Role of psychosocial factors on the effect of physical activity on physical function in patients after lumbar spine surgery

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Background

Lumbar spine surgery

Physical activity

Improved Long-term outcomes

Archives of Physical Medicine and Rehabilitation
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In Press, Journal Pre-proof

Original Research

How many steps per day during the early postoperative period is associated with patient-reported outcomes of disability, pain, and opioid use after lumbar spine surgery?

Gilmore et al. BMC Musculoskeletal Disorders (2019) 20:418
https://doi.org/10.1186/s12891-019-2806-7

BMC Musculoskeletal Disorders

RESEARCH ARTICLE Open Access

Predictors of substantial improvement in physical function six months after lumbar surgery: is early post-operative walking important? A prospective cohort study

Background

Lumbar spine surgery

Physical activity

Poor physical function

Impair the ability to engage in active lifestyle

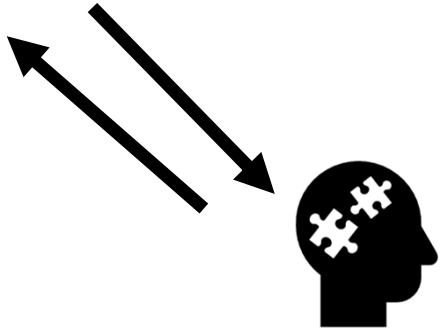
Observational Study > Arthritis Care Res (Hoboken). 2018 Jul;70(7):1005-1011.
doi: 10.1002/acr.23448. Epub 2018 May 6.

Minimum Performance on Clinical Tests of Physical Function to Predict Walking 6,000 Steps/Day in Knee Osteoarthritis: An Observational Study

Background

Lumbar spine surgery

Physical activity



Psychosocial factors

Poor physical function

> Spine J. 2014 May 1;14(5):759-67. doi: 10.1016/j.spinee.2013.06.087. Epub 2013 Nov 6.

Early postoperative fear of movement predicts pain, disability, and physical health six months after spinal surgery for degenerative conditions

Study objective - Conceptual model of postoperative recovery?

Lumbar spine surgery

Physical activity

Poor physical function

Psychosocial factors

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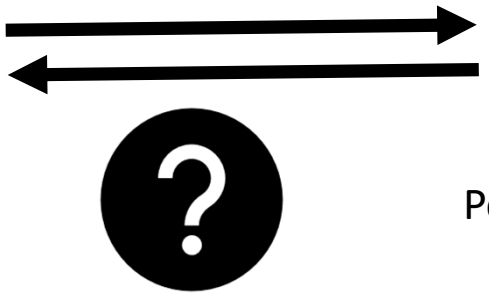

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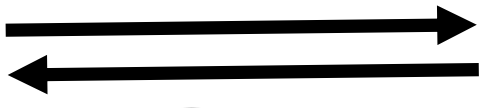

Poor physical function

Psychosocial factors

Method

- 248 patients who underwent a laminectomy procedure (with or without fusion) for lumbar degenerative condition

- 2 clinical sites

This study was funded through a Patient-Centered Outcomes Research Institute® (PCORI®) Award (CER-1306-01970)

Methods

Physical activity

Poor physical function

Psychosocial factors

Actigraph GT3X

Patient-reported outcome measures

Quantified as steps per day

Methods

Poor physical function

Computerized adaptive test domain version of Patient-Reported Outcomes Measurement Information System

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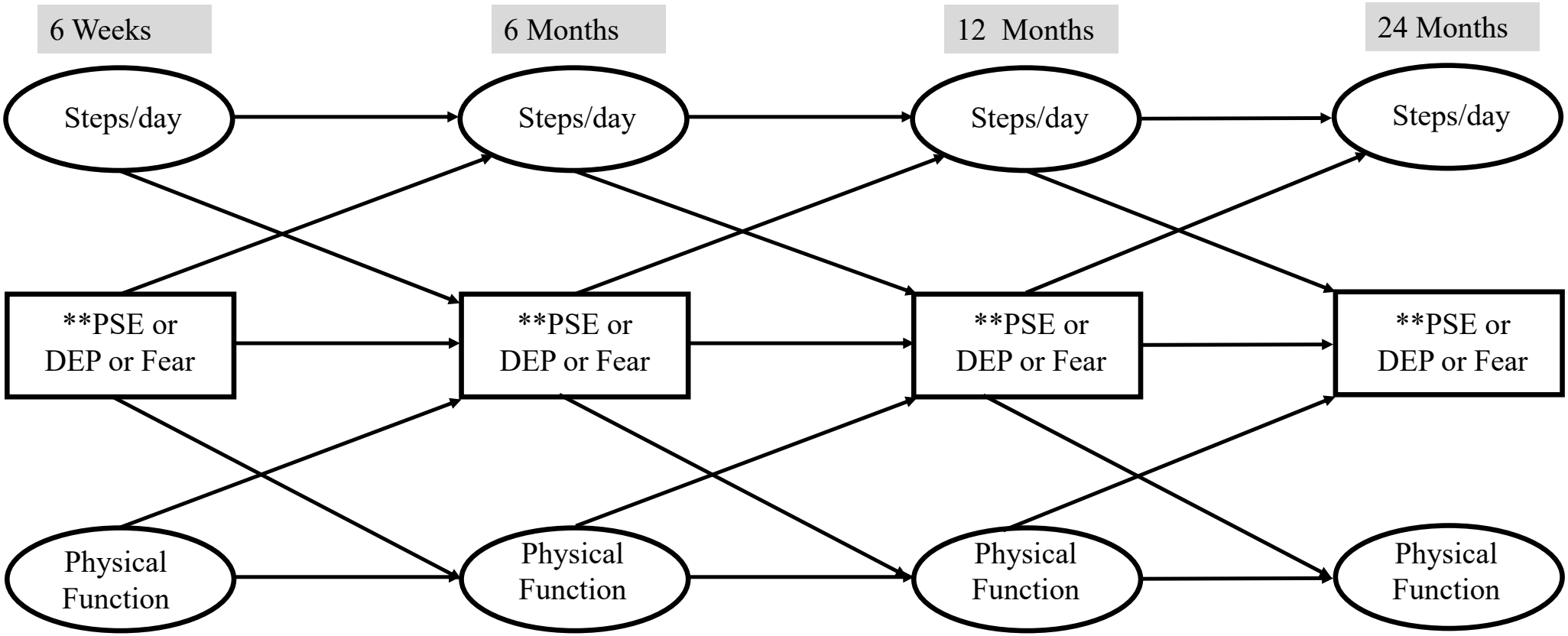
Methods

