



## Research paper

# Model of rapid response teams in paediatrics and their influence on the quality and safety of inpatient care

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### ABSTRACT

**Introduction:** The implementation of the rapid response teams (RRTs) system in paediatrics was possible due to the participation of the Regional Specialized Children's Hospital in Olsztyn, Poland in a project launched by the National Centre for Quality Assessment in Health Care in Cracow, Poland.

**Aim:** Present a model of RRTs system and the effects of its implementation in child care.

**Material and methods:** The medical staff survey ( $n = 97$ ) analysis and complete analysis of the medical records of patients (document analysis;  $n = 1020$ ) were performed. The variables such as: the number and the type of RRTs interventions, the number of patients admitted to the intensive care unit (ICU) and the hospital mortality rate were analysed. These were compared with the variables obtained before the implementation of RRTs (from 1<sup>st</sup> November 2018 to 31<sup>st</sup> August 2019 vs. 1<sup>st</sup> November 2017 to 31<sup>st</sup> August 2018).

**Results and discussion:** RRTs made 626 surveillance visits to patients with serious conditions staying at hospital wards, 266 scheduled visits to 89 patients transferred from the ICU to other wards and 126 interventions in response to calls from different wards. The number of patients transferred from the hospital wards to the ICU decreased from 125 to 90. The number of deaths in the ICU decreased from 20 to 13.

**Conclusions:** The evaluation of the 10-month implementation period for this project encourages to keep RRTs operational. The interviewed staff admitted that the safety of inpatient care increased along with more meticulous supervision over patients needing intensive care.

## 1. INTRODUCTION

The Regional Specialized Children's Hospital in Olsztyn, Poland started the implementation of the rapid response teams (RRTs) system in January 2018 as a part of the project 'Support for hospitals in implementing quality standards and increasing inpatient care safety.' The project was implemented by the National Centre for Quality Assessment in Health Care in Cracow and the Regional Specialized Children's Hospital in Olsztyn took part only with regard to RRTs module. The preparation before implementing the programme lasted 10 months. Over that period, the medical managing personnel as well as the doctors and nurses from different hospital wards received intensive training provided with the support from external experts and the RRTs system coordinator. Individuals were appointed to the positions of the RRTs system coordinator (the head of the Emergency Department), RRT team leader (an anaesthesiologist) and coordinating nurse (a nurse anaesthetist). The anaesthesiologists and other paediatric specialists as well as nurses, all of whom had experience with life-threatening conditions in children, were selected to form the specialist staff of RRTs. All of them underwent training in advanced cardiopulmonary resuscitation techniques used in life-threatening conditions in children, which concluded with an exam. The necessary portable equipment was purchased. It included e.g., an emergency resuscitation trolley with monitoring equipment, a defibrillator/monitor, infusion pumps, a surgical suction pump and a computer providing remote access to the patient's medical records. After that, the RRTs guiding principles, which best fit the needs of a paediatric hospital, were outlined. It included a decision that, as of November 2018, a separate shift of an RRT doctor and nurse would be on duty during the hospital duty hours (Monday to Friday, 3:00 p.m. to 7:30 a.m., excluding non-working days). Additionally, the rules and the criteria for an RRT call were also established. In order to make an intervention quicker, the authority of nurses on call was expanded to include RRT call, when in doubt, without the need to inform the doctor on call at the ward. The doctor on call would be notified after an RRT was called in. Apart from interventions upon being called in, the range of an RRT's tasks was broadened to include a daily ward round, consultation visits to patients who remained under surveillance, as well as 48-hour surveillance of patients transferred from the ICU to other wards. The RRTs coordinator conducted 16 training sessions (each 1.5-hour long) at all the hospital wards. It concerned the guiding principles of the RRTs functioning at the hospital, the team's authority and the tasks of the personnel of other hospital wards. 'A paediatric RRT intervention record' was designed and introduced into the hospital's information technology system. Hospital wards were provided with posters and leaflets informing their personnel about the rules of and trigger criteria for RRT call. The leaflets and posters had been printed by the National Centre for Quality Assessment following consultation with our hospital's RRTs system coordinator. The coordinator and the RRT leader were in constant

contact with experts from the National Centre for Quality Assessment in Health Care, including prof. Roman Jaeschke (MD; Critical Care Response Team, St. Joseph's Healthcare Hamilton, Canada) – the project consultant. This contact was based on teleconferencing, regular phone calls and meetings in order to discuss any concerns and compare the effects achieved. Up-to-date training materials were made available on the [zwr.cmj.org.pl](http://zwr.cmj.org.pl) website. At a special ceremony, the new work organisation model was inaugurated, the team members formally received their appointments to RRTs and, as of 5<sup>th</sup> November 2018, the Regional Specialized Children's Hospital in Olsztyn (Poland launched its RRTs). What are the effects of their activities, how is the new work organisation perceived by the hospital's medical personnel, has this change translated into improved patients' safety? This paper is an attempt to answer the above mentioned questions.

