Mobilisation in the EveNing to prevent and TreAt deLirium (MENTAL): a mixed-methods, randomised controlled feasibility trial

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Summary

Background Delirium is common in critically ill patients and associated with longer hospital stays, increased morbidity and higher healthcare costs. Non-pharmacological interventions have been advocated for delirium management, however there is little evidence evaluating feasibility and acceptability of physical interventions administered in the evening. The aim of this study was to conduct a feasibility trial of evening mobilisation to prevent and treat delirium in patients admitted to intensive care.

Methods In this mixed-methods, randomised controlled feasibility trial we recruited participants from intensive care units at two university hospitals in the United Kingdom. Eligible participants who were able to respond to verbal stimulus (Richmond agitation and sedation scale ≥3) and expected to stay in intensive care for at least 24 h were randomly assigned (1:1) to receive usual care or usual care plus evening mobilisation. The evening mobilisation was delivered between 19:00 and 21:00, for up to seven consecutive evenings or ICU discharge, whichever was sooner. All outcome assessments were completed by a team member blinded to randomisation and group allocation. Primary objective was to assess feasibility and acceptability of evening mobilisation. Primary feasibility outcomes were recruitment, consent and retention rates, and intervention fidelity. Intervention acceptability was evaluated through semi-structured interviews of participants and staff. Secondary outcomes included prevalence in incidence and duration of delirium, measured using the Confusion Assessment Method for ICU. This trial is registered at ClinicalTrials.gov, NCT05401461.

Findings Between July 16th, 2022, and October 31st, 2022, 58 eligible patients (29 usual care; 29 usual care plus evening mobilisation) were enrolled. We demonstrated the feasibility and acceptability of both the trial design and evening mobilisation intervention. Consent and retention rates over three months were 88% (58/66) and 90% (52/58) respectively, with qualitative analysis demonstrating good acceptability reported by both participants and staff. Secondary outcomes for the evening intervention group compared with the control group were: delirium incidence 5/26 (19%; 95% CI: 6–39%) vs 8/28 (29%; 95% CI: 13–49%) and mean delirium duration 2 days (SD 0.7) vs 4.25 days (SD 2.0).

Interpretation Results of this trial will inform the development of a definitive full-scale randomised controlled trial investigating the effects of evening mobilisation to treat delirium and improve health-related outcomes.

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Research in context

Evidence before this study

Before starting this trial, a systematic review and meta-analysis was completed evaluating the effects of early mobilisation in critically ill adults in the risk and duration of delirium compared to usual care. A search in PubMed, CINAHL, PEDRo and Cochrane from 1st January 2000 to March 2022 identified 13 studies (n = 2164). Results demonstrated early mobilisation almost halved the risk of delirium onset and significantly reduced delirium duration. Significant heterogeneity means there remains an uncertain effect of mobilisation on delirium. More specifically, it remains unclear as to the optimal method and timing of rehabilitation delivery, as well as those most likely to respond to the interventions. No studies had currently evaluated the impact of evening mobilisation to prevent or treat delirium.

Added value of this study

We conducted a dual centre, mixed-methods feasibility randomised controlled trial in patients admitted to intensive care. We tested the feasibility and acceptability of an evening mobilisation intervention, along with trial methodology to inform a future, definitive randomised controlled trial.

Implications of all the available evidence

Our results suggested that the evening intervention was both feasible and acceptable to patients admitted to intensive care units. Modifications to increase the window for intervention delivery and improve measures of sleep quality would be required for future trials. Reductions were seen in both the incidence and duration of delirium which warrant further investigation in an appropriate powered clinical trial.

Introduction

Delirium is a common complication for people admitted to intensive care units (ICUs), affecting around 30% of general ICU populations[1] and up to 80% in those receiving mechanical ventilation.[2] Delirium can be a distressing experience, characterised by disturbance of consciousness, inattention, disorganised thinking, and a fluctuating course.[3] ICU-acquired delirium is associated with up to threefold increases in duration of mechanical ventilation and length of stay,[4,5] placing considerable burden on caregivers, healthcare services, and increasing healthcare costs.[6] In the longer-term, delirium is associated with ongoing functional disability requiring specialist rehabilitation services or residential care.[7] Systematic reviews report up to 71% of patients mechanically ventilated with a positive diagnosis of delirium experience persisting cognitive impairment at 12 months, and less than half have returned to work.[8,9]

There is currently no established strategy to directly treat or prevent ICU-acquired delirium. Clinical guidelines have suggested the usefulness of delirium bundles, developed under the umbrella term 'non-pharmacological interventions'.[10] These care bundles include elements such as regular reorientation of patients, noise reduction, sleep protocols and early mobilisation whilst in ICU,[11] however evidence to support specific interventions is lacking.[10,12] Targeted research is urgently needed to evaluate potentially reversible risk factors for the development of delirium.

