P.); 0000-0003-0271-195X (G.C.); 0000-0001-9802-7516 (M.v.D.); 0000-0002-3592-4671 (D.v.D.); 0000-0003-2665-1672 (W.A.v.K.); 0000-0002-6379-8780 (O.t.C.).

## ABSTRACT

**Background:** To meet coronavirus disease (COVID-19) demands in the spring of 2020, many intensive care (IC) units (ICUs) required help of redeployed personnel working outside their regular scope of practice, causing an expansion and change of staffing ratios.

**Objective:** How did this composite alternative ICU workforce experience supervision, interprofessional collaboration, and quality and safety of care under the unprecedented clinical circumstances at the height of the first pandemic wave as lived experiences uniquely captured during the first peak of the pandemic?

**Methods:** An international, cross-sectional survey was conducted among physicians, nurses, and allied personnel deployed or redeployed to ICUs in Utrecht, New York, and Dublin from April to May of 2020. Data were analyzed separately for the three sites. Quantitative data were treated for descriptive statistics; qualitative data were analyzed thematically and combined for general interpretations.

**Results:** On the basis of 234, 83, and 34 responses (response rates of 68%, 48%, and 41% in Utrecht, New York, and Dublin, respectively), we found that the amount of supervision and the quality and safety of care were perceived as being lower than usual

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but still acceptable. The working atmosphere was overwhelmingly felt to be collaborative and supportive. Where IC-certified nurse-to-patient ratios had decreased most (Utrecht), nurses voiced criticism about supervision and quality of care. Continuity within the work environment, team composition, and informal (“curbside”) consultations were critical mediators of success.

**Conclusion:** In the exceptional circumstances encountered during the COVID-19 pandemic, many ICUs were managed by a composite workforce of IC-certified and redeployed personnel. Although supervision is critical for safe care, supervisory roles were not clearly related to the amount of prior ICU experience. Vital for satisfaction with the quality of care was the span of control for those who assumed supervisory roles (i.e., the ratio of certified to noncertified personnel). Stable teams that matched less experienced personnel with more experienced personnel; a strong, interprofessional, collaborative atmosphere; a robust culture of informal consultation; and judicious, more flexible use of rules and regulations proved to be essential.

**Keywords:**

supervision; quality and safety of care; interprofessional collaboration; COVID-19; intensive care

The coronavirus disease (COVID-19) pandemic has affected populations differently across times and geographic locations. On May 10, 2020, the World Health Organization reported over 3.9 million cases and 274,000 deaths worldwide. On that day, the Netherlands, the United States, and Ireland reported 311, 244, and 304 deaths per million inhabitants, respectively, excluding

undocumented cases (1). These countries were among the many that had been forced to adapt healthcare systems rapidly in response to the pandemic in April. Major bottlenecks included shortages of intensive care (IC) unit (ICU) beds, materials, and qualified personnel (2, 3). Typically, qualification for practice requires proper licensing, specialty certification, and hospital credentialing or

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**Correspondence and requests for reprints should be addressed to** Marije P. Hennis, M.D., Ph.D., M.Sc., University Medical Center Utrecht, Post Office Box 85090, 3508 AB Utrecht, the Netherlands  
E-mail: m.p.hennis@umcutrecht.nl.

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participation in a relevant training program with sufficient supervision. In regions experiencing a surge of patients requiring hospitalization, and particularly ICU admission, the COVID-19 pandemic disrupted the usual criteria for the scope of practice (4, 5). Rules of permission and privileging to perform specialized medical and nursing tasks became malleable. Numerous healthcare workers, including primary care physicians, ambulatory center-based medical specialists (e.g., dermatologists, rheumatologists), surgeons, psychiatrists, pediatricians, pediatric IC nurses, retired healthcare workers, and final-year medical students graduating early, were mandated or volunteered themselves to care for patients in the ICUs (6, 7). ICUs can be dynamic, complex, and highly stressful work environments, where three features are critical for success: adequate supervision, interprofessional collaboration, and patient safety (8). “Supervision,” defined as the provision of guidance and support in learning and working effectively in health care by observing and directing the execution of tasks or activities, and ensuring that these are done correctly and safely, from a position of being in charge (9), is a responsibility that should not be taken lightly. A supervisor must be able to make *ad hoc* entrustment decisions for those working under their responsibility and gauge supervisees’ capacities. Providing supervision or being supervised forms an integral part of training and daily practice for most physicians. Most IC-certified physicians (attending physicians, fellows) have experience in providing supervision of non-IC-certified physicians (residents, students). That does not hold true for nursing. Most registered nurses have been supervised during the years in training but are generally less accustomed to providing

supervision. That role is usually reserved for a limited number of registered nurses specifically trained for and officially appointed to supervisory positions. During the extraordinary circumstances of the COVID-19 pandemic, however, most IC-certified nurses were asked to supervise redeployed, non-IC-certified personnel, in addition to providing regular patient care for their own patients.