Psychosocial factors

- Pain self-efficacy (PSE) - 10-item Pain Self-Efficacy Questionnaire
- Depression (DEP) -Patient Health Questionnaire-9
- Fear of movement (Fear) - 13-item Tampa Scale for Kinesiophobia

Figure: Structural equation model for postoperative recovery after lumbar spine surgery



PSE = Pain self-efficacy; Dep = Depressive symptoms;
*SEM models controlled for age, employment, comorbidities, prior spine surgery, and preoperative self-efficacy, depression, fear of movement, physical function, and back and leg pain;
**PSE, DEP and Fear were explored in separate SEM models

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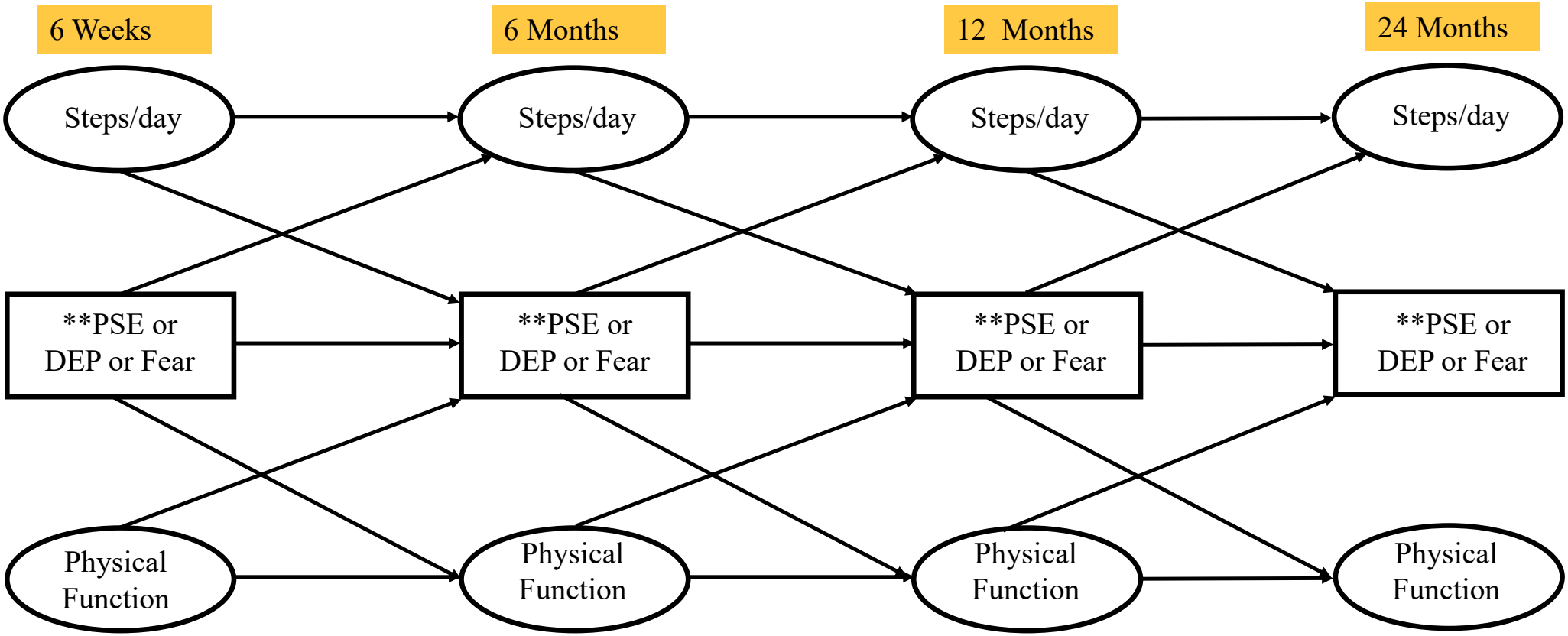
Figure: Structural equation model for postoperative recovery after lumbar spine surgery



