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Abstract:

The evaluation of new assessment units can identify areas of improvement for healthcare services. The South Warwickshire NHS Foundation Trust (SWFT) wants to evaluate a new Paediatrics Assessment Unit (PAU), the analysis is yet to begin. A comprehensive understanding of key performance indicators, including patient waiting times, length of stay (LOS), analysis of times series, and diagnosis severity is required for this service evaluation. This project aimed to analyse relevant performance indexes and describe in more detail the role of the PAU in supporting a high-quality paediatric emergency service. For this reason, data sources from different supplies such as the SWFT analytics team, operational managers, medical staff, and online platforms were gathered. The data was analysed by applying descriptive statistics for patients' characteristics and Welch's two-sample t-tests for examining changes in waiting times and LOS among others. In addition, I analysed patient reviews for assessing satisfaction. The study period included the COVID pandemic. Waiting times and LOS indicators increased, but the PAU has played a pivotal role as a healthcare provider for infants and toddlers. Furthermore, there was positive patient feedback regarding the Accidents and Emergency (A&E) and the paediatric unit. The results underlined the importance of taking patients' experience, internal managerial, external factors, and data perspectives limitations into account when evaluating health services.

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1. Introduction

Ever since the creation of the National Health Service (NHS) Act 1946, it has endured success and shared social commitment with the motivation to supply good, strong and reliable healthcare (Brain, J. 2022). In 2019, the NHS published its long-term plan. In this plan, there is a commitment to improve emergency care “*The NHS will reduce pressure on emergency hospital services as well as an action in response to the complex challenges of delivering 21st-century healthcare and building a resilient recovery from the recent COVID pandemic*” (Longtermplan.nhs.uk., 2019).

The pressures on urgent and emergency care services continue to dominate the headlines and are a daily concern for many patients using the services and the healthcare professionals who work in the NHS. The annual number of emergency attendances and admissions has been steadily increasing over many years. In accordance with this, prior to the COVID pandemic, the South Warwickshire NHS Foundation Trust (SWFT) had considered opening a Paediatric Assessment Unit (PAU) to reduce overcrowding in the Accidents & Emergencies department (A&E) and improve patient care.

However, during the COVID pandemic, concerns regarding overcrowding in the A&E department increased. Therefore, the SWFT intervened by establishing a PAU during the COVID pandemic. This action was aligned with national strategies, including the delivery of Same Day Emergency Care (SDEC). The PAU also aims to reduce admissions to the hospital by providing high quality SDEC thereby freeing up hospital beds for more critically ill patients. In the PAU SDEC, *patients presenting at the hospital with relevant conditions can be rapidly assessed and treated without being admitted to a ward* (England, N. 2022).

In more detail, this intervention was for alleviating capacity issues in the A&E and avoid children with minor illnesses to stay unnecessarily in the A&E. The PAU is located in the Warwick Hospital, adjacent to the paediatric ward. It is a 6-bed facility and became fully operational with the department assessing its first patient on January 12th, 2021. The service is designed to provide efficient care for infants, toddlers, children and young people under 16 years old who require urgent medical attention in Warwickshire and may not require hospital admission.

Patients can be referred by their GP (General Practitioners), no ambulance as paediatrics should be ambulatory, NHS 111, and A&E to be admitted to the unit, and then assessed by a proper

clinician promptly (Swft.nhs.uk. 2022). Exclusions on admissions are being applied for emergency transfer for resuscitation\stabilisation, isolation to prevent cross-infection and COVID positive or suspected. Additionally, the PAU was established to increase the capacity of the children's ward, so that clinicians could refer children directly to the unit for assessment, reducing the number of paediatric patients that had to be assessed by the paediatric team in the A&E. Furthermore, co-locating the PAU next to the children's ward enabled the inpatient paediatric team to work efficiently. (Swft.nhs.uk.,2022).

Generally, overcrowding and delays in A&E departments can compromise patient care. Establishing a PAU, and reducing the number of paediatric attendances at the A&E department, should reduce the likelihood of overcrowding and delays in the A&E. This could improve outcomes for patients not admitted to the PAU. Earlier studies revealed a major cause of morbidity and mortality cases is due to delays in the A&E diagnosis and treatment. Addressing this problem will have practical benefits for the PAU department at the SWFT and contribute to the understanding of future improvements (Rcpch.ac.uk., 2022).

Despite these beliefs, the PAUs effectiveness and appropriateness need to be evaluated, monitored, and assessed, especially at the post-intervention stage. Doing this analysis will contribute to the constant improvement required for the quality of healthcare services at the trust. This evaluation needs ongoing improvement and revision since the implementation has been approximated rather correct, and post-analysis has been found difficult to carry out. Prior to this evaluation there were also concerns that the PAU was not working efficiently and effectively. In view of these concerns, SWFT was keen for the PAU to be evaluated. The goal of this study is to generate insights in response to the evaluation of the PAU at the SWFT by extracting and manipulating data resources from the three principal platforms: Lorenzo, evolve (e-records), and IWantGreatCare¹ forum.

¹ [Reviews of Warwick Hospital - Page - iWantGreatCare](#)

1.1 Study aims and objectives:

As the Warwick hospital established a new PAU, understanding whether the specific performance indicators have been achieved was required. This study assessed the improvement in delivering patient care. Therefore, the following dissertation objectives were:

1. To establish the added value of the PAU on ameliorating the pressure of the A&E.
2. To determine how the patients' demand is satisfied with the service provided at the PAU/ A&E.

1.2 Methods

This study utilized the statistical examination of key performance indicators and outcomes between the A&E and the PAU. Those included an analysis and comparison of the following in the PAU & A&E: patient demographics description, time taken for a patient to be seen by a clinician/doctor, time of patient arrival and discharge in the A&E & PAU, referral type, discharge time, length of stay (LOS). Additionally, the use of time series analysis approaches to explain underlying patterns. Lastly, the application of sentiment analysis helped to determine patients' satisfaction.

1.3 Dissertation outline

This dissertation has the following structure:

1. Section 1 provides a brief introduction to the topic and the research objectives formulation.
2. Section 2 highlights relevant literature review to provide an overview of current knowledge.
3. For Section 3, the methodologies used are presented including data processing techniques, descriptive, statistical analyses, and sentiment analysis approaches.
4. Section 4 outlines the analysis of the results obtained through the process.
5. Section 5 suggests potential limitations and future research activities.
6. Section 6 summarizes the findings.

2. Literature review

2.1 key performance measures for A&E, evaluation and interventions

As has been previously reported in the literature, overview and significance of paediatric patients' studies reveal a range of 20%-30% of the visits A&E's are paediatric patients. These patients are significant because they stand for a large volume of patients (nearly one-third of all A&E visits), and because of the often-complex issues and risks to paediatrics. Although, most Paediatrics A&E visits are due to minor or benign conditions. Children and infants tend to have an increased vulnerability to illness and injury, including susceptibility to infections, and respiratory problems. (Sharon E, Mace. 2001).

There is a significant amount of published research regarding the impact of the implementation of rapid assessment units and the role of a PAU in providing exemplary healthcare services. A preliminary literature review shows and several studies suggest that the addition of these units has helped hospitals separate emergency rapid assessment from A&E services and has also helped alleviate the excessive burden on the A&E. Additionally, it is widely emphasized that overcrowding in the emergency department (ED) negatively affects patient outcomes, limits effective treatment for time-sensitive conditions such as pneumonia and sepsis, and reduces the safety and timeliness of care (Miake-Lye IM, et al. 2017).

Those research studies involve the evaluation of A&E's in countries such USA, Australia, New Zealand, among others. Since this study includes an end-to-end implementation of a Data mining project, it follows the CRISP-DM (Cross Industry Standard Process for Data Mining) method as the standard framework for data mining tasks (Wirth, R. and Hipp, J. 2000). In context, earlier observation studies have assessed the effect effectiveness of dedicated facilities (observation units) for patients who require short-course treatment and frequent reassessment, then they are monitored by dedicated staff. It has been identified that the aim here is to free up A&E space and resources for patients who are acutely ill (Hung, Geoffrey R. MD. et al. 2009) by avoiding the use of inpatient beds for short stays. A considerable number of studies have reported the effectiveness of such solutions (Hung, Geoffrey R, MD. et al. 2009 and Sharon E, Mace. 2001), and emphasised the importance of monitoring LOS, patient flow and admissions records.

Research studies have gone beyond these indicators when examining how to improve the service in A&Es. The papers published by Ardagh, M., et al. 2022 ; Li D, Abeywickrema M., et al 2021 highlight the importance of acquiring new medical staff to improve patient care. Interestingly, studies show extending the opening hours is not operationally efficient. Ardagh, M., et al. 2022 study showed that there was a significant improvement in the average waiting times to see a doctor when an additional nurse and doctor were rostered.

Most studies evaluate the performance of one-day rapid assessment units in comparison to previous practice of managing the patients in the A&E. However, few studies which focused on key performance indicators of these will prove to be particularly helpful during this research. A study of a unit in a busy London hospital, which primarily focused on the patient waiting times, concluded that about 63% of the patients in the department were seen by a clinician within 4 hours of being in the unit (M, Dunstan.et al. 2015). Dunstan, (2015) further explains that the provisioning of rapid assessment within few hours of patient being in the PAU will help further the RCS guidelines of improving emergency aid. Fearon et al. (2016) also focused on the waiting time KPI, and percentage of patients (69%) seen by a clinician within the first hour of arrival in a hospital in Ireland.

Another study focused on analysing whether rapid assessment units lead to a reduction in unnecessary hospital admissions (Reeds. et al., 2020). Reeds. et al. (2020) cited that about 44% of the referrals made to PAU were at once discharged and helped in reducing the admissions to the hospital. Further, reduced admissions also improved patient care efficiency, and patient experience and helped in cost reduction. Research on the referral of patients from various sources is also relevant to this dissertation. Research conducted on the PAU of an Ireland hospital revealed that most referral sources in both the A&E & rapid unit were GP referrals (Boyle, E., et al. 2012). The same study also posited that the presence of PAU helped significantly divert patients from A&E to the unit.

Research from Monash University, published in 2022, identified the importance of monitoring time series data to measure the increase in volume (number of patients) and age-specific rates of presentations to public hospital emergency departments (EDs), as well as any patterns in LOS; and to describe trends in ED utilisation. Furthermore, understanding patient's characteristics in the relation to median LOS and several patient demographic and clinical factors for all presentations were categorised according to age group, sex, referral source, type of transport to

the ED, Australasian Triage Scale (ATS) category which the level of immediately life-threatening, clinical diagnosis, ED LOS and discharge destination.

Broadly speaking, LOS has been considered by a series of recent studies as a quality indicator that stands for one of the most important performance measures in emergency departments. In a study carried out in Germany by Otto, R., et al. (2021) they stratified the LOS by (1) patient-related, (2) organizational-related and (3) structure-related factors. Average LOS for all patients was 3h 28 min (95% CI 3 h 27 min–3 h 29 min). LOS increased with patients' age and was shorter for walk-in patients compared to medical referrals was also found LOS was dependent on patient-related factors (age), disease-related factors (presentation complaint and triage level), and organizational factors (weekday and admitted/non-admitted status) (Otto, R., et al. 2021). As mentioned in this academic paper, these findings are determinant for the development of management strategies to enhance patient flow through the ED and thus prevent overcrowding.

One method employed by NJ Creasey, et al. 2015 carried out a study in a PAU which arose out of necessity and occupied a small space with limited privacy. The results emphasized on the long waiting times some children had to go through and proved that longer stays (>4–6 h) are inappropriate. Within the areas for improvement included consultant cover at peak times, facilities and space, waiting times to see a decision maker, early discharge/admission planning, and even parental information which contemplates patient's feedback. Although studies have been conducted by many authors, this problem is still insufficiently explored because of no patient's feedback for assessing quality health care, and the comparison for waiting times by gathering patient's characteristics presenting similar age, diagnosis and CABS score based on vitals in children at admission for prediction of severity of illness and outcome are not clearly presented in the literature.(Hassan, M.and David, K. 2006).

However, when having an ongoing increase in the demand of patients coming from different channels, it is essential to evaluate the effectiveness of new departments based on a timeframe basis as well as their connection to other units. The evaluation of the effectiveness of a rapid assessment zone to mitigate emergency department pressure has come to a wide awareness in the healthcare sector. The Emergency Medicine Journal (Bullard, M., et al.2022) evaluates this by gathering and reporting numeric data on at least one the following outcomes: (LOS; time in min from patient arrival to departure from the A&E), physician initial assessment (time in min from patient arrival to being seen by a doctor) and proportion of patients who left without being seen. Then, using a 2-sample t-test for continuous variables with a normal distribution mentioned by

(Jared S. Anderson, et al.,2020), mean, the standard deviation to compare between having no rapid assessment zones and having them, a comparative before and after intervention suggested by Tsai , VW. Sharieff ,GQ,. et al. (2012). The latter also states that rapid medical assessment is an effective way to improve patient flow, plus minimize the left without being seen (LWBS) rates in a paediatric emergency department (ED). A decrease in the LWBS rate allows the ED to provide health care to these potentially high-risk patients.

Following what it has been researched above, emergency department operation metrics and metrics were involved by Shari, J, Welch., et al.(2011) to improve the timeliness and efficiency of emergency care. ED Characteristics were identified including Acuity (Patients receiving codes of level 4 or 5 are high acuity; those receiving codes of 1 or 2, low acuity), admission rate (Percentage of ED visitors who are admitted as inpatients, Paediatric rate (Percentage of ED visitors younger than 18 years), Infant paediatric rate (Percentage of ED visitors younger than 2 years). Time intervals:

- ED LOS: Arrival time to departure time
- Arrival to treatment space time
- Admit decision to departure time: Decision to departure time
- Treatment space to provider time: Treatment space time to providers contact time

After having performed systemic literature, it was found that many studies tested the effect of an improvement intervention by analysing use measures as described above. However, there exist certain research projects that have included additional resources and data to be abstracted. For instance, Dr Paul Shekelle, Director of Evidence-based Synthesis Program (ESP) in Los Angeles, carried out an investigation in 2017 titled “Effectiveness of Interventions to Improve Emergency Department Efficiency (Miake-Lye IM, et al.2017). The study will be discussed below.