Building trust in the capacities of redeployed workers, during times such as the COVID-19 crisis, requires familiarity with their skill levels combined with at least some experience of working together. Supervision is intimately related to the concept of “entrustment.” Decisions to trust learners with tasks in health care now often pertain to “entrustable professional activities” (EPAs) (10). Supervision for these EPAs—units of professional practice that can be entrusted to a trainee once he or she has demonstrated adequate competence—has been framed as five levels of supervision that are applied according to what is adequate for a learner (*see* Table E1 in the data supplement), which is determined on the basis of a learner’s stage of development (4, 10–12). In regular training circumstances, the progression of trainees in EPA-based programs is determined by clinical competency committees on the basis of the reported experiences with the learner, as collected in a portfolio and in other data sources, to arrive at valid, summative entrustment decisions to advance learners and formally decrease required supervision levels for EPAs (13). The COVID-19 pandemic precluded regular processes and evoked the question of how the new mix of experienced personnel and unexperienced learners navigated acceptable demands and provisions of supervision. An adequate ratio of supervisors to

coworkers, both for physicians and nursing staff, is key to not only quality of care but also the safety of both the patient and the learner.

“Interprofessional collaboration,” another key element, describes the active and ongoing partnership among professionals from diverse backgrounds who have distinctive professional cultures, who possibly represent different organizations or sectors, and who work together to provide services for the benefit of patients (14). Evidence suggests that effective interprofessional collaboration results in improved outcomes for ICU patients (15).

“Patient safety,” a priority in health care since the 1980s (16, 17), not only requires avoidance of errors but also relies on an intelligent environment and a cooperative culture that facilitates the safe delivery of acute care (18).

To meet COVID-19 demands in the spring of 2020, ICUs employed several strategies to increase capacity. In particular, they decreased nursing staffing ratios and brought new staff into the ICU. Adequate supervision, targeted for personnel with varying degrees of preparedness, is key to maintaining a basic level of care quality and safety. The purpose of this study was to understand the lived experiences of delivering care during the height of the first pandemic peak. Specifically, we wanted to understand 1) the perceived quality of supervision; 2) the perceived quality of patient care provision, as reported by physicians and nurses of various backgrounds and amounts of experience; and 3) how interprofessional collaboration was perceived, with the purpose of generating recommendations for similar situations in the future. We aimed to report quantitative data summarizing supervision practices and qualitative data describing the lived experience of working

in new team structures during the pandemic. As this was not a local crisis in one hospital or country, we sought collaboration among three institutions in similar circumstances in different countries with the aim of drawing generalized conclusions.

## METHODS

This international cross-sectional survey was conducted between April 16, 2020, and May 15, 2020, among healthcare professionals deployed at ICUs at the University Medical Center (UMC) Utrecht, the Netherlands; two of Northwell Health’s teaching hospitals (Long Island Jewish Medical Center and North Shore University Hospital) in New York, New York, United States; and two Dublin hospitals (St. James’s Hospital, affiliated with Trinity College Dublin, and Beaumont Hospital, affiliated with the Royal College of Surgeons Ireland). Ethical approval was waived by the medical ethical review board of UMC Utrecht (No. 20-216/C); granted by the institutional review board at Northwell Health; and approved by the National COVID Research Ethics Committee in Dublin.

### Settings and Participants

*Utrecht.* Between April 16 and April 23, data were collected from three ICUs (two of which were newly created after March 18) at UMC Utrecht, a 1,042-bed hospital including 24 ICU beds. As COVID-19 admissions increased, the ICU-bed capacity was expanded to 80, superseding other hospital functionalities. The ICUs were run by a limited number of certified IC personnel and supplemented with physicians and nurses recruited from neighboring health professions, resulting in an IC-certified nurse-to-patient ratio of (rounded) 1:3 (normally 1:1). A mixture of

**Table 1.** Surveyed population and respondents

	Surveyed	Respondents	Response* (%)	Volunteered <sup>†</sup> (%)
<b>Utrecht respondents</b>				
Physicians, IC-certified	34	14	41.2	25.0
Physicians, not IC-certified	24	20	83.3	40.0
Nurses, IC-certified	172	79	45.9	43.1
Nurses, not IC-certified <sup>‡</sup>	112	121	108.0	47.2
Total	342	234	68.4	43.8
<b>New York respondents</b>				
Residents, not IC-certified	52	35	67.3	28.6
Fellows, not IC-certified	25	14	56.0	42.9
Attendings, not IC-certified	114	44	38.6	47.7
Total	191	93	48.7	39.8
<b>Dublin respondents</b>				
Physician, IC-certified	25	13	52.0	—
Nurses, IC-certified <sup>§</sup>		12		—
Nurses, not IC-certified <sup>§</sup>	118	34	38.9	—
Total	143	59	41.2	—
Total respondents	—	386	—	—

*Definition of abbreviation:* IC = intensive care.