The present study is focussed on two risk areas for development of ICU-acquired delirium, namely sleep disturbance and immobilisation. Sleep disturbance is common in critically ill patients, with patients sleeping an average of only 2 h per day (with <6% of this rapid eye movement) and polysomnography demonstrating severely disrupted sleep throughout ICU stay.[13] Poor sleep can lead to impairments of cognition and over half of patients who develop delirium report reversal of day–night rhythms, sleeping more during the day and experiencing nocturnal exacerbation of delirium symptoms.[14]

Bed-rest and delays in mobilisation cause substantial physical and psychological harms for people treated in ICUs.[15–17] Programmes of early mobilisation have been effective in improving some health-related outcomes, including associated reductions in both the incidence and duration of delirium.[18–20] Typically, mobilisation occurs during the day due to working patterns of therapy staff,[21] with patients often sleeping directly afterwards due to the intensity of the activity and having lower physical reserves.[22]

We hypothesise that the addition of mobilisation in the evening will help to promote overnight sleep, in turn reducing the likelihood of patients developing delirium or potentially reducing the duration of delirium when it does occur. We have demonstrated proof of concept in a pilot, multicentre study in Germany,[23] leading us to design the Mobilisation in the EveNing to TreAt delirium (MENTAL) feasibility trial. We aimed to assess feasibility of participant recruitment, retention, intervention delivery and outcome assessment in two ICUs. An embedded qualitative evaluation was included which aimed to evaluate the acceptability of our intervention

and trial methodology to participants and service providers. This would then provide justification for whether a definitive, multicentre randomised controlled trial could be undertaken.

Methods

Study design

MENTAL is a mixed-methods, feasibility, parallel group RCT with 1:1 randomisation conducted across ICUs in two United Kingdom NHS hospitals. The trial protocol was registered prospectively on ClinicalTrials.gov (NCT05401461) and approved by the Wales Research and Ethics Committee 6 (22/WA/0106). A full and more comprehensive summary of the methodology has been published previously.[24] This report was prepared according to the CONSORT (Consolidated Standards of Reporting Trials) Extension to Pilot and Feasibility Trials guidelines[25] and the Consolidated criteria for reporting qualitative studies (COREQ).[26]

Participants

Eligible patients were able to respond to verbal stimulus (Richmond Agitation Sedation Scale (RASS) ≥−3) and expected to remain on ICU for ≥24 h. Exclusion criteria included immobility prior to hospital admission, a diagnosis of delirium prior to screening or severe neurological deficit or injury. A complete list of participant eligibility criteria are provided in Supplementary Table S1. All patients were screened daily for inclusion by the critical care research team. Where eligible patients with altered consciousness caused by illness and therapeutic sedation lacked capacity to consent a Personal Consultee or an independent Registered Medical Practitioner was approached (if no Personal Consultee was available). Once the participant had recovered from their incapacity, they were approached to obtain permission to continue in the study.

Randomisation and masking

Patients were randomly allocated on a 1:1 basis to receive either usual care or usual care plus additional evening mobilisation using a concealed envelope system with randomly sized block design (block size 2–4) and stratified by study site. Enrolled patients were assigned a sequential identification number at each site. Randomisation sequences were generated by an independent statistician.

Given the nature of the intervention it was not possible to fully blind physiotherapists or participants to group allocation. However, all assessments were completed by a team member blinded to randomisation and group allocation.

Procedures

Intervention

Participants randomised into the evening mobilisation group received, in addition to usual care, a planned mobilisation session between 19:00 and 21:00 h delivered by a dedicated mobilisation team that included trained ICU physiotherapists in conjunction with bedside nursing staff as required. Participants were also offered the opportunity to engage in activities which may be part of their normal evening routines, such as watching television, having a wash or brushing their teeth. The intervention began on day one of admission or the first evening following recruitment to the study, and was carried out for up to a maximum of seven consecutive evenings.