## 2. AIM

The purpose of this paper was to evaluate the effects of the implementation of the RRTs model in the paediatric hospital and to investigate the opinions of the hospital's medical personnel on the introduced changes.

## 3. MATERIAL AND METHODS

This study was conducted in September 2019 at the Regional Specialized Children's Hospital in Olsztyn (Poland). The medical staff survey ( $n = 97$ ) analysis and complete analysis of medical records of patients ( $n = 1020$ ) were performed.

The medical staff survey at different hospital wards was conducted among 97 subjects, including 49 nurses, 44 doctors and 4 paramedics. The questionnaire used in this study had been designed by the National Centre for Quality Assessment in Health Care in Cracow (Poland) and provided to the hospital for the fulfilment of project. The questionnaire consisted of five questions. The questionnaire was anonymous.

The document analysis method was carried out in September 2019. In this part of the research, covering the period from 5<sup>th</sup> November 2018 to 31<sup>st</sup> August 2019, 1020 medical records of patients who underwent an RRT intervention were analysed. This included all medical records where the external call was initiated as well as those done on RRT's own initiative as a surveillance measure for patient recently transferred from the ICU. The comparative analysis of the effectiveness of the RRT implementation during two different periods of time lasting 10-months was done (before: 5<sup>th</sup> November 2017 to 31<sup>st</sup> August 2018 vs. after: 5<sup>th</sup> November 2018 to 31<sup>st</sup> August 2019). The variables relevant to care safety which were taken under consideration were: the number of patients transferred from other hospital wards to the ICU, the overall number of deaths in the hospital, including the number of deaths among ICU patients who were transferred from other hospital wards.

