Living With Multimorbidity: CO-ORDINATE Program

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Study Protocol

1. Abstract

Background: In times of stress and critical illness, physical, social and psychological vulnerabilities for patients and their families are amplified and this fragility is most noted in older adults. This study is focused on adult aged 55 years and above, living with multimorbidity, admitted at or eligible to admitted to the intermediate care unit (IMCU). The IMCU is widely used to care for critically ill patients requiring more monitoring or nursing care than is provided on hospital acute care floors but who do not have intensive care needs. Half of the patients in these units present with multimorbidity and are hospitalized for a range of reasons. Further, these vulnerable patients are not often categorized in single disease specific categories such as, cardiac, respiratory and gastrointestinal because of multiple conditions and symptoms and have a greater potential to fall through the cracks. Additionally, the current pandemic, COVID-19 has primarily affected these adults with multimorbidity. There is a need to assess symptom trajectory and symptom burden and to develop an effective, and financially sustainable approach to meet the health needs of critically ill adults and families with multimorbidity.

Aims: The study aims 1) to understand symptom trajectory and symptom burden from the perspectives of patients, family caregivers, health professionals and other key stakeholders and collectively develop a symptom management toolkit; 2) to refine and pilot test the nurse-driven symptom management toolkit/intervention among adults aged 55 years and above living with multimorbidity to improve symptom management and quality of life.

Methods: The study will use mixed study design with 2 phases. The first phase will empirically describe the prevalence and burden of symptoms from the perspective of patients, family caregivers, health professionals and other key stakeholders. Using participatory, experience-based co-design methodology, we will develop a symptom management toolkit. This approach will identify care delivery and care transitioning preferences and needs of patients with multimorbidity, family caregivers, healthcare providers, and other stakeholders. In the second phase, the data from phase one will inform the refinement and evaluation of a patient-centered symptom management intervention using a pre-post quasi-experimental design.

2. Objectives

The specific aims and goals of this study include:
Aim 1 (Phase 1-Year 1): Describe the symptom trajectory and burden from the perspectives of patients, family caregivers, health professionals and other key stakeholders and collectively develop a symptom management toolkit.
Goal 1: Develop symptom management toolkit
Aim 2 (Phase 2-Year 2): Refine and pilot test the nurse-driven symptom management toolkit/intervention to decrease the symptom burden and increase the QOL of critically ill adults with multimorbidity.
Goal 2: Toolkit refinement/Intervention development
Goal 3: Intervention pilot test

Goal 4: Intervention evaluation

- Primary outcomes: Symptom burden, Quality of life
- Secondary outcomes: Pain, Fatigue, Social support, Resilience, Health-care utilization

3. Background

Multimorbidity is common and is the coexistence of two or more chronic conditions in the same individual. The prevalence estimate of multimorbidity is 50% for individuals aged under 65, 62% aged 65-74, 75.5% aged 75-84, and 81.5% aged 85 and older in the US [1,2]. Multimorbidity is higher among older adults and is expected to increase due to the aging population, advanced medical care and improved longevity [3]. Multimorbidity adversely affects health status and wellbeing and is closely related to increased healthcare utilization, costs and mortality [2,4,5]. Additionally, in the current COVID-19 pandemic, the higher mortality has been predicted by the older age and the presence of multimorbidity [6]. People with multimorbidity suffer from a high symptom burden such as pain, fatigue, difficulty in breathing, difficulty sleeping, lack of energy and such symptom directly affecting quality of life (QOL) [1,7,8]. Symptom burden related to multimorbidity is also associated with increased functional decline and higher risk for caregiver strain and burden [9]. Adults with multimorbidity often experience hospitalization and are admitted to critical care units because of multiple organ dysfunction [10]. Hospitalization can be a window of opportunity to initiate interventions to promote recovery and resilience and enhance QOL. Interventions targeting the symptom trajectory and burden of patients with multimorbidity are lacking [11]. Our preliminary work has identified that often patients in the medical Intermediate Care Unit (IMCU) do not necessarily access post discharge services because of the organ centered arrangement of programs (e.g. chronic heart failure, chronic obstructive airways disease, chronic renal failure, and ICU survivorship).

