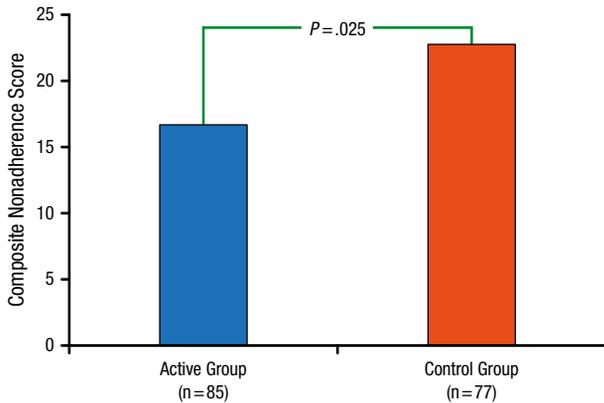




Figure 2. Primary End Point: Patient-Registered Drug Noncompliance



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satisfaction was higher in the active group as compared with the control group (usability score of 100, 87 vs 78; $P = .001$).

The majority (68%) of active group participants would keep using the app if it were generally available, and most (97%) would recommend the app to other acute MI patients receiving drug therapy.

Among patients with acute MI, the interactive smartphone app was successful in enhancing motivation to continue drug therapy adherence and adopt healthy lifestyle changes. Thus, disease-specific apps could aid secondary prevention care.

Geneva Stairs Study Findings: Workplace Physical Activity Reduces Serum PCSK9 Levels

Written by Brian Hoyle

As described by Christel Kamani, MD, Geneva University Hospitals, Geneva, Switzerland, further blood analysis of participants in the Geneva Stairs Study [Meyer P et al. *Eur J Cardiovasc Prev Rehab.* 2010] has linked regular workplace physical activity in the form of stair climbing with decreased plasma level of proprotein convertase subtilisin/kexin type 9 (PCSK9). These results bolster the value of regular physical activity in the reduction of low-density lipoprotein cholesterol (LDL-C), suggesting a novel mechanism through the modulation of the PCSK9 pathway.

In the Geneva Stairs Study, 77 Geneva University Hospitals employees who were healthy but physically

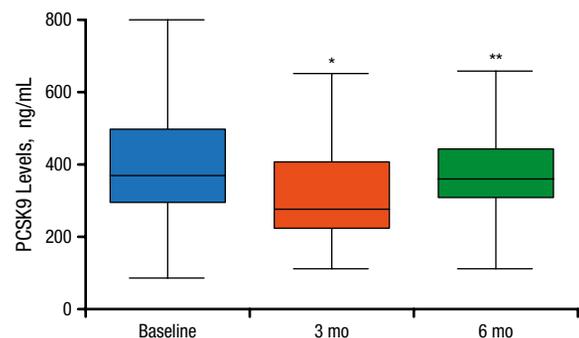
inactive regularly used stairs in their workplace instead of the elevator for a 6-month period. The use of stairs during the first 3 months was actively promoted, followed by another period of 3 months with no specific recommendations and where the use of stairs was less intensive. Monitoring over the 6 months revealed exercise-related improvements in a number of parameters usually associated with an increased risk of adverse cardiovascular events, including LDL-C (absolute change, $-0.13\% \pm 0.49\%$; relative change, $-3.0\% \pm 13.5\%$; $P = .026$). The findings implicated stair climbing as a simple means to reduce cardiovascular disease risk.

Presently, the blood samples from 67 of the study participants (mean age, 42.7 ± 8.8 years) were examined for PCSK9, a protein present in the liver as well as the kidney and tissues of the small intestine. PCSK9 functions to reduce the number of LDL receptors on the plasma surface of hepatocytes; thus, there is a correlation between plasma level of PCSK9 and plasma level of LDL-C.

In the first 3 months of the study, which was the period of peak stair-climbing activity, a significant decrease in PCSK9 levels was observed (baseline, 403.6 ± 166.0 ng/mL; 3 months, 324.3 ± 146.2 ng/mL; $P = .001$). In the final 3 months, when stair climbing was less intensive, serum PCSK9 levels rose to approximate the baseline condition (6 months, 381.8 ± 127.9 ng/mL; $P = .260$). A similar pattern was apparent for LDL-C, with a significant difference ($P = .010$) from baseline (3.5 ± 0.9 mmol/L) to 3 months (3.3 ± 0.9 mmol/L), with a return to the baseline value at 6 months ($P = .527$).