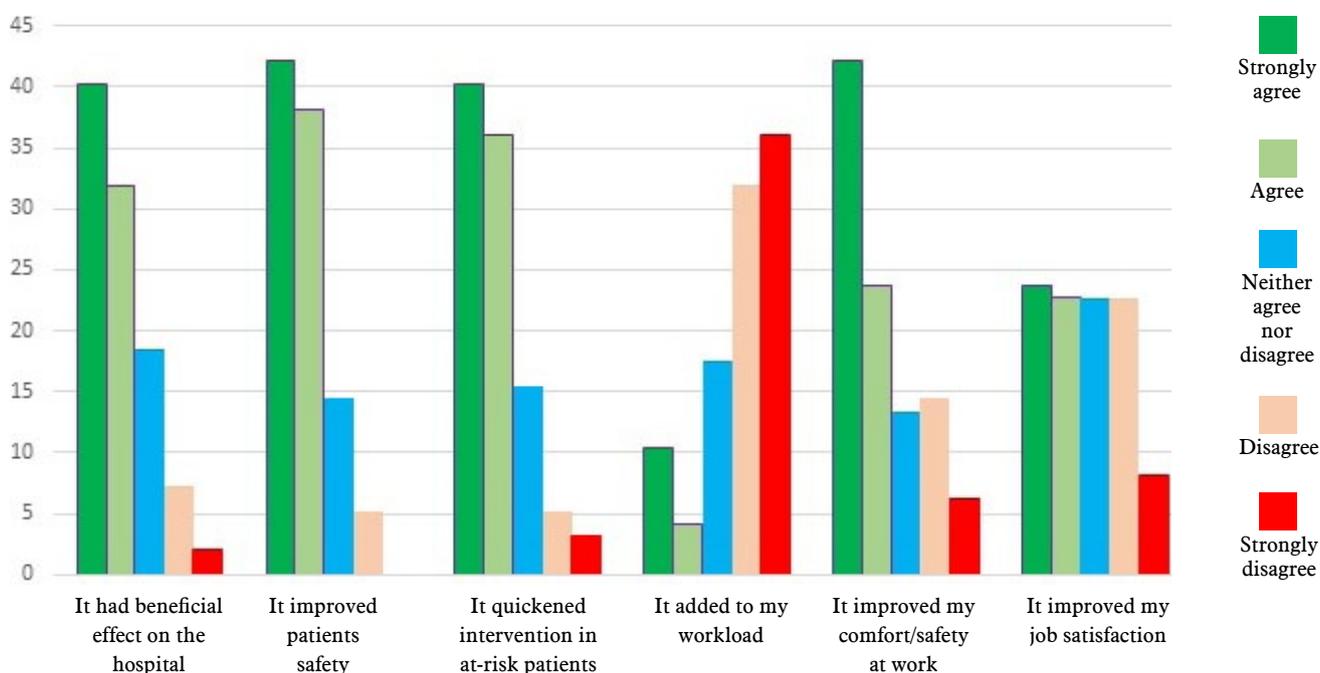


Figure 1. The assessment of RRT from the perspective of the medical personnel surveyed.

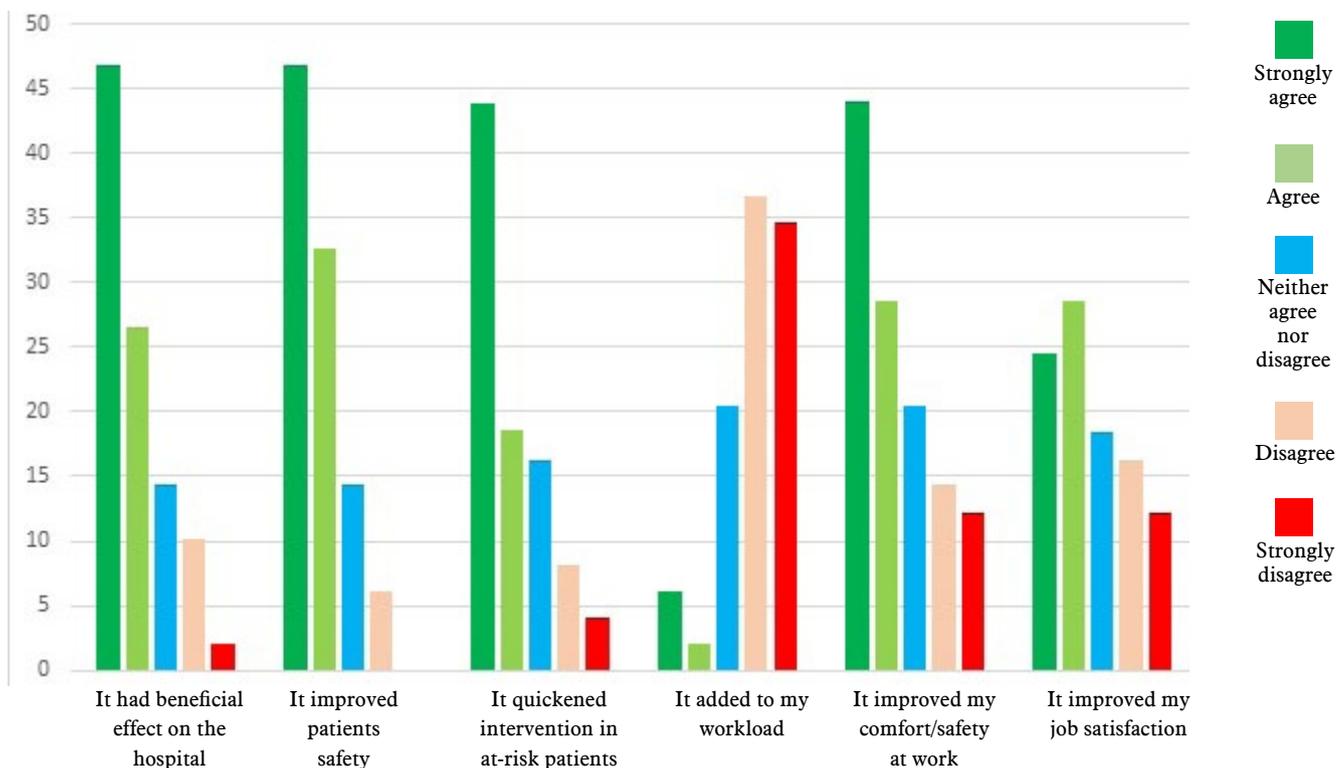


Figure 2. The assessment of the RRT functioning by nurses.