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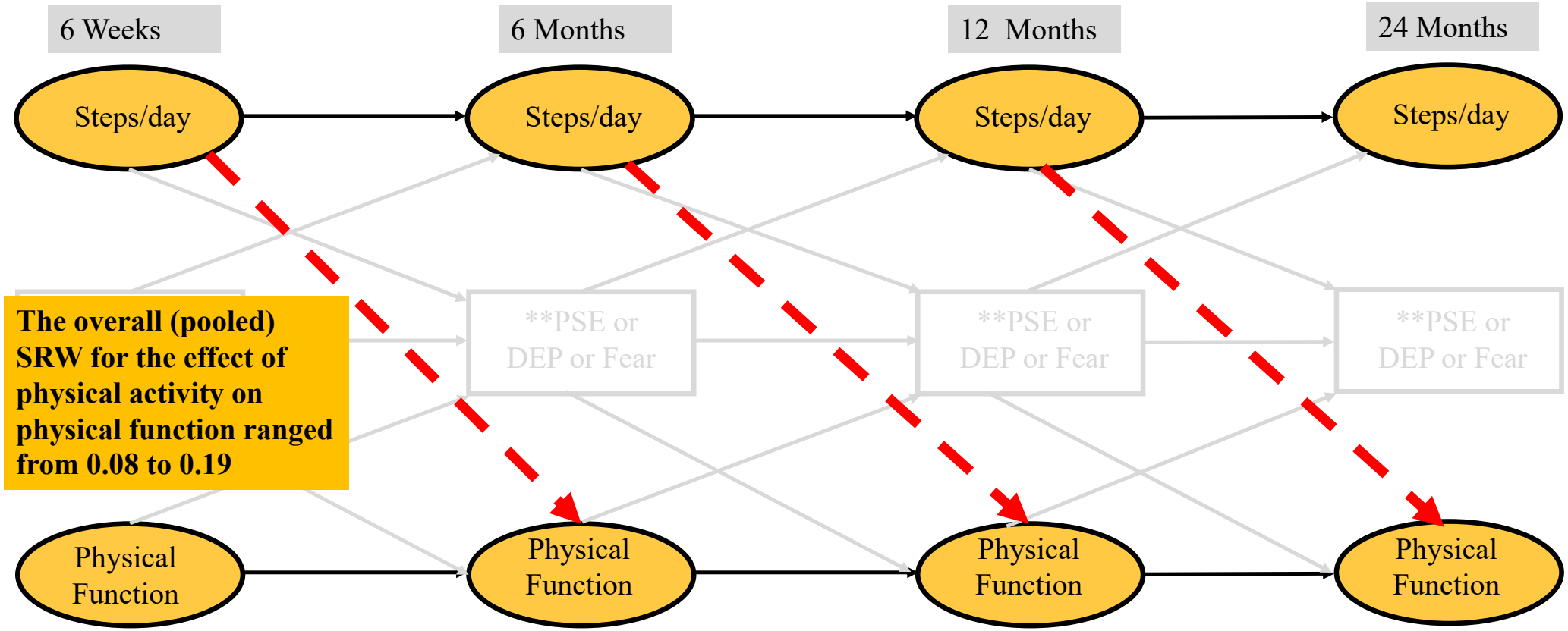
Analysis

- Missing data were handled with multiple imputation using predictive mean matching and 5 imputed datasets
- SEM model was conducted on all five imputed datasets
- Each SEM model was tested for model fit
  - All models were stable
- Standardized regression weights (SRW) and p-values were computed for each imputed dataset and pooled estimates were obtained from the five imputed datasets using Rubin's approach

Results: Structural equation model for postoperative recovery after lumbar spine surgery



The overall (pooled) SRW for the effect of physical activity on physical function ranged from 0.08 to 0.19

PA = physical activity as measured by accelerometer (average steps per day); PF = Physical function as measured by PROMIS; PSE = Pain self-efficacy; Dep = Depressive symptoms;

*SEM models controlled for age, employment, comorbidities, prior spine surgery, and preoperative self-efficacy, depression, fear of movement, physical function, and back and leg pain;

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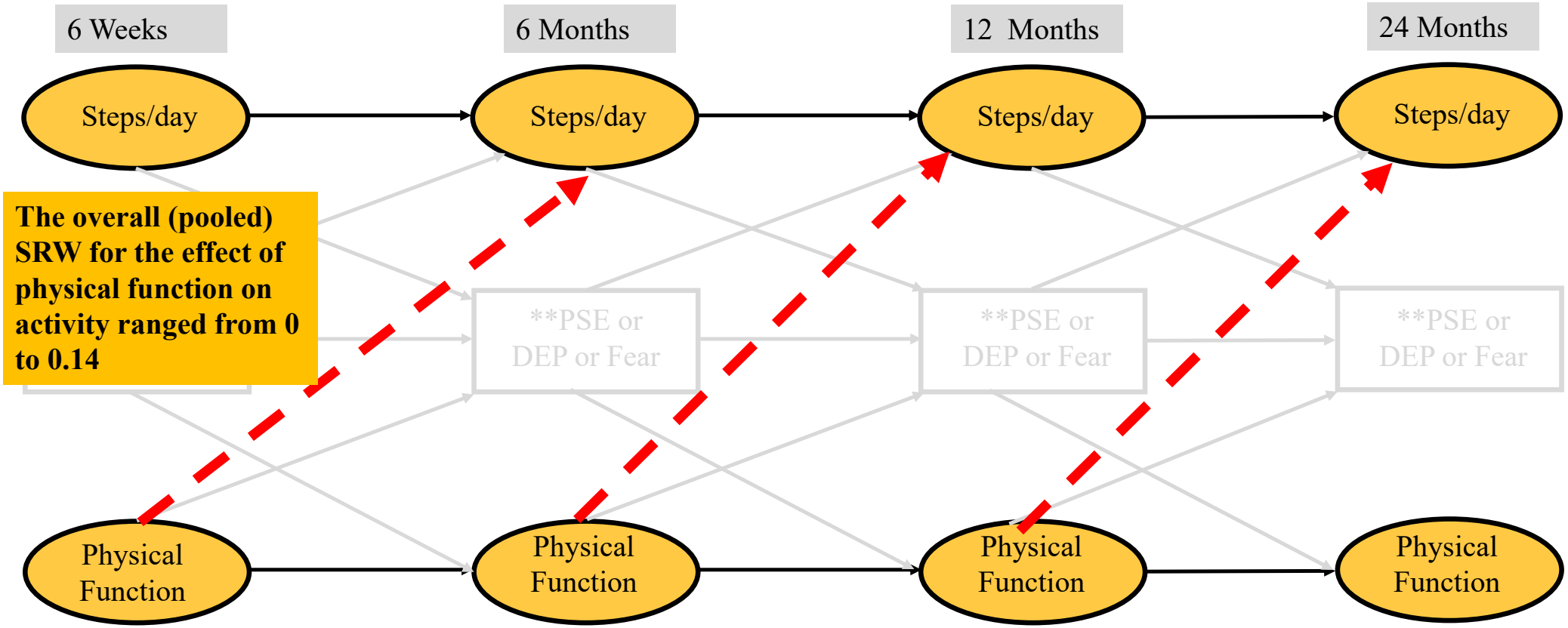