\*Response rates are approximations based on the best available data.

<sup>†</sup>In Dublin, people were rostered according to skill level, with an option to opt out in liaison with the site manager or with a derogation.

<sup>‡</sup>Not all scheduled non-IC-certified, trained nurses in Utrecht were properly registered.

<sup>§</sup>In Dublin, IC-certified and non-IC-certified nurses could not be differentiated for eligibility to participate.

voluntary and mandated redeployed professionals received 1 day of IC-specific prior training. This training included lectures on COVID-19, lectures on admitting patients to an ICU and ICU logistics, a guided ICU tour, an introduction to Peer Support, and a practical skills carousel (donning personal protection equipment, prone positioning, collecting blood samples from arterial lines, etc.). On the basis of the week schedule, 34 IC physicians and 24 non-IC physicians of various specialties (including residents) as well as 172 IC-certified and 112 non-IC-certified

nurses (including regular ward and scrub nurses, anesthesiology technicians, physician assistants, and pharmacy assistants) were eligible for inclusion (Table 1). Participation was voluntary.

*New York.* Between April 16 and May 5, data were collected at Northwell Health, a 24-hospital system in the New York metropolitan region. Two of its teaching hospitals participated in this study, Long Island Jewish Medical Center and North Shore University Hospital. Combined, the two hospitals typically have 1,256 beds,

including 145 ICU beds. From March 16, 2020, the total number of patients with COVID-19 in the ICUs increased, requiring a peak ICU-bed capacity of 333 (130% increase). During this time, 52 residents, 25 fellows, and 114 attending physicians were redeployed to the ICUs. All of those who were redeployed did not typically practice in either setting. Redeployment was a mixture of voluntary and mandated redeployment. All 191 redeployed residents, fellows, and attending physicians were invited to participate in the survey (Table 1).

**Dublin.** Data were collected between May 8 and May 15 at the two Dublin university teaching hospitals that participated in the study, St. James's Hospital and Beaumont Hospital. These have a combined acute inpatient capacity of 1,340 beds and had a pre-COVID-19 ICU-bed capacity of 56 beds (31 at St. James's and 25 at Beaumont). From March 13 to May 15, 2020, the number of patients with COVID-19 increased, requiring a peak capacity of 171% and 192%, respectively. Additional ICU beds were created by using alternative critical care areas, such as cardiac care units, neurologic ICUs, cardi thoracic units, and operating theater recovery suites across both hospitals. On the basis of the week schedule, 23 IC consultant physicians and trainees and 120 nurses (IC-certified nurses plus nurses redeployed from regular wards, specialized units, or operating theaters) were invited to participate in the survey (Table 1).

### Instrument

This study was conceived and performed during the first peak of the COVID-19 pandemic in the spring of 2020. Within the constraints placed by UMC Utrecht's Medical Ethics Committee and Outbreak

Management Team, a concise, one-page questionnaire was created. After a literature search that did not yield a similar useful survey, the questionnaire was developed using six steps of a recommended seven-step process for designing high-quality questionnaires (19); the last step of pilot testing was not included because of time constraints. The survey was initially designed by a pediatric intensivist educator (M.P.H.) who worked together with an experienced health profession education researcher (O.t.C.), and it was critically reviewed by an anesthesiology educator and an intensivist educator (R.G.H. and M.v.D.). The resulting survey was reviewed and adapted by the Dutch author team. This version was pretested by using think-aloud cognitive interviewing with four qualified pediatric ICU nurses, two pediatric ICU residents, and one ICU physician, who led minor textual revisions. Finally, the questionnaire was translated into English, reviewed, and amended for use in New York and Dublin (J.Q.Y. and M.H.). The New York site decided to add an item on comparison with baseline care after the Utrecht and Dublin surveys had been consolidated. *See* Figure E1 in the data supplement for questionnaire items from the Utrecht version of the survey. The survey was conceived in Dutch and translated, and sites (J.Q.Y. and M.H.) made adaptations to meet local needs and distributed the surveys either on paper (Utrecht and Dublin) or online (the research platform Research Electronic Data Capture [National Institutes of Health] was used in New York). The questionnaire included items on demographics, the voluntary versus mandated nature of the work, and the perceived amount and quality of supervision, the perceived quality of care, and the perception of interprofessional collaboration as assessed by using 5-point Likert scales



(20). For supervision, we asked the following questions: 1) “How often (1 = ‘never’ to 5 = ‘almost always’) have you worked at each of five levels of supervision (i.e., received this supervision) in the week before the survey?” and 2) “How did you evaluate the supervision provided (1 = ‘poor’ to 5 = ‘excellent’)?” Similarly, participants were asked to evaluate the perceived quality of both care and inter-professional collaboration (1 = “very poor” to 5 = “very good” and 1 = “insufficient” to 5 = “excellent,” respectively). Open-space boxes were added to provide “tops” (“What went well?”), “tips” (“What could be improved?”), and additional comments.

