Supplemental files for „Dose-response relationship and effect modifier of stabilisation exercises in non-specific low back pain: a project-wide individual patient data re-analysis on 1,483 intervention participants“

1. Supplemental file 1:

Details on the prospective meta-analysis

(cited from Niederer D, Engel T, Vogt L, Arampatzis A, Banzer W, Beck H, Moreno Catalá M, Brenner-Fliesser M, Güthoff C, Haag T, Hönning A, Pfeifer A-C, Platen P, Schiltenwolf M, Schneider C, Trompeter K, Wippert P-M, Mayer F. Motor Control Stabilisation Exercise for Patients with Non-Specific Low Back Pain: A Prospective Meta-Analysis with Multilevel Meta-Regressions on Intervention Effects. Journal of clinical medicine 2020;9(9); page 2 & page 3):

“In prospective meta-analyses, individual studies are evaluated and determined to be eligible before the results of any of the studies are published [13]. This can be afforded by a systematic search in clinical trial registries for planned and ongoing studies with following contacts to the corresponding authors [14], or, as in the present analysis, by pooling collectively planned ongoing studies from a network, before the results of the individual studies are known [13]. In both, pooled data from concurrently conducted clinical trials are published prospectively. Rigorous meta-analyses undertaken according to the corresponding principles was shown to lead to more reliable evidence than retrospective meta-analysis [11,12].

This analysis adopts a prospective meta-analysis and sensitivity meta-regression design. The patient's, study's and training's characteristics are considered potential predictors of the pooled effect size. The studies and analyses were performed within the MiSpEx Network (Medicine in Spine Exercise – network [17]). The statistical strategy for the meta-analysis has been previously published [18]. We followed the relevant (inter alia Cochrane) recommendations for prospective meta-analyses [11–13] when conducting this analysis.

Overall, the results from two major multicentre studies (MCS 1 and MCS 2) with a total of 11 (five and six, respectively) study sites with individual randomisation lists and two smaller, single centre studies (SCS 1 and SCS 2) were pooled. A total of 13 study parts consisting of 18 arms were included in the analyses.”

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12. Egan, M.; Seeger, D.; Schöps, P. Physiotherapie und physikalische Therapie in der Schmerzmedizin. Schmerz 2015, 29, 562–568. [

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14. Margiti´c, S.E.; Morgan, T.M.; Sager, M.A.; Furberg, C.D. Lessons learned from a prospective meta-analysis.J. Am. Geriatr. Soc. 1995, 43, 435–439.

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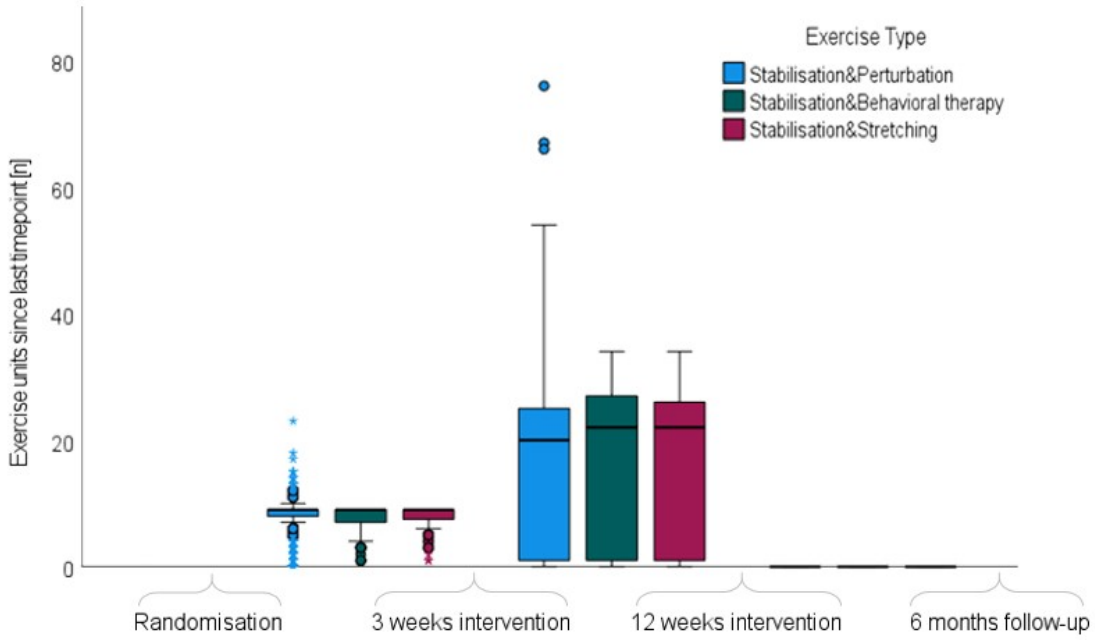
2. Supplemental file 2: Table S1: Interventional exercises details. For each exercise, level (1-12), surface (stable/instable) and description are provided.

