Klinikum rechts der Isar
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Mobilisation von beatmeten Patienten

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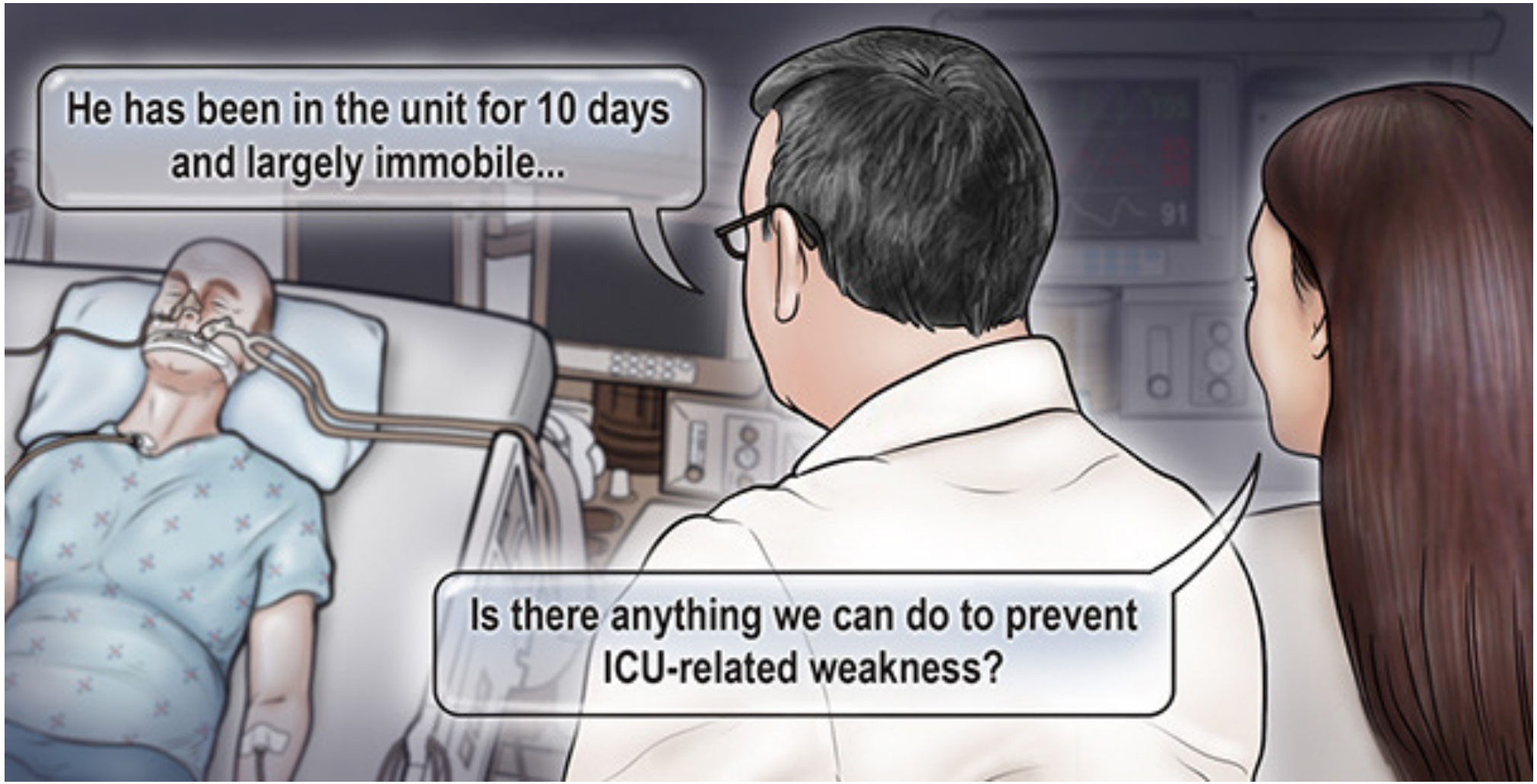
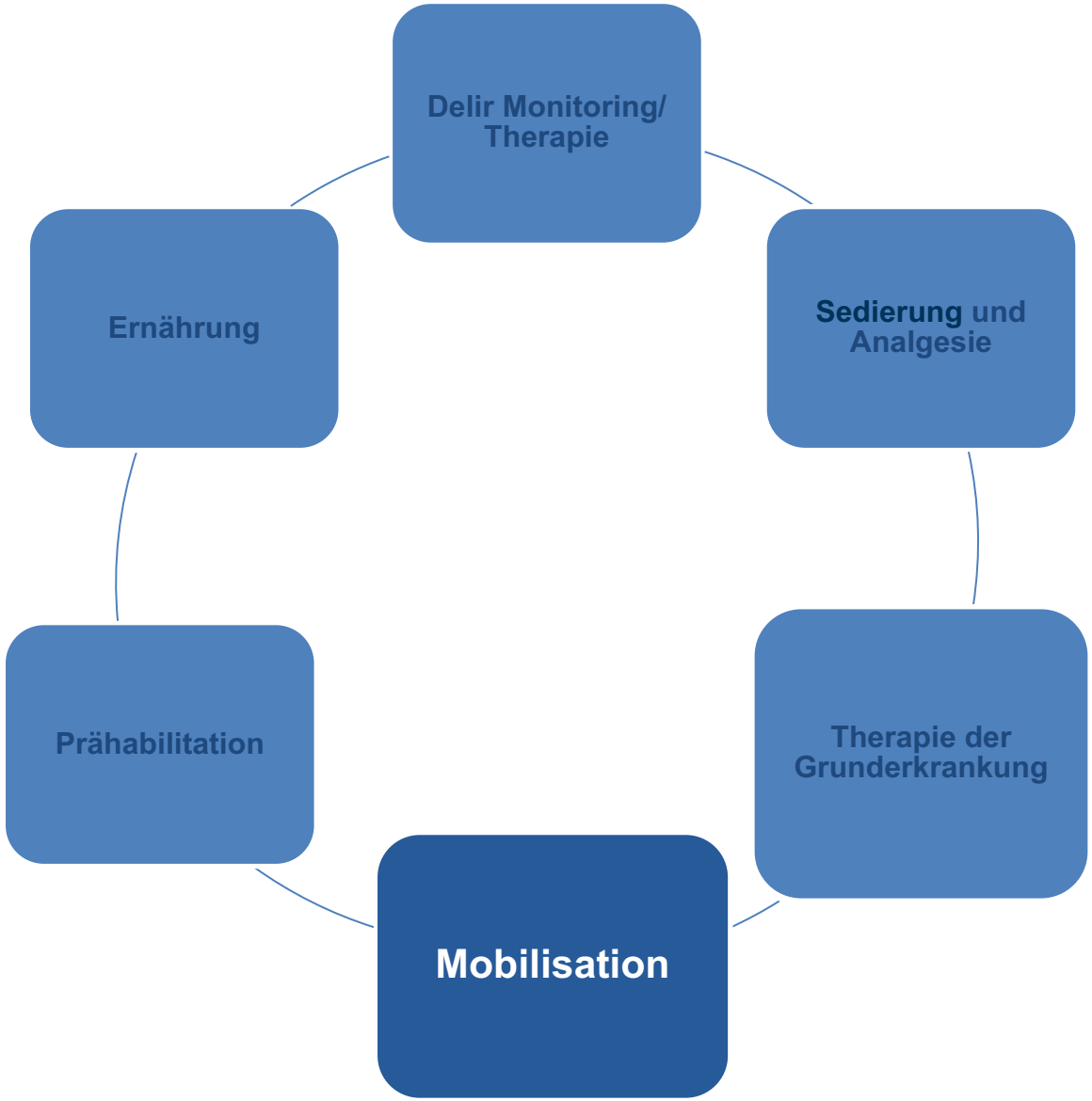
Intensivmedizin hat trotz der Erfolge häufig **schwerste Auswirkungen** auf unsere PatientInnen