The overall (pooled) SRW for the effect of physical function on activity ranged from 0 to 0.14

PA = physical activity as measured by accelerometer (average steps per day); PF = Physical function as measured by PROMIS; PSE = Pain self-efficacy; Dep = Depressive symptoms;
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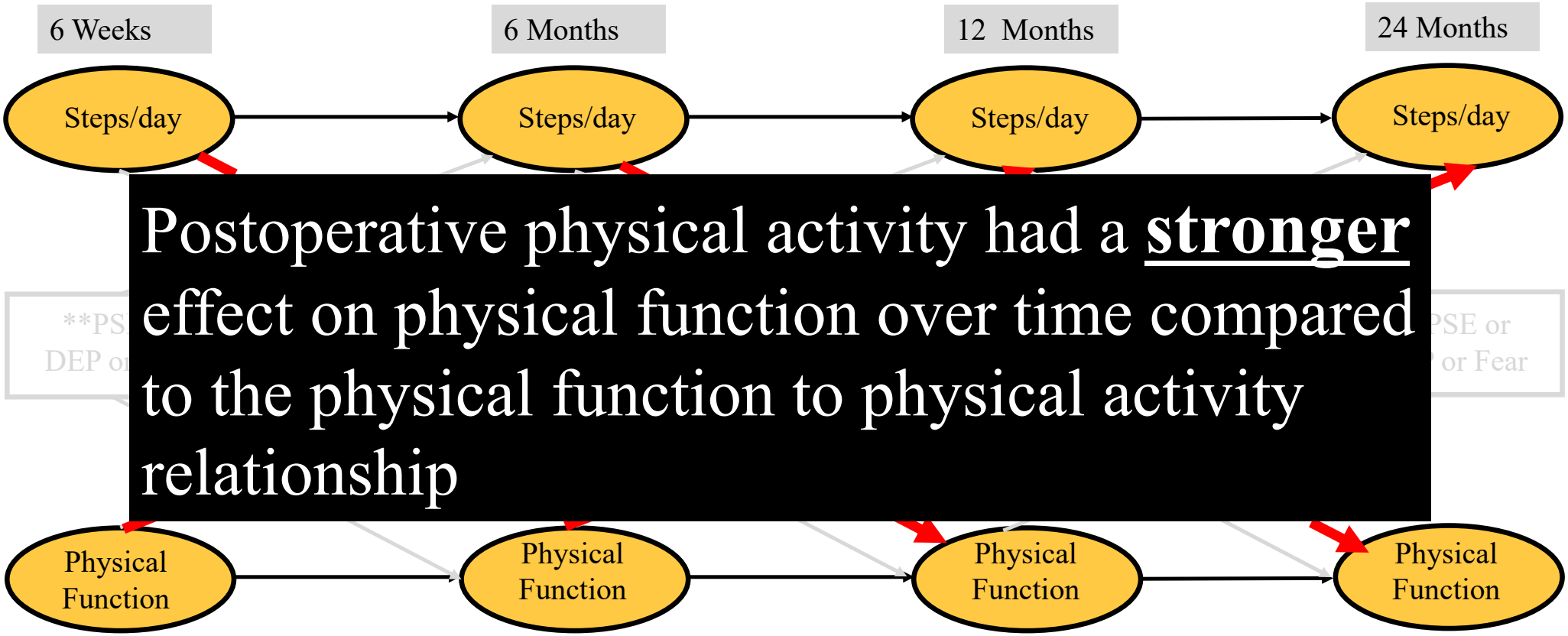
Results: Structural equation model for postoperative recovery after lumbar spine surgery



Postoperative physical activity had a **stronger** effect on physical function over time compared to the physical function to physical activity relationship