Usual care

Consisted of routine care delivered during normal working hours (between 08:00 and 17:00 h), including physiotherapy-led mobilisation and rehabilitation interventions, and activities of daily living.

Outcomes

Primary feasibility outcomes included 1) recruitment and consent rates (overall and by centre); 2) retention rate (proportion of participants allocated to the evening intervention who received evening mobilisation and remained in the study until completion); 3) intervention fidelity (completion rates of evening mobilisation); and 4) acceptability of the intervention.

Secondary outcomes included

Measures that will be used in the future full-scale trial were also collected at baseline, 7 days, ICU and hospital discharge. The proposed primary outcome for the definitive trial was the incidence of delirium assessed as a positive Confusion Assessment Method for the Intensive Care Unit (CAM-ICU). The CAM-ICU is a valid, reliable instrument for delirium detection[2] and has been routinely conducted in the centres for several years.

Additional measures include 1) duration of delirium (counted at 12-h periods; the end of delirium is defined when patients are delirium-negative for 24 h or discharged to the ward); 2) Self-reported sleep quality collected daily and calculated as an average across the ICU stay (using the Richards-Campbell Sleep Questionnaire (RCSQ))[27]; 3) ICU and hospital mortality; 4) duration of invasive mechanical ventilation; 5) ICU and hospital length of stay; 6) mobilisation-related complications; and 7) mobility level at ICU discharge using the Manchester Mobility Score.[28]

Qualitative interviews

To explore the intervention acceptability in-depth, semi-structured interviews were conducted with participants, physiotherapists and nursing staff. An interview topic guide was developed (Supplementary Table S2) which included a pilot interview. Participants were interviewed in a private area of their step-down ward as close to ICU discharge as reasonably practical. Interviews were audio

recorded and transcribed verbatim. Interviews were completed by the same author for each study site (EK and DMc) to ensure consistency. Staff were interviewed at any time during, or shortly after, the intervention period at their site. Staff interviews were conducted by EK via telephone or face to face, and were audio recorded and transcribed verbatim.

A traffic light 'stop-amend-go' system[29] was established a *priori* to guide decision-making for a definitive trial (Supplementary Table S3).

Statistical analysis

As this was a feasibility trial no formal sample size calculation was undertaken. We planned to recruit up to 60 participants based on local case-mix data and study timeline limitations. Descriptive statistics were used to explore the demographic, clinical and outcome data between the two groups and as a population whole, depending on the type of data (e.g., mean/median; SD/IQR; frequency, proportion and range). Intervention fidelity was explored using descriptive statistics for each component. Secondary outcomes were assessed on an intention to treat basis. Data was assessed for normality, with a Mann–Whitney U test used to analyse non-normally distributed data, and reported with medians and interquartile ranges. Metrical normal data was analysed using t-tests and summarised using means ± standard deviations (SDs). Ordinal variables were also analysed using Mann–Whitney U tests, with Fisher's exact test used for nominal variables. All analyses were performed using IBM SPSS 22 (IBM Corp. Armonk, NY).

Qualitative analysis

Verbatim anonymised transcripts of semi-structured interviews were thematically.

Analysed with the support of NVivo 12 (QSR international) software, with identified themes further refined using an iterative process.[30]

Role of the funding source

There was no funding source for this study. DM and OG had access to the final dataset and final responsibility for the decision to submit for publication.

Results

Sample

A total of 584 patients were screened across the two hospitals during the three months recruitment period, from (July 16, 2022, to October 31, 2022). Of these, 66/584 (11%) met the inclusion criteria and were invited to participate; 58/66 (88%) consented and were randomised to either usual care plus evening mobilisation or usual care only. We achieved our target of recruiting more than 45 patients within the three-month time frame, and we randomised 10% (58/584) of those screened in ICU. The most common reasons patients were deemed ineligible were an expected stay of less than 24 h (247/584, 42%), significant neurological injury (60/584, 10%), and death expected within less than 72 h (54/584, 9%). Of note 54/584 (9%) of participants were already delirious at the time of screening. Participants were broadly similar at baseline, with similar age and sex distributions between groups and the majority having at least one co morbidity. Baseline and demographic data are provided in Table 1.