Quelle: April 24, 2014 N Engl J Med 2014; 370:1626-1635 DOI: 10.1056/NEJMra1209390

Is there anything we can do...?



Frühmobilisation wird mittlerweile in den meisten **Leitlinien** empfohlen

→ Leitlinie Lagerungstherapie und Frühmobilisation 2015

- Unter Frühmobilisation wird der Beginn der Mobilisation innerhalb von 72h nach Aufnahme auf die Intensivstation verstanden
- Grundsätzlich soll die Frühmobilisation bei allen intensivmedizinisch behandelten PatientInnen durchgeführt werden, für die keine Ausschlusskriterien gelten (Evidenzgrad 2b, Empfehlung Grad A)

Frühmobilisation hat neben der Funktionalität noch weitere **positive Effekte**

- Delir
- LOS & Beatmungszeit
- Motivation, emotionale Auswirkungen
- Dekubitus & Druckstellen
- Thromboseprophylaxe

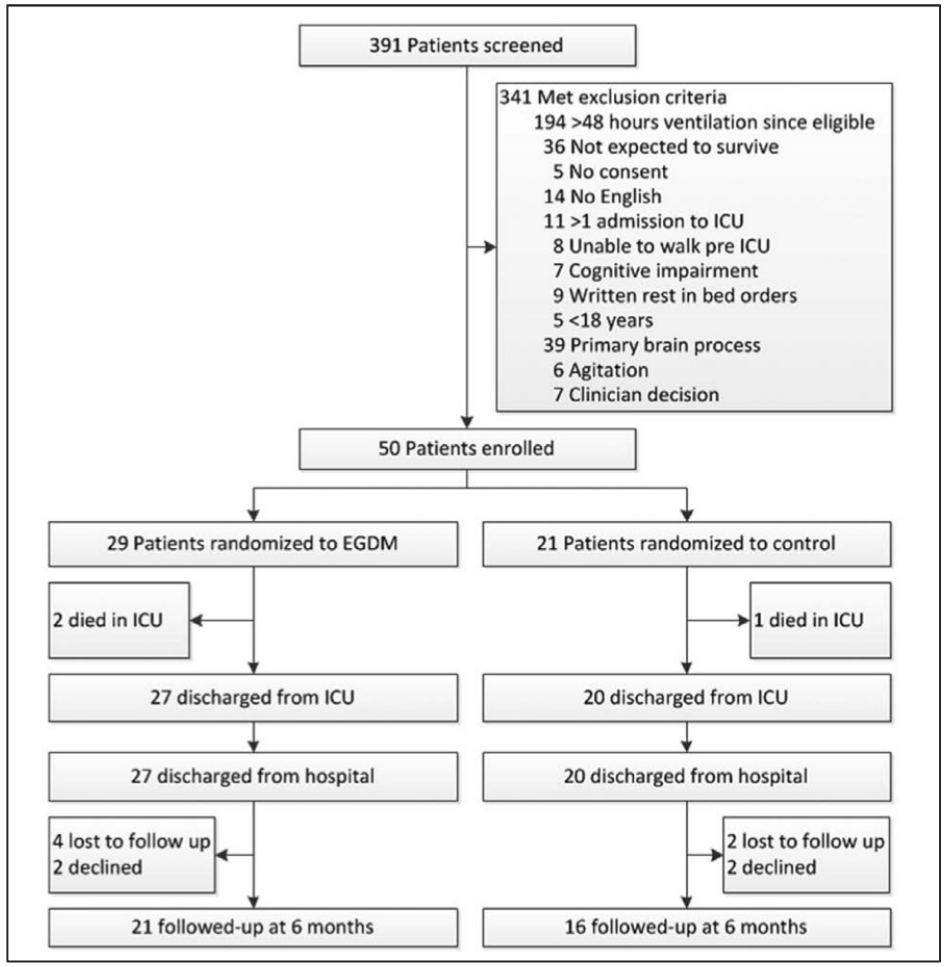
Quelle: https://www.isaweb.in/Attachment/Supportive%20therapy%20for%20MV%20patients.pdf https://husite.nl/euppt/wp-content/uploads/sites/218/2019/12/O-VA-03-Quality-TZanen.-Improvement-Intervention-to-Promote-Early-Mobilization-in-critically-ill-children_.pdf https://asiapac.medtronic.com/content/dam/covidien/library/us/en/clinical-procedural-therapy/icu-early-mobility/icu-rise-interactive-infographic/index.html

