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Original article

The Timed Up & Go test in pregnant women with pelvic girdle pain compared to asymptomatic pregnant and non-pregnant women

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ABSTRACT

Background: The Timed Up and Go (TUG) test, a standardized functional mobility test, has been proposed as a physical performance-based measure in pregnant women with pelvic girdle pain (PGP).
Objectives: This cross-sectional study aimed to investigate physical function by the use of TUG in pregnant women with PGP compared to asymptomatic pregnant and non-pregnant women, and to identify factors associated with increased TUG.
Methods: In total, 25 pregnant women with PGP, 24 asymptomatic pregnant and 25 asymptomatic non-pregnant women participated. One-way analysis of variance was used to explore difference in TUG between the groups and multiple linear regression analyses to explore associations between TUG and potential explanatory variables.
Results: The time on TUG varied among pregnant women with PGP, and was significantly higher (mean (95% CI) 6.9 (6.5, 7.3) seconds) than for asymptomatic pregnant (5.8 (5.5, 6.0), $p < 0.001$) and non-pregnant (5.5 (5.4, 5.6), $p < 0.001$) women. In the total study sample, group, increased BMI and sick leave were significantly associated with increased TUG (p-values ≤ 0.02). In pregnant women with PGP, pain intensity was the only significant clinical factor associated with increased TUG ($p = 0.002$).
Conclusion: Pregnant women with PGP used longer time and showed larger variation in TUG than asymptomatic pregnant and non-pregnant women, this underpins that TUG targets activities relevant to PGP. Our results provide new knowledge about factors influencing TUG time. Importantly, multivariable analyses suggest that pain intensity should be considered when interpreting TUG time in pregnant women with PGP.

1. Introduction

Pelvic girdle pain (PGP) is common during pregnancy (Robinson et al., 2010b; Gutke et al., 2017), and limits daily activities, work capacity and quality of life (Olsson and Nilsson Wilkmar, 2004; Robinson et al., 2006). As pregnant women with PGP report weight-bearing activities, particularly walking, to be their main disability (Stuge et al., 2011), physical function i.e. the ability to perform daily activities (Terwee et al., 2006a) is a core issue in the clinical evaluation of these women. Commonly, self-reported and performance-based instruments capture complementary aspects of physical function (Guildford et al., 2017). Only the active straight leg raise (ASLR) test, assumed to assess pelvic load transfer by self-reported impairment of leg lift (Mens et al., 2001), has previously been recommended to evaluate function in PGP patients (Vleeming et al., 2008). Later, the self-reported Pelvic Girdle Questionnaire (PGQ) including activities, participation and bodily symptoms was developed (Stuge et al., 2011). However, both the ASLR and PGQ capture the patient's perception of their performance or condition. As self-reported functioning is not always indicative of the actual performance (Terwee et al., 2006b), performance-based measures assist in determining the extent of disability.

Recently, Evensen and colleagues (2015, 2016) proposed the Timed Up and Go (TUG) test (Podsiadlo and Richardson, 1991) undertaken at maximum speed as a reliable and valid weight-bearing physical performance-based measure for pregnant women with PGP. The TUG is a standardized, timed, functional mobility test (Podsiadlo and

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Table 1
Description of the inclusion and exclusion criteria for the pregnant women with pelvic girdle pain (PGP) and asymptomatic pregnant and non-pregnant women.

	Pregnant with PGP (n = 25)	Asymptomatic pregnant (n = 24)	Asymptomatic non-pregnant (n = 25)
Inclusion			
	Posterior pelvic pain[a] with onset in current pregnancy	No posterior pelvic pain, or pubic symphysis pain during the last 6 months, that had led to disability or sick leave	
	ASLR[b] score > 0	ASRL score = 0	
	Positive P4[c] unilateral or bilateral	Negative P4	
	Pregnant ≤ 26 gestation week		Not pregnant > 6 months since last pregnancy
Exclusion			
	Current multiple gestation		
	Any risk pregnancy as determined by midwife		
	Low back pain during the last 6 months, that had led to disability or sick leave		
	Surgery in the pelvis, back or abdomen during the last 6 months		
	Any former surgery in the lower extremities		
	Any former traumatic head injury		
	Any neurological or inflammatory systemic diseases (e.g., multiple sclerosis, rheumatoid arthritis, ankylosing spondylitis)		
	Positive Slumps test indicating symptoms referred from the lumbar spine		

[a] Posterior pelvic pain defined as unilateral or bilateral pain in the area between the crista iliaca and the gluteal folds.
[b] ASLR, active straight leg raise test.
[c] P4, posterior pelvic pain provocation test.

