WEARCON

Wearable home-monitoring of asthma control in children.

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RATIONALE: Pediatric asthma is one of the most common chronic disease in childhood. Treatment is focused on the control of asthma symptoms, enabling patients to fully participate in daily life. However, children's expression of asthma symptoms is often difficult to assess and interpret. Additionally, accurate monitoring of pediatric asthma is challenging as symptoms are episodic and therefore often absent during outpatient evaluation. These aspects hamper the treatment of asthma and urge the development of a monitoring tool that can signal worsening of asthma control and offer an opportunity to anticipate the waves of asthma. Therefore, this study aimed to discover relevant home-monitoring parameters for asthma control in children using wearable technology.

Figure 1: Smart devices from top-left to bottom-right: Spirobank II, Actigraph wGT3X-BT, Cohero Health smart inhalers, eMotion Faros 180.

METHODS:

- ►60 asthmatic children,
- ►aged between 4 and 14 years old,
- ►performed a home-monitoring period of 2 weeks.

During this period lung function, physical activity & sleep, heart rate & respiratory rate and medication use were monitored with smart monitoring devices (figure 1). Asthma questionnaires (C-ACT and PAQLQ) were filled in once a week. Afterwards, they performed an exercise provocation challenge in cold air. Children with a fall in FEV1 of more 13% were categorized as non-controlled asthma (NC) (n=28) others as controlled asthma (n=32).

RESULTS: Univariate analysis revealed several monitoring parameters that were significantly different between controlled and non-controlled asthma (table 1). The post exercise recovery time of the respiratory rate was the most significant parameter (figure 2). The asthma questionnaires (C-ACT p=0.11 and PAQLQ p=0.26) did not significantly distinguish controlled and non-controlled asthma.

Home-monitoring parameters	Control	Non-control	P-value
Baseline FEV1 (% predicted)	86.2%	82.2%	0.31
Variation baseline FEV1 (%)	12.4%	20.9%	0.01
FEV1 change after exercise (%)	-0.6%	-11.5%	<0.01
Total activity (min/day)	372	377	0.81
Vigorous activity (min/day)	9.6	10.2	0.46
Wake up time	07:14	06:41	<0.01
Sleep restlessness before wake-up	3.18	3.79	0.12
Controller adherence (%)	86.4%	80.6%	0.31
Salbutamol use	3	10	0.04
Respiratory rate recovery time (s)	23	61	<0.01

Table 1: Selection of the most relevant home-monitoring parameters, with mean values for both asthma groups and the corresponding p-value.

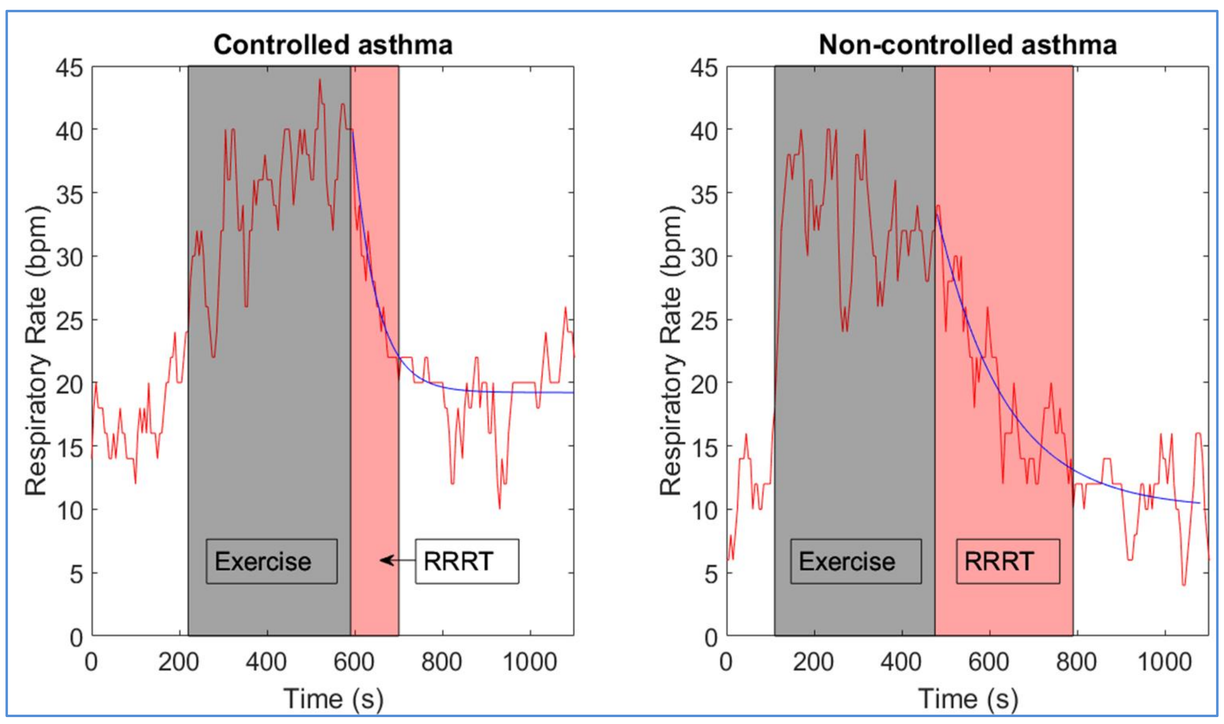

Figure 2: Example of the respiratory rate of a controlled (-9.8% FEV1) and a non-controlled (-39.2% FEV1) asthmatic child. An exponential fit of the respiratory recovery is indicated by the blue line. The gray area indicates the period of exercise. The red area indicates the respiratory rate recovery time.

CONCLUSION: This study strongly suggests that wearable devices can be used for home-monitoring of pediatric asthma, as relevant parameters differentiate between controlled and non-controlled asthma. Wearable home-monitoring is feasible and provides the pediatrician with complementary information, which supports the clinical evaluation of asthma control.

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