Key conditions for the successful uptake and implementation of evidence-based practice in concurrent disorder nursing care with the ECHO Model: insights from a mixed methods study

Gabrielle Chicoine (✉ gabrielle.chicoine@umontreal.ca)
Faculty of Nursing, Université de Montréal

José Côté
Faculty of Nursing, Université de Montréal

Jacinthe Pepin
Faculty of Nursing, Université de Montréal

Pierre Pluye
Faculty of Medicine, Department of Family Medicine, McGill University

Didier Jutras-Aswad
Faculty of Medicine, Department of Psychiatry and Addiction, Université de Montréal

Research Article

Keywords: Mixed methods, Concurrent disorders, Dual diagnosis, Nurse, Continuing professional education, Distance learning, Knowledge translation, Implementation

Posted Date: January 27th, 2023

DOI: https://doi.org/10.21203/rs.3.rs-2504874/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License
Abstract

Background: People with concurrent mental health and substance use disorders have complex biopsychosocial problems, but risk not having their healthcare needs met. Nurses are positioned to meet these needs but often lack training in concurrent disorder management. Extension for Community Healthcare Outcomes (ECHO©) is a promising technology-enabled collaborative learning model used to implement evidence-based practice and build capacity among healthcare professionals in managing complex, chronic health conditions. This study aimed to understand how an ECHO program for concurrent disorder management impacts nurses’ competency development and clinical practice, and uncover key conditions for successful uptake and implementation.

Methods: We used a mixed-methods convergent design to collect, analyze, and interpret data from nurse participants in the first two years of a Canadian ECHO program for concurrent disorder management. Two studies were conducted simultaneously: (1) an uncontrolled before-and-after study using online surveys at baseline, 6 months, and 12 months to measure changes in nurse-related outcomes, with self-efficacy in concurrent disorder competencies as the primary outcome; and (2) a qualitative, interpretive description study using individual semi-structured interviews with a nurse subgroup, to explore how they developed and implemented competencies, and what factors influenced this process. Quantitative and qualitative results were then merged for comparison and complementarity, using the Pillar Integration Process.

Results: Six interrelated conditions were identified for successful uptake and implementation of evidence-based practice in nursing care: (1) Practice and validation opportunities; (2) Reciprocal and trusting relationships in an interprofessional learning environment; (3) Peer-to-peer experience sharing and mentoring; (4) Collaboration with experts; (5) Reinforcement of positive attitudes about professional work in complex or adverse situations; (6) Learning experiences that are team-based, tailored to the setting, and organizationally supported.

Conclusions: Outcome measures, perspectives, and experiences collected over 12 months indicated that ECHO contributed to nurses’ competency development and, under some conditions, to effective nursing practice changes. Given the challenges in implementing clinical guidelines in concurrent disorder nursing care, our results highlight the importance of understanding the key conditions for successful uptake and implementation. This informs approaches to optimally adapt implementation strategies to the needs and specificities of nurses, to obtain impactful, sustainable results.

Background

Importance of concurrent disorders

Concurrent disorders (CDs) refer to varied combinations of substance-use and mental-health disorders in the same individual simultaneously (1). While the reported prevalence rates for CDs vary (2, 3), it is estimated that up to 50% of individuals with psychiatric or other serious mental health disorders will
develop a substance use disorder at some point in their lives, and vice versa (4). People experiencing CDs consistently have poorer physical health, greater psychological distress, and less-than-optimal healthcare compared to people with only a single disorder (5). They are also more vulnerable to a wide range of psychosocial difficulties, including housing instability and homelessness, stigma, violence and incarceration, and worsening social functioning (6). Furthermore, CDs are frequently associated with premature mortality, due to an increased vulnerability to medical illnesses and infections, and a higher risk of suicide and accidental death (7).

The complex healthcare needs of the population with CDs increase symptom severity and complicates recovery, resulting in sub-optimal levels of engagement in treatment, high relapse rates, long hospital stays, and increased healthcare costs (8, 9). Thus, delivering quality healthcare services that address the specific needs of individuals with CDs constitutes a high priority for many healthcare organizations and providers worldwide (10). To address this priority, evidence-based interventions are a crucial first step to enhance the quality of care and improve patient health outcomes (1).

**Evidence-based interventions for CD management**

Integrated care (or treatment) is an approach relying on the concurrent delivery of multiple evidence-based interventions (e.g., pharmacotherapy, psychotherapy, motivational interviewing, relapse prevention) for both mental-health and substance-use disorders by a provider or a team of providers within the same facility, or by separate healthcare teams working in close collaboration (11). Despite multiple clinical guidelines promoting the virtues of integrated care as an evidence-based practice (EBP) (1), research has shown that only 7.4% of individuals with CDs receive care for both their mental-health and substance-use needs, and that up to 55% receive no treatment at all (12). Some researchers suggest CD management guidelines are translated into clinical practice in a fragmented and inconsistent way, and that CDs remain complex to manage for many healthcare professionals (13, 14). The challenges involve, for instance, screening mental health needs in active users, managing persistent and chronic symptoms, coping with negative symptoms adversely affecting social relationships and functioning, managing substance withdrawal and cravings, and dealing with medication noncompliance and treatment dropout.

Contributing to this evidence-practice gap is a lack of sufficient training in CD management (15, 16). An integrative review by Priester et al (12) reports that primary healthcare professionals frequently cite having a skill deficit and a lack of preparation in identifying both mental-health and substance-use disorders. In addition, a systematic review of 28 studies indicates that judgmental attitudes towards patients with substance use disorders are common in healthcare professionals and can lead to suboptimal treatment (17). As regards nurses—the largest group of healthcare professionals in all sectors of healthcare systems around the world (18)—most continuing education programs available do not provide training on CDs (19), and many mental health nurses do not feel confident discussing substance use issues with their patients (20-22). Further, research indicates that most addiction treatment nurses perceive themselves as ill-equipped to screen, assess for, and refer those with mental health disorders (23).
Promoting the uptake and implementation of EBP for CD management

Continuing professional education is consistently described as a significant implementation strategy for healthcare professionals to successfully transfer guidelines into clinical practice (24-26). A recent Cochrane review of 215 studies shows that educational meetings and workshops have slightly moderate effects on changing professional practice (27). Educational strategies targeting healthcare professionals’ practice include technology-enabled collaborative learning and capacity-building models (28). Among these, the Extension for Community Healthcare Outcomes (ECHO©) model has shown promise for implementing EBP and improving patients’ health outcomes (29-31). ECHO is a tele-mentoring model that uses videoconferencing technology to actively spread EBP, and build capacity among healthcare professionals to manage patients’ complex, chronic health conditions (32). Real-time educational sessions pair frontline medical and allied healthcare professionals (‘the spokes’), typically in undeserved or remote communities, with an interdisciplinary panel of experts at an academic medical center (‘the hub’), using case-based learning, peer learning, and formal didactics to share clinical guideline recommendations and provide rapid access to reliable information (33, 34).

Three systematic reviews have investigated the impact of ECHO and suggest that this continuing education model positively impacts healthcare professionals’ satisfaction, knowledge, clinical confidence, and behavior changes (29-31). In addition, a few recent randomized and nonrandomized controlled studies show that ECHO significantly improves patient-related outcomes, including care processes and outcomes of care (35-41). Despite this breadth of evidence, most of the empirical research on ECHO has focused on programs in hepatitis C treatment, chronic pain management, and geriatric care. Thus, the three above-mentioned systematic reviews call for more research on this model across diverse fields and contexts. Indeed, environment and organizational context are often cited as factors playing a role in how successful technology-enabled implementation strategies are at securing changes in practice (42). However, the literature reporting on the outcomes of CD-focused ECHO programs often lacks details about contextual specificities and provides limited information about the barriers and enablers to a successful implementation (43-46). Moreover, the ECHO-related literature gives little attention to the factors that influence practice changes among healthcare professionals—or to understanding the relationships between these factors (47). Specifically, there is a dearth of studies focusing on the nursing perspective and on outcomes in the field of CD care (48, 49). These topics are particularly important for two reasons: nurses are on the front lines in most healthcare service access models for individuals with CDs, and they are the professionals most likely to be responsible for case management roles that involve patient care, discharge planning, and team and care coordination (50).