A key conclusion reached during Dr Paul Shekelle's study was that a minor number of studies have reported the types of data needed to fully assess the effectiveness of efficiency improvement interventions. Affirming that very few studies have reported utilization, cost, and quality of care outcomes together. The following two maps display the improvement in the LOS and wait time by 11 types of interventions subsequently:

1. Physician Triage
2. Expand Nurse Scope of Practice
3. Fast Track
4. Point of Care Testing
5. information technology (IT)
6. Rapid Assessment Unit
7. Medical Scribe
8. Team Triage
9. Care Teams
10. Observation Unit
11. Other

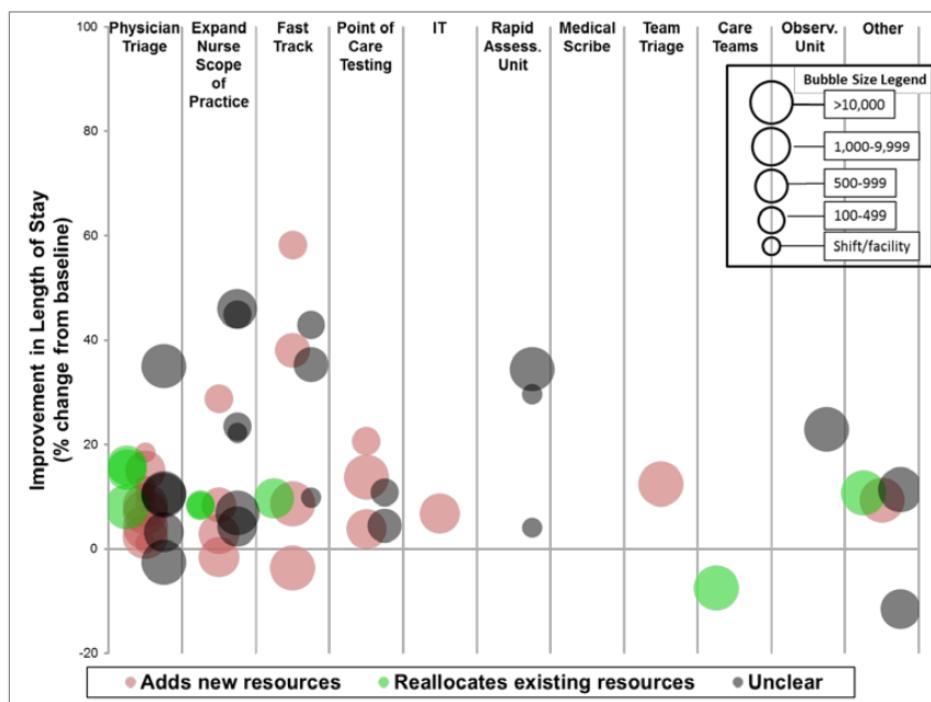


Figure 1. Evidence Map Displaying Improvement in LOS taken from Miake-Lye IM, et al. (2017).

Most studies that reported changes in LOS (n:67) improved mean LOS by between 10 and 40 minutes (e.g., Fernandes ,CM., et al. 1996; Day, TE., et al.2013; Rodi ,SW.,et al.2016). The results show that Fast Track and Nurse Scope of Practice interventions had the highest frequency of studies that were able to yield improvements greater than 30%. Whether Rapid assessment units reported LOS outcomes is unclear (Figure 1).

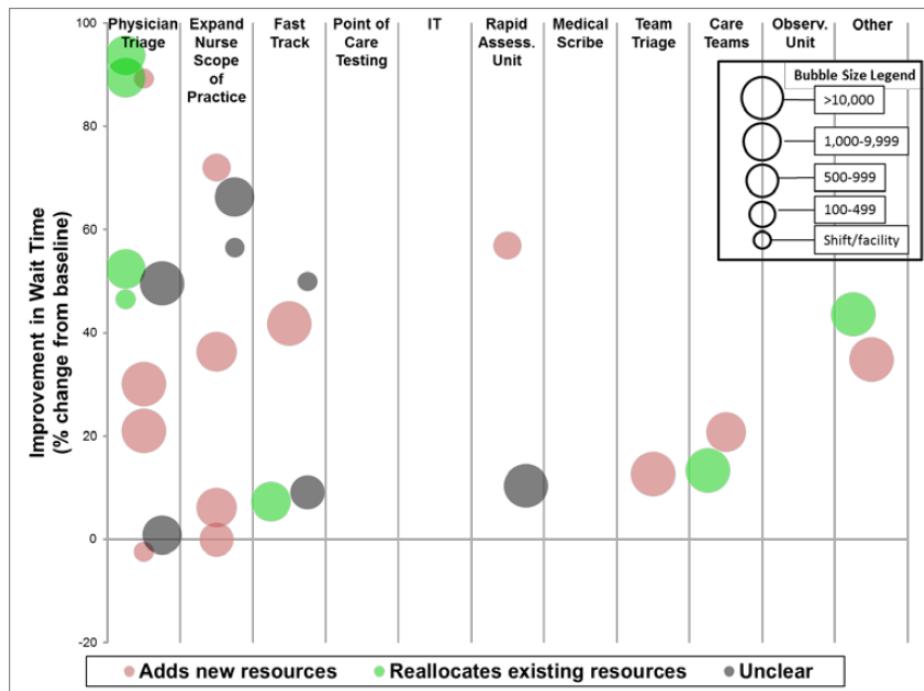


Figure 2. Evidence Map Displaying Improvement in Wait time taken from Miake-Lye IM, et al. (2017).

Improvements in wait time tended to range between 10 and 40 minutes (figure 2). Studies with a physician triage and additional nurses as interventions had the highest improvements, of more than 60% by reallocating existing resources. Rapid assessment unit resources interventions reported lower effects on Wait Time. Essentially, expanding the size of the ED is a clear fix for overcrowding, however, this is often costly and impractical. For decision-makers with resource constraints, more accurate reporting of resource requirements is imperative. (Miake-Lye IM, et al. 2017)

2.2 Text Mining and Sentiment Analysis Techniques

Opinion mining or sentiment analysis has recently come to the interest of many industries and fields. As said by Robinson, J. 2022. When human readers approach a text, we use our understanding of the emotional intent of words to infer whether a section of text is positive or negative. To begin performing this technique, tidy text format is a necessary and powerful way to make handling data easier and more effective. This is defined as a table with one token per row, a token is most often a single word per row. Packages such dplyr, tidyr, and broom are used, then to allow the manipulation and exploration of the text. These include word frequencies and sentiment analysis. Stine, R.A. (2019) represents the evolution of the field as a three-phase process summarized as below:



Figure 3. Phases of development of sentiment analysis based on Stine, R.A. (2019).

The first phase was stimulated by technological progress but predates modern computers. The vast quantity of documents that could serve as for identifying features in the text that might predict an opinion required human input, such as supplying a list of key words to be counted. ... In the second phase, the rapid growth of computers and storage expanded the counting task. Rather than counting a few predetermined words, it became possible to count them all... Lately, the third phase of sentiment analysis began in the past decade with the appearance of practical methods for applying deep learning to NLP. Stine, R.A. (2019).

Robinson, J.2022 suggests a process of sentiment analysis chart that uses tidytext. It supplies a way to explore attitudes and opinions expressed in texts. Text mining offers tools such as sentiment analysis to understand the changes in customer's/patient's attitudes, which can give the basis for identifying positive or negative reviews. In the following figure a step-by-step sentiment analysis approach is displayed:

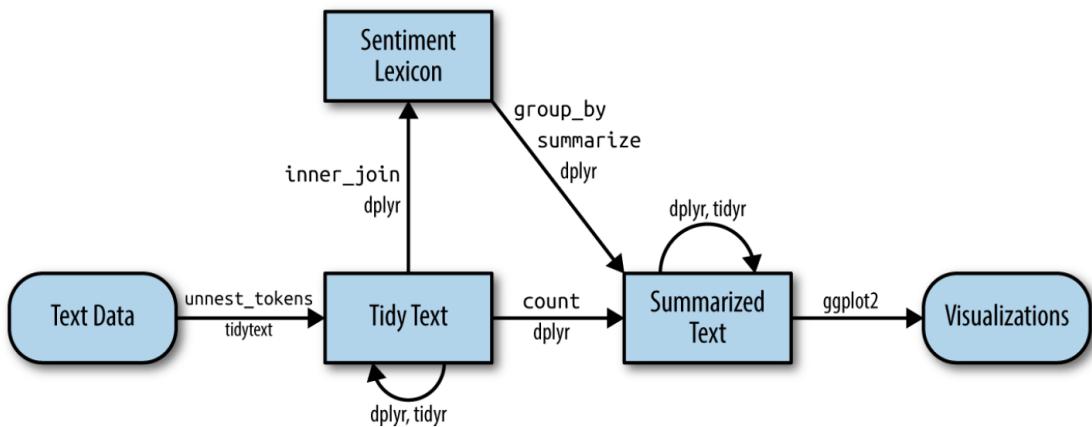


Figure 4. Flowchart for sentiment analysis taken from Robinson, J. 2022.

Text Data must be prepared, clean, and converted to the proper format. After having developed the needed format by using dplyr, tidyr, and broom among other packages for the text data, which is called Tidy Text, it is joined and matched with the sentiment lexicon or dictionary methods that hold a list of words and their respective sentiment categorization or level of sentiment. Moving on through the process, while selecting the rightest dictionary type is subjective and depends upon the text structure once it is decided summarizing and visualization approaches come next on the flow.

A series of recent studies has indicated as Stine, R.A. (2019) that sentiment analysis or opinion mining aims to assign an opinion or emotional label to text. Frequently, it is to examine whether the text expresses a positive or negative opinion often called polarity. The most widely used form of opinion mining assumes that the text of a website/document/form presents a collection of information of some entity by the customer/patient, such as the opinion of a customer/patient expressed in a product review/service subsequently. More systematic and theoretical analysis is needed for extracting the reviewer's intention from what may be a brief, sarcastic comment making sentiment analysis a challenging problem in natural language processing (NLP). Excellent reviews of NLP include Jurafsky ,D. and Martin ,JH. 2009; Manning ,CD. and Schütz ,H. 1999 ;W,T, Lin, et al.2011.

Earlier studies have shown that the most direct approach to sentiment analysis which relies on a dictionary, or lexicon, that assigns positive or negative labels to a list of predetermined words is

the oldest and simplest. The predominance of these marked words decides the opinion assigned to a record. For example, Kumar, C.S.P., 2021 conducted experiments on the proposed approach using NHS England, NHS Choices, Hospitals, Patient Comments and Ratings, and patients expressing their experiences over social media. The proposed approach defined a new domain-specific dictionary and uses this in sentiment scoring to enhance the overall sentiment classification on patient authored text (Kumar, C.S.P et al. 2001). Additionally, Agarwal ,A, Xie B. et al. 2011; Gohil ,S. Vuik ,S. Darzi, A. 2018; Kouloumpis, E.,et al. 2011 carried out a Twitter health care research quantitative method of sentiment analysis for the free-text messages (tweets) using AFINN dictionary.

By citing and exploring the structure of the dictionaries, it is possible to describe that the Bing dictionary (Hu M, Liu, B. 2004), as explained by several authors and widely used, is the simplest and perhaps the best known. It contains 6,788 words as positive or negative. As it has been examined, the Bing dictionary has far more negative than positive word types (4,782 vs. 2,006). The AFINN (Nielsen, FA. 2011) has fewer types but assigns a numerical sentiment range from -5 to +5 to types rather than a category. The remaining dictionaries (NRC, Loughran) hold a more diversified list of emotions to word types. Rather than just labelling words as positive or negative, these categories include anger and joy (Mohammad, SM, Turney, PD. 2013) and litigious (Loughran and McDonald. 2011, which is oriented toward business applications).

3. Methodology

The definition of key indicators performances and understanding of the PAU role within the Warwick hospital are important activities. This section contains the description of the approaches performed for both datasets (A&E and PAU), and patients' reviews.

3.1 Dataset 1: A&E Paediatrics and Dataset 2: PAU Data (inpatient)

This methodology was developed to determine the benefit of having established the PAU. The collected information involved primarily quantitative resources but also touched upon descriptive qualitative methods. As the client provided data resources directly, those were extracted, manipulated, and analysed as a primary data analysis resource. For data processing, this project followed the CRISP-DM (Cross Industry Standard Process for Data Mining) method (Wirth, R. and Hipp, J., 2000) (Please refer to Figure 5). Further, R Studio was the main tool.

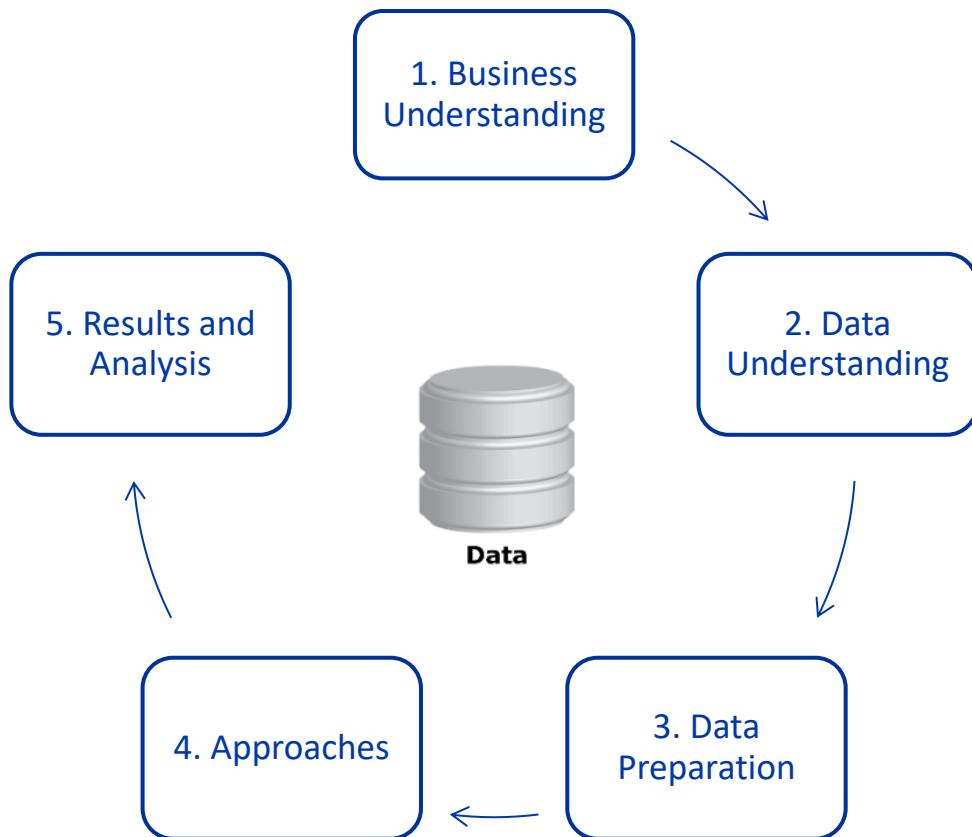


Figure 5. Process Diagram based on CRISP-DM

1. Firstly, the business understanding:

To begin with the business understanding, the problem statement, the validation of the approaches carried out, and all necessary clarifications were gathered by arranging meetings and discussions with staff and Consultants at the hospital. (See appendix)

2. As a second stage, data understanding:

The data was provided by the Information & Performance team of the TRUST. Firstly, Dataset 1: A&E patients from 01/01/2019 to 31/03/2022 (241174 patients to which 47284 correspond to < 16 years old) was collected, and its variables are as follows:

Variable	Description
Arrival Date	Patient arrival time and date
Age on arrival	Patient's Age
Patient Gender	Female and Male
Arrival > Initial Assessment	Elapsed time between Arrival and Initial assessment (minutes) (blank: unattended patient)
Arrival > Triage	Elapsed time between Arrival and triage (minutes) ((blank: unattended patient))
Arrival > Treatment	Elapsed time between Arrival and treatment (minutes) (blank: unattended patient)
Arrival > DTA	Elapsed time between Arrival and DTA (DECISION TO ADMIT) (minutes) (blank: unattended patient)
Arrival > Departure	Elapsed time between Arrival and Departure (minutes) (blank: unattended patient)
Diagnosis	Diagnosis Description
Acuity	Level of urgency
Admission Source	Referral type
Admitted	Y:yes, N:no

Admitting speciality	Admission speciality
Local patient Number	Identifier
Referred to Service	When the patient came to ED, were they referred to
Month Ending	Month of admission

Table 1. Dataset 1: A&E patients

Following the table above, each patient who walks into the A&E goes through the stages illustrated in figure 6. Describing and exploring those phases was needed, then these relevant KPIs were used as measures for assessing the establishment of the PAU were determined as follows:

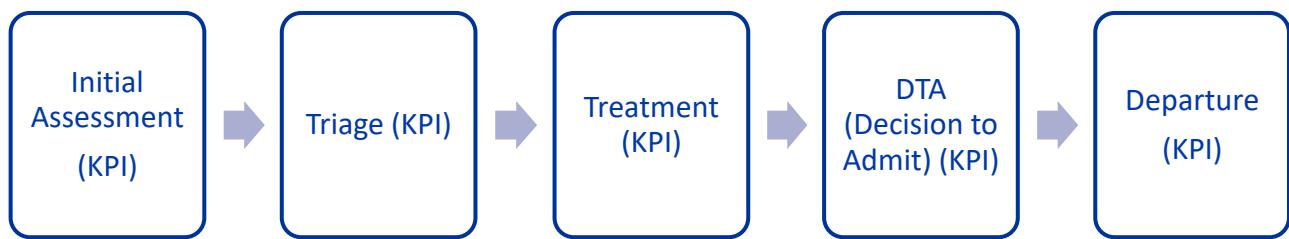


Figure 6. Patient flow stages A&E (KIP's)

Additionally, since the valuation of healthcare services can also be developed by identifying patient characteristics, a second database was introduced. The new database provided details for descriptive analysis, operational characteristics analysis, and assessing LOS for the PAU. This new dataset stored inpatient information for the PAU from 06/04/2020 to 30/06/2022 with a total of 4916 observations. The explanation for each variable is in table 2.

