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Yves Chochard, Jenny Gentizon et Serge Gallant

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Résumé de l'article

Cette recherche porte sur l'évaluation de l'efficacité d'une formation en milieu hospitalier à partir d'indicateurs de tailles d'effet et d'indice d'hétérogénéité. L'évaluation portait sur une formation en soins intermédiaires destinée aux infirmiers-ères, d'une durée de 23 jours et qui intégrait notamment trois jours d'enseignement clinique au chevet du patient. Les compétences ont été mesurées en début et en fin de formation, à partir d'une grille d'observation standardisée basée sur les domaines de compétences d'expert clinique, de communicateur, de collaborateur, de manager et d'apprenant-formateur. Les estimateurs de Cohen et de Glass ont démontré des effets significatifs de la formation sur les cinq domaines alors que l'indice d'hétérogénéité a mis en évidence une réduction des disparités de comportements au sein du groupe d'infirmiers-ères au terme de la formation. La discussion aborde la question des balises utilisées pour interpréter les tailles d'effet.

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Assessing the Transfer of Nursing Competencies: Analysis of the effects of intermediate care training in a hospital setting*

Yves Chochard
Université du Québec à Montréal

Jenny Gentizon

Serge Gallant
Centre hospitalier universitaire vaudois (CHUV), Lausanne

Key words: Nursing education and training, intermediate care, competency assessment, effect size, heterogeneity index

This research focuses on evaluating the effectiveness of a training course in a hospital setting, using indicators of effect size and heterogeneity index. The evaluation focused on a training course in intermediate care for nurses. The course lasted 23 days and included clinical teaching at the patient's bedside. The competencies were measured at the beginning and end of the training course, using an observation grid based on five domains: Clinical Expert, Communicator, Collaborator, Leader and Learner-Trainer. Cohen's and Glass's estimators demonstrated significant effects of training on the five domains while the heterogeneity index showed a reduction in behavioural disparities within the nursing group at the end of the training course. The discussion addresses issues relating to the boundaries used to interpret effect sizes.

* French version : *Évaluer le transfert des compétences infirmières : analyse des effets d'une formation en soins intermédiaires en milieu hospitalier* – vol. 42, n°3, 1-28

Mots clés : formation en soins infirmiers, soins intermédiaires, évaluation des compétences, taille d'effet, indice d'hétérogénéité

Cette recherche porte sur l'évaluation de l'efficacité d'une formation en milieu hospitalier à partir d'indicateurs de tailles d'effet et d'indice d'hétérogénéité. L'évaluation portait sur une formation en soins intermédiaires destinée aux infirmiers-ères, d'une durée de 23 jours et qui intégrait notamment trois jours d'enseignement clinique au chevet du patient. Les compétences ont été mesurées en début et en fin de formation, à partir d'une grille d'observation standardisée basée sur les domaines de compétences d'expert clinique, de communicateur, de collaborateur, de manager et d'apprenant-formateur. Les estimateurs de Cohen et de Glass ont démontré des effets significatifs de la formation sur les cinq domaines alors que l'indice d'hétérogénéité a mis en évidence une réduction des disparités de comportements au sein du groupe d'infirmiers-ères au terme de la formation. La discussion aborde la question des balises utilisées pour interpréter les tailles d'effet.

Palavras-chave: formação em enfermagem, cuidados intermediários, avaliação de competências, tamanho do efeito, índice de heterogeneidade

Esta investigação trata da avaliação da eficácia da formação em ambiente hospitalar por meio de indicadores de tamanho do efeito e de índice de heterogeneidade. A avaliação abrangeu um curso de formação em cuidados intermediários destinado às enfermeiras e aos enfermeiros com uma duração de 23 dias e que incluiu três dias de ensino clínico realizado à cabeceira do paciente. As competências foram medidas no início e no final da formação, a partir de uma grelha de observação padronizada com base nas funções de especialista clínico, de comunicador, de colaborador, de gestor e de aprendiz-formador. Os estimadores de Cohen e Glass demonstraram efeitos significativos da formação em todos os cinco domínios, enquanto o Índice de heterogeneidade evidenciou uma redução das disparidades comportamentais dentro do grupo após a conclusão da formação. A discussão aborda a questão das marcas utilizadas para interpretar os tamanhos do efeito.

Authors' note: Correspondence related to this article may be addressed to [chochard.yves@uqam.ca].

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Introduction

Context of the study

Intermediate care units[1] aim to improve care for patients whose conditions do not justify admission to an intensive care unit, but whose unstable state of health calls for continuous nursing supervision and highly specialized medical and nursing care. These units require specifically trained nurses in order to perform monitoring and treatment tasks for patients with latent life-threatening risk. The first intermediate care units emerged in Switzerland in the 1990s (Lavina et al., 2017) and developed rapidly, leading to some discrepancy in clinical practices. The guidelines established in 2013 established the framework and qualifications required to work in such a unit. They prompted a real need for training: the guidelines stipulated that 40% of nurses in these units had to undergo specific training in intermediate care (IMC, 2013, p.17).

