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1 **Clinicians' perceptions of rationales for rehabilitative exercise in a critical care setting: A**  
2 **cross-sectional study**

3 Australian Critical Care, in press

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- 29

30 **Abstract:**

31 Background:

32 Rehabilitative exercise for critically ill patients may have many benefits; however, it is unknown what  
33 intensive care unit (ICU) clinicians perceive to be important rationale for the implementation of  
34 rehabilitative exercise in critical care settings.

35 Objective:

36 To identify which rationales for rehabilitative exercise interventions were perceived by ICU clinicians  
37 to be important and determine whether perceptions were consistent across nursing, medical and  
38 physiotherapy clinicians.

39 Methods:

40 A cross-sectional study was undertaken among clinicians (nursing, medical, physiotherapy) working  
41 in a mixed medical surgical ICU in an Australian metropolitan tertiary hospital. Participants  
42 completed a customised web-based questionnaire developed by a clinician working-group. The  
43 questionnaire consisted of 11 plausible rationales for commencing rehabilitative exercise in ICUs  
44 based on prior literature and their own clinical experiences grouped into 4 over-arching categories  
45 (musculoskeletal, respiratory, psychological and facilitation of discharge). Participants rated their  
46 perceived importance for each potential rationale on a 5-point Likert scale.

47 Results:

48 Participants (n=76) with a median (interquartile range) 4.8 (1.5, 15.5) years of experience working in  
49 ICUs completed the questionnaire. Responses were consistent across professional disciplines.

50 Clinicians rated rehabilitative exercise as either 'very much' or 'somewhat' important for facilitating  
51 discharge (n=76, 100%), reducing muscle atrophy (n=76, 100%), increasing muscle strength (n=76,  
52 100%), prevention of contractures (n=73, 96%), reducing the incidence of ICU acquired weakness

53 (n=62, 82%), increasing oxygenation (n=71, 93%), facilitating weaning (n=72, 97%), reducing anxiety  
54 (n=60, 80%), reducing depression (n=64, 84%), reducing delirium (n=53, 70%), and increasing mental  
55 alertness (n = 65, 87%).

56 **Conclusions:**

57 Any shortcoming in implementation of rehabilitation exercise is unlikely attributable to a lack of  
58 perceived importance by nursing, medical or physiotherapy clinicians who are the most likely  
59 clinicians to influence rehabilitation practices in ICUs. It is noteworthy that this study examined self-  
60 reported perceptions, not physiological or scientific legitimacy of rationales, or clinician behaviours  
61 in practice.

62

63 **Keywords:**

64 Critical Care

65 Critical Illness

66 Exercise

67 Exercise Therapy

68 Intensive Care

69 Intensive Care Units

70 Length of Stay

71 Questionnaires

72 Rehabilitation

73

74

75

76 **Introduction:**

77 Survivors of critical illness experience prolonged deficits in physical and psychological function that  
78 negatively impact on health-related quality of life that can persist for over 5 years.<sup>1-3</sup> Clinicians  
79 working within intensive care units (ICUs) are responsible for implementing interventions that are  
80 targeted to assisting critically ill patients to not only survive but to also optimise function and health-  
81 related quality of life post hospital discharge. Rehabilitative exercise introduced early in the ICU stay  
82 is one strategy that has been shown to improve patients' physical and psychological outcomes and  
83 reduce hospital length of stay.<sup>4,5</sup> Rehabilitative exercises include but are not limited to range of  
84 motion exercises, resistance exercises, cycle ergometry, sitting balance, transferring from bed to  
85 chair, standing balance, marching on the spot and mobilising away from the bedside.<sup>5-8</sup> Studies that  
86 have reported clinician perceptions on rehabilitative exercise have focused on barriers and  
87 strategies to the implementation of exercise interventions.<sup>9-12</sup> Currently there is no literature that  
88 describes what ICU clinicians believe to be the rationales underpinning implementation of  
89 rehabilitative exercise with critically ill patients.