Variable	Description
Financial year	Fiscal year yyyy/d format
Financial month number	Month encoding 1 to 12
Month ending	Month ending date for each patient visit d/m/yyyy format
LOS	LOS for inpatient
Admission method group description	Admission method

Admission method hospital provider Spell description	Admission method specific description
Admission method hospital Provider spell	Admission code
Specialty group	Non-Paediatric/ Paediatrics
Treatment function code at admission	Treatment encoding
Age on admission	Age
Child	Grouping age 13 - 16, 17 and over, 3 to 5, 6 - 12 and Under 3 years
Main primary diagnosis	Main Diagnosis
Diagnosis description	Description for Diagnosis
Diagnosis main grouping	Description for main diagnosis
Start date hospital provider spell	Arrival date at PAU
Start time hospital provider spell	Arrival time at PAU
Discharge time hospital provider spell	Discharge time from PAU
Local patient number	Unique identifier
Priority type description	Level of emergency

Table 2. Dataset 2: PAU Data (inpatient)

3.Thirdly, data preparation

After identifying the measures for evaluation (KPI), the specification for pre- and post-implementation dates was completed. At least three months gap were included within the intervention for settling purposes, and to avoid seasonality effects, as suggested by several studies. The periods before and after were as follows:

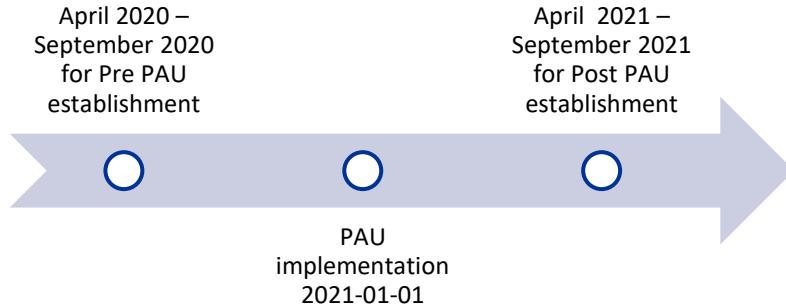


Figure 7. Pre and Post implementation

The figure above reflects two periods: from April 2020 to September 2020 (6 months) for the period before the establishment of the PAU and from April 2021 to September 2021 for the Post PAU establishment. Filters were applied before performing any statistical approach and analysis. These filters were decided based on the specific characteristics that PAU patients possess. The extractions were:

- To take patients younger than 16 years old since the PAU is exclusively for infants, children, and teenagers.
- To filter admission times from 10 am to 8 pm since the PAU opens from 10 am and admits the last patient at 8 PM.
- To filter by standard-level emergency care (regime/therapy) and non-urgent-level emergency care (regime/therapy) since the PAU only deals with those sorts of acuties.

(Note: There was no need to filter by day because the PAU opens every day)

4. Following our methodology, our fourth phase is called “Approaches”

- Null hypothesis significance testing (NHST) and estimation approach

Performing the analysis for each KPI began. It started with the creation of five data frames for each KPI while removing NAs. Besides that, a new dummy variable called implementation was inserted containing the number 1 for after or 0 for before PAU. Then, to examine those evaluation measures, independent samples null-hypothesis significance testing (NHST) (Howell, D.C. 2017) shall have been applied to continuous data (where p-value < 0.05 is statistically significant). A

Welch's test was run since its assumptions are that the comparison is for two independent means, and the variances are unequal.

The **KPI**'s included were a total of 5:

1. Arrival > Departure (minutes)
2. Arrival > DTA (minutes)
3. Arrival > Treatment
4. Arrival > Triage
5. Arrival > Initial Assessment

Subsequently, Null hypothesis significance testing (NHST) formula was applied:

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{s_{\bar{x}_1 - \bar{x}_2}} = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Howell, D.C. (2017)

Where the variables are:

Symbol	Description
\bar{x}_i	The mean of the sample i
$s_{\bar{x}_1 - \bar{x}_2}$	The standard error of the difference in sample means
s_i	The standard deviation of sample i
n_i	The number of observations in the sample i

NHST assumes hypothesis such:

- Null Hypothesis: The difference between mean of **KPI** after PAU implementation (implementation1) and before PAU implementation (implementation0) is zero.
- Alternate Hypothesis: The difference between mean of **KPI** after PAU implementation (implementation1) and before PAU implementation (implementation0) is NOT zero.

Following this testing, linear regression model for **KPI** and implementation of PAU as independent variable was created as below:

$$z. \text{KPI} = \beta_{Intercept} + \beta_{implementation} \times implementation + \epsilon$$

Cumming, G. and Calin-Jageman, R. (2016) ; Cumming, G. (2014)

The summary lm() output contains an NHST of whether the coefficient is zero or not.

Furthermore, estimation approach (Cumming, G. and Calin-Jageman, R. 2016; Cumming, G. 2014) for calculating confidence intervals for each **KPI** was run. The estimation approach was carried out and took a 98% confidence interval range. Since the confidence interval range is between 95% CI [lower-upper], it tells us how confident we can be that our estimate coefficient for implementation1 will fall into that range depending on how wide our interval is. Additionally, it was important to mention how narrow the interval was and whether it did not include zero. Here we made a model object m.**KPI**.by.implementation and then use emmeans to get confidence intervals for **KPI** for PAU implementation and non-implementation and pairs () and confint() to contrast the implementation and no implementation.

- Descriptive analysis and Time series:

The application of time series analysis and examination of patterns were used for specific purposes. This approach covered explanations behind trends based on qualitative information from medical staff and recent official resources such as NHS websites, newspapers, and governmental information.

- Assessing LOS

To verify whether the LOS at the PAU was due to patient-related circumstances or organizational (Otto, R., et al. 2021), a comparison between similar patients admitted to the PAU was made. For this approach, 32 patients were selected randomly while applying eight filtering steps. Their characteristics filtered were:

- Emergency admission method.
- Pediatrics specialist.
- 0 years old.

- Respiratory diagnosis.
- Acute upper respiratory infection (most common diagnoses).
- Urgent priority.
- Accident and emergency admission method.
- Admission date from 2020 to 2021.

Subsequently, their Paediatric Early Warning Score (PEWS) was obtained by using their local hospital number on the records platform. PEWS score holds vital signs and observations essential to assess child's clinical status. This score provides a range from 0 (low severity) to 6+ (highest severity) depending on patient vital signs such heart rate, respiratory rate, temperature, among others (see appendix). Then, LOS within similar severity of illness was evaluated.

As a result, a Table 3 was created which included variables such:

- LOS in minutes.
- First ward of stay
- Admission method
- Admission date
- Start time when admitted
- Local patient number
- LOS in hours
- Description PEWS form
- New ID for security purposes

LOS in mins	FIRST_WARD_STAY_NAME	ADMISSION_METHOD_HOSPITAL_PROVIDER_SPELL_DESCRIPTION	ADMIT_DATE	
1	180	PAA	Accident and emergency	2020-05-03
2	281	PAA	Accident and emergency	2020-05-03
3	8	PAA	Accident and emergency	2020-05-27
START_TIME_HOSPITAL_PROVIDER_SPELL	LOCAL_PATIENT_NUMBER	LOS in hours	DescriptionPWESFORM	NEWID
16:30:00		3	0	1
10:09:00		5	-0	2
04:07:00		0	0.5	3

Table 3. PEWS score

5. Our last step for this methodology is Results and Analysis: Those will be covered in section 4

3.2 Text analytics–reviews

On the other hand, IWantGreatCare is an independent organization. This platform is available for measuring patient experience and outcomes, storing over six million healthcare reviews across 28 countries worldwide. From this website, reliable and transparent Warwick hospital reviews from patients were extracted. Hence, using these valuable resources to assess a patient's experience during their stay was plausible for this study. Text mining insights were developed in this scenario for generating insights into patients' satisfaction.

Further, patients' comments analysis was done through sentiment analysis. It is the process of extracting the emotions of the author of a text at the time of writing it. This text mining technique has recently been used to examine a large amount of qualitative data, often called a type of text analytics. The steps for this technique were 5 based on Robinson, J. 2022: preparing the dataset, cleaning data, preparation analysis, finding sentiment, and choosing the dictionary, and finding dominant and positive words. (See figure 8).

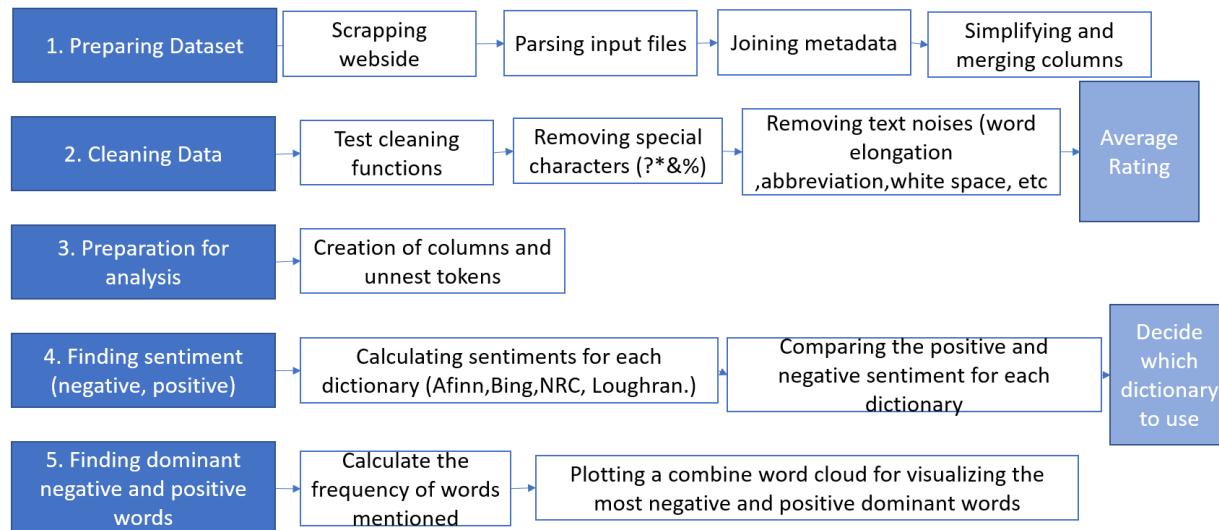


Figure 8. Method for sentiment analysis based on Robinson, J. 2022

To explain in detail figure 8, we have the following steps:

1. Preparing Dataset

As shown on figure 8, preparing Dataset is the beginning of the process. Raw data was converted to rds format. Collapsed text like reviews per SKU was split into different columns using separate and pivot longer functions. 9,263 and 967 reviews from A&E and Paediatrics A&E respectively were kept after omitting duplicated or missing data. Likewise, through web scrapping 16,370 from A&E and 2,850 from Paediatrics A&E reviews were extracted. So, two data sets were obtained where variables include: rating (from 1 to 5 stars), date and reviews.

2. Cleaning Data

Moving onto the second step, review text data was tokenized for this analysis. Anomalies removed were:

- Emotions: emoticons, grades, and ratings are replaced with corresponding.
- Spelling Mistakes: Spelling in the text was checked using the Hunspell package.
- Suggested words to correct the text. Those last ones were revised and corrected manually
- Special characters, numbers and double spaces.

3. Preparation for analysis

This third stage involved the creation of columns with the words extracted from the reviews and then ready for unnesting tokens.

4. Finding sentiment (negative, positive)

In this evaluation stage represented as number four on the mentioned figure, four dictionaries have been considered (Afinn, Bing, loughran and Nrc) to compare between them and determine the one with highest detectability/coverage of words' polarity.

5. Finding dominant negative and positive words

Lastly, the fifth approach was to find the most dominant words and their frequency of mention to create the word cloud plot.

4. Results and Analysis

The study aims to establish the added benefit of the PAU for the A&E and determine how the patients' satisfaction has been met. The first section of this chapter outlines the results obtained from data and time series analysis. And the second section, sentiment analysis presents the reviews collected from the IWantGreatCare website.

4.1 Data and time series analysis

There were several approaches that served to determine the added value of the PAU. These are statistical tests to assess relevant KPIs, explanatory analysis for patients' characteristics, and time series for trend analysis.

Null hypothesis significance testing (NHST) assumes normally distributed variables. Skewness is present as shown on the distribution of every KPI variable in figure 9. However, since the number of records is considerable, running a NHST hypothesis testing and estimation approach was suitable.