Exercise 1: quadrupedal/all-fours stability		**Exercise 2: deadlift/rowing**		**Exercise 3: double leg – single leg heel-pad-stance**		**Exercise 4: side planks**	
Stable ground	**Instable ground**	**Stable ground**	**Instable ground**	**Stable ground**	**Instable ground**	**Stable ground**	**Instable ground**
1. Hand and knee-stance: Bending, stretching a leg **2**. Hand and knee-stance diagonal arm and leg: from body centre upwards (horizontal) **4**. Hand and feet stance: Bending, stretching a leg	**3**. Hand and knee-stance diagonal arm and leg: from body centre upwards (horizontal) **5**. Hand and feet stance: Bending, stretching a leg **6**. Hand and feet-stance: diagonal arm and leg: from body centre upwards (horizontal) **7**. Hand and feet-stance: release arm, trunk rotation **8**. planks: leg horizontal **9**. planks: diagonal leave arm and leg **10**. planks: leave arm , rotate trunk **11**.. planks: leave arm and diagonal leg, , rotate trunk **12**.press-up: leave arm	**1**. rowing plus additional weight **3**. rowing in ball stance plus additional weight **5**. one handed rowing plus additional weight **6**. one handed rowing plus additional weight In ball stance **9**. one handed rowing plus additional weight in single leg stance **10**. one handed rowing plus additional weight In single leg ball stance	**2**. rowing plus additional weight **4**. rowing in ball stance plus additional weight **7**. one handed rowing plus additional weight **8**. one handed rowing plus additional weight In ball stance **11**. one handed rowing plus additional weight In single leg stance **12**. one handed rowing plus additional weight In single leg ball stance	**1**.bipedal: heel-pad-stance **3**.unipedal stance plus hip abduction **4**. unipedal stance plus hip abduction and leg extension **6**. unipedal ball stance plus hip abduction and leg extension **10**.unipedal squat **11**. unipedal squat plus additional weight	**2**. bipedal: heel-pad-stance **5**. unipedal stance plus hip abduction and leg extension **7**. unipedal ball stance plus hip abduction and leg extension **8**.Squat in ball stance **9**. Squat in ball stance and hip bending **12**. Squat in ball stance with additional weight	**1**.knee on ground; hip released from ground **2**. knee on ground; hip stable **3**. knee on ground; hip up/down **5**.legs stretched, hip fixed upwards **8**. legs stretched, release leg from ground **10**. legs stretched, release leg and diagonal arm from ground: horizontal-contact **12**. legs stretched, hip upwards, release leg and diagonal arm from ground: horizontal-contact	**4**. knee on ground; hip up/down **6**. legs stretched, hip fixed upwards **7**. legs stretched, hip up/down **9**. legs stretched, release leg from ground **11**. legs stretched, release leg and diagonal arm from ground: horizontal-contact

The level (and the number and type of self-initiated additional motor tasks perturbation and additional weight) for each of the four exercises is determined by an experienced therapist at the beginning of the intervention for all subjects in the intervention group. The therapist in charge rates the participants' performance accuracy at level one and derives a starting level. Performance accuracy is thereby standardized rated based on the axis and plane alignment (extremities, trunk) during motion, movement goal (endpoint) accuracy and no loss of balance during motion or single movements order. The starting level is defined as the highest level in which this accuracy can be reached. This level (incl. the number and type of self-initiated additional motor tasks and additional weight) is further adaptive and may be corrected in both direction (increase or even decrease in level) continuously by the therapist during centre-based phase. The goal for the intervention was to increment by one level once a week until the maximum level 12 is reached

3. Supplemental file 3: Figure S1

Figure S1: exercise dose (displayed as number of trainings) during the 6-month duration, separated by the type of intervention., The exercise amount is displayed as medians, interquartile ranges, whisker bars and outliers.



4. Supplemental file 4: Table S2: Detailed mixed models outcomes:

Detailed outcomes of the linear mixed models on the dose-response relationship of the stabilisation exercises on pain, disability and disability days. For each outcome, a simple dose (type, duration, frequency) response model and a more complex model including the further effect modifiers are displayed. The fixed effects are depicted at the top of the table, whilst the random effects (slope, intercept, for the intervention duration) are depicted below. Bold letters indicate significant contributors.