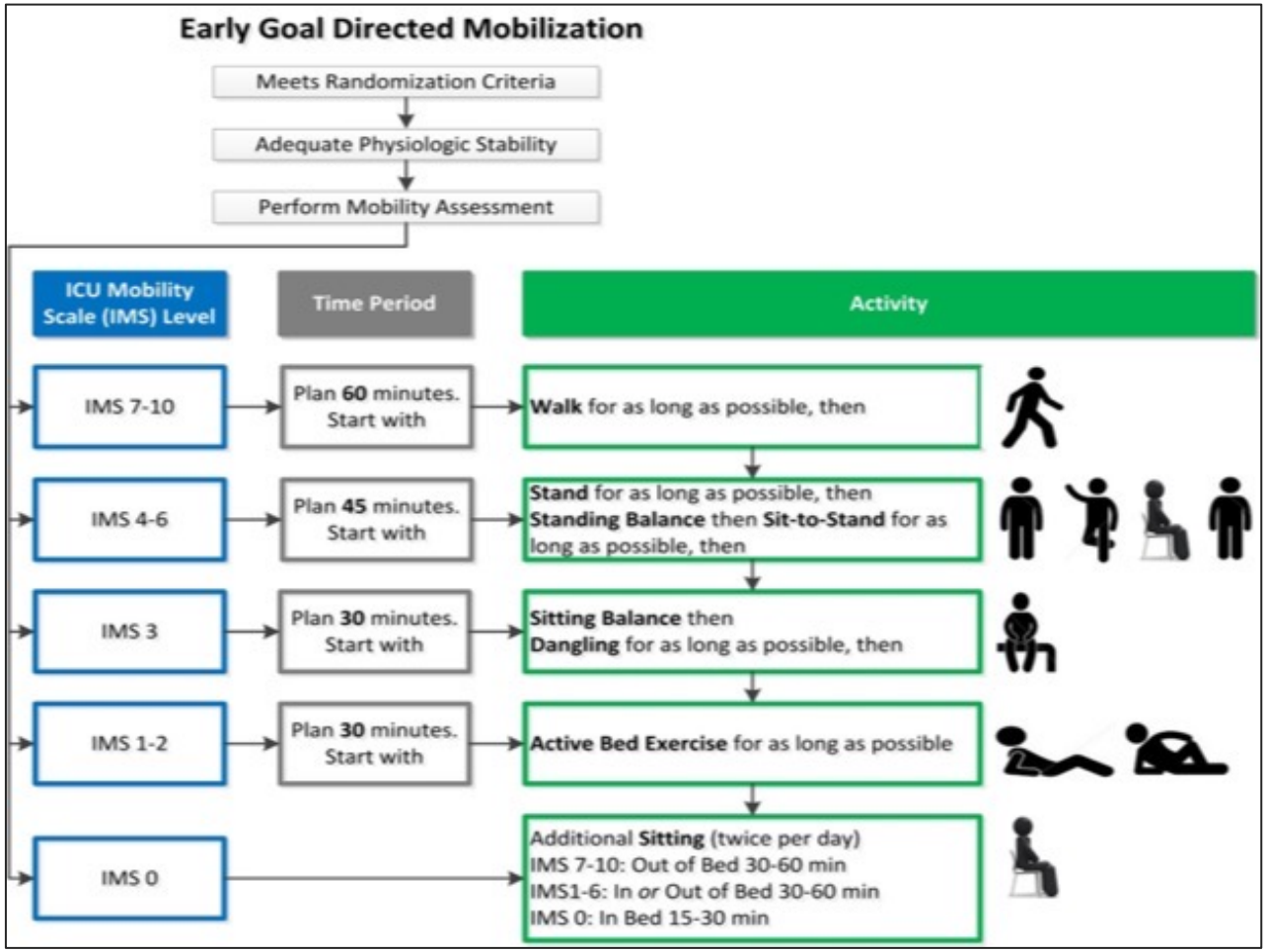
Wer von Ihnen mobilisiert.....?