This study strives to help fill these gaps. Its overarching aim was to develop a comprehensive understanding of the impact of a Canadian CD-focused ECHO program on nurses’ competency development and clinical practice, and to uncover the conditions for successful uptake and implementation of CD EBP in nursing care.

Methods
Context and educational intervention

In 2018, an ECHO program for CD management (ECHO-CD) was developed and implemented at the University of Montreal Hospital Center (CHUM) in the province of Quebec, Canada. The initiative showed a high level of acceptance in the community: during its first two cycles (2018–2019 and 2019–2020 curricula), ECHO-CD was offered to up to 200 registrant healthcare professionals each year, with an average of 50 to 60 attendees connecting at the same time in any given online educational session.

Congruent with the ECHO model, the structure and delivery of ECHO-CD was informed by behavior change theory (51), social learning theories (52, 53), and adult teaching methods (32), and its content was developed in alignment with recent clinical guidelines for CD management (1, 11, 54). Online educational sessions occurred every two weeks over a 10-month period, for a total of 20 sessions per cycle. During a session, healthcare professionals from primary and secondary care (spokes) and the expert team (hub) discussed an active, deidentified patient case presented by a healthcare professional (or a team of healthcare professionals) for about an hour, after which, hub and spoke participants provided clinical recommendations and individualized feedback. The last 20 minutes were reserved for an expert didactic presentation about various topics related to CD EBP.

A detailed description of the educational program—including adaptations made for the learners and their local context, and unplanned modifications that took place in delivering the program's 2019–2020 curriculum due to the COVID-19 pandemic—was previously reported in a publication elsewhere (55), in accordance with the Guideline for Reporting Evidence-based practice Educational interventions and Teaching (GREET) (56). More information is also publicly available online (https://ruisss.umontreal.ca/cectc/services/echo-troubles-concomitants/).

Study design

Our approach relied on a social-constructivist-inspired conception viewing quantitative (QUAN) and qualitative (QUAL) methods as two inputs that can enrich each other through a "looping effect" (57, 58); producing fertile ground for developing a comprehensive understanding of the ECHO-CD’s impact on nurses’ competency development and clinical practice, and to uncover the conditions linked with successful uptake and implementation of CD EBP. Specifically, this study was guided by the following three research questions:

- What is the evolution in nurse-related outcomes over a 12-month period of participation in ECHO-CD? (QUAN research question)
- How did the nurses implement, in their clinical practice, the competencies they perceived as having developed through their participation in ECHO-CD, and what factors have influenced this process? (QUAL research question)
- In what ways is the evolution in nurse-related outcomes over a 12-months’ participation in ECHO-CD linked with the development and implementation of their competencies in clinical practice? (mixed methods [MM] research question)
To answer these research questions, the study employed a MM convergent parallel design (59), which is recognized as the ideal method for investigating the impact and conditions of knowledge translation strategies (60-62). It involves using the quantitative (QUAN) and qualitative (QUAL) methods concomitantly to collect, analyze, and interpret the data; and then both sets of results are compared in the final integration of the study (63). The rationale for using this MM approach was complementarity (64), as it was expected that the nurses’ perspectives on their competency development and the factors influencing this process, from the QUAL component of the MM study, would be complementary to the QUAN component on the ECHO-CD’s impact on nurse-related outcomes. A visual representation of the convergent MM design was previously published in the study protocol, which can be found in a publication elsewhere (57).

This article presents the emerging MM findings from the analysis and integration of QUAN and QUAL results, and on how and when this integration occurred. The study is reported in accordance with the Good Reporting of A Mixed Methods Study (GRAMMS) (65) (see Additional file 1).

**Ethics**

Ethics approval was obtained from the Ethics Committee of the CHUM (#19.295), and the University of Montreal’s Research Ethics Committee in Sciences and Health (#CERSES-20–017 R). Written consent to participate in the study was obtained from all surveyed participants before program onset for the QUAN component of the study, and then before each interview for the QUAL component. Participation was voluntary and not connected to program registration or performance; interview participants were compensated with C$50.

**Study population and sampling**

The study took place during the program's first two years of implementation, from September 2018 to December 2020. The potential study population comprised all nurses who registered in ECHO-CD for the 2018–2019 and/or 2019–2020 curricula (N = 65). In the QUAN component of the MM study, a census approach to sampling was undertaken: all nurses who registered in ECHO-CD and who consented to the research were included and invited to complete self-administered surveys online. For the QUAL component of the MM study, nurses who participated in at least one online educational session were recruited and invited to participate in semi-structured interviews. Table 1 summarizes the sociodemographic data and practice profiles of participants for both the QUAN and QUAL components.

Table 1. Sociodemographic data and practice profiles of the nurse participants in the QUAN and QUAL components of the MM study.

[INSERT TABLE 1 HERE]

**QUAN component of the MM study**
An uncontrolled before-and-after design was used to measure changes in nurse-related outcomes over a 12-month period of participation in ECHO-CD. Based on Moore et al’s (66) conceptual framework, self-efficacy in CD management was chosen as the primary outcome. Secondary outcomes included knowledge of, and attitude toward working with people with CDs; program participation, satisfaction and acceptability; and perception of clinical performance. A total of 28, 19, and 12 nurses completed an online survey on SurveyMonkey© at baseline, and at the 6- and 12-months follow-ups, respectively. Detailed methods and results from the QUAN component of the MM study can be found elsewhere (67).

QUAL component of the MM study

An interpretive description methodology was chosen to explore the experiences and perceptions of the nurses who participated in ECHO-CD about the competencies they developed and implemented in their clinical practice, and the factors that influenced this process. All interviews were conducted by the primary author (GC) via the Zoom platform (Zoom Video Communications Inc, 2022) and lasted between 45 and 90 minutes. An interview guide was drafted and refined during the data collection. The recruitment took place between May 2020 and July 2020. Ten nurses volunteered to participate in the interviews (see Table 1). Detailed methods and results from the QUAL component of the MM study have been previously reported (55).

Analysis and integration of QUAN and QUAL results

The MM analysis involved three steps: (1) QUAN results: descriptive quantitative analysis, analysis of variance, and subgroup analysis; (2) QUAL results: thematic inductive analysis and member checking; and (3) integration of QUAN and QUAL results. As this article focuses on the study’s MM findings, the contributing QUAN (i.e., statistics) and QUAL (i.e., themes) results—which have been published elsewhere—are presented here as inputs in the integration process (i.e., MM analysis of two interdependent sets of results).