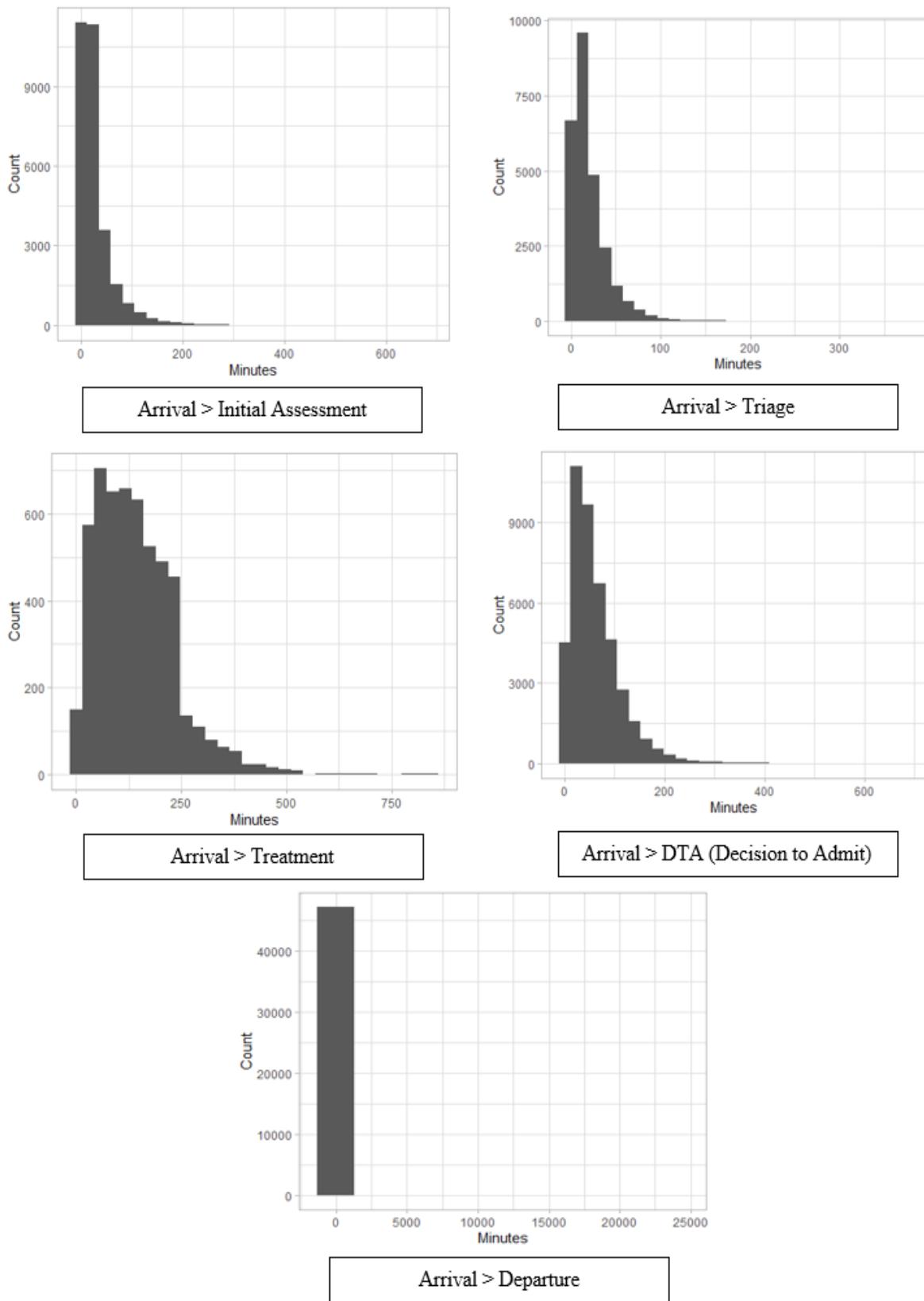


Figure 9. Distribution of the 5 KPIs

After checking the distribution for each KPI, the results from the t-test (NHST) along with Estimation approach techniques were generated to verify whether the waiting times: Departure, DTA (decision to admit), treatment, triage, and Initial assessment had a similar or different average waiting times before and after the PAU. The results revealed the next 5 bullet points:

- For Departure KPI:

Welch Two Sample t-test	
t	-14.629
df	1688.5
p-value	< 2.2e-16
95 percent confidence interval	
-15.07184	-11.57973
Sample Estimates:	
mean in group 0	mean in group 1
16.56921	29.895

Interpretation: The mean of Arrival > Departure (minutes) after PAU implementation (implementation1) and before PAU implementation (implementation0) is NOT zero. $t(1688.5) = -14.629$, $p < 0.00$.

Therefore, the t -test tells us that we should accept the Alternate hypothesis and the data is statistically significant. However, the waiting times for departure did not significantly improve post-intervention but increased.

Summary lm()					
Residuals:					
Min	1Q	Median	3Q	Max	
-124.24	-43.76	-9.50	31.76	491.76	
Coefficients:					
	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	98.756	2.102	46.99	<2e-16 ***	
implementation1	43.480	2.972	14.63	<2e-16 ***	
Signif. Codes: 0 *** 0.001 ** 0.01 * 0.05 . 0.1 ' 1					
Residual standard error: 63.23 on 1808 degrees of freedom					
Multiple R-squared: 0.1058, Adjusted R-squared: 0.1053					
F-statistic: 214 on 1 and 1808 DF, p-value: < 2.2e-16					

Interpretation: The summary () output contains an NHST of whether the coefficient is zero or not. Given the results we find that the effect of implementation (implementation1) on the Departure (time) is NOT zero. However, waiting times did not reduce. $t(1808) = 14.63$. $p < .00$

Estimation approach

Here we make a model object `m.Departure.by.implementation` and then use `emmeans` to get confidence intervals for the Arrival > departure waiting times for PAU implementation and non-implementation and pairs () and `confint()` to contrast the implementation and no implementation.

Estimation Approach						
implementation	emmean	SE	df	lower.CL	upper.CL	
0	98.8	2.1	1808	94.6	103	
1	142.2	2.1	1808	138.1	146	
Confidence level used: 0.95						
contrast		estimate	SE	df	lower.CL	upper.CL
implementation0 - implementation1		-43.5	2.97	1808	-49.3	-37.7
Confidence level used: 0.95						
coefficients		2.5 %	97.5 %			
(Intercept)		98.75580	94.63383	102.87777		
implementation1		43.47956	37.65021	49.30891		

Interpretation reporting 95% confidence interval difference: The mean in Departure waiting times for no implementation is 98.8 95% CI. The mean in Departure waiting times for implementation is 142.2 95% CI. This difference in means is significantly different from zero, but implementation did not reduce waiting times overall. (See Figure 10 for confidence intervals by implementation and contrast).

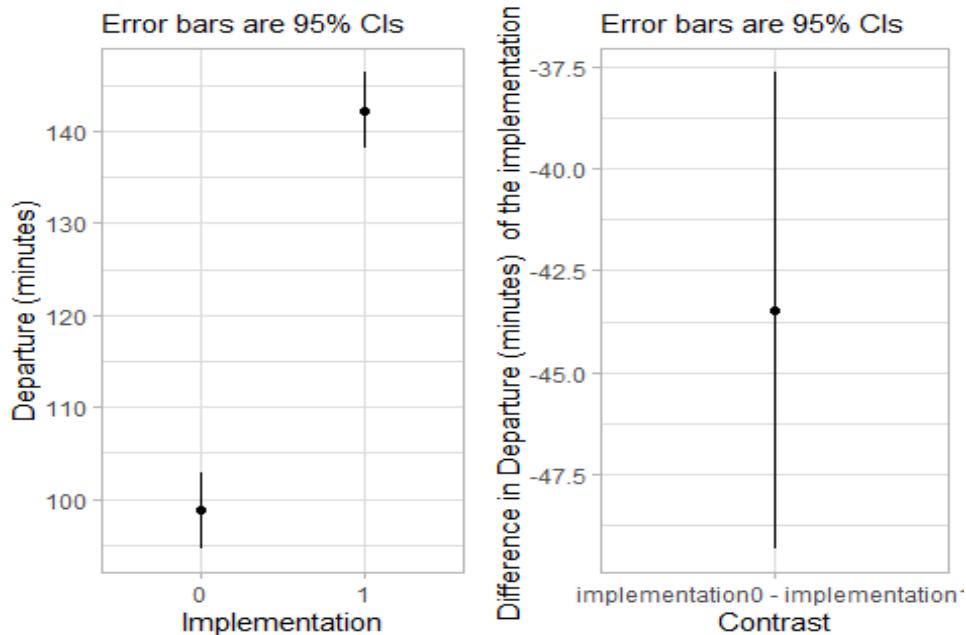


Figure 10. Confidence intervals and contrast for Departure

- For DTA KPI

Welch Two Sample t-test	
t	-9.3995
df	314.34
p-value	< 2.2e-16
95 percent confidence interval	
-109.42	-71.54
Sample Estimates:	
mean in group 0	mean in group 1
82.907	173.3888

Interpretation: The mean of Arrival > DTA (decision to admit) (minutes) after PAU implementation (implementation1) and before PAU implementation (implementation0) is NOT zero. $t(314.34) = -9.3995, p < 0.00$

Therefore, the t -test tells us that we should accept the Alternate hypothesis and the data is statistically significant. However, the waiting times for DTA did not significantly improve post-intervention but increased.

Summary lm()					
Residuals:					
Min	1Q	Median	3Q	Max	
-162.39	-61.39	-14.91	42.61	459.61	
Coefficients:					
	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	82.908	8.641	9.594	< 2e-16 ***	
implementation1	90.481	10.934	8.275	3.67e-15 ***	
Signif. Codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					
Residual standard error: 94.27 on 315 degrees of freedom					
Multiple R-squared: 0.1786, Adjusted R-squared: 0.176					
F-statistic: 68.48 on 1 and 315 DF, p-value: 3.674e-15					

Interpretation: The summary () output contains an NHST of whether the coefficient is zero or not. Given the results we find that the effect of implementation (implementation1) on the DTA (decision to admit) time is NOT zero. However, it did not reduce waiting times. $t(315) = 8.275, p < .00$

Estimation approach

Here we make a model object `m.DTA.by.implementation` and then use `emmeans` to get confidence intervals for the Arrival > DTA waiting times for PAU implementation and non-implementation and pairs () and `confint()` to contrast the implementation and no implementation.

Estimation Approach						
implementation	emmean	SE	df	lower.CL	upper.CL	
0	82.9	8.64	315	65.9	99.9	
1	173.4	6.70	315	160.2	186.6	
Confidence level used: 0.95						
contrast		estimate	SE	df	lower.CL	upper.CL
implementation0 - implementation1		-90.5	10.9	315	-112	-69
Confidence level used: 0.95						
coefficients		2.5 %	97.5 %			
(Intercept)		82.90756	65.90535	99.90978		
implementation1		90.48133	68.96825	111.99440		

Interpretation reporting 95% confidence interval difference: The mean in DTA (decision to admit) waiting times for no implementation is 82.9, 95%CI. The mean in DTA (decision to admit) waiting times for implementation is 173.4 95%CI. This difference in means is significantly different from zero, but the implementation did not reduce waiting times overall. (See Figure 11 for confidence intervals by implementation and contrast).

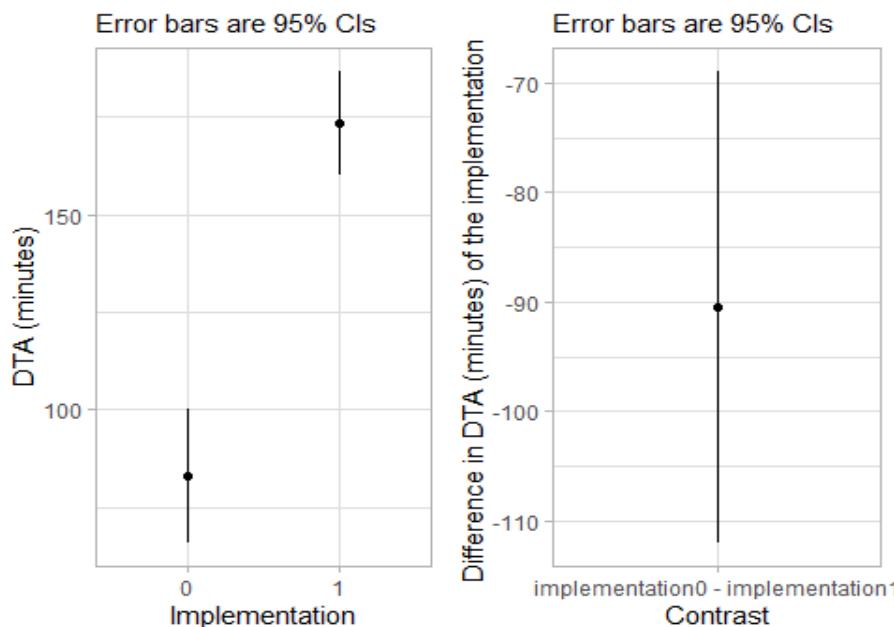


Figure 11. Confidence Interval and Contrast for DTA

- For treatment KPI

Welch Two Sample t-test	
t	-18.351
df	1334.6
p-value	< 2.2e-16
95 percent confidence interval	
-40.18874	-32.4261
Sample Estimates:	
mean in group 0	mean in group 1
49.6926	86

Interpretation: The mean of Arrival > treatment (minutes) after PAU implementation (implementation1) and before PAU implementation (implementation0) is NOT zero. $t(1334.6) = -18.351, p < 0.00$

Therefore, the t -test tells us that we should accept the Alternate hypothesis and the data is statistically significant. However, the waiting times for treatment did not significantly improve post-intervention but increased.

Summary lm()					
Residuals:					
Min	1Q	Median	3Q	Max	
-80.000	-27.693	-5.693	19.000	304.000	
Coefficients:					
	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	49.693	1.412	35.18	<2e-16 ***	
implementation1	36.307	1.988	18.27	<2e-16 ***	
Signif. Codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 '' 1					
Residual standard error: 39.55 on 1582 degrees of freedom					
Multiple R-squared: 0.1742, Adjusted R-squared: 0.1737					
F-statistic: 333.7 on 1 and 1582 DF, p-value: < 2.2e-16					

Interpretation: The summary () output contains an NHST of whether the coefficient is zero or not. Given the results, we find that the effect of implementation (implementation1) on the treatment (time) is NOT zero. However, it did not reduce waiting times. $t(1582) = 18.13, p < .00$

Estimation approach

Here we make a model object `m.DTA.by.implementation` and then use `emmeans` to get confidence intervals for the Arrival > DTA waiting times for PAU implementation and non-implementation and pairs () and `confint()` to contrast the implementation and no implementation.

Estimation Approach						
implementation	emmean	SE	df	lower.CL	upper.CL	
0	49.7	1.41	1582	46.9	52.5	
1	86.0	1.40	1582	83.3	88.7	
Confidence level used: 0.95						
contrast		estimate	SE	df	lower.CL	upper.CL
implementation0 - implementation1		-36.3	1.99	1582	-40.2	-32.4
Confidence level used: 0.95						
coefficients		2.5 %	97.5 %			
(Intercept)		49.6926	46.92211	52.46310		
implementation1		36.3074	32.40896	40.20583		

Interpretation reporting 95% confidence interval difference: The mean in treatment waiting times for no implementation is 49.7, 95% CI. The mean in treatment waiting times for implementation is 86.0, 95% CI. This difference in means is significantly different from zero, but the implementation did not reduce waiting times overall. (See Figure 12 for confidence intervals by implementation and contrast).

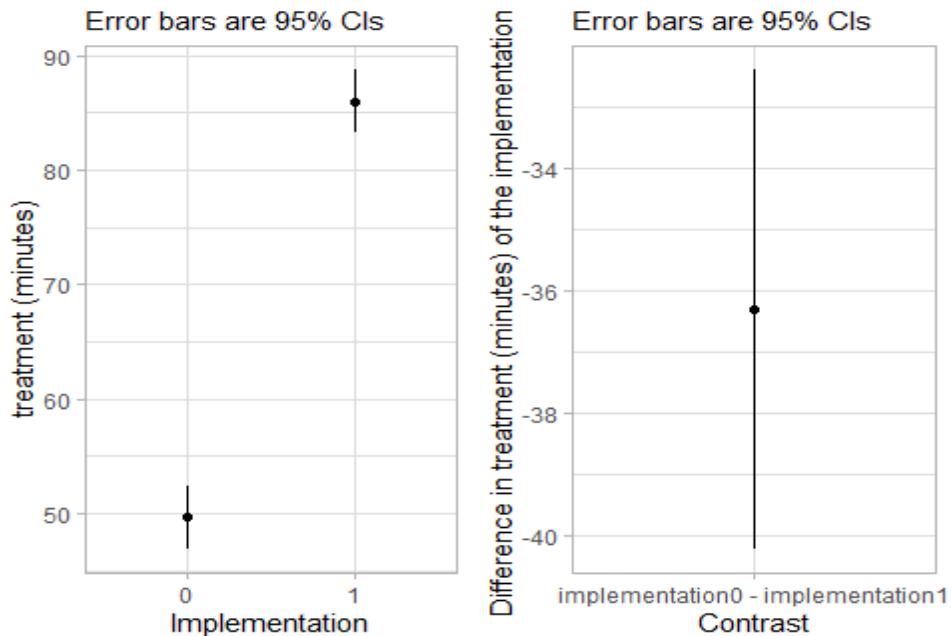


Figure 12. Confidence Intervals and Contrast for treatment

- For triage KPI

Welch Two Sample t-test	
t	-14.972
df	1721.3
p-value	< 2.2e-16
95 percent confidence interval	
-14.35946	-11.03305
Sample Estimates:	
mean in group 0	mean in group 1
16.56575	29.262

Interpretation: The mean of Arrival > triage (minutes) after PAU implementation (implementation1) and before PAU implementation (implementation0) is NOT zero. $t(1721.3) = -14.972, p < 0.00$

Therefore, the t -test tells us that we should accept the Alternate hypothesis and the data is statistically significant. However, the waiting times for triage did not significantly improve post-intervention but increased.

