BMJ Open

Impact of a videoconferencing educational programme for the management of concurrent disorders on nurses' competency development and clinical practice: protocol for a convergent mixed methods study

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To cite: Chicoine G, Côté J, Pepin J, *et al*. Impact of a videoconferencing educational programme for the management of concurrent disorders on nurses' competency development and clinical practice: protocol for a convergent mixed methods study. *BMJ Open* 2021;**11**:e042875. doi:10.1136/bmjopen-2020-042875

► Prepublication history and additional material for this paper are available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2020-042875).

Received 20 July 2020
Revised 12 January 2021
Accepted 02 February 2021

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ABSTRACT

Introduction Extension for Community Healthcare Outcomes (Project ECHO©) is an innovative model for continuing professional development that uses videoconferencing technology to support and train general practitioners remotely. The model has been replicated to a variety of settings and locations for capacity building in healthcare professionals caring for patients with chronic and complex health conditions. Limited research has been conducted so far on the impact of ECHO in the field of concurrent mental health and substance use disorders (ie, concurrent disorders (CDs)). Therefore, this mixed methods study aims to develop a comprehensive understanding of an ECHO programme impact for CD management on nurses' competency development and clinical practice.

Methods and analysis The proposed mixed methods study, based on a convergent parallel design, will be conducted in the province of Quebec, Canada, to collect, analyse and interpret quantitative (QUAN) and qualitative (QUAL) data from a specific ECHO Program on CDs. In the QUAN component, an observational prospective cohort study will be conducted over a 12-month period. All nurses who participated in the programme between 2018 and 2020 and who consent to research will be recruited to collect data on the extent of their learning and practice outcomes at three time points. Alongside the surveys, nurses will be invited to participate in individual semistructured interviews. In-depth QUAL data will be subjected to a thematic analysis and will assist in exploring how and in which conditions nurses developed and mobilised their competencies in clinical practice. A comparison-of-results strategy will be used in the final integration component of the study.

Ethics and dissemination This study protocol was approved by the Ethics Committee of the Université de Montréal Hospital Center (#19.295) and the Université de Montréal Ethics Committee (CERSES-20–017 R). We aim to disseminate the findings through international academic conferences, international peer-reviewed journals and professional media.

Strengths and limitations of this study

- ► To the best of our knowledge, this is the first mixed methods study aiming to understand the long-term impact of an ECHO programme for CD management on nurses' competency development and clinical practice.
- ► In accordance with guidelines for reporting a mixed methods study, the proposed convergent parallel design will rely on a closely coordinated combination of methods and on an explicit wording of when and how integration will occur.
- ► Using an interpretive description approach, the qualitative method will expand on the process of competency development in the context of a videoconferencing educational programme, as well as facilitators and barriers to their mobilisation in clinical practice.
- ► The non-experimental nature of the quantitative method and the anticipated small sample size will limit the results' interpretation by preventing any causal association and generalisability.
- ► Guided by an innovative social constructionism conceptual framework, this mixed methods study will combine a diversity of outcomes and perceptions to make recommendations about how to effectively support nurses in acquiring a high level of competency.

INTRODUCTION

Concurrent disorders (CDs)

CDs refers to co-occurring mental health (MH) and substance use disorders (SUD).[1] In addition to their high prevalence,[2] CDs are frequently associated with higher rates of relapse, worse psychiatric symptoms, increased odds of unplanned rehospitalisation, poorer treatment compliance and

prognosis compared with MH only.[3 4] Furthermore, individuals with CDs often experience higher risks of suicide, violence or delinquency, cardiovascular illnesses, as well as transmitted infections.[5] CDs are also correlated with poor psychosocial outcomes including homelessness, social isolation, stigma and incarceration.[6] A typical example illustrating this clinical problem is a person suffering from a dual diagnosis of schizophrenia and opioid use disorder who also contracted the hepatitis C virus and uses cannabis on a regular basis.[7] This complex relationship between MH, SUD and related psychosocial problems highlights the specific needs of individuals living with CDs, which can pose a significant challenge for healthcare professionals attempting to care for them.[8]

Despite evidence supporting the efficiency of integrated treatment of both MH and SUD,[9 10] it has been suggested that individuals living with CDs have poor access to care.[11] A report from the Substance Abuse and Mental Health Services Administration[12] revealed that among American individuals living with CDs who sought health services in the last 12 months, only 7.4% of them received care for at least one of their conditions. Furthermore, it appears that 55% of the patients' group received no treatment at all. This gap in access to care is associated with issues in healthcare provision, for example, the lack of competent human resources and suggests a clear need to improve care and patients' outcomes.[13]

Nurses' competencies in caring for individuals with CDs

As the largest professional group within MH and addiction primary care services,[14] nurses are uniquely positioned to provide care for patients with CDs. Indeed, nurses are qualified in assessment and intervention delivery and spend most of their time in direct contact with patients.[15] However, nurses' difficulties in caring for patients with MH problems who also problematically use alcohol or drugs have been highlighted in numerous studies.[16–18] For example, Wener and Woodgate[19] reported that feelings of ambivalence, frustration and powerlessness are common among Canadian primary care nurses who encounter individuals living with CDs. This situation is further exacerbated in rural and remote areas,[20] whereas many nurses frequently feel ill-equipped and emotionally exhausted in addressing the care needs of complex and severe cases of patients with CDs.[21 22]

Consequently, caring for this challenging population can create a significant pressure on nurses, which has been associated with a higher vulnerability to burnout syndrome, low job satisfaction and poor employee retention.[23–25] Research also indicates that nurses have suboptimal competencies for screening mental disorders in active users, offering appropriate interventions in crisis situations and coordinating care.[11 26] In addition, multiple studies have shown that nurses may hold negative or judgemental attitudes towards patients with CDs.[17 27] Results from a systematic review (n=28) indicated that healthcare professionals holding stigmatised attitudes towards SUD have a more task-oriented approach and perceived their knowledge and skills as inadequate.[28]

Continuing professional education in CDs

In light of the complexities related to CDs, combined with the challenges faced by professionals in providing appropriate care for this priority patient population, there has been a growing recognition that further educational opportunities are needed.[29–31] A recent scoping review (n=32) underlines the growing body of evidence with regard to the effectiveness of continuing education in improving attitudes, increasing knowledge and confidence and supporting clinical practice change in nurses working with individuals with CDs.[15] In this context, continuing education can be understood as a planned and systematic effort to support healthcare professionals in developing a higher level of competency in order to improve clinical performance and patients' health outcomes.[32]

A potential intervention for developing nurses' competencies in CDs is Extension for Community Healthcare Outcomes (ECHO), a promising model in continuing education using videoconferencing (VC) technology to establish networks between specialists from centralised academic centres and other healthcare professionals.[33] ECHO provides telementoring and opportunities for sharing best practices on the management of a wide range of topics and conditions. Ultimately, the programme seeks to reduce variation in care delivery and improve patients' health outcomes. The ECHO model considers factors affecting professionals' participation in continuing education activities such as cost, lack of time, long-distance travelling, ability to access and use technology and credential incentives.[34] Thus, it constitutes an interesting, flexible and convenient online learning intervention. Indeed, the ECHO model offers professionals the opportunity to discuss real patient cases, share common realities with peers, practise what they have learnt in a safe environment and be positively reinforced.

A systematic review (n=52) reported a positive impact of the ECHO model on healthcare professionals' outcomes such as satisfaction, knowledge and confidence.[35] Furthermore, there is growing evidence in support of the acceptability and feasibility of the ECHO programme, notably for reducing professionals' sense of isolation in rural settings and in terms of cost-effectiveness.[36] There is also a body of research showing the ECHO model effectiveness in terms of providing comparable care to specialists in the case of hepatitis C treatment,[37 38] chronic pain management[39–41] and geriatric care.[42 43] Despite those promising results,[35 36] the evidence regarding the impact of ECHO in the field of CDs remains limited. For instance, we found only four studies reporting on MH and/or addiction-specific ECHO programmes.[44–47] In three of these studies, increases in professionals' knowledge using objective measures and self-efficacy using survey rating scales were reported after a 6-month,[46 47] and 8-month

periods.[45] However, these results were statistically significant only in Mehrotra *et al*.[47]

In conclusion, the few studies discussed previously included quantitative observational designs, of which we noted several limitations: small sample sizes, lack of longitudinal data, interpretation of findings independently of professional groups and lack of control for cofounders.[35 48] The majority of these studies contain insufficient information on how the implemented programme was replicated or adapted and how well it was delivered.[48 49] Although few studies have been conducted to assess the impact of ECHO on nurses,[50 51] these studies were not specific to CDs and have not adequately captured nurses' views on how and in which conditions they developed their competencies. Indeed, limited research has been conducted so far to explore ECHO's impact on competency development, and how these new acquisitions were applied into clinical nursing practice. Thus, there is a need to obtain quantitative (QUAN) results on the long-term impact and to enrich our comprehension of these results using detailed qualitative (QUAL) findings. The present study aims to bridge these gaps by developing a comprehensive understanding of an ECHO programme impact for CD management on nurses' competency development and clinical practice.

Philosophical and conceptual foundations

Ian Hacking's social constructionism,[52] which emphasises a pluralistic-embedded ontological and epistemological inquiry, will guide this study. This worldview is well suited for planning, conducting and appraising mixed methods research.[53 54] Hacking's proposal for a social theory of science has inspired the development of a conceptual framework for the purpose of achieving a comprehensive understanding of a VC educational programme impact for CD management on nurses' competency development and clinical practice. Our conceptualisation stipulates that studying the impact of a programme implies the combination of different forms of evidence, each of them producing a *mixed kind of evidence* using a *looping effect* (feedback effect). This conceptualisation is illustrated in figure 1 and summarised below.

In accordance with Gregor's typology,[55] our conceptual framework provides a description (how we will understand) of the phenomena of interest (the programme impact), the categories of outcomes of continuing education (Moore *et al*'s[56] first five levels of assessment) and the main concepts (competency development and their mobilisation in clinical practice).[57] Outcomes and concepts will be described using QUAN and QUAL evidence, respectively. The framework represents the related inputs (data source, collection and analysis), the interactions between the constructs' 'outcomes and competencies' (*looping* effect between QUAN and QUAL evidence) and how these might be understood (integration of QUAN and QUAL methods). This conception is innovative because it builds on existing and traditional evidence of the ECHO model, while it also suggests an alternative perspective to the current dominance of 'gap-spotting' in the literature.[58]

METHODS AND ANALYSIS

The proposed study seeks to answer the following three overarching research questions:

- Q1. QUAN question: what is the evolution in nurses' outcomes over a 12-month period of participation in a Canadian ECHO programme for CD management?
- Q2. QUAL question: how and in which conditions nurses mobilised in their clinical practice the competencies they perceived to have developed through their participation?
- Q3. Mixed QUAN and QUAL question: in what ways the evolution in nurses' outcomes over a 12-month

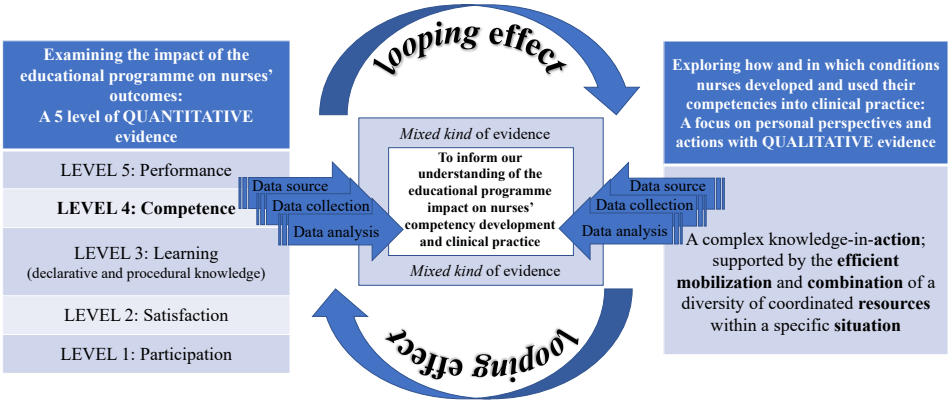

Figure 1 Integrative conceptual framework for studying the impact of a videoconference educational programme for the management of concurrent disorders on nurses' competency development and clinical practice.[52 56 57]

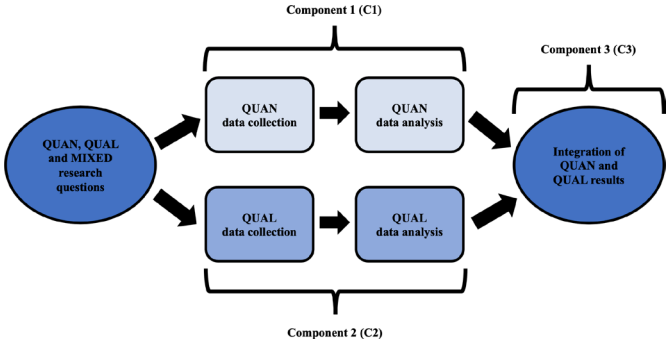

Figure 2 Visual model for the mixed methods convergent parallel design. QUAL, qualitative; QUAN, quantitative.

period of participation in a Canadian ECHO programme for CD management is related to the development and mobilisation of their competencies in clinical practice?

This protocol was organised according to the Good Reporting of A Mixed Method Study checklist,[59] the Strengthening the Reporting of Observational studies in Epidemiology guidelines,[60] the Consolidated Criteria for REporting Qualitative research checklist[61] and Phillips *et al*'s[62] guideline for Reporting Evidence-based practice Educational interventions and Teaching. The items of the checklists are fulfilled in online supplemental file 1.

Study design

This study will use a mixed methods convergent parallel design for the purpose of complementarity and comparison between QUAN and QUAL methods.[63] We will collect and analyse QUAN and QUAL data simultaneously and independently. Then, we will combine QUAN and QUAL results in the final integration of the study (see figure 2). Integration—the merging or dialogue between the QUAN and QUAL component of the study—will allow the QUAL results to give meaning and depth to the QUAN results collected over a long period.[64] In the integration component of the study, the knowledge yield via QUAN and QUAL methods undertaken independently will achieve a 'whole greater than the sum of the parts'.[64] In other words, we do not aim to explain QUAN results and do not need to wait for them to undertake the QUAL component of the study.

As shown in figure 2, the planned convergent parallel design involves three components, C1, C2 and C3, which address the research questions Q1, Q2 and Q3, respectively.

(C1) QUAN data collection and analysis: Among nurses who participated in a Canadian ECHO programme for CD management, we intend to examine the evolution of nurses' outcomes over a 12-month period. This will be achieved using an observational prospective single group cohort study design (QUAN method).

(C2) QUAL data collection and analysis: we will conduct individual semistructured interviews using an interpretive description approach[65] with nurses who participated in the ECHO programme. We aim to explore the competencies that nurses perceive to have developed in CDs and to enlighten our understanding of how and in which conditions they mobilised these competencies in their clinical practice (QUAL method).

(C3) Integration of QUAN and QUAL results: the integration aims to merge the QUAN and QUAL methods.[54] The final product of the integration, which is also the final result of the study, will be obtained by considering the insights gained from merging nurses' outcomes on the programme impact (QUAN results) with nurses' perceptions of their competency development (QUAL results).

Setting, VC educational programme and technical features

Based on the ECHO model, this study will use VC technology to connect professionals across multiple settings and disciplines in real-time educative sessions with an interdisciplinary team of experts in CDs. The programme was developed in 2017 and implemented in September 2018 in a Canadian tertiary hospital in the province of Quebec. One of the promising elements of the programme is the group modality, according to the premise that social interactions are essential conditions for effective learning to occur.[66] Thus, the ECHO model endorses that sharing professional experiences improves and reinforces learning, while peer support enhances one's motivation and self-perception of being able to perform new behaviours.[67] To consolidate learning, opportunities for practice and feedback in authentic settings are also provided.

The educative programme is organised in scheduled virtual sessions with the Zoom platform (Zoom Video Communications Inc, 2016), which allows professionals to connect with and see each other in real time from their work or home environment. PowerPoint presentations can be shared throughout the sessions, and a chat forum is also available to participants. To run a virtual session online, each participant needs a desktop or a laptop computer (Windows, macOS or Linux), a reliable internet connection (broadband wired or wireless), speakers and a microphone (built-in, USB plug-in or wireless Bluetooth) and a webcam or HD cam (built-in, USB pug-in, an HD cam or HD camcorder with a video-capture card). Participants also have the possibility to join the virtual sessions from their tablet, phone or any mobile device. Prior to the beginning of the programme, information and tips about running a Zoom session are provided to participants by email. Before each virtual session, an encrypted Zoom meeting link with an encryption used is sent only to registered participants to prevent hacking of the platform. A computer scientist is also available in person for the expert team and online for other participants to resolve any technical issues. Registered participants are not required to hold a Zoom licence to run the virtual sessions online. More information about VC equipment and other technical features of the VC setting can be found in Phillips *et al*'s[62] guideline (see online supplemental file 1).