- beatmete PatientInnen
- PatientInnen mit Katecholaminen
- Dialyse PatientInnen
- ECMO PatientInnen

Quelle https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.colourbox.de%2Fvektor%2Fdemokratie-hande-abstimmung-vektor-25904836&psig=AOvVaw2aie7XS3NOk6lYQ3Eb4rPE&ust=1696425668521000&source=images&cd=vfe&opi=89978449&ved=0CBEQjRxqFwoTCKDllcb82YEDFQAAAAAdAAAAABAD

Hodgson führte 2016 eine Machbarkeitsstudie an beatmeten PatientInnen mit **vorgegebenem Mobilisierungsziel** durch





Team Study Investigators, CCM,June 2016 44(6)

Die Ergebnisse dieser **Pilotstudie** waren beeindruckend:

Outcome Measure	Early Goal-Directed Mobilization ($n = 29$)	Control ($n = 21$)	p
Duration of ventilation, median [IQR]	5.4 [3.5–10.0]	7.0 [5.0–12.0]	0.18
Ventilator-free days, mean ± SD	19.2 ± 7.4	17.1 ± 8.7	0.4
Extubated within 5 d from randomization, *n* (%)	14 (48)	5 (24)	0.08
ICU mobility scale maximum score during the ICU stay, mean [IQR]	7.3 [6.3–8.3]	5.8 [4.9–6.9]	0.05
Mobility milestones during ICU, *n* (%)			
Sit out of bed	26 (90)	17 (81)	0.38
Stand	26 (90)	13 (62)	0.02
Walk	19 (66)	8 (38)	0.05
Death in ICU, *n* (%)	2 (7)	1 (5)	0.75
Death in hospital, *n* (%)	2 (7)	1 (5)	0.75
ICU length of stay, d, median [IQR]	9 [6–17]	11 [8–19]	0.28
Hospital length of stay, median [IQR]	19 [14–30]	29 [16–34]	0.33
Total length of stay (hospital and inpatient rehabilitation), d, median [IQR]	20 [15–35]	34 [17.5–42.5]	0.37
Patients discharged to home, *n* (%)	19 (66)	13 (62)	0.69

IQR = interquartile range.

Team Study Investigators, CCM,June 2016 44(6)

Die Interventionsgruppe hat sowohl im **Level** als auch in der **Dauer** schneller Fortschritte erzielt

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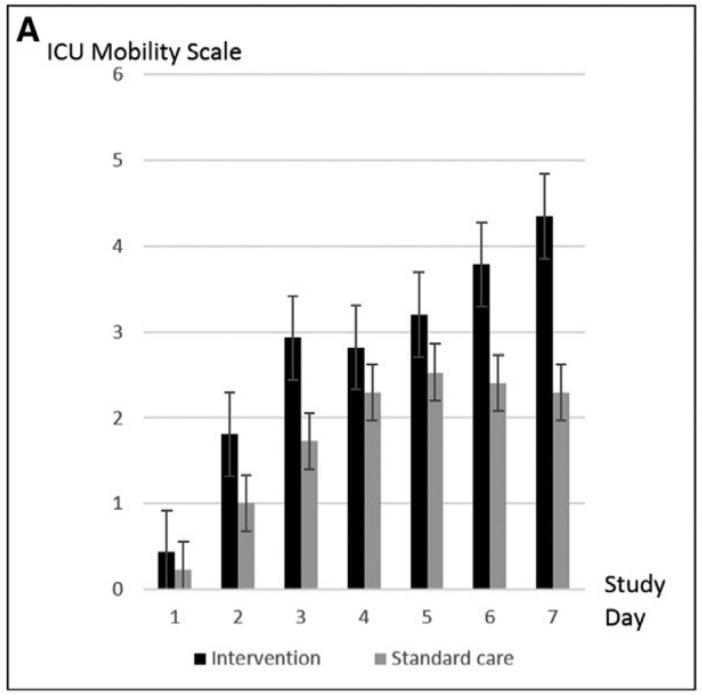