The purpose of this study is to assess the continuing training that was developed by a Francophone Swiss university hospital in response to the challenges of quality and safety of care set out in the guidelines. This is a 23-day (160-hour) program for nurses already working in an intermediate care unit. The program has two modules. The first consists of six days of classroom learning that deepen knowledge of clinical examination, pathologies, equipment and treatments associated with the cardiorespiratory and neurological systems. This module also strengthens trainees' supervision, interprofessional communication and risk management competencies.

The evaluation presented in this article focuses on the second module of the intermediate care training, which aimed at optimizing training transfer. This module was designed to promote the practical application of the knowledge and skills learned in training in the course of the trained nurses' daily lives. To this end, the 17-day course alternates between theoretical classes in the classroom, simulated hands-on workshops, and clinical teaching at the patient's bedside, led by nurse educators specializing

in intensive care. The module also includes three onsite clinical teaching sequences, i.e., at the patient's bedside, in the intermediate care unit. During this clinical teaching, nurses are individually accompanied and evaluated by nurse educators.

Continuing education and training transfer

Assessing training transfer is a relevant issue, given that the training of caregivers does not always guarantee optimal patient care. Numerous studies show that only a small proportion of skills acquired in training translate into behavioural change (Alhassan, 2019; Stander et al., 2018; Lauzier & Denis, 2016; Saks & Burke-Smalley, 2014; Runciman, 2012). Moreover, this change is sometimes only temporary (Burke & Hutchins, 2007; Yoshinaga, 2017). For example, a study conducted in 2014 in the same hospital university uncovered several barriers to training transfer following continuing training on pain (Gentizon et al., 2014): the transfer had sometimes been hindered by some patients' reluctance to postpone their pain, by nurses' attitude toward their suffering, or by nurses' perceived difficulty of influencing treatment decisions.

In the field of nursing, training transfer has been a long-standing subject of research as it remains a poorly understood process (Pentland et al., 2011). In cases of complex activity, such as in a critical care setting, teaching strategies should focus on repetition and practice (Blume et al., 2010). In these situations, a combination of instructional interventions such as individualized clinical teaching at the patient's bedside, simulated laboratory practice or the involvement of a resource person are believed to better support training transfer in practice. Accordingly, the assessment of transfer should focus on the effects of training on the work behaviours of trainees (Siron, Dagenais & Ridde, 2015). This article discusses three issues that this type of assessment brings into play: (1) defining the constructs to be measured (knowledge, skill, behaviour, attitude), (2) choosing useful indicators to exercise sound judgment or a relevant interpretation and (3) carrying out measurements at the appropriate times.

Structure of the article

The first section of this article examines three parameters for defining competency, and competency assessment in the workplace. The second presents estimators used in previous studies to quantify the effect

of training. The third section, the methodology, presents the data collection procedure, the observation grid and the analysis plan used to assess the competencies addressed by the intermediate care training. The methodology concludes with a statement of ethical considerations. The fourth section details the effects of the training on the development and harmonization of nursing competencies. The fifth section discusses the interpretation of these effects and the limitations of the assessment process that was followed. Finally, the conclusion offers some ways forward for future research.

Conceptual framework: Measuring transfer

The notion of competency in work situations

In the field of education and training, competence is essential in order to develop programs, define educational objectives, assess students and professionalize teachers (Coulet, 2016). Three parameters must be taken into account when assessing the competencies developed during continuing training. The first is the resources that make up a competency (Le Boterf, 2018). To work effectively, individuals mobilize the resources they possess, in an integrated manner. These resources are categorized in different ways, such as knowledge, know-how and interpersonal skills; knowledge, skills and abilities; as well as declarative and procedural knowledge (Baartman & de Bruijn 2011, Foucher, 2010). Whichever category is chosen, competency is the ability to use these resources adequately in order to respond to professional situations (Paquay et al., 2010). Assessing a competency therefore entails listing these resources and determining the right combination thereof (Tourmen, 2015).

A second parameter is the work situation. A number of authors define competence as the ability to deal with a category of work situations of varying levels of complexity (Coulet, 2016; Mayen & Métral, 2008; Gérard, 2007). These work situations are essential for successfully carrying out a given activity; difficult to master; and central to the identity of a given occupation (Mayen et al., 2010). Assessing a competency here means identifying the type of situations in which it will be mobilized (Kahn & Rey, 2016), and then observing the individual's behaviour in response to those situations (Siron et al., 2015). According to this view, assessment is an opportunity to present the trainee with one or more key situations and

see how they do (Tourmen, 2015). To properly reflect the work situation, the assessment is often based on job position guidelines, job descriptions, or competency grids. However, these documents may be imprecise or far removed from the realities of the job. Indeed, in many professional fields, there is no "one best way" to perform the activity—which complicates the task of the assessors.