90 Clinicians working in a mixed ICU in an Australian tertiary hospital in a metropolitan setting were  
91 invited to complete a customised questionnaire with the purpose of identifying which rationales for  
92 rehabilitative exercise interventions were perceived to be important. In addition, this study aimed to  
93 determine if clinicians from different professional backgrounds share the same views regarding the  
94 relative importance of rationales for rehabilitative exercise. By identifying what ICU clinicians  
95 perceive to be important rationales for rehabilitative exercise, targeted quality improvement  
96 strategies that optimise the use of exercise interventions may be developed.

97

98 **Methods:**

99 **Design**

100 A questionnaire was administered to a cross-section of clinicians using a web-based survey platform.

### 101 **Questionnaire Development**

102 The questionnaire was developed by a clinician working group which included clinical  
103 physiotherapists, an intensive care consultant and a health services researcher experienced in the  
104 design of web-based questionnaires for clinical analysis. The purpose of the questionnaire was to  
105 ascertain current intensive care clinicians' perspectives with regard to the rationale of incorporating  
106 rehabilitative exercise with critically ill patients. The clinician working group compiled a list of  
107 plausible rationales for commencing rehabilitative exercise with critically ill patients from the  
108 literature and their prior experiences working with clinicians in critical care settings.<sup>5, 13, 14</sup> For each of  
109 these rationale a 5-point Likert rating scale was provided for participants to rate their perceived  
110 importance of each rationale, with 1 and 5 representing the least and greatest importance ratings on  
111 this scale respectively. The 11 rationales to be rated in this study were grouped into 4 categories;  
112 musculoskeletal, respiratory, psychological and facilitation of discharge (see Figures 1-4 for specific  
113 rationales). Participants were invited to nominate any additional rationales, but none were  
114 identified. Demographic data regarding the participants were also collected and included: clinical  
115 discipline, years of experience working in current ICU, and years of experience working at other ICUs.

116

### 117 **Setting, participants and procedure**

118 The target sample were clinicians currently working in a 30 bed mixed medical surgical ICU in a  
119 tertiary hospital in Brisbane, Australia. The participants were from either a medical, nursing or  
120 physiotherapy discipline. For analysis the nursing cohort was divided into two groups: registered  
121 nurses and clinical nurses. Clinical nurses are senior nurses staff who have: completed a post  
122 graduate qualification in critical care nursing, a minimum of four years' experience, completed  
123 advanced competencies such as; advance haemodynamic monitoring and fulfil clinical leadership



124 roles including; unit co-ordination, quality improvement activities and supervision of junior staff.  
125 Potential participants were invited to participate via the hospital email system. The invitation email  
126 provided a brief description of the study and a hyperlink to the web-based platform. Three email  
127 reminders were sent out over a 3 month period to encourage staff to complete the questionnaire.  
128 The questionnaire was promoted in the departmental electronic newsletter, and with promotional  
129 posters placed in the staff dining room.

130 Ethical approval for the study was obtained for the Metro South Human Research Ethics Committee  
131 (HREC/12/QPAH/009) and from the Queensland University of Technology University Human  
132 Research Ethics Committee (1400000587). Participants provided informed consent on the web-  
133 based survey platform prior to their participation.

134

### 135 **Analysis**

136 Descriptive statistics were used to summarize the sample characteristics and perceived importance  
137 ratings. Distribution of responses were examined using frequency histograms. Mean and standard  
138 deviation (SD) were calculated for normally distributed data and median and interquartile range  
139 (IQR) presented for non-normally distributed data.