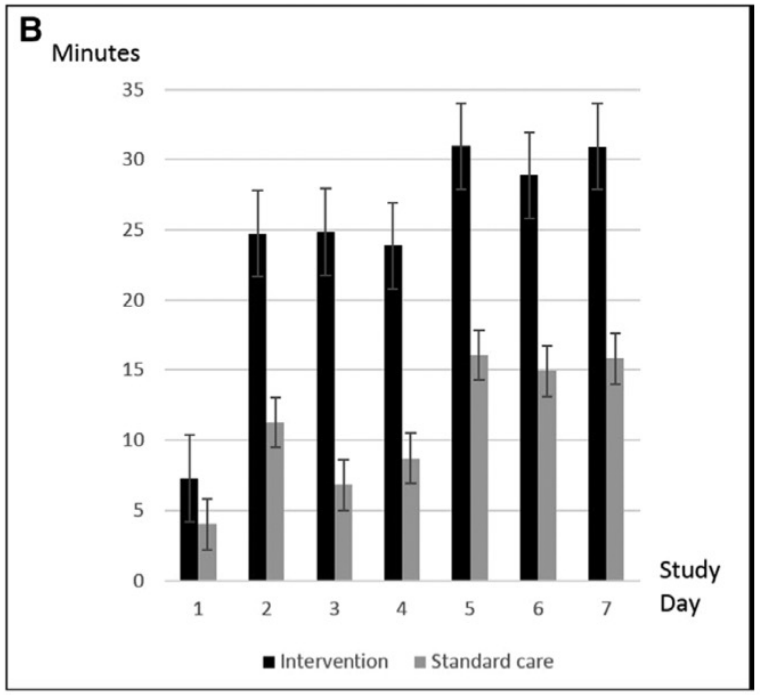

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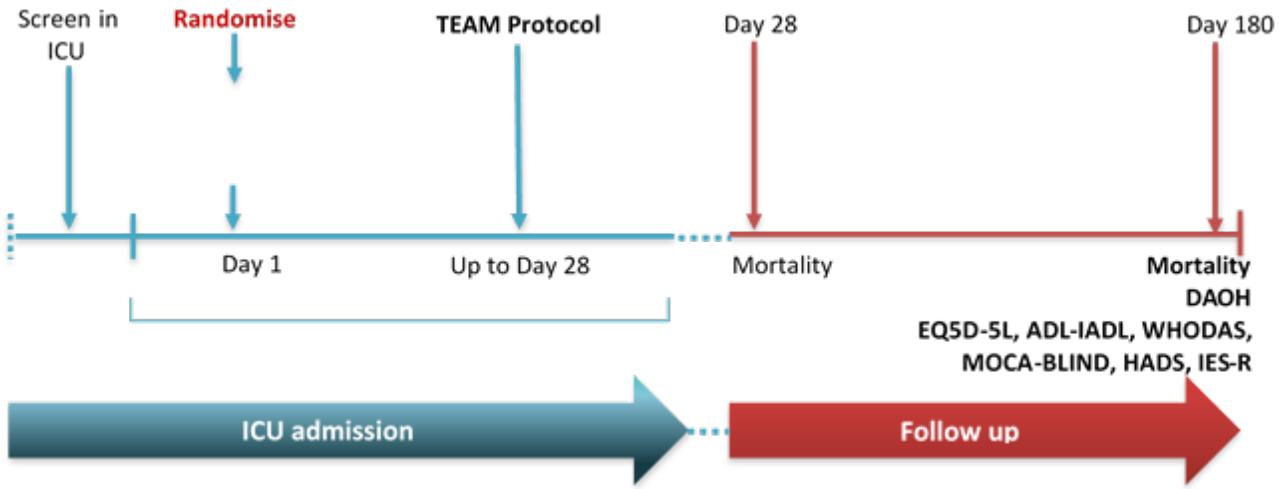
Aus dem Pilot entstand die **größte multizentrische Mobilisierungsstudie** – das TEAM Trial



- 750 PatientInnen
- multizentrisch
- verblindet*
- randomisiert- kontrolliert
- 2-armig
- 49 Krankenhäuser
- 6 Länder

Es wurden kritisch Kranke mit prämorbider funktioneller Unabhängigkeit und **Freigabe zur Mobilisation** untersucht

Table 1. Characteristics of the Patients at Baseline.*

Characteristic	Early Mobilization (N=371)	Usual Care (N=370)
Age — yr	60.5±14.8	59.5±15.2
Female sex — no. (%)	128 (34.5)	146 (39.5)
Body-mass index†	29.9±7.9	30.4±7.8
Frailty and function		
Median score on Clinical Frailty Scale (IQR)‡	3 (2 to 4)	3 (2 to 4)
Median score on Functional Comorbidity Index (IQR)§	2 (1 to 3)	2 (1 to 3)
Median score on WHODAS 2.0 (IQR)¶	10.4 (2.1 to 25.0)	8.7 (2.1 to 22.7)
Highest score on the ICU Mobility Scale in wk before ICU admission‖	9.9±0.6	9.8±0.7
Median interval from hospital admission to randomization (IQR) — hr	88.3 (50.5 to 137.0)	81.6 (48.2 to 147.0)
Median interval from ICU admission to randomization (IQR) — hr	60.1 (35 to 92.3)	61.3 (33.8 to 96.1)
ICU admission type — no. (%)		
Planned ICU admission after elective surgery	68 (18.3)	58 (15.7)
Unplanned ICU admission	303 (81.7)	312 (84.3)
Median RASS score at randomization (IQR)**	−3 (−4 to −2)	−3 (−4 to −2)
Measurements and interventions at randomization††		
Positive end-expiratory pressure — cm of water	8.9±3.0	8.8±3.1
Pa_{O_2}:Fi_{O_2}	226±79.1	230±85.2
Receipt of vasopressors by infusion — no. (%)	228 (61.5)	231 (62.4)
Receipt of renal-replacement therapy — no. (%)	82 (22.1)	79 (21.4)
APACHE II score‡‡	18.2±6.8	18±6.9
Diagnosis subgroup — no. (%)§§		
Sepsis¶¶	246 (66.3)	245 (66.2)
Trauma	15 (4.0)	14 (3.8)
Covid-19	7 (1.9)	10 (2.7)

Die Mobilisation in der Kontrollgruppe war **überraschend gut**, die Ergebnisse bei Intensiventlassung gleich

Table 2. Mobilization in the ICU.*

Characteristic	Early Mobilization (N=371)	Usual Care (N=370)	Between-Group Difference (95% CI)†
Patients who were assessed by a physiotherapist on day of randomization — no./total no. (%)	320/370 (86.5)	265/363 (73.0)	13.5 (6.7 to 20.3)
No. of days per patient when physiotherapy assessment occurred	0.94±0.11	0.81±0.24	0.14 (0.12 to 0.16)
No. of minutes of active mobilization per day	20.8±14.6	8.8±9.0	12.0 (10.4 to 13.6)
Mobilization milestones‡			
IMS 3 or higher			
Patients — no. (%)	331 (89.2)	330 (89.2)	0 (–4.3 to 4.3)
Median no. of days since randomization (IQR)	3 (1 to 6)	4 (2 to 7)	–1 (–2.2 to –0.2)
IMS 4 or higher			
Patients — no. (%)	287 (77.4)	286 (77.3)	0.1 (–6.0 to 6.1)
Median no. of days since randomization (IQR)	3 (2 to 7)	5 (3 to 8)	–2 (–3.4 to –0.6)
IMS 7 or higher			
Patients — no. (%)	176 (47.4)	150 (40.5)	6.9 (–0.2 to 14.0)
Median no. of days since randomization (IQR)	5 (3 to 8)	7 (4 to 13)	–2 (–3.4 to –0.7)
Median peak IMS (IQR)	6 (4 to 8)	6 (4 to 8)	0 (–1 to 1)