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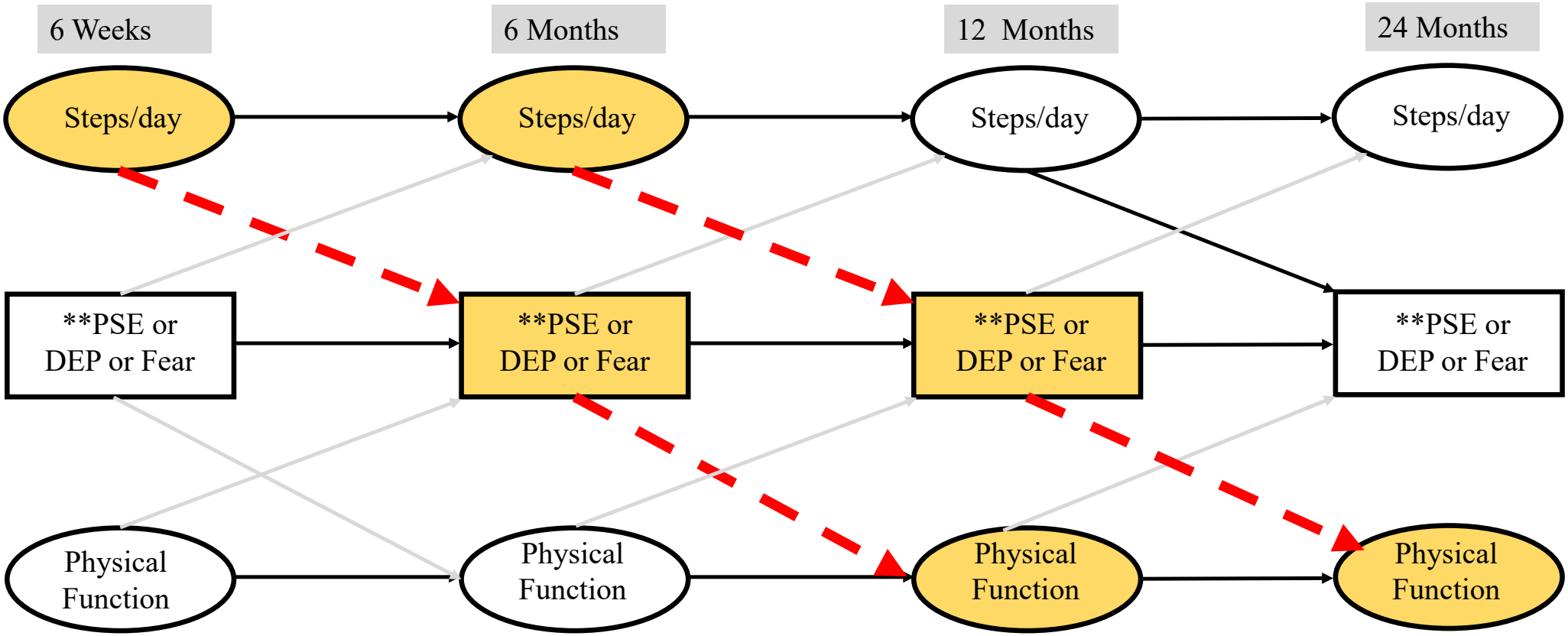

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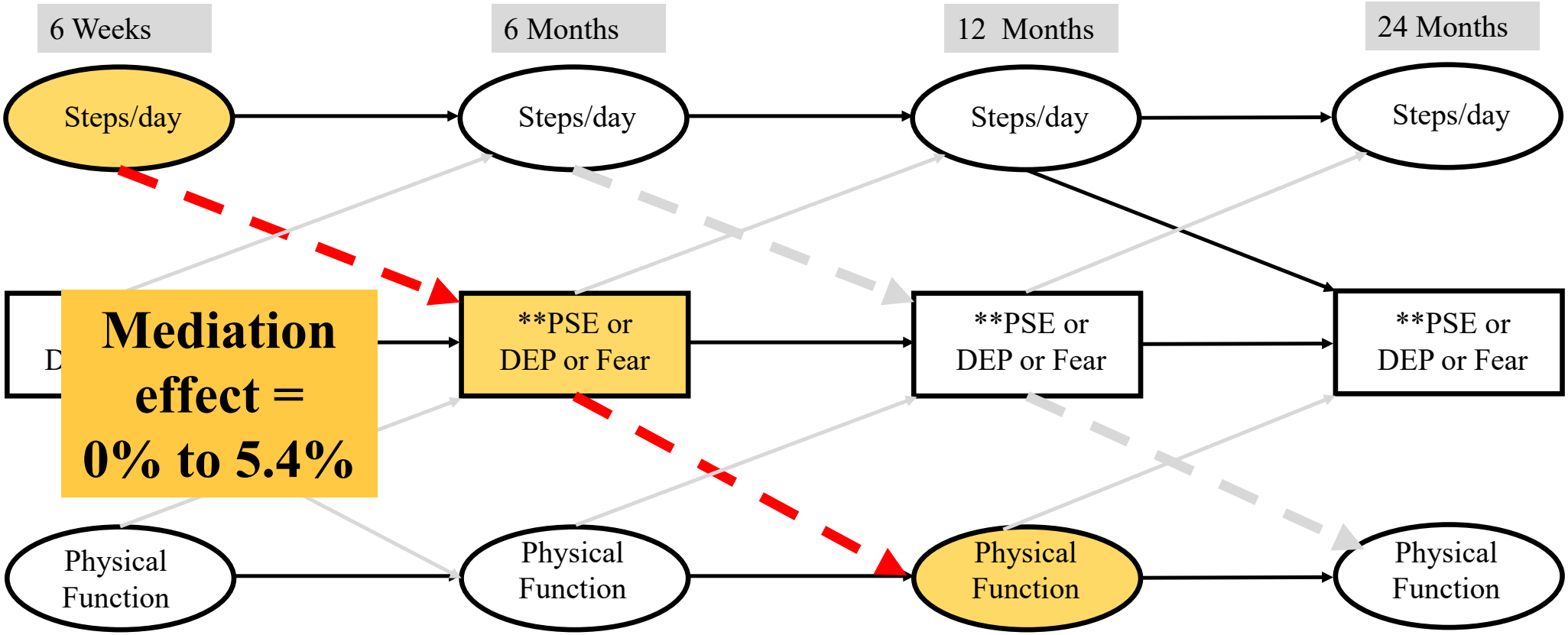
Mediators	M1	M2	M3	M4	M5	Overall	p-value	Mediation effect
Pain Self-Efficacy (PSE)								
T1PA → T3 PF	0.28	0.27	0.28	0.30	0.31	0.29	0.0001	
T1 PA → T2 PSE	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0%
T2 PSE → T3 PF	0.15	0.20	0.12	0.17	0.12	0.15	0.017	
T2 PA → T4 PF	0.24	0.19	0.23	0.25	0.29	0.24	0.0001	
T2 PA → T3 PSE	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0%
T3 PSE → T4 PF	0.13	0.16	0.14	0.20	0.16	0.15	0.0214	
Depression (Dep)								
T1 PA → T3 PF	0.28	0.26	0.30	0.29	0.29	0.28	0.0001	3.43%
T1 PA → T2 Dep	-0.09	-0.08	-0.09	-0.07	-0.09	-0.08	0.108	
T2 Dep → T3 PF	-0.12	-0.19	-0.12	-0.10	-0.09	-0.12	0.0266	
T2 PA → T4 PF	0.24	0.18	0.24	0.21	0.24	0.22	0.0001	
T2 PA → T3 Dep	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0%
T3 Dep → T4 PF	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	
Fear of Movement (Fear)								
T1 PA → T3 PF	0.28	0.27	0.28	0.30	0.32	0.29	0.0001	5.38%
T1 PA → T2 Fear	-0.12	-0.14	-0.11	-0.13	-0.13	-0.12	0.0092	
T2 Fear → T3 PF	-0.13	-0.12	-0.11	-0.15	-0.13	-0.13	0.0104	
T2 PA → T4 PF	0.23	0.18	0.23	0.22	0.27	0.22	0.0001	
T2 PA → T3 Fear	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0%
T3 Fear → T4 PF	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	