#### **Ethical Considerations and Data Management Plan**

All participants received information and actively gave written consent to participate. All data were collected anonymously, saved on local network drives in secure locations, and only shared among the core author team. In Utrecht, paper surveys were used for logistical reasons. Participants were to deposit their completed surveys in one of the secured, closed-off boxes strategically placed in the ICUs. These boxes were emptied on multiple days by one of the authors (M.P.H.). After being scanned and saved to local network drives in secure locations for data entry, paper surveys were destroyed to ensure anonymity. Both other sites used electronic surveys.

#### **Data Analysis**

For quantitative analysis, frequencies, means, and variances (standard deviation and 95% confidence interval) were calculated by using Microsoft Excel (2016). As an observational study, no tests of significance were performed. Data were broken down by groups and/or clinical settings differently by location. Open-text-

box (qualitative) data were thematically analyzed by using the established six-step process of thematic analysis as described by Kiger and Varpio (21). In short, comments were independently categorized by multiple researchers at each location (Utrecht: M.P.H. and O.t.C., New York: J.Q.Y. and K.A.F.; Dublin: M.H. and A.P.). Recurrent comments were identified with initial codes and led to general themes, which were all tabulated by using Microsoft Excel (2016). Differences were resolved by discussion at each location. Next, the themes were compared among the locations and merged into a limited number of broad themes.

## **RESULTS**

Guided by the survey questions and on the basis of the qualitative data, we structured the results into five themes: supervision experienced; perceived quality and safety of care; collaboration, communication, and atmosphere; scheduling and team composition; and organization and facilities. The latter three theme results are based on qualitative data only.

#### **Population and Response**

Utrecht had 234 respondents (response rate of 68%), including physicians and nurses, most of whom (66%) were not IC-certified. New York had 93 physician respondents (response rate of 49%), including attending physicians, fellows, and resident physicians, none of whom were IC-certified. Dublin had 59 respondents (response rate of 45%), including only trained or trainee IC physicians and a mix of IC-certified and non-IC-certified nurses. A minority across the settings (34–44%) had volunteered to work on a COVID-19 unit; others were asked or scheduled. (Table 1)

**Table 2.** Percentage of respondents acting often to always (score 4 or 5) under a supervision level of 1–5

	Utrecht				New York				Dublin	
	Medical		Nurse		Resident		Attending		Medical	Nurse
	Not IC-certified (n = 20)	IC-certified (n = 14)	Not IC-certified (n = 121)	IC-certified (n = 79)	Not IC-certified (n = 35)	IC-certified (n = 79)	Not IC-certified (n = 44)	IC-certified (n = 44)	IC-certified (n = 12)	Not IC-certified (n = 34)
Level 1: to only observe new tasks, not perform them (observe)	20.0	0.0	24.4	4.2	50.0	4.2	18.4	23.1	15.2	36.4*
Level 2: to perform new tasks with a more experienced colleague physically present (direct supervision)	30.0	21.4	42.5	32.9	46.4	32.9	10.5	30.8	42.4	27.3
Level 3: to perform new tasks with a more experienced colleague available but not physically present (indirect supervision)	45.0	42.9	44.5	52.9	67.8 <sup>†</sup>	52.9	36.8	38.5	30.3	54.5
Level 4: to perform new tasks without supervision (no supervision)	35.0	50.0	26.3	60.9	17.9	60.9	39.5	30.8	15.2	50
Level 5: to act as a supervisor for less experienced colleagues (supervise)	15.8	71.4	9.5 <sup>‡</sup>	71.1	17.9	71.1	55.3	61.5	12.5	54.5
In the past week, how often was the amount of supervision lower than needed? <sup>§</sup>	--	--	--	--	1.8	--	1.9	--	--	--
In the past week, how did you experience the supervision you received? <sup>§</sup>	4.1 (0.7–0.3)	3.7 (1.0–0.5)	3.7 (0.8–0.2)	3.2 (1.1–0.3)	4.0 (1.0–0.3)	3.3 (1.3–0.8)	4.2 (0.9–0.3)	4.5 (1.0–0.5)	3.7 (1.2–0.4)	4 (1.2–0.7)

Definition of abbreviation: IC = intensive care.

A score 4–5 means “in the past week, I have often or always experienced this level of supervision” (level 1, 2, 3, 4, or 5).

\*One of three examples on how to interpret the table: 36.4% (n = 4) of the 13 Dublin IC-certified nurses never performed tasks (as they were likely superfluous).

†One of three examples on how to interpret the table: 67.8% of the 35 New York residents stated that they often or always performed tasks under indirect supervision.

‡One of three examples on how to interpret the table: 9.5% of the non-IC-certified Utrecht nurses stated that they often or always provided supervision (as they were likely needed).