Step 1 – QUAN results: Descriptive statistics, repeated measures analysis (ANOVA), and subgroup analysis

QUAN analyses were conducted using the Statistical Analysis System (SAS) software V.9.4 (SAS Institute Inc, 2022). Participants' characteristics were assessed descriptively at the baseline. Their satisfaction with and acceptance of the program and their perception of their clinical performance were covered in the 6- and 12-month follow-ups. To measure changes in the main participant-related outcomes (i.e., self-efficacy, knowledge, and attitude) over the three data collection time points, a repeated measures analysis (ANOVA) was performed. The linear mixed models (68) included the continuous dependent outcome measured at baseline, 6 months, and 12 months, with the within-participant time effect as a fixed effect, and the participant intercept as a random effect (69). Similarly, linear mixed models were used to examine subgroups and interactions with the study’s main outcomes, stratified by session attendance frequency (i.e., low [0–5 sessions] versus high [6–20 sessions]).
Overall, the ANOVA longitudinal analysis revealed that there was no statistically significant improvement in the nurses’ self-efficacy at the 6-month or 12-month follow-ups (Fig. 1), as compared to the baseline (67). Nevertheless, the results showed that both knowledge and attitude scores significantly improved from baseline to the 6-month and 12-month follow-ups (Fig. 1). In the subgroup analysis, the results indicated that self-efficacy improved significantly from baseline to the 12-month follow-up among nurses with high attendance (Fig. 2a). As for knowledge (Fig. 2b) and attitude (Fig. 2c), the improvements found in the ANOVA longitudinal analysis only remained statistically significant for nurses with high session attendance, at both the 6-month and 12-month follow-ups.

[INSERT FIG. 1 HERE]

[INSERT FIG. 2 HERE]

**Step 2 – QUAL results: Thematic inductive analysis and member checking**

Qualitative analyses were conducted with MAXQDA 2020.1 (©1995–2020, MAXQDA – Distribution by VERBI GmbH) using a thematic inductive analysis (70). Once completed, the recorded interviews were professionally transcribed and the transcripts, supplemented with the interviewer’s notes (GC), were coded and analyzed using an iterative, data-driven approach to code development. The analyst (GC) listened to the audio recordings and read the interview transcripts to familiarize herself with the data, and make sure that the transcription was accurate. Then, meaningful units of text within the transcripts were coded and grouped together to generate a list of initial themes that pinpointed patterns in the data. Charting and visualization tools in MAXQDA were used to further explore the data and scrutinize relationships among emerging themes. This took shape as a hierarchy of themes and subthemes that reflected a deeper understanding and interpretation of how the data contributed to answering the QUAL research question.

The analytical process took place through frequent discussions between the analyst (GC) and two research team members (JC and JP) to arrive at a common understanding of the nurses’ experiences, by refining and renaming the themes and subthemes until a consensus was reached. To enhance trustworthiness, a member checking technique (71), also known as participant validation, was used to explore the credibility of the QUAL results. Four main themes and eighteen contributing subthemes resulted from the inductive thematic analyses and member checking (see Additional file 2). Together, these themes reflected the progress made by the nurses on some clinical nursing competencies and how these competencies were implemented into their clinical practice (theme 1); they also illuminated how this learning process took place during ECHO-CD (theme 2); and they depicted the factors that facilitated (theme 3) or limited (theme 4) the nurses’ competency development and practice changes (55).

**Step 3 – MM findings: Integration of QUAN and QUAL results**

Then, the study’s QUAN and QUAL results were merged to compare, contrast, and corroborate the emerging results, and to gather complementarity insights (72). This was achieved by applying an integration strategy inspired by the Pillar Integration Process (PIP) (73). The PIP involves a structured,
four-stage process to centralize, balance, and interpret the QUAN and QUAL results, visually and technically, within the same analytical framework (73). PIP was chosen because it focuses on exploring or expanding on the findings and generating new inferences, rather than comparing two different data collection methods focused on the same phenomena, simply for validation purposes.

In this study, the first step in the analysis and integration of QUAN and QUAL results involved juxtaposing the main study results into a single table, usually referred to as a “matrix” or “joint display” in the literature (74). Second, once the listing was completed, a “matching process” was conducted, in which two independent coders (GC and JC) performed a side-by-side comparison of the QUAN and QUAL results to identify similarities, differences and/or discrepancies, and complementary information. Third, for each combination of QUAN and QUAL results, a preliminary MM interpretation was generated by the first author (GC) and then reviewed with another researcher (JC) to verify its accuracy with the study’s QUAN and QUAL results and to stimulate further insights into the arising MM interpretations.

In the fourth and final stage, namely, pillar building, the preliminary MM interpretations were collated and synthesized in a last analytical effort, by searching for commonalities and/or relationships between them, and by narrowing down the preliminary interpretations into broad-based categories that pinpoint the final MM findings. The resulting MM findings were refined and renamed until a consensus was reached among the research team members (GC, JC, JP, and DJA). To illustrate the analytical integration process through which the study’s MM findings emerged, a sample of combinations between QUAN and QUAL results, alongside their corresponding preliminary MM interpretations, are displayed in Table 2 for each final MM finding.

Table 2. Sample of combinations between QUAL and QUAL results with their corresponding preliminary MM interpretations, for each MM finding.

[INSERT TABLE 2 HERE]

**Results**

Integration of QUAN and QUAL results produced a total of six new themes, identified as the study’s MM findings 1 to 6 (see Table 2). Together, these themes describe how the evolution in nurse-related outcomes, over their participation in ECHO-CD, is linked to the development and implementation of their competencies in clinical practice (MM research question). Using a three-layered representation, the six MM findings from the integration process are summarized in Fig. 3 to highlight the relationships among them, and then dare escribed in greater detail in the following paragraphs.

[INSERT FIG. 3 HERE]

Overall, Fig. 3 illustrates how MM findings 1 to 6 are interconnect in a comprehensive view of how ECHO-CD impacts nurses’ competency development and what the key conditions are for successful uptake and implementation of CD EBP in nursing care. In the top layer of Fig. 3, i.e., the contextual layer, the
educational and practice contexts appear, intertwined, highlighting that these two environments are constantly interacting with and feeding off one another. It also points out that it is paramount, for the successful uptake and implementation of CD EBP, that these two environments (i.e., ECHO-CD and CD nursing care) be aligned and form a cohesive whole rather than two separate entities. This interplay between education and practice depicts how each MM finding influences the others; meaning that each key condition emphasizes this inseparable relationship between education and practice, within the context of an implementation strategy through continuing professional education.

Then, the center of Fig. 3 illustrates MM finding 1, which reflects the experiential learning process that took place as the nurses developed their competencies and further refined their clinical practice. In an educational environment, this process begins with the nurses taking action in their own learning journey and engaging in meaningful learning experiences. According to our results, these meaningful learning experiences were for the nurses to present a clinical situation of a real, anonymized patient-case and to actively engage in problem-solving activities with their ECHO peers and mentors. Meanwhile, in the practice setting, the nurses engage in an ongoing learning and competency-building process, based on practicing what they have learned in their workplace, to consolidate learning. These opportunities for practice and feedback in authentic settings were catalysts for the implementation of new CD competencies in clinical nursing practice and for fostering ongoing learning and renewed practice. Above that, Fig. 3 shows that the nurses’ commitment to and sustained participation in ECHO-CD (linked with MM finding 2) were key aspects for this dual process of learning-while-practicing process to take place.