Richardson, 1991), requiring the patient to stand up from a chair, walk 3 m, turn, walk back and sit down again. As the TUG targets core activities commonly limited in pregnant women with PGP, TUG time is presumably increased in these women. However, a large fraction of asymptomatic pregnant women report disability (Robinson et al., 2010a) and walk slower than non-pregnant women (McCrory et al., 2011; Bertuit et al., 2015), implying that pregnancy in itself limits physical function. Hence, it is relevant to investigate whether TUG differs in pregnant women with PGP, asymptomatic pregnant and non-pregnant women.

Measurement of physical function is complex as it contains multi-dimensional constructs (Terwee et al., 2006a) and no gold standard for its assessment exists (Dobson et al., 2012). Evensen et al. (2016) found a strong correlation between TUG and ASLR in pregnant women with PGP. In other populations, increased TUG time has been associated with multiple factors such as pain (Kwan et al., 2011), increased body mass index (BMI), decreased mental health (Kear et al., 2017) and lower education levels (Gomes Gde et al., 2015). Hence, it seems important to investigate the TUG further and identify whether other factors influence TUG in pregnant women. This may facilitate TUG's clinical utility as a measure of physical function in this population. Clinical variables, psychological factors and personal characteristics (e.g. BMI) could be of relevance.

The primary aim of this study was to explore physical function in pregnant women with PGP, by the use of TUG. Further, to identify potential factors associated with increased TUG time. We hypothesized that pregnant women with PGP would demonstrate reduced function, i.e. increased TUG time, compared with asymptomatic pregnant and non-pregnant women, and that increased TUG time would be associated with higher ASLR scores and increased pain intensity.

2. Methods

2.1. Participants and procedures

Commonly, women in Norway seek maternity care units (MCU) for health services during pregnancy. In this cross-sectional study, pregnant women with PGP were recruited by midwifes at MCUs, one hospital and from women treated by physiotherapists and chiropractors. Asymptomatic pregnant and non-pregnant women were recruited through MCUs, participants, colleagues and advertisement on websites. All were recruited from around Oslo, aged 18–50 years and with Norwegian language proficiency. We matched participants on age (± 4 years) and pregnant women on gestational week (± 4 weeks). Pregnant women with no-risk pregnancy were included before gestation week 27. Pregnant women with PGP should have posterior pelvic pain between the crista iliaca and the gluteal folds (Vleeming et al., 2008) with onset in current pregnancy, and have a positive posterior pelvic pain provocation (P4) test (Ostgaard et al., 1994) and an ASLR score > 0 (Mens et al., 2012) on clinical examination. Asymptomatic pregnant and non-pregnant women should have no pelvic pain during the last 6 months and have negative results on the clinical tests. Exclusion criteria are presented in Table 1. One researcher (LC) performed all clinical examinations.

Data was collected during 2016. Eligibility to participation was determined through a semi-structured telephone interview. Out of 202 interviewed women, 93 were scheduled for testing and 83 attended (Fig. 1). In total 74 women who met the inclusion criteria completed one assessment.

The 25 pregnant women with pelvic girdle pain (PGP) had a positive active straight leg raise (ASLR) score above 0, a positive posterior pelvic pain provocation (P4) test and a pain drawing with posterior pelvic pain. The 24 asymptomatic pregnant and the 25 asymptomatic non-pregnant women had both negative ALSR and P4 tests, as well as no reported posterior pelvic pain.

As this study was part of a larger biomechanical study, the researchers were not blinded due to practical issues. The Regional Committee for Medical and Health Research Ethics in Norway approved the study (2013/2312). All women gave written informed consent prior to inclusion.

2.2. TUG

The TUG was performed in a large room with a linoleum floor. Participants wore sneakers and could use walking aids if needed. A demonstration was given and one practice trial was allowed. Time was recorded by a SPORTX PRO 30 Lap Stopwatch (Wenaas Nordic AS, Norway). All participants performed the TUG from a chair (height: 46 cm) with back-support and armrests. A 3-m walkway was marked using two white parallel lines on the floor. This reliable and valid TUG variant (Evensen et al., 2015, 2016) included a standardized instruction, asking participants to walk as fast as they could, and a timing protocol.