§1 = insufficient; 2 = mediocre; 3 = sufficient; 4 = good; 5 = excellent. Data are means (95% confidence intervals).



### Survey Results: Quantitative

*Supervision.* The condensed results of the questions related to supervision are summarized in Table 2. Generally, much of the work was performed under “indirect supervision” (i.e., a supervisor was not present but was quickly available if needed) for all categories of personnel, even among those with IC certification. Direct supervision (i.e., a supervisor being physically present) was common among non-IC-certified personnel, with the exception of redeployed fellows and attending physicians who operated more independently (New York). Most non-IC-certified personnel (except fellows, New York) reported regular instances of “observing only,” and some IC-certified personnel reported this as well (Dublin). All IC-certified personnel and redeployed fellows and attending physicians regularly acted in a supervisory role themselves. The perceived quality of supervision was, in general, reported to be “good” across all categories of personnel. However, closer analysis revealed that IC-certified personnel in Utrecht, nurses in particular, were less satisfied with the supervision provided. More than 15% of physicians and 20% of nurses in Utrecht found supervision to be “mediocre” or “poor.” These respondents included both individuals who received and individuals who provided supervision. Emerging supervisory roles were not always clearly linked to prior IC experience. In the largest sample (Utrecht), 86 respondents qualified themselves as “not IC-certified or experienced.” Nevertheless, 30 of them (35%) indicated that they regularly, often, or always acted in a supervisory role. Conversely, 79 qualified themselves as “IC-certified or experienced,” but 23 (29%) of them indicated that they

regularly, often, or always worked under direct supervision.

*Quality of care.* At all three sites, the quality of care provided was perceived as ranging from being acceptable to being good (with means of 3.3–4.3 on a 5-point scale across all groups) (see Table 3). New York respondents were also asked to compare the quality of care with baseline standards and judged that less favorably (with means of 2.4, 2.4, and 2.5 for residents, fellows, and attending physicians, respectively) (see Table 3).

*Interprofessional collaboration* was generally experienced as being better (means >3.0) than usual in the regular working environment at all three sites (see Table 3).

### Survey Results: Qualitative

In total, 335 (Utrecht), 193 (New York), and 292 (Dublin) comments were made by 211, 83, and 51 participants, respectively. Thirteen (Utrecht), 6 (New York), and 15 (Dublin) general themes emerged for categorization of comments. The contents aligned in many respects across locations, and it was not difficult to consolidate the qualitative results into the five broad themes discussed below. Table 4 shows frequencies, summaries, and examples of comments.

*Supervision* in Utrecht was generally reported as being acceptable but insufficient for the quality of care at a tertiary level ICU. In addition, supervision was experienced as being quite diluted at the height of the surge. IC-certified nurses regularly commented that too many inexperienced helpers required too much direct supervision, which negatively impacted their available time for regular patient care. In contrast, IC-certified personnel in Dublin (where ICU capacity was stretched less than in

**Table 3.** Mean score (plus standard deviation) for quality of care and interprofessional collaboration

Overall quality of care* and interprofessional collaboration <sup>†</sup>	U		NY		D	
	Care Quality	Collab.	Care Quality	Collab.	Care Quality	Collab.
Medical: not IC-certified (number of respondents: U = 20, D = N/A)	4.1 (0.4)	4.2 (0.7)	—	—	—	—
Medical: IC-certified (number of respondents: U = 14, D = 12)	3.9 (0.4)	3.6 (1.1)	—	—	—	3.8 (0.8)
Nurses: not IC-certified (number of respondents: U = 121, D = 34)	4.2 (0.5)	3.4 (0.8)	—	—	4.3 (1.3)	3.3 (1.0)
Nurses: IC-certified (number of respondents: U = 79, D = 13)	3.4 (0.7)	3.4 (1.0)	—	—	—	3.8 (1.0)
Residents: not IC-certified (number of respondents: NY = 35)	—	—	3.7 (1.0)	3.3 (1.1)	—	—
Fellows: not IC-certified (number of respondents: NY = 14)	—	—	3.3 (0.9)	3.8 (1.2)	—	—
Attending physicians: not IC-certified (number of respondents: NY = 44)	—	—	4.2 (0.8)	4.0 (0.9)	—	—

*Definition of abbreviations:* collab. = collaboration; D = Dublin; IC = intensive care; N/A = not applicable; NY = New York; U = Utrecht.

\*Overall quality of care (1 = very poor to 5 = very good [Utrecht/Dublin scale transformed from 10 to 5-point scale]).

<sup>†</sup>Quality of the interprofessional collaboration, compared with baseline (1 = far worse to 5 = far better).

Utrecht) reported a high degree of satisfaction with supervision. Although formal supervision in New York was experienced as being reduced, respondents described “curbside” consultations as more frequent

and accessible, compensating for formal supervision.