Retention

Fig. 1 shows the flow of participants through the study, including those lost to follow up over 28 days. Following recruitment, one participant in the intervention arm withdrew from the study reporting they no longer wanted to receive evening physiotherapy/mobilisation or be a part of the trial data collection procedures due to fatigue. Two participants did not receive the evening intervention (one was unexpectedly discharged to the ward and one suffered medical deterioration on the day of recruitment). A further two patients suffered medical deterioration after the evening mobilisation intervention had commenced, making ongoing involvement in the study inappropriate. All patients and staff members who were approached agreed to be interviewed.

Intervention fidelity

Patients in the intervention group spent a median (IQR) of 2 (1–4) nights in ICU following recruitment with mobilisation completion rates for both groups presented in Table 2. Evening mobilisation was completed on 43 of 76 potential opportunities (57%). Reasons for missed mobilisation sessions were participant refusal (n = 17, 22%), clinical instability (n = 9, 12%), and reduced staffing/competing priorities (n = 7, 9%). After removing those incidences where mobilisation was inappropriate due to clinical instability, this represents a mobilisation rate of 64% (43/67 sessions completed). This is slightly lower than our pre-defined intervention adherence success rate (75%), with potential reasons and solutions to this presented in Supplementary Table S4. No differences were observed between intervention delivery rates between hospital sites. One adverse event (reduced blood pressure) was reported in the intervention group, although this was asymptomatic and resolved on return to bed and no consequence was recorded.

Acceptability of intervention and trial methodology

Patients and staff were purposively sampled to ensure an appropriate mix of age, sex and admission reason; or profession and years' experience in the case of staff. In total, seven patient and nine staff interviews (three nurses and six physiotherapists) were conducted. Median (IQR) duration of patient and staff interviews were

	All (n = 58)	Intervention (n = 29)	Control (n = 29)
Age in years, median (IQR)	66 (57–73)	67 (57–73)	64 (55–72)
Sex			
Female	30 (52%)	14 (48%)	16 (55%)
Male	28 (48%)	15 (52%)	13 (45%)
BMI, median (IQR)	26.7 (23.5–32.1)	26.7 (23.9–30.75)	26.2 (21.8–36.7)
Ethnicity			
Asian	4 (7%)	2 (7%)	2 (7%)
White	54 (93%)	27 (93%)	27 (93%)
SOFA, median (IQR)	4 (2–7)	4 (2–6)	3 (2–7)
Charlson Comorbidity Index, median (IQR)	1 (0–3)	1 (0.5–3)	1 (0–2)
Functional Comorbidity Index, median (IQR)	1 (0–2)	1 (0–2)	1 (0–2)
Admission Specialty			
Cardiovascular	3 (5%)	0 (0%)	3 (10%)
Neuro	3 (5%)	3 (10%)	0 (0%)
Respiratory	6 (10%)	2 (7%)	4 (14%)
Sepsis	8 (14%)	3 (10%)	5 (17%)
Surgery	17 (29%)	7 (24%)	10 (35%)
Trauma	11 (19%)	5 (17%)	6 (21%)
Other	10 (17%)	9 (31%)	1 (3%)

Data are reported as Number (percentage) unless otherwise stated. Abbreviations: BMI, Body Mass Index; IQR, Inter quartile range; SOFA, Sequential Organ Failure Assessment.

Table 1: **Participant demographics.**

4 (3–4) and 20 (13.5–26.5) minutes respectively. Characteristics of interviewed patients and staff are available in Supplementary Table S5. Four themes were identified; balancing fatigue; spinning plates with time and care needs; normalising 24-h routines and late-night staffing. Themes and selected associated quotes are presented below with a detailed table of quotes available in Supplementary Table S6.

Balancing fatigue

A common theme highlighted by patients was the need to balance any additional activity with physical exhaustion. Some patients highlighted they were too tired to engage, yet when they could it helped them become tired. One stated 'Some days it was good and some days I was too knackered' (Patient one), whilst another stated 'I think at night it is a benefit as well, it kind of relaxes you…I suppose it is like having exercise…it did make me more tired' (Patient three). Overall, there was a general feeling from both patients and staff that the evening mobilisation sessions might aid natural sleep. Staff also recognised fatigue as a challenge for participation: 'Can be a little bit fatiguing, and I'm not sure that all of our patients would be up to having three sessions—Staff six, physio).