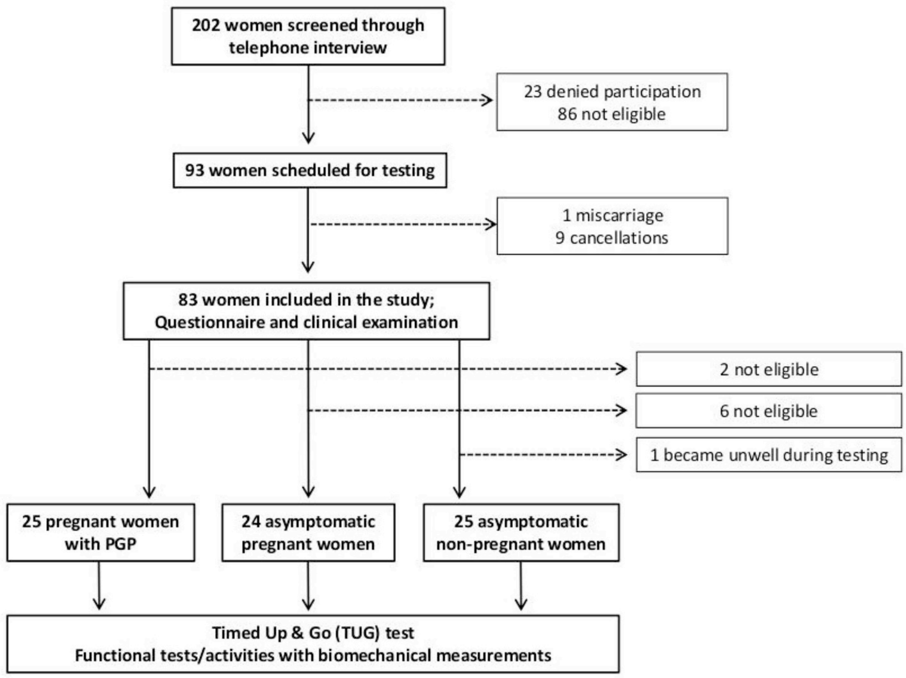

Fig. 1. Flow diagram of the study.

2.3. Questionnaires

Prior to performing the TUG, all participants filled out an online questionnaire recording variables such as age, marital status (married/partner, single), education (≤ 4 and > 4 years at university), gestation week, exercise frequency during the last seven days (≤ 1 day/week, 2–3 days/week, almost every day) and working conditions (most of the time seated, a lot of walking, a lot of walking and lifting). For employment (full time, part time, student and sick leave) participants could answer yes or no to more than one category.

All participants completed the Hopkins Symptom Checklist-10 (SCL-10), assessing distress (symptoms of anxiety, depression and somatization). The SCL-10 consists of 10 items on a four-point scale ranging from 1 (not at all) to 4 (extremely). An average item score was calculated. A score of 1.85 or more indicates non-specific distress (Strand et al., 2003).

Women with PGP reported current pain intensity on a numeric rating scale with scores ranging from 0 (no pain) to 10 (worst pain imaginable) (Grotle et al., 2004). Fear of movement was measured by the response to one substitute question of the Tampa Scale for Kinesiophobia (Verwoerd et al., 2012): "How much "fear" do you have that your PGP would be increased by physical activity?" Scores ranged from 0 (no fear) to 10 (very much fear) (Verwoerd et al., 2012). Furthermore, we used the PGQ to assess activity limitations (20-item subscale) and symptoms (5-item subscale). Response alternatives on a four-point scale gave a total score between 0 and 75. The sum scores were converted to percentages between 0 and 100% where higher percentages indicated reduced function. Activity and symptom subscales were calculated separately (Stuge et al., 2011).

2.4. Clinical examination

All participants performed the ASLR in supine with feet approximately 20 cm apart (Mens et al., 2001). The standardized instruction was; "Lift your right/left leg 20 cm up from the bench keeping your leg straight". Participants rated the degree of difficulty from 0 (no difficulties) to 5 (impossible to lift). The score from each leg was added to a sum score (0–10). Higher score indicates more reduced function (Mens et al., 2001). To distinguish between strong and less affliction the ASLR was dichotomized based on a cut off value of 4 (Vøllestad and Stuge, 2009).