140

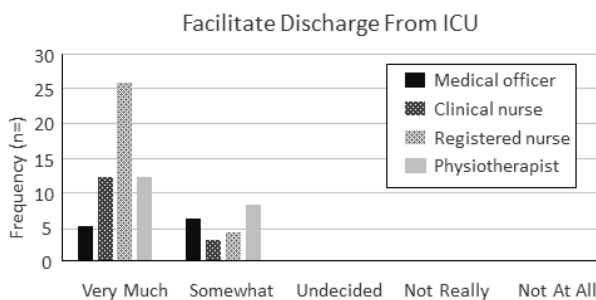
### 141 **Results:**

142 A total of n = 76 participants completed the questionnaire (82% completion rate among those  
143 confirmed to have received the invitation to participate). The nursing discipline had the greatest  
144 representation in the questionnaire (n = 45, 59% of participants). Overall, the sample had a range of  
145 experience levels working in ICU settings (from < 1 year to 36 years). More than half (n = 41, 54%) of  
146 the participants had gained experience working in different intensive care settings to where this  
147 study was conducted either within Australia or internationally (Table 1).

148 **Table 1 Participant role and experience working in intensive care settings (n = 76)**

<b>Total Experience in ICU</b>	<b>Median</b>	<b>IQR</b>
Years' experience working in any ICU	4.8	1.5,15.5
<b>Professional Role</b>	<b>n</b>	<b>%</b>
Registered Nurse	30	39
Clinical Nurse	15	20
Physiotherapist	20	26
Medical Officer	11	14
<b>Clinical Experience</b>	<b>n</b>	<b>%</b>
Experience in current ICU only	35	46
Additional experience in another ICU within Australia	18	24
Additional experience in an international ICU	23	30

149



150

151 **Figure 1: Perceptions of importance of Facilitate Discharge rationale**

152 All questionnaire participants considered rehabilitative exercise as either 'very much' or 'somewhat'

153 important for facilitating discharge (Figure 1). There was a strong perception of support for the

154 musculoskeletal rationales for rehabilitative exercise by clinicians from all professions (Figure 2). All

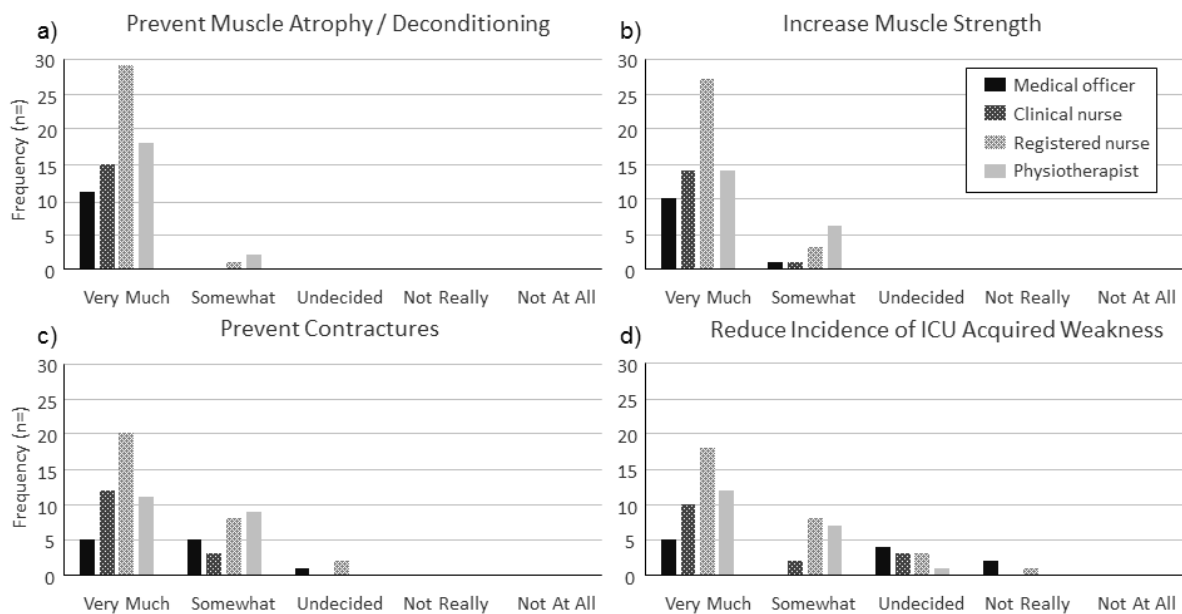
155 clinicians considered rehabilitative exercise important for preventing muscle atrophy and increasing

156 muscle strength, and the majority rated rehabilitative exercise as either 'very much' or 'somewhat'

157 important, (n=73, 96%) for prevention of contractures. Fewer clinicians (n=62, 82%) rated  
 158 rehabilitative exercise as either 'very much' or 'somewhat' important for reducing the incidence of  
 159 ICU acquired weakness.