Figure: Structural equation model for postoperative recovery after lumbar spine surgery



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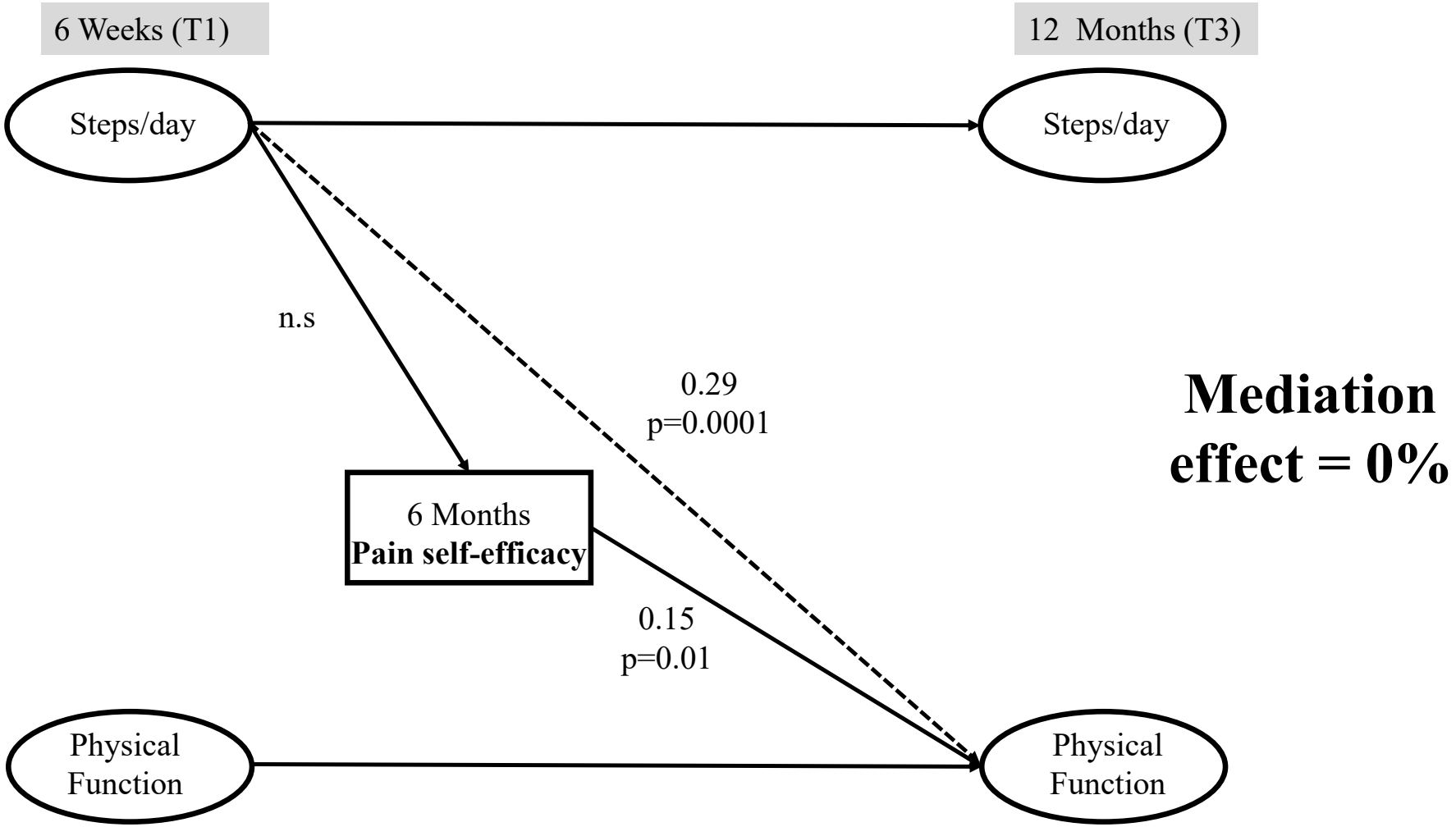