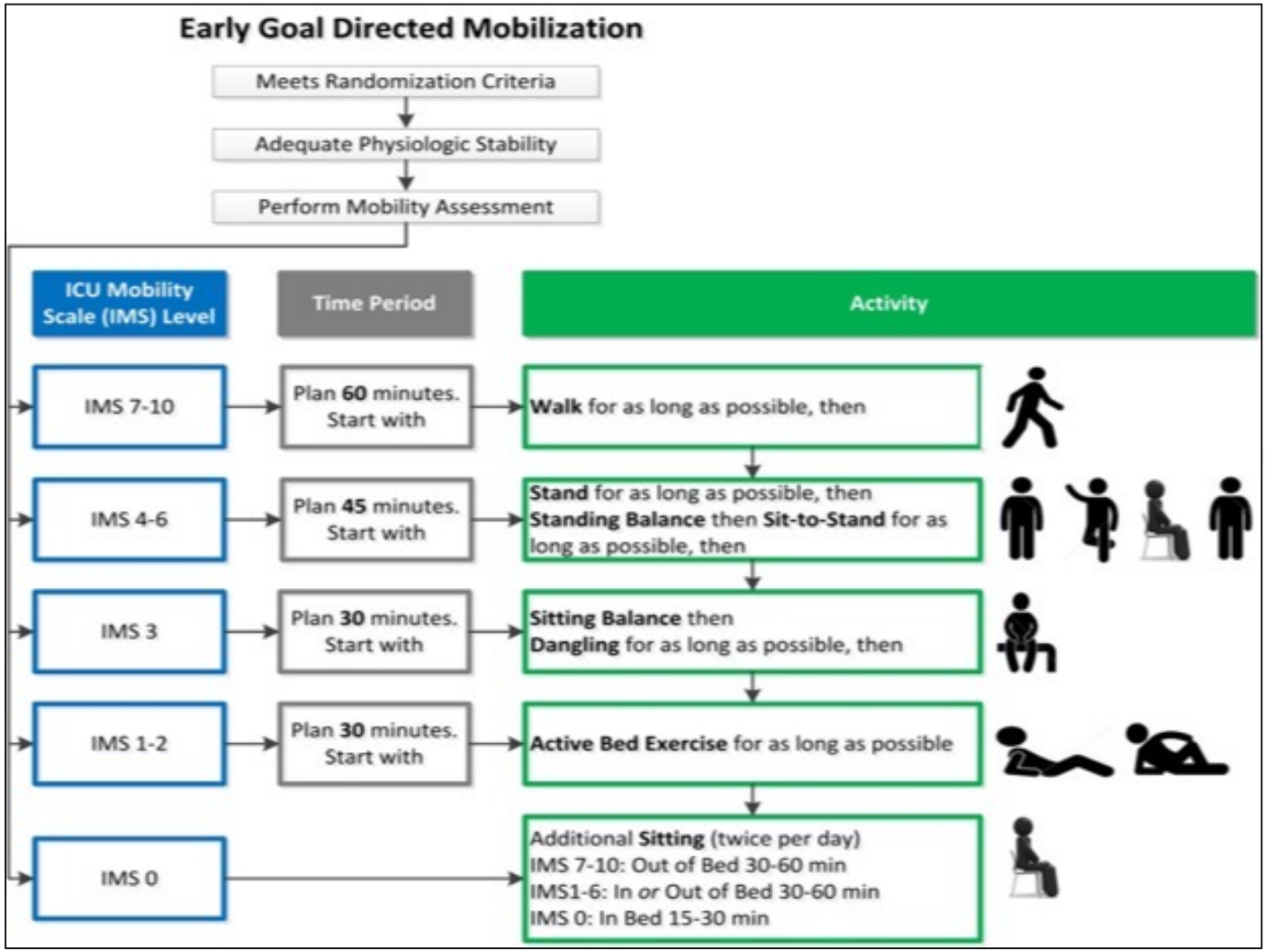
Outcome
Primary outcome
Days alive and out of hospital at day 180‡
Median no. (IQR)
Key secondary outcomes
Death at day 180
Patients — no. (%)
Median no. of days since randomization (IQR)
Median no. of ventilator-free days at day 28 (IQR)
Median no. of ICU-free days at day 28 (IQR)
Functional outcomes in survivors at day 180¶
Score on EQ-5D-5L utility score‖
Score on EQ Visual Analogue Scale**
Median score on Barthel Index of ADL (IQR)††
Median score on IADL (IQR)‡‡
Median score on WHODAS 2.0 (IQR)§§

Was wurde in den erfolgreichen Studien zur Mobilisierung **richtig gemacht?**

EINFLUSSFAKTOREN

- Frühmobilisierung
- Vorgehen nach **Algorithmus**
- Definition von **Mobilisierungszielen**
- Definition von **Abbruchkriterien**
- **Safety**-Assessment
- **Schulung** von Mitarbeitern
- **Interdisziplinäre Zusammenarbeit**
- **Re-Evaluation** nach der Intervention

Das Studiendesign des TEAM-Trial war **detailliert ausgearbeitet**



- Frühmobilisierung
- Definition eines **Tagesziels**
- Vorgehen nach **Algorithmus**
- Definition einer **Mindestdauer**
- Definition von **Abbruchkriterien**

