



Smartphone-Acquired Patient Reported Outcomes and Wrist-Worn Wearable Device-Acquired Sensing Data in Rheumatoid Arthritis: A Multicenter Single-Arm Prospective Study for Digital Biomarker (interim report)

Izumi K¹, Higashida-Konishi M¹, Saito S², Hama S¹, Hiramoto K², Kajio N³, Kondo Y², Suzuki K², Fukami T⁴, **Minato K**⁴, Aoki Y⁵, Taguchi H³, Kaneko Y²

¹NHO Tokyo Medical Center, Tokyo, Japan, ²Keio University School of Medicine, Tokyo, Japan, ³Kawasaki Municipal Hospital, Kawasaki, Japan, ⁴TechDoctor, Inc., Tokyo, Japan, ⁵Keio University, Yokohama, Japan

Contact: **Kaz Minato** _minato@technology-doctor.com

OBJECTIVES

Symptoms in patients with rheumatoid arthritis (RA) are potentially influenced by exercise load, and often vary from day to day. We aimed to develop an internet of things (IoT) systems that collects patients' daily condition and activity levels using smartphones and wearable devices, and to elucidate the relationship between smartphone-acquired patient reported outcomes (PRO) and wrist-worn wearable device-acquired daily sensing data in RA.

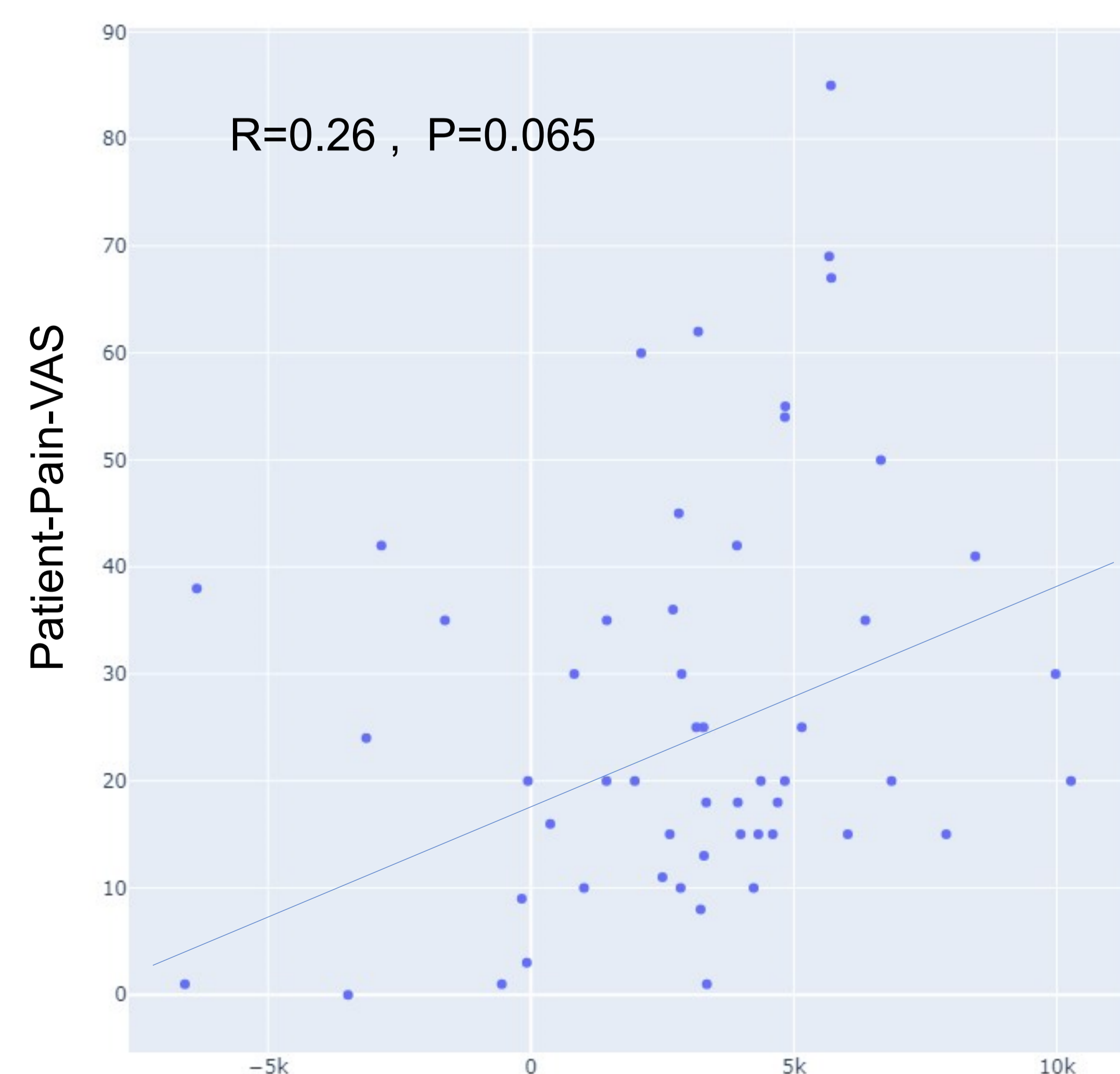
METHODS

A smartphone (iPhone12) and a wristband-type smartwatch (Fitbit Sense2) were lent to each patient for free. A mobile app was developed and installed into the smartphones to collect patients' daily PRO including patient-pain-visual analogue scale (Pt-P-VAS, 0-100 mm; 0 is best; 100 is worst.), patient-general-VAS (Pt-G-VAS; 0-100 mm; the same above), etc. Also, the smartwatch data and physicians' assessment were collected from the same subject. Patients visited the clinic every 4 weeks and were observed for a total of 12 weeks.