Each curriculum of the programme includes a total of 20 sessions delivered over a 10-month period (September–June). The sessions last 1 hour and a half and are held at 2-week intervals. During each session, a professional or a team of professionals present a patient case for management guidance. The case-based discussions are supplemented with expert recommendations and short didactic presentations on a disease-related topic that are both tailored to professionals' needs along the curriculum (see online supplemental file 2).

C1: quantitative method

Participants and recruitment

All nurses who participated in the ECHO programme on CDs for the 2018–2019 and 2019–2020 curricula will be invited to participate in the study (n=65). Nurses will be eligible for inclusion if they hold a valid licence of practice. Participation will be considered if nurses have attended at least one virtual session during an entire curriculum. This will ensure that eligible participants have a minimal exposition of the educative intervention,[35] without excluding those who participated more passively and may potentially benefit from the program.[68]

Outcomes and measurements

We intend to collect a number of outcomes as part of a self-administered online survey (SurveyMonkey, 2019–2020) including nurses' participation, satisfaction and acceptability regarding the programme, attitudes towards patients with CDs, knowledge in CDs, self-efficacy in CDs management and perceived clinical performance.[56] Sociodemographic and practice information will also be collected. Table 1 summarises the QUAN outcomes' description and operationalisation, with corresponding sources of data to be captured.

A visual representation of when each outcome will be measured during the study is shown in online supplemental file 3. At each data collection point, a link to the survey will be provided to nurses, and they will be asked to complete it within a 3-week period. The instruments to be used in the survey were developed with a panel of experts in CDs and inspired from previous studies on the ECHO programme.[33 45] Further detail regarding each instrument is provided in online supplemental file 4. QUAN data from nurses will be collected at three time points (before attending the programme (T0), 6 (T1) and 12 (T2) months after the first programme attendance). The developed survey was pilot tested with a small sample of healthcare professionals prior to its use in the study.[69]

Sample size consideration

We aimed for a sample size of 30 participants with completed questionnaires at T0, T1 and T2. Considering the total available population (n=65) and previous ECHO studies recruitment rates, we assume: (1) 60% of the total hospital nurse population will be recruited and will complete the baseline questionnaire; (2) 90% of those recruited will remain in the study at 6 months and will complete the evaluation questionnaires; and (3) 90% of those who participated at 6 months will remain in the study and will complete the final 12-month questionnaires. As this study is descriptive and exploratory, we do not plan to test any specific statistical hypothesis and will not make sample size estimates from a power analytic perspective. The sample size of 30 will allow us to estimate the binary outcomes of participation with no more than 18% precision using the normal approximation to the 95% CI.

Statistical analysis plan

We will use simple univariate descriptive statistics to evaluate the ECHO programme impact. The available sociodemographic and the evolution in nurses' outcomes (participation, satisfaction, knowledge, attitudes, self-efficacy and clinical performance) at each time point will be calculated. For continuous variables, descriptive statistics (mean, SD, median, IQR, minimum and maximum) will be provided. For categorical variables, the number of patients and the percentages will be reported. Paired t-test will be used for changes from baseline measures. If we have enough data, the bivariate analyses will examine the sociodemographic and professional level factors associated with study outcomes. The evaluation in time for all longitudinal variables will be presented in graphical form. The effect sizes of the ECHO programme impact with 95% CI will be extracted from the respective statistical models. The SAS V.9.4 statistical software will be used for all calculations (SAS Institute Inc, 2020).

C2: qualitative method

Participants and recruitment

All nurses with a valid licence of practice who participated in the ECHO programme between 2018 and 2020 for at least one virtual session and who consent to research will be included in the QUAL component. Each potential participant will be recruited by the first author (GC) through email or by phone, according to their preferred contact information. According to Thorne,[65] data saturation is not a desired outcome in the interpretive description approach since practical disciplines such as nursing tend to appreciate that subjective experience can theoretically possess infinite variation. Instead, interpretive description focuses on obtaining a deeper understanding of participants' perspective while recognising that variation in perceptions may exist.[70] Considering that QUAL strategies for data collection are time consuming and based on prior studies in the field of nursing education,[70] we anticipate that 50% of the whole population (n=65) will agree in taking part of the QUAL component (n=±32). However, sample size will be evaluated on an ongoing basis as participants volunteer: by noting nurses' characteristics (ie, registration year in the ECHO programme, academic background, past and current clinical experiences and healthcare settings) and by ensuring that the data gathered from participants are rich enough to answer the QUAL research question (Q2).

Table 1 QUAN outcomes' description and operationalisation, with corresponding sources of data

Assessment levels and desirable outcomes in Moore *et al*'s[56] framework	Outcomes measurement in this study	Corresponding sources of QUAN data	Number of items or questions	Internal consistency
Level 1 Participation	Participation	► Attendance records within the last 6 months. ► Learning objectives and motivations for attending the programme. ► Number of virtual sessions in which nurses interacted (verbal interaction or within the chat forum) with the other participants within the last 6 months. ► Number of virtual sessions in which nurses presented a patient case within the last 6 months. ► Perceived level of participation within the last 6 months.	Three questions	Study-specific questionnaire
Level 2 Satisfaction	Satisfaction and acceptability regarding the ECHO programme	► A self-reported questionnaire including measurement of the degree of nurses' satisfaction and acceptability regarding the programme. The questionnaire comprises the following dimensions: quality of the information (2), quality of the technological infrastructure (1), general satisfaction (2) and perceived usefulness of the programme (8).[81]	13 items	NA
Level 3A Declarative knowledge	Declarative and procedural knowledge: ► Attitudes towards patients with CDs. ► Knowledge in CDs.	► A French version of the *Comorbidity Problems Perceptions Questionnaire* to measure nurses' attitudes towards patients with CDs.[82]	33 items	α=0.90[83–85]
Level 3B Procedural knowledge		► A declarative and procedural knowledge test in CDs consisting of four patient vignettes.	16 multiple-choice questions	Study-specific questionnaire
Level 4 Competence	Self-efficacy in CD management.	► A self-reported questionnaire measuring nurses' level of confidence in CDs management.[86 87]	19 items	Study-specific questionnaire
Level 5 Performance	Perceived clinical performance	► A self-reported questionnaire measuring: (1) the number of patients with CDs seen or followed in the last 6 months, (2) the number of patients with CDs that nurses were able to manage without referring them to a specialised service in CDs and (3) the extent of nurses' application of the experts' recommendations and/or new learning acquisitions in their clinical practice within the last 6 months.	Three questions	Study-specific questionnaire
Level 6 Patient health	NA			
Level 7 Community health	NA			

Note: adapted from 'Achieving desired results and improved outcomes: integrating planning and assessment throughout learning activities', by D E Moore, J S Green and H A, Gallis, 2009, *Journal of Continuing Education in the Health Professions, 29*(1), p. 3. This study will not report on patient and community health outcomes. While Moore *et al*'s[56] framework has seven levels of assessment, this study will focus on the first five levels as part of an initial programme investigation. We have added attitudes towards people with CDs since they are known to play a central role in the quality of care delivery.[22]
α, Cronbach's alpha; CDs, concurrent disorders; NA, not applicable; QUAN, quantitative.

Semistructured interviews

We will conduct individual semistructured interviews with the Zoom platform for the purpose of exploring nurses' perceptions of how they developed their competencies over their participation in the ECHO programme and how they mobilised them into clinical practice when

attempting to care for individuals with CDs. We also intend to collect data on nurses' perceptions of the conditions that might have foster or hinder their competency development (eg, personal or contextual factors, educational programme components and technical setting). Interviews will allow us to investigate nurses' perceptions of the programme benefits for their competency development and to have the opportunity to explore how the programme could be further improved. Interviews will be guided by prompts as well as open-ended questions (see online supplemental file 5). Nurses will be encouraged to give significant examples from their clinical practice and to reflect on their clinical decisions and actions. Interviews will last approximately 1 hour and will be conducted by the first author (GC) at the time each participant will deem convenient.

Qualitative data analysis

QUAL data will be subjected to a thematic analysis.[71] In interpretive description, data collection and analysis occur concurrently each informing the other in an iterative process.[70] Therefore, the analytic process will begin after conducting a first interview and will approximately last 9 months. This will enable prolonged and close contact with the data. Once the interviews are transcribed by a researcher assistant, the first author (GC) will be listening to the audio recordings to familiarise herself with the data and to verify transcripts' accuracy. Data will be imported, coded and managed using the QUAL data analysis software tool MAXQDA Standard (MAXQDA – Distribution by VERBI GmbH, 1995–2020).

The following step will be taken to scrutinise each interview transcript for meaningful units (quotations) and to generate initial codes. The codes will be subsequently classified under broad categories for further analysis. In each category, codes will be examined, and common themes among the codes will be searched to create a first set of themes representing the data patterns. The next step implicates to make sense of the data by reviewing the meaningful themes within each interview transcripts and across datasets. In this way, a hierarchy of themes pinpointing relationships between themes will first be created, and the themes will be refined and renamed until the emergent results contribute to answer Q2.

Confirmation of coding and themes will be performed at each stage of the process with two other researchers (JC and JP) in order to prevent researcher bias. Trustworthiness of the QUAL findings will also be validated using a member checking technique,[72] in which the analysed data (ie, emergent themes) will be returned to each participant to check for accuracy and resonance with his or her perceptions.

C3: integration of QUAN and QUAL results

In the integration component of the study, we will adopt a comparison strategy to combine and contrast the QUAN and QUAL results.[54] In this strategy, the resource composed of the QUAN and QUAL results obtained through separated data collection and analysis, and the final product constitute the mixed methods inferences. Figure 3 summarises the overall process and procedures to be applied in the comparison strategy.[73]

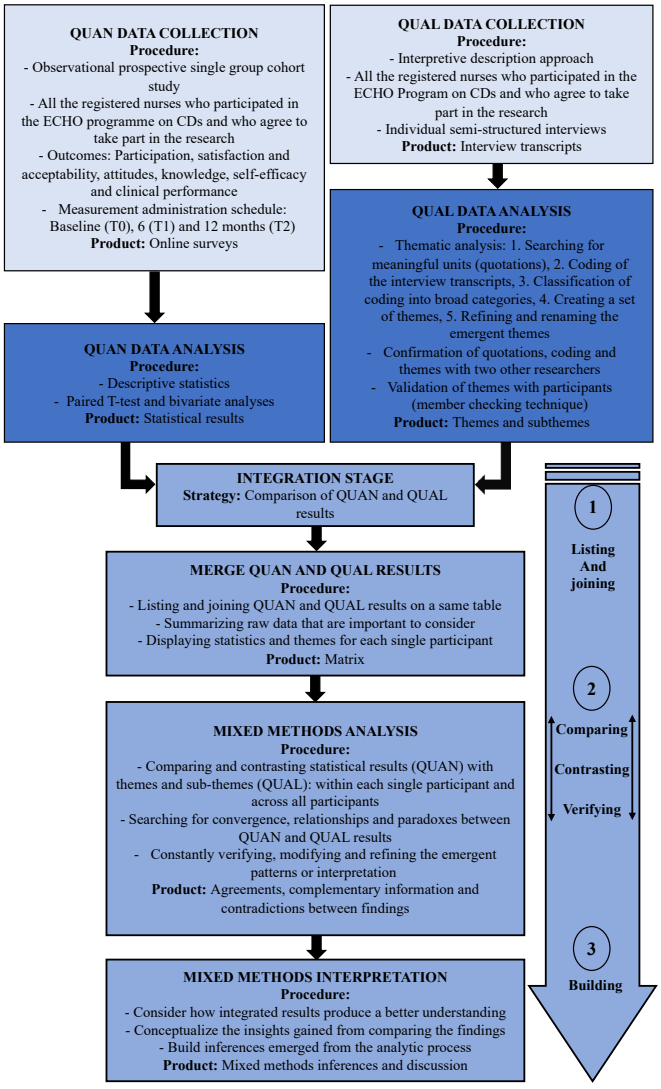

Figure 3 Mixed methods procedures for integrating QUAN and QUAL results using a comparison of results' strategy.[54 73] CDs, concurrent disorder; ECHO, Extension for Community Healthcare Outcomes; QUAL, qualitative; QUAN, quantitative.

To achieve this comparison, we will use a matrix technique to summarise and display the QUAN and QUAL results, thereby allowing consideration of both methods simultaneously.[74] This technique will assist in conducting a 'third effort' of analysis[75] and deepen our understanding of the overall results. Statistical results from surveys and emergent themes from the interviews will be charted in order to concisely map the main study findings on the same page. Information will be organised in a results-by-participant fashion.[64] This organisation will allow us to pay attention in unexpected relationships and paradoxes between QUAN and QUAL results shared within a single

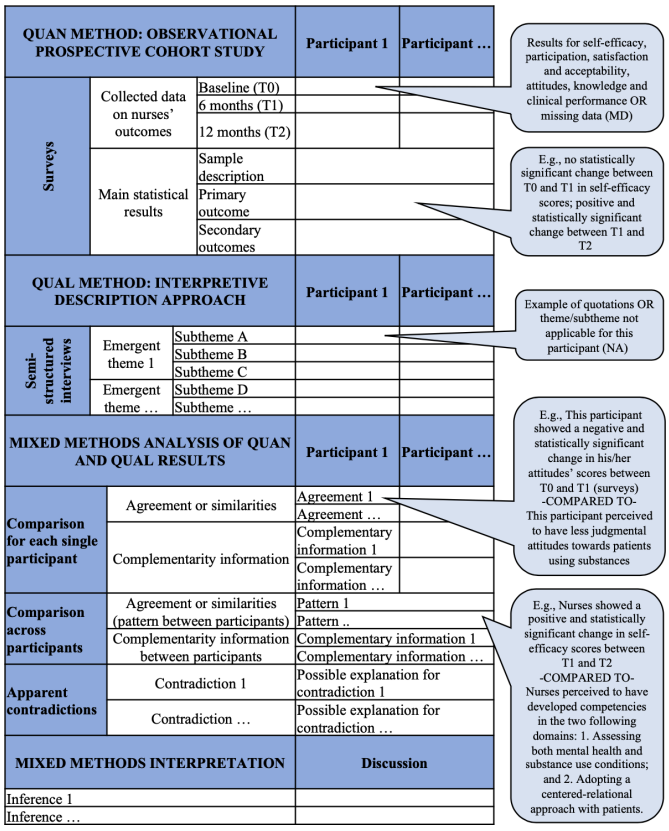

Figure 4 Example of a matrix to compare QUAN and QUAL results. QUAL, qualitative; QUAN, quantitative.

participant, and then search for patterns across all participants.[76] Findings from each component of the study will be assessed for agreement (convergence and similarities) and complementarity. We will meticulously scrutinise any apparent divergences (contradiction, discrepancy or dissonance), and consider possible explanations to resolve them.[77] Figure 4 shows an example of a matrix.

Patient and public involvement

Patients and the public will not be involved in the design of, recruitment for and conduct of this study. However, nurses will be invited to reflect on their appreciation of the programme content, structure and delivery (eg, didactic presentations, teaching methods, experts' recommendations, time allowed for case-based discussions, schedule, VC equipment, material and other resources) through an online survey after each virtual session (as part of the programme requirements to obtain continuing education credentials) and as part of the online satisfaction and acceptability questionnaire developed for this study. The programme has also implemented an 'ECHO participant committee' in which voluntary nurses are asked for suggestions and/or modifications in order to better adapt the programme to their learning and practice needs (ie, programme improvements). Education for healthcare professionals has been identified as a priority research area for its impact on the quality and security of care and relation to patients' outcomes.[78] We expect that the study findings will inform on the conditions and strategies that are likely to strengthen the effectiveness of educational programmes in CDs.

Current status

This mixed methods study is an addition to an ongoing prospective observational cohort study for which ethical approval has been obtained in December 2018 from the Ethics Committee of the Université de Montréal Hospital Center (#18.245). As of December 2020, we are currently collecting QUAN and QUAL data, and we will continue collecting through 2021.