Summary lm()						
Residuals:						
Min	1Q	Median	3Q	Max		
-29.262	-12.566	-4.262	8.434	161.738		
Coefficients:						
	Estimate	Std. Error	t value	Pr(> t)		
(Intercept)	16.5657	0.6273	26.41	<2e-16 ***		
implementation1	12.6963	0.8658	14.66	<2e-16 ***		
Signif. Codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1						
Residual standard error: 18.87 on 1903 degrees of freedom						
Multiple R-squared: 0.1015, Adjusted R-squared: 0.1011						
F-statistic: 215 on 1 and 1903 DF, p-value: < 2.2e-16						

Interpretation: The summary () output contains an NHST of whether the coefficient is zero or not. Given the results we find that the effect of implementation (implementation1) on the triage (time) is NOT zero. However, it did not reduce waiting times. $t(1903) = 14.66, p < .00$

Estimation approach

Here we make a model object `m.triage.by.implementation` and then use `emmeans` to get confidence intervals for the Arrival > triage waiting times for PAU implementation and non-implementation and pairs () and `confint()` to contrast the implementation and no implementation.

Estimation Approach						
implementation	emmean	SE	df	lower.CL	upper.CL	
0	16.6	0.627	1903	15.3	17.8	
1	29.3	0.597	1903	28.1	30.4	
Confidence level used: 0.95						
contrast		estimate	SE	df	lower.CL	upper.CL
implementation0 - implementation1		-12.7	0.866	1903	-14.4	-11
Confidence level used: 0.95						
coefficients		2.5 %	97.5 %			
(Intercept)		16.56575	15.33549	17.79600		
implementation1		12.69625	10.99823	14.39427		

Interpretation reporting 95% confidence interval difference: The mean in triage waiting times for no implementation is 16.6, 95% CI. The mean in triage waiting times for implementation is 29.3, 95% CI. This difference in means is significantly different from zero, but implementation did not reduce waiting times overall. (See Figure 13 for confidence intervals by implementation and contrast)

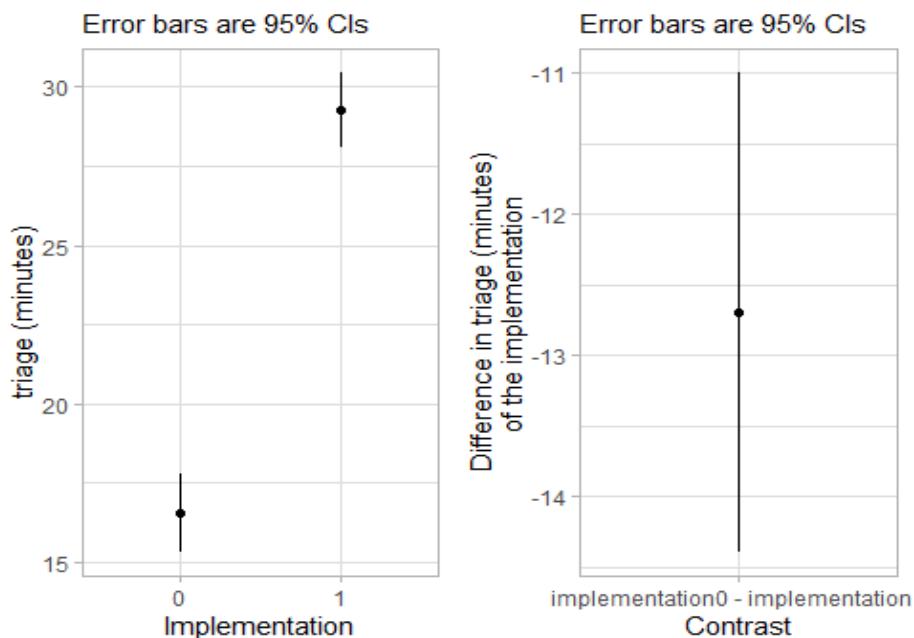


Figure 13. Confidence Intervals and Contrast for Triage

- For Initial Assessment KPI

Welch Two Sample t-test	
t	-14.969
df	1661.8
p-value	< 2.2e-16
95 percent confidence interval	
-15.07184	-11.57973
Sample Estimates:	
mean in group 0	mean in group 1
16.56921	29.895

Interpretation: The mean of Arrival > initial assessment (minutes) after PAU implementation (implementation1) and before PAU implementation (implementation0) is NOT zero. $t(1661.8) = -14.969, p < 0.00$

Therefore, the t -test tells us that we should accept the Alternate hypothesis and the data is statistically significant. However, the waiting times for initial assessment did not significantly improve post-intervention but increased.

Summary lm()						
Residuals:						
Min	1Q	Median	3Q	Max		
-28.895	-12.569	-4.569	8.431	161.105		
Coefficients:						
	Estimate	Std. Error	t value	Pr(> t)		
(Intercept)	16.5692	0.6610	25.07	<2e-16 ***		
implementation1	13.3258	0.9118	14.61	<2e-16 ***		
Signif. Codes: 0 *** 0.001 ** 0.01 * 0.05 . 0.1 ' 1						
Residual standard error: 19.86 on 1901 degrees of freedom						
Multiple R-squared: 0.101, Adjusted R-squared: 0.1005						
F-statistic: 213.6 on 1 and 1901 DF, p-value: < 2.2e-16						

Interpretation: The summary () output contains an NHST of whether the coefficient is zero or not. Given the results we find that the effect of implementation (implementation1) on the assessment (time) is NOT zero. However, it did not reduce waiting times. $t(1901) = 14.61, p < .00$

Estimation approach

Here we make a model object m.initial_assessment.by.implementation and then use emmeans to get confidence intervals for the Arrival > initial assessment waiting times for PAU implementation and non-implementation and pairs () and confint() to contrast the implementation and no implementation.

Estimation Approach						
implementation	emmmean	SE	df	lower.CL	upper.CL	
0	16.6	0.661	1901	15.3	17.9	
1	29.9	0.628	1901	28.7	31.1	
Confidence level used: 0.95						
contrast	estimate	SE	df	lower.CL	upper.CL	
implementation0 - implementation1	-13.3	0.912	1901	-15.1	-11.5	
Confidence level used: 0.95						
coefficients	2.5 %	97.5 %				
(Intercept)	16.56921	15.27286	17.86557			
implementation1	13.32579	11.53748	15.11410			

Interpretation reporting 95% confidence interval difference: The mean in initial assessment waiting times for no implementation is 16.6, 95% CI. The mean in assessment waiting times for implementation is 29.9, 95% CI. This difference in means is significantly different from zero, but implementation did not reduce waiting times overall. (See Figure 14 for confidence intervals by implementation and contrast)

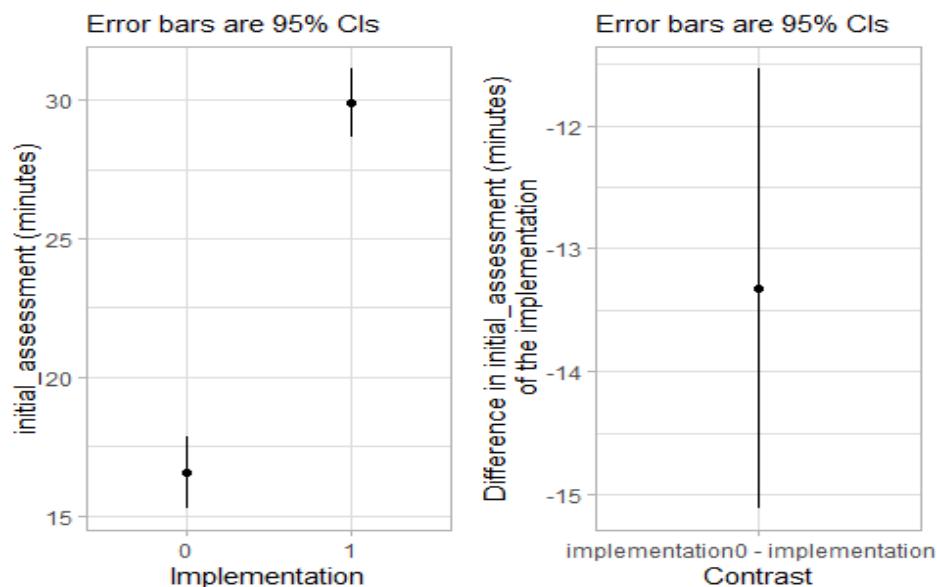


Figure 14. Confidence Intervals and Contrast for Initial Assessment

After carrying out Null Hypothesis testing for mean difference and estimation approach, the results concluded that the intervention of setting up a 6-bed PAU with 1 (Nurse) staffing did not improve waiting times at any stage of the patient flow. Instead, waiting times increased dramatically after implementation. Initial assessment and triage pre- and post-resulted in a much smaller range difference than other stages. Regarding the confidence intervals, the most critical stages appear to be "decision to admit" and treatment because of their difference in the confidence intervals.

However, these results needed further examination to consider huge external impacts such as COVID-19, and lockdowns in the Warwickshire area. Moreover, patients' specific characteristics are yet to be analyzed to understand the PAU role within the hospital for Pediatrics.

Two indicators to understand patients' characteristics are as follows: (Shari ,J, Welch,.et al.2011)

- The pediatric rate relates to the Percentage of A&E visitors younger than 16 years of 241176 total patients. In our case, 42294 are younger than 16 years old, meaning that 17% of the patients from the A&E are pediatrics across the years of study.
- At the same time, the Infant pediatric rate stands for the Percentage of A&E visitors younger than three years old. 241176 patients whose age is less than three years old. In total, 17484 are younger than three years old, so 7.2% is the infant rate for this period. This number also represents nearly 41% of pediatric patients (42294).

Figure 15 depicts the age on arrival < 16 years old at the A&E. By exploring this distribution, the interpretation was that most patients age 0 to 3 years old while 5 to 10 years old children account for a smaller number. The mean is seven years old.

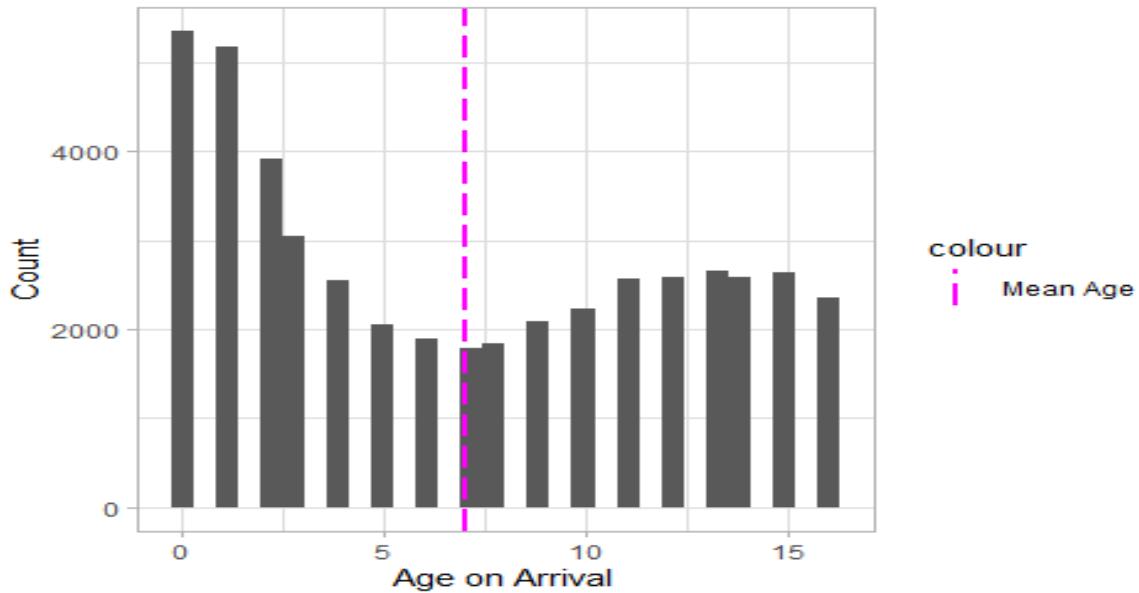


Figure 15. Distribution of Age in the A&E for Paediatrics

Moreover, about patients' gender contrast. As pictured in figure 16, there has been a higher percentage of Male patients while female corresponds to a minority group. The figure also exhibits the evident increasing trend in the number of patients from 2019 to 2022 overall, specifically from 2021.

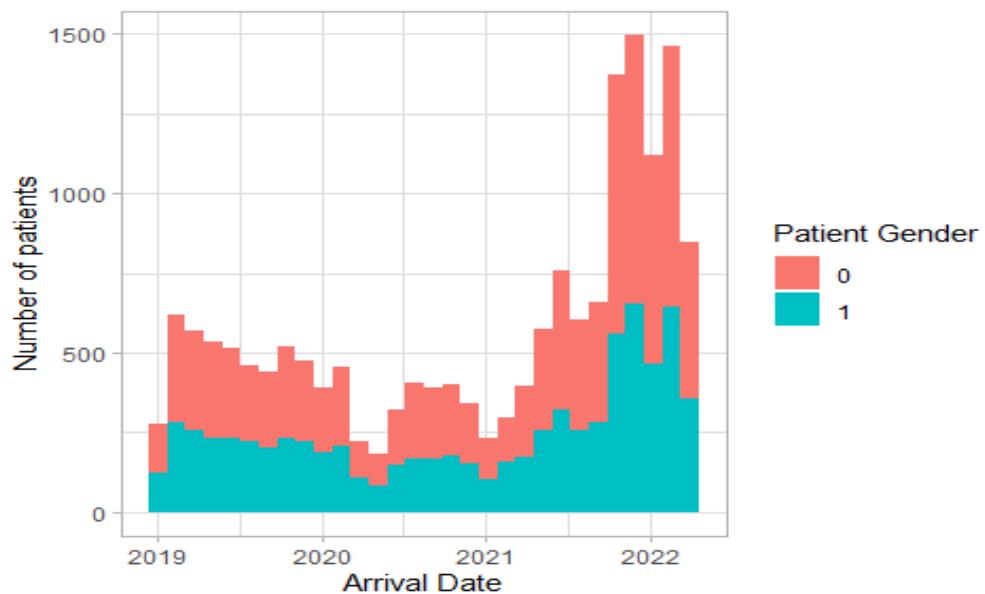


Figure 16. Patients by Gender in the A&E for Paediatrics

Additionally, regarding operational factors, the A&E operates daily. A time series plot (Figure 17) of the number of Pediatrics patients from 2019 to 2022 by day was introduced to describe operational details through the years of study. The number of patients on the y-axis against the years of study grouped by each day. This exploration revealed that Monday and Sunday are the busiest days for the A&E. Note that attendance started to rise in the middle of 2021 onwards, as shown and proven in Figure 17.



