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Activity pacing in daily life: A within-day analysis

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ABSTRACT

Activity pacing is a widely used self-management strategy, but we lack a clear understanding of its nature and usefulness. One source of confusion is a lack of clarity about the use of pacing in everyday life (ie, naturalistic pacing) in people not trained on how to pace activities. It is unknown whether people engage in more pacing when pain is high (pain-contingent) or when fatigue is high (fatigue-contingent). Conversely, it is not known whether naturalistic pacing results in reduced symptoms. We conducted a multilevel daily process study in which participants with osteoarthritis (N = 162) reported pain and fatigue severity and frequency of pacing behaviors 5 times per day over 5 days. We hypothesized that increased pain and fatigue would predict increased pacing and that pacing would have a short-term benefit in terms of decreased pain and fatigue. Multilevel modeling results showed that, as expected, both momentary pain and fatigue were positively associated with subsequent pacing behaviors. Contrary to our hypothesis, increased pacing was associated with higher subsequent levels of pain and fatigue. Naturalistic pacing seems symptom-contingent and not reinforced by symptom reduction. Naturalistic pacing may be distinct from trained or programmatic pacing in terms of outcomes, and further research into naturalistic pacing may provide an important foundation for how best to deliver activity pacing interventions.

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1. Introduction

Activity pacing is a central concept underlying chronic pain theory and treatment, yet it is not well characterized. It has been defined broadly as, "…regulation of activity level and/or rate in the service of an adaptive goal or goals" [34], p. 465. The 2 most common pacing domains examined in pain research are (1) slowing down/moving slowly and (2) breaking up activities into smaller pieces [35].

Pacing skills are often taught in pain treatment. We refer to this type of pacing as programmatic pacing. The specific goals of this training vary depending on the theoretical orientation of the treatment and include pain reduction, energy conservation (or reduced fatigue), and/or increased overall productivity. The 2 theoretical models guiding pacing treatment are operant theory (OPT) and energy conservation (EC) [34]. OPT emphasizes that all behavior, including pacing, is maintained by reinforcement (ie, the payoff of the behavior) [14], such as reduced pain or increased productivity [15]. OPT-based interventions teach adaptive pacing behaviors that aim to limit the extent to which activity is symptom-contingent (eg, reduce excessive resting when pain or fatigue are high) in order to achieve predetermined activity goals [14]. EC-based interventions, on the other hand, seek to preserve energy for completing valued activities [16] while reducing overall pain and fatigue [34]. The existence of these 2 different conceptual traditions and definitions of adaptive pacing likely contribute to the current lack of clarity about the nature and impact of pacing.

Another source of confusion is limited knowledge about the pacing behaviors people enact in daily life without pacing instruction, or naturalistic pacing [28,34]. Results of research on naturalistic pacing are inconsistent; some show that naturalistic pacing is associated with disability and other poor health indicators [23,25], whereas others show the opposite or no association [22,32,33]. The cross-sectional nature of existing studies limits us to asking what happens to people *who* pace more or less. To better understand the nature of pacing and guide treatment efforts, studies are needed that examine what happens in terms of symptoms and functioning *when* a person engages in naturalistic pacing. Research that allows for examination of such within-person processes is

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sparse, with 1 pilot study in osteoarthritis (OA) finding that naturalistic pacing (in this study, defined as going slower and breaking up activities into smaller pieces) was related to more pain, fatigue, and lower physical activity [30].

In the current study, we examined within-person momentary associations between naturalistic pacing and pain and fatigue symptoms in individuals with OA. We hypothesized that increased pain or fatigue would be associated with subsequent increased pacing based on the expectation that naturalistic pacing may be pain or fatigue-contingent (consistent with OPT theory). We also hypothesized that pacing behaviors would have a short-term benefit of subsequent symptom decrease, a pattern consistent with both the OPT model [14], in which pacing is a learned behavior reinforced by lower symptom intensity, and by the EC model, in which resting is thought to reduce fatigue.

2. Methods

2.1. Design

This is an analysis of data from a multilevel daily process study in which participants reported pain and fatigue severity and frequency of use of pacing behaviors 5 times per day over 5 days [27]. All study procedures were approved by the Institutional Review Board at the University of Michigan.