The P4 test (Ostgaard et al., 1994) was performed as previously described (Robinson et al., 2010b). Both left and right side were tested. Reproduction of familiar pain in the posterior pelvis on the provoked side was recorded (yes, no) for each side separately.

The Beighton score, consisting of 9 tests of joint laxity in peripheral joints, was used to determine general joint hypermobility (sum score 0–9) (Verhoeven et al., 1999). A sum score ≥ 5 was considered as hypermobility (van Dongen et al., 1999).

Height and weight were measured with a stadiometer and a scale, respectively and present BMI (Kg/m^2) calculated (variable named BMI). Weight gain was calculated as the difference between present weight and self-reported pre-pregnancy weight in the two pregnancy groups.

2.5. Statistical analyses

Descriptive data are presented as frequencies (percentages), means (standard deviations (SDs) or 95% confidence intervals (CIs)), or medians (min-max). Between-group differences were tested by chi-squared test or Fisher exact test for categorical variables, and by one-way analysis of variance (ANOVA) for continuous variables. Pairwise comparisons were performed using Bonferroni correction. Differences in weight gain and gestation week between the pregnancy groups were tested by Mann-Whitney test.

Simple linear regression analysis (with a 10% level of significance) and clinical considerations formed basis for the selection of explanatory variables in the multiple linear regression analyses. Associations between explanatory variables were studied using Pearson or Spearman correlation coefficients (as appropriate). Categorical variables were coded by dummy variables in the regression analysis. We performed linear regression analyses in the total study sample and in women with PGP.

Plausible interaction effects were tested. The residuals were inspected for model assumptions. Data was analyzed using SPSS (version 24, SPSS Inc., Chicago, IL), and a 5% level of significance was used.

Table 2
Characteristics and results of clinical assessment for the total sample and in pregnant women with pelvic girdle pain (PGP) and asymptomatic pregnant and non-pregnant women.