The innovation in this study is embedded in the heterogeneity of the population, the locus of care and the need for transitional and supportive care strategies. The study aims to involve patients living with multimorbidity including those with COVID-19 to understand their symptoms and develop symptom management intervention, which will be a timely and valuable knowledge. Based on our review of the literature on multimorbidity symptom burden –key symptoms include difficulty breathing, fatigue, sleep disturbance, weakness, and pain [1,8]. We envisage a nurse led pre-discharge intervention augmented by telephone support and engaging caregivers, focusing on addressing key symptoms originating from inactivity and deconditioning as well as recommended self-management interventions. This approach is anticipated to reduce symptom burden, improve QOL, promote resilience, enhance social support and decrease healthcare utilization of adults living with multimorbidity. We are conscious that the proposed Experience Based Co-design (EBCD) methodology will be formative in developing the intervention.

4. Study Procedures

The proposed mixed method study will be conducted in two phases using social (justice)/human centered design. The first phase (Year 1) will empirically describe the prevalence and burden of symptoms from the perspective of patients, family caregivers, health professionals and other stakeholders. Using participatory co-design methodology, EBCD, we will develop a symptom

management toolkit. This approach will identify care delivery and care transitioning preferences and needs of patients with multimorbidity, family caregivers, healthcare providers, and other stakeholders. In the second phase, (Year 2) the data from phase one will inform the refinement and evaluation of a patient-centered symptom management intervention using a pre-post quasi-experimental design.

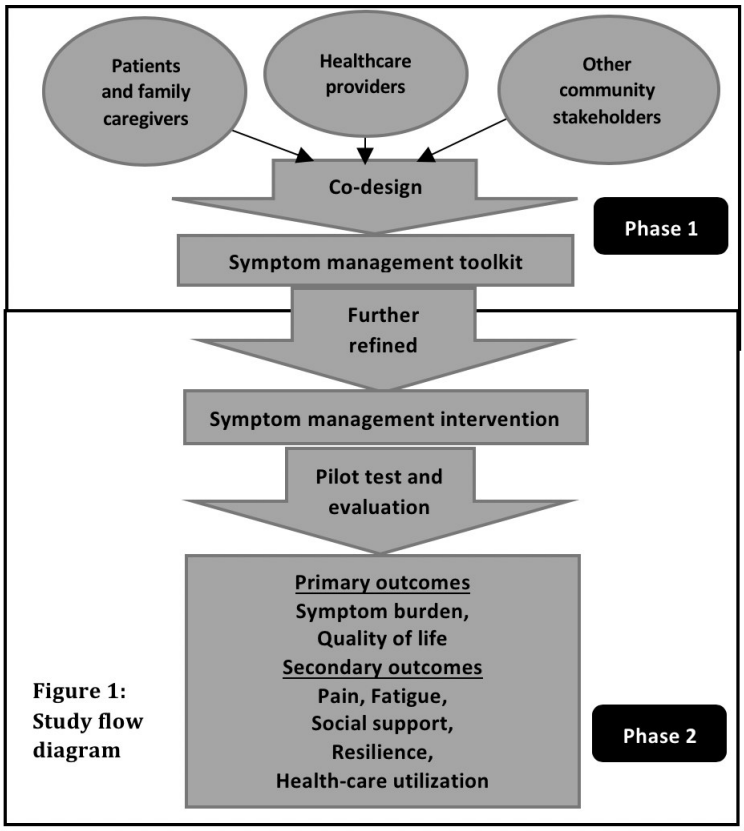

Figure 1: Study flow diagram

Phase 1: A collaborative study will be implemented to describe the symptom trajectory and burden including pain and fatigue and develop symptom management toolkit for critically ill adults with multimorbidity.