Spinning plates with time and care needs

All nurses suggested the delivery period was challenging due to conflicting demands, primarily preparation for handover to the night team, 'seven and nine……we'll be doing our final writing, our shift reviews' (Staff five, nurse). This was also identified by some physiotherapists who had an awareness of the nursing challenges, whilst highlighting their own caseload conflicts such as acute respiratory interventions. The interviews highlighted a need to balance the delivery of evening mobilisation with other cares and interventions: 'They do want to help, it's not that they don't want to, it's just that they obviously have their own routine and their own priorities.' (Staff two, physio).

Normalising 24-h routines

All staff and some patients recognised evening rehabilitation could facilitate day and night cycles, support the restoration of normal evening routines and aid with re-orientation. One staff member describes that it would facilitate 'a better routine for them' meaning patients 'won't routinely be in bed for four, five, 6 h' at a time (Staff one, physio). Most staff made reference to the additional mobilisation sessions extending the patient's active day, which may better reflect their usual daytime pattern. Additionally, some described that evening rehabilitation could increase the rehabilitation dosage received on ICU, suggesting patients might be more independent and this could promote their readiness to step down on to the ward. Some staff thought the study population should be extended to patients who are already delirious based on their previous experiences of mobilising delirious patients: 'I think it would be beneficial to see patients that are already delirious.' (Staff