Variable	All (n = 74)	Pregnant with PGP (n = 25)	Asymptomatic pregnant (n = 24)	Asymptomatic non-pregnant (n = 25)	P-value
Age (years), mean (SD)	31.2 (3.7)	30.9 (2.2)	31.5 (3.7)	31.7 (4.1)	0.82[a]
Height (cm), mean (SD)	167.0 (6.7)	167.3 (7.0)	167.0 (7.3)	166.6 (6.2)	0.93[a]
Weight (kg), mean (SD)	66.5 (7.7)	68.7 (8.0)	67.3 (7.8)	63.4 (6.5)	0.04[a]
BMI[b] (kg/m^2), mean (SD)	23.8 (2.4)	24.5 (2.6)	24.1 (2.4)	22.8 (1.8)	0.03[a]
Weight gain[c] (kg), median (min-max)[d]	5.1 (0.04–15.9)	5.0 (0.04–11.2)	5.2 (1.7–15.9)	–	0.58[e]
Gestation week, median (min-max)[d]	23 (13–26)	23 (13–26)	23 (14–26)	–	0.90[e]
Parity (≥1 child), n (%)	23 (31.1)	11 (44.0)	4 (16.7)	8 (32.0)	0.12[f]
Ethnicity, n (%)					
Norwegian	67 (90.5)	24 (96.0)	21 (87.5)	22 (88.0)	0.62[g]
Other	7 (9.5)	1 (4.0)	3 (12.5)	3 (12.0)	
Marital status, n (%)		25 (100)	24 (100)		0.001[g]
Married/Partner	66 (89.2)			17 (68.0)	
Single	8 (10.2)			8 (32.0)	
Education, n (%)					0.12[f]
≤ 4 years higher education	32 (43.3)	15 (60.0)	9 (37.5)	8 (32.0)	
> 4 years higher education	42 (56.8)	10 (40.0)	15 (62.5)	17 (68.0)	
Employment[h] (Yes), n (%)					
Full time	65 (87.8)	20 (80.0)	23 (95.8)	22 (88.0)	0.28[g]
Part time	5 (6.8)	1 (4.0)	1 (4.2)	2 (12.0)	0.61[g]
Student	4 (5.4)	1 (4.0)	1 (4.2)	1 (4.0)	1.00[g]
Sick leave	9 (12.2)	7 (28.0)	1 (4.2)	1 (4.0)	0.02[g]
Working conditions, n (%)					
Mostly seated	48 (64.9)	9 (36.0)	20 (83.3)	19 (76.0)	0.007[g]
A lot of walking	11 (14.9)	6 (24.0)	2 (8.3)	3 (12.0)	
A lot of walking and lifting	15 (20.3)	10 (40.0)	2 (8.3)	3 (12.0)	
Exercise frequency (days), n (%)					
≤1day/week	30 (40.5)	14 (56.0)	9 (37.5)	7 (28.0)	0.12[f]
2–3 days/week	25 (33.8)	9 (36.0)	7 (29.2)	9 (36.0)	
Almost every day	19 (25.7)	2 (8.0)	8 (33.3)	9 (36.0)	
PGP in past pregnancy, n (%)					
Yes	13 (21.6)	7 (28.0)	2 (8.3)	4 (16.0)	0.25[g]
No	16 (17.6)	4 (16.0)	4 (16.7)	8 (32.0)	
No previous pregnancies	45 (60.8)	14 (56.0)	18 (75.0)	13 (52.0)	
SCL-10[i], n (%)					
< 1.85	69 (93.2)	21 (84.0)	24 (100.0)	24 (96.0)	0.12[g]
≥ 1.85	5 (6.8)	4 (16.0)		1 (4.0)	
Beighton score[j], n (%)					
< 5	66 (89.2)	24 (96.0)	19 (79.2)	23 (92.0)	0.16[g]
≥ 5	8 (10.8)	1 (4.0)	5 (20.8)	2 (8.0)	
Onset of PGP (week), mean (SD)[k]		14.9 (5.9)			
Symptom location, n (%)[k]					
Posterior pain (uni- and bilateral)		12 (48.0)			
Combined posterior and pubic symphysis pain		13 (52.0)			
Use of walking aids (Yes), n (%)[k]		3 (12.5)			
PGQ[l], mean (SD)[k]					
Activity subscale		42.6 (16.2)			
Symptom subscale		43.1 (18.2)			
Pain intensity[m] mean (SD)[j]		2.5 (1.9)			
Fear of movement[n] median, (min-max)[j]		6.5 (1–10)			
ASLR[o] score (cut off ≥ 4), n (%)[p]					
< 4		17 (68.0)			
≥ 4		8 (32.0)			
P4[q] test, n (%) [p]					
Positive unilateral		7 (28.0)			
Positive bilateral		18 (72.0)			

[a] One way analysis of variance.
[b] Present BMI, body mass index calculated from measures of weight and height on the day of testing.
[c] Weight gain calculated from measured weight and self-reported pre-pregnancy weight.
[d] n = 49.
[e] Mann Whitney test.
[f] Chi-squared test.
[g] Fisher exact test.
[h] Multiple answers were allowed.
[i] SCL-10, Hopkins Symptom Checklist – 10 items.
[j] Beighton score for general joint hypermobility.
[k] n = 24.
[l] PGQ, Pelvic Girdle Questionnaire.
[m] Pain intensity measured by numeric rating scale.
[n] Fear of movement measured by one substitute question for the Tampa Scale for Kinesiophobia.
[o] ASLR, active straight leg raise test.
[p] n = 25·
[q] P4, posterior pelvic pain provocation test.

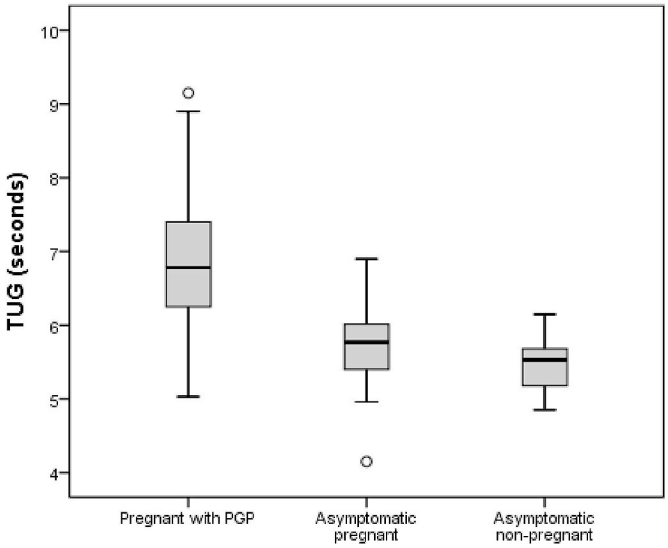

Fig. 2. Box plot of the Timed Up and Go (TUG) test for the three different groups: Pregnant women with pelvic girdle pain (PGP) (n = 25), asymptomatic pregnant women (n = 24), asymptomatic non-pregnant women (n = 25). Median, quartiles and range are shown.