2.2. Participants

Community-living adults were recruited through public advertisements (newspaper, online, radio, and flyers) in southeastern Michigan. Details about recruitment have been reported elsewhere [27]. In brief, participants were included if they were age 65 and older, reported at least mild to moderate pain severity overall (a score of $\geqslant$4 and at least 2 activities with at least moderate pain [17]) on the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) pain subscale [5], and showed evidence of osteoarthritis in a corresponding knee or hip joint determined by the American College of Rheumatology clinical criteria [2,3]. Participants also needed to meet fatigue criteria by reporting that they felt that they could not get going or that everything they did was an effort [4] for at least 3 to 4 days in the past week. Participants also needed to have adequate cognitive ability (scoring $\geq$5 on the 6-item screener to identify cognitive impairment) [8]; be able to enter ratings on the Actiwatch-Score accelerometer used in the study; and have a consistent, typical sleep schedule (with usual wake-up time before 11 am and bedtime before 2 am). People were excluded if they were nonambulatory (unable to walk with or without an assistive device), experienced a period of bed rest for >2 days in the past month, changed medications within the past 2 weeks, had medical conditions that could interfere with symptom ratings or accelerometer data (eg, rheumatoid arthritis, current cancer treatment, sleep apnea), or had other medical reasons for fatigue (abnormal thyroid-stimulating hormone level or low hemoglobin).

2.3. Procedure

Potential participants deemed initially eligible from a telephone screening came in for a baseline clinic visit. After written informed consent was obtained, further screening was done to assess eligibility (blood work, ascertainment of clinical criteria for osteoarthritis, and health history) and enrolled participants completed questionnaires. Participants were asked to return for a second clinic visit that included physical performance testing and instruction on how to use the Actiwatch-Score accelerometer with an accompanying logbook for use in a 5-day home monitoring period. Participants wore the Actiwatch-Score on their nondominant wrist for 5 days and were asked to input ratings of pain and fatigue severity and frequency of pacing behaviors into the device 5 times per day as well as record ratings in a logbook. They also reported wake and bed times in the logbook, to assist in actigraphy data processing. A 5-day sampling period was chosen because it has been deemed an acceptable length of time needed to obtain reliable and valid physical activity data in adult samples [18,42], without being overly burdensome to participants. Participants were asked to wear the device continuously for the 5-day period except for times when the device could become wet (eg, showering or swimming). At the end of the home monitoring period, participants were asked to return the device and logbook by mail in a prepaid envelope and were compensated $80 for all study procedures. There was an overall completion rate of 98% of the symptom reporting. Eighty-six percent of participants had complete symptom reporting (at all 25 time points over the 5 days); the remaining 14% of people had 1 to 5 responses missing.

2.4. Measures

2.4.1. Momentary measures

Five times per day for 5 days, participants were asked to input symptom and pacing behavior ratings into the Actiwatch-Score accelerometer [Philips Respironics, Mini Mitter, Bend, OR]. Rating times occurred at wake-up, 11 am, 3 pm, 7 pm, and bedtime (lights out). An audible alarm prompted participants to enter ratings at all time points except at wake up and bedtimes. Pain and fatigue severity were each rated on a scale of 0 (no pain/fatigue) to 10 (pain/fatigue as bad as you can imagine) [13,26]. Fatigue was defined for participants as tiredness or weariness [47]. Pacing behaviors were assessed using 3 questions based on item stems from the activity pacing subscale of the Chronic Pain Coping Inventory [32] and modified from an earlier study using these questions [30]. Participants were asked to report on the frequency of pacing behaviors in the time since the last reporting period, 4 times per day (excluding wake-up time). On a scale of 0 to 4 (not at all, very little, sometimes, most of the time, always), participants were asked to rate the frequency of use of pacing behaviors in each of 3 questions: (1) How often have you gone slowly and taken breaks to do your activities since the last time you rated your symptoms?; (2) How often have you maintained a reasonable pace during activities (not too fast or too slow) to reduce the effect of pain on what you were doing since the last time you rated your symptoms?; and (3) How often did you break activities into manageable pieces to do them since the last time you rated your symptoms? Items were summed into a single pacing behaviors scale with a possible range of 0 to 12. This scale demonstrated excellent internal consistency (Cronbach's alpha = 0.97) in this sample.

2.4.2. Baseline demographic and covariate measures

The following measures were administered as part of a survey battery at the baseline visit. Demographics of interest included age, sex, race/ethnicity, and marital status. Health status variables of interest included self-reported pain severity in each joint with osteoarthritis, body mass index (BMI); calculated from measured [weight (kg)/height (m)]^2, illness burden measured as the total number of endorsed symptoms (eg, headache, stomach pain) out of a list of 41 possible symptoms, and depressive symptoms measured by the short-form Center for Epidemiologic Studies Depression Scale [4]. Physical function variables included the 6-minute walk test [7] and the WOMAC [5] physical disability subscale short form. The 6-minute walk test is a validated objective physical function measure in which individuals are asked to walk a standard course at their usual pace for 6 minutes and the distance achieved is recorded. The WOMAC physical function short-form scale