Year 1, Goal 1: Develop multimorbidity management (which includes symptom management) toolkit, using co-design, by understanding disease trajectories, symptom trajectory, burden, gender roles and needs of the patient and family caregivers and key stakeholders' priorities

To achieve goal 1 we will use the EBCD and follow its six-stage process (Table 1), using online EBCD toolkit[12] for consistency in documentation and processes. We will work with patients, family caregivers, healthcare providers, and other stakeholders through iterative rounds of data collection, analysis, validation and development strategies to address symptom burden. EBCD takes typically 9-12 months to complete[13] and is proven means for understanding how to make the best use of data about patient, family, and healthcare providers' experience to improve the quality of care and culture of health services. Table 1 details the activities required for each stage of the EBCD process.

Table 1: Phase 1

Goal 1: Develop symptom management toolkit by understanding symptom trajectory, burden, and needs of the patient and family caregivers and key stakeholders' preferences	
Stages/ Goals	**Goals and Activities**
Stage 1	**Project preparation and relationship building** - IRB approval - Identify and gain support from the stakeholders to prepare for the stages of research
Stage 2	**Collect data form patients and family caregivers' experiences on symptom trajectories and burden via filmed narrative interviews and survey** Approximately 12 participants identified and recruited who meet the inclusion criteria Conduct a baseline survey and filmed and/or narrative interviews (narrative in-person or virtual interviews) The baseline survey will include questions on demographics (age, gender, ethnicity, education, and postal code), caregiver type, clinical profiles (co-morbidities, diagnoses, healthcare utilization in the last 3 months), symptom burden, quality of life, pain, fatigue, social support, and resilience. Patient-family shared event to validate findings, agree on quotes from interviews to represent shared patient-family experiences to include in the experience film and identify 3-5 strategies for effective symptom management
Stage 3	**Collect data from key-stakeholders (nurses, physicians, researchers, community partners, and other identified stakeholders) experiences and priorities** Approximately 12 in-depth filmed and/or narrative interviews (semi-structured in-person or virtual interviews) Non-participants observations of critically ill patients admitted or eligible be admitted at the JHH-IMCU Analysis of data followed by stakeholders' workshops to validate findings and identify 3-5 improvement priorities for symptom management
Stage 4	**Co-design event** All participants will collaborate in a workshop-style event Patients, family caregivers, and key-stakeholders experiences and improvement priorities shared via film and discussion Symptom trajectory developed in a timeline chart with patients and family experiences since the diagnosis of multimorbidity Facilitated discussion supports the identification of 3-5 shared priorities for the toolkit to reduce symptom burden and improve QOL in multimorbidity
Stage 5	**Co-design working groups** Small groups of patients, family caregivers, and key-stakeholders will work on identified priorities, developing and guiding the implementation of measurable goals and strategies Likely focus on goals include symptom management including pain and fatigue, QOL, resilience, social support, healthcare utilization
Stage 6	**Celebration and evaluation event** Final outcomes will be evaluated for agreement across participants Outcomes measures will be evaluated for implementation Dissemination of strategies and outcome measures will be published for academic dissemination The evaluation will address toolkit development and confirm participant commitment The celebration and evaluation event will provide an opportunity for reflection and refocusing of the intervention

Phase 1 will be extended for longer period and additional participants specifically with heart failure and other chronic conditions will be recruited to understand multimorbidity disease trajectories, symptom trajectory, burden, gender roles and needs of the patient and family caregivers and key stakeholders' priorities using EBCD design. Additional 60 participants will be recruited for this (30 health care providers and stakeholders and 30 patient and family members). Semi-structured interview guide for healthcare providers and caregivers have been

attached. Patients baseline data collection will include data on heart failure clinical profile, multimorbidity disease burden, symptom burden, quality of life, co-morbidity, self-efficacy, social support, resilience and healthcare utilization (no. of hospitalization, no. of readmission and mortality in 30 days and one year, admission to nursing homes/assisted living). Additionally, data on fear of COVID-19 will be collected to understand effect of Pandemic. Co-design event and working groups will be organized in-person/virtually considering CDC-guideline for COVID-pandemic. Final outcome data will be compiled and presented as multimorbidity management toolkit. Consent form for this extended phase has been attached for review.

