How Children Walk: Bout Length during Real-World Locomotor Behavior

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INTRODUCTION

The sustained scientific effort to investigate human locomotion has lead to a detailed understanding of the three dimensional joint kinematics and kinetics associated with normal and pathological gait. However, it is still not known how technical gait deficits impact the ability to meet the challenges of everyday community mobility. As a first step toward understanding the community mobility demand, this investigation aims to define the duration of locomotor bouts performed by typically developing adolescent children.

METHODS

Forty children (age 12 years and 6 months ± 18 months) gave informed assent and their parents gave informed consent to participate in this IRB-approved study. Each child wore a StepWatch Activity Monitor (SAM; OrthoCare Innovations, Mountlake Terrace, WA, USA) on their ankle for fourteen days. SAMs were programmed for each individual’s height and collected all steps in each 10 second time interval. Custom code (Sadaka, LLC, Huntington Beach, CA, USA) counted sequential steps to define the length of each locomotor bout (number of steps before stopping) [1]. A frequency distribution was calculated by partitioning the length of locomotor bouts (the number of steps in a row before stopping) into a quasi-log scale of 2-9, 10-19, 20-49, 50-99, 100-199, 200-299, 300-499, 500-999, 1000-1999, and 2000+ steps in a row. These data were calculated as a percentage of total locomotor bouts each day and as a percentage of total steps each day.

RESULTS and DISCUSSION

An overwhelming number of bouts were extremely short with more than 36% of all bouts just 2-9 steps in a row. More than 55% of all bouts lasted less than 20 steps in a row and bouts of 500-999 steps in a row were less than 1% of all walking bouts. This suggests that most walking covers very short distances before stopping, with stability and maneuverability of primary importance. The ability to initiate gait, accelerate to the desired speed, maneuver around obstacles, decelerate and terminate gait is the most fundamental locomotor behavior. It is this type of walking that allows participation in daily activities with peers, and this should be the primary

Figure 1. Locomotor bout length plotted as a percent of total daily bouts.
walking goal for children with gait
pathology. Once short duration walking is
accomplished, longer duration bouts should
be the secondary goal to acquire the full
capacity to engage in all activities.

Although many extremely short walking
bouts were observed in typically
developing children, these did not account
for a large percentage of total daily steps:
Only 10.1% of total daily steps occurred in
bouts of less than 20 steps in a row. About
45% of all steps were taken in bouts of 20-
200 steps in a row. Bouts of less than 300
steps in a row accounted for more than 65%
of total daily steps. Bouts of 2000+ steps in
a row were rare occurrences, but accounted
for about 6% of all steps taken each day.
These long duration bouts occurred
approximately once every four days
suggesting a natural work-recovery cycle.

When grouped by age, the percent of steps
taken in bouts of 2000+ in a row decreased in older children.

beginning to decline in 12 and 13 year old children. The decrease may be the
beginning of a sedentary lifestyle as children cease active play and do not
engage in organized sports.

**SUMMARY AND CONCLUSIONS**

The real-world locomotor demand for
children consists of short bouts of walking
containing a low number of total daily steps; moderate duration bouts that contain
the majority of total daily steps; and very
infrequent long duration bouts with a larger
number of total daily steps that may
stimulate a training response and ultimately
reduce inactivity-related risk factors. This
method characterizes the bout length
distribution that defines the real-world
mobility demands for typically developing
children and adolescents. Methods to
assess intensity have been published
previously[2], and combining these
methods could objectively characterize the
intensity, duration, frequency and
adherence of locomotor exercise programs.

**REFERENCES**


Strength Cond Res*, in press.