*The quality and safety of care* were generally perceived as being lower than at baseline but as being acceptable at all three sites.

**Table 4.** Thematically organized qualitative findings

Theme	Salient Findings Summarized	Quotes from Participants
Supervision (numbers of comments*: U: 13+, 29-; NY: 23+, 9-; D: 3+, 0-)	Supervision was considered to be acceptable but insufficient to deliver the desired quality of care in a regular ICU. Many nurses with IC experience (U) commented on the dilution of supervision (number of experienced doctors and nurses available to supervise redeployed staff). Care could be accommodated with skilled alternative employees, but monitoring staff without satisfactory skill levels diverted resources from COVID-19 patient care to direct supervision. In a less-diluted ICU (D), however, IC-trained personnel deemed supervision to be good to excellent.	<p>U: "Supervision of nonqualified personnel is insufficient at times due to lack of availability of experienced ICU nurses and/or lack of time" (#176).</p> <p>NY: "Everyone is working somewhat outside their comfort zones and stretched thin. Given the circumstances, supervision while less than average was adequate" (#12).</p> <p>D: "More support from ICU staff (not everyone was approachable). Try to give less complex patients to ward staff, only send ward staff to ICU if there is no ICU staff available" (#110).</p>
Quality and safety of care (numbers of comments: U: 6+, 34-; NY: 2+, 10-; D: 9+, 2-)	While the quality and safety of the care were described as being lower than at baseline, respondents overwhelmingly described the quality as being acceptable. Again, however, many IC-trained nurses (U) were critical about the care delivered.	<p>U: "Quality of care is very low, as there is not . . . enough time for the usual care" (#180).</p> <p>NY: "I did feel that the safety and quality of care was reduced solely because of the large volume of patients and that the providers were not used to taking care of these patients. Overall, the care was good, but it was not to the same level as our normal care, simply because of the nature of the situation" (#37).</p> <p>D: "excellent consultant cover and support" (#98).</p>
Collaboration, communication, and atmosphere (numbers of comments: U: 184+, 34-; NY: 76+, 11-; D: 22+, 7-)	The overall picture that emerges is largely one of great appreciation for the commitment, cooperation, and willingness of all involved in the COVID-19 ICU work. Respondents described how everyone in the hospital supported each other, using terms such as "trust," "camaraderie," "collaboration," and "spirit of togetherness." The collegiality manifested in the emergence of informal "curbside" consultations as a commonplace and key way that expertise was shared efficiently. Collaboration, triage of patients, formal and informal access to supervision and consultations, and provision of protocols were cited as significant positive factors.	<p>U: "Collaboration is great. Many are very grateful for the support that we are providing. I feel to be part of the team" (#135).</p> <p>NY: "There was excellent collaboration among all team members. Everyone was very helpful and happy to answer my questions" (#37).</p> <p>D: "Amazing teamwork and camaraderie observed" (#1).</p>

**Table 4. (Continued).**

Theme	Salient Findings Summarized	Quotes from Participants
Recruitment, scheduling, and team composition (numbers of comments: U: 19+, 107–; NY: 8+, 35–; D: 13+, 13–)	A key issue was the scheduling of personnel in the five ICUs. Frequent rotations between wards and within teams was deemed undesirable, as time spent becoming familiar with the context of each ICU and time spent by supervisors estimating the expertise of new coworkers was lost for patient care. Common complaints concerned schedules, including knowing when and where to arrive, knowing who was on your team, and staggered team start times. Respondents appreciated teams being composed of less-experienced personnel paired with more-experienced personnel and team stability over time.	<p>U: "Assess capabilities of redeployed personnel upfront, they often require much more input (explaining and demonstrating how things work) than we get out of it (number of shifts a person works/their ability to do things)" (#181).</p> <p>NY: "I think there were issues with scheduling and being informed what our daily schedules would entail. Pairing inexperienced surgical attending with medicine residents was perhaps the ideal way to approach the unusual nature of deployment" (#106).</p> <p>D: "Have nurses start at the same time as the ICU nurses as it was frustrating at 8 or 9 and you had to stop and hand over again and explain everything you had already done" (# 10).</p>
Organization and facilities (numbers of comments: U: 24+, 51–; NY: 6+, 13–; D: 12+, 11–)	There was general appreciation, but lower quality and safety of care was also attributed to fluctuations in medication supply, older ventilators and their settings, patient volume, and limited understanding of the illness. The most common area for improvement centered on more intensive orientation to and/or training for the medicine service as well as the local systems (including the electronic health record). For those with less experience, visual algorithms (e.g., if SpO <sub>2</sub> is less than x, then do y) were especially valued. Creative use of facilities, rules, and regulations was appreciated.	<p>U: "A lot has been achieved in such a short period of time, a lot of work has been done to be able to open so many extra ICU beds" (#131). "[There was space] to act 'differently' given the circumstances to make the best of it . . . with daily jokes from the management" (#90).</p> <p>NY: "There should be more effective orientation. The orientation should be in the unit in which we are working because each unit runs differently. There should be specific instruction on what our roles are. We had adequate access to PPE" (#19).</p> <p>D: "I was put with a scrub nurse on Day 1 and in a room with poor visibility for other staff with queries" (#158).</p>

*Definition of abbreviations:* COVID-19 = coronavirus disease; D = Dublin; IC = intensive care; ICU = intensive care unit; NY = New York; PPE = personal protective equipment;

SpO<sub>2</sub> = oxygen saturation as measured by pulse oximetry; U = Utrecht.