The third parameter speaks to a dynamic view of competency in the sense that it must be transferable from one situation to another (Kahn & Rey, 2016). The effects of training described by Kirkpatrick (1954 in Kirkpatrick & Kirkpatrick, 2016) suggest two types of situations: learning situations and work situations. A learning situation is an educational sequence in which individuals develop elements of knowledge, know-how and interpersonal skills. The emotional effects of the training are assessed through a satisfaction questionnaire, and the cognitive effects, through a written or oral test. A work situation is one in which individuals use the learning they developed in training, in their daily lives (Rivard & Lauzier, 2013). On an individual level, competency assessment then corresponds to an expert's observation or a self-assessment of the behaviours enacted to carry out a task. On a collective level, assessment consists of measuring the consequences of behavioural changes on the functioning and results of the organization. In Kirkpatrick's model, assessing the effect of training on competencies comes down to looking at what has been transferred between the training situation and the work situation, and involves taking measurements in both situations.

The three parameters described above help to define the competencies to be assessed, while the choice of indicators serves to make a relevant judgment or to correctly interpret the measurements obtained. We now turn to the indicators selected for this study.

Two training transfer estimators

We identified two statistical indicators for better understanding the effect of the training on the competencies transferred to work. The first is the effect size, which can be defined as the magnitude of an intervention's effect or the strength of the relationship between two variables (Barry et al., 2016). Effect size measurements are complementary to significance tests, which determine whether an observed effect is real or can be attributed to chance (Maher et al., 2013). Applied to training, the

effect size may correspond to the standardized difference between pre- and post-training means (Streiner et al., 2015). For example, the effect size can shed light on the difference between the initial skill level of a group of participants and the level they achieved at the end of their training. It can also correspond to a difference in results between a group of people who underwent training and a control group that did not. In all cases, standardization is ensured by expressing the difference in the number of standard deviations.

There are several advantages to expressing the impact of training in terms of effect size. First, as a standardized parameter, it makes it easier to compare individual and collective changes or to examine different learning methods (Fröhlich et al., 2009). Second, the magnitude of the observed effect can be judged according to the classifications proposed by Cohen (1992), Hattie (2017) and Rosenthal (1996, in Maher, et al., 2013). For Cohen, 0.2 equates to a low effect size, but high enough to consider the association between variables. A unit effect size of 0.4 to 0.5 can be considered moderate. In Hattie's work, an educational practice is recommended only when it exceeds a 0.4 unit effect size, a value considered to be the threshold of the "zone of desired effect." Within this zone, Cohen interprets the 0.5 unit value as a change that can be seen with the naked eye and the 0.8 unit value as a strong effect. Rosenthal suggests a fourth degree, describing a unit effect size of 1.30 as very strong. Although these values have not been empirically defined and are used merely as a convention or guidepost, Sedlmeier (1996) notes that this classification does effectively reflect effects in different fields. Third, effect size is easy to calculate, even if there are several ways to go about it (Mahe et al., 2013). The most common is to use the estimator of Cohen's *d* (1992), which expresses a difference between two groups based on a combination of their standard deviations.

Cohen's *d* has been used in a number of continuing training studies. For example, Morrow, Jarrett and Rupinski (1997) measured the impact of 18 technical, managerial and business training programs on some 20 employee skills in a large North American company. Some effects on skills were moderate and strong (e.g., $d = 1.07$ for training on written communication), while others were weak or even negative (e.g., $d = -0.09$ for laboratory manager training). Studies in nursing have also used Cohen's *d*:

- Lamont and Brunero (2018), for example, evaluated a violence management seminar. The training was attended by 78 nurses working in at-risk departments, such as emergency, neuroscience or community service. They found strong effects on trained nurses' ability to evaluate risk (d = 0.92), follow de-escalation strategies (d = 0.89), and use breakaway and evacuation techniques (d = 0.90).
- The case study of Amiri, Khademia and Nikandish (2018) focused on a two-day training program dealing with the safety culture for patients hospitalized in intensive care units. The study included a group of trained nurses and supervisors and a similarly sized control group. A very strong effect on skills (d = 1.94) emerged from the comparison of the two groups.
- Two other studies have investigated communication skills. A first training program was evaluated by Alhassan (2019). The program outcomes included the ability to demonstrate empathy toward patients. A trained group and a control group of 80 and 93 female nursing students, respectively, completed a self-assessment questionnaire at the beginning of the training, at the end, and six months later. The second study was conducted by the Yoshinaga team (2017). In this case, the training focused more on the ability to honestly and transparently express opinions, needs and feelings to co-workers. The training consisted of two 90-minute sessions, spaced one month apart. A total of 33 nurses working in two Japanese hospitals were evaluated. Skills were measured by self-assessment questionnaires at four times: the beginning of the training, the end, and then three and six months later. Both studies yielded very similar measurements and reported small effect sizes. In the first, the d value was between 0.16 and 0.20 units depending on the time considered. The second study yielded a 0.22 unit effect size. The authors, however, came to contradictory conclusions. Alhassan (2019) concluded that the training had had no impact, a result consistent with the previous studies cited in the two articles. Short training thus appeared insufficient to develop communication skills. Conversely, however, Yoshinaga et al. (2017) considered the observed effect to be sufficiently large. In their view, a few hours of training may suffice to have a lasting effect on this type of skill.