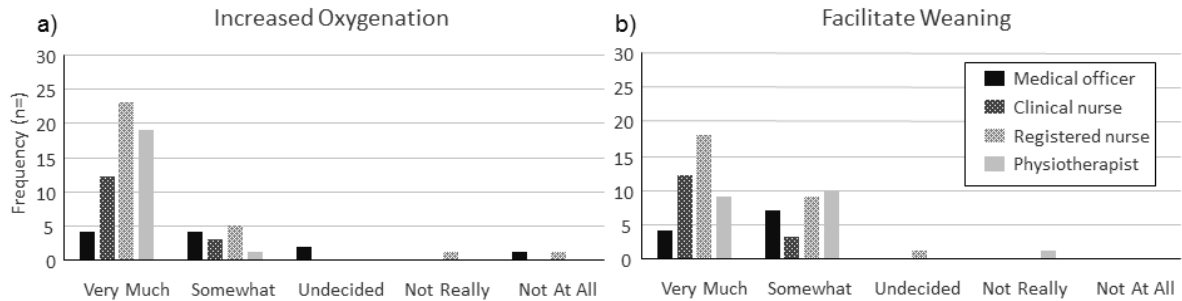
160 Participants from all professions considered the two respiratory rationales for rehabilitative exercise  
 161 to be important (Figure 3). The majority of clinicians rated the rationale increasing oxygenation  
 162 (n=71, 93%) and facilitating weaning (n=72, 97%) as either 'very much' or 'somewhat' important.

163 Regardless of professional background, clinicians' perceptions of the importance of psychological  
 164 rationales had a broader distribution in comparison to the importance of musculoskeletal and  
 165 respiratory rationale. A large percentage of clinicians (n=60, 80%) rated the perceived importance of  
 166 the psychological rationale of rehabilitative exercise to 'reduce anxiety' as either 'very much' or  
 167 'somewhat' important (Figure 4). The majority, (n=64, 84%) and (n=53, 70%) rated rehabilitative  
 168 exercise as either 'very much' or 'somewhat' important for reducing depression and delirium,  
 169 respectively. Nearly all clinicians (n = 65, 87%) perceive the importance of increasing mental  
 170 alertness as either 'very much' or 'somewhat' important for rehabilitative exercise interventions  
 171 with critically ill patients (Figure 4).