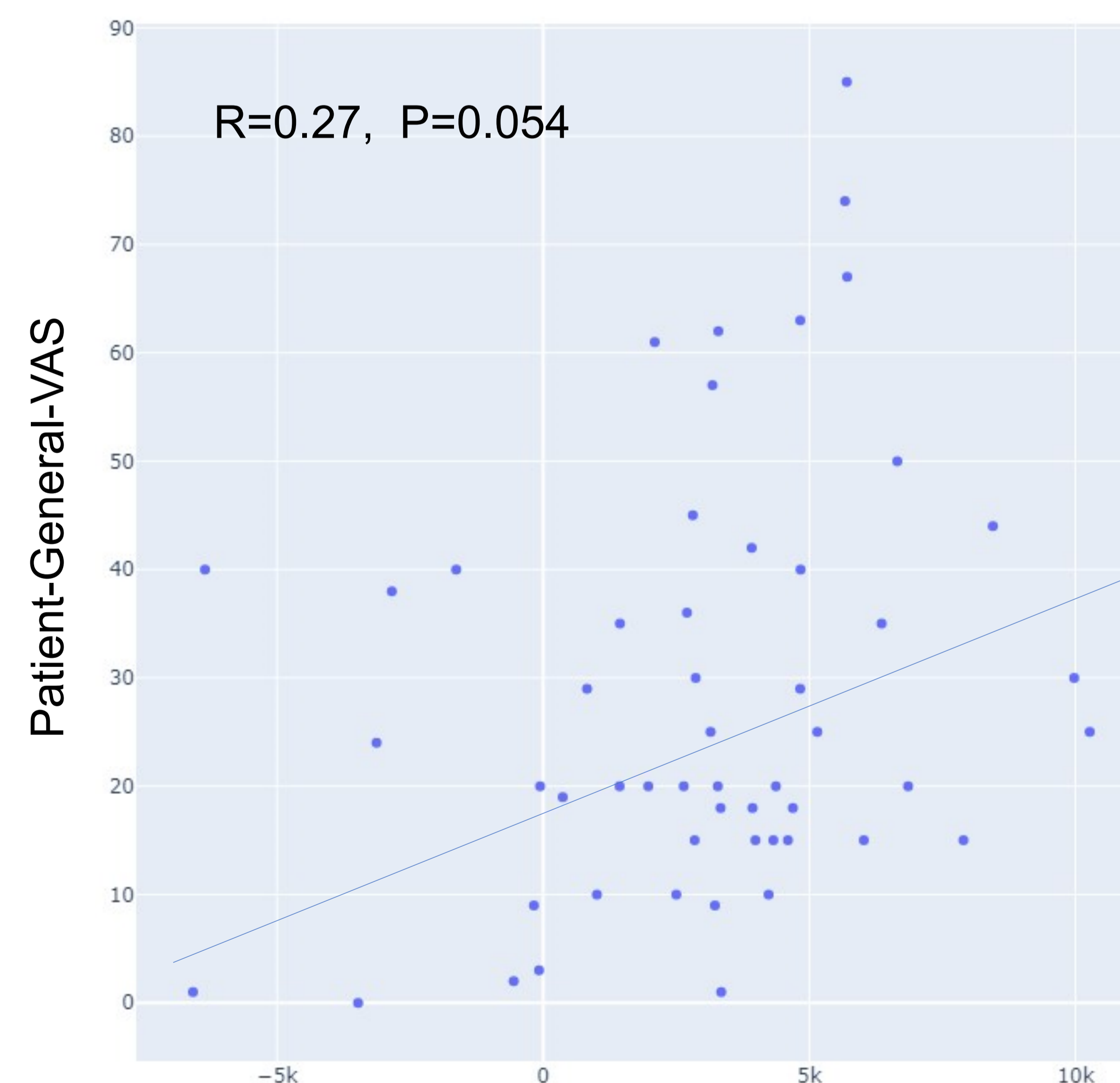
We conducted a simple linear regression analysis with outcome variables of Pt-P-VAS, Pt-G-VAS, etc. The independent variables included smartwatch-acquired daily steps.

RESULTS

- A total of 34 patients (7 men; 27 women) were enrolled.
- At baseline, mean age was 57.7 years; mean disease duration was 10.3 years; mean DAS28-ESR was 3.58. The total number of PRO data was 53.
- The difference between the number of steps taken on the day of PRO answer (overall average 11,585 steps) and the average daily number of steps for the last 7 days prior to the day of the PRO answer (7,788 steps) was associated with Pt-P-VAS (R=0.26, P=0.065) and Pt-G-VAS (R=0.27, P=0.054).



*The difference of steps



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*The difference of steps is the difference between the number of steps taken on the day of PRO answer and the average daily number of steps for the last 7 days prior to the day of the PRO answer.

CONCLUSIONS

An IoT system that collects patients' daily physical condition and activity level was developed. Patients with RA were more likely to feel pain and be in bad health on days when they walked more than usual. Using wearable devices and IoT technologies, it may be possible to predict and prevent worsening of patients' symptoms. The results of the final analysis are awaited.