Although Cohen's *d* is the most common in the literature, the estimator requires several conditions. It should only be used when (1) the sizes of the two groups are close, (2) the populations from which the groups are derived have similar standard deviations and (3) these populations exhibit a normal distribution (Maher et al., 2013). When one or more of these conditions are not met, alternative effect size estimators are preferable. When group sizes differ significantly, the Maher team (2013) recommends calculating the Hedges g (1981), an estimator that takes into account the size of each group in the calculation of the combined standard deviation. When the standard deviations of the populations differ, the authors recommend using the Glass Δ (Glass et al., 1981), which uses the standard deviation of the control group instead of the combined standard deviation to standardize the difference in scores or means. Finally, regardless of which estimator is chosen, it is advisable to present a confidence interval that indicates the margin of error associated with the effect size estimate.

The second estimator used for this study is less common. We refer to the heterogeneity index (η) that Gérard (2003) defines as an index of the degree of agreement between respondents, or the degree of homogeneity of their assessments. Developed by the management sciences, this index provides another perspective on skill assessment. Specifically, it is a percentage that reflects a level of agreement in answers to statements. As with the effect size, there are guideposts to facilitate interpretation of the heterogeneity index: below 15%, the convergence of skill perception between respondents is considered strong. In a training situation, this means that the scores assigned to the skills are close. Conversely, above 30%, the scores are heterogeneous, indicating a discrepancy between participants' perception of skills. Considering that training is expected to reduce the skill gap in a group, one would expect a decrease in the heterogeneity index in response to the training. Although this indicator is easy to calculate, it has not yet been estimated for care training, to our knowledge. Yet importantly, the harmonization of good nursing practices within a team, especially in an academic setting with high staff turnover, is crucial both for the safety of care and for the adoption of these good practices by new nurses on the team.

Methodology

To evaluate the effects of the training in intermediate care units, the first step in our approach was to measure the training transfer using a two-measurement protocol and a standardized observation grid. The second step was to attempt to make a judgment on this transfer based on the effect size and heterogeneity estimators. This section describes the data collection procedure, the observation grid, the analysis plan, the treatment of non-assessed resources, and the ethics arrangements adopted for the research.

Data collection procedure

The parameter of the competency's transferability was taken into account in the measurement protocol. The effect of intermediate care training was assessed using a pre-post-type protocol, which allows measurements to be taken in training and work situations. The first measurement was performed during the first clinical teaching sequence, after the end of the in-class training module. The second measurement took place three to six months later, during the last clinical teaching which corresponded to a practical examination. Concretely, the real-life behaviours of each learner were observed and assessed in the course of a morning of care for one or two patients hospitalized in intermediate care units. In both cases, the trainer completed a standardized competency observation grid. To pass the practical exam, at least 67% of the trained nurse's competencies had to meet or exceed an anticipated level, which we describe below.

Standardized competency observation grid

The competency measurement was performed using a standardized observation grid incorporating the five roles of nurses, namely: A. Clinical Expert, B. Communicator, C. Collaborator, D. Leader and Learner-Trainer (Table 1). These roles are broken down into 16 competencies, themselves translated into 58 skill components referred to as "resources." These resources correspond to the knowledge, learned abilities, modes of reasoning, aptitude or other components that a nurse possesses and that are necessary to manage professional situations (Le Boterf, 2018).

Table 1
Structure of the skill observation grid

Role	Number of competencies	Number of resources	Example of resources
A. Clinical Expert	4	26	– Plan actions in accordance with priorities. – Recognize situations where the patient's life is in danger. – Coordinate care coherently.
B. Communicator	4	13	– Make sure that information is adequately received and grasped, in a timely manner. – Speak for the interests of the patient and their loved ones.
C. Collaborator	3	4	– Demonstrate an open and assertive attitude in teamwork – Plan cooperation and intra-professional coordination, and set priorities.
D. Leader	2	7	– Be familiar with institutional mechanisms for quality management, safety, and risk management. – Systematically apply internal procedures in all stages of patient management.
E. Learner-Trainer	3	8	– Seek out necessary support while using various means of learning. – Develop regular and relevant reflection on the professional situations encountered.