Mediation effect = 0%

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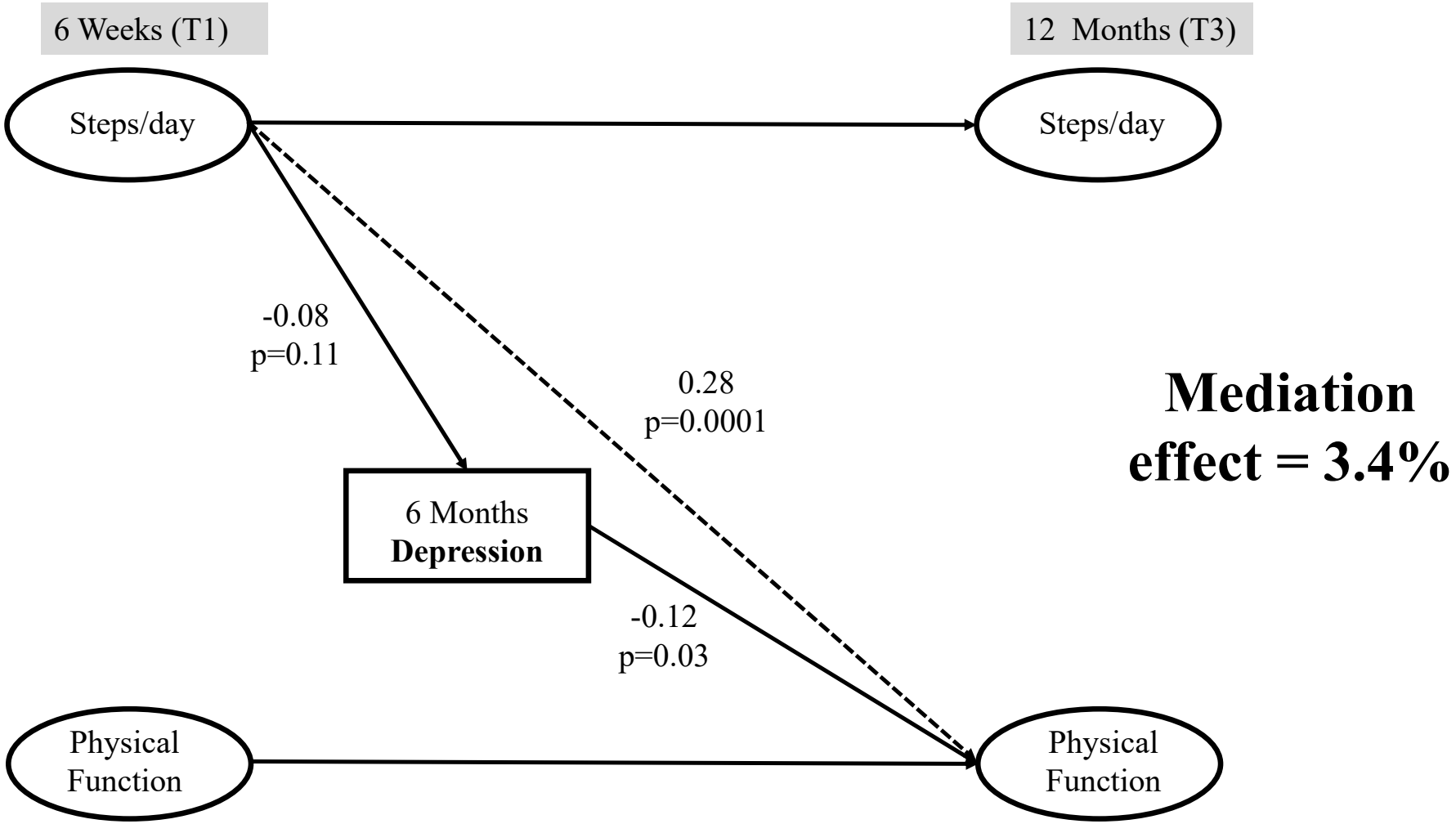