ETHICS AND DISSEMINATION

Ethical considerations

This study protocol was approved by the Ethics Committee of the Université de Montréal Hospital Center on 14 January 2020 (#19.295) and from the Université de Montréal Ethics Committee (CERSES-20–017 R) on 30 January 2020. The proposed study follows the Canadian Tri-Council Policy Statement ethical guidelines[79] as described in the paragraphs below.

First, written informed consent will be obtained from nurses for both QUAN and QUAL data collection. On registration to the ECHO programme, a first electronic consent form will be sent to nurses informing them on the nature and specific objectives of the QUAN component of the study. Nurses will also be asked their contact information and if they agree to be contacted for further research projects. This information will be stored in an encrypted and separated document on a secure server of the tertiary hospital research centre. The contact information will be maintained until the QUAL data collection stage, so that surveys can be sent and linked with responses and interviews' transcripts. Contact information will be removed and replaced with a random identification code after interview completion. A second electronic informed consent form will be sent to nurses engaging in the semi-structured interviews. Before each interview, the first author (GC) will make sure that nurses are aware that the discussion will be audio recorded.

Second, several precautions will be taken to ensure that nurses understand that their participation in the study is voluntary and outside of the ongoing programme. Both consent forms will explain that nurses' participation is confidential and that they have the right to withdraw at any time throughout the study. We will also ensure that nurses are aware that refusing to participate will have no effect on their registration in the programme. Solicitation for the interviews will not take place during the videoconference sessions. This will ensure fairness between nurses and other healthcare professionals and distinction between the study and the programme. All the interviews will be conducted outside working hours, and nurses who accept to participate will be offered a $C50 voucher for their contribution.

Third, this study will collect a combination of electronic and material-based data that will be securely

and safely stored throughout the study. All electronic data, including signed consent forms, survey responses, audio files and transcribed interviews, will be stored on a secured server. Answers from completed surveys will be uploaded from SurveyMonkey and organised in a protected-encrypted Excel document by a research assistant. Physical documentation including observation notes taken during the interviews will be exclusively kept within the hospital research centre in a locked drawer of a locked room. Only the first author (GC), members of the research team (JC, JP and DJ-A) and those involved in interview transcription will have access to the raw data. All electronic and material documents will be kept for a 7-year period and destroyed afterwards, in line with the ethics committee's policies. We also recognise that nurses may be anxious or fearful of reprisal when completing a survey or participating in an interview that explores their knowledge and competencies in CDs. However, nurses will be made aware that the collected data will in no way be used to assess employee performance.

Finally, a key issue concerning linking outcomes from the surveys with verbatim from transcripts interview is whether a participant is identifiable from the information collected. To manage this risk, sociodemographic and practices' outcomes will be collected and reported in broad categories (eg, area of practice will be collected instead of specific names of work settings). Any information that could identify a particular participant or setting during the interviews will be removed from transcripts. Also, the observation notes will not contain any information related to the participants' identity, as they will only be referred to by their role (eg, registered, assistant or specialist nurse). The thematic analysis will provide a certain level of abstraction within the raw data so that any association between emergent themes and participants will be prevented. Any identifiable information (ie, interview transcripts and quotations) will be retrieved from the final study report and will not be disseminated as per the plan described below.

Dissemination plan

The dissemination plan will include both traditional (ie, academic publication, scientific conferences and professional congresses) and innovative (eg, Project ECHO Institute software repository, links with local and regional agencies and web portals) means of ensuring the study findings are communicated locally, regionally and internationally. The plan will ensure that the results from this study are accessible to a broad audience and transdisciplinary communities including scholars, students, practitioners, citizens, policymakers and other stakeholders. A summary report will be shared through emails to the participating nurses and available online (http://www.ruis.umontreal.ca/CECTC_echo; https://labo-jutras-aswad.ca/). Finally, it is expected that the results of this study will be suitable for publication in relevant peer-reviewed journals; we plan to prepare a first manuscript detailing the QUAL method and results and a second manuscript including the QUAN and MIXED components of the study.

STRENGTHS AND LIMITATIONS

This study will add to the existing body of evidence regarding the ECHO programme's impact on nurses' competency development and clinical practice. Also, we proposed an integrative conceptual framework to guide the proposed study, and we expect that this creative conceptualisation might shed new light on the ECHO programme's impact. A key strength of this study is that the planned mixed methods convergent design relies on a thoughtful, strategic and synergic use of two methods, which will enhance the overall comprehensiveness of the study results.

However, this study has limitations. Given the observational nature of the QUAN method, a single cohort study design was chosen. Hence, the absence of a control group will limit the QUAN results' interpretation at the description level, preventing any causal association between nurses' participation in the ECHO programme and the evolution in their learning and practice outcomes. In terms of generalisability, this study will focus on nurses so that findings may not be broadly applicable to other professional groups in contact with patients with CDs in their clinical practice. Since many of the instruments we intend to use in the surveys are not validated, it is possible that the measurements may not truly reflect the outcomes targeted by this study. Given that participation in this study is voluntary, a selection bias may exist as nurses who do not wish to participate may not have similar outcomes and/or perceptions that we will not be able to capture.

Other limitations include small sample size, loss to follow-up and missing data. Efforts to minimise loss to follow-up will include offering a $C50 voucher as acknowledgement of participants' contribution, multiple reminders and flexible hours for data collection. It is also possible that participants may over-rate the programme impact in terms of learning and practise benefits due to the presence of the researcher that would challenge the internal validity of the reported results. Nonetheless, these biases should be limited based on the breadth and depth of comprehensiveness that we intend to gain in mixing both QUAN and QUAL methods (corroboration of results).

Finally, we anticipate that divergences between QUAN and QUAL results are a potential mixed methods' threat to internal validity in the case of a convergent design.[63] To address and reflect on this issue, the matrix technique will help to identify those contradictions and clarify how we will resolve them in a transparent and rigorous manner. From another angle, discrepancy can also generate unexpected discoveries, pave the way to new ideas and raise challenging questions that may contribute to further research and practice recommendations. Discussing how divergence issues will be approached throughout this mixed methods study will offer appropriate and

meaningful guidance in conducting and reporting convergent designs and perhaps contribute to methodology advancement.[80]

Despite those limitations, we expect that this study will expand our current knowledge on how effectively the ECHO model supports nurses in developing higher levels of competency in CDs. Furthermore, this study will contribute to ensuring that new ECHO programmes in the field of CDs and future larger controlled studies assessing their efficacy are well designed. There is the potential both to provide guidance to educators, clinical leaders and researchers and ultimately to positively impact access to adequate care by people living with CDs.

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Acknowledgements This study protocol was developed as part of the PhD training of GC and for which she received scholarships from the following: Université de Montréal Hospital Center Foundation, Quebec's Ministry of Education and Higher Education Scholarship Program, Fonds de recherche du Québec – Société et Culture (FRQSC), Université de Montréal Research Chair in Innovative Nursing Practices, Université de Montréal Center for Innovation in Nursing Education and Équipe FUTUR (FRQSC).

Contributors GC conceptualised the study, designed the study, developed the study protocol and wrote the first draft of this manuscript. JC, JP and DJ-A helped to conceptualise the study, design the study and made comments on the first draft of this manuscript. JC is principal supervisor, and JP and DJ-A are cosupervisors for the PhD training of GC. PP and LB are discipline-specific members of GC thesis committee and have contributed to conceptualise and design specific aspects of the study. PP, LB, GF and GR helped develop the study protocol and made comments on the draft. All authors critically reviewed, edited and approved the final manuscript. The recruitment of participants for the study, data collection, management and analysis and the final interpretation of the study results will be led by GC. SD is medical director of the ECHO program on concurrent disorder management at the Université de Montréal Hospital Center, and he assisted GC in developing the measuring instruments for the study. GC will have access to the quantitative online database and the qualitative raw data. JC, JP and DJ-A will assist GC in analysing the data, interpretating the study results and disseminating the study results.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

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REFERENCES

1 American Psychiatric Association [APA]. *Diagnostic and statistical manual of mental disorders: DSM-5*. 5 edn. Washington, DC: American Psychiatric Publishing, 2013.
2 Kessler RC, Chiu WT, Demler O, *et al*. Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National comorbidity survey replication. *Arch Gen Psychiatry* 2005;62:617–27.
3 Urbanoski K, Inglis D, Veldhuizen S. Service use and unmet needs for substance use and mental disorders in Canada. *Can J Psychiatry* 2017;62:551–9.
4 World Health Organization [WHO]. Mental health action plan, 2013. Available: https://www.who.int/publications/i/item/9789241506021 [Accessed 21 Dec 2020].
5 Fleury M-J, Grenier G, Bamvita J-M, *et al*. Profiles associated respectively with substance dependence only, mental disorders only and co-occurring disorders. *Psychiatr Q* 2015;86:355–71.
6 Khan S. Troubles concomitants de santé mentale et de consommation d'alcool ou de drogues au Canada (Rapports sur la santé): Statistique Canada, 2017. Available: http://www.statcan.gc.ca/pub/82-003-x/2017008/article/54853-fra.pdf [Accessed 21 Dec 2020].
7 Crockford D, Addington D. Canadian schizophrenia guidelines: schizophrenia and other psychotic disorders with coexisting substance use disorders. *Can J Psychiatry* 2017;62:624–34.
8 Ghabrash MF, Bahremand A, Veilleux M, *et al*. Depression and outcomes of methadone and buprenorphine treatment among people with opioid use disorders: a literature review. *J Dual Diagn* 2020;16:1–17.
9 O'Neill S, Lapalme M, Camiré M. Modèles de dispensation des soins et services aux personnes présentant des troubles concomitants de santé mentale et de dépendance: Institut Nationale d'Excellence en Santé et en Services Sociaux [INESSS], 2016. Available: https://www.inesss.qc.ca/fileadmin/doc/INESSS/Rapports/ServicesSociaux/INESSS_Avis_Dispensation_soins_services_troubles_concomitants.pdf [Accessed 15 Dec 2020].
10 National Institute for Health and Care Excellence [NICE]. Coexisting severe mental illness and substance misuse: community health and social care services, 2016. Available: https://www.nice.org.uk/guidance/ng58 [Accessed 21 Dec 2020].
11 Padwa H, Guerrero EG, Braslow JT, *et al*. Barriers to serving clients with co-occurring disorders in a transformed mental health system. *Psychiatr Serv* 2015;66:547–50.
12 Substance Abuse and Mental Health Services Administration [SAMHSA]. Behavioral health trends in the United States: results from the 2014 national survey on drug use and health, 2014. Available: https://www.samhsa.gov/data/sites/default/files/NSDUH-FRR1-2014/NSDUH-FRR1-2014.pdf [Accessed 7 Jan 2020].
13 Levesque J-F, Sutherland K. Combining patient, clinical and system perspectives in assessing performance in healthcare: an integrated measurement framework. *BMC Health Serv Res* 2020;20:23.
14 Canadian Institute for Health Information [CIHI]. Health care cost drivers: the facts, 2011. Available: https://secure.cihi.ca/free_products/health_care_cost_drivers_the_facts_en.pdf [Accessed 16 Apr 2020].
15 Garrod E, Jenkins E, Currie LM, *et al*. Leveraging nurses to improve care for patients with concurrent disorders in inpatient mental health settings: a scoping review. *J Dual Diagn* 2020;16:1–16.
16 Wheeler A, Crozier M, Robinson G. Assessing and responding to hazardous and risky alcohol and other drug use: the practice, knowledge and attitudes of staff working in mental health services. *Drugs: Education, Prevention and Policy* 2014;21:234–43.
17 Roncero C, Szerman N, Terán A, *et al*. Professionals' perception on the management of patients with dual disorders. *Patient Prefer Adherence* 2016;10:1855–68.

18 Coloma-Carmona A, Carballo JL, Tirado-González S. Barriers for identification and treatment of problem drinkers in primary care. *Gac Sanit* 2017;31:95-99.
19 Wener P, Woodgate RL. Looking for Help: Primary Care Providers' Need for Collaboration to Deliver Primary Mental Healthcare Services. *Can J Commun Ment Health* 2017;36:29–39.
20 Somers JM, Moniruzzaman A, Rezansoff SN, *et al*. The prevalence and geographic distribution of complex co-occurring disorders: a population study. *Epidemiol Psychiatr Sci* 2016;25:267–77.
21 Coombes L, Wratten A. The lived experience of community mental health nurses working with people who have dual diagnosis: a phenomenological study. *J Psychiatr Ment Health Nurs* 2007;14:382–92.
22 Pinderup P, Thylstrup B, Hesse M. Critical review of dual diagnosis training for mental health professionals. *Int J Ment Health Addict* 2016;14:856–72.
23 Behilak S, AS-e A. The relationship between burnout and job satisfaction among psychiatric nurses. *J Nurs Educ Pract* 2020;10.
24 Dawood E, Mitsu R, Monica A. Perceived psychiatric nurses job stress: a cross sectional study. *IOSR Journal of Nursing and Health Science* 2017;06:37–47.
25 Havens DS, Gittell JH, Vasey J. Impact of relational coordination on nurse job satisfaction, work engagement and burnout: achieving the quadruple aim. *J Nurs Adm* 2018;48:1.
26 Priester MA, Browne T, Iachini A, *et al*. Treatment access barriers and disparities among individuals with co-occurring mental health and substance use disorders: an integrative literature review. *J Subst Abuse Treat* 2016;61:47–59.
27 Molina-Mula J, González-Trujillo A, Simonet-Bennassar M. Emergency and Mental Health Nurses' Perceptions and Attitudes towards Alcoholics. *Int J Environ Res Public Health* 2018;15:1733.
28 van Boekel LC, Brouwers EPM, van Weeghel J, *et al*. Healthcare professionals' regard towards working with patients with substance use disorders: comparison of primary care, general psychiatry and specialist addiction services. *Drug Alcohol Depend* 2014;134:92–8.
29 Petrakis M, Robinson R, Myers K, *et al*. Dual diagnosis competencies: a systematic review of staff training literature. *Addict Behav Rep* 2018;7:53–7.
30 Pinderup P. Improving the knowledge, attitudes, and practices of mental health professionals regarding dual diagnosis treatment – a mixed methods study of an intervention. *Issues Ment Health Nurs* 2018;39:292–303.
31 Savic M, Best D, Manning V, *et al*. Strategies to facilitate integrated care for people with alcohol and other drug problems: a systematic review. *Subst Abuse Treat Prev Policy* 2017;12:19.
32 Pepin J, Goudreau J, Lavoie P, *et al*. A nursing education research framework for transformative learning and interdependence of academia and practice. *Nurse Educ Today* 2017;52:50–2.
33 Arora S, Kalishman S, Dion D, *et al*. Partnering urban academic medical centers and rural primary care clinicians to provide complex chronic disease care. *Health Aff* 2011;30:1176–84.
34 Coventry TH, Maslin-Prothero SE, Smith G. Organizational impact of nurse supply and workload on nurses continuing professional development opportunities: an integrative review. *J Adv Nurs* 2015;71:2715–27.
35 McBain RK, Sousa JL, Rose AJ, *et al*. Impact of Project echo models of medical Tele-Education: a systematic review. *J Gen Intern Med* 2019;34:2842–57.
36 Zhou C, Crawford A, Serhal E, *et al*. The impact of Project echo on participant and patient outcomes: a systematic review. *Acad Med* 2016;91:1439–61.
37 Beste LA, Glorioso TJ, Ho PM, *et al*. Telemedicine specialty support promotes hepatitis C treatment by primary care providers in the Department of Veterans Affairs. *Am J Med* 2017;130:432–8.
38 Ní Cheallaigh C, O'Leary A, Keating S, *et al*. Telementoring with project echo: a pilot study in Europe. *BMJ Innov* 2017;3:144–51.
39 Furlan AD, Zhao J, Voth J, *et al*. Evaluation of an innovative tele-education intervention in chronic pain management for primary care clinicians practicing in underserved areas. *J Telemed Telecare* 2019;25:484–92.
40 De Witt Jansen B, Brazil K, Passmore P, *et al*. Evaluation of the impact of telementoring using ECHO© technology on healthcare professionals' knowledge and self-efficacy in assessing and managing pain for people with advanced dementia nearing the end of life. *BMC Health Serv Res* 2018;18:228.
41 Carlin L, Zhao J, Dubin R, *et al*. Project echo Telementoring intervention for managing chronic pain in primary care: insights from a qualitative study. *Pain Med* 2018;19:1140–6.
42 Fisher E, Hasselberg M, Conwell Y, *et al*. Telementoring primary care clinicians to improve geriatric mental health care. *Popul Health Manag* 2017;20:342–7.
43 Moore AB, Krupp JE, Dufour AB, *et al*. Improving transitions to Postacute care for elderly patients using a novel Video-Conferencing program: ECHO-Care transitions. *Am J Med* 2017;130:1199–204.
44 Komaromy M, Bartlett J, Manis K, *et al*. Enhanced primary care treatment of behavioral disorders with echo case-based learning. *Psychiatr Serv* 2017;68:873–5.
45 Sockalingam S, Arena A, Serhal E, *et al*. Building provincial mental health capacity in primary care: an evaluation of a project echo mental health program. *Acad Psychiatry* 2018;42:451-457.
46 Frank JW, Carey EP, Fagan KM, *et al*. Evaluation of a telementoring intervention for pain management in the Veterans health administration. *Pain Med* 2015;16:1090–100.
47 Mehrotra K, Chand P, Bandawar M, *et al*. Effectiveness of NIMHANS echo blended tele-mentoring model on integrated mental health and addiction for counsellors in rural and underserved districts of Chhattisgarh, India. *Asian J Psychiatr* 2018;36:123–7.
48 Faherty LJ, Rose AJ, Chappel A, *et al*. Assessing and expanding the evidence base for project echo and ECHO-Like models: findings of a technical expert panel. *J Gen Intern Med* 2020;35:899–902.
49 Albarqouni L, Glasziou P, Hoffmann T. Completeness of the reporting of evidence-based practice educational interventions: a review. *Med Educ* 2018;52:161–70.
50 White C, McIlfatrick S, Dunwoody L, *et al*. Supporting and improving community health services-a prospective evaluation of echo technology in community palliative care nursing teams. *BMJ Support Palliat Care* 2019;9:202–8.
51 Dowling MJ, Payne C, Larkin P, *et al*. Does an interactive, Teleconference-Delivered, palliative care lecture series improve nursing home staff confidence? *J Palliat Med* 2020;23:179–83.
52 Hacking I. *The social construction of what?* Cambridge, MA: Harvard University Press, 1999.
53 Pluye P, Gagnon M-P, Griffiths F, *et al*. A scoring system for appraising mixed methods research, and concomitantly appraising qualitative, quantitative and mixed methods primary studies in mixed studies reviews. *Int J Nurs Stud* 2009;46:529–46.
54 Pluye P, Kaur N, Granikov V. Mixing phases, results and data in patient oriented research. *Int J Mult Res Approaches* 2018;10:41–56.
55 Gregor S. The nature of theory in information systems. *MIS Quarterly* 2006;30:611–42.
56 Moore DE, Green JS, Gallis HA. Achieving desired results and improved outcomes: integrating planning and assessment throughout learning activities. *J Contin Educ Health Prof* 2009;29:1–15.
57 Tardif J. *L'évaluation des compétences: Documenter Le parcours de développement: Montreal*. Canada: Chenelière-éducation, 2006.
58 Sandberg J, Alvesson M. Ways of constructing research questions: gap-spotting or problematization? *Organization* 2011;18:23–44.
59 O'Cathain A, Murphy E, Nicholl J. The quality of mixed methods studies in health services research. *J Health Serv Res Policy* 2008;13:92–8.
60 von Elm E, Altman DG, Egger M, *et al*. Strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. *BMJ* 2007;335:806–8.
61 Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care* 2007;19:349–57.
62 Phillips AC, Lewis LK, McEvoy MP, *et al*. Development and validation of the Guideline for reporting evidence-based practice educational interventions and teaching (GREET). *BMC Med Educ* 2016;16:237.
63 Creswell JW, Plano Clark VL. *Designing and conducting mixed methods research*. 3 edn. Los Angeles, CA: SAGE Publications, 2018.
64 O'Cathain A, Murphy E, Nicholl J. Three techniques for integrating data in mixed methods studies. *BMJ* 2010;341:c4587.
65 Thorne S. *Interpretive description*. New York, NY: Routledge, 2008.
66 Socolovsky C, Masi C, Hamlish T, *et al*. Evaluating the role of key learning theories in echo: a telehealth educational program for primary care providers. *Prog Community Health Partnersh* 2013;7:361–8.
67 Arora S, Thornton K, Murata G, *et al*. Outcomes of treatment for hepatitis C virus infection by primary care providers. *N Engl J Med* 2011;364:2199–207.
68 McLoughlin C, Patel KD, O'Callaghan T, *et al*. The use of virtual communities of practice to improve interprofessional collaboration and education: findings from an integrated review. *J Interprof Care* 2018;32:136–42.
69 Grove SK, Burns N, Gray J. *The practice of nursing research: appraisal, synthesis, and generation of evidence*. 8 edn. St-Louis, MO: Elsevier, 2017.