The educational and learning processes layer, which is displayed in the middle layer of Fig. 3, relates to both the educational and practice-related conditions that were required throughout the nurses’ participation in ECHO-CD. This trajectory begins with their entry in the program, continues through their active participation, and then moves on to their implementing new CD competencies in clinical nursing practice and pursuing their own professional development:

- Reciprocal and trusting relationships in an interprofessional learning environment (MM finding 2)
- Peer-to-peer sharing of similar experiences and mentoring activities (MM finding 3)
- Collaboration with experts (MM finding 4)
- Reinforcement of positive attitudes about performing professional role in complex and adverse clinical situations (MM finding 5)
- Learning experiences that are team-based, tailored to the setting specifics and receive organizational support (MM finding 6)

Finally, the educational and learning-processes layer is linked to the impacts targeted by the conditions in place for the successful uptake and implementation of CD EBP in nursing care, as shown in the bottom layer of Fig. 3, i.e., the impact layer:

- Normalize experience and provide emotional support (MM finding 3)
- Facilitate cross-disciplinary knowledge sharing and rapid knowledge uptake (MM finding 4)
Discussion

Main findings

Using a convergent parallel design, this MM study developed a comprehensive understanding of the impact of a Canadian ECHO program for CD management (ECHO-CD) on nurses’ competency development and clinical practice. The QUAN results (nurses’ self-efficacy, knowledge, attitude, participation, satisfaction and acceptability, and perception of clinical performance) were merged with the QUAL results (nurses’ experiences and perceptions about the competencies they developed and implemented in their clinical practice, and the factors that influenced this process) to produce greater insights into the conditions linked to the successful uptake and implementation of CD EBP in nursing care. Overall, our findings suggest that participating in ECHO-CD contributed to the nurses’ competency development and that this participation can, under certain conditions, result in effective and sustainable clinical practice changes. To interpret and discuss the main findings of this study, below we pinpoint a number of questions to highlight our findings’ contributions to the advancement of knowledge, and their implications for nursing education and practice, and future research.

What do the findings of this study add to our current knowledge of the ECHO model and what are their implications for research?

Based on social learning (52, 53) and behavior change (51) theories, both of which build on the premise that social interactions are essential conditions for effective learning and behaviour change to occur (75), one promising component of the ECHO model is the interprofessional environment that fosters collaborative learning. The ECHO model therefore endorses that sharing professional experiences improves and reinforces learning, while peer support enhances one’s motivation to and self-perception of being able to perform new behaviours in clinical practice (34). Consistently, our results indicated that peer-to-peer sharing of similar experiences and mentoring activities were essential conditions to normalize the nurses’ experience with CD management and provide emotional support in difficult clinical situations. Previous MM and QUAL research in the field of ECHO have also reported several benefits of the model’s interprofessional and collaborative component in terms of sharing EBP, empowering participants to manage complex clinical situations, and increasing their understanding of the roles played by each profession (76-80).

Moreover, our study contributes to advancing this evidence on the impact of the ECHO model by highlighting that the opportunity for practice and validation—as a “key educational condition” (81) of the ECHO model—seem beneficial to fostering nurses’ competency development and practice change. This finding is critical both for the field of nursing science and for future research on the ECHO model with regard to how continuing professional education is designed for, and tailored to needs of, the participants.
to help them further contextualize their learnings and improve their confidence in implementing relevant, evidence-based interventions in their practice. As the ECHO model can be characterized as a complex educational intervention, i.e., multiple interacting components within the intervention and with its context (82-84), further research is needed to elucidate which educational conditions and learning methods are better suited to foster successful uptake and implementation of CD EBP in nursing care through ECHO. For example, future studies could use a “blending” approach to adult learning theory/frameworks and design components of implementation research (85) and, in doing so, assess more specifically the clinical effects of ECHO on relevant outcomes (e.g., sustainable practice change and patients’ health), while systematically gathering and documenting the planned and unplanned strategies used during the research (86, 87) to improve the implementation and sustainability of EBP.

**How do the findings of this study help increase our understanding of the ECHO model’s impact on nurses’ competency development and practice change, and what are their implications for education and practice?**

As outlined previously, our results showed that ECHO-CD provided opportunities for nurses to engage in ongoing learning and practice change, a process that includes two broad activities, namely practicing new acquired learnings and then receiving validation from peers and experts regarding the changes made in the workplace. This allowed nurses to share with other participants how they effectively—or not—implemented into their clinical practice their new learnings, which, in turn, helped strengthen their belief in their own ability to suitably manage CD or helped them find tangible solutions to deal with complex and adverse clinical situations. This process was an essential steppingstone in the nurses’ competency development in CD care, and most importantly, in clinical practice change. Thus, competency development and practice change occurred simultaneously, through both educational and workplace learning situations. These two environments aided the nurses to consolidate “critical learnings,” which, according to Tardif (88), are sustainable learnings that represent a “cognitive reorganization” or a crucial developmental stage.

These findings reinforce the idea that nurses learn and develop their competencies through experience, and that consequently, education and practice, must align and work interdependently (89). Indeed, the belief that nurses learn while practicing nursing is based on decades of evidence in nursing (90-94) and adult education (95-98). For example, Jantzen (94) finds, from a grounded theory, that refining nursing practice includes both formal and informal learning; however, significant nursing expertise is developed through “puzzling and enquiring”, an active, iterative process described as learning while nursing in the work setting, which requires self-consciousness and autonomy. In a related fashion, it has been asserted, as conceptualized in a systematic review by Davis et al (99), that working and learning must be understood as an integrated experience that enables nurses to implement contemporary, evidence-based, professional practice and continuously improve safe, quality patient care. Following along similar lines, a recent metasynthesis showed that contextualizing learning and placing it in close proximity to practice enhanced nurses’ motivation and engagement toward continuing professional development (100). Likewise, it has been robustly documented that fragmentation in continuing professional development
initiatives should be actively avoided, and that this would require strong practice–education organizational partnerships and the promotion of learning in the practice setting (99, 100).

Another important finding from this MM study is that ECHO contributed to reinforce nurses’ positive attitudes about performing their professional role in complex and adverse situations, which further stimulated ongoing learning and practice renewal. This is congruent with adult learning theory and previous nursing education research showing that transformative learning helps to develop emancipated and responsible attitudes in nurses toward their own learning (101, 102). To this end, Hoggan (103) argues that a strong professional identity can have a powerful influence on behavior change because it prompts nurses to show receptiveness to new learning and openness to self-directed and reflexive learning, and to demonstrate accountability for their own professional development. Overall, the findings of this study corroborate the evidence from many existing knowledge syntheses (24, 100, 104-106) stating that building a culture of lifelong learning in the workplace, one that values continuing professional education and encourages nurses to grow professionally, is a key condition to maintain high standards of care through competent nursing practice (102, 104).

**What theoretical insights do the findings of this study raise?**

This study adds to the current literature on the ECHO model by shedding new light on the learning and educational processes that contribute to the successful uptake and implementation of CD EBP in nursing care. Indeed, although the ECHO model was built on the theoretical foundations of social learning theories, the findings of this study particularly resonate with transformational learning theory (107). Transformative learning is a process that facilitates the transition from a transmissive pedagogical standpoint to a transformative paradigm of learning and interdependence between continuing education and practice (89, 108). It advocates for democratic education for sustainable development, whereby learners are co-creators of their own learning through questioning, critical reflection, and creativity, in order to arrive at viewpoint changes that guide their actions (107). Transformative learning is dynamic and interactive, and, thus, it engages nurses to actively participate in their own learning and it enables the construction of contextualized knowledge that is useful for real-life professional setting (101). Transformative learning stimulates nurses to learn how to think independently. It develops their self-confidence and competence to meet the multifaceted healthcare needs of their patients, and to renew and adapt their practice in constantly shifting contemporary work environments (109).

In this MM study, we found that ECHO allowed nurses to actively engage in opportunities for practice and validation, which according to transformative learning, refers to an integrative process of making connections between concepts and experiences so that knowledge and skills can be reinvested into new, multifaceted clinical challenges (110). Congruent with our findings, Tsimane and Downing (101) report, from their concept analysis results, that the process of transformative learning in nursing education is facilitated through investigative, collaborative, inventive, and interactive learning activities which,
together, constitute the educational processes that should be put forward in developing and implementing any potential continuing educational program.

