

Will People with Severe Chronic Pain Utilize Wearable Pain Relief Technology?

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BACKGROUND

About 100 million US adults have chronic pain, many with severe manifestations including several underlying pain conditions, multiple sites of pain, high pain intensity, and substantial interference with quality of life. The past few decades have seen a dramatic increase in use of prescription opioids for chronic pain despite concerns about their adverse effects and potential for addiction. Wearable devices and digital health are emerging as non-pharmacological options for treating chronic pain. One such technology is wearable pain relief devices using surface neurostimulation. To maximize their impact, these solutions must appeal to those with severe chronic pain because they are most reliant on pain medications.

The objective of this study was to determine the demographic and clinical characteristics of wearable pain relief device users.

METHODS

This study examined users of a commercial wearable pain relief device (Quell®, NeuroMetrix, Waltham, MA, USA). This device is a fixed-site high-frequency transcutaneous electrical nerve stimulator that is thought to evoke analgesia by increasing descending pain inhibition through opioidergic pathways. The device and its associated smartphone app collect demographic, self-reported clinical (painful health conditions and pain characteristics), objective biometric (sleep, activity and gait) and therapy utilization data. Users may log pain intensity and interference with sleep, activity and mood on an 11-point NRS throughout the usage period. Typical pain intensity and pain interference are defined as median of all logged values for each user.

Inclusion criteria were devices users who

- provided demographic and clinical information,
- opted in to storage of their data in a cloud database, and
- consented to use of their anonymized data for clinical research purposes.

IRB approval was not required because the study was limited to an analysis of anonymized data.

Table 1. User Characteristics (N=7811)

Demographic/Clinical	% or mean ± stdev
Female: (%)	54%
Age (yrs)	56 ± 14
BMI (kg/m ²)	30 ± 7
Pain duration ≥ 3 Years (%)	66%
No. painful health condition	3.3 ± 2.0
No. pain site	4.3 ± 2.4

Table 2. Pain Intensity and Interference (NRS 0–10)

Typical Intensity and Interference	mean ± stdev
Pain Intensity	5.8 ± 2.0
Interference with	
Sleep	4.6 ± 2.8
Activity	5.7 ± 2.5
Mood	5.4 ± 2.7

Table 3. Anatomical Distribution of Pain Sites

Location: n (%)	N = 7811
Lower extremity	6655 (85.2%)
Feet/ankles	3656 (46.8%)
Legs (including knees)	5410 (69.3%)
Hips	3927 (50.3%)
Lower back	5933 (76.0%)
Trunk (midsection)	1561 (20.0%)
Upper extremity	4594 (58.8%)
Hands / wrists	2799 (35.8%)
Arms	1678 (21.5%)
Shoulders	3565 (45.6%)
Neck	3591 (46.0%)
Head / face	1128 (14.4%)
Other	589 (7.5%)

Note: Each user may report more than one location

Table 4. Self-Reported Painful Health Conditions

Condition: n (%)	N = 7811
Musculoskeletal	
Arthritis	4477 (57.3%)
Fibromyalgia	1635 (20.9%)
Spinal	
Herniated disc	2190 (28.0%)
Spinal stenosis	1963 (25.1%)
Neuropathic	
Diabetes	1088 (13.9%)
Complex regional pain syndrome	1403 (18.0%)
Shingles / post herpetic neuralgia	302 (3.9%)
Restless leg syndrome	1315 (16.8%)
Multiple-sclerosis	114 (1.5%)
Previous injury	
Back	3005 (38.5%)
Neck	1719 (22.0%)
Arm / hand	1485 (19.0%)
Leg / foot	397 (5.1%)
Cancer	356 (4.6%)
Headaches / migraine	1743 (22.3%)
Other	2283 (29.2%)

Note: Each user may report more than one condition

Table 5. Pain Pattern Distribution

Pattern: n (%)	N = 7811
All-time	3493 (44.7%)
Active	1680 (21.5%)
Morning	960 (12.3%)
Night-Sleeping	826 (10.6%)
Rest	513 (4.1%)
Not-sure	321 (6.6%)

RESULTS

Demographic and Clinical Characteristics (Table 1). A total of 7811 device users met the inclusion criteria as of September, 2017. The age of the subjects was 56±14 years (range 12-103, 32% ≥65), 54% were female, and the BMI was 30±7 kg/m². Most subjects (66%) reported chronic pain for at least 3 years, with 32% declaring a duration >10 years.

Typical Pain Intensity and Pain Interference (Table 2). The typical pain intensity was 5.8±2.0. The pain interference was 4.6±2.8 for sleep, 5.7±2.5 for activity and 5.4±2.7 for mood. Typical pain intensity was mild (0-3) for 14% of users, moderate (4-6) for 45% of users, and severe (7-10) for 41% users. Number of pain and interference ratings was 8.0±14.2 per subject.

Anatomical Distribution of Pain Sites (Table 3). The number of pain sites was 4.3±2.4, with lower back (76%), legs (69%) and hips (50%) most frequently reported. Eighty-five percent (85%) of users reported one or more pain sites in lower extremity and 59% of users reported one or more pain sites in upper extremity.

Painful Health Conditions (Table 4). The number of painful health conditions was 3.3±2.0, with arthritis (57%), back injury (39%), and herniated disc (28%) as most frequently reported.

Daily Pain Pattern (Table 5). The most common daily pain patterns were “all the time” (45%) and “when active” (22%). Nearly all users (93%) reported that they had pain every day.

CONCLUSIONS

In this study, users of a commercial wearable pain relief device were generally older adults with long-standing, moderate to severe chronic pain. The subjects tended to have complex chronic pain characterized by multiple painful health conditions and multi-site pain. The high percentage of older subjects argues against the commonly held belief that older adults will not adopt new health technology. The fact that the study subjects trended towards severe chronic pain suggests that this population may be a viable target for advances in wearable and digital health technologies.