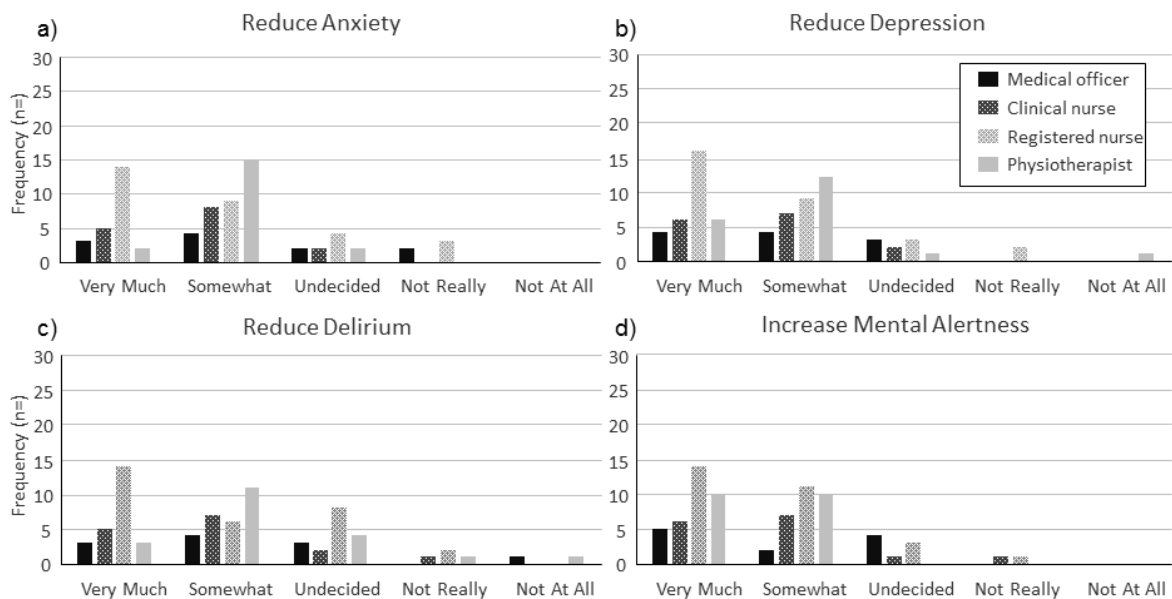
172

173 **Figure 2: Perceptions of importance of musculoskeletal rationales; (a) prevent atrophy, (b)**  
 174 **increase strength, (c) prevent contractures, (d) reduce ICU acquired weakness**



175

176 **Figure 3: Perceptions of importance of respiratory rationales; (a) increase oxygenation, (b)**  
 177 **facilitate weaning**



178

179 **Figure 4: Perceptions of importance of psychological rationales; (a) reduce anxiety, (b) reduce**  
 180 **depression, (c) reduce delirium, (d) increase mental alertness**

181

182 **Discussion:**

183 This is the first paper, to the authors' knowledge, to describe what ICU clinicians from different  
184 professional backgrounds perceive to be important rationales for rehabilitative exercise  
185 interventions for critically ill patients. Perhaps the most notable finding was that participants in this  
186 study shared very similar perceptions regardless of their professional background. This may be, at  
187 least in part, due to participants having worked in the same clinical facility. However, more than half  
188 of the participants had previously worked in ICUs at other facilities, with 30% of participants having  
189 worked in ICUs in other countries adding to the likelihood that this finding could be generalised  
190 beyond this particular clinical setting.

191 The rationale that had the highest rating across all the clinician groups was that early rehabilitation  
192 may facilitate discharge from ICU. The very strong ratings for this rationale by clinicians are  
193 supported by empirical research in the field. A recent meta-analysis concluded that rehabilitative  
194 exercise with critically ill patients does reduce intensive care length of stay.<sup>14</sup> In addition to stability  
195 in physiological systems, the achievement of functional tasks such as walking and sitting out of bed  
196 are likely to be seen as a factor influencing the timing of a decision to discharge patients from ICUs.  
197 This is despite ability to perform functional tasks such as walking and sitting out of bed not  
198 necessarily being recognised as formal discharge criterion.

199 Musculoskeletal rationales for rehabilitative exercise including preventing muscle atrophy,  
200 increasing strength, and preventing contractures were consistently rated very highly by ICU clinicians  
201 regardless of their professional background (Figure 2). These perceptions are consistent with  
202 findings from a meta-analysis of systematic reviews examining the benefits of rehabilitative  
203 exercises with critically ill patients which reported that rehabilitative exercises improved physical  
204 outcomes including functional independence and peripheral muscle strength.<sup>14-16</sup> This perception is  
205 also consistent with clinical guidelines in the field. The NHS National Institute for Health and Clinical  
206 Excellence, Rehabilitation after Critical Illness guideline recommends that for patients at risk, start  
207 rehabilitation as early as clinically possible.<sup>17</sup>

208 In addition the European Respiratory Society and European Society of Intensive Care Medicine  
209 advises that critically ill patients should start active and passive exercise as early as possible.<sup>18</sup> It  
210 appears the ICU clinicians from different clinical backgrounds were likely to be aware of and in  
211 agreement with these current international guidelines, familiar with the literature in the field on  
212 which the guidelines were based, or were able to reach this conclusion based on their own clinical  
213 knowledge and experiences.