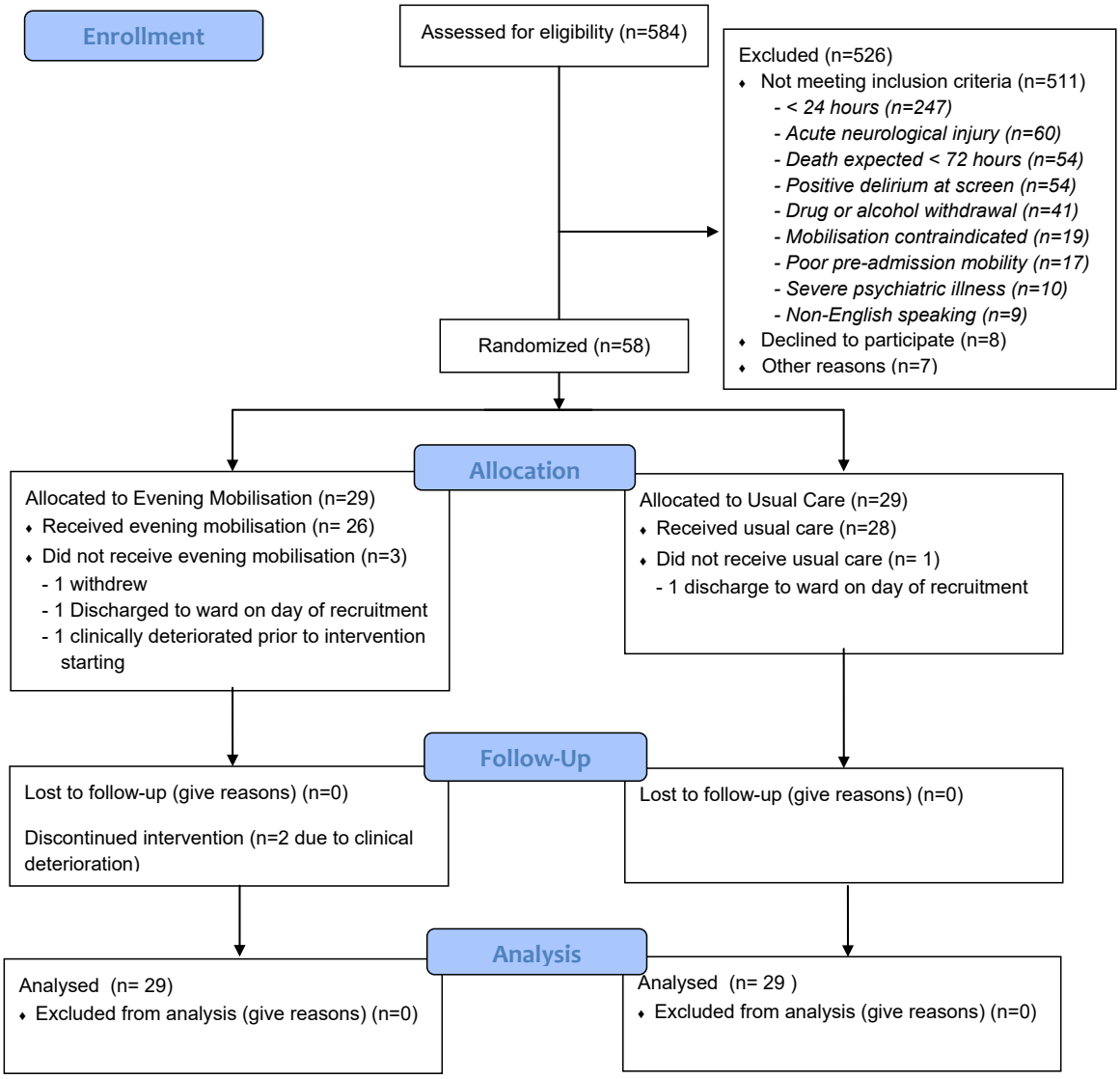

***Fig. 1:* Consort diagram**. In the evening mobilisation arm, 3 patients failed to receive the planned intervention due to patient withdrawal (n = 1), being discharged to the ward on the evening of randomisation (n = 1) or a clinical deterioration prior to commencement of the intervention (n = 1). The intervention was also discontinued for 2 further patients due to unrelated clinical deterioration and worsening of critical illness making mobilisation no longer appropriate. In the usual care arm, one patient was excluded from the outcomes analysis as they were discharged to the ward on the day of randomisation.

seven, physio). Some patients remarked that additional evening mobilisation increased their motivation and facilitated recovery progression, 'I think it was an extra session per day, I think it was ideal really' (Patient four). This supports recognising the interplay between physical and non-physical health for patients.

Late-night staffing

Although there was no consensus on the optimal time to deliver evening rehabilitation, most staff recognised adjustments in working patterns are required to achieve an evening mobilisation service. Few staff identified cost and service implications to ensure sustainability of the intervention model, stating 'There's quite a lot of operational challenges associated with deploying the intervention' (Staff nine, physio). Overall, the feedback was positive and it was perceived it could be a welcome evolution in rehabilitation provision and elicit a positive cultural change.

Secondary outcomes

Secondary outcomes for the evening intervention group compared with the control group were: delirium incidence 5/26 (19%; 95% CI: 6–39%) vs 8/28 (29%; 95%

	Intervention (n = 29)	Control (n = 29)
Missing/withdrawn	3	1
Potential mobilisation days for all patients combined	76	105
Total number of mobilisation treatments received for all patients combined	109	87
Proportion of usual care sessions completed per day	0.88	0.83
Proportion of evening sessions completed per day	0.64[a]	0
Mean evening sessions completed per patient	1.8	0
Adverse events	1	0

The proportion of sessions completed is calculated as a proportion of the total number of sessions completed compared to the total number of potential mobilisation days for all patients combined. [a]Represents proportion of sessions completed where evening mobilisation was still appropriate.

Table 2: **All mobilisation sessions delivered.**

CI: 13–49%) and mean delirium duration 2 days (SD 0.7) vs 4.25 days (SD 2.0).

Both the incidence 5/26 (19%; 95% CI: 6–39%) vs 8/28 (29%; 95% CI: 13–49%) p = 0.53) and mean duration (2.0 days SD 0.7 vs 4.25 days SD 2.0, p = 0.016) of new-onset delirium were lower for patients in the intervention group in comparison to controls (see Table 3). No statistically significant differences were observed for sleep scores, although overall completion rate for self-reported sleep questionnaires was only 62% (111/178). Both ICU and hospital length of stay were also shorter in the intervention arm despite apparently longer durations of sedation and mechanical ventilation.

Discussion

This feasibility trial was shown to be feasible and acceptable by both patients and healthcare staff within ICU and provides extensive information to be implemented in a full-scale trial. The results of this trial support the development of a definitive full scale randomised controlled trial investigating the effects of evening mobilisation to treat delirium and improve outcomes.