Plasma PCSK9 levels at baseline, 3 months, and 6 months are summarized in Figure 1.

Figure 1. Plot of Plasma PCSK9 Levels at Baseline, 3 Months, and 6 Months



PCSK9, proprotein convertase subtilisin/kexin type 9.

* $P < .011$ vs baseline; ** $P < .260$.

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Table 1. Multivariate Mixed Model Results at Baseline and 3 Months

Parameters With Fixed Effect	Coefficient	SE	P Value
Physical activity intervention	-77.77	24.41	.001
Age, per 10 y	33.90	14.84	.022
Male vs female	-10.15	29.82	.734
Baseline VO _{2max} , per 10 mL/kg/min	-49.28	21.53	.022
LDL-C per 1 mmol/L			
Baseline	24.00	15.99	.133
Changes	48.22	27.03	.074
Body mass index changes, per 1 kg/m ²	47.70	18.48	.010

We estimated regression coefficient building multivariate adjusted linear mixed model using a fixed effect for the factors above and a random intercept at the individual level.

LDL-C, low-density lipoprotein cholesterol; VO_{2max}, maximum oxygen consumption.

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A multivariate analysis revealed a significant association of the decreased PCSK9 level at 3 months with physical activity intervention, after adjustment for age, baseline maximum oxygen consumption, plasma LDL-C value at baseline, plasma LDL-C value changes, and body mass index (Table 1).

In an analysis stratified according to the upper and lower baseline LDL-C values, the significant association between physical activity intervention and low plasma PCSK9 value at 3 months was similar across groups.

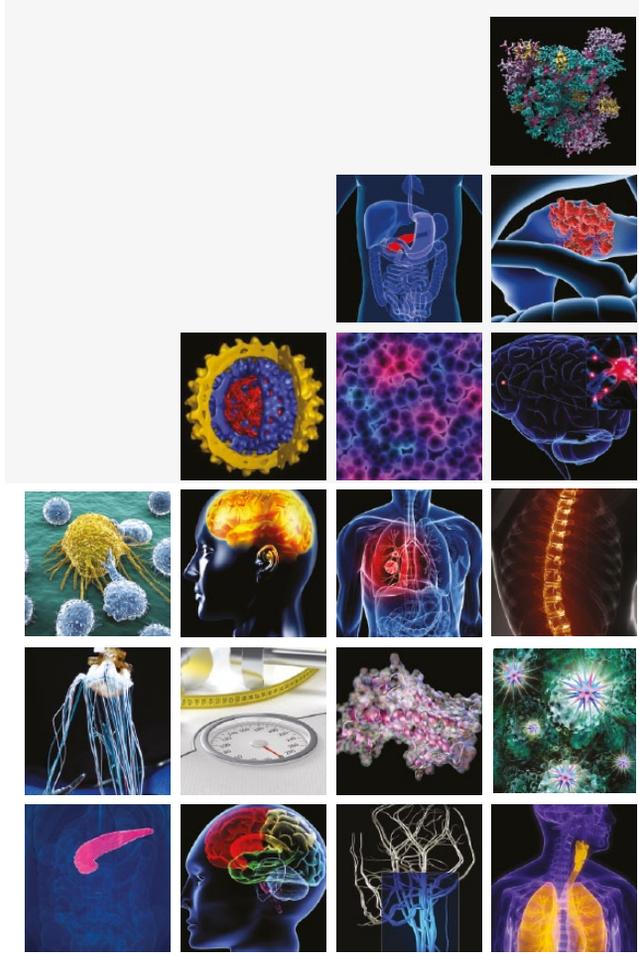
The findings are limited by the post hoc nature of the analyses, the lack of statistical power for some of the parameters, and the possible different influences of physical activity due to individual differences in the intensity of stair climbing.

Nonetheless, the findings indicate a novel means of cardioprotection via physical activity through the modulation of the PCSK9 pathway. Confirmation through a large randomized trial is needed.



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