This can have implications for the future implementation of ECHO-affiliated programs, as regards the extent of what, and in what ways, the original ECHO model can be adapted to the needs of end users to promote transformative learning. It also has implications for educators and/or facilitators (e.g., the ECHO interdisciplinary panel of experts) regarding their readiness to embrace roles as active knowledge translation agents, mentors, and learning coaches, rather than serving as a transmission channel for the passive dissemination of EBP.

What can be inferred from the findings of this study to improve future implementations of the ECHO model?

This study lays bare an important number of cultural, contextual, and organizational factors that negatively affected the nurses’ consistent participation in ECHO-CD (e.g., time constraints, access to technology, lack of contextualized educative content), as well as their capacity to implement new interventions in their patients’ care plan and to foster practice changes within multidisciplinary care teams (e.g., limited CD-specialized resources, lack of employer support toward practice changes) (55). Such barriers have also been uncovered in other ECHO programs addressing complex and chronic health topics, within the constraints of resource-scarce healthcare settings (30, 31). For example, Pagé et al. use a QUAL study design to explore the factors influencing healthcare providers’ uptake of an ECHO program for chronic pain management and find that expert recommendations and/or feedback were often “lost in translation,” which was mainly associated with insufficient multidisciplinary healthcare resources to offer gold-standard care. The same research group insists that ECHO programs should offer participants evidence-based guidance balanced between acknowledging the optimal therapeutic path for a given patient and what this patient can realistically have access to. This can have implications for the future implementation of ECHO-affiliated programs, as regards the extent of what, and in what ways, the original ECHO model can be adapted to the needs of end users. It also has implications for educators and/or facilitators regarding their readiness to embrace roles as active knowledge translation agents, mentors, and learning coaches, rather than serving as a transmission channel for the passive dissemination of EBP.

Similar to our findings, research has shown that nurses are often reluctant to leave or prevented from leaving the clinical setting to attend continuing professional education due to heavy workloads and a lack of relief coverage, use of personal time to undertake mandatory training, and organizational culture and leadership issues constraining the implementation of learning to benefit patients (104). Instead, as noted by Mlambo et al. (100), relevant organizational support should prioritize both structural (e.g., allocation of time and funding for continuing education, adequate staffing, healthy workplace culture conducive to practice change) and moral support (e.g., explicit managerial support and recognition for professional development, encouragements from peers, experts, and mentors). Our results, however, highlight that concurrent with supportive environments, emotional support provided through peer-to-peer
sharing and mentoring activities—as a key condition for the successful implantation of CD EBP in nursing care—should also be emphasized within the educational setting, to normalize nurses’ experience toward the many challenges they face in managing CDs.

Lastly, our results showed that a key condition for successful uptake and implementation of CD EBP was for nurses to attend ECHO with their co-workers. This facilitated knowledge sharing and practice changes, and it fostered a common, patient-centered vision in care team members. In the implementation science literature, a team-based approach has shown promising results for improving the implementation of evidence-based interventions in interprofessional primary healthcare settings and for overcoming barriers such as a lack of communication and unshared professional values (111, 112). As most ECHO participants are primary care providers who work in multidisciplinary teams, future studies should aim to evaluate the impact of ECHO on specific outcomes of care performance and/or care processes such as teamwork and collaborative skills. Research is also needed to deepen our understanding of the ECHO model’s influence on relational dynamics at work and to explore how it can be used or improved further to foster interdisciplinarity and create a healthy learning culture in the workplace.

**Strengths and limitations**

This MM study is unique in that it relies on an integrative conceptual framework (57) developed by taking inspiration from a social-constructivist worldview of science (58), stipulating that an in-depth inquiry arises from a “looping effect” between QUAN and QUAL evidence that produces a “mixed kind” of evidence. Hence, the major strength of this study is its rigorous, thoughtfully planned MM design. In our MM convergent parallel design, both QUAN and QUAL methods were used concurrently, bolstering one other, and allowing us to develop a comprehensive understanding of the impact of an ECHO program for CD management on nurses’ competency development and clinical practice. In addition, we used a structured and systematic integration process, the PIP (73), to merge, compare, and contrast the QUAN with the QUAL results, which added value to either method in itself. This interwoven approach provided a fertile analytical ground to study the key conditions for successful implementation of EBP in CD nursing care with the ECHO model.

This MM study also has some limitations. First, the QUAN study relied on a prospective cohort study design without the use of a control group and the sample size available for analysis was small (n = 28). For this reason, causal inferences regarding exposure to the educational program and nurse-related outcomes could not be made. Second, our study was conducted in only one Canadian province, and the educational program was strongly contextualized to CD care in this area. Although this may well reflect specific contextual aspects, it can also make our results difficult to transfer to other settings or regions. We therefore provided, a detailed description of ECHO-CD, in accordance with reporting guidelines for EBP educational interventions (55, 56), which will facilitate its adaptation in other contexts. Third, we investigated outcomes and perspectives at the level of individual nurse participants. Outcomes and/or perspectives at the organizational and patient level warrant further exploration.
Finally, one important issue to consider in MM convergent design is the divergences (also called contradictions, discrepancies, dissonances, and differences) between QUAN and QUAL results that can arise during the integration process, constituting a potential threat to the reliability of the MM findings (59, 113). From a conceptual standpoint, however, some authors in the field of MM research argue that divergences in data/results can also stimulate rich theoretical questionings and shed new light on existing empirical knowledge (114). In this study, the divergences noticed during the integration process by the first author (GC) were systematically discussed with another researcher (JC), and then resolved by reviewing the preliminary MM interpretations and providing possible explanations, where appropriate. In addition, the PIP ensured rigor throughout the integration procedures, discrepancies being systematically addressed and documented, and its use further enhanced transparency in their reporting.

Conclusions

Continuing professional education is central to nurses’ lifelong learning and is a vital part of maintaining high standards of nursing care through competent EBP. Outcome measures and perspectives collected over 12 months indicated that participation in ECHO-CD contributed to nurses’ self-efficacy in CD management, knowledge of and attitude toward CDs, and the factors that moderated competency development and practice change such as consistent, active participation in an interprofessional community of learners supported by their organizations. Given the challenges associated with the implementation of recommended clinical guidelines in CD nursing care, our findings highlight the importance of furthering our understanding of the key conditions for successful uptake and implementation. As a prerequisite, a better understanding of these conditions can help inform ways to optimize the applicability of the implementation strategy to the needs and specificities of nurses in order to obtain impactful, sustained results. The findings of this study will provide guidance to nursing implementation researchers, educators, and practitioners in selecting strategies and conditions that facilitate adoption of concurrent disorder nursing guidelines. Next steps for future research include adapting valid, reliable tools to measure changes in behavior and intention to use and actual use of CD EBP, and assessing the effectiveness of ECHO-CD using outcomes at the patient and organizational levels.

Abbreviations

CDs: Concurrent disorders

EBP: Evidence-based practice

CHUM: University of Montreal Hospital Center

ECHO: Extension for Community Healthcare Outcomes

ECHO-CD: ECHO program for concurrent disorder management
Declarations

Ethics approval and consent to participate

All methods were carried out in accordance with relevant guidelines and regulations. (115). The study was approved by the Ethics Committee of the CHUM (#19.295), and the University of Montreal's Research Ethics Committee in Sciences and Health (#CERSES-20–017 R). All participants provided written informed consent.

Consent for publication

Not applicable.

Availability of data and materials

The data that support the results of this study are available from the corresponding author upon reasonable request.

Competing interests

The authors have no competing interests to declare with respect to the research, authorship, and/or publication of this article.