## 4. RESULTS

### 4.1. The questionnaire results in medical staff

The detailed assessment of RRT from the perspective of the surveyed medical staff was shown in Figure 1.

The analysis of the questionnaire results revealed that 72% of the hospital's medical staff stated that the RRT im-

plementation had a positive effect on the hospital. 80% of the subjects observed an improvement in patients' safety. The 76% of those surveyed admitted that RRT made the interventions faster which was significant especially to those patients requiring additional medical support. The 68% of the subjects stated that the implementation of RRT didn't have the influence on their workload, while 32% of the staff confirmed that their workload had increased.

The comparative analysis was also performed in the selected professional groups: doctors, nurses and paramedics.

The assessment of RRT functioning by doctors does not differ from those shown in Figure 1.

A comparison was also made between the survey results obtained from doctors of surgery wards and doctors of conservative treatment. More favourable assessment of the influence of RRT on the hospital and patients' safety were given by the doctors of surgery wards. The analysis was also performed taking the doctors' work experience into account. It was observed that the shorter work experience, the more favourable one's evaluation and the greater one's sense of safety at work.

The assessment of RRT functioning made by nurses was shown in Figure 2. Nurses gave a more favourable evaluation of the effects on the hospital and patients' safety as well as their own sense of safety at work than doctors did.

The comparative analysis was also based on the nurses' work experience. The results obtained from nurses were opposite to those of doctors. The longer a nurse's length of service, the better the assessment of the effects of RRT on the hospital's functioning and patients' safety. A nurse's place of work also had an influence on the nurse's evaluation of those effects. Positive effects of RRT implementation were more often observed by the nurses in surgery treatment wards and those on RRT duty.

The smallest number of positive effects were shown in paramedics. As there were only 4 paramedics surveyed, their responses have not been shown as percentage. Three of the surveyed paramedics neither agreed nor disagreed with the statement that RRT implementation had been beneficial to the hospital and they were of the view that the changes improved patients' safety. All of them had the opinion that RRT implementation did not add more to their workload.

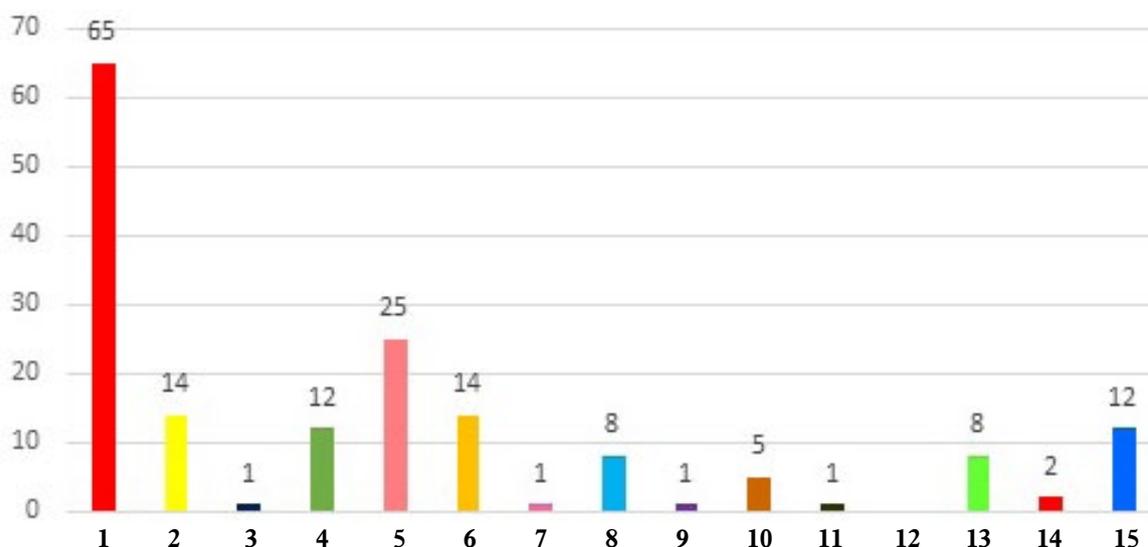
#### 4.2. Document analysis

The analysis of documentation included: patients' medical records, RRT intervention records from 1<sup>st</sup> November 2018 to 31<sup>st</sup> August 2019 (10 months), as well as statistical analyses of the hospital's functioning with regard to a taking selected variables into account during two 10-month periods – before and after the RRT implementation (5<sup>th</sup> November 2017 to 31<sup>st</sup> August 2018 vs. 5<sup>th</sup> November 2018 to 31<sup>st</sup> August 2019).