Figure 17. Time Series for Paediatrics patients by Weekday

Likewise, the opening hours are 24 hours a day. To evaluate peak hours when there is the highest number of attendees, a distribution of the number of patients at each time from 12 pm to 12 am by weekday was plotted. Then, the busiest hours of the day for the A&E start at 8 am and go on until 11 pm approximately. Therefore, it is not operationally efficient to open a 24-hour PAU since the demand of patients before 7 am and after 8 pm is not significant. (Figure 18).

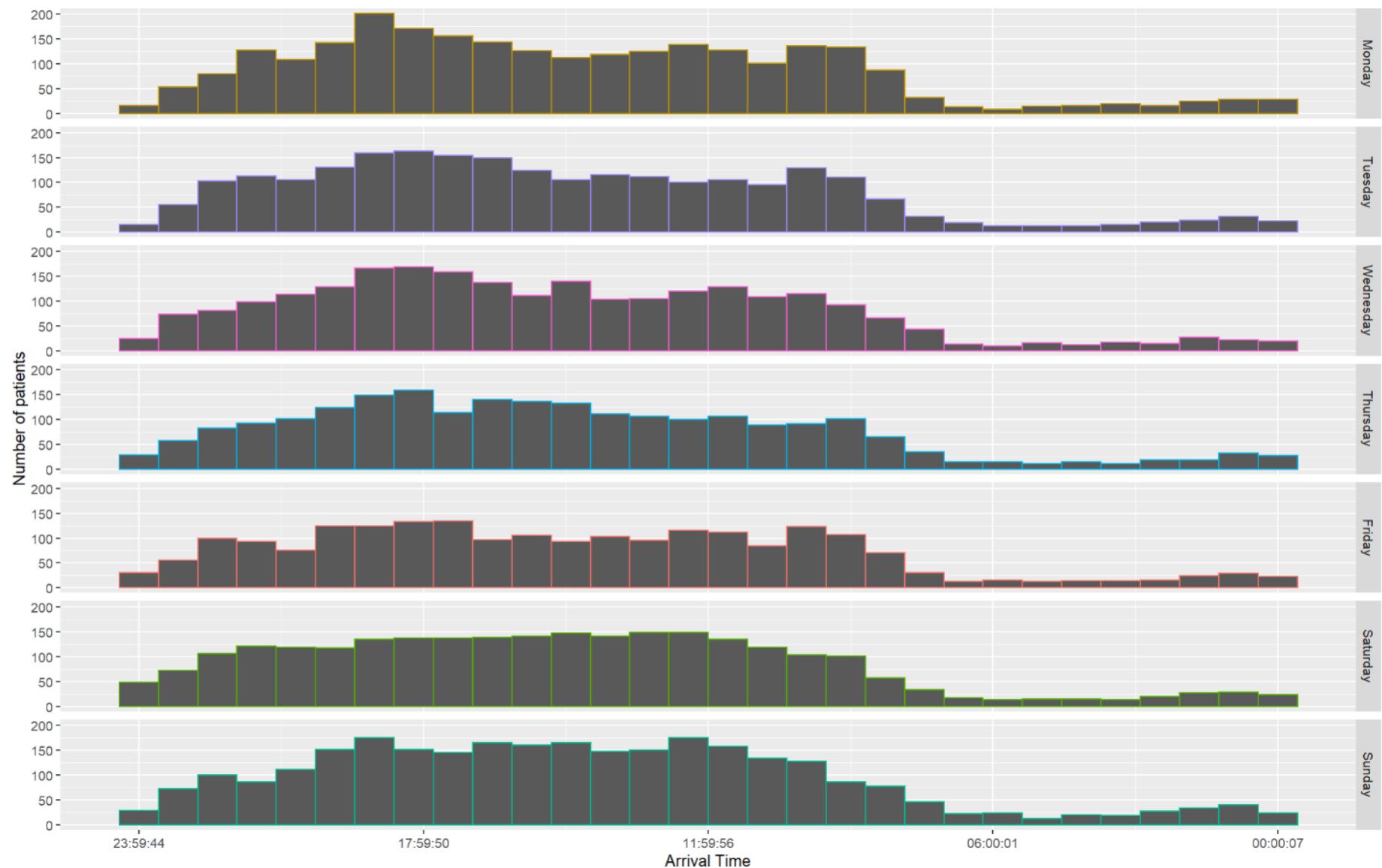


Figure 18. Distribution of patients at each Arrival Time by weekday

The previous tests and exploratory analysis revealed that the waiting times and the number of patients were soaring progressively. For further revision, time series analysis was utilized to explain the circumstances that led to those dramatic changes. This analysis will be presented before diving into inpatient data details.

Additional explanations for the next graphs are: a magenta vertical line that points at the date the first COVID case was reported in Warwickshire, a dark blue as for the PAU data was set up, and finally, two dashed light blue lines standing for the period March to July 2021 on which England began leaving lockdown. (Baker, C., et al.2021; coronavirus.data.gov.uk.n.d;www.ons.gov.uk. n.d.)

Figure 19 displays how the waiting times in minutes for each KPI have behaved from 2019 until 2022. The time series reflect that Arrival > Initial Assessment (minutes) have increased from 2019 to 2022 (figure 19), especially surging from around 2021 middle of the year. These graphs also show that there were no changes in waiting times at the very start of the pandemic in the UK.

As the pandemic surged, lockdowns were put in place. Afterwards, in July 2021, when lockdown restrictions were lifted the A&E waiting times rose rapidly. Establishing the PAU may have reduced the pressure on the A&E department, but it was not preventing an increasing waiting time during the pandemic, as shown on the graph. However, DTA (Decision to admit) seems to be less affected by the pandemic.

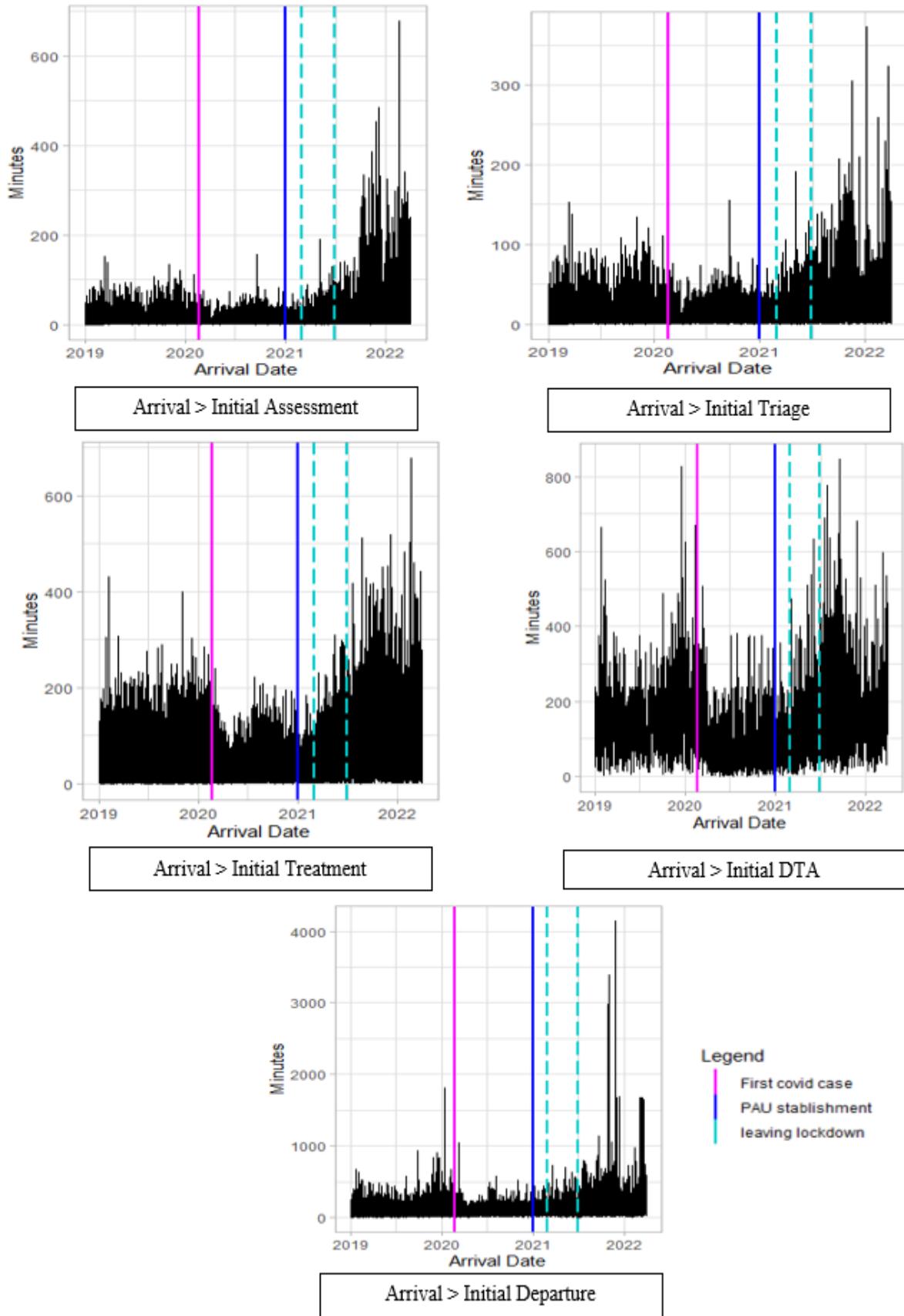


Figure 19. Time series contrast for each KPI

As described above, the waiting times have risen, especially after the leaving lockdown periods. As the number of patients attending at the A&E increased, then the A&E performance declined. So, following up with time series analysis, Figure 20 compares three-time series graphs. First, the number of COVID cases in Warwickshire, then the number of COVID patients at the Warwick Hospital, and the number of non-COVID patients that came into the A&E between Jan 2019 to March 2022.

On this figure, after leaving the lockdown (March to July 2021) and January 2021, there is a trend surging in terms of the number of patients walking into the A&E department (non-COVID patients). On 8 March 2021, England began a phased exit from lockdown. A “cautious but irreversible” decision to ease lockdown restrictions began by lifting restrictions in all areas. (Baker, C., et al. 2021).

Prior to the pandemic, nearby hospitals provided emergency services for patients. However, in the middle of 2020, the Solihull Hospital (30 minutes away by car) stopped admitting emergency cases. Solihull Urgent Treatment Centre temporally closed. Closures had an impact on GPs (General Practitioners), West Midlands Ambulance Service, and other A&E departments. Hence, people who would normally attend Solihull Hospital had to commute to other places to get treatment, including some residents travelling to Warwick hospital for care (BBC, News.,2022;www.birminghamandsolihullccg.nhs.uk.n.d.). To summarize, previous statements explain why the number of patients had increased, consequently affecting the waiting times.

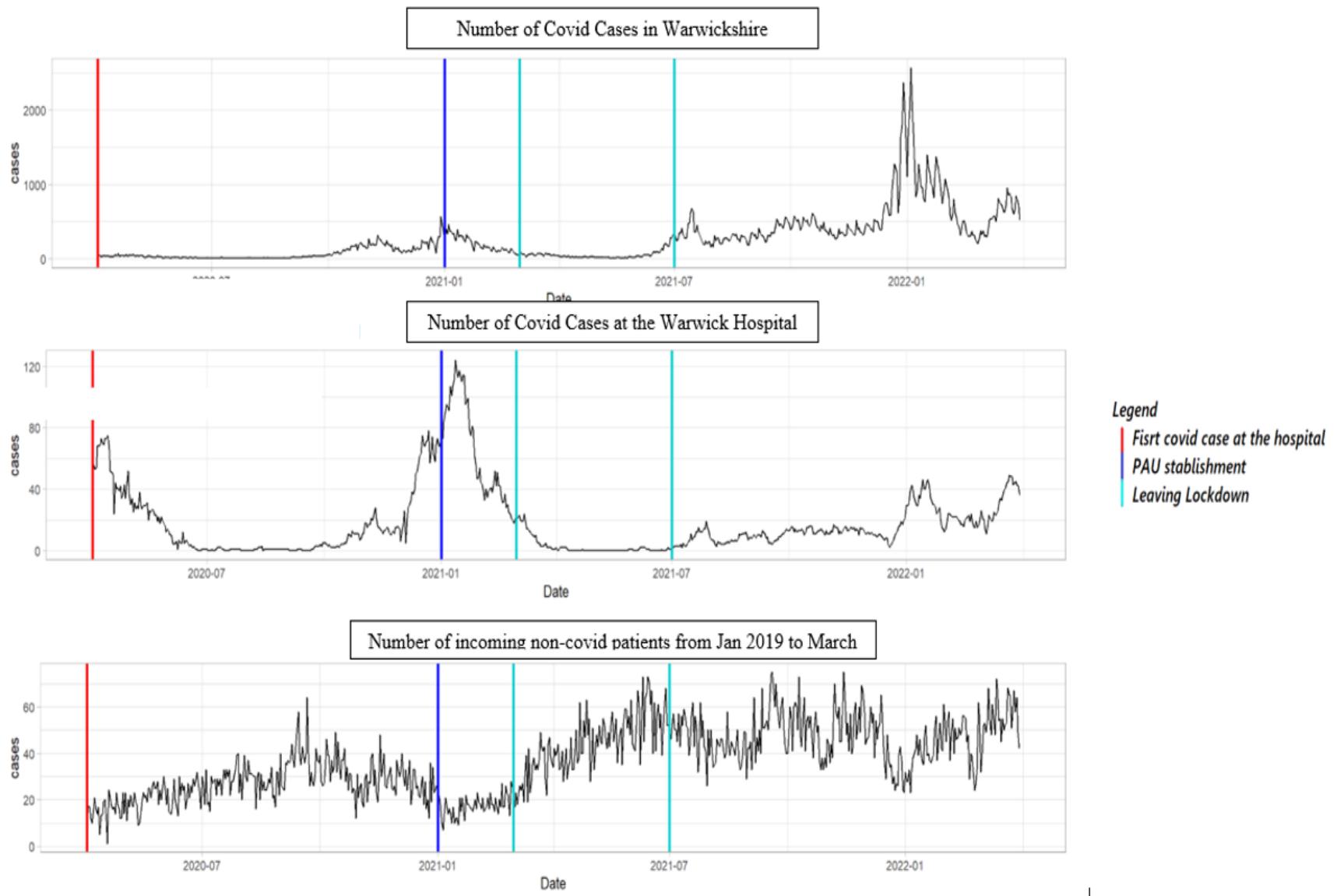


Figure 20. Time Series Contrast

As exploring inpatient details is also fundamental for this study, the dataset containing PAU attendees' specifications is now added. Figure 21 describes the distribution of Age on Admission. There is a considerable number of PAU patients whose age is between 0 and 4 while teenagers and 5 to 13 years old children constitute a lower percentage.

