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Science Letter

Association between functional capacity and motivation to engage in physical activity before surgery

Functional capacity assessment before surgery identifies older adults at increased risk of functional decline after major surgery [1]. Increasing physical activity before surgery has shown efficacy to mitigate functional decline afterwards [2]. A key component necessary to initiate physical activity is motivation, defined as the processes that energises, orients and sustains behaviour. The COM-B model proposes that there are three necessary components for any behaviour change to occur: capability; opportunity; and motivation. As physical activity interventions before surgery vary in the amount of supervision and social support provided (i.e. facility based vs. home-based), individual differences in self-determined motivation may impact participation and improvements in functional capacity. It is unclear whether motivation for physical activity varies between patients with high vs. low functional capacity before surgery. Links between these determinants would indicate the need for multifaceted strategies and our aim was to explore the association between motivation and functional capacity.

Older adults (aged ≥ 60 y) were screened prospectively from the Anaesthesia Peri-operative Medicine Clinic at the University of Chicago Medical Center. Patients were included if they were able to walk with or without an assistive device. We did not study those patients who were non-English speaking or scheduled for ophthalmic surgery. The University of Chicago institutional review board approved the study and written informed consent was obtained. Patient characteristics, medical history and structured questionnaires were assessed. We used the 19-item Behavioural Regulation in Exercise Questionnaire [3]. Patients rated each item on a 5-point Likert scale (0–4, 0 = not true for me; 4 = very true for me) to assess five reasons for engaging in physical activity. Scale scores were weighted and combined to estimate the relative autonomy index score, a cumulative score of level of self-determined motivation. Lower, negative scores indicated more controlled regulation whereas higher, positive scores indicated larger relative autonomy. We used the Fried frailty phenotype to evaluate frailty status and the Duke Activity Status Index (DASI) to measure functional capacity [4, 5]. A DASI score < 34 identified patients with a poor functional capacity who may benefit from exercise before surgery [6].

We performed descriptive analyses for patient characteristics, comorbidities, frailty, outcome expectations and motivation to exercise. We used χ^2 tests for categorical variables or t-tests for continuous variables for comparisons between patients with low and high functional capacity. To evaluate for differences in relative autonomy index and motivation subtypes we used the Mann–Whitney U test. All analyses were performed using STATA v16.1 (StataCorp LLC, College Station, TX, USA).

In total, 294 patients were approached, 164 provided consent and 154 completed all survey instruments. In our study cohort, the mean (SD) age was 71 (7.3) y, 60% (93/154) identified as female and the average mean (SD) BMI was 30 (6.1) kg.m^{-1} (Table 1). Median (IQR [range]) DASI was 37 (19–50 [7–58]). Figure 1 illustrates the breakdown of the relative autonomy index and its subtypes stratified by low vs. high functional capacity. The median (IQR [range]) relative autonomy index was greater in patients with high compared with low functional capacity (13 (8–16 [-5–20]) vs. 9 (2–14 [-14–18]), respectively (p = 0.002)). Similar median (IQR [range]) differences were observed between high and low functional capacity groupings for identified regulation for physical activity (high 3.0 (2.5–3.5 [0.5–4]) vs. low 2.5 (1.8–3.0 [0–4.0]), p = 0.001) and intrinsic motivation for physical activity (high 2.8 (1.5–4.0 [0–4.0]) vs. low 2.0 (0.5–3.3 [0–4.0]), p = 0.007).

Older adults with poor functional capacity showed lower self-determined motivation which may undermine participation to prescribed physical activity programmes before surgery and limit potential improvements in functional capacity [7]. Participation in physical activity prescriptions is necessary to show functional gains from exercise to mitigate functional decline after surgery. As clinical practice guidelines emphasise pre-operative physical activity for older adults, it is imperative for clinicians to develop programmes that can support and meet the needs of all older adults who would benefit, including those with low functional capacity. Thus, programmes may need to offer different levels of support (supervised vs. home-based) to reduce motivational barriers to physical activity.

Our study was performed at an urban academic institution and it remains unclear how generalisable our

Table 1 Baseline characteristics of patients stratified by functional capacity. Values are mean (SD), number (proportion) or median (IQR [range]).