We were able to recruit the desired number of patients, within a desirable time frame from across both hospitals. This demonstrates feasibility of using multiple sites, and a willingness of patients to undertake the evening mobilisation within ICU. Patients admitted to ICU often present with fluctuating levels of consciousness due to the severity of illness or the use of sedative medication, which can limit their capacity to provide informed consent. The use of proxies in the form of relatives or, when this was not possible, an independent medical practitioner allowed us to overcome this and achieve our recruitment target. Patients were then re-consented when they had regained capacity and demonstrated an ongoing willingness to take part. Of note, 54 (9%) of patients were excluded as they had a positive CAM-ICU prior to screening, indicating they were already delirious. In light of the potential reduction seen in the duration of delirium it would seem appropriate to remove this as an exclusion for future trials, further increasing the pool of potential participants available.

	All		Intervention		Control		p
	N		N		N		
Incidence of Delirium, n (%)	54	13 (24%)	26	5 (19%)	28	8 (29%)	0.53
Delirium duration days—mean (SD)	13	3.4 (1.9)	5	2.0 (0.7)	8	4.25 (2.0)	0.016[a]
Ventilation days, median (IQR)	34	4.0 (1–6)	18	4.0 (2–6.75)	16	2.0 (1–4.5)	0.39
Sedation days, median (IQR)	28	4.0 (1–7)	16	4.0 (1–7.25)	12	2.0 (1–5)	0.62
ICU length of stay, median (IQR)	48	5.0 (4–10)	23	5.0 (3–9.5)	25	6.0 (4–10)	0.35
Hospital length of stay, median (IQR)	42	17.0 (11–30)	19	13.0 (9.5–36)	23	18.0 (12–30)	0.29
RCSQ, median (IQR)	46	51 (37–64)	21	49.2 (34–64.2)	25	51 (37.3–63.8)	0.83
Died—ICU, n (%)	54	7 (13%)	26	4 (15%)	28	3 (11%)	0.70
Died—ward, n (%)	47	7 (15%)	22	4 (18%)	25	3 (12%)	0.69
MMS ICU discharge, median (IQR)	47	5 (4–6)	22	4 (4–5.75)	25	5 (4.25–6)	0.19
Barthel ICU discharge, median (IQR)	47	5 (2–9)	22	4 (2.5–9)	25	7 (4–11)	0.23

Abbreviations. ICU, Intensive Care Unit; SD, standard deviation; IQR, inter quartile range; RCSQ, Richards Campbell Sleep Questionnaire—scored from 0 to 100, with higher scores representing better quality of sleep; MMS, Manchester Mobility Score—scored from 1 to 7 with higher scores indicating higher levels of mobility. Barthel scores from 0 to 20 with higher scores representing higher levels of functional independence. [a]Represents p values significant at p < 0.05.

Table 3: **Secondary outcomes**

In regards to retention, the majority of patients randomised remained in the trial until completion, with only one patient withdrawing. Of those randomised to the intervention group, 90% received at least one mobilisation session. This is in line with previous research, where retention rate was reported as 85%.[31] Two patients (1 x intervention and 1 x standard care) were unexpectedly discharged to the ward on the day of recruitment. Efforts were made to ensure the eligibility of patients who were consented and randomised to the trial, including a confirmation of the minimum expected stay of at least 24 h with the lead nurse and intensivist for the ICU. However due to the unpredictable nature of critically ill patients this is not always assured and would need consideration to ensure future trials are adequately powered.

Adherence to the evening mobilisation was lower than anticipated at 57%. Due to the complex nature of mobilisation practice in ICU, patient's ability to engage in rehabilitation can vary[32] meaning mobilisation is not always appropriate every day. When accounting for this clinical instability, adherence rates increased to 64%. Whilst valuing the intervention, patient and staff feedback recommended slightly more flexibility to the intervention with a suggestion to widen the evening mobilisation window to 7pm–10pm. This would allow more flexibility around nursing staff handovers and other competing priorities, as well as patient preference for normal routines to improve adherence rates. This would however have implications for the working patterns of physiotherapists and the ability to define successful models for 'real world' implementation would be important in any future trials. This was a key aspect identified through staff interviews which highlighted the potential challenges of implementing new models of therapy delivery.

Based on our semi structured interviews, patients and staff reported the research methodology including randomisation to be acceptable, with positive feedback obtained from patients and staff for the intervention. Whilst logistical challenges and competing priorities were cited as barriers to delivery, there was a clear consensus regarding the perceived benefit of the evening mobilisation intervention from both participants and staff.