214

215 There was a relative lower rating by ICU clinicians of the perceived importance of the rationale  
216 underpinning rehabilitative exercise to reduce the incidence of ICU acquired weakness. This mixed  
217 opinion may reflect the knowledge of some ICU clinicians that the development of ICU acquired  
218 weakness is multi-factorial. Multiple factors that have been associated with increased incidence for  
219 ICU acquired weakness include severe systemic inflammation, multiple organ failure, elevated blood  
220 glucose levels, immobility and specific medications (corticosteroids and neuromuscular blocking  
221 agents).<sup>19, 20</sup> The multi-dimensional nature of ICU acquired weakness may contribute to the lack of  
222 clear evidence in regard to whether rehabilitative exercise interventions improve outcomes in  
223 patients with ICU acquired weakness.<sup>21</sup> This lack of clarity has been articulated in the American  
224 Thoracic Society ICU acquired weakness clinical practice guidelines and may contribute to clinicians'  
225 variable opinion about its efficacy. Consequently more research is required to investigate the effects  
226 of rehabilitative exercise interventions on the incidence, severity, duration on ICU acquired  
227 weakness and long-term patient outcomes.

228

229 There was consistency in positive ratings of importance for the respiratory rationale for  
230 rehabilitative exercise. Clinicians generally considered rehabilitative exercise as beneficial for  
231 weaning and increasing oxygenation. Rehabilitative exercise has been demonstrated to be beneficial  
232 to facilitate weaning and increase ventilator free days for critically ill patients whose ICU length of  
233 stay was greater than 48 hours.<sup>5, 22</sup> When considering respiratory function in the short term there is

234 limited evidence regarding the effect of rehabilitative exercise on acute blood oxygenation levels of  
235 critically ill patients. Studies have noted that individuals have had acute desaturation to less than  
236 80% during exercise interventions.<sup>5, 6, 23</sup> However, these acute desaturations are not common and  
237 are usually transient and reversible by temporarily increasing the fraction of inspired oxygen. Given  
238 that rehabilitative exercise is associated with an improvement in ventilator free days it is reasonable  
239 to conclude that exercise leads to an improvement in respiratory function for most critically ill  
240 patients.<sup>5, 6, 22</sup>

241

242 A lower number of ICU clinicians considered rehabilitative exercise as being important for  
243 psychological benefits in comparison to musculoskeletal or respiratory benefits. These lower  
244 importance ratings may be due to the multi-factorial nature of psychological compromise. It has  
245 been reported that depression with critically ill patients is not correlated with severity of illness or  
246 age.<sup>24</sup> In addition delirium has been shown to be associated with medications given during an ICU  
247 admission and sleep disturbances.<sup>25</sup> It has been reported that survivors of critical illness suffer  
248 deficits in physical function that persist for several years after a period of critical illness.<sup>26, 27</sup>  
249 However, evidence of negative consequences of critical illness on long-term cognitive function has  
250 only been brought to the fore in more recent times.<sup>28</sup> There is emerging evidence that physical  
251 activity and associated decrease in sedation medication has a positive effect on psychological health  
252 for survivors of critical illness.<sup>5, 29</sup> An early screening instrument that was developed for predicting  
253 psychological morbidity after critical illness identified 21 potential risk factors.<sup>30</sup> However, inactivity  
254 during critical illness was not identified as a potential contributor to the development of  
255 psychological problems. In comparison with physical function, the lack of evidence regarding  
256 rehabilitation exercise intervention and psychological problems may be contributing to ICU clinicians  
257 placing less importance on utilising rehabilitative exercise to improve psychological outcomes of  
258 critical illness survivors.