Phase 2: Refinement, pilot test and evaluation of the toolkit/intervention focused on decreasing symptom burden and improving QOL among critically ill adults with multimorbidity.
To achieve Goal 2-4 we will continue to draw on a collaborative co-design approach and implement the quasi-experimental design. Figure 2 outlines the study protocol and Table 2 details the activities necessary for the completion of phase 2.

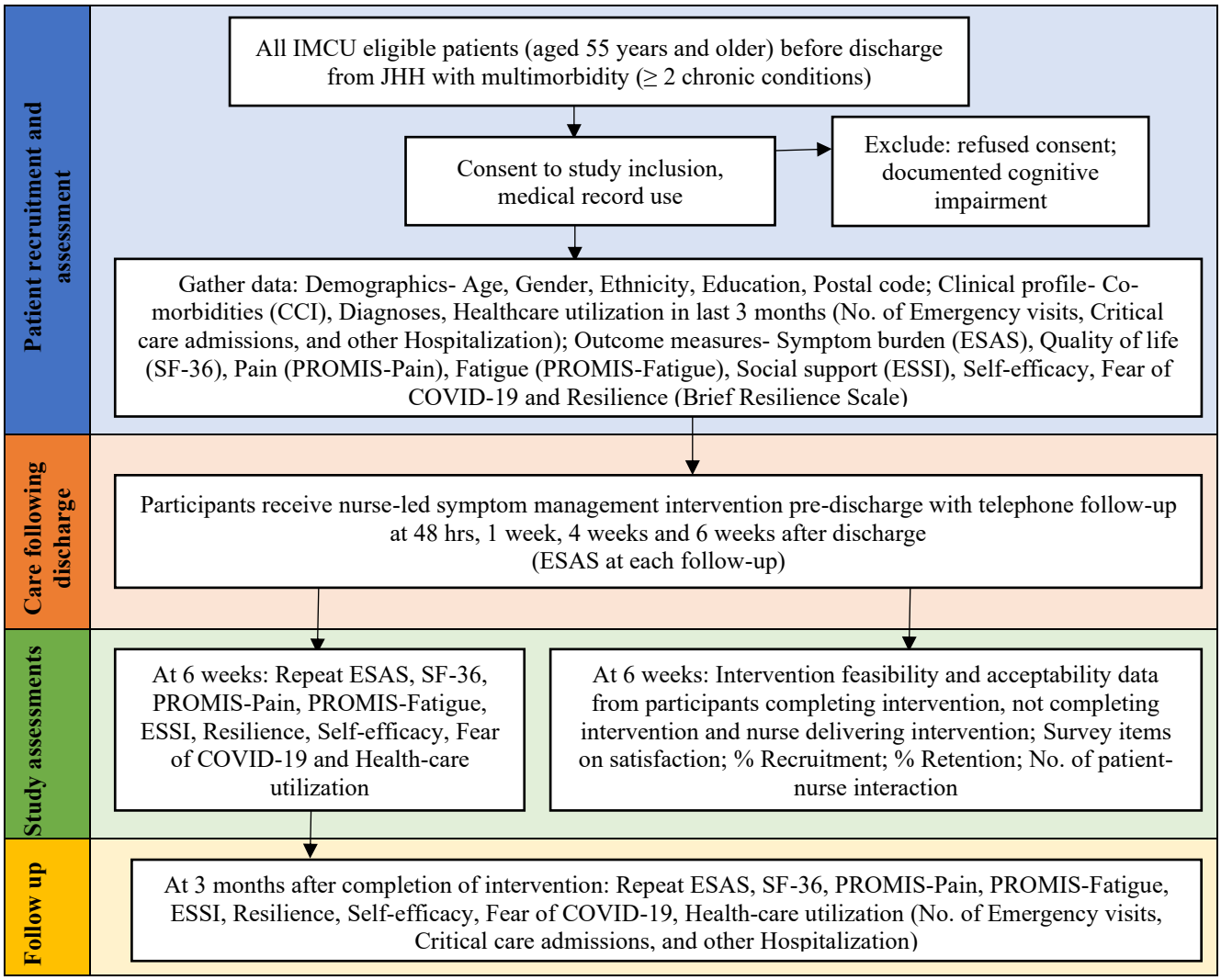

Figure 2: Study protocol for Phase 2

Table 2: Phase 2

Goal 2-4: Develop, pilot test and evaluate the toolkit/intervention	
Stages/Goals	**Goals and Activities**
Goal 2	**Toolkit refinement/Intervention development** Co-designed strategies/toolkit from phase 1 will be compiled in the user-friendly intervention protocol for implementation
Goal 3	**Intervention pilot test** Recruitment of 25 participants meeting eligibility criteria Baseline survey data collection on the same measures used in Phase 1, Stage 2 Initiation of co-designed symptom-management intervention pre-discharge with telephone follow-up (symptom burden will be assessed at each follow-up) Survey data collection, at the end of the intervention (i.e., 6 weeks) and at 3 months after completion of the intervention
Goal 4	**Intervention evaluation** Participants survey and interview on satisfaction, feasibility, and acceptability of the intervention Data analysis
Dissemination	Manuscripts and project summary Dissemination at professional organization R01 Randomized Control Trial planning for scalability of the intervention

Year 2 Goal 2: The user-friendly intervention protocol will be developed by refining the symptom management toolkit established in Phase 1. The intervention will be nurse-driven person-centered pre-discharge intervention engaging caregivers followed by telephone support, which will focus on the management of symptoms such as difficulty breathing, pain, fatigue and sleep disturbances among critically ill patients with multimorbidity and as identified from the survey on symptom burden.

Year 2 Goal 3: We will pilot test the intervention among 25 participants over 9 month's local rollout period. The symptom management intervention will be delivered by a nurse pre-discharge with telephone follow up over a 6 weeks period (at 48 hrs, 1 week, 4 weeks and 6 weeks) after the discharge from JHH-IMCU.