Funding

This study received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Authors’ contributions

GC: Conceptualization of the study, recruitment of participants, acquisition of QUAN and QUAL data, QUAN and QUAL data analysis and interpretation, integration and analysis of QUAN and QUAL results, interpretation of MM findings, writing of original draft, conceptualization of the figures, editing and reviewing of the manuscript.

JC: Conceptualization of the study, QUAN and QUAL data analysis and interpretation, contribution to the integration and analysis of QUAN and QUAL results, contribution to the interpretation of MM findings,
editing and reviewing of the manuscript.

JP: Conceptualization of the study, data analysis for the QUAL component of the MM study, interpretation of QUAN and QUAL data, contribution to the interpretation of MM findings, editing and reviewing of the manuscript.

PP: Conceptualization of the study’s framework and MM design, editing and reviewing of the manuscript.

DJA: Conceptualization of the study, acquisition of QUAN data, data analysis for the QUAN component of the MM study, interpretation of QUAN and QUAL data, contribution to the interpretation of MM findings, editing and reviewing of the manuscript.

Acknowledgements

The authors wish to thank the nurses who participated in this study and Clémence Provost-Gervais for her assistance with study coordination. The authors gratefully acknowledge the University of Montreal’s Réseau Universitaire Intégré en Santé et Services Sociaux and the CHUM for their valuable support and assistance with the development and implementation of ECHO-CD.

ECHO-CD was supported by funds received from Health Canada and the Quebec Ministry of Health and Social Services; the views and opinions expressed in this manuscript do not necessarily reflect those of these funding entities.

This study was conducted as part of the doctoral studies of the first author (GC), who received scholarships from the following: Foundation of the University of Montreal Hospital Center, Fonds de Recherche du Québec—Société et Culture (FRQSC), Quebec's Ministry of Higher Education Scholarship Program, the Research Chair in Innovative Nursing Practices and Équipe FUTUR-FRQSC.

DJA is the recipient of a clinical scientist career award from the Fonds de Recherche du Québec (FRQS).

References


19. Garrod E, Jenkins E, Currie LM, McGuinness L, Bonnie K. Leveraging Nurses to Improve Care for Patients with Concurrent Disorders in Inpatient Mental Health Settings: A Scoping Review. J Dual


Tables

Table 1. Sociodemographic data and practice profiles of the nurse participants in the QUAN and QUAL components of the MM study.
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>QUAN $n = 28$</th>
<th>QUAL $n = 10$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender—$n$ (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>27 (96.4)</td>
<td>9 (90.0)</td>
</tr>
<tr>
<td>Male</td>
<td>1 (3.6)</td>
<td>1 (10.0)</td>
</tr>
<tr>
<td><strong>Age—Mean ($SD$)</strong></td>
<td>39.1 (6.2)</td>
<td>39.4 (3.3)</td>
</tr>
<tr>
<td><strong>Degree earned—$n$ (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undergraduate diploma</td>
<td>2 (7.1)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>20 (71.4)</td>
<td>4 (40.0)</td>
</tr>
<tr>
<td>Master’s degree</td>
<td>6 (21.4)</td>
<td>6 (60.0)</td>
</tr>
<tr>
<td><strong>Professional role—$n$ (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse</td>
<td>25 (89.3)</td>
<td>8 (80.0)</td>
</tr>
<tr>
<td>Clinical nurse specialist</td>
<td>2 (7.1)</td>
<td>2 (20.0)</td>
</tr>
<tr>
<td>Auxiliary nurse</td>
<td>1 (3.6)</td>
<td>0 (0)</td>
</tr>
<tr>
<td><strong>Years of clinical experience—$n$ (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–5 years</td>
<td>3 (10.7)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>6–10 years</td>
<td>5 (17.9)</td>
<td>2 (20.0)</td>
</tr>
<tr>
<td>11–15 years</td>
<td>15 (53.6)</td>
<td>7 (70.0)</td>
</tr>
<tr>
<td>16–10 years</td>
<td>2 (7.1)</td>
<td>1 (10.0)</td>
</tr>
<tr>
<td>21+</td>
<td>3 (10.7)</td>
<td>0 (0)</td>
</tr>
<tr>
<td><strong>Work setting—$n$ (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital-based healthcare</td>
<td>15 (53.6)</td>
<td>3 (30.0)</td>
</tr>
<tr>
<td>Community-based addiction treatment</td>
<td>3 (10.7)</td>
<td>2 (20.0)</td>
</tr>
<tr>
<td>Primary mental healthcare services</td>
<td>9 (32.1)</td>
<td>4 (40.0)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (3.6)</td>
<td>1 (10.0)</td>
</tr>
<tr>
<td><strong>Area of practice—$n$ (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban/Suburban</td>
<td>17 (60.7)</td>
<td>5 (50.0)</td>
</tr>
<tr>
<td>Rural/Remote</td>
<td>9 (32.1)</td>
<td>4 (40.0)</td>
</tr>
<tr>
<td>Mixed$^a$</td>
<td>2 (7.1)</td>
<td>1 (10.0)</td>
</tr>
<tr>
<td>Registration year in the program—n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018–2019 curriculum</td>
<td>10 (35.7)</td>
<td>6 (60.0)c</td>
</tr>
<tr>
<td>2019–2020 curriculum</td>
<td>18 (64.3)</td>
<td>4 (40.0)</td>
</tr>
<tr>
<td>Attendance—Mean (SD)b</td>
<td>8.6 (5.9)</td>
<td>9.1 (4.5)</td>
</tr>
</tbody>
</table>

n = number; SD = standard deviation.

a Nurse participant who worked in a large area of the province that included both urban and rural settings.

b During first year of participation in the program.

Table 2. Sample of combinations between QUAL and QUAL results with their corresponding preliminary MM interpretations, for each MM finding.
In what ways is the evolution in nurse-related outcomes over a 12-months’ participation in ECHO-CD linked with the development and implementation of their competencies in clinical practice? (MM research question)

<table>
<thead>
<tr>
<th>QUAN results</th>
<th>MM interpretation</th>
<th>QUAL results</th>
</tr>
</thead>
</table>

MM finding 1: Opportunities for practice and validation to consolidate learning and foster the implementation of new competencies in clinical nursing practice

**Self-efficacy in CD management (primary outcome)**

ANOVA; n=28:
- LS Mean (95% CI):
  - T0: 7.8 (7.4; 8.2)
  - T1: 7.8 (7.4; 8.3)
  - T2: 7.9 (7.3; 8.4)
- P-value, ES\(^a\):
  - T1-T0: 0.8363\(^b\), 0.06
  - T2-T0: 0.7665\(^b\), 0.07

**Highlight:** Learning based on experiential knowledge therefore seems more helpful in reinforcing self-efficacy.

**Theme 2 – Learning through a shifting lens and transforming clinical practice:**

- Subtheme 2.1 – Developing one’s competencies through peer experience
- Subtheme 2.2 – Developing one’s competencies by collaborating with CD experts

Subgroup analysis (low vs high attendance; n=12/28 vs n=16/28):

Low attendance (0–5 sessions; n=12/28):
- LS Mean (95% CI):
  - T0: 8.0 (6.7; 9.4)
  - T1: 7.6 (6.1; 9.2)
  - T2: 7.0 (5.5; 8.6)
- P-value, ES\(^a\):

**Highlight:** Prolonged and committed participation in ECHO-CD is essential for nurses to practice their learnings in the clinical setting and then receive peer feedback in the educational setting. These learning opportunities allow for self-reflection and help reinforce nurses’ belief in their own capacity to manage CD.

