Early Identification of Deteriorating Patients with Continuous Non-Invasive Respiratory Monitoring: A Systematic Review

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Introduction

Failure to recognize deterioration in hospitalized patients may contribute to cardiopulmonary arrest, unscheduled ICU admission and increased mortality. The purpose of this review is to examine whether continuous respiratory monitoring on the general ward can increase patient safety and assist caregivers with early identification of deteriorating patients.

Methods

We searched electronic databases (Medline, Embase, Cinahl and Cochrane library) for publications using keywords and corresponding synonyms: 'ward', 'continuous', 'monitoring', 'respiration'. Studies were selected, data were extracted and quality assessed by two independent reviewers.

Results

Of the 690 articles, five could be included, evaluating the use of 4 different devices for continuous non-invasive respiratory monitoring on relevant clinical outcomes. Taenzer et al. demonstrated a significant decrease in rescue calls and ICU transfers, whereas the other studies could not find a significant effect on primary outcome. (Table 1) Methodological quality of these studies was poor, e.g., before-after designs (1-2,4), incomplete reporting of primary outcomes (1,3), and an insufficient caregiver notification system that was not able to alert caregivers directly (1,3,5).

Conclusion

This systematic review found insufficient evidence to recommend implementation of continuous respiratory monitoring on general hospital wards. The few selected articles were diverse, of poor quality and did not demonstrate a significant positive effect on the incidence of serious adverse outcomes. Selected studies had sample sizes that were too small to detect any possible effect on mortality. A more formal scientific evaluation should be executed with particular focus on all elements of the monitoring system, including sensing principle, data modelling, caregiver notification and protocolised therapy. Subsequent research should focus on innovative sensor technology to monitor respiratory rate, because the drawbacks of conventional hardwired technology (patient discomfort, sensor dislodgment) place a considerable burden on patients and nurses during hospitalization.

Figure 1

Authors	Device	Sensing principle	Data modelling before alarm	Caregiver notification	Protocolised therapy on abnormalities	Primary outcome	Reduction of primary outcome	Patient comfort
Hravnak[1]	Biosign algorithm	s m	+	b c	-	VI	-	-
Kisner[2]	Auricall pulse oximeter	s	-	n d	+	AF	-	+
Ochroch[3]	Nellcor pulse oximeter	s	-	b c	-	ICU	-	-
Taenzer[4]	Masimo pulse oximeter	s	+	n	-	SAE	+	+
Watkinson[5]	Biosign algorithm	s m	+	b	-	SAE	-	-