Die Rate an **unerwünschten Ereignissen** war in der Interventionsgruppe höher

Adverse events — no. (%) ¶¶				
Patients with ≥1 adverse event potentially due to mobilization — no. (%)	34 (9.2)	15 (4.1)	2.55 (1.33–4.89)§	0.005
Adverse events per patient — no. (%)				0.02
0	337 (90.8)	355 (95.9)		
1	19 (5.1)	11 (3.0)		
2	4 (1.1)	2 (0.5)		
≥3	11 (3.0)	2 (0.5)		
Type of adverse events — no. (%)‖‖				
! Altered blood pressure	13 (3.5)	8 (2.2)		0.27
! Cardiac arrhythmia	13 (3.5)	4 (1.1)		0.03
Oxygen desaturation	8 (2.2)	1 (0.3)		0.02
Pain or agitation	4 (1.1)	1 (0.3)		0.37
Removal of invasive line	2 (0.5)	2 (0.5)		1.00
Gastrointestinal	2 (0.5)	1 (0.3)		1.00
Tachypnea	3 (0.8)	0		0.25
Altered neurologic state	1 (0.3)	1 (0.3)		1.00
Other	4 (1.1)	0		0.12

Frühmobilisation ist **sicher**

Reference	Study Type	Country	*N*	ICU Type	Active Mobilization Protocol*	Adverse Events	Quality†
Clark et al[25]	Cohort	United States	2,176	Trauma and burn	2, 3, 4, 5, 6, 7, 8	None	7
Bourdin et al[26]	Cohort	France	20	Medical	5, 6, 7, 8	Adverse events in 3% of sessions (13 of 424): drop in muscle tone ($n = 7$), hypoxemia ($n = 4$), unscheduled extubation ($n = 1$), hypotension ($n = 1$)	6
Bailey et al[27]	Cohort	United States	103	Respiratory	3, 4, 5, 6, 8	Adverse events in 0.96% of sessions (14 of 1,449): fell to knees without injury ($n = 5$), change in systolic blood pressure ($n = 5$), drop in oxygen desaturation ($n = 3$), nasal-small bowel feeding tube removal ($n = 1$)	6
Boyd et al[28]	Cohort	Australia	91	Cardiothoracic	3, 4, 5, 6, 7, 8	Adverse events in 1.8% of sessions (10 of 549): disruption of indwelling catheter ($n = 1$), increased heart rate and low-flow alarm on ECMO ($n = 1$), cardiovascular instability ($n = 6$), P_{aO_2} decreased ($n = 1$), blood sugar level decreased ($n = 1$)	6
Morris et al[29]	Cohort	United States	330	Medical	1, 2, 3, 4, 5, 6, 7, 8	None	9
Thomsen et al[30]	Cohort	United States	104	Respiratory	3, 4, 5, 6, 7, 8	Not stated	6
Witcher et al[31]	Cohort	United States	68	Neuroscience	1, 2, 3, 4, 5, 6, 7, 8	Not stated	7
Davis et al[32]	Cohort	United States	15	Medical, surgical	2, 3, 4, 5, 6, 7, 8	Adverse event in 0.6% of sessions (1 of 171): drop in blood pressure	6
Gao et al[33]	Cohort	China	158	General	1, 2, 3, 4, 5, 6, 7, 8	Adverse events in 1.4% of sessions (16 of 1,105): not specified	6
Zeng et al[34]	RCT	China	54	General	1, 2, 3, 4, 5, 6, 7, 8	Not stated	B
Dong et al[35]	RCT	China	60	General	1, 2, 3, 4, 5, 6, 7, 8	1 adverse event of postural hypotension	B
Liu et al[36]	RCT	China	107	Respiratory	1, 2, 3, 4, 5, 6, 7	None	B
Dantas et al[37]	RCT	Brazil	59	General	1, 2, 3, 4, 5, 6, 7, 8	Not stated	B
Dong et al[38]	RCT	China	106	General	1, 2, 3, 4, 5, 6, 7, 8	Not stated	B
Hodgson et al[39]	RCT	Australia	50	General	1, 2, 3, 4, 5, 6, 7, 8	Agitation ($n = 2$), transient hypotension ($n = 2$)	A
Mcwilliams et al[40]	RCT	United Kingdom	103	General	1, 2, 3, 4, 5, 6, 7, 8	Not stated	B
Schweickert et al[41]	RCT	United States	104	General	1, 2, 3, 4, 5, 6, 7, 8	Adverse event in 1 of 498 sessions: $S_{pO_2} < 80\%$	A
Schaller et al[4]	RCT	Multicenter	200	Surgical	1, 2, 3, 4, 5, 6, 7, 8	Adverse events in 2.3% of sessions (35 of 2,164): hypotension	A
Moss et al[42]	RCT	United States	120	General, medical	2, 3, 4, 5, 6, 7, 8	2 adverse events: syncopal episode ($n = 1$), readmission with polyarthralgia ($n = 1$)	B
Wright et al[43]	RCT	United Kingdom	308	General	1, 2, 3, 4, 5, 6, 7, 8	2 adverse events: no specific description	B
Morris et al[44]	RCT	United States	300	Medical	1, 2, 3, 4, 5, 6, 7, 8	1 adverse event: asymptomatic bradycardia lasting < 1 min	B
Wang et al[45]	RCT	China	90	General	1, 2, 3, 4, 5, 6, 7, 8	Not stated	B
Yu et al[46]	RCT	China	76	General	2, 3, 4, 5, 6, 7, 8	S_{pO_2} decreased ($n = 2$), hypotension ($n = 2$), fell to knees without injury ($n = 1$)	B
Zhu et al[47]	RCT	China	40	General	1, 2, 3, 4	Not stated	B