This shows that the evening mobilisation intervention was acceptable to patients in ICU, and therefore, a full-scale trial is warranted.

The feasibility trial assessed a wide range of important secondary outcomes that would support an evaluation of effectiveness and facilitate the sample size calculation in a full-scale trial. Patients receiving the evening mobilisation intervention had a lower incidence of delirium (19% vs 29%), and for those that developed a delirium the duration was shorter (2 vs 4.25 days). This is in keeping with other trials showing advantageous effects of mobilisation on delirium.[25] No differences were seen between groups with regards to sleep quality, although the difficulties in assessing sleep quality became apparent for patients who developed delirium (see Table 3). Despite longer apparent durations for both sedation and ventilation, patients in the intervention group also had shorter lengths of stay in both ICU and hospital.

It is important to note this feasibility trial was not statistically powered or developed to assess differences between the intervention and control arms. Any perceived trend cannot be interpreted as an indication of effect and conclusions should not be drawn from these findings. In addition, as ongoing delirium assessment was not continued once patients were transferred to the ward our results may not represent an accurate representation on the effect of the evening intervention on delirium duration. The potential for a positive impact in the intervention group does however further support the case for a full trial of effectiveness. Another consideration and potential limitation would be that the evening intervention constituted an increased dose of rehabilitation and attempts at normalisation through the addition of actitives such as reading a book or watching television. There is therefore introduce uncertainty as to whether any potential improvements seen in a definitive trial were due to a change in timing or an increased dosage, or indeed both. This will require consideration around whether to include a second afternoon session for control participants in future trials.

Implementation of the feasibility trial has enabled us to develop a robust protocol for a definitive multi-centre trial. The completion of this feasibility trial enables us to address issues that may not have been considered prior to the conduct of a larger definitive trial. Potential shortcomings related to pragmatic issues with data collection were identified. For example, measures of sleep using the Richards Campbell sleep questionnaire were more challenging for weak or confused patients. The addition of proxy measures for sleep or the addition of more formal sleep monitoring should be adopted for future trials. Another element requiring consideration was the short length of stay of patients recruited, with a number spending only one night in ICU following randomisation and three actually being unexpectedly discharged on the same day. Future trials may benefit from recruiting patients later in the day when discharge decisions have already been confirmed, or a change to the inclusion criteria for an expected stay of at least 48 h.

An important consideration for future studies would also be the current staffing and culture within participating ICUs. Both ICUs included in this feasibility trial had well established rehabilitation services, although the reality is that the content and delivery of rehabilitation does vary between ICUs nationally.[33] A standardised approach to delivery would be essential, paying particular regard to safety criteria for initiation and progression of mobilisation.[34] In addition, both units in the

feasibility trial already had established evening services in place. Whilst these were focussed on the provision of respiratory care and cover until 8pm only, the existing service was able to deliver the rehabilitation intervention with only small changes to focus and structure. To allow for an evaluation of implementation and effectiveness in future trials, it is important to include ICUs with a variety of different staffing models. It would be essential to include a process evaluation as part of the evaluation to identify the effectiveness of different models of delivery and how these are incorporated into services to inform future implementation.

In conclusion, the findings from our feasibility trial can be used to inform the design and conduct in ICU acquired delirium research. We have demonstrated the safety and feasibility of introducing an evening mobilisation intervention, alongside positive evaluation of the proposed methodology. Lessons learned from this feasibility trial will inform key modifications to the intervention delivery. The impact of this intervention on delirium rates and outcomes warrants further investigation in a definitive randomised controlled trial.

Contributors

DM and PN conceived the study. DM, EK, PN, JD, LG and OG contributed to the study design. DM, PN, OG and EK developed the intervention. JD and LG led the patients and public involvement for the development of the protocol. All authors contributed to the development of the study protocol. EK, OG and DM developed the interview topic guide. EK undertook the staff interviews, and EK, DM and DB conducted the participant interviews. OG and DM accessed and verified the underlying data and led the development of the manuscript. All authors read the manuscript, provided critical input and approved the final manuscript.

Data sharing statement

The primary results of the MENTAL trial will be made available on clinicaltrials.gov (NCT05401461). The data that support the findings of this study are available from the corresponding author, [DM], upon reasonable request. Patient level data will not be made available.

Declaration of interests

All authors declare no competing interests.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.eclinm.2023.102101.

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