Initially, the roles and competencies were derived from the competency framework for the field of health professions in Switzerland (Ledergerber et al., 2009), which is in turn inspired by the CanMEDS competency framework for Canadian physicians (Frank & Danoff, 2007). The observation grid was developed to incorporate specific resources describing the care and supervision to be provided to inpatients in acute settings.

The first competency domain consists of 26 resources related to the role of *Clinical Expert* (A). For example, it includes the responsibility to provide individualized preventive and therapeutic care, to carry out monitoring and to know the protocols in effect for ensuring equipment safety and patient comfort.

The second competency domain covers 13 resources relating to the role of *Communicator* (B). The nurse communicates information to colleagues and the medical team in a structured way, adapts vocabulary to patients and loved ones, and develops a relationship of trust. The nurse conveys relevant information, develops a common understanding of care situations, and shares knowledge and experience with peers. The role of *Collaborator* (C) makes up the third area of expertise. The grid contains four resources in line with this role, which involves the nurse's active participation in the activities of an interdisciplinary or interprofessional team. The nurse is committed to advocating for optimal individualized care, supporting and assisting other team members, and participating in decision-making. The role of *Leader* (D) is described based on seven resources. The nurse exercises professional leadership, for example by reporting adverse events and risks of errors and by making suggestions to improve quality and patient safety. The skills associated with the role of *Learner-Trainer* are described through eight resources. The role refers to a professional commitment based on reflective practice, as well as the use of evidence.

Each resource is assessed using an ordinal scale with five taxonomic levels. The first level, *"0. Not Observed,"* indicates that an expected competency for performing a task was not observed during the assessment. The second level, *"1. Initial level,"* means that the observed nurse acquired the competency with assistance. The nurse is able to make links between what they do, see and know. The next level, *"2. Partial mastery,"* suggests that the nurse partially mobilizes the resources necessary to effectively complete the task, and is able to describe why and how they carry it out. Level *"3. Demonstrated mastery"* recognizes that the nurse uses the resources autonomously and performs the task efficiently. The final level, *"4. Expertise"* means that the nurse actively participates in the creation of collective knowledge, for example, by being able to help write protocols. Another available option was *"NA. Not applicable"* for statements that could not be assessed on the day of the evaluation. For most resources,

the taxonomic level expected at the end of the training corresponded to level 3, i.e., mastery. Trained nurses had to have reached this level by the time of the practical examination that concluded the training.

Analysis plan

Data from the observation grids was compiled in Microsoft Excel and Stata software (StataCorp., 2013). Descriptive analyses were run for each statement. To determine the statistical significance of the competency development of each cohort between time 1 (at the beginning of training) and time 2 (at the end of training), a Wilcoxon signed rank test was conducted. The significance threshold was set at $p \leq 0.05$.

To measure the magnitude of competency development, two effect size estimators were calculated. The first, Glass's Δ (Glass et al., 1981), is calculated as follows:

$$\text{Equation 1: } \Delta = \frac{M_2 - M_1}{s_1}.$$

In the case of the evaluated care training, M_2 and M_1 correspond to the overall means of the assessments from the observation grids, at time 2 and time 1, respectively. The s_1 variable corresponds to the standard deviation of the mean assessments at time 1. The second effect size estimator used is Cohen's *d* (1992), calculated as follows:

$$\text{Equation 2: } d = \frac{M_2 - M_1}{\sigma_{pooled}}.$$

Variables M_2 and M_1 are the same as those presented in equation 1. The variable σ_{pooled} corresponds to the combined standard deviation of the distribution of means (Tomczak & Tomczak, 2014). This variable is calculated as follows:

$$\text{Equation 3: } \sigma_{pooled} = \sqrt{\frac{(n_1 - 1)SD_1^2 + (n_2 - 1)SD_2^2}{n_1 + n_2 - 2}}.$$

In equation 3, the variables n_1 and n_2 correspond to the size of the nurse samples observed at times 1 and 2, and SD_1 and SD_2 correspond to the standard deviations of the means measured in the two samples.

For both estimators, a 95% effect size confidence interval was calculated (Thompson, 2007) using Stata 13 software (Tanner-Smith & Tipton, 2014).

The third estimator used to study changes in competencies was heterogeneity rate (η) (Gérard, 2003). For time 1 (start of training), this rate is calculated as follows:

$$\text{Equation 4: } \eta_1 = \frac{SD_1}{M_1} \times 100\,\%,$$

where variables M_1 and SD_1 are identical to those in equation 1. A heterogeneity index was also calculated for the end of training (time 2).