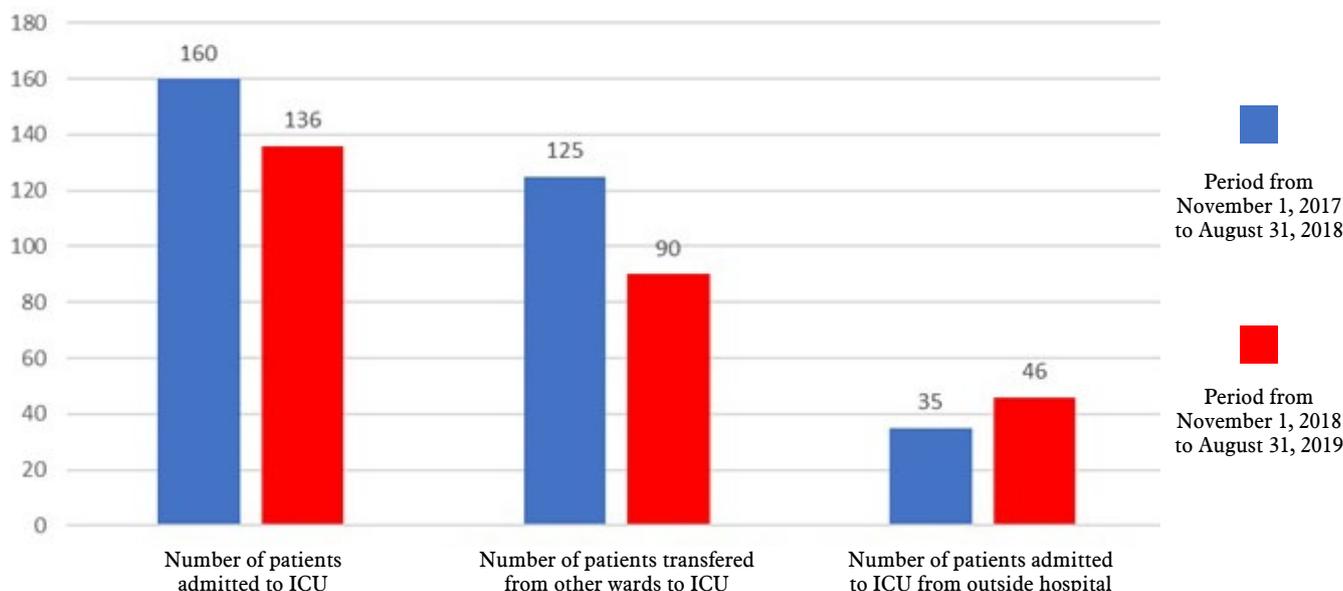
The analysis of the service type carried out by RRT showed that in the analysed period the most common type of interventions was the so-called active monitoring of patients. The RRT made 892 visits in total, with 266 scheduled visits to patients transferred from the ICU to other wards – during the first 48 h after the transfer, and 626 scheduled visits done on the RRT's own initiative to patients with serious conditions in all hospital wards. During the period of RRT functioning, the team covered patient-care-units and received an average of 128 calls. The analysis of the location of patient showed that RRT was most often called in to the Oral and Maxillofacial Surgery Ward (24 times), the Clinical Paediatric Surgery and Urology Ward and Clinical Haematology and Oncology ward (18 times), the Clinic of Paediatrics (16 times) and the Infectious Diseases Ward (13 times).

No calls were placed by the Ophthalmology Ward, the Orthopaedic and Injury Ward and the Clinic of Rehabilitation.

The most common cause of RRT activation were the medical staff concerns. The second most common criteria for RRT activation was a decrease in peripheral capillary oxygen saturation ( $SpO_2 < 90\%$ ) – 25 cases. In many cases, more than one cause was given from among the established activation criteria. The criteria for RRT activation were shown in Figure 3.