	CHARACTERISTIC PAIN INTENSITY					DISABILITY					DISABILITY DAYS				
Part A: Estimates of fixed effects	Estimate	Standard error	p-value	95% Confidence interval		Estimate	Standard error	p-value	95% Confidence interval		Estimate	Standard error	p-value	95% Confidence interval	
				Lower level	Upper level				Lower level	Upper level				Lower level	Upper level
Dose-response without effect modifiers and covariates															
Intercept	5.50	1.08	0.001	3.39	7.62	0.997	1.017	0.327	-1.00	2.99	0.24	0.12	0.04	0.01	0.48
Intervention duration: **3 weeks**	**-7.42**	**0.59**	**0.001**	**-8.58**	**-6.25**	**-7.234**	**0.569**	**0.001**	**-8.35**	**-6.12**	**-0.65**	**0.07**	**0.001**	**-0.79**	**-0.52**
12 weeks	**-2.96**	**0.70**	**0.001**	**-4.33**	**-1.59**	**-2.028**	**0.702**	**0.004**	**-3.41**	**-0.65**	**-0.23**	**0.08**	**0.001**	**-0.39**	**-0.07**
6 months	reference														
Type of intervention: Stabilisation & perturbation	**-3.07**	**0.75**	**0.001**	**-4.53**	**-1.60**	**-1.681**	**0.692**	**0.015**	**-3.04**	**-0.32**	-0.14	0.08	0.10	-0.30	0.03
Stabilisation & behavioural	0.40	0.94	0.668	-1.45	2.26	-1.187	0.884	0.18	-2.92	0.55	-0.09	0.11	0.37	-0.30	0.11
Stabilisation & stretching	reference														
Exercise frequency [week^{-1}]	**-0.93**	**0.31**	**0.003**	**-1.54**	**-0.32**	-0.093	0.293	0.75	-0.67	0.48	**-0.07**	**0.04**	**0.04**	**-0.14**	**0.00**
Dose-response with effect modifiers and covariates															
Intercept	11.81	3.67	0.002	4.54	19.09	6.031	3.618	0.098	-1.13	13.19	0.53	0.41	0.20	-0.27	1.33
Intervention duration: **3 weeks**	**-7.35**	**0.60**	**0.001**	**-8.54**	**-6.17**	**-7.253**	**0.57**	**0.001**	**-8.37**	**-6.13**	**-0.66**	**0.07**	**0.001**	**-0.80**	**-0.52**
12 weeks	**-2.82**	**0.71**	**0.001**	**-4.20**	**-1.43**	**-2.261**	**0.681**	**0.001**	**-3.60**	**-0.93**	**-0.26**	**0.08**	**0.001**	**-0.42**	**-0.10**
6 months	reference														
Type of intervention: **Stabilisation & perturbation**	**-3.03**	**0.93**	**0.002**	**-4.88**	**-1.17**	-1.051	0.938	0.264	-2.91	0.81	-0.05	0.11	0.65	-0.26	0.16
Stabilisation & behavioural	-0.31	0.95	0.744	-2.21	1.58	-1.321	0.954	0.169	-3.21	0.57	-0.16	0.11	0.14	-0.37	0.05
Stabilisation & stretching	reference														
Exercise frequency [week^{-1}]	**-0.71**	**0.32**	**0.025**	**-1.34**	**-0.09**	0.014	0.314	0.964	-0.60	0.63	**-0.07**	**0.04**	**0.06**	**-0.14**	**0.00**
Baseline pain grade [0 to 4]	**-3.48**	**0.35**	**0.001**	**-4.18**	**-2.79**	**-4.243**	**0.348**	**0.001**	**-4.93**	**-3.55**	**-0.45**	**0.04**	**0.001**	**-0.53**	**-0.38**
Age [years]	0.03	0.02	0.083	0.00	0.07	0.024	0.019	0.197	-0.01	0.06	0.00	0.00	0.04	0.00	0.01
Blue / white collar worker	0.33	0.89	0.710	-1.44	2.10	-0.681	0.877	0.44	-2.42	1.06	0.04	0.10	0.71	-0.16	0.23
Exercise total [minutes/week]	-0.001	0.001	0.411	-0.002	0.001	8E-04	7E-04	0.252	0.00	0.00	0.00	0.00	0.99	0.00	0.00
Postural control [mm]	<0.01	<0.01	0.747	<0.01	<0.01	-0.003	0.004	0.392	-0.01	<0.01	<0.01	<0.01	0.26	<0.01	<0.01
Depression [HADS]	**0.33**	**0.15**	**0.026**	**0.04**	**0.61**	0.239	0.144	0.096	-0.04	0.52	0.02	0.02	0.14	-0.01	0.06
Anxiety [HADS]	-0.02	0.13	0.874	-0.28	0.24	-0.062	0.131	0.636	-0.32	0.20	0.00	0.01	0.76	-0.03	0.02
Perceived social support [BSSS]	-1.13	0.74	0.128	-2.59	0.33	-0.056	0.723	0.939	-1.49	1.37	0.00	0.08	0.96	-0.16	0.17
Painkiller intake (no / yes)	0.99	0.61	0.102	-0.20	2.19	0.221	0.594	0.71	-0.95	1.39	**-0.12**	**0.07**	**0.08**	**-0.26**	**0.01**
Part B: Estimates of covariance parameters															

UN (1.1)	18.6	13.2				21.84	13.25				0.447	0.172			
UN (2.1)	20.0	11.0				13.02	8.933				-0.003	0.144			
UN (2.2)	71.7	0.00				63.8	0				1.012	0			
UN (3.1)	-24.9	10.9				-34	9.003				-0.5	0.144			
UN (3.2)	-1.4	0.00				-3.683	0				-0.221	0			
UN (3.3)	75.1	0.00				65.45	0				1.005	0			
UN (4.1)	-15.9	0.00				-9.11	0				-0.298	0			
UN (4.2)	-7.7	0.00				-3.801	0				-0.13	0			
UN (4.3)	-16.5	0.00				-6.645	0				-0.202	0			
UN (4.4)	78.0	0.00				65.56	0				1.022	0			