3. Results

3.1. Participant characteristics

In total, 25 pregnant women with PGP, 24 asymptomatic pregnant and 25 non-pregnant women, participated in the study (Fig. 1). Weight, BMI, marital status, sick leave and working conditions were significantly different between groups (p-values ≤ 0.04) (Table 2). Post hoc analyses revealed that pregnant women with PGP had significantly higher weight (p = 0.04) and BMI (p = 0.03) than non-pregnant women, while no significant differences were found between the two pregnancy groups (p-values = 1.0). Moreover, pregnant women with PGP had higher prevalence of sick leave and working conditions with a lot of walking or walking and lifting than both asymptomatic pregnant and non-pregnant women (0.004 ≤ p ≤ 0.05). Only 9 women were on sick leave and only five participants scored ≥1.85 on the SCL-10.

The clinical variables showed large variation in pregnant women with PGP: ASLR scores ranged 1–8, pain intensity 0–7, fear of movement 1–10 and PGQ 10–73%.

3.2. TUG

TUG differed significantly between groups (p < 0.001). Pregnant women with PGP used significantly longer time (mean (95% CI) on TUG 6.9 (6.5, 7.3) seconds) than asymptomatic pregnant (5.8 (5.5, 6.0), p < 0.001) and non-pregnant (5.5 (5.4, 5.6), p < 0.001) women. No significant difference was found between asymptomatic pregnant and non-pregnant women (p = 0.62). As shown in Fig. 2 there was much larger variation in TUG among the pregnant women with PGP than for the other groups, with about 75% having higher TUG times than the slowest among non-pregnant women.

3.3. Factors associated with TUG in the total study sample

Group, sick leave, BMI and exercise frequency were significantly associated with TUG in the simple linear regression analyses of the total sample (Table 3). Group, sick leave and BMI remained significant in the multiple linear regression model (p ≤ 0.02; R^2 = 0.58) (Table 3). Univariate analyses showed weak associations between group and both BMI and sick leave (r-values = −0.30), and no significant association between BMI and sick leave (p = 0.45). Age, height, previous given birth, former low back pain, former PGP, education, working conditions and Beighton score were not significantly associated with TUG in univariate analyses (0.15 ≤ p ≤ 0.86). Gestation week was significantly associated with TUG (p = 0.001), but highly correlated with group (p = 0.01). Thus, these variables were not included in the multiple linear regression model. Gestation week showed weak associations with BMI (r = 0.31), while no significant association with sick leave (p = 0.15). Furthermore, we found no significant correlations between gestation week and BMI, pain intensity or ASLR in pregnant women with PGP ($-0.11 \le r_s \le 0.39$, 0.06 ≤ p ≤ 0.84).

In the multiple regression analysis, pregnant women with PGP had significantly increased TUG than non-pregnant women (adjusted mean difference (95% CI) between the two groups 1.05 (0.66, 1.45) seconds), while no significant difference was found between asymptomatic pregnant and non-pregnant women (0.15 (−0.22, 0.52) seconds). We found significant interaction between sick leave and BMI ($p_{interaction}$ = 0.005), with a stronger effect of BMI on TUG in women on sick leave than in women not on sick leave. Due to the low number of women on sick leave (Table 2), the model is presented without interaction (Table 3).

3.4. Factors associated with TUG in pregnant women with PGP

Based on simple linear regression analysis among pregnant women with PGP, ASLR, pain intensity and fear of movement were included in a multiple linear regression model (Table 4). Then, ASLR and fear of movement were not significantly associated with TUG (p-values ≥ 0.09) while pain intensity remained significant (p = 0.02, R^2 = 0.37).

Table 3
Simple and multiple linear regression analyses of the association between Timed Up and Go (TUG) (seconds) and potential explanatory variables (n = 74).