Year 2 Goal 4: We will evaluate the effectiveness of the intervention on primary outcomes (i.e., symptom burden and QOL) by comparing pre-post intervention data (i.e., baseline, 6 weeks and 3 months). Additionally, the intervention is anticipated to improve secondary outcomes (i.e., pain, fatigue, social support, resilience, and healthcare utilization). To evaluate the acceptability and feasibility of the intervention both quantitative (survey items on satisfaction and acceptability, no. of nurse-patient contacts, recruitment rate and retention rate) and qualitative (unstructured interview with selected participants who attended the intervention and the nurse delivering the intervention) data will be examined.

Statistical Analysis Plan

a. Primary outcome variable.

- Symptom Burden: Edmonton Symptom Assessment System (ESAS)
- Quality of Life: BRICS NINR Short Form Survey (SF-36)

b. Secondary outcome variables.

- Health-care Utilization: No. of emergency visit, Hospitalizations, Critical care admissions

c. Statistical plan including sample size justification and interim data analysis.

Data collection and analysis are iterative processes throughout Goal 1, Stages 1-6 of the EBCD process, and Goal 3 and Goal 4 for intervention evaluation. The majority of data collected in phase 1, except the baseline survey, are qualitative and will be analyzed using thematic analysis. [14,15] The software Atlas ti. will support qualitative analysis.

Quantitative data will be analyzed using descripting statistics followed by inferential statistics. As a pilot study, the analyses of Phase 2 data will likely not have adequate power to detect significant differences. Therefore, effect sizes, followed by statistical significance will be explored for evidence of the effectiveness of the intervention on outcomes. To compare quantitative data at different time points, we will use Wilcoxon signed rank test to evaluate changes from baseline to 6 weeks and baseline to 3 months post-intervention. Additionally, the changes across baseline, 6 weeks, and 3 months post-intervention will be analyzed using the Friedman test for repeated measures, with Kendall's W employed to assess effect size. Quantitative analyses will be performed using the Statistical Package for the Social Sciences (SPSS) or equivalent software. We will evaluate the acceptability and feasibility of the intervention using qualitative analysis of interview data from selected participants who attended the intervention, left the intervention if agree to interviewed and the nurse delivering the intervention. The quantitative data from satisfaction and feasibility items will be descriptively analyzed (mean, range, percentages). Further, evaluation of participants' recruitment rate, retention rate and no. of nurse patient interaction will be performed.

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