**Divergence** between QUAN (significant improvements for self-efficacy only among nurses who participated in more than 5 online sessions during a curriculum) and QUAL results (nurses viewed that their participation in ECHO-CD contributed to reinforcing their self-confidence in CD management).
Possible explanation: It is possible that, with minimal attendance in ECHO-CD (i.e., 0–5 sessions), nurses were exposed to their peers’ experiences, which provided them with practical solutions on how to manage the complex healthcare needs of their patients with CDs (i.e., seeing the benefits of changing their own behaviors). In this case, learning through storytelling allowed them to reinforce their belief in their own potential to manage CDs. However, improvement in nurses’ self-efficacy (i.e., self-evaluation of clinical practice performance) requires prolonged (i.e., 12 months) and committed (i.e., presenting a patient case, interacting with others) participation.

**MM finding 2: Reciprocal and trusting relationships in an interprofessional learning environment to strengthen commitment to continuing education and sustain participation**

**Satisfaction and acceptability toward the program**

Highlight: The group modality in ECHO-CD can be either an enabler for, or a barrier to, nurses’ engagement in the program and competency development. It facilitates self-reflection, knowledge sharing, and uptake. It also gives nurses in difficult situations emotional support and prevents professional isolation. However, trust-based relationships and positive interactions are essential in this type of environment, for participants to engage in learning activities and thereby develop their competencies.

**Similarity between QUAN and QUAL results:** Nurses felt positively about group interactions, and the educational environment was experienced as supportive and convivial. The presence of a facilitator throughout the sessions and the positive feedback from the expert team helped participants share their personal experiences during the online educational sessions. The interdisciplinary background of the participants was viewed as an advantage for knowledge sharing.

**Corroboration between QUAN and QUAL results:** Nurses felt uncomfortable about sharing their knowledge, ideas, and personal experiences, which indicated a need for more opportunities to engage in meaningful interactions and discussions.
T2 (n=12): 5.1(1.1)

- “The group members provided positive feedback at the right time” (mean[SD]):

T1 (n=19): 6.1(1.1)

T2 (n=12): 5.2(0.8)

- “I felt comfortable sharing my knowledge, expertise and personal experiences with other participants” (mean[SD]):

T1 (n=19): 3.9(1.6)

T2 (n=12): 3.8(1.4)

---

**Self-efficacy in CD management (primary outcome)**

Subgroup analysis (low vs high attendance; n=12/28 vs 16/28):

Low attendance (0–5 sessions; n=12):

- LS Mean (95% CI):
  
  T0: 8.0 (6.7; 9.4)
  
  T1: 7.6 (6.1; 9.2)
  
  T2: 7.0 (5.5; 8.6)

- P-value, ES
  
  T1-T0: 0.3534\textsuperscript{b}, -0.55
  
  T2-T0: 0.0626\textsuperscript{b}, -0.90

High attendance (6–20 sessions; n=16):

- LS Mean (95% CI):
  
  T0: 7.9 (7.3; 8.4)
  
  T1: 8.1 (7.6; 8.7)
  
  T2: 8.5 (7.8; 9.1)

---

**Highlight:** Active engagement, which involves participants taking action in their own learning journey and being part of the community (e.g., presenting a patient case and engaging in group discussions and problem-solving activities to help others), is essential for transformative learning. Passive participation, which implies being in listening mode, may be sufficient for nurses to acquire new knowledge, but these gains remain potential cognitive resources to use in clinical practice.

---

**Theme 3 – Factors facilitating competency development and practice change:**

- Subtheme 3.2 – Feeling a sense of belonging to a community

---

**Complementarity** between QUAN and QUAL results: The QUAN results on nurse-led outcomes (from subgroup analysis) and the QUAL results (factors facilitating competency development and practice change) complement one another and provide an overview of the “ideal” type of participation in ECHO-CD for learning to occur and be reinvested in clinical practice. Beyond the minimum required level of exposure to ECHO-CD (QUAN results; > 5 sessions and over a 12-month period), the QUAL results provide details on the type of participation essential in each session for participants to develop their own competencies and then implement them in their clinical practice.
P-value, ES\textsuperscript{a}:

T1-T0: 0.2162\textsuperscript{b}, 0.33

T2-
T0: 0.0213\textsuperscript{c}, 0.53 (medium ES of change)

**Knowledge of CDs**

ANOVA; \( n=28 \):

- LS Mean (95% CI):
  
  T0: 63.4 (58.6; 68.2)  
  T1: 71.5 (66.0; 77.1)  
  T2: 74.5 (67.9; 81.1)

- P-value; ES\textsuperscript{a}:
  
  T1-T0: 0.0045\textsuperscript{c}, 0.72 (medium ES of change)
  T2-T0: 0.0014\textsuperscript{c}, 0.94 (large ES of change)

**MM finding 3**: Peer-to-peer sharing of similar experiences and mentoring activities to normalize experience and provide emotional support

<table>
<thead>
<tr>
<th>Participants’ characteristics (from sociodemographic data)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptive statistics (T0; ( n=28 )):</td>
</tr>
</tbody>
</table>

Years of clinical experience (n[%]):

- 0–5: 3(10.7)
- 6–10: 5(17.9)
- 11–15: 15(53.6)
- 16–20: 2(7.1)
- 21+: 3(10.7)

**Highlight**: Emotional support and mentoring are critical components in continuing education programs targeting healthcare professionals who provide care to people with chronic and complex healthcare needs, to prevent professional isolation.

**Theme 2**: Learning through a shifting lens and transforming clinical practice:

- Subtheme 2.1 – Developing one’s competencies through peer experience
- Subtheme 2.2 – Developing one’s competencies by collaborating with CD experts

**Complementarity** between QUAN and QUAL results: The nurses who registered for ECHO-CD are not novices (QUAN results), making them open to reflexive-based learning methods (QUAL results). Nurses demonstrated a capacity for introspection during peer-to-peer sharing of similar experiences and when receiving feedback from other participants (peers and experts). Although most nurses (71.4%) had more than 11 years of clinical experience (QUAN results), they experienced ECHO-CD as an opportunity to discuss difficult clinical situations with other healthcare professionals sharing common realities (QUAL results). They expressed a sense of comfort in seeing that others were challenged with the same clinical situations or in receiving positive feedback.
from experts on their capacity to implement new interventions in their practice.

**MM finding 4: Collaboration with experts to facilitate cross-disciplinary knowledge sharing and rapid knowledge uptake**

**Knowledge of CDs**

ANOVA; n=28:
- LS Mean (95% CI):
  - T0: 63.4 (58.6; 68.2)
  - T1: 71.5 (66.0; 77.1)
  - T2: 74.5 (67.9; 81.1)
- P-value; ES:
  - T1-T0: 0.0045c; 0.72 (medium ES of change)
  - T2-T0: 0.0014c; 0.94 (large ES of change)

**Highlight:** ECHO-CD allows experts from diverse backgrounds to share CD EBP with other participants and let them access reliable information quickly. This interdisciplinary panel of experts is essential for the nurses to acquire knowledge on CDs, which inherently require multidisciplinary care.

**Theme 1 – Developing competencies to use in clinical practice when encountering people with CDs:**
- Subtheme 1.4 – Using new knowledge and skills to deliver evidence-based interventions to people with CDs

**Knowledge of CDs**

ANOVA; n=28:
- LS Mean (95% CI):
  - T0: 63.4 (58.6; 68.2)
  - T1: 71.5 (66.0; 77.1)
  - T2: 74.5 (67.9; 81.1)
- P-value; ES:
  - T1-T0: 0.0045c; 0.72 (medium ES of change)
  - T2-T0: 0.0014c; 0.94 (large ES of change)

**Highlight:** Mentoring activities with experts are essential for participants to acquire specialized knowledge, and less-active means of learning (i.e., didactic presentations) remain beneficial for sharing EBP with participants.