	Simple linear regression ß[a] (95%CI[b])	p-value	Multiple linear regression ß[a] (95%CI[b])	p-value
Group				
Asymptomatic non-pregnant	Reference	0.001	Reference	0.001
Asymptomatic pregnant	0.26 (−0.14,0.66)		0.15 (−0.22, 0.52)	
Pregnant with PGP	1.43 (1.04, 1.83)		1.05 (0.66, 1.45)	
BMI (kg/m²)	0.11 (0.03, 0.20)	0.01	0.08 (0.01, 0.15)	0.02
Sick leave				
No	Reference	0.001	Reference	0.001
Yes	1.47 (0.90, 2.04)		1.03 (0.55, 1.51)	
Exercise frequency				
≤1day/week	Reference	0.006		
2–3 days/week	−0.68 (−1.16, −0.20)			
Almost every day	−0.71 (−1.23, −0.20)			

[a] Estimated regression coefficient.
[b] CI, confidence interval. PGP, pelvic girdle pain; BMI, present body mass index.

Table 4
Simple and multiple linear regression analyses of the association between Timed Up and Go (TUG) (seconds) and potential explanatory variables. Only pregnant women with PGP (n = 24).

	Simple linear regression		Multiple linear regression	
	ß[a] (95%CI[b])	p-value	ß[a] (95%CI[b])	p-value
Pain intensity (0–10)	0.29 (0.12, 0.46)	0.002	0.29 (0.12, 0.46)	0.002
Fear of movement (0–10)	0.15 (0.05, 0.25)	0.007		
ASLR		0.001		
< 4	Reference			
≥ 4	1.62 (1.02, 2.20)			

[a] Estimated regression coefficient.
[b] CI, confidence interval. Pain intensity measured on a numeric rating scale for present pelvic girdle pain, Fear of movement measured by one substitute question for the Tampa Scale for Kinesiophobia; ASLR, active straight leg raise test.

4. Discussion

4.1. TUG

Pregnant women with PGP had larger variation and used significantly longer time on TUG, amounting 1.1 and 1.4 s compared to asymptomatic pregnant and non-pregnant women, respectively. As the expected time on TUG undertaken at maximum speed is 5–6 s in non-pregnant women aged 20–39 years (Isles et al., 2004), the present between-group differences of above 1 s constitute around 20% difference in TUG. This is presumably a clinical meaningful difference in physical function and underpins that TUG targets relevant activities in pregnant women with PGP. The TUG times in this study were comparable with previous results on TUG in pregnant women with PGP (Evensen et al., 2016). However, the paucity of studies on TUG in younger women as well as the use of different TUG variants preclude comparison with other populations. This highlights the necessity of standardized TUG protocols in future research.

Although not designed to establish normative data, this is the first study reporting values of TUG in asymptomatic pregnant women. We found no significant difference in TUG between asymptomatic pregnant and non-pregnant women. This can be seen as contradictory with previous studies reporting disability and reduced walking velocity in asymptomatic pregnant women (Robinson et al., 2010a, 2010b; McCrory et al., 2011; Bertuit et al., 2015). However, this might also reflect that TUG as a performance-based measure captures the actual performance of multiple activities (Terwee et al., 2006b).

The large variation in TUG in pregnant women with PGP was in concordance with the study of Evensen et al. (2016). The smaller variation in TUG in asymptomatic pregnant women can be considered to be in contrast to a previous study reporting large variation in disability also in asymptomatic pregnant women (Robinson et al., 2010a). This might be due to our inclusion of women in early pregnancy, suggesting that the effect of pregnancy itself had not yet developed. However, it may also reflect inherent differences between self-reported and performance-based instruments, supporting that TUG captures complementing information about physical function.

4.2. Factors associated with TUG in the total study sample

In the multivariable analyses of the total study sample, group, sick leave and BMI were significantly associated with increased TUG. As no previous studies have explored TUG in pregnant women using multivariable analyses, comparisons are limited. From a clinical perspective, it seems plausible that each of the identified variables might influence physical function. Conversely, sick leave and increased BMI might be caused by PGP or be related to gestation week. Due to the cross-sectional design, we are unable to draw causal associations. Still, neither BMI nor weight gain were significantly different between the two pregnancy groups indicating that the increase in BMI was related to pregnancy. However, there was a weak association between group and BMI, and gestation week showed weak association with BMI and no significant association with sick leave in the total study sample. There were no significant associations between gestation week and BMI, pain intensity and ASRL in the PGP group. Together, these findings support that group, sick leave and BMI independently influenced TUG in our study.