Treatment of unassessed resources

Several resources could not be assessed on the day of clinical teaching. In the grid, they were marked "*NA. Not applicable.*" When this situation applied to more than 50% of the clinical teaching, the corresponding resource was removed from the analysis. In all, 17% of the resources were removed (10 of 58), such as "*preparing the care environment for patient admission according to current protocols*" or "*determining the source of misunderstandings and tensions in interprofessional collaboration and demonstrating a constructive attitude.*" The following results thus concern a total of 48 resources: 23 under *Clinical Expert*, 11 under *Communicator*, four under *Collaborator*, five under *Leader* and eight under *Learner-Trainer*.

Ethical considerations

This study was approved by the review committee for inquiries at the hospital university, and the project goals were validated by the people in charge of the intermediate care units. No patient consent was required. This study did not include any data that could identify nurse learners who participated in the clinical teaching. Ethical rules pertaining to confidentiality were applied.

Results

The data collection was conducted between January 2016 and April 2018. During this period, six nurses withdrew from the training. Another nurse failed the practical exam, as more than one third of the resources she mobilized in the work situation were deemed to be below the expected taxonomic level. In other words, she was unable to mobilize these resources autonomously and to carry out the associated tasks efficiently. The results thus pertain to the clinical teaching grids completed with 89 nurses (i.e., 178 clinical teaching grids), between January 2016 and April 2018.

The sample consisted of 70 women (78.65%) and 19 men (21.34%). The mean age was 37 years old (SD = 8 years). As for their nationality, 39 were Swiss, 26 French, 14 Portuguese, and 10 were other. All nurses had experience, averaging 11.6 years (SD = 6.3 years) beyond initial tertiary nurse training. Just over half had an undergraduate university degree (bachelor's of science in nursing degree, n = 48; 52.93%) and two individuals had even held a master's degree in nursing for three years (2.25%). The remaining persons were registered nurses with a diploma in nursing (n = 39; 43.82%).

The vast majority (80%) of the trained nurses worked in various intermediate care units at the university hospital and a few (n = 12) came from outlying hospitals to attend the training. Of the 77 nurses working at the university hospital, 22 worked in surgery (including thoracic, visceral, otorhinolaryngology), 10 in cardiology and cardiac surgery, 9 in musculoskeletal intermediate care (including traumatology and orthopedics), 9 in pediatrics, 9 in internal medicine, 8 in neurology and neurosurgery, 8 in recovery room and endoscopy, and 2 in gynecology.

Table 2 presents the means and standard deviations for the competency scores at the beginning of the clinical teaching sequence (time 1) and at the end of the training (time 2). Overall, the training had a positive impact on the development of the five roles. Taking all the competencies together, the mean measured at time 2, at the end of the training, is significantly higher than that measured at time 1, at the end of the first clinical teaching. The overall effect can be described as strong to very strong, regardless of the effect size estimator examined (Glass Δ or Cohen *d*).

Significant development was observed for each role taken individually. However, the extent of development varied: the training moderately influenced competencies related to the role of employee and *Leader*. A somewhat greater extent was found for the more technical competencies related to the role of *Clinical Expert*. Skill development can be considered strong, even very strong, for the competencies of *Communicator* and *Learner-Trainer*.

Figure 1 shows the results obtained for the third estimator, the heterogeneity index. A first observation is that, with a mean of 9%, the rate was already very low at the first time of measurement. This indicates a low level of competency disparity in the group of people trained at the

Table 2
Competencies development following care training. N = 89

Role	M_1	SD_1	M_2	SD_2	Z	*p*	Glass Δ	CI 95%	Cohen *d*	CI 95%	Judgment
A. Clinical Expert	3.57	0.25	3.73	0.19	4.84	<0.001	0.64	[0.33-0.95]	0.72	[0.42-1.02]	Moderate-strong
B. Communicator	3.83	0.26	4.07	0.22	5.93	<0.001	0.92	[0.60-1.24]	1.00	[0.68-1.31]	Strong-very strong
C. Collaborator	3.96	0.43	4.16	0.22	3.47	<0.001	0.47	[0.16-0.77]	0.59	[0.28-0.88]	Moderate
D. Leader	3.65	0.37	3.84	0.30	3.85	<0.001	0.51	[0.21-0.82]	0.56	[0.26-0.86]	Moderate
E. Leaner-Trainer	3.78	0.38	4.11	0.31	5.73	<0.001	0.87	[0.55-1.19]	0.95	[0.64-1.26]	Strong-very strong
Global (A-E)	3.69	0.22	3.90	0.17	6.19	<0.001	0.85	[0.63-1.28]	1.07	[0.75-1.38]	Strong-very strong

Note. M = mean; *SD* = standard deviation; Z = Wilcoxon signed-rank test statistic; CI = Confidence interval for effect size.

beginning of the training sequence, at the patient's bedside. Nevertheless, the training did lead to greater homogeneity. At time 2, the heterogeneity index was only 6%.