**Figure 3.** The criteria for the RRT activation in Regional Specialized Children's Hospital in Olsztyn, Poland. Comments: (1) Personnel's concerns; (2) Bradycardia/tachycardia; (3) Sudden change in blood pressure by more than 30%; (4) Sudden dyspnoea; (5) Peripheral capillary oxygen saturation ( $SpO_2$ ) less than 90%; (6) Respiratory rate less than 8 breaths per minute or more than 28 breaths per minute; (7) Acute massive bleeding; (8) Sudden change in neurological condition; (9) Sudden loss (reduction) of facial movement or extremity movement; (10) Convulsions; (11) Sudden increase in oxygen demand over 50%; (12) Sudden chest pain; (13) Oliguria; (14) Sudden change in integument colour; (15) Serious disorders in laboratory test results.



**Figure 4.** The number of patients admitted to the ICU.

**Table 1.** The number of in-hospital deaths in the analyzed two periods.

	In-Hospital Deaths (total)	ICU deaths	ICU deaths among patients transferred from other wards	ICU deaths during the first 24 h after transfer from other wards	Deaths in other wards	Patients admitted to hospital	Patients admitted to ICU	Patients transferred from other wards to ICU	Patients admitted to ICU from outside hospital
Before RRT implementation*	22	20	8	2	2	18353	160	125	35
During RRT functioning**	17	13	4	1	4	18452	136	90	46

Comments: \* from 1 November 2017 to 31 August 2018; \*\* 1 November 2018 to 31 August 2019.

Out of 128 RRT calls, only 45 were nurse-led and 83 were placed by a physician. Most often, RRT was activated by nurses in from the Oral and Maxillofacial Surgery Ward (19 times). The doctors were the only ones to activate the RRT to Clinical Ward of Infants' Pathology and Congenital Disease and the Infectious Diseases Wards, the Paediatric Ward (specialized in endocrinology and diabetes). In the other wards, calls were placed by doctors and nurses alike.

The next stage of the research was to compare selected healthcare criteria which may be of relevance to healthcare safety in two 10-month periods before and after the RRT implementation. The comparison was made between the number of patients transferred from other hospital departments to the ICU, the overall number of deaths in the hospital, including the number of deaths among ICU patients who were transferred from other hospital wards.

The comparison of the number of patients admitted to the Intensive Care Unit and those transferred to the Intensive Care Unit from other wards of the Hospital was shown in Figure 4.

When analysing the period of RRT's functioning and a comparable period before RRT implementation, i.e. November 2017 – August 2018, it was observed that the num-

ber of patients transferred from other hospital wards to the ICU decreased from 125 to 90 patients, that is by approximately 25%. Also, there was a decrease in the overall number of deaths in the hospital: from 22 to 17, the number of deaths in the ICU: from 20 to 13 and the number of patients transferred to the ICU from other hospital wards: from 8 to 4. During the two analysed periods, the overall number of patients admitted to the hospital was comparable (Table 1).

The decreased number of patients transferred from other wards to the ICU and the decreased number of deaths during the operation of RRT in relation to the period before RRT implementation may be the effect of improved care safety and improved organisation in the Hospital.

## 5. DISCUSSION

RRTs has been implemented in some countries with the aim of recognising and responding earlier to critical care triggers for the better patient outcome. The RRTs members, who are well-qualified clinicians, make the critical care expertise to the patient bedside within a short period of time from the first call. It has been shown that hundreds of lives are

now being saved in hospitals with the use of rapid response teams. The purpose of these teams is to assess and make the patient state stable, assist with communication among the interdisciplinary care providers, educate and support the staff caring for the patient, and assist with the transfer of the patient if necessary.<sup>1</sup> The necessity of the implementation of a RRTs was shown in Latin America hospitals with structural restrictions, such as the lack of intensive care unit beds.<sup>2</sup> In Australia and New Zealand the RRTs systems has a history of more than 20 years. Three hundred and forty-two hospitals were contacted, of whom 284 (83.0%) responded. Two hundred and thirty-two hospitals submitted data, and the other 52 declined to participate or did not have an RRTs. In hospitals with an ICU, intensivist attendance at RRT calls occurred less often outside office hours.<sup>3</sup>

So far, there have been no presentations or scientific articles concerning the effects of RRT operation in Polish paediatrics and their influence on inpatient child care safety. Nor have there been any articles concerning evaluation made by medical staff of an RRTs model in a paediatric hospital.