70 Thompson Burdine J, Thorne S, Sandhu G. Interpretive description: a flexible qualitative methodology for medical education research. *Med Educ* 2021;55:336–43.
71 Paillé P, Mucchielli A. L'analyse thématique. In: Paillé P, Mucchielli A, eds. *L'analyse qualitative en sciences humaines et sociales*. 4 edn. Malakoff, France: Armand Colin, 2016: 235–312.
72 Birt L, Scott S, Cavers D, *et al*. Member checking: a tool to enhance Trustworthiness or merely a NOD to validation? *Qual Health Res* 2016;26:1802–11.
73 Johnson RE, Grove AL, Clarke A. Pillar integration process: a joint display technique to integrate data in mixed methods research. *J Mix Methods Res* 2017;13.
74 Guetterman TC, Fetters MD, Creswell JW. Integrating quantitative and qualitative results in health science mixed methods research through joint displays. *Ann Fam Med* 2015;13:554–61.
75 Morgan DL. Practical strategies for combining qualitative and quantitative methods: applications to health research. *Qual Health Res* 1998;8:362–76.
76 Wendler MC. Triangulation using a meta-matrix. *J Adv Nurs* 2001;35:521–5.
77 Moffatt S, White M, Mackintosh J, *et al*. Using quantitative and qualitative data in health services research - what happens when mixed method findings conflict? [ISRCTN61522618]. *BMC Health Serv Res* 2006;6:28.
78 Frenk J, Chen L, Bhutta ZA, *et al*. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. *Lancet* 2010;376:1923–58.
79 Canadian Institutes of Health Research [CIHR], Natural Sciences and Engineering Research Council of Canada [NSERCC], Social Sciences and Humanities Research Council [SSHRC]. Tri-Council policy statement: ethical conduct for research involving humans (TCPS2), 2018. Available: https://ethics.gc.ca/eng/documents/tcps2-2018-en-interactive-final.pdf [Accessed 26 Dec 2020].
80 Chicoine G. How are we conducting and reporting mixed methods research in nursing sciences?: a commentary on Seah et al. (2018) publication. *Arch Psychiatr Nurs* 2018;32:784–5.
81 Arora S, Kalishman S, Thornton K, *et al*. Expanding access to hepatitis C virus treatment--Extension for Community Healthcare Outcomes (ECHO) project: disruptive innovation in specialty care. *Hepatology* 2010;52:1124–33.
82 Watson HE, Maclaren W, Shaw F. *Effective interventions unit: measuring staff attitudes to people with drug problems: the development of a tool (drug misuse research programme)*. Glasgow, Scottish: Glasgow Caledonian University, 2003. https://www.webarchive.org.uk/wayback/archive/20180515184547/http://www.gov.scot/Publications/2003/08/17735/23437
83 Munro A, Watson HE, McFadyen A. Assessing the impact of training on mental health nurses' therapeutic attitudes and knowledge about co-morbidity: a randomised controlled trial. *Int J Nurs Stud* 2007;44:1430–8.
84 Crowe TP, Kelly P, Pepper J, *et al*. Service based internship training to prepare workers to support the recovery of people with co-occurring substance abuse and mental health disorders. *Int J Ment Health Addict* 2013;11:269–80.
85 Pinderup P. Training changes professionals' attitudes towards dual diagnosis. *Int J Ment Health Addict* 2017;15:53–62.
86 Bandura A. Guide for constructing self-efficacy scales. In: Pajares F, Urdan T, eds. *Self-Efficacy beliefs in adolescents*. Greenwich, Connectivut: Information Age Publishing, 2006: 307–37.
87 Hughes E. *Closing the gap: a capability framework for working effectively with people with combined mental health and substance use problems (dual diagnosis*. Mansfield, UK: University of Lincoln, Centre for Clinical and Academic Workforce Innovation, 2006. http://eprints.lincoln.ac.uk/id/eprint/729/1/uoa12eh05.pdf

Correction: *Impact of a videoconferencing educational programme for the management of concurrent disorders on nurses' competency development and clinical practice: protocol for a convergent mixed methods study*

Chicoine G, Côté J, Pepin J, *et al* Impact of a videoconferencing educational programme for the management of concurrent disorders on nurses' competency development and clinical practice: protocol for a convergent mixed methods study*BMJ Open* 2021;11:e042875. doi: [10.1136]/bmjopen-2020-042875

This article was previously published with an error.The author name Pepin was published as Pépin.

BMJ Open 2021;**11**:e042875corr1. doi:10.1136/bmjopen-2020-042875corr1

Supplementary file 1: Reporting guidelines checklists

The Good Reporting of a Mixed Methods Study (GRAMMS) checklist[59]

No.	Criteria	Manuscript reference and/or commentaries/description
1	Describe the justification for using a mixed methods approach to the research question	Current gaps in the literature – See Introduction section (Continuing professional education in CDs section – 3rd paragraph). Justification for using a mixed methods approach – See Introduction section (Continuing professional education in CDs section – 4th paragraph).
2	Describe the design in terms of the purpose, priority and sequence of methods	Purpose of the design – See Methods and analysis section (Study design – 1rst paragraph). Priority - Methods and analysis section – (Study design – 1rst paragraph). Sequence of methods - Parallel design, See Methods and analysis section (Study design – 1rst paragraph).
3	Describe each method in terms of sampling, data collection and analysis	<u>QUAN method:</u> Sampling – See Methods and analysis section (C1: Quantitative method - Participants and recruitment + Sample size consideration). Data collection – See Methods and analysis section (C1: Quantitative method - Outcomes and measurements). Analysis – See Methods and analysis section (C1: Quantitative method - Statistical analysis). <u>QUAL method:</u> Sampling – See Methods and analysis section (C2: Qualitative method - Participants and recruitment). Data collection – See Methods and analysis section (C2: Qualitative method - Semi-structured interviews). Analysis – See Methods and analysis section (C2: Qualitative method - Qualitative data analysis).
4	Describe where integration has occurred, how it has occurred and who has participated in it	Where - Methods and analysis section (C3. Integration of quantitative and qualitative results – 1rst paragraph). How - Methods and analysis section – 2nd paragraph + Figure 3). Who – Integration procedures will be led by the principal investigator and verify with three members of the research team (JC, JP and DJA).
5	Describe any limitation of one method associated with the presence of the other method	<u>Anticipated</u> limitations of the mixed methods associated with the QUAN method: - Given that participation in this study is voluntary, the participants recruited for the QUAN method may not be representative of the whole population. - Some of the instruments that we will use in the surveys are not validated. Consequently, we will have to

		analyze the data "item-by-item" instead of as a distinct dimension. We anticipate that this lack of clarity in the QUAN results may affect the integration process, especially when comparing numerous QUAN results with QUAL themes/subthemes in a same table (matrix). Anticipated limitations of the mixed methods associated with the QUAL method: - All nurses who participated in the program will be invited for the QUAL method. However, it is possible that the perspectives from the ones who will not consent to research might be different the ones who agree in taking part of the study.
6	Describe any insights gained from mixing or integrating methods	The description of the integration component in terms of strategy, procedures, and techniques in the manuscript explained how we anticipated obtaining any insights from mixing QUAN and QUAL results (see Figure 3 in Methods and Analysis section - C3. Integration of quantitative and qualitative results): - Comparison strategy - Matrix technique - Within participant comparison/across participant comparison

NA: Not applicable; No.: Item reference number; QUAL: Qualitative; QUAN: Quantitative.
Note. Given that we are reporting an ongoing mixed methods study, some of the criteria/recommendations or items may not be applicable and fulfilled (e.g., results and discussion sections).

The Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidelines for cohort studies[60]

Item	No.	Recommendation	Manuscript reference and/or commentaries/description
Title and abstract	**1**	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Done. See Title page and Abstract – Methods and analysis section. We indicated the convergent parallel mixed methods study and the specific design for the QUAN method (observational prospective cohort study).
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	Done. See Abstract – Methods and analysis section We provide information on what is planned to be done in

			the QUAN method: target population, recruitment and data collection method, outcomes and measurements.
Introduction			
Background/rationale	**2**	Explain the scientific background and rationale for the investigation being reported	Done. See Introduction section (Continuing professional education in CDs section – 3rd paragraph). We explained the current state of empiric knowledge on the ECHO Program (type of studies, main results and limitations of those studies).
Objectives	**3**	State specific objectives, including any prespecified hypotheses	Done. We indicated the general aim of the mixed methods study in the Introduction section (Continuing professional education in CDs section – 4th paragraph). We indicated the QUAN research question and the specific QUAN objective in the Methods and analysis section (Study design section).
Methods			
Study design	**4**	Present key elements of study design early in the paper	Done. We explained the QUAN study design early in the Methods and analysis section - See Methods and analysis section (Study design).
Setting	**5**	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Done. We provided details about the setting, location, relevant dates for participation in the program and recruitment and exposure - See Methods and Analysis section (Setting, videoconferencing educational program and technical features and C1: QUAN method). Information

			regarding follow-up was provided in the Strengths and limitation section. Administration measure schedule was detailed in Supplementary file 3.
Participants	**6**	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	Done - See Methods and analysis section (C1: QUAN method - Participants and recruitment).
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	NA
Variables	**7**	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Done - See Methods and analysis section (C1: QUAN method – Outcomes and measurement).
Data sources/measurement	**8**	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Done. We described each outcome of interest and sources of data in the Methods and analysis section (C1: QUAN method – Table 1). We also provided further details of all the instruments to be used in the surveys in Supplementary file 4.
Bias	**9**	Describe any efforts to address potential sources of bias	Done - See Strengths and limitations section – 2nd and 3rd paragraphs.
Study size	**10**	Explain how the study size was arrived at	Done. We provided details about the target population and estimation of the sample size. See Methods and analysis section (C1: QUAN method – Sample size consideration).
Quantitative variables	**11**	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Done - See Methods and analysis section (C1: QUAN method –statistical analysis). Grouping: NA.
Statistical methods	**12**	(*a*) Describe all statistical methods, including those used to control for confounding	Done - See Methods and analysis section (C1: QUAN method –statistical analysis).

		(*b*) Describe any methods used to examine subgroups and interactions	Done - See Methods and analysis section (C1: QUAN method –statistical analysis).
		(*c*) Explain how missing data were addressed	NA
		(*d*) If applicable, explain how loss to follow up was addressed	NA
		(*e*) Describe any sensitivity analyses	NA
Results			
Participants	**13**	(a) Report numbers of individuals at each component of study—e.g., numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analyzed	NA
		(b) Give reasons for non-participation at each component	NA
		(c) Consider use of a flow diagram	NA
Descriptive data	**14**	(a) Give characteristics of study participants (e.g., demographic, clinical, social) and information on exposures and potential confounders	NA
		(b) Indicate number of participants with missing data for each variable of interest	NA
		(c) Summarize follow-up time (e.g., average and total amount)	NA
Outcome data	**15**	Report numbers of outcome events or summary measures over time	NA
Main results	**16**	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included	NA
		(*b*) Report category boundaries when continuous variables were categorized	NA
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	**17**	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			

Key results	**18**	Summarize key results with reference to study objectives	NA
Limitations	**19**	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Done. We discussed the anticipated limitations of the QUAN method - See Strengths and limitations section - 2nd and 3rd paragraphs.
Interpretation	**20**	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	NA
Generalizability	**21**	Discuss the generalizability (external validity) of the study results	This issue was discussed as part of the anticipated limitations of the study. See Strengths and limitations section – 2nd paragraph.
Other information			
Funding	**22**	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Done - See Funding statement, Competing interests' statement and Acknowledgements.

NA: Not applicable; No.: Item reference number; QUAN: Quantitative.