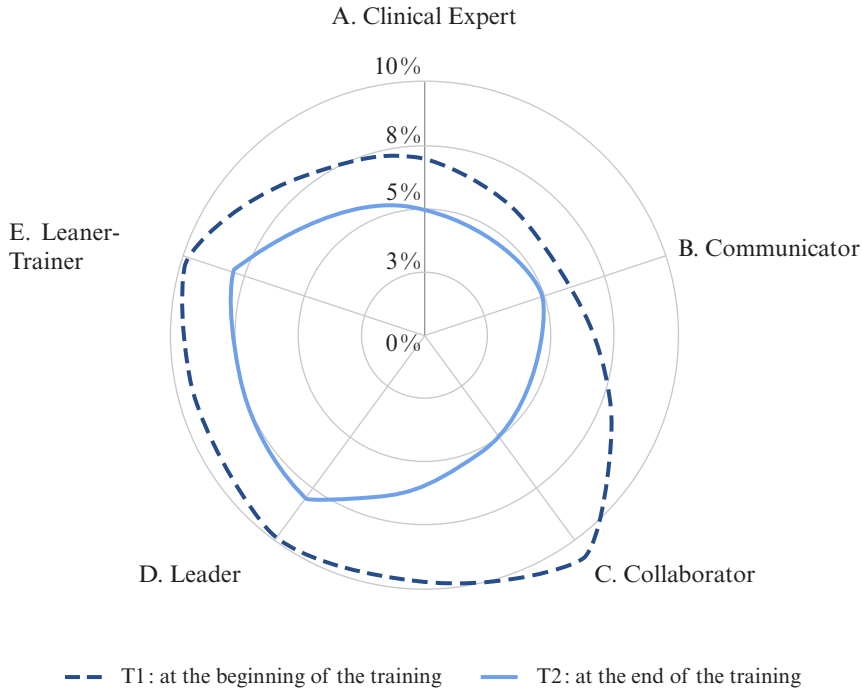

Figure 1. Group heterogeneity index by competency area

In addition, index variations can be noted between the roles. The disparity is more pronounced for competencies related to the role of *Collaborator*. The index was 11% at the beginning of the training, i.e., at its highest. It decreased by 6% at the end of the training. This being said, the competency indexes related to the roles of *Clinical Expert* and *Communicator* were already less than 10% at the beginning of the training (respectively 6% and 7%). These indexes decreased by 5% at the end of the training.

Discussion

This study aimed to evaluate the effects of a training program specific to intermediate care units on the development and harmonization of nursing competencies. The results indicate that clinical teaching at the patient's bedside in the course of intermediate care training was an effective teaching strategy. First, the approach of assisting training transfer in practice significantly developed the five roles of the nurse, namely Clinical Expert, Communicator, Collaborator, Leader and Learner-Trainer. Moreover, the clinical teaching reduced the disparity in behaviours among the trained nurse group.

The interpretation of the Cohen *d* and Glass Δ indicators led to identical conclusions, even if the Glass Δ values are systematically lower than the Cohen *d* values. The two estimators confirm that all effect sizes measured by nurse trainers using the observation grids were above 0.40 unit, in the "desired effects zone" of Hattie (2017) and where, according to Cohen (1992), the effect is visible to the naked eye. The effect sizes also allow a differentiated judgment according to the competency domains. The evaluation highlights a weaker development of competencies related to the roles of *Leader*, *Collaborator* and, to a lesser extent, *Clinical Expert*. Regarding *managerial* skills, the results are consistent with the observations of Morrow, Jarrett and Rupinski (1997), who also measured smaller effect sizes with managerial training ($d = 0.31$) compared to with technical training ($d = 0.64$). Two hypotheses may be put forward to explain these results. The first has to do with training: managerial competencies are more difficult to develop through clinical training, at the patient's bedside. This hypothesis entails that time and teaching resources must be considered in order to be able to correctly interpret the effect of training, as suggested by Hattie (2017). The other hypothesis relates to the assessment process. Managerial competencies are more difficult to ascertain through observation. Each clinical teaching sequence lasted a half day, which may not be sufficient for the nurse trainer to be able to assess this type of competency. In addition, these competencies may be observed in settings other than the patient's bedside or at specific times during a nurse's work week.

As for the role of Collaborator, the mean measured at time 1 indicates that the nurses were close to the level of expertise at the beginning of clinical teaching. Thanks to the training, they made significant progress. The mean

measured at time 2, the highest of all the recorded values, is above the level of expertise. This result suggests that it may have been more difficult to observe a strong effect on this family of competencies than on the others, as the initial level was already high and the potential gain, lower. To incorporate this aspect into the interpretation of effect size, it might be useful to also estimate an average relative gain that Gérard defines as "the ratio between what was gained and what could be gained" (2003, p.12, freely translated).