\*For the numbers of comments, a plus sign indicates positive comments (tops), and a minus sign indicates negative comments (tips).

Simple, visual COVID-19 protocols were particularly valued, especially for those least familiar (New York). However, one-third ( $n = 27$ ) of the IC-trained nurses in Utrecht perceived the quality of care delivered to clearly be below standards.

*Collaboration, communication, and atmosphere* were overwhelmingly appreciated as being positive (see Table 4, in which plus signs in the leftmost column indicate positive comments), with a vast majority providing this as a spontaneous comment. The commitment, cooperation, and willingness of all involved in the COVID-19 ICU work were described using terms such as “trust,” “camaraderie,” and “spirit of togetherness.” In addition, a willingness to support each other’s “learning on the job” responsively was noted at all three sites.

*Recruitment, scheduling, and team composition* were often mentioned as critical. Frequent rotations between wards and teams were deemed undesirable. Schedules, knowing when and where to arrive, and team assignment appeared to be critical. Having teams that were stable over time with fewer members but a higher proportion of experienced personnel was appreciated. Recruitment of helpers with little background was criticized (Utrecht). Assignment of patients to teams with an appropriate skill mix for patient needs was identified as being important for both redeployed and trained personnel.

*Organization and facilities* were generally appreciated, but the medication supply, ventilator quality, use of unfamiliar electronic health record systems, and insufficient training and/or orientation were reported to hamper the work (Utrecht). The ability to creatively apply rules and regulations was felt to be conducive to an effective working atmosphere. Advance preparation and training, especially with respect to

personal protective equipment, was commended, and daily communication of recent evidence for forward planning was seen as being critical (Dublin and Utrecht).

## DISCUSSION

Our study yielded a number of salient findings. A sudden surge of critically ill patients can be accommodated by a composite workforce of IC-certified and redeployed, non-IC-certified personnel. The majority of our population (268, 69%) was not certified for IC work and reported often working under *direct* or *indirect* supervision (supervisor *present* or *quickly available* if needed, respectively). The quality of care and amount of supervision, although lower than usual, were generally reported as being at least acceptable and experienced in a superior interprofessional, collaborative atmosphere. Where IC-certified nurse-to-patient ratios had decreased most (Utrecht), however, nurses were the most critical about supervision and the quality of care.

The overall high degree of appreciation for the commitment, collaborative atmosphere, and mutual solidarity across professions may have affected judgments regarding the perceived adequacy of supervision. Discrepant judgments, notably from IC-certified nurses at UMC Utrecht about receiving and providing supervision, may be less surprising, given their sense of benchmarks for high-quality ICU care in combination with a lower imposed ratio of IC nurses to patients. The dual role of supervisors, serving the interests of patients and learners, requires skills to balance and prioritize these interests differently at different moments.

Hiring coworkers who must be supervised at level 1 (to be present and only observe) and level 2 (to act under direct

supervision) for more than a brief introductory phase is a less efficient investment in crises and should be discouraged. Workers requiring only indirect supervision, on the other hand, are highly useful; such workers typically have an adequate background and some working experience in a similar or related context in a not too distant past and are able to access supervision when needed.

Frequent comments on the need for stable team compositions, mixing more experienced colleagues with less experienced colleagues, across interprofessional boundaries also speaks to two key features of teams that help compensate for the inexperience of some. Working with a team that is stable over time and includes mixed experience degrees facilitated both formal and informal support, even across professional boundaries. We found that clinical experience did not always predict who provided and who received supervision. Qualified professionals, working unsupervised, are not necessarily skilled to act as supervisors in the strict sense, but informal peer collaboration across professions and hierarchies may have been felt to be highly rewarding and conducive to a collaborative atmosphere. Indeed, this atmosphere may be explained by abundant opportunities to receive and provide peer-level supervision, which is in concordance with our survey results.

Does this mean that formal supervision would not be necessary? We do not believe so. Safe patient care requires decisions about care that pertain to coworkers to be made by accountable supervisors. Employing many alternative professionals in crises requires a sufficient volume and quality of supervisors. Although preparing ICUs for calamities such as pandemics has been described,

stressing the need for alternate hospital sites; non-ICU staff being under the supervision of those trained in IC; and rapid, appropriate, “just-in-time” education of new staff during times of surge has been highlighted (22–24), but the significance of having an adequate volume and quality of supervision has not been described well and may indicate a possible gap in the outbreak preparedness of ICUs.