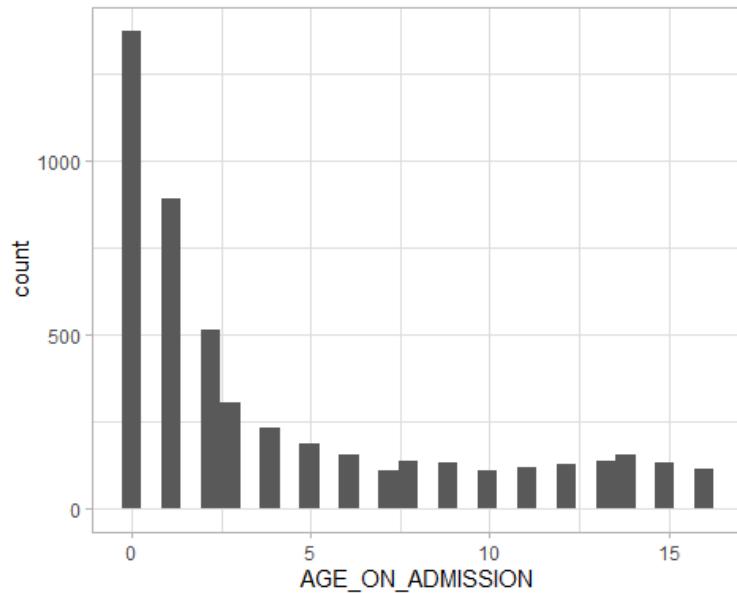


Figure 21. Distribution of the Age on Admission at PAU

Moving onto the distribution of patients through the years of operation, figure 22 represents the number of patients at each Arrival Date by age (0-16). Then, the PAU targeted those patients between 0 to 3 years old (infants and toddlers) to prevent complications in their health and cross-infection. Infants of 0 years old receive exceptional care in the hospital as they have been admitted to the PAU regularly.

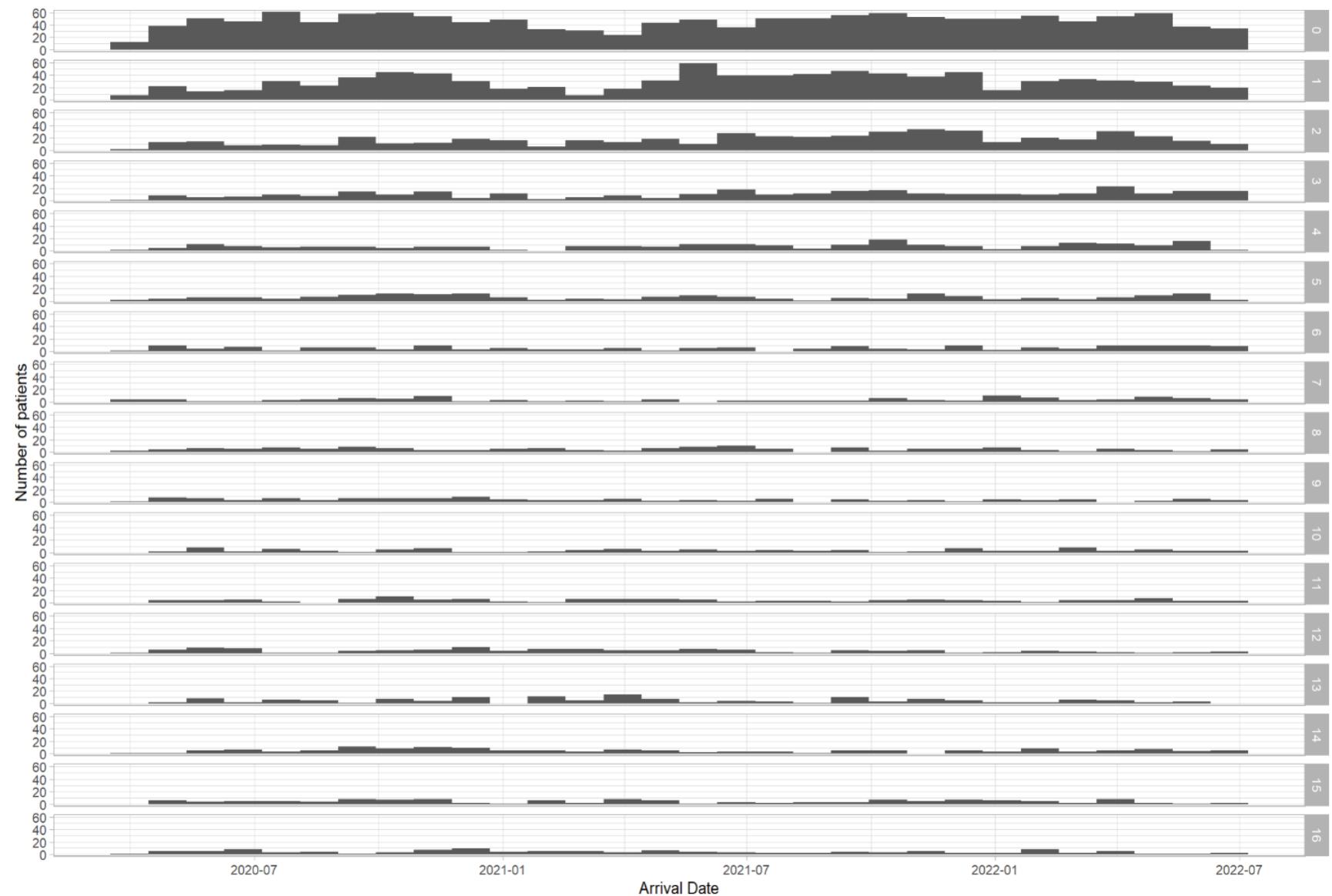


Figure 22. Number of patients at PAU by Age

As a general overview, the number of PAU admissions through the years has been steady. Figure 23 reflects the distribution of admissions at the PAU from 2020 to 2022 and the distribution of patients for non-urgent and standard emergency levels in the A&E. The latter is in the bottom right corner of the figure mentioned.

Admissions for PAU are between 0 to 200 patients monthly, as described in figure 23. In contrast, A&E paediatrics patients account for at least 1000 (Acuity level standard, non-urgent emergency, and arrival time between the PAU admission hours). The PAU is constantly admitting up to 200, around 20% of A&E paediatric patients. Even though the waiting times have not improved after post-implementation, this unit has been contributing with reducing the burden in the A&E.

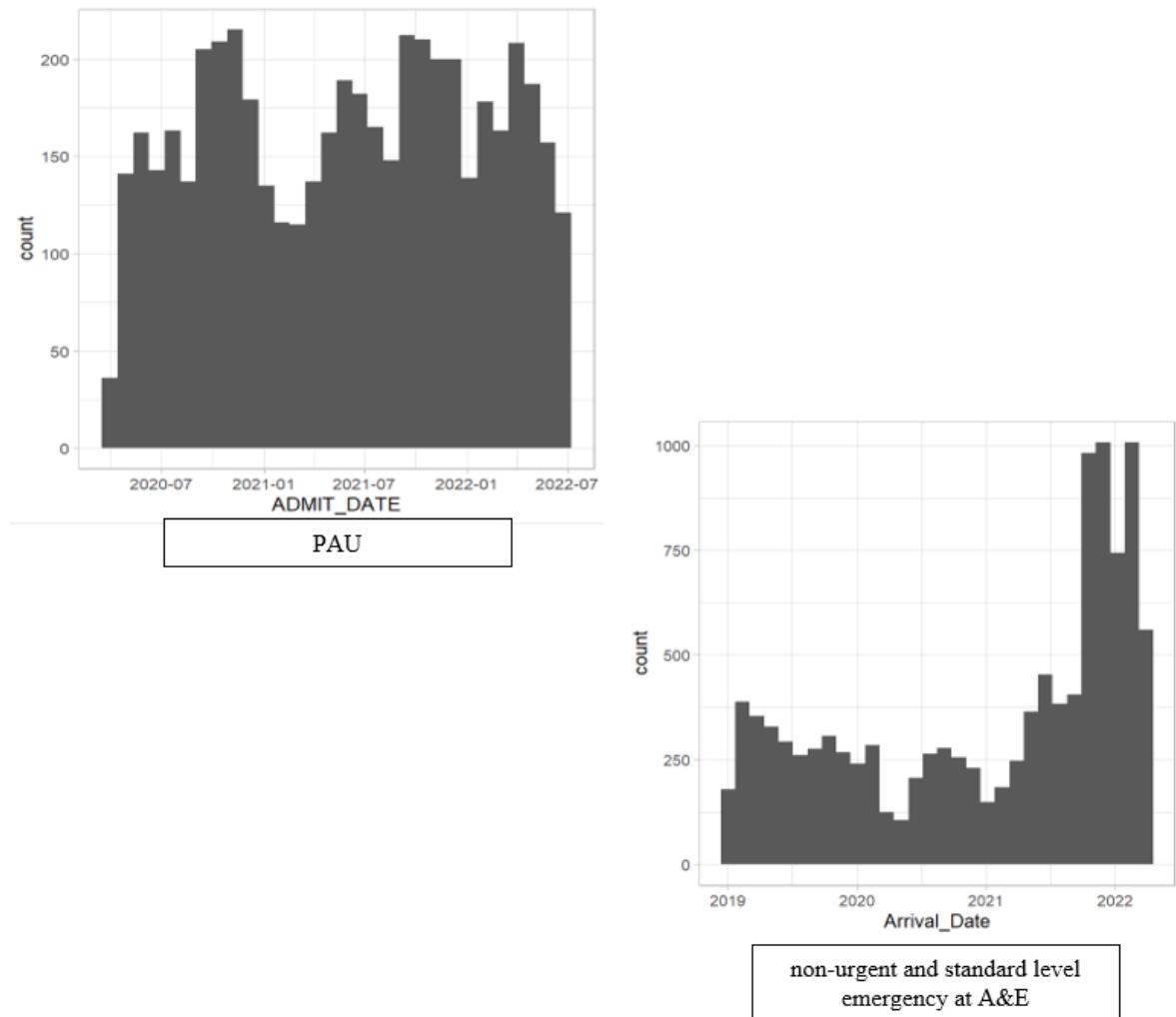


Figure 23. Distribution of admissions

Figure 24 reveals the earlier statement. The admission method for patients at the PAU was plotted as a proportion to verify the most common admission route for PAU patients. There is a slightly decreasing trend in the proportion of patients admitted into the PAU through the A&E. Even so, emergency admission method corresponds to one highest percentage followed by general practitioner referrals. Next, the latter shows an upward trend through the years of operation. As roughly 50% of the PAU patients have been admitted through the A&E, its burden has been reducing.

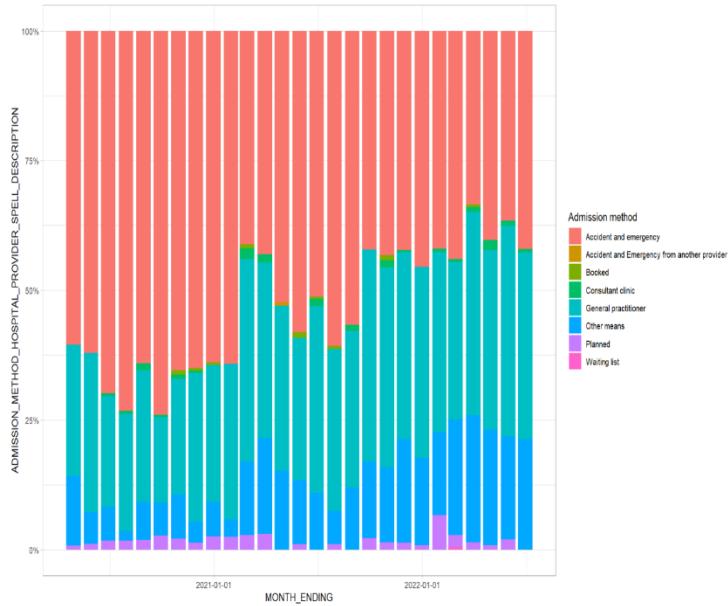


Figure 24. Proportion of admissions method at PAU

Within those admitted patients, the most common diagnosis is respiratory just before perinatal. Also, Viral infections are among the most suffered. Figure 25 shows the number of children per diagnosis.

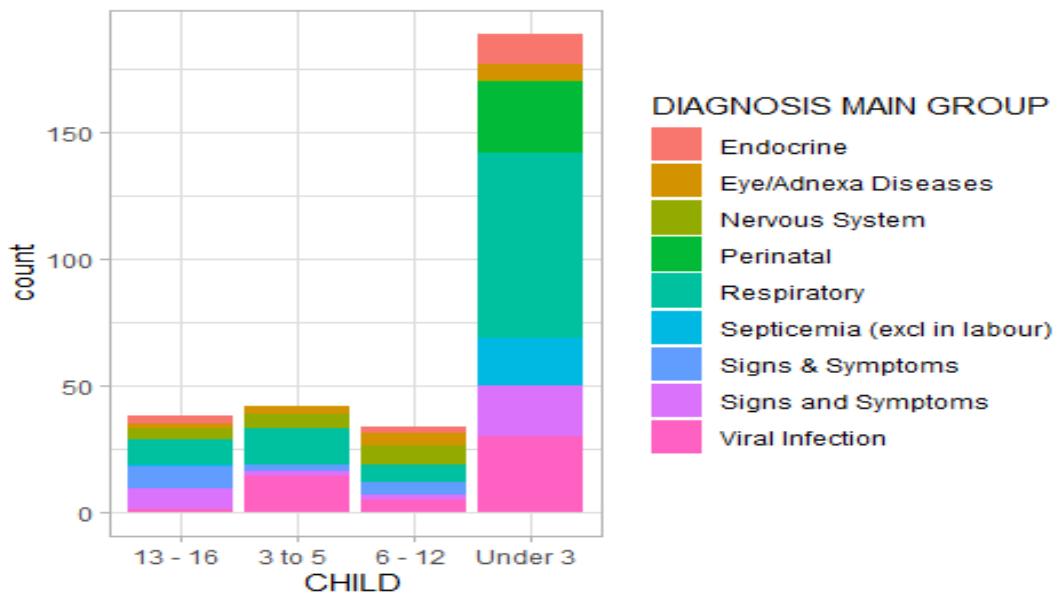


Figure 25. Distribution of Diagnosis main group by Age Category

Refer to appendix (Extra graphs) to view graphs of the number of patients through the years of study, Distribution of the number of patients at each Discharge Time by weekday for PAU, and Distribution of the number of patients at each Arrival Time by weekday for PAU.

Furthermore, to begin assessing LOS for inpatient data, given that:

- The most prevalent diagnosis is respiratory,
- PAU admits 0-years-old patients frequently,
- PAU admission acuity is standard/low,
- Emergency department is the most frequent admission method

, 32 patients presenting those characteristics were randomly selected to assess LOS. A new data frame was created after having collected the PEWS (Paediatric Early Warning Score) for these patients. Its most relevant variables are in Table 4.

Patient Number ID	Admit Date	LOS in Hours	PEWS Description
1	2020-05-03	3	0
2	2020-05-03	5	-0 Form no filled
3	2020-05-27	0	0.5 little more pain
4	2020-06-09	0	0
5	2020-06-25	2	-0 Form no filled
6	2020-06-30	4	2 Critical
7	2020-07-27	1	0.5 Only temperature
8	2020-07-29	3	0
9	2020-08-11	2	1
10	2020-08-28	3	0.5 Temperature only
11	2020-09-05	1	1

12	2021-05-18	5	2
13	2021-05-20	2	1
14	2021-05-23	1	1
15	2021-05-28	8	1
16	2021-06-02	1	-0 Form no filled
17	2021-06-03	20	3 stay many hours
18	2021-06-29	3	0.5 Temperature only
19	2021-07-11	3	3
20	2021-10-17	1	3
21	2021-12-10	8	1.5

22	2022-01-19	2	2
New format pilot introduced 23	2022-03-08	4	2
24	2022-03-29	3	5
25	2022-04-08	3	4
26	2022-04-10	6	4.5
27	2022-04-11	2	1
28	2022-04-29	1	2
29	2022-05-08	2	1.5
30	2022-05-14	2	3
31	2022-06-08	14	3.5 stay long hours
32	2022-06-21	9	2.5 stay long hours

Table 4. Sample of 32 PAU patients

Following that, LOS at the PAU is, in most cases, consistent with the severity of illness and urgency. Also, over the last few months, the PAU has focused more on assessing and assisting patients between 0 to 3 years old presenting high PEWS scores.