The Consolidated Criteria for REporting Qualitative Studies (COREQ) checklist[61]

No.	Item	Description
Domain 1: Research team and reflexivity		
Personal characteristics		
1	Interviewer/facilitator	I #1 (GC) – Principal investigator of the proposed mixed methods study
2	Credentials	I #1 (GC) – MSc, PhD Candidate (Nursing) SR #1 (JC) – PhD (Nursing) R #2 (DJA) – MD, MSc, FRCPC (Psychiatry) R #3 (JP) – PhD (Nursing) R #4 (LB) – PhD (Nursing) SR #5 (PP) – PhD (Family Medicine) C #1 (GR) – PhD, Postdoctoral fellow (Nursing) C #2 (GF) – MSc, PhD Candidate (Nursing) C #3 (SD) - MD, MSc, FRCPC (Psychiatry)
3	Occupation	I #1 (GC) – RN, PhD Candidate (Faculty of Nursing, Université de Montréal, QC, Canada).

		SR #1 (JC) – RN, Full Professor (Faculty of Nursing, Université de Montréal, QC, Canada); Researcher and Chairholder (Université de Montréal Hospital Research Center, QC, Canada). R #2 (DJA) – MD, Associate Professor (Faculty of Medicine, Université de Montréal, QC, Canada); Director and Researcher (Center of Excellence and Collaboration in Concurrent Disorders, Université de Montréal Hospital Research Center, QC, Canada). R #3 (JP) – RN, Full Professor (Faculty of Nursing, Université de Montréal, QC, Canada); Scientific Director (Équipe FUTUR-FRQSC, Faculty of Nursing, Université de Montréal, QC, Canada). R #4 (LB) – RN, Assistant Professor (Faculty of Nursing, University of Montreal, QC, Canada). SR #5 (PP) – Full Professor and Senior Researcher (Faculty of Medicine, Department of Family Medicine, McGill University, QC Canada). C #1 (GR) – RN, PhD, Postdoctoral fellow (Women's College Hospital, ON, Canada); Research Chair Coordinator (Université de Montréal Hospital Research Center, QC, Canada). C #2 (GF) – RN, PhD Candidate (Faculty of Nursing, Université de Montréal, Canada, QC, Canada). C #3 (SD) - R #2 (DJA) – MD, Assistant Professor (Faculty of Medicine, Université de Montréal, QC, Canada); Medical Director of ECHO CHUM TC (Université de Montréal Hospital Center, QC, Canada); Researcher (Center of Excellence and Collaboration in Concurrent Disorders, Université de Montréal Hospital Research Center, QC, Canada).
4	Gender	Interviewer: female identifying. Research team: four females identifying, three male identifying.
5	Experience and training	I #1 – has clinical experience in CDs, has experience in mixed methods research and in conducting semi-structured interviews for patient-oriented research. She has interests in virtual continuing educational interventions and in competency development. SR #1 –has expertise in developing and evaluating nursing and non-nursing interventions among people living with chronic conditions. R #2 – is a psychiatrist specializing in CDs, has expertise in conducting registered controlled trials, including pharmacologic and non-pharmacologic interventions for patients with CDs. He is the guarantor of the larger QUAN cohort study; he was directly involved in participants' recruitment and QUAN data collection. R #3 – has expertise in qualitative research, including nursing education research and nursing discipline advancement. R #4 – has expertise in qualitative research, including competency development and nursing education research. SR #5 – has expertise in mixed methods research, including patient-oriented research and primary health care.

		I #2 –has experience in developing and evaluating virtual nursing interventions, in conducting qualitative research and in knowledge synthesis. I #3 – has experience in developing and evaluating virtual nursing interventions, in conducting quantitative research and in knowledge synthesis. C #3 - is a psychiatrist specializing in CDs. He was the guarantor of the larger QUAN cohort study; he was directly involved in the ECHO Program development and implementation. He participated in the recruitment of the participants for the QUAN data collection.
Relationship with participants		
6	Relationship established	I #1 will conduct the semi-structured interviews. She will be directly involved in nurses' recruitment and QUAL data collection. Prior to planning this study, she was working as a RN at the Université de Montréal Hospital Center.
7	Participant knowledge of interviewer	I #1 will introduce herself to participants as a PhD nursing student at the University of Montreal. She will use the interview guide in order to facilitate the conduct of the interviews with prompts and open-ended questions. Anticipated desirability bias – See Strengths and limitations section – 2nd paragraph.
8	Interviewer characteristics	I #1 is a RN, PhD candidate and principal investigator of the study. She has experience in semi-structured interviews and in CDs, she is under the supervision of JC (principal supervisor), DJA and JP (co-supervisors).
Domain 2: Study design		
Theoretical framework		
9	Methodological orientation and theory	Conceptual framework - See Introduction section (Philosophical and conceptual foundations). Methodological orientation (interpretive description approach) - See Methods and analysis section– (Study design).
Participant selection		
10	Sampling	See Methods and analysis section (C2: QUAL method – Participants and recruitment).
11	Method of approach	See Methods and analysis section (C2: QUAL method – Participants and recruitment).
12	Sample size	See Methods and analysis section (C2: QUAL method – Participants and recruitment).
13	Non-participation	NA
Setting		
14	Setting of data collection	See Methods and analysis section (C2: QUAL method – semi-structured interviews).
15	Presence of non-participants	No.
16	Description of sample	NA
Data collection		

17	Interview guide	See Supplementary file 5.
18	Repeat focus group	No.
19	Audio/visual recording	See Methods and analysis section (C2: QUAL method – semi-structured interviews).
20	Field notes	The principal investigator (I#1) will take personal notes during and after each interview (reminders, questions, thoughts, interpretations, etc.)
21	Duration	See Methods and analysis section (C2: QUAL method – semi-structured interviews).
22	Data saturation	NA
23	Transcripts returned	No.
Domain 3: Analysis and findings		
Data analysis		
24	Number of data coders	Interview recordings will be transcribed by a research assistant. I #1 will be listening to all the audio recordings to ensure the accuracy of the transcripts and to become familiar with the raw data. Prior to coding, I #1 will read the interview transcripts several times in order to become familiar with the raw data and develop a comprehensive understanding of participants' responses. Coding will be led by I #1 and will involve searching for meaningful units and patterns in the data. Common categories and emergent themes will be reviewed by SR #1 and R #3 throughout the analytic process to ensure the trustworthiness and consistency of the findings.
25	Description of the coding tree	NA. To be reported in the final report of I #1 PhD thesis.
26	Derivation of themes	NA. To be reported in the final report of I #1 PhD thesis and in a further publication of the study results (QUAL results).
27	Software	See Methods and Analysis section (C2: QUAL method – QUAL data analysis).
28	Participant checking	No.
Reporting		
29	Quotations presented	See Ethics and dissemination section (Ethical considerations)
30	Data and findings consistent	NA. To be reported in the final report of I #1 PhD thesis and in a further publication of the study results (QUAL results).
31	Clarity of major themes	NA. To be reported in the final report of I #1 PhD thesis and in a further publication of the study results (QUAL results).
32	Clarity of minor themes	NA. To be reported in the final report of I #1 PhD thesis and in a further publication of the study results (QUAL method).

C: Collaborator; CDs: Concurrent disorders; I: Investigator; MD: Medical Doctor; NA: Not applicable; No.: Item reference number; PI: Principal investigator; QUAL: Qualitative; QUAN: Quantitative; R: Researcher; RN: Registered nurse; SR: Senior Researcher.

The guideline for Reporting Evidence-based practice Educational interventions and Teaching (GREET)[62]

No.	Item	Manuscript reference and/or commentaries/description
NAME: The Extension for Community Healthcare Outcomes (ECHO) Program on CDs		
1	INTERVENTION (brief description)	See Introduction section (Continuing professional education in CDs – 2nd paragraph) + Methods and analysis section (Setting, videoconferencing educational program and technical features).
WHY - this educational process		
2	THEORY	The ECHO model is rooted in established social educational theories including Bandura's Social Cognitive Theory, Vygotsky's Situated Learning Theory, and Wenger's Communities of Practice, with a particular emphasis on enhancing professionals' self-efficacy[33 67].
3	LEARNING OBJECTIVES	The didactic topics and learning objectives were developed to match the National Institute for Health and Care Excellence (NICE) guideline in CDs[10]. Learnings objectives were developed so that they could be applicable to all professional groups (see Supplementary file 2 for an example of the learning objectives for the 2018-2019 curriculum of the program).
4	CONTENT	Case-based discussion one hour and 15 minutes) Short didactic presentations (i.e., Powerpoint presentations) (15 minutes) – See Methods and analysis section (Setting, videoconferencing educational program and technical features) + Supplementary 2 for examples of the program content and topics of the didactic presentations.
WHAT		
5	EDUCATIONAL MATERIALS	Description provided in the Methods and analysis section (Setting, videoconferencing educational program and technical features). **Learning materials provided to learners:** A specific document explaining the rationale of the program, the functioning of the videoconference sessions, the learning objectives, the activities and the engagement required from participants is provided at the time of their registration. An electronic document is sent by email one week before each virtual session detailing the patient case to be discussed. This document has predetermined sections that are filled by each participating professional (or

		team of professionals) who is presenting a patient case. The program has also a web site that contains several resources in CDs' evidence-based practice that professionals can consult at any time. Emails are sent each month from a librarian to the participating professionals to share new scientific articles related to CDs. Didactics are supported with a PowerPoint presentation containing relevant clinical information that are also shared by email to the participants. **Materials used in the training of educational intervention providers:** A paper document detailing the ECHO model principles (learning objectives, learning strategies, functioning, etc.) is given to each professionals of the expert team (after having attend the required four-day training/immersion at the ECHO Institute, University of New Mexico, NM, USA). This document also provides guidance on how to replicate the program in other contexts (step-by-step approach) and on evidence-based teaching methods (abilities required as training providers). **VC equipment:** See Methods and analysis section (Setting, videoconferencing educational program and technical features – 1rst paragraph). Additional information on VC equipment: Nurses are equipped by their employer for the minimum technical equipment required to run a virtual session online (i.e. desktop or laptop computer, Internet connection, speakers, microphones and webcam or HD cam). The expert team will use a Logtech Group ConferenceCam kit that is connected to a Lenovo Windows PC with two 55" screen mounted on a support as videoconferencing equipment.
6	EDUCATIONAL STRATEGIES: Describe the teaching/learning strategies (e.g., tutorials, lectures, online modules) used in the educational intervention.	See Methods and analysis section (Setting, videoconferencing educational program and technical features – 1rst paragraph). See Supplementary file 2 for examples of didactic presentations.
7	INCENTIVES	Credits for participation are given to participants as continuing education units (credentialing and certificate of completion).
WHO		
8	INSTRUCTORS	There are no formal instructors but an expert team of healthcare professionals including psychiatrists, physicians with expertise in SUD, registered nurses, pharmacists, social workers, psychologists, an

		occupational therapist and a librarian. An assistant (not a clinician) is also present to coordinate the sessions in terms of timing, answering questions in the forum application, ensure that each professional has the opportunity to ask questions, etc. **Experience and expertise:** Psychiatrists from the expert team all have expertise in CDs. All registered nurses from the expert team have a bachelor's degree with at least six months of clinical experience in CDs. Each other professional from the expert team have at least six months of experience in working with patients with CDs. According to their discipline, the professionals from the expert team have different expertise such as motivational interviewing, relapse prevention, cognitive and behavioral therapy, working with vulnerable population (youth, homeless people, pregnant women), Hepatitis C treatment, treatment for opioids use disorders, etc. **Roles:** One of the psychiatrists has a specialization in CDs and acts as the main instructor during each virtual session. He introduces each member of the expert team, makes sure that each connected professional has time to introduce themselves, summarizes the expert team recommendations at the end of the sessions, ensures that the session goes smoothly and that the schedule is respected. He also gives feedback throughout the session. After a case of patient is presented, professionals from the expert team ask questions for further information. After the end of the discussion, each professional from the expert team provides recommendations and/or feedback related to their specific area of practice. **Training related to the educational intervention provided for the instructors:** When a hospital center or clinic decides to develop and implement an ECHO Program, at least two professionals from the expert team has to attend a 4-day immersion at the ECHO Institute in New Mexico, USA (see the educational materials section for more details on the ECHO immersion).
	LEARNERS	The participating healthcare professionals may include psychiatrists, physicians, registered nurses, social workers, pharmacists, psychologists and other clinicians in contact with patients with CDs in their daily practice. They habitually have experience in mental health/psychiatric care OR in substance use treatment; but some of them may also work in

		general settings such as emergency, primary care clinics, local agencies, etc. These healthcare professionals could work in different types of settings that vary in terms of the level of care (primary or secondary care), of services (psychiatric services, addiction services, residential therapies, crisis center, emergency, etc.) or in terms of population served (e.g., psychotic disorders, mood disorders, personality disorders, alcohol use disorders, opioid use disorders, homeless people, etc.).
HOW		
9	DELIVERY	**Modes of delivery:** See Methods and analysis section (Setting, videoconferencing educational program and technical features – 1rst paragraph). Group modality: Methods and analysis section (Setting, videoconferencing educational program and technical features – 1rst paragraph). **Ratio:** There are no formal limits on the number of participants that can be connected at the same time. A curriculum generally includes between 100 and 200 subscribed participants; sessions normally includes 50 to 60 healthcare professionals. The expert team includes over ten specific healthcare professionals in CDs and of those, a minimum of four healthcare professionals are required to be present at each virtual session. Attention is given to which healthcare professional from the expert team is present in a given session so that different professional groups are represented (in order that recommendations are tailored to a variety of disciplines). **Sequence of the learning activities:** 1) introduction and presentation of each professional connected (professionals from the experts team and the participants) (10 minutes), 2) patient case presentation (15 minutes), 3) questions and discussion regarding the patient case (35 minutes), 4) formal recommendations and clinical guidance from the expert team and recommendations from other participants (15 minutes), 5) didactics presentations (15 minutes). **Feedback/ Retroaction:** Participant will receive feedback from the expert team after completing each online survey (T0, T1, T2) regarding their scores for the knowledge test.

WHERE		
10	ENVIRONMENT: Describe the relevant physical learning spaces (e.g., conference, university lecture theater, hospital ward, community) where the teaching/learning occurred.	See Methods and analysis section (Setting, videoconferencing educational program and technical features - 2nd paragraph). **Additional information on the Zoom platform as a technical environment:** Several measures are taken to prevent hacking of the Zoom platform. First, Zoom has its own encryption used for all meetings. The Zoom meeting link is sent to the registered participants only, so the risk of unauthorized access by an outside party is minimal. Second, the animator account is using an SSO group connection; meaning that there is a double verification for authentication when trying to access the accounts.
WHEN AND HOW MUCH?		
11	SCHEDULE	**Number of sessions, frequency, timing and duration:** See Methods and analysis section (Setting, videoconference educational program and technical features – 2nd paragraph). An example of schedule for the 2018-2019 curriculum is detailed in Supplementary file 2.
12	FACE-TO-FACE CONTACT WITH INSTRUCTORS/SELF-DIRECTED LEARNING ACTIVITIES	Each virtual session consists of virtual face-to-face contact with instructors (healthcare professionals from the expert team). Self-directed activities consist of clinical guidance and recommendations of evidence-based practice for participants. Recommendations are tailored to each healthcare professionals (or team of professionals) that is presenting a case of patient. This information is shared throughout a given virtual session so that all connected healthcare professionals can benefit from others' experience. After the virtual session, written recommendations are provided to the healthcare professional (or team of professionals) who presented a patient case; which habitually consists of interventions to add to the patient care plan.
PLANNED CHANGES		
13	SPECIFIC ADAPTATION FOR THE LEARNERS	YES: During the program, the virtual sessions' content is adapted to healthcare professionals as follow: - Topics of the 15-minute didactic presentations are adapted to professionals' requests and learning needs (see Patient and public involvement section);

		- In case of a specific medical or mental issue in a presented patient case, the expert team may invite an additional professional to the session in question for further guidance; - In case of a specific issue discussed during a session that generate clinical questions from the participating professionals, further resources/information may be given. This information (i.e., evidence-based practice, clinical tools, scientific articles) is provided by a librarian who has experience in searching literature recent in the field of CDs.
UNPLANNED CHANGES		
14	Was the educational intervention modified during the course of the study? If yes, describe the changes (what, why, when, and how).	See the Patient and Public involvement section for changes and modifications that can be made during the course of the program (an online appreciation questionnaire developed by the educational program is sent by email to each participant in order to collect information on their learning needs and suggestions, an ECHO participant committee was created in order to improve the program delivery and content).
HOW WELL		
15	ATTENDANCE: Describe the learner attendance, including how this was assessed and by whom. Describe any strategies that were used to facilitate attendance.	This will be described in the final study report (PhD thesis) and in further publication of the study results.
16	Describe any processes used to determine whether the materials (item 5) and the educational strategies (item 6) used in the educational intervention were delivered as originally planned.	This will be described in the final study report (PhD thesis) and in further publication of the study results.
17	Describe the extent to which the number of sessions, their frequency, timing and duration for the educational intervention were delivered as scheduled (item 11).	This will be described in the final study report (PhD thesis) and in further publication of the study results.