Variables	Low functional capacity n = 71	High functional capacity n = 83
Age; y	73 (8)	70 (6)
Height; cm	169 (10.6)	170 (9.7)
Weight; kg	85 (21.4)	84 (17.1)
BMI; kg.m^{-2}	30 (6.8)	29 (5.6)
Ethnicity		
Caucasian	30 (42%)	44 (53%)
African American	35 (49%)	26 (31%)
Asian	3 (4%)	1 (1%)
Pacific islander	0	1 (1%)
Other/mixed	1 (1%)	0
Unspecified	2 (3%)	11 (13%)
Type of surgery		
General	14 (20%)	47 (57%)
Vascular	6 (9%)	3 (4%)
Plastic	1 (1%)	0
Neurosurgery	1 (1%)	0
Orthopaedic	23 (32%)	5 (6%)
Transplant	3 (4%)	2 (2%)
Other	23 (32%)	26 (31%)
ASA physical status		
2	14 (20%)	23 (28%)
3	54 (76%)	57 (69%)
4	3 (4%)	3 (4%)
Revised Cardiac Risk Score		
0	24 (36%)	21 (26%)
1	22 (33%)	46 (57%)
2	14 (21%)	12 (15%)
3	5 (8%)	1 (1%)
4	1 (2%)	1 (1%)
Diabetes	28 (40%)	17 (21%)
Coronary artery disease	23 (32.4%)	11 (13%)
Peripheral artery disease	6 (9%)	3 (4%)
Cerebral vascular disease	6 (9%)	3 (4%)
Hypertension	58 (82%)	55 (66%)
Heart failure	20 (28%)	8 (10%)
Arrythmia	3 (4%)	10 (12%)
Relative autonomy index	9 (2–14 [-14–18])	13 (8–16 [-5–20])
Multidimensional outcome expectations for exercise scale	40 (37–45 [20–52])	42 (39–46 [30–52])
Fried frailty phenotype		
Non-frail	16 (23%)	47 (57%)
Pre-frail	51 (72%)	35 (42%)
Frail	4 (6%)	1 (1%)

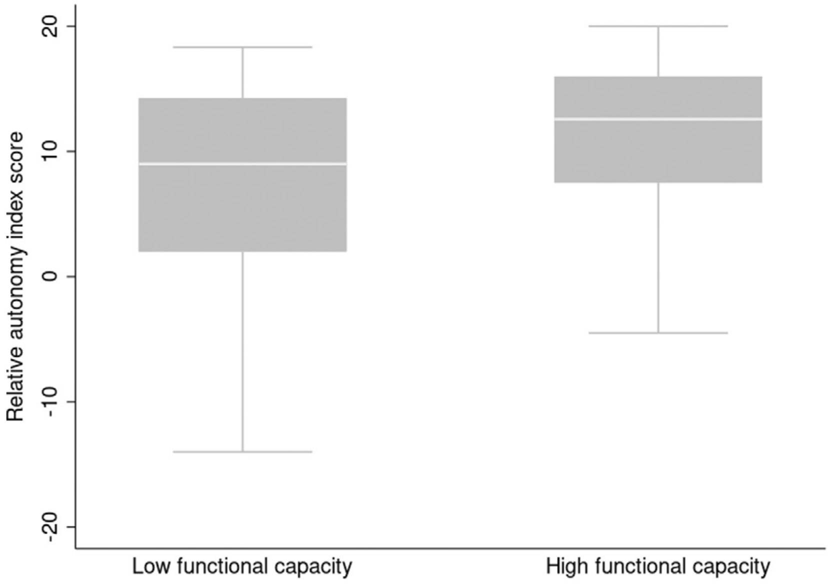

Figure 1 Relative autonomy index stratified by low vs. high functional capacity as measured by the Duke Activity Status Index.

results are to other settings (e.g. rural clinics and community practices). We did not survey our patients during a physical activity intervention; thus, it is unclear if engaging these targets would modify patients' behaviour change during the intervention if offered one.

In conclusion, our study addresses the importance of motivation for older adult patients who plan to engage in physical activity programmes to successfully mitigate risks for functional decline.

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References

1. Wijeysundera DN, Pearse RM, Shulman MA, et al. Assessment of functional capacity before major non-cardiac surgery: an international, prospective cohort study. *Lancet* 2018; **391**: 2631–40. https://doi.org/10.1016/s0140-6736(18)31131-0.
2. Tew GA, Ayyash R, Durrand J, Danjoux GR. Clinical guideline and recommendations on pre-operative exercise training in patients awaiting major non-cardiac surgery. *Anaesthesia* 2018; **73**: 750–68. https://doi.org/10.1111/anae.14177.
3. Markland D, Tobin V. A modification to the behavioural regulation in exercise questionnaire to include an assessment of amotivation. *J Sport Exerc Psychol* 2004; **26**: 191–6. https://doi.org/10.1123/jsep.26.2.191.
4. Fried LP, Tangen CM, Walston J, et al. Frailty in older adults: evidence for a phenotype. *J Gerontol A Biol Sci Med Sci* 2001; **56**: M146–56. https://doi.org/10.1093/gerona/56.3.m146.
5. Hlatky MA, Boineau RE, Higginbotham MB, et al. A brief self-administered questionnaire to determine functional capacity (the Duke Activity Status Index). *Am J Cardiol* 1989; **64**: 651–4. https://doi.org/10.1016/0002-9149(89)90496-7.
6. Wijeysundera DN, Beattie WS, Hillis GS, et al. Integration of the Duke Activity Status Index into preoperative risk evaluation: a multicentre prospective cohort study. *Br J Anaesth* 2020; **124**: 261–70. https://doi.org/10.1016/j.bja.2019.11.025.
7. Teixeira PJ, Carraça EV, Markland D, Silva MN, Ryan RM. Exercise, physical activity, and self-determination theory: a systematic review. *Int J Behav Nutr Phys Act* 2012; **9**: 78. https://doi.org/10.1186/1479-5868-9-78.

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