**Theme 2 – Learning through a shifting lens and transforming clinical practice:**
- Subtheme 2.2 – Developing one’s competencies by collaborating with CD experts

**Theme 3 – Factors facilitating competency development and practice change:**
- Subtheme 3.1 – Being provided with relevant educational material

**MM finding 5: Reinforcement of positive attitudes about performing professional role in complex and...**
adverse situations to foster ongoing learning and renewed practice

**Attitude toward working with people with CDs**

ANOVA; \( n = 28 \):

- **LS Mean (95% CI):**
  - T0: 90.5 (83.4; 97.6)
  - T1: 82.2 (74.0; 90.5)
  - T2: 78.0 (68.2; 87.8)

- **\( P \)-value; ES\(^a\):**
  - T1-T0: 0.0472\(^c\), -0.44 (small ES of change)
  - T2-T0: 0.0139\(^c\), -0.59 (medium ES of change)

**Highlight:** Participating in ECHO-CD gave nurses an opportunity to share their CD management problems with peers and mentors, thereby allowing nurses to reflect on their own attitudes toward CDs. This stimulated nurses to shift their outlook to a positive one as regards their professional role and the possibility of recovery for people with CDs. This open-mindedness further motivated the nurses to pursue their own professional development in order to offer quality care.

**Theme 1 – Developing competencies to use in clinical practice when encountering people with CDs:**

- **Subtheme 1.1** – Pursuing its own professional development and further enhancing practices for CDs by using one’s learning experience
- **Subtheme 1.2** – Integrating new interventions while dealing with the complex healthcare needs of people with CDs
- **Sub-theme 1.8** – Adopting non-judgmental attitudes toward people with CDs to maintain therapeutic alliance

**Complementarity between QUAN and QUAL results:** The QUAL results provided more details about how ECHO-CD contributed to the nurses’ reinforcement of positive attitudes toward working with people with CDs (QUAN), and how these improvements were implemented in their clinical practice. Reflecting on their participation in ECHO-CD, the nurses appreciated listening to peers’ experiences and witnessing how they were able to manage CDs. This helped them cultivate therapeutic optimism for their own patients. This sense of hopefulness for the possibility of recovery in people with CDs fostered the nurses’ interest and their motivation to pursue their own professional development (e.g., other educational opportunities than ECHO-CD).

There is a **corroboration** between QUAN and QUAL results regarding nurses’ adoption of a positive attitude toward working with people with CDs. The QUAL results also complemented the QUAN results by providing further insights into how the nurses’ improvement in their attitude toward CDs was used in their clinical practice; that is, adopting nonjudgmental attitudes toward their patients’ choices and lifestyle, to maintain the therapeutic alliance.

**MM finding 6:** Learning experiences that are team-based, tailored to the setting specifics and receive organizational support to promote coherency in practices and a culture of change

**Participation**

Descriptive statistics:

- **Session attendance frequency for first year of participation (\( n = 28 \); mean[SD];**

**Highlight:** Lack of support from organizations may have hindered the nurses’ willingness to engage in continuing educational programs and reinvest their new learnings in clinical settings.

**Theme 4 – Factors limiting competency development and practice change:**

- **Subtheme 4.2** – Experiencing lack...
**Number of patient case presented in the last 6 month (mean[SD]; median[min; max]):**

- T1 ($n=19$): 0.3(0.6); 0(0; 2)
- T2 ($n=12$): 0.7(0.9); 0(0; 2)

**Complementarity between QUAN and QUAL results:** The QUAL results help clarify why the nurses did not participate in the program optimally, in terms of session attendance frequency and number of patient cases presented over a curriculum (QUAN).

Organizational-level factors negatively impacted nurses’ attendance and engagement in the program. For example, lack of support from employers hindered nurses’ capacity to engage in the program (i.e., lack of time to prepare a patient case presentation or to participate in a full session) or their ability to take full advantage of the program’s learning methods (i.e., unavailable minimum required technological equipment, such as webcam, good Internet connectivity, or firewalls that hindered access to the Zoom app).

**Perception of clinical performance**

Descriptive statistics:

Percentage of nurses who said they implemented into their clinical practice either the recommendations they received or the learning they acquired during ECHO-CD, over the last 6 months (mean[SD]):

- T1 ($n=19/28$): 58%
- T2 ($n=12/28$): 58%

Highlight: Team-based educational strategies are essential to enhance coherence between the care team members and to foster the uptake and implementation of CD EBP. Tailoring educational content to the participants’ specifics is a prerequisite for learners to engage in meaningful learning opportunities and foster their capacity to implement EBP in CD care.

**Theme 4 – Factors limiting competency development and practice change:**

- Subtheme 4.1 – Working with limited resources outside of major urban centers

**Complementarity between QUAN and QUAL results:** The QUAL results provided insights into the factors that limited the nurses’ capacity to implement what they learned from their participation in ECHO into their clinical practice.

- Interpersonal factors: Nurses expressed being unable to implement recommendations or new learnings into their patient care plan due to their coworkers’ lack of openness to change or their continued work with a punitive approach toward people with CDs. However, this was not the case for nurses who participated in ECHO-CD with their coworkers;

Contextual factors: Clinical recommendations proposed during ECHO-CD that did not match the local CD resources at the nurses’ disposal; lack of organizational support to implement CD EBP and sustain practice change (e.g., utilization of new clinical tools); and difficulty in implementing interventions using an integrated care approach due to the pervasiveness of a silo culture of care (e.g.,
treating substance use disorders before addressing mental health needs).

CDs = concurrent disorders; EBP = evidence-based practice; ECHO = Extension for Healthcare Community Outcomes; ECHO-CD = ECHO program for concurrent disorder management; ES* = estimated effect size; Max = maximum; Min = minimum; MM = mixed methods; n = number of participants; SD = standard deviation; T0 = baseline; T1 = 6-month follow-up; T2 = 12-month follow-up.

a Cohen’s d effect size(69) was calculated as the estimated means difference divided by the pooled standard deviation.

b Statistically not significant.

c Statistically significant.

d Each item was rated on a 7-point Likert scale, from 1 (strongly disagree) to 7 (strongly agree).

**Figures**
Figure 1

QUAN results from longitudinal ANOVA analysis for self-efficacy, knowledge and attitude \((n = 28\) responders).

Fig.1 shows the least-squares mean estimators from linear-mixed models with self-efficacy, knowledge, and attitude outcomes. \(P\)-value of change from baseline: *** \(<0.01\) ** \(<0.05\) * \(<0.1\). For attitude (in blue
color): results show a significant decrease in nurses’ mean scores on the Co-Morbidity Problems Perceptions Questionnaire (CMPPQ) from baseline to 6 and 12 months, representing an improvement in their attitude toward CDs, i.e., a lower score on the CMPPQ denotes a more positive attitude toward working with CDs, while a higher score represents a more negative attitude (6).

**Figure 2**

QUAN results from longitudinal ANOVA analysis, stratified by session attendance frequency ($n = 12/28$ versus $n = 16/28$).

Results for the subgroup with low session attendance frequency (0–5 sessions; $n = 12/28$) are represented with solid lines, and the subgroup with high session attendance frequency, with dotted lines (6–20 sessions; $n = 16/28$). $P$-value of change from baseline: *** $< 0.01$ ** $< 0.05$ * $< 0.1$. 
Figure 3

Key conditions for successful uptake and implementation of CD EBP in nursing care with ECHO.

CDs = concurrent disorders; ECHO = Extension for Healthcare Community Outcomes

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Additionalfile1.docx
- Additionalfile2.docx