259

260 Implications for Practice

261 Results of this questionnaire show that ICU clinicians perceive rehabilitative exercise to be important  
262 to achieve a number of different outcomes including facilitation of discharge from ICU, improved  
263 oxygenation, facilitation of weaning from mechanical ventilation and improved physical and  
264 psychological outcomes. However, there is evidence in other ICU settings that rehabilitative exercise  
265 does not occur routinely.<sup>31, 32</sup> Workplace cultural barriers have been identified as inhibiting  
266 rehabilitative exercise within ICU's.<sup>12, 33-35</sup> A challenge to the implementation of rehabilitative  
267 exercise interventions is that ICU clinicians may not see the immediate benefits, therefore the need  
268 for these interventions to be prioritised may not be recognised.<sup>5, 14</sup> Practice change strategies such  
269 as the development of an exercise protocol or the introduction of a rehabilitation team may be  
270 beneficial for improving rates of implementation of rehabilitative exercise interventions.<sup>7, 35-38</sup>

271

272 Limitations

273 Perceptions of ICU clinicians regarding rehabilitative exercise may differ across hospital facilities.  
274 This study was conducted in a single centre and may limit the ability to generalise results to other  
275 ICUs, although it should be noted that over half of the participants had experience working in other  
276 ICUs. It is plausible that individuals have generated their perceptions based on their experiences at  
277 multiple ICUs, and consequently improve the likelihood of the generalisability of results.  
278 Unfortunately, it was not possible to determine from the available data whether there was any self-  
279 selection bias with clinicians most interested in rehabilitation exercises choosing to complete the  
280 questionnaire. Clinicians who valued rehabilitation exercise the least may have chosen not to  
281 participate in this study. Further, clinicians may have answered questions in what they considered to  
282 be a socially acceptable manner. However, as the study was conducted using an online  
283 questionnaire that preserved the anonymity of clinicians, the investigators do not believe there was



284 any direct social incentive that influenced participants. A final limitation was that this study focused  
285 on clinical rationales for outcomes that could be observed within a patient's admission and  
286 potentially attributed (at least in part) to rehabilitation exercises in ICU. Other potential long term  
287 benefits that may be difficult to attribute to rehabilitation exercise practices in ICU were considered  
288 beyond the scope of the present investigation.<sup>26</sup>

### 289 Areas for further research

290 Uncertainty remains regarding the effect of rehabilitative exercise interventions on the incidence,  
291 severity or duration of ICU acquired weakness.<sup>21</sup> Consequently, further investigations are warranted  
292 to evaluate if rehabilitative exercise interventions are able to reduce the incidence, duration and  
293 severity of ICU acquired weakness. Additional studies that include clinicians from other facilities  
294 internationally would be valuable to confirm or refute whether findings from the present study are  
295 consistent across geographical regions. Further research is also required to determine if the  
296 perceptions reported in the present study are congruent with clinician behaviours regarding their  
297 prioritisation and engagement with rehabilitation exercise practices during their clinical practices.  
298 This may also assist to determine what practice change strategies are likely to result in an increased  
299 implementation of effective rehabilitative models of care within ICUs. The effectiveness of  
300 rehabilitative exercise at facilitating ICU discharge, and improving physical, respiratory and  
301 psychological outcomes also requires further investigation.

302

### 303 **Conclusion:**

304 Despite an expanding evidence base that rehabilitative exercise with critically ill patients is safe and  
305 beneficial<sup>15, 16, 39, 40</sup>, there is evidence that rehabilitative exercise does not occur routinely<sup>31, 32</sup>. This  
306 study has identified that in a single centre ICU clinicians perceive the importance of various  
307 rationales for rehabilitative exercise positively and consistently regardless of the professional

308 background. Consequently, quality improvement activities that aim to increase the occurrence of  
309 rehabilitative exercise interventions should focus on the other aspects of successful implementation  
310 including overcoming cultural or resourcing barriers.

311

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