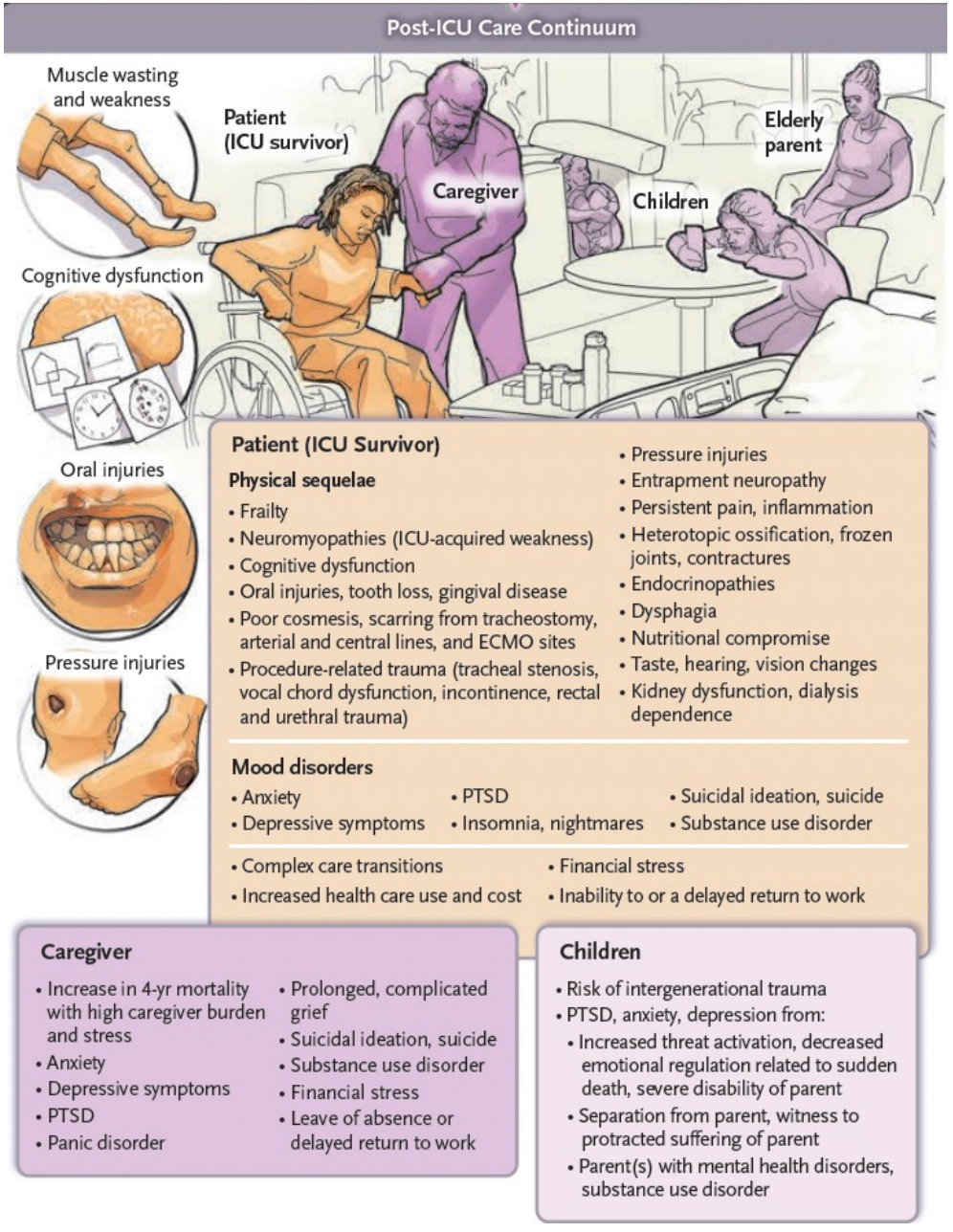
*In-bed activities: (1) active assisted/resistive exercise on 4 limbs, (2) sitting in bed and against gravity/counter-resistance exercise, (3) sitting on the edge of bed and dangling; Out-of-bed activities: (4) transferring to chair from the bed, (5) sitting in chair, (6) transferring to standing from sitting, (7) standing or tilting up beside the bed (with or without tilt-table support), (8) marching on the spot or walking away from the bedside.
†Quality of randomized controlled trials was assessed according to the Cochrane 5.1.0 manual (letter scale); quality of cohort studies was evaluated with the Newcastle Ottawa Quality Assessment Scale (numerical scale).
ECMO = extracorporeal membrane oxygenation
RCT = randomized controlled trial

Die Rate an unerwünschten Ereignissen lag in einer Analyse von 4500 Patienten bei < 3%

Quelle: Ruiqi Yang, Qiulan Zheng, Dan Zuo, Chuanlai Zhang and Xiuni Gan Respiratory Care February 2021,66 (2) 307-315;

Was machen wir jetzt daraus?

Quelle: https://icon-library.com/icon/pros-and-cons-icon-17.html



The NEW ENGLAND JOURNAL of MEDICINE

REVIEW ARTICLE

C. Corey Hardin, M.D., Ph.D., *Editor*

Outcomes after Critical Illness

Margaret S. Herridge, M.D., M.P.H., and Élie Azoulay, M.D., Ph.D.

- **Funktionalität** erhalten
- **Autonomie** und **Unabhängigkeit** wiederherstellen
- Aktivitäten des **täglichen Lebens** schulen

Kernaussagen

- Frühmobilisierung **ist sicher** und hat multiple positive Nebeneffekte
- In Bezug auf Dosierung von Mobilisierung scheint es einen **Ceiling-Effekt** zu geben, ab dem **unerwünschte Effekte** zunehmen und der positive Effekt abnimmt
- Neben der Evaluation der **optimalen Dosis** für die PatientInnen müssen wir **individuelle Herangehensweisen** für ein optimales Behandlungsergebnis erarbeiten
- Ein Zurück zu Zeiten der **Immobilisation** von kritisch kranken, beatmeten PatientInnen **muss unbedingt vermieden** werden