CDs: Concurrent disorders; ECHO: Extension for Community Healthcare Outcomes; NA: Not applicable; No.: Item reference number; SUD: Substance use disorder; T0: Baseline; T1: 6 months; T2: 12 months; VC: Videoconferencing

1

Supplementary file 2: Example of didactics schedule, topics and learning objectives for the 2018–2019 curriculum of the ECHO Program for the management of CDs

No.	Schedule	Topics	Learning objectives[11]
ECHO's structure and functioning			
1	September 11, 2018 12 PM to 1:30 PM	- Program functioning and proposed learning activities throughout the videoconference sessions; - Participants' engagement and responsibilities.	- Understanding the basic technical features to run a virtual session online; - Understand the basic principles underlying the ECHO sessions; - Identify the benefits of the collaborative learning model; - Use the different forms for active participation in the sessions (case presentation, case follow-up, teleclinic evaluation).
Basic knowledge in CDs			
2	September 25, 2018 12 PM to 1:30 PM	Core values, attitudes and relational skills related to CDs.	- Identify the right conditions for the management of patients with CDs; - Initiate a reflective approach to participants' clinical practice; - Acquire basic knowledge regarding the assessment, treatment and referral of patients with CDs.
3	October 9, 2018 12 PM to 1:30 PM	Characteristics and particular needs of people with CDs.	
4	October 23, 2018 12 PM to 1:30 PM	Basics in MH.	
5	November 6, 2018 12 PM to 1:30 PM	Basics in SUD.	
6	November 20 2018 12 PM to 1:30 PM	Screening, assessing and diagnosing CDs.	
7	December 4, 2018 12 PM to 1:30 PM	Induced MH disorders vs. primary diagnosis of MH disorders.	- Use effective screening and assessment tools; - Differentiate among substance-related disorders; - Work as a team, in collaboration with the patient, to deliver care focused on the patient's needs; - Determine a safe long-term monitoring method to prevent relapses.
8	December 18, 2018 12 PM to 1:30 PM	Mood and anxiety disorders and SUD.	
9	January 15, 2019 12 PM to 1:30 PM	Planning and coordinating care between professionals, team and agencies.	
10	January 29, 2019 12 PM to 1:30 PM	This didactic presentation was determined according to the participants' learning needs.	
11	…	…	…

CDs: Concurrent disorders; ECHO: Extension for Community Healthcare Outcomes; MH: Mental health; No.: Session number, SUD: Substance use disorder

Supplementary file 3: Measure Administration Schedule

Outcomes	**Baseline (T0)**	**6 months (T1)**	**12 months (T2)**
Sociodemographic and practice information	X	Practice information only*	Practice information only*
Participation		X	X
Satisfaction and acceptability regarding the program		X	X
Attitudes towards patient with CDs	X	X	X
Knowledge in CDs	X	X	X
Self-efficacy in the management of CDs	X	X	X
Perceived clinical performance	Two first items of the questionnaire	Full questionnaire	Full questionnaire

CDs: Concurrent disorders
*Given that employment changes are common in the mental health, psychiatric and addiction sectors, practice information will be asked at each data collection point.

Supplementary file 4: Outcomes measure and related instruments for the QUAN data collection

***Sociodemographic and practice information*.** Sociodemographic information will be collected at baseline (T0) including age, gender, years of practice, academic background, and other past training. Practice information will be collected by asking participants to indicate the type of setting in which they are currently working, the type of population they serve, and to estimate the proportion of patients with CDs they see or follow on a regular basis (from 0 % to 100 %).

Participation. Biweekly attendance will be tracked using a web-based management tool (iECHO), developed by the ECHO Institute at the University of New Mexico, USA. We will also ask participants about their learning objectives and motivations for attending the ECHO Program on CDs as part of an open-ended question at baseline. We will ask nurses to indicate the number of videoconference sessions in which they have interacted (video interaction or within the chat forum) with the other participants within the last six months, as well as the number of videoconference sessions in which they presented a patient case within the last six months. Finally, participants will be asked to rate their level of participation over the last six months on a scale of one (passive) to ten (active).

***Satisfaction and acceptability regarding the program*.** A French version of a questionnaire created by the ECHO Institute will be used for the purposes of measuring nurses' satisfaction and acceptability[33]. The questionnaire is a thirteen-item measure where the respondents are asked to indicate how satisfied they are with the content and structure of the program and how useful it was for their own objectives and practice, using a seven-point Likert scale (strongly agree to strongly disagree). The questionnaire explores different dimensions of satisfaction and acceptability including the quality of information, the quality of the system (technological infrastructure), general satisfaction and perceived usefulness of the program.

Table 2. Full questionnaire for measuring nurses' satisfaction and acceptability regarding the ECHO Program for the management of CDs

No.	ITEM	RATING SCALE from 1 to 7 1 = strongly agree 7 = strongly disagree						
		1	2	3	4	5	6	7
QUALITY OF INFORMATION								
1	The ECHO program met my learning needs.							
2	The content of the ECHO program's short didactic presentations was sufficient, new, and up to date.							
QUALITY OF THE SYSTEM								
3	The ECHO program provided me with a flexible learning opportunity.							
GENERAL SATISFACTION								
4	My participation in the ECHO program was a worthwhile experience.							
5	I would recommend that my colleagues participate in the ECHO program.							
PERCEIVED USEFULNESS								
6	My participation in ECHO has enhanced my professional satisfaction.							
7	ECHO has diminished my professional isolation.							
8	My participation in ECHO has enhanced the quality and security of care I provide to patients with CDs.							
9	Collaboration among agencies in ECHO is a benefit to my clinic.							
10	ECHO has expanded access to treatment for patients with co-occurring disorders in our community.							
11	The ECHO program improved the quality and safety of care provided to people with CDs.							
12	The ECHO program allowed for accelerated learning and sharing of best practices.							
13	The educational program reduced care disparities among people with CDs.							

CDs: Concurrent disorders; ECHO: Extension for Community Healthcare Outcomes; No.: Item number.

Attitudes towards patients with CDs. The Comorbidity Problems Perceptions Questionnaire (CMPPQ) will be used to measure changes in nurses' attitudes[70]. The CMPPQ is a self-complete questionnaire using a seven-point Likert scale that was previously developed as an adaptation to

the Alcohol and Alcohol Problems Perceptions Questionnaire (AAPPQ). The AAPPQ is a well-validated tool for measuring professionals' therapeutic attitudes to people with alcohol problems[70]. The CMPPQ has established content validity and has good internal consistency for the full scale ($\alpha = 0.90$)[71-73]. The questionnaire consists of 33 statements featured in six subscales (role adequacy, role legitimacy, role support, motivation, self-esteem, and work satisfaction), which corresponds of the six factors associated with attitudes. Response options range from "strongly agree" (1) to "strongly disagree" (7), such that a low score (range from 33 to 231) represents a positive attitude towards caring for patients with CDs. For the purpose of this study, the CMPPQ was translated from English to French language using forward-translations and back-translations with three reviewers (GC, DJA and a research assistant).

Table 3. Sample of the Comorbidity Problems Perceptions Questionnaire (CMPPQ)

No.	**ITEM**	**RATING SCALE from 1 to 7 1 = strongly agree 7 = strongly disagree**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
1	I feel I am able to work as well with individuals with CDs as with other client groups.							
2	I feel that there is little I can do to help individuals with CDs.							
3	In general, I have less respect for individuals with CDs than for most other patients I work with.							
…	…							

CDs: Concurrent disorders; No.: Item number.

Knowledge in CDs. The knowledge questionnaire was designed specifically for the study to reflect the course content by two members of the research team (GC and DJA), and a psychiatrist that is holding an expertise in CDs. The questionnaire consists of four clinical vignettes (i.e., case of patient with CDs) with a total of 16 multiple-choice questions, which includes both declarative and procedural knowledge. Each clinical vignette describes a case scenario related to various aspects of working with patients with CDs. Prior to the study conduct (QUAN method), the questionnaire was pilot tested using a small sample of professionals from health and social disciplines.

Table 4. Sample of a clinical vignette and multiple-choice questions in the knowledge questionnaire

EXAMPLE OF A CLINICAL VIGNETTE
You work at a mental health access point and have an evaluation appointment scheduled this morning with 48-year-old Ms. Bertrand, who was referred to you by her family doctor for depression and a recent increase in daily alcohol intake. During this appointment, Ms. Bertrand tells you that she's been on sick leave for several years as a result of chronic lower back pain for which she takes opioids every day as prescribed by her family doctor.
EXAMPLE OF MULTIPLE-CHOICE QUESTIONS
Based on this information, you conclude that Ms. Bertrand's alcohol consumption puts her at risk. What is that risk? a) *Risk of respiratory depression* b) *Risk of toxic psychosis* c) *Risk of seizures* d) *Risk of opioid withdrawal*
Ms. Bertrand tells you that she frequently exceeds her prescribed dose of opioids. If she were currently high on opioids, what clinical presentation would you expect? *a) Agitation, aggressiveness, auditory and visual hallucinations* *b) Anxiety, insomnia, diaphoresis, and hypertension* *c) Drowsiness, difficulty sustaining attention, slowed respiratory rate* *d) Diarrhea, nausea, rhinorrhea, piloerection*
…

Self-efficacy in CDs management. A questionnaire consisting of 19 items was developed for the purpose of measuring self-efficacy in the management of CDs. The questionnaire was organized upon Bandura's theory of self-efficacy and guidelines for self-efficacy scale development[74]. The selected items were based upon the latest version of a "Capability Framework" for working

effectively with individuals with CDs from the UK government[75]. Each self-efficacy items will allow participants to rate their perceived confidence in using each of the 19 specific competencies in CDs into their clinical practice from one (not certain at all can do) to ten (highly certain can do).

Table 5. Sample of the questionnaire for measuring self-efficacy in CDs management

No.	ITEM	RATING SCALE from 1 to 10 1 = Not certain at all can do 10 = Highly certain can do									
		1	2	3	4	5	6	7	8	9	10
1	Offering basic but accurate and up-to-date information and advice about effects of substances on mental and physical health and vice versa.										
2	Demonstrating effective skills such as active listening, reflection, paraphrasing, summarizing, utilizing open-ended questions, affirming, elaboration.										
3	Planning and coordinating care in collaboration with individuals with CDs, their family, and other healthcare professionals.										
…	…										

CDs: Concurrent Disorders; No.: Item number.

Perceived clinical performance. Items to measure perceived clinical performance will consist of three questions. The first two questions will ask nurses to estimate the number of patients with CDs seen or followed in the past six months and the number of patients with CDs they were able to manage without referring them to a specialized service in CDs. At six- and 12-month follow-ups, nurses will be asked if they have applied into their clinical practice the learning acquisitions they realized throughout their participation or any of the experts' recommendations during the past six months (yes/no).

Supplementary file 5: Examples of prompts and open-ended questions to guide the individual semi-structured interviews (QUAL method)

⇒ ***In order to get to know you better, please start by telling me about your clinical practice as a nurse.***

Questions:

a) In which care setting do you currently work?
b) With which patient population do you currently work?
c) Describe your daily routine as a mental health/addiction/psychiatric/primary care nurse (use the participant's words) in your care setting (main activities, roles, and functions).

⇒ ***Please explain what led you to sign up for the ECHO program on CDs.***

Questions:

a) What prompted or motivated you to sign up for the ECHO Program?
b) What is it about this program that appealed to you?
c) What did you hope to get out of it?
d) What were you expecting as a participant?

⇒ ***Please think about your overall participation in the ECHO Program on CDs.***

Questions:

a) How would you describe your experience in the ECHO Program as a participant?
b) How would you describe your interactions with the expert team and the other participants?
c) Did you have the opportunity to present a patient case during your participation? If yes, can you describe what took place during that virtual session?
d) Which aspects of the program have you appreciated the most?
e) Which aspects of the program have you less appreciated, or would you have changed?
f) Are there any circumstances or factors that affected your participation?

⇒ ***Please think about the skills and knowledge you think you may have acquired over your participation in the ECHO Program.***

Questions:

a) What skills and knowledge do you believe you have acquired over time?
b) Which of these new skills and knowledge have you been able to apply into your clinical practice when attempting to care for individuals with CDs?
c) In your opinion, what has been beneficial or helpful in supporting the development of your skills and knowledge in CDs?
d) What has been less beneficial?
e) What factors might have had an influence on your capacity to apply the skills and knowledge you believe that you have acquired during your participation?

CDs: Concurrent disorders; ECHO: Extension for Community Healthcare Outcomes; QUAL: Qualitative.

Supplementary file 1: Reporting guidelines checklists

The Good Reporting of a Mixed Methods Study (GRAMMS) checklist[59]

No.	Criteria	Manuscript reference and/or commentaries/description
1	Describe the justification for using a mixed methods approach to the research question	Current gaps in the literature – See Introduction section (Continuing professional education in CDs section – 3rd paragraph). Justification for using a mixed methods approach – See Introduction section (Continuing professional education in CDs section – 4th paragraph).
2	Describe the design in terms of the purpose, priority and sequence of methods	Purpose of the design – See Methods and analysis section (Study design – 1rst paragraph). Priority - Methods and analysis section – (Study design – 1rst paragraph). Sequence of methods - Parallel design, See Methods and analysis section (Study design – 1rst paragraph).
3	Describe each method in terms of sampling, data collection and analysis	<u>QUAN method:</u> Sampling – See Methods and analysis section (C1: Quantitative method - Participants and recruitment + Sample size consideration). Data collection – See Methods and analysis section (C1: Quantitative method - Outcomes and measurements). Analysis – See Methods and analysis section (C1: Quantitative method - Statistical analysis). <u>QUAL method:</u> Sampling – See Methods and analysis section (C2: Qualitative method - Participants and recruitment). Data collection – See Methods and analysis section (C2: Qualitative method - Semi-structured interviews). Analysis – See Methods and analysis section (C2: Qualitative method - Qualitative data analysis).
4	Describe where integration has occurred, how it has occurred and who has participated in it	Where - Methods and analysis section (C3. Integration of quantitative and qualitative results – 1rst paragraph). How - Methods and analysis section – 2nd paragraph + Figure 3). Who – Integration procedures will be led by the principal investigator and verify with three members of the research team (JC, JP and DJA).
5	Describe any limitation of one method associated with the presence of the other method	<u>Anticipated</u> limitations of the mixed methods associated with the QUAN method: - Given that participation in this study is voluntary, the participants recruited for the QUAN method may not be representative of the whole population. - Some of the instruments that we will use in the surveys are not validated. Consequently, we will have to

		analyze the data "item-by-item" instead of as a distinct dimension. We anticipate that this lack of clarity in the QUAN results may affect the integration process, especially when comparing numerous QUAN results with QUAL themes/subthemes in a same table (matrix). Anticipated limitations of the mixed methods associated with the QUAL method: - All nurses who participated in the program will be invited for the QUAL method. However, it is possible that the perspectives from the ones who will not consent to research might be different the ones who agree in taking part of the study.
6	Describe any insights gained from mixing or integrating methods	The description of the integration component in terms of strategy, procedures, and techniques in the manuscript explained how we anticipated obtaining any insights from mixing QUAN and QUAL results (see Figure 3 in Methods and Analysis section - C3. Integration of quantitative and qualitative results): - Comparison strategy - Matrix technique - Within participant comparison/across participant comparison

NA: Not applicable; No.: Item reference number; QUAL: Qualitative; QUAN: Quantitative.
Note. Given that we are reporting an ongoing mixed methods study, some of the criteria/recommendations or items may not be applicable and fulfilled (e.g., results and discussion sections).

The Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidelines for cohort studies[60]

Item	No.	Recommendation	Manuscript reference and/or commentaries/description
Title and abstract	**1**	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Done. See Title page and Abstract – Methods and analysis section. We indicated the convergent parallel mixed methods study and the specific design for the QUAN method (observational prospective cohort study).
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	Done. See Abstract – Methods and analysis section We provide information on what is planned to be done in

			the QUAN method: target population, recruitment and data collection method, outcomes and measurements.
Introduction			
Background/rationale	**2**	Explain the scientific background and rationale for the investigation being reported	Done. See Introduction section (Continuing professional education in CDs section – 3rd paragraph). We explained the current state of empiric knowledge on the ECHO Program (type of studies, main results and limitations of those studies).
Objectives	**3**	State specific objectives, including any prespecified hypotheses	Done. We indicated the general aim of the mixed methods study in the Introduction section (Continuing professional education in CDs section – 4th paragraph). We indicated the QUAN research question and the specific QUAN objective in the Methods and analysis section (Study design section).
Methods			
Study design	**4**	Present key elements of study design early in the paper	Done. We explained the QUAN study design early in the Methods and analysis section - See Methods and analysis section (Study design).
Setting	**5**	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Done. We provided details about the setting, location, relevant dates for participation in the program and recruitment and exposure - See Methods and Analysis section (Setting, videoconferencing educational program and technical features and C1: QUAN method). Information

			regarding follow-up was provided in the Strengths and limitation section. Administration measure schedule was detailed in Supplementary file 3.
Participants	**6**	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	Done - See Methods and analysis section (C1: QUAN method - Participants and recruitment).
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	NA
Variables	**7**	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Done - See Methods and analysis section (C1: QUAN method – Outcomes and measurement).
Data sources/measurement	**8**	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Done. We described each outcome of interest and sources of data in the Methods and analysis section (C1: QUAN method – Table 1). We also provided further details of all the instruments to be used in the surveys in Supplementary file 4.
Bias	**9**	Describe any efforts to address potential sources of bias	Done - See Strengths and limitations section – 2nd and 3rd paragraphs.
Study size	**10**	Explain how the study size was arrived at	Done. We provided details about the target population and estimation of the sample size. See Methods and analysis section (C1: QUAN method – Sample size consideration).
Quantitative variables	**11**	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Done - See Methods and analysis section (C1: QUAN method –statistical analysis). Grouping: NA.
Statistical methods	**12**	(*a*) Describe all statistical methods, including those used to control for confounding	Done - See Methods and analysis section (C1: QUAN method –statistical analysis).

		(*b*) Describe any methods used to examine subgroups and interactions	Done - See Methods and analysis section (C1: QUAN method –statistical analysis).
		(*c*) Explain how missing data were addressed	NA
		(*d*) If applicable, explain how loss to follow up was addressed	NA
		(*e*) Describe any sensitivity analyses	NA
Results			
Participants	**13**	(a) Report numbers of individuals at each component of study—e.g., numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analyzed	NA
		(b) Give reasons for non-participation at each component	NA
		(c) Consider use of a flow diagram	NA
Descriptive data	**14**	(a) Give characteristics of study participants (e.g., demographic, clinical, social) and information on exposures and potential confounders	NA
		(b) Indicate number of participants with missing data for each variable of interest	NA
		(c) Summarize follow-up time (e.g., average and total amount)	NA
Outcome data	**15**	Report numbers of outcome events or summary measures over time	NA
Main results	**16**	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included	NA
		(*b*) Report category boundaries when continuous variables were categorized	NA
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	**17**	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			

Key results	**18**	Summarize key results with reference to study objectives	NA
Limitations	**19**	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Done. We discussed the anticipated limitations of the QUAN method - See Strengths and limitations section - 2nd and 3rd paragraphs.
Interpretation	**20**	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	NA
Generalizability	**21**	Discuss the generalizability (external validity) of the study results	This issue was discussed as part of the anticipated limitations of the study. See Strengths and limitations section – 2nd paragraph.
Other information			
Funding	**22**	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Done - See Funding statement, Competing interests' statement and Acknowledgements.

NA: Not applicable; No.: Item reference number; QUAN: Quantitative.

The Consolidated Criteria for REporting Qualitative Studies (COREQ) checklist[61]

No.	Item	Description
Domain 1: Research team and reflexivity		
Personal characteristics		
1	Interviewer/facilitator	I #1 (GC) – Principal investigator of the proposed mixed methods study
2	Credentials	I #1 (GC) – MSc, PhD Candidate (Nursing) SR #1 (JC) – PhD (Nursing) R #2 (DJA) – MD, MSc, FRCPC (Psychiatry) R #3 (JP) – PhD (Nursing) R #4 (LB) – PhD (Nursing) SR #5 (PP) – PhD (Family Medicine) C #1 (GR) – PhD, Postdoctoral fellow (Nursing) C #2 (GF) – MSc, PhD Candidate (Nursing) C #3 (SD) - MD, MSc, FRCPC (Psychiatry)
3	Occupation	I #1 (GC) – RN, PhD Candidate (Faculty of Nursing, Université de Montréal, QC, Canada).

		SR #1 (JC) – RN, Full Professor (Faculty of Nursing, Université de Montréal, QC, Canada); Researcher and Chairholder (Université de Montréal Hospital Research Center, QC, Canada). R #2 (DJA) – MD, Associate Professor (Faculty of Medicine, Université de Montréal, QC, Canada); Director and Researcher (Center of Excellence and Collaboration in Concurrent Disorders, Université de Montréal Hospital Research Center, QC, Canada). R #3 (JP) – RN, Full Professor (Faculty of Nursing, Université de Montréal, QC, Canada); Scientific Director (Équipe FUTUR-FRQSC, Faculty of Nursing, Université de Montréal, QC, Canada). R #4 (LB) – RN, Assistant Professor (Faculty of Nursing, University of Montreal, QC, Canada). SR #5 (PP) – Full Professor and Senior Researcher (Faculty of Medicine, Department of Family Medicine, McGill University, QC Canada). C #1 (GR) – RN, PhD, Postdoctoral fellow (Women's College Hospital, ON, Canada); Research Chair Coordinator (Université de Montréal Hospital Research Center, QC, Canada). C #2 (GF) – RN, PhD Candidate (Faculty of Nursing, Université de Montréal, Canada, QC, Canada). C #3 (SD) - R #2 (DJA) – MD, Assistant Professor (Faculty of Medicine, Université de Montréal, QC, Canada); Medical Director of ECHO CHUM TC (Université de Montréal Hospital Center, QC, Canada); Researcher (Center of Excellence and Collaboration in Concurrent Disorders, Université de Montréal Hospital Research Center, QC, Canada).
4	Gender	Interviewer: female identifying. Research team: four females identifying, three male identifying.
5	Experience and training	I #1 – has clinical experience in CDs, has experience in mixed methods research and in conducting semi-structured interviews for patient-oriented research. She has interests in virtual continuing educational interventions and in competency development. SR #1 –has expertise in developing and evaluating nursing and non-nursing interventions among people living with chronic conditions. R #2 – is a psychiatrist specializing in CDs, has expertise in conducting registered controlled trials, including pharmacologic and non-pharmacologic interventions for patients with CDs. He is the guarantor of the larger QUAN cohort study; he was directly involved in participants' recruitment and QUAN data collection. R #3 – has expertise in qualitative research, including nursing education research and nursing discipline advancement. R #4 – has expertise in qualitative research, including competency development and nursing education research. SR #5 – has expertise in mixed methods research, including patient-oriented research and primary health care.

		I #2 –has experience in developing and evaluating virtual nursing interventions, in conducting qualitative research and in knowledge synthesis. I #3 – has experience in developing and evaluating virtual nursing interventions, in conducting quantitative research and in knowledge synthesis. C #3 - is a psychiatrist specializing in CDs. He was the guarantor of the larger QUAN cohort study; he was directly involved in the ECHO Program development and implementation. He participated in the recruitment of the participants for the QUAN data collection.
Relationship with participants		
6	Relationship established	I #1 will conduct the semi-structured interviews. She will be directly involved in nurses' recruitment and QUAL data collection. Prior to planning this study, she was working as a RN at the Université de Montréal Hospital Center.
7	Participant knowledge of interviewer	I #1 will introduce herself to participants as a PhD nursing student at the University of Montreal. She will use the interview guide in order to facilitate the conduct of the interviews with prompts and open-ended questions. Anticipated desirability bias – See Strengths and limitations section – 2nd paragraph.
8	Interviewer characteristics	I #1 is a RN, PhD candidate and principal investigator of the study. She has experience in semi-structured interviews and in CDs, she is under the supervision of JC (principal supervisor), DJA and JP (co-supervisors).
Domain 2: Study design		
Theoretical framework		
9	Methodological orientation and theory	Conceptual framework - See Introduction section (Philosophical and conceptual foundations). Methodological orientation (interpretive description approach) - See Methods and analysis section– (Study design).
Participant selection		
10	Sampling	See Methods and analysis section (C2: QUAL method – Participants and recruitment).
11	Method of approach	See Methods and analysis section (C2: QUAL method – Participants and recruitment).
12	Sample size	See Methods and analysis section (C2: QUAL method – Participants and recruitment).
13	Non-participation	NA
Setting		
14	Setting of data collection	See Methods and analysis section (C2: QUAL method – semi-structured interviews).
15	Presence of non-participants	No.
16	Description of sample	NA
Data collection		

17	Interview guide	See Supplementary file 5.
18	Repeat focus group	No.
19	Audio/visual recording	See Methods and analysis section (C2: QUAL method – semi-structured interviews).
20	Field notes	The principal investigator (I#1) will take personal notes during and after each interview (reminders, questions, thoughts, interpretations, etc.)
21	Duration	See Methods and analysis section (C2: QUAL method – semi-structured interviews).
22	Data saturation	NA
23	Transcripts returned	No.
Domain 3: Analysis and findings		
Data analysis		
24	Number of data coders	Interview recordings will be transcribed by a research assistant. I #1 will be listening to all the audio recordings to ensure the accuracy of the transcripts and to become familiar with the raw data. Prior to coding, I #1 will read the interview transcripts several times in order to become familiar with the raw data and develop a comprehensive understanding of participants' responses. Coding will be led by I #1 and will involve searching for meaningful units and patterns in the data. Common categories and emergent themes will be reviewed by SR #1 and R #3 throughout the analytic process to ensure the trustworthiness and consistency of the findings.
25	Description of the coding tree	NA. To be reported in the final report of I #1 PhD thesis.
26	Derivation of themes	NA. To be reported in the final report of I #1 PhD thesis and in a further publication of the study results (QUAL results).
27	Software	See Methods and Analysis section (C2: QUAL method – QUAL data analysis).
28	Participant checking	No.
Reporting		
29	Quotations presented	See Ethics and dissemination section (Ethical considerations)
30	Data and findings consistent	NA. To be reported in the final report of I #1 PhD thesis and in a further publication of the study results (QUAL results).
31	Clarity of major themes	NA. To be reported in the final report of I #1 PhD thesis and in a further publication of the study results (QUAL results).
32	Clarity of minor themes	NA. To be reported in the final report of I #1 PhD thesis and in a further publication of the study results (QUAL method).

C: Collaborator; CDs: Concurrent disorders; I: Investigator; MD: Medical Doctor; NA: Not applicable; No.: Item reference number; PI: Principal investigator; QUAL: Qualitative; QUAN: Quantitative; R: Researcher; RN: Registered nurse; SR: Senior Researcher.

The guideline for Reporting Evidence-based practice Educational interventions and Teaching (GREET)[62]

No.	Item	Manuscript reference and/or commentaries/description
NAME: The Extension for Community Healthcare Outcomes (ECHO) Program on CDs		
1	INTERVENTION (brief description)	See Introduction section (Continuing professional education in CDs – 2nd paragraph) + Methods and analysis section (Setting, videoconferencing educational program and technical features).
WHY - this educational process		
2	THEORY	The ECHO model is rooted in established social educational theories including Bandura's Social Cognitive Theory, Vygotsky's Situated Learning Theory, and Wenger's Communities of Practice, with a particular emphasis on enhancing professionals' self-efficacy[33 67].
3	LEARNING OBJECTIVES	The didactic topics and learning objectives were developed to match the National Institute for Health and Care Excellence (NICE) guideline in CDs[10]. Learnings objectives were developed so that they could be applicable to all professional groups (see Supplementary file 2 for an example of the learning objectives for the 2018-2019 curriculum of the program).
4	CONTENT	Case-based discussion one hour and 15 minutes) Short didactic presentations (i.e., Powerpoint presentations) (15 minutes) – See Methods and analysis section (Setting, videoconferencing educational program and technical features) + Supplementary 2 for examples of the program content and topics of the didactic presentations.
WHAT		
5	EDUCATIONAL MATERIALS	Description provided in the Methods and analysis section (Setting, videoconferencing educational program and technical features). **Learning materials provided to learners:** A specific document explaining the rationale of the program, the functioning of the videoconference sessions, the learning objectives, the activities and the engagement required from participants is provided at the time of their registration. An electronic document is sent by email one week before each virtual session detailing the patient case to be discussed. This document has predetermined sections that are filled by each participating professional (or

		team of professionals) who is presenting a patient case. The program has also a web site that contains several resources in CDs' evidence-based practice that professionals can consult at any time. Emails are sent each month from a librarian to the participating professionals to share new scientific articles related to CDs. Didactics are supported with a PowerPoint presentation containing relevant clinical information that are also shared by email to the participants. **Materials used in the training of educational intervention providers:** A paper document detailing the ECHO model principles (learning objectives, learning strategies, functioning, etc.) is given to each professionals of the expert team (after having attend the required four-day training/immersion at the ECHO Institute, University of New Mexico, NM, USA). This document also provides guidance on how to replicate the program in other contexts (step-by-step approach) and on evidence-based teaching methods (abilities required as training providers). **VC equipment:** See Methods and analysis section (Setting, videoconferencing educational program and technical features – 1rst paragraph). Additional information on VC equipment: Nurses are equipped by their employer for the minimum technical equipment required to run a virtual session online (i.e. desktop or laptop computer, Internet connection, speakers, microphones and webcam or HD cam). The expert team will use a Logtech Group ConferenceCam kit that is connected to a Lenovo Windows PC with two 55" screen mounted on a support as videoconferencing equipment.
6	EDUCATIONAL STRATEGIES: Describe the teaching/learning strategies (e.g., tutorials, lectures, online modules) used in the educational intervention.	See Methods and analysis section (Setting, videoconferencing educational program and technical features – 1rst paragraph). See Supplementary file 2 for examples of didactic presentations.
7	INCENTIVES	Credits for participation are given to participants as continuing education units (credentialing and certificate of completion).
WHO		
8	INSTRUCTORS	There are no formal instructors but an expert team of healthcare professionals including psychiatrists, physicians with expertise in SUD, registered nurses, pharmacists, social workers, psychologists, an

		occupational therapist and a librarian. An assistant (not a clinician) is also present to coordinate the sessions in terms of timing, answering questions in the forum application, ensure that each professional has the opportunity to ask questions, etc. **Experience and expertise:** Psychiatrists from the expert team all have expertise in CDs. All registered nurses from the expert team have a bachelor's degree with at least six months of clinical experience in CDs. Each other professional from the expert team have at least six months of experience in working with patients with CDs. According to their discipline, the professionals from the expert team have different expertise such as motivational interviewing, relapse prevention, cognitive and behavioral therapy, working with vulnerable population (youth, homeless people, pregnant women), Hepatitis C treatment, treatment for opioids use disorders, etc. **Roles:** One of the psychiatrists has a specialization in CDs and acts as the main instructor during each virtual session. He introduces each member of the expert team, makes sure that each connected professional has time to introduce themselves, summarizes the expert team recommendations at the end of the sessions, ensures that the session goes smoothly and that the schedule is respected. He also gives feedback throughout the session. After a case of patient is presented, professionals from the expert team ask questions for further information. After the end of the discussion, each professional from the expert team provides recommendations and/or feedback related to their specific area of practice. **Training related to the educational intervention provided for the instructors:** When a hospital center or clinic decides to develop and implement an ECHO Program, at least two professionals from the expert team has to attend a 4-day immersion at the ECHO Institute in New Mexico, USA (see the educational materials section for more details on the ECHO immersion).
	LEARNERS	The participating healthcare professionals may include psychiatrists, physicians, registered nurses, social workers, pharmacists, psychologists and other clinicians in contact with patients with CDs in their daily practice. They habitually have experience in mental health/psychiatric care OR in substance use treatment; but some of them may also work in

		general settings such as emergency, primary care clinics, local agencies, etc. These healthcare professionals could work in different types of settings that vary in terms of the level of care (primary or secondary care), of services (psychiatric services, addiction services, residential therapies, crisis center, emergency, etc.) or in terms of population served (e.g., psychotic disorders, mood disorders, personality disorders, alcohol use disorders, opioid use disorders, homeless people, etc.).
HOW		
9	DELIVERY	**Modes of delivery:** See Methods and analysis section (Setting, videoconferencing educational program and technical features – 1rst paragraph). Group modality: Methods and analysis section (Setting, videoconferencing educational program and technical features – 1rst paragraph). **Ratio:** There are no formal limits on the number of participants that can be connected at the same time. A curriculum generally includes between 100 and 200 subscribed participants; sessions normally includes 50 to 60 healthcare professionals. The expert team includes over ten specific healthcare professionals in CDs and of those, a minimum of four healthcare professionals are required to be present at each virtual session. Attention is given to which healthcare professional from the expert team is present in a given session so that different professional groups are represented (in order that recommendations are tailored to a variety of disciplines). **Sequence of the learning activities:** 1) introduction and presentation of each professional connected (professionals from the experts team and the participants) (10 minutes), 2) patient case presentation (15 minutes), 3) questions and discussion regarding the patient case (35 minutes), 4) formal recommendations and clinical guidance from the expert team and recommendations from other participants (15 minutes), 5) didactics presentations (15 minutes). **Feedback/ Retroaction:** Participant will receive feedback from the expert team after completing each online survey (T0, T1, T2) regarding their scores for the knowledge test.