It should be noted that the variable group was predefined and included both pain location and response on clinical tests, and can as such be considered as multifactorial. Thus, group might have reduced the influence of other variables in our analyses. Since weight gain is expected during pregnancy and group included pregnancy as a factor, the effect of increased BMI on TUG was likely reduced when adjusting for group. Similarly, this observation applies to the association between sick leave and increased TUG, as PGP has been identified as the most common cause of sick leave in pregnant women (Robinson et al., 2006; Gutke et al., 2014). Nevertheless, in this study, both being on sick leave and having an increased BMI, in addition to being pregnant and having PGP, were factors associated with increased TUG.

Finally, exercise frequency was not associated with TUG in the final model, implying that it did not influence physical function. This is surprising, as exercise is reported to improve functional ability and maternal health during pregnancy (Nascimento et al., 2012). However, the lack of association could be influenced by the other variables in the model and by the short time frame used in the formulation of the question (last seven days).

4.3. Factors associated with TUG in pregnant women with PGP

In pregnant women with PGP, only pain intensity was significantly associated with TUG in the multivariable analysis. TUG increased with 0.29 s with 1 point increase in pain intensity, which amounts to 3 s increase in TUG with an increase in pain intensity from 0 (no pain) to 10 (worst imaginable pain). ASLR and fear of movement had no significant additional effect. These findings can be seen in concordance with a larger cohort study of pregnant women reporting associations between pain intensity and disability, while no associations were found between disability and ASLR or fear-avoidance (Robinson et al., 2010b). Previously, fear of movement has been associated with reduced walking velocity in pregnant women with PGP (Wu et al., 2008). Due to the low number of women with PGP (and thereby low statistical power), we cannot exclude an influence of fear of movement on TUG.

Interestingly, we found a positive association between TUG and ASLR in pregnant women with PGP in our univariate analyses, which is in line with Evensen et al. (2016). However, we also performed multivariable analysis revealing no association between TUG and ASLR when controlling for pain intensity. This is surprising, as it seems plausible that the TUG subtasks challenge load transfer. One explanation could be the difference in test position (supine vs. sitting, standing and walking). Biomechanical studies have identified altered motor control in PGP populations, suggesting increased muscle activity as a compensatory strategy, which paradoxically might be a mechanism for ongoing pain (de Groot et al., 2008; Beales et al., 2009; Bussey, 2015). Hence, we might speculate whether compensations could explain the lack of association between ASLR and TUG. To shed light on these potential mechanisms, biomechanical studies are needed to quantify movement and motor control strategies. From our results, we cannot support that increased TUG is related to dysfunctional load transfer as measured with the ASLR. Instead, the affliction of PGP manifested in increased TUG seems to be influenced by pain intensity.

4.4. Strengths and limitations

Strengths of this study are the inclusion of pregnant women with PGP, asymptomatic pregnant and non-pregnant women based on predefined criteria and clinical examination, the use of a standardized TUG version and multivariable statistical analysis. The small sample size and few women on sick leave are limitations. Hence, some of the results should be interpreted with caution. Further, we cannot draw causal associations due to the cross-sectional design, or explore potential compensatory mechanisms.

5. Clinical implications

The TUG targets core activities commonly impaired in pregnant women with PGP, and is quick to perform, easy to administer and can be applied in most environmental settings. Our finding that pregnant women with PGP use longer time on TUG, with about 75% having higher TUG times than the slowest among non-pregnant women, support that TUG may assist in determining the extent of functional disability. Multivariable analyses suggest that BMI, sick leave, pregnancy and PGP, in particular pain intensity are important to consider when interpreting TUG. We recommend TUG as a measure of physical function in pregnant women with PGP used together with self-reported instruments and clinical tests.

6. Conclusion

Our findings support that the TUG undertaken at maximum speed is a suitable physical performance measure in pregnant women with PGP. We found larger variation and significant longer time on TUG in this group compared to asymptomatic pregnant and non-pregnant women. In addition, our results provide new knowledge about factors influencing TUG and indicate that the affliction of PGP manifested in an increased TUG seems to be influenced by pain intensity.

Conflicts of interest

None declared.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.msksp.2019.03.006.

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