Mediation effect = 3.4%

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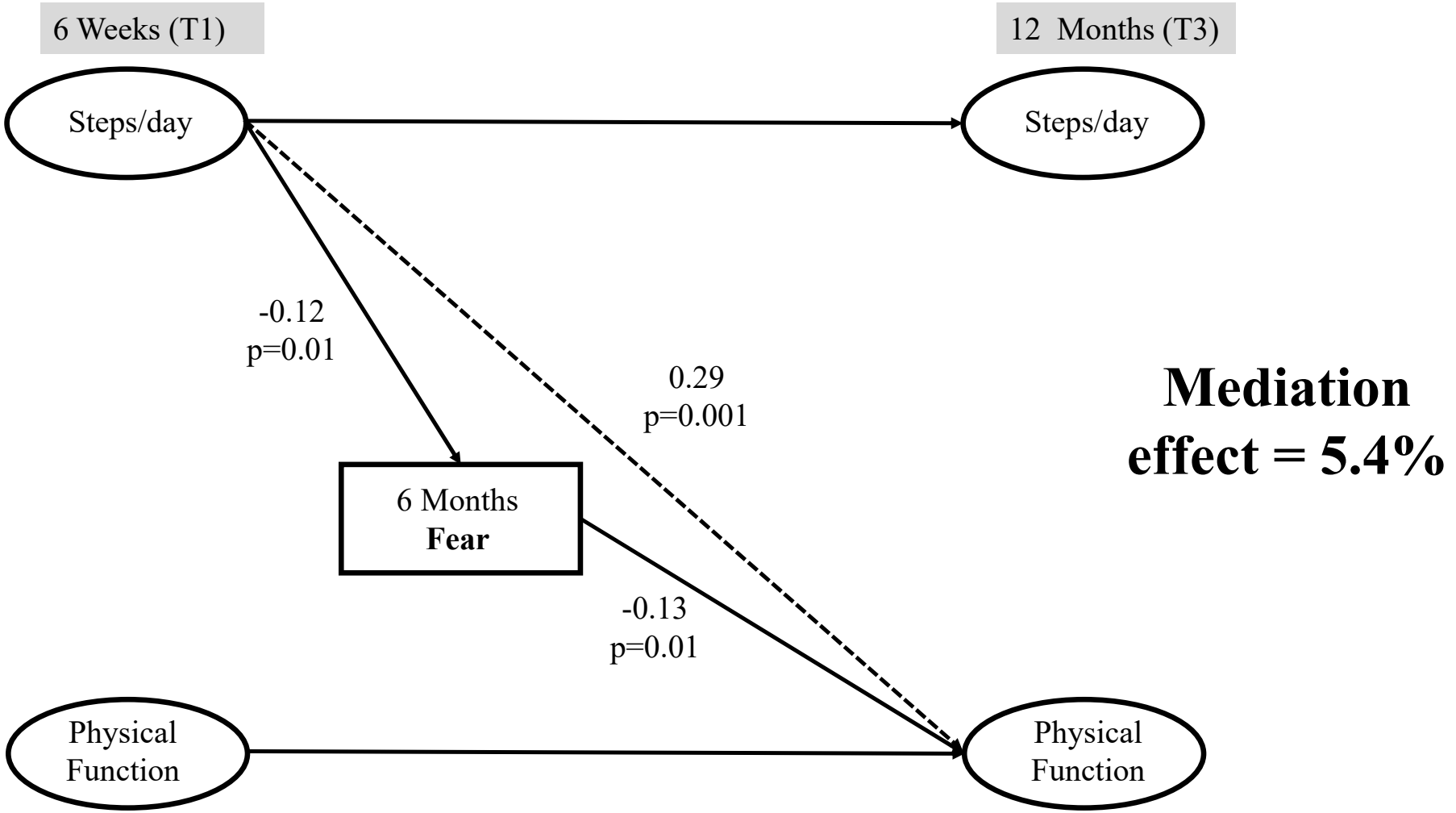
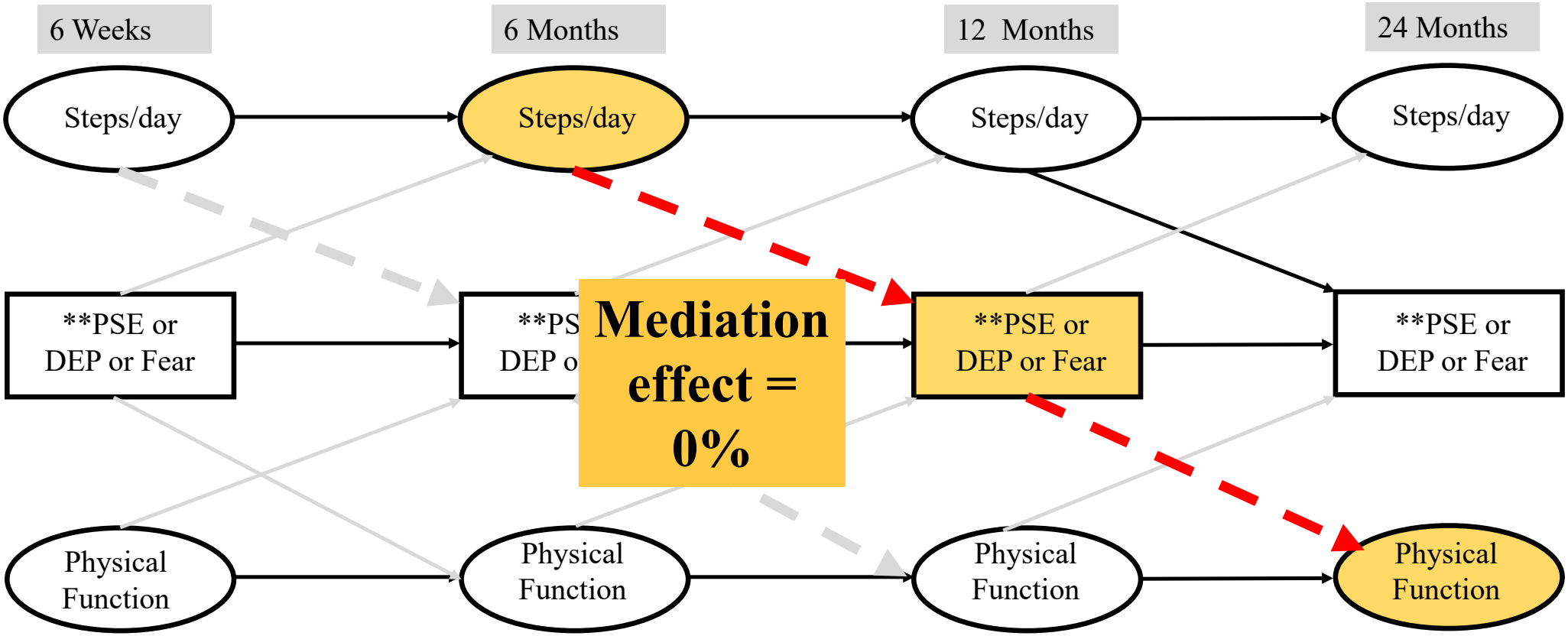


Results: Structural equation model for postoperative recovery after lumbar spine surgery



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Clinical take home messages

- Relationship between physical activity and physical function is stronger than the relationship of function to activity
- Depression and fear of movement at 6-months mediated 3% to 5 % effect of steps per day at 6-weeks on physical function at 12-month
- Future research is needed to examine whether promoting physical activity during the early postoperative period may result in improvement of long-term physical function
- Future work is needed to investigate other potential mediating factors such as pain catastrophizing and exercise self-efficacy

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Thank you

Contact

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