Nevertheless, it was imperative to evaluate the LOS by (1) patient-related, (2) organizational-related and (3) structure-related factors. LOS is likely to be influenced by not only the severity of the illness (patient-related) but also organizational-related or structure-related factors. In some cases, for a few patients, their LOS differed even when presenting the same type of illness and severity (PEWS score). When the LOS is associated with a delay in treatment or assistance, and patients were not discharged rapidly there is likely to be an organizational-related or structure-related cause.

To summarise, since the PAU currently employs only one medical nurse, based on the results of this project, it is advised and recommended that the number of staff at PAU should increase while monitoring the patients' trends regularly. The PEWS score collection revealed inconsistencies for similar patients in terms of their LOS. Furthermore, although the waiting times are consistently increasing, the PAU has been pivotal in providing medical services to infants and toddlers in need, mainly presenting respiratory diseases. Hence, the importance of PAU in the provision of medical services for paediatric patients is significant.

4.2 Text analytics–reviews

Reviewing patient experience is a reliable practice to generate insights on the services offered. For this reason, sentiment analysis approach was used to establish patient satisfaction. Therefore, after extracting the reviews from the website “IWantGreatCare”, the calculation for rating scores submitted by patients was calculated and plotted as a distribution bar chart. Figure 26 represents the distribution of the average rating from 1 as the lowest to 5 stars as an excellent satisfaction for emergency reviews and paediatrics. A vast number of comments were rated more than 4.5 out of 5.0. The average rating for the A&E reviews is 4.54, whereas the paediatrics unit is 4.53. Overall, a positive experience is shown. (Figure 26)

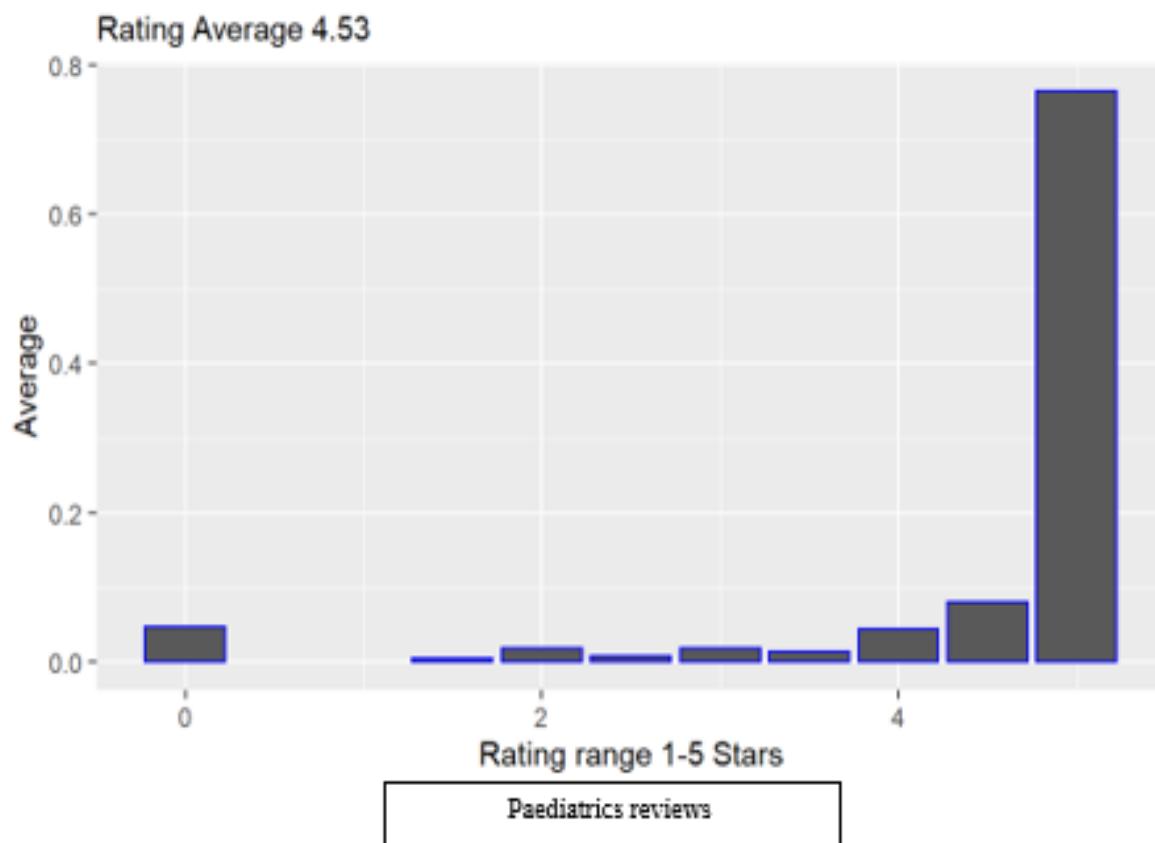
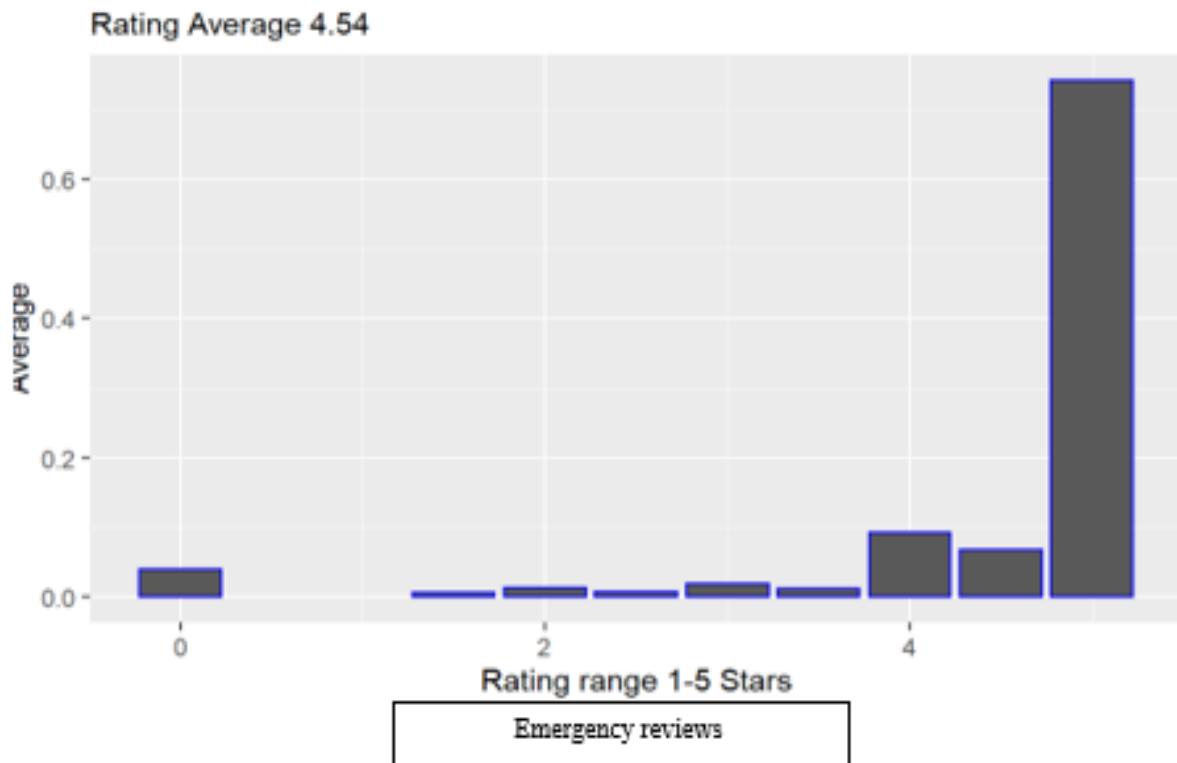


Figure 26. Distribution of the Average rating

Referring to our methodology for reviews text data, the results reflected:

Finding sentiment: Dictionary Coverage

Four dictionaries are available to find the highest coverage. They were bing, afinn, nrc and loughran. The type of sentiment was estimated for each dictionary using the obtained tokens. Figures 27 and 28 represent the total number of words on the y-axis, and the x-axis includes the dictionary. From this, the conclusion was that bing detected both positive and negative polarity for the higher number of words while Loughran had the least number of words. When it came to measuring polarity, note that Bing is slightly better.

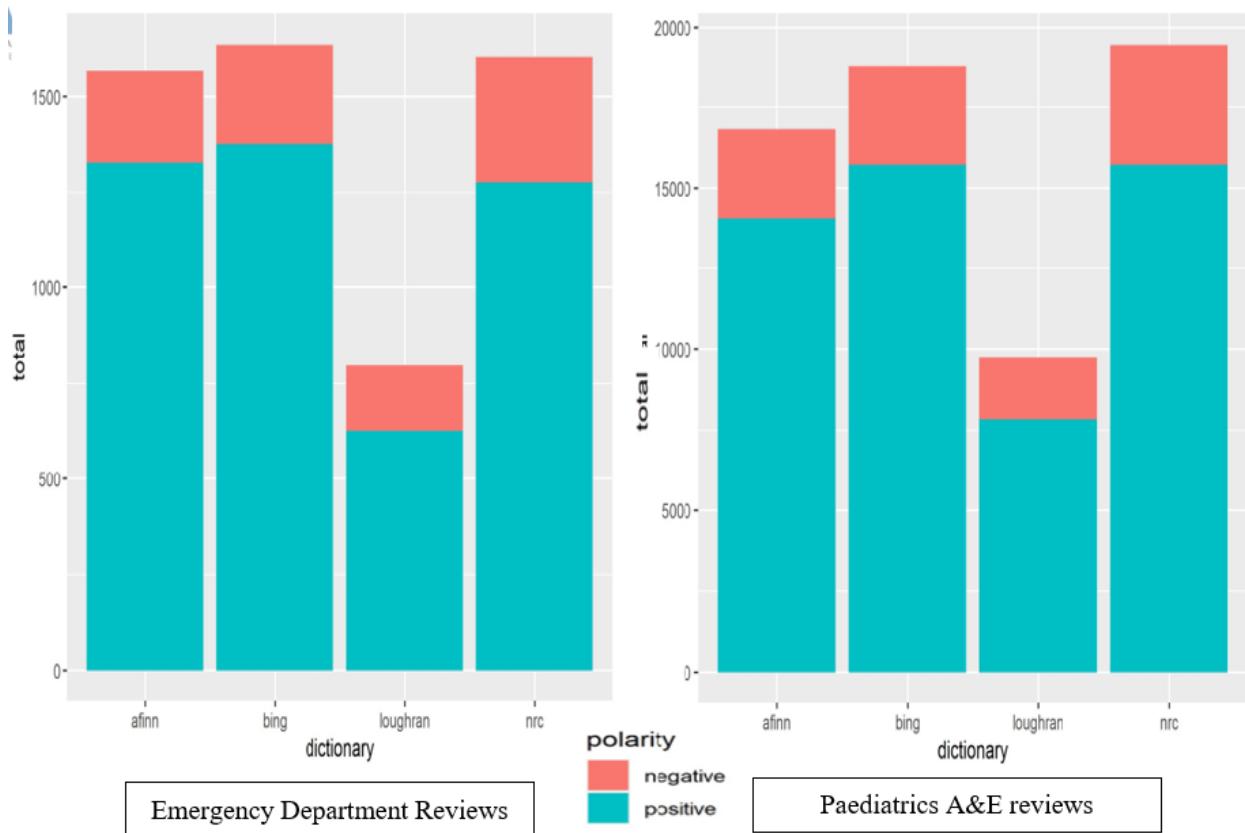


Figure 27. Polarity of Words per Dictionary

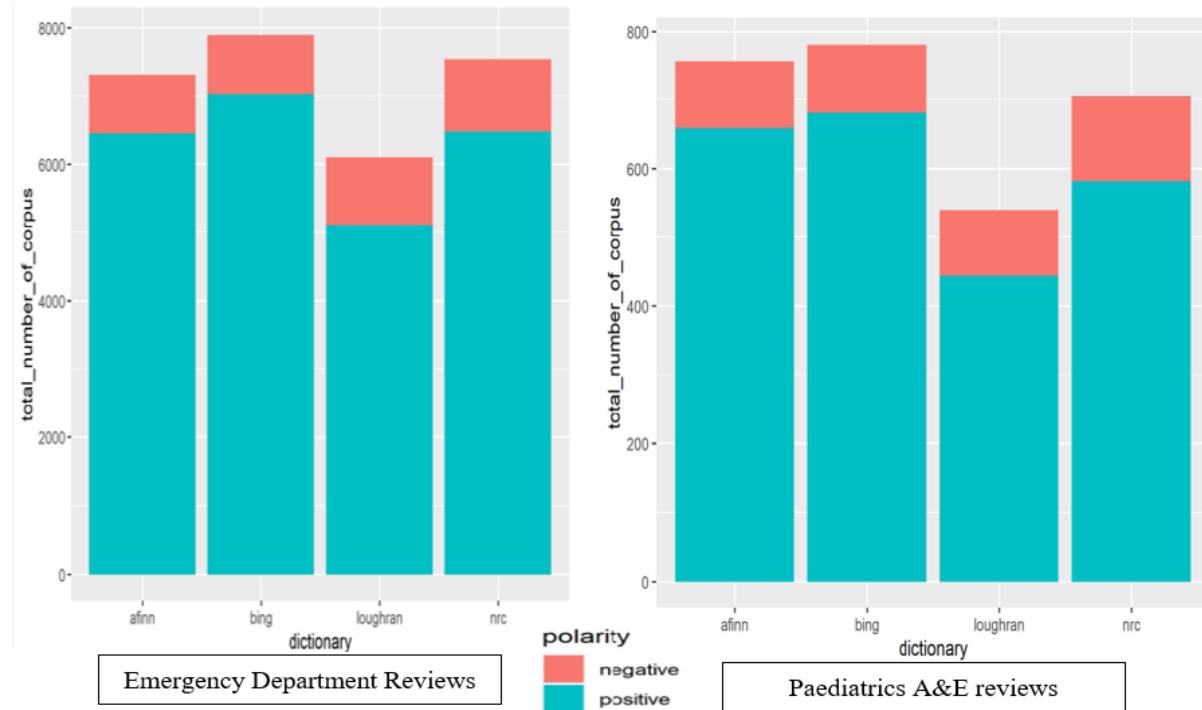


Figure 28. Polarity of Corpuses for Each Dictionary

Sentiment Analysis by Using Bing

Based on the previous results, Bing had the highest coverage of words. This dictionary was the choice for this analysis. Figures 29 and 30 reflect the percentage of negative and positive expressions for A&E and paediatrics, pre-and post-implementation. It informed that there was a slight increase in negative sentiment for both the A&E and Paediatrics. However, most negative words are about illness. Therefore, this concludes that the overall satisfaction is positive.



Figure 29. Polarities of Word for Bing Dictionary for A&E