Another observation relates to the influence of nurses' initial training on the level of competencies observed during the training. Some of them had a university degree while others were registered nurses who had completed a nursing diploma. University training provided added value in terms of specialized knowledge in the areas of clinical evaluation, the ability to manage more complex cases or the optimization of care concepts. The professional training, contrastingly, was based on the work/study alternation approach, which placed greater emphasis on learning by doing. While differences in initial training could have led to competency disparities within the group of nurses trained, both during classroom training (module 1) and during clinical teaching sequences (module 2), our findings could not support this assumption. The analysis of heterogeneity rates reveals a decrease in the heterogeneity of competencies at the end of the training while interpreting these rates according to the guidelines of Gérard (2003) suggests that the group of nurses learners presented homogeneous practices in terms of communication, collaboration and management of care at the end of the classroom training module. This homogeneity may be explained by an environment that is likely already conducive to training transfer. Professional practice in a university hospital setting, reflectivity and interaction in medical-nursing teamwork, and the presence of specialized clinicians in most intermediate care units tend toward a standardization of practices. Continuing training in intermediate care was undoubtedly an additional contribution, and highlights the importance of updating knowledge and skills throughout professional life.

Despite the possibilities for comparison offered by effect size indicators, interpreting them remains a complex undertaking, as demonstrated by the comparison of the results of Alhassan (2019) and Yoshinaga et al. (2017). In this study, the complexity comes from the 95% confidence intervals of Cohen's *d* that appear large. For example, the confidence interval of the first family of clinical expert competencies lies between a lower value (0.29 units) which corresponds to a small effect and outside the "desired

effect zone," and a higher value (1.15 units) close to the threshold defining a very strong effect. In this context, the results, in our view, demonstrate the usefulness of calculating a heterogeneity index in addition to an effect size. As Spurlock (2017) points out, the most relevant information on the contributions of care training may lie beyond effect size measurement. This measurement essentially relates to the whole group of people trained, whereas the major contributions of the training may appear in only a few learners. By allowing for an interpretation of competency gaps between learners, the heterogeneity index paves the way for new ways of thinking about and describing the benefits of care training.

The results also highlight some limitations of this study. First, they emphasize the difficulty of observing certain competencies. Indeed, 17% of the resources mentioned in the grid were marked "Not applicable." These competency elements could not be observed in a work situation, despite the fact that each clinical teaching sequence lasted several hours and that competencies had been defined based on two validated competency frameworks. The second limitation relates to training transfer. The last competency measurement was conducted at the end of the training, during the practical examination, in the context of a care situation. There is no guarantee that the use of learned skills will be maintained over time, which is a prerequisite for a genuine impact on the quality of care. Finally, the causes of the variations in effect are not truly known. The training transfer may have been hindered by the work environment, motivation or preparation of trained nurses, training period or other factors (Ford et al., 2018).

Research outlook and conclusion

This research assessed the training transfer associated with care training based on effect size and heterogeneity index indicators. The first indicator demonstrated the magnitude of the effect on competency development, while the second showed a reduction in behavioural disparities within the nurse learner group.

The results suggest some avenues for reflection on the use of an observation grid to assess care competencies. The grid used to evaluate clinical teaching could be improved by modifying resources that could not be observed and assessed by nurse trainers. These resources could be integrated into a table of specifications, i.e., an instrument used in program

development to verify that the same items are being taught and evaluated (Parent, 2008). A parameter in the table would then be used to specify the frequency of observation, in a care situation, of the competency element contained in the resource. Further consideration could also be given to the persons responsible for carrying out the assessment and filling in the grid. A self-assessment could be completed by the trained nurse concurrently with the trainer's assessment. An interjudge reliability index would verify the consistency of competency measurements, which would validate the measured effect sizes for managers' competencies.

This research focused on the direct and short-term measurement of training transfer at the patient's bedside following continuing training in intermediate care for nurses. Several lines of research would allow us to deepen our knowledge of the effects of training. Another complementary study could investigate the causes of the observed variations between roles. Multiple studies have shown that factors related to the training design, the working environment or the characteristics of the people trained may explain the differences between the effect sizes that are measured (Ford et al., 2018 ; Burke & Hutchins 2007). In particular, such a study could verify whether certain factors specific to the hospital environment might have hampered the transfer of the roles of Leader, Collaborator and Clinical Expert. It could also assess the influence of the COVID-19 pandemic, which became widespread after the end of the training, on these same competencies.

A different study could look at the long-term effects of such training. The effect on competencies appears to be significant and a substantial number of nurses from the same hospital were trained, with possible effects on the quality of patient care and hospital functioning. A study could assess the impact of training in terms of organizational, clinical, and human resource indicators (e.g., length of patients' hospital stay, occurrence of adverse events, or nursing staff satisfaction). Pursuing research in this vein would be topical in the health sector, which is subject to significant financial pressure and, in the case of continuing training for care personnel, various budget cuts.

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NOTE

1. In Switzerland, the term "continuous care units" equates to "intermediate care."

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