Certified ICU nurses were generally unfamiliar with and unprepared for providing supervision while simultaneously caring for more than one critically ill patient, which may explain some of the tensions we found. The Utrecht and Dublin samples had a similar ratio of IC-certified to non-IC-certified respondents, but at the peak of the pandemic, Utrecht faced more patients per experienced ICU nurse (3:1) than Dublin (1–2:1), although less than 2:1 is recommended (25). Many ICU nurses, particularly in Utrecht, were forced to supervise in addition to managing their own increased patient load. These ratios are more critical for nurses than for physicians, who foremost make clinical decisions rather than providing minute-to-minute care. In Utrecht, the capacity to accommodate fewer skilled and autonomous “helpers” and adapt to their deficits seemed to have been exceeded. This may explain Dublin’s higher degree of satisfaction with the supervision among ICU-certified personnel in comparison with Utrecht’s. An adequate ratio of formal supervisors to coworkers, both for medical and nursing staff, is key to patient safety and quality of care.

### Limitations

Our study has several limitations. It was conceived and designed using only six steps of the seven-step process for designing high-quality questionnaires in a very



**Table 5.** Recommendations for future redeployments

Themes	Recommendations
Supervision	<ul style="list-style-type: none"> <li>• Redeploying alternative professionals who require indirect supervision (level 3) is the predominant target group in situations such as the COVID-19 pandemic.</li> <li>• Redeploying alternative professionals who continue to require direct supervision (level 2) is inefficient and should be discouraged, as providing adequate supervision at this level distracts from provision of high-quality care.</li> <li>• Deploying professionals with a supervisory role (level 5) is critically important in an adequate ratio to those who need indirect or direct supervision. Professionals must be trained or experienced for this role.</li> </ul>
Quality and safety of care	<ul style="list-style-type: none"> <li>• The ICU ratio of IC-certified nurses to patients should preferably not exceed 1:2. Further decreases make preserving team composition, stability, and scheduling more critically difficult.</li> </ul>
Collaboration, communication, and atmosphere	<ul style="list-style-type: none"> <li>• As high degrees of interprofessional collaboration, effort, and camaraderie compensate for other deficiencies, this atmosphere must be supported and is critically important to maintain quality.</li> </ul>
Recruitment, scheduling, and team composition	<ul style="list-style-type: none"> <li>• Selection of alternative professionals should focus on individuals who are able to work with indirect supervision (level 3) after a short, instructive introduction.</li> <li>• ICU teams should include a mix of designated supervisors (level 5), experienced professionals (level 4), and professionals requiring indirect supervision (level 3).</li> <li>• Team composition should remain as stable as possible over time.</li> </ul>
Organization and facilities	<ul style="list-style-type: none"> <li>• Rules and regulations should be applied judiciously to ease quick decisions if necessary.</li> <li>• Visible clinical protocols and easy access to informal (“curbside”) consultations should be secured.</li> </ul>

*Definition of abbreviations:* COVID-19 = coronavirus disease; IC = intensive care; ICU = intensive care unit.

brief period of time to capture participant experiences during a crisis period at three quite different sites. Furthermore, it should

be recognized that our data reflect the self-reported (i.e., perceived) quality of care. Although self-reporting is a common

approach for gathering data in epidemiologic and medical research, bias in self-rating may be of concern (26). Namely, a recent study among hospitalized patients with COVID-19 in the United States showed that mortality in surge settings during the first wave of the pandemic appeared to be higher (27). Finally, given its cross-sectional nature, survey limitations, and differences among settings, institutions, and/or countries, data could not be easily merged. Generally, however, many aspects of the findings converged.

### Conclusions

A surge of critically ill patients can be accommodated by a composite workforce of IC-certified and redeployed, non-IC-certified personnel. Although the perceived quality of care, supervisory capacity, training background, and experience were compromised to meet COVID-19 demands, several key features to maintain an acceptable degree of perceived quality of care could be identified. These included stable teams that matched less experienced personnel with more experienced personnel, allowing for supervision adapted to needs, constructive interprofessional collaboration, a robust culture of informal consultation, and more flexibility in hospital rules. Furthermore, deploying professionals trained or experienced in supervision is critically important for

future response preparedness. This requires not only specified training and certification, and maybe even a fundamental definition of competence and qualification for healthcare work (28), but also an adequate ratio of supervisors to those needing (indirect or direct) supervision.

On the basis of these findings, several recommendations for future redeployment in crisis situations regarding supervision; quality and safety of care; collaboration, communication and atmosphere; recruitment, scheduling, and team composition; and organization and facilities were formulated (Table 5). In addition, further research on the long-term impact of providing patient care during the COVID-19 surge on the healthcare workforce in general seems warranted.

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