WHERE		
10	ENVIRONMENT: Describe the relevant physical learning spaces (e.g., conference, university lecture theater, hospital ward, community) where the teaching/learning occurred.	See Methods and analysis section (Setting, videoconferencing educational program and technical features - 2nd paragraph). **Additional information on the Zoom platform as a technical environment:** Several measures are taken to prevent hacking of the Zoom platform. First, Zoom has its own encryption used for all meetings. The Zoom meeting link is sent to the registered participants only, so the risk of unauthorized access by an outside party is minimal. Second, the animator account is using an SSO group connection; meaning that there is a double verification for authentication when trying to access the accounts.
WHEN AND HOW MUCH?		
11	SCHEDULE	**Number of sessions, frequency, timing and duration:** See Methods and analysis section (Setting, videoconference educational program and technical features – 2nd paragraph). An example of schedule for the 2018-2019 curriculum is detailed in Supplementary file 2.
12	FACE-TO-FACE CONTACT WITH INSTRUCTORS/SELF-DIRECTED LEARNING ACTIVITIES	Each virtual session consists of virtual face-to-face contact with instructors (healthcare professionals from the expert team). Self-directed activities consist of clinical guidance and recommendations of evidence-based practice for participants. Recommendations are tailored to each healthcare professionals (or team of professionals) that is presenting a case of patient. This information is shared throughout a given virtual session so that all connected healthcare professionals can benefit from others' experience. After the virtual session, written recommendations are provided to the healthcare professional (or team of professionals) who presented a patient case; which habitually consists of interventions to add to the patient care plan.
PLANNED CHANGES		
13	SPECIFIC ADAPTATION FOR THE LEARNERS	YES: During the program, the virtual sessions' content is adapted to healthcare professionals as follow: - Topics of the 15-minute didactic presentations are adapted to professionals' requests and learning needs (see Patient and public involvement section);

		- In case of a specific medical or mental issue in a presented patient case, the expert team may invite an additional professional to the session in question for further guidance; - In case of a specific issue discussed during a session that generate clinical questions from the participating professionals, further resources/information may be given. This information (i.e., evidence-based practice, clinical tools, scientific articles) is provided by a librarian who has experience in searching literature recent in the field of CDs.
UNPLANNED CHANGES		
14	Was the educational intervention modified during the course of the study? If yes, describe the changes (what, why, when, and how).	See the Patient and Public involvement section for changes and modifications that can be made during the course of the program (an online appreciation questionnaire developed by the educational program is sent by email to each participant in order to collect information on their learning needs and suggestions, an ECHO participant committee was created in order to improve the program delivery and content).
HOW WELL		
15	ATTENDANCE: Describe the learner attendance, including how this was assessed and by whom. Describe any strategies that were used to facilitate attendance.	This will be described in the final study report (PhD thesis) and in further publication of the study results.
16	Describe any processes used to determine whether the materials (item 5) and the educational strategies (item 6) used in the educational intervention were delivered as originally planned.	This will be described in the final study report (PhD thesis) and in further publication of the study results.
17	Describe the extent to which the number of sessions, their frequency, timing and duration for the educational intervention were delivered as scheduled (item 11).	This will be described in the final study report (PhD thesis) and in further publication of the study results.

CDs: Concurrent disorders; ECHO: Extension for Community Healthcare Outcomes; NA: Not applicable; No.: Item reference number; SUD: Substance use disorder; T0: Baseline; T1: 6 months; T2: 12 months; VC: Videoconferencing

1

Supplementary file 2: Example of didactics schedule, topics and learning objectives for the 2018–2019 curriculum of the ECHO Program for the management of CDs

No.	Schedule	Topics	Learning objectives[11]
ECHO's structure and functioning			
1	September 11, 2018 12 PM to 1:30 PM	- Program functioning and proposed learning activities throughout the videoconference sessions; - Participants' engagement and responsibilities.	- Understanding the basic technical features to run a virtual session online; - Understand the basic principles underlying the ECHO sessions; - Identify the benefits of the collaborative learning model; - Use the different forms for active participation in the sessions (case presentation, case follow-up, teleclinic evaluation).
Basic knowledge in CDs			
2	September 25, 2018 12 PM to 1:30 PM	Core values, attitudes and relational skills related to CDs.	- Identify the right conditions for the management of patients with CDs; - Initiate a reflective approach to participants' clinical practice; - Acquire basic knowledge regarding the assessment, treatment and referral of patients with CDs.
3	October 9, 2018 12 PM to 1:30 PM	Characteristics and particular needs of people with CDs.	
4	October 23, 2018 12 PM to 1:30 PM	Basics in MH.	
5	November 6, 2018 12 PM to 1:30 PM	Basics in SUD.	
6	November 20 2018 12 PM to 1:30 PM	Screening, assessing and diagnosing CDs.	
7	December 4, 2018 12 PM to 1:30 PM	Induced MH disorders vs. primary diagnosis of MH disorders.	- Use effective screening and assessment tools; - Differentiate among substance-related disorders; - Work as a team, in collaboration with the patient, to deliver care focused on the patient's needs; - Determine a safe long-term monitoring method to prevent relapses.
8	December 18, 2018 12 PM to 1:30 PM	Mood and anxiety disorders and SUD.	
9	January 15, 2019 12 PM to 1:30 PM	Planning and coordinating care between professionals, team and agencies.	
10	January 29, 2019 12 PM to 1:30 PM	This didactic presentation was determined according to the participants' learning needs.	
11	…	…	…

CDs: Concurrent disorders; ECHO: Extension for Community Healthcare Outcomes; MH: Mental health; No.: Session number, SUD: Substance use disorder

Supplementary file 3: Measure Administration Schedule

Outcomes	**Baseline (T0)**	**6 months (T1)**	**12 months (T2)**
Sociodemographic and practice information	X	Practice information only*	Practice information only*
Participation		X	X
Satisfaction and acceptability regarding the program		X	X
Attitudes towards patient with CDs	X	X	X
Knowledge in CDs	X	X	X
Self-efficacy in the management of CDs	X	X	X
Perceived clinical performance	Two first items of the questionnaire	Full questionnaire	Full questionnaire

CDs: Concurrent disorders
*Given that employment changes are common in the mental health, psychiatric and addiction sectors, practice information will be asked at each data collection point.

Supplementary file 4: Outcomes measure and related instruments for the QUAN data collection

***Sociodemographic and practice information*.** Sociodemographic information will be collected at baseline (T0) including age, gender, years of practice, academic background, and other past training. Practice information will be collected by asking participants to indicate the type of setting in which they are currently working, the type of population they serve, and to estimate the proportion of patients with CDs they see or follow on a regular basis (from 0 % to 100 %).

Participation. Biweekly attendance will be tracked using a web-based management tool (iECHO), developed by the ECHO Institute at the University of New Mexico, USA. We will also ask participants about their learning objectives and motivations for attending the ECHO Program on CDs as part of an open-ended question at baseline. We will ask nurses to indicate the number of videoconference sessions in which they have interacted (video interaction or within the chat forum) with the other participants within the last six months, as well as the number of videoconference sessions in which they presented a patient case within the last six months. Finally, participants will be asked to rate their level of participation over the last six months on a scale of one (passive) to ten (active).

***Satisfaction and acceptability regarding the program*.** A French version of a questionnaire created by the ECHO Institute will be used for the purposes of measuring nurses' satisfaction and acceptability[33]. The questionnaire is a thirteen-item measure where the respondents are asked to indicate how satisfied they are with the content and structure of the program and how useful it was for their own objectives and practice, using a seven-point Likert scale (strongly agree to strongly disagree). The questionnaire explores different dimensions of satisfaction and acceptability including the quality of information, the quality of the system (technological infrastructure), general satisfaction and perceived usefulness of the program.

Table 2. Full questionnaire for measuring nurses' satisfaction and acceptability regarding the ECHO Program for the management of CDs

No.	ITEM	RATING SCALE from 1 to 7 1 = strongly agree 7 = strongly disagree						
		1	2	3	4	5	6	7
QUALITY OF INFORMATION								
1	The ECHO program met my learning needs.							
2	The content of the ECHO program's short didactic presentations was sufficient, new, and up to date.							
QUALITY OF THE SYSTEM								
3	The ECHO program provided me with a flexible learning opportunity.							
GENERAL SATISFACTION								
4	My participation in the ECHO program was a worthwhile experience.							
5	I would recommend that my colleagues participate in the ECHO program.							
PERCEIVED USEFULNESS								
6	My participation in ECHO has enhanced my professional satisfaction.							
7	ECHO has diminished my professional isolation.							
8	My participation in ECHO has enhanced the quality and security of care I provide to patients with CDs.							
9	Collaboration among agencies in ECHO is a benefit to my clinic.							
10	ECHO has expanded access to treatment for patients with co-occurring disorders in our community.							
11	The ECHO program improved the quality and safety of care provided to people with CDs.							
12	The ECHO program allowed for accelerated learning and sharing of best practices.							
13	The educational program reduced care disparities among people with CDs.							

CDs: Concurrent disorders; ECHO: Extension for Community Healthcare Outcomes; No.: Item number.

Attitudes towards patients with CDs. The Comorbidity Problems Perceptions Questionnaire (CMPPQ) will be used to measure changes in nurses' attitudes[70]. The CMPPQ is a self-complete questionnaire using a seven-point Likert scale that was previously developed as an adaptation to

the Alcohol and Alcohol Problems Perceptions Questionnaire (AAPPQ). The AAPPQ is a well-validated tool for measuring professionals' therapeutic attitudes to people with alcohol problems[70]. The CMPPQ has established content validity and has good internal consistency for the full scale ($\alpha = 0.90$)[71-73]. The questionnaire consists of 33 statements featured in six subscales (role adequacy, role legitimacy, role support, motivation, self-esteem, and work satisfaction), which corresponds of the six factors associated with attitudes. Response options range from "strongly agree" (1) to "strongly disagree" (7), such that a low score (range from 33 to 231) represents a positive attitude towards caring for patients with CDs. For the purpose of this study, the CMPPQ was translated from English to French language using forward-translations and back-translations with three reviewers (GC, DJA and a research assistant).

Table 3. Sample of the Comorbidity Problems Perceptions Questionnaire (CMPPQ)

No.	**ITEM**	**RATING SCALE from 1 to 7 1 = strongly agree 7 = strongly disagree**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
1	I feel I am able to work as well with individuals with CDs as with other client groups.							
2	I feel that there is little I can do to help individuals with CDs.							
3	In general, I have less respect for individuals with CDs than for most other patients I work with.							
…	…							

CDs: Concurrent disorders; No.: Item number.

Knowledge in CDs. The knowledge questionnaire was designed specifically for the study to reflect the course content by two members of the research team (GC and DJA), and a psychiatrist that is holding an expertise in CDs. The questionnaire consists of four clinical vignettes (i.e., case of patient with CDs) with a total of 16 multiple-choice questions, which includes both declarative and procedural knowledge. Each clinical vignette describes a case scenario related to various aspects of working with patients with CDs. Prior to the study conduct (QUAN method), the questionnaire was pilot tested using a small sample of professionals from health and social disciplines.

Table 4. Sample of a clinical vignette and multiple-choice questions in the knowledge questionnaire

EXAMPLE OF A CLINICAL VIGNETTE
You work at a mental health access point and have an evaluation appointment scheduled this morning with 48-year-old Ms. Bertrand, who was referred to you by her family doctor for depression and a recent increase in daily alcohol intake. During this appointment, Ms. Bertrand tells you that she's been on sick leave for several years as a result of chronic lower back pain for which she takes opioids every day as prescribed by her family doctor.
EXAMPLE OF MULTIPLE-CHOICE QUESTIONS
Based on this information, you conclude that Ms. Bertrand's alcohol consumption puts her at risk. What is that risk? a) *Risk of respiratory depression* b) *Risk of toxic psychosis* c) *Risk of seizures* d) *Risk of opioid withdrawal*
Ms. Bertrand tells you that she frequently exceeds her prescribed dose of opioids. If she were currently high on opioids, what clinical presentation would you expect? *a) Agitation, aggressiveness, auditory and visual hallucinations* *b) Anxiety, insomnia, diaphoresis, and hypertension* *c) Drowsiness, difficulty sustaining attention, slowed respiratory rate* *d) Diarrhea, nausea, rhinorrhea, piloerection*
…

Self-efficacy in CDs management. A questionnaire consisting of 19 items was developed for the purpose of measuring self-efficacy in the management of CDs. The questionnaire was organized upon Bandura's theory of self-efficacy and guidelines for self-efficacy scale development[74]. The selected items were based upon the latest version of a "Capability Framework" for working

effectively with individuals with CDs from the UK government[75]. Each self-efficacy items will allow participants to rate their perceived confidence in using each of the 19 specific competencies in CDs into their clinical practice from one (not certain at all can do) to ten (highly certain can do).

Table 5. Sample of the questionnaire for measuring self-efficacy in CDs management

No.	ITEM	RATING SCALE from 1 to 10 1 = Not certain at all can do 10 = Highly certain can do									
		1	2	3	4	5	6	7	8	9	10
1	Offering basic but accurate and up-to-date information and advice about effects of substances on mental and physical health and vice versa.										
2	Demonstrating effective skills such as active listening, reflection, paraphrasing, summarizing, utilizing open-ended questions, affirming, elaboration.										
3	Planning and coordinating care in collaboration with individuals with CDs, their family, and other healthcare professionals.										
…	…										

CDs: Concurrent Disorders; No.: Item number.

Perceived clinical performance. Items to measure perceived clinical performance will consist of three questions. The first two questions will ask nurses to estimate the number of patients with CDs seen or followed in the past six months and the number of patients with CDs they were able to manage without referring them to a specialized service in CDs. At six- and 12-month follow-ups, nurses will be asked if they have applied into their clinical practice the learning acquisitions they realized throughout their participation or any of the experts' recommendations during the past six months (yes/no).

Supplementary file 5: Examples of prompts and open-ended questions to guide the individual semi-structured interviews (QUAL method)

⇒ ***In order to get to know you better, please start by telling me about your clinical practice as a nurse.***

Questions:

a) In which care setting do you currently work?
b) With which patient population do you currently work?
c) Describe your daily routine as a mental health/addiction/psychiatric/primary care nurse (use the participant's words) in your care setting (main activities, roles, and functions).

⇒ ***Please explain what led you to sign up for the ECHO program on CDs.***

Questions:

a) What prompted or motivated you to sign up for the ECHO Program?
b) What is it about this program that appealed to you?
c) What did you hope to get out of it?
d) What were you expecting as a participant?

⇒ ***Please think about your overall participation in the ECHO Program on CDs.***

Questions:

a) How would you describe your experience in the ECHO Program as a participant?
b) How would you describe your interactions with the expert team and the other participants?
c) Did you have the opportunity to present a patient case during your participation? If yes, can you describe what took place during that virtual session?
d) Which aspects of the program have you appreciated the most?
e) Which aspects of the program have you less appreciated, or would you have changed?
f) Are there any circumstances or factors that affected your participation?

⇒ ***Please think about the skills and knowledge you think you may have acquired over your participation in the ECHO Program.***

Questions:

a) What skills and knowledge do you believe you have acquired over time?
b) Which of these new skills and knowledge have you been able to apply into your clinical practice when attempting to care for individuals with CDs?
c) In your opinion, what has been beneficial or helpful in supporting the development of your skills and knowledge in CDs?
d) What has been less beneficial?
e) What factors might have had an influence on your capacity to apply the skills and knowledge you believe that you have acquired during your participation?

CDs: Concurrent disorders; ECHO: Extension for Community Healthcare Outcomes; QUAL: Qualitative.