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114.SICKLE CELL DISEASE, SICKLE CELL TRAIT AND OTHER HEMOGLOBINOPATHIES, EXCLUDING THALASSEMIAS: CLINICAL AND EPIDEMIOLOGICAL

Use of Apple Watch to Acquire Baseline Wearable Biometric Data for Patients with Sickle Cell Disease and Correlations to Symptoms Such As Pain and Fatigue

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Background:
Sickle cell disease (SCD) is an inherited blood disorder that impacts the structure of red blood cells. The most common complication of SCD are vaso-occlusive crises (VOCs), commonly called pain crisis. Frequency and intensity of VOCs can differ among individuals. The unpredictable nature of VOCs increases risk of further complications, limits daily activities, affects mental well-being, and decreases health related quality of life. The use of mHealth and wearables for those living with SCD allows the opportunity to better understand pain and general wellbeing through real time data and analysis.
Objectives:
We aimed to: 1) Establish a comprehensive baseline health profile for individuals with SCD; and 2) determine potential relationships between patient reported symptoms and biometric data.
Methods:
Following IRB approval, patients entering the SCD clinic or the SCD Day Hospital at Duke University were approached, consented, and provided with the Nanbar Health app. Participants were instructed to make entries at least once daily and wear an Apple Watch throughout the day for 6 months. If a participant did not have Apple devices, an iOS Apple smartphone and/or Apple Watch series SE were provided. Self-reported general symptoms were recorded in the Nanbar Health app on scales from 0 (none) to 10 (most severe). General wellbeing was rated on an emoji scale, converted to 1 (worst/'frowny face') to 5 (best/'smiley face'). The biometric data from wearable collected included heart rate, step count, heart rate variability (HRV), resting heart rate (RHR), respiratory rate, and O2 saturation. For participants that had their own Apple Watch, 3 months of retroactive data was acquired. Statistical and network analysis was performed to analyze the correlations between symptoms, biometric data, and the general wellbeing of the participant.
Results:
Over 3 months, 18 participants were enrolled in the study. Median age of participant was 25 (IQR 21-33), 10 females, all Black/African American, and most either HgbSS (72%) or HgbSC (16%). Participants logged symptoms in the app 597 times over 93 days with a median of 0.33 entries/day/patient (IQR 0.22-0.44). The average pain score participants reported was 5.9 (SD 2.4, n=220). The three most reported symptoms, besides pain, were tiredness (22.1%), headache (5.2%), and priapism (5%). The patient-reported general feeling average was 3.3 (n=597, SD 1.6). Heart rate (n=74646), HRV (n=1277), and step count (n=1566) were the most recorded biometrics from the wearables. The average heart rate, HRV, and step count were 105.1 bpm (SD 26.8), 31.9 ms (SD 13.3), and 4100 steps/day (SD 5960), respectively. Significant expected correlations include between pain and priapism ($r=0.85$, $p<0.01$), aching and pain ($r=0.78$, $p<0.01$), and feeling bad and aching ($r= -0.74$, $p<0.01$). We also found feeling well correlated positively to back pain and tired correlated negatively with aching (see Table 1). Using network analysis of biometrics, RHR and HRV had a higher expected influence on patient feeling compared to the other biometrics collected.
Conclusion:

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Baseline biometric characteristics for patients were similar to other diseases with chronic pain and as expected, pain is the most common symptom reported. Our data reflected lower HRV compared to healthy individuals and consistent with other disorders characterized by chronic pain. However, compared to other chronic pain disorders, patients with SCD appeared to have lower HRV values. There was no strong correlation (>0.7) between biometrics obtained by the watch and SCD patient-reported pain scores. Our study found a strong significant correlation between priapism and feeling cold. The strongest correlation was between feeling tired and feeling cold, however, tired/fatigue was also significantly correlated with priapism and feeling cold, although negatively correlated with aching. Limitations to conducting comprehensive analyses and making direct comparisons with other conditions include discrepancies in biometrics due to high variability and participant adherence. These limitations underscore the need to enroll more patients and improve patient adherence to improve the reliability of biometric data in future studies. Future efforts will compare the use of other mHealth devices besides the Apple Watch and expand to patients outside our institution.

Disclosures Shah: *Bluebird bio:* Consultancy; *Agios Pharmaceuticals:* Consultancy; *Vertex:* Consultancy; *Global Blood Therapeutics/Pfizer:* Consultancy, Research Funding, Speakers Bureau; *Alexion Pharmaceuticals:* Speakers Bureau; *Forma:* Consultancy.

Positive correlations:							
X	Y	n	r	CI95%	p-unc	p-corr	power
Tired intensity	Cold intensity	265	0.916920946	[0.9 0.93]	6.38E-107	6.48E-106	1
Pain intensity	Priapism intensity	552	0.845308852	[0.82 0.87]	7.52E-152	9.17E-151	1
Feeling	Back pain intensity	137	0.792280168	[0.72 0.85]	9.33E-31	5.17E-30	1
Aching intensity	Pain intensity	131	0.779749 93	[0.7 0.84]	5.22E-28	2.66E-27	1
Aching intensity	Headache intensity	129	0.746432373	[0.66 0.81]	3.24E-24	1.32E-23	1
Tired intensity	Priapism intensity	296	0.719259544	[0.66 0.77]	2.02E-48	1.54E-47	1
Negative correlations:							
X	Y	n	r	CI95%	p-unc	p-corr	power
Pain intensity	Nausea intensity	92	-0.841013337	[-0.89 -0.77]	9.68E-26	4.22E-25	1
Feeling	Aching intensity	197	-0.744012526	[-0.8 -0.67]	5.44E-36	3.69E-35	1
Tired intensity	Aching intensity	109	-0.736342059	[-0.81 -0.64]	7.28E-20	2.47E-19	1

Figure 1

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