There is only one article concerning the implementation of rapid response teams in Poland (Szczeplik et al. 2019).<sup>4</sup> It described the idea and the purpose of the implementation of an RRTs organisational model in Poland, based on data from 25 Polish hospitals participating in the project: 'In 2016, the National Centre for Quality Assessment in Health Care launched the project "Rapid Response Teams" (RRT). The implementation of RRT in hospitals is aimed to improve safety and quality of care through rapid identification of patients at risk of sudden deterioration of their health or to prevent cardiac arrest as well as quickly determine and implement a plan of action...'<sup>5</sup> On the basis of an analysis of RRTs operation in all of the 25 hospitals participating in the project (among those there were only 2 paediatric hospitals) presented in the paper quoted above, the following effects of RRTs implementation were put forward: increased authority of female and male nurses due to formalization of their ability to call in help whenever a patient's health suddenly deteriorates, and an improved sense of safety and comfort at work on the part of nursing teams working outside of the ICU. The Szczeplik et al. (2018),<sup>6</sup> also showed that the implementation of RRTs in hospitals was found to have a major effect on the variables of hospitalized patient safety and the medical staff sense of comfort and safety at work. The comparable results were also shown in this study.

The frequency of sudden cardiac arrest in the hospital was found to have decreased on average by 39%, along with rationalization of the admission process through reducing the number of patients admitted to the ICU from other hospital wards, reducing the number of patients readmitted to the ICU due to their deteriorated condition. The same effects are also shown by the this research conducted in the paediatric hospital: the implementation of RRTs brought about a decrease in the number of children admitted to the ICU from other wards, a decrease in the number of deaths and a 50% decrease in the number of deaths among patients

transferred from other wards to the ICU. In 2004, in the United States, a 1.5-year programme was launched in order to improve the safety and quality of inpatient care. Six interventions were selected, whose implementation may be of the greatest influence on hospital mortality rate, 1 of these being implementation of rapid response teams.<sup>7</sup> Another research project carried out in the USA in the years 2005–2011 showed that in the case of children requiring emergency admission to the ICU, the implementation of a RRTs had the effect of lower mortality and reduced duration of stay.<sup>8</sup>

The decrease in mortality rate by 4.88% and the decrease in code blue calls by 2.44% were shown in Rashid et al. studies.<sup>9</sup> Average length of stay in ICU and hospital post RRTs assistance for patients was 2.55 and 6.95 days, respectively. Conversely percentage of patients requiring a higher level of care was more (75.61%) than those who stayed in their rooms/wards (24.39%).<sup>9</sup>

Between 2013 and 2014, the RRTs attended to 2,296 patients. This study showed a nonsignificant reduction in mortality from 8.3% in cycle 1 to 5.0% in cycle 4; however, death rates remained stable in cycles 3 and 4, with frequencies of 5.2% and 5.0%, respectively. Regarding patient flow and continuum of critical care, which is a premise of the RRTs system, there was a reduction in waiting time for ICU beds with a decrease from 45.9% to 19.0% in the frequency of inpatients who could not be admitted immediately after indication ( $P < 0.001$ ), representing improved patient flow in the hospital. In addition, an increase in the recognition of palliative care patients from 2.8% to 10.3% was noted ( $P = 0.005$ ).<sup>2</sup>

In a British study (2019) covering a review of research showing into the effectiveness of RRTs, the authors pointed out that the research findings available in the literature concerned few individual centres, which made it difficult to generalize them, while the available research findings showed a decrease in mortality.<sup>10</sup>

The assessment of the project of RRTs implementation in paediatric hospital offers encouragement to continue with the organisational model of RRTs and to keep them in operation in the paediatrics.

## 6. CONCLUSIONS

- (1) The decreased number of patients transferred from other wards to the ICU and the decreased number of deaths during the operation of RRTs in comparison with the period before RRTs implementation may be the effect of improved care safety and improved organisation in the Hospital.
- (2) The implementation of a RRTs system in a paediatric increased sense of safety among the medical staff. The nurses' job satisfaction improved as they now stand a better chance of fulfilling their professional potential.
- (3) The large number of interventions and satisfactory opinion of RRTs by medical staff performed during the RRTs operation period showed the biggest advantage of this project.

- (4) The number of patients transferred to the ICU from the other wards decreased by approximately 25%, which rationalized the use of intensive care services.

## CONFLICT OF INTEREST

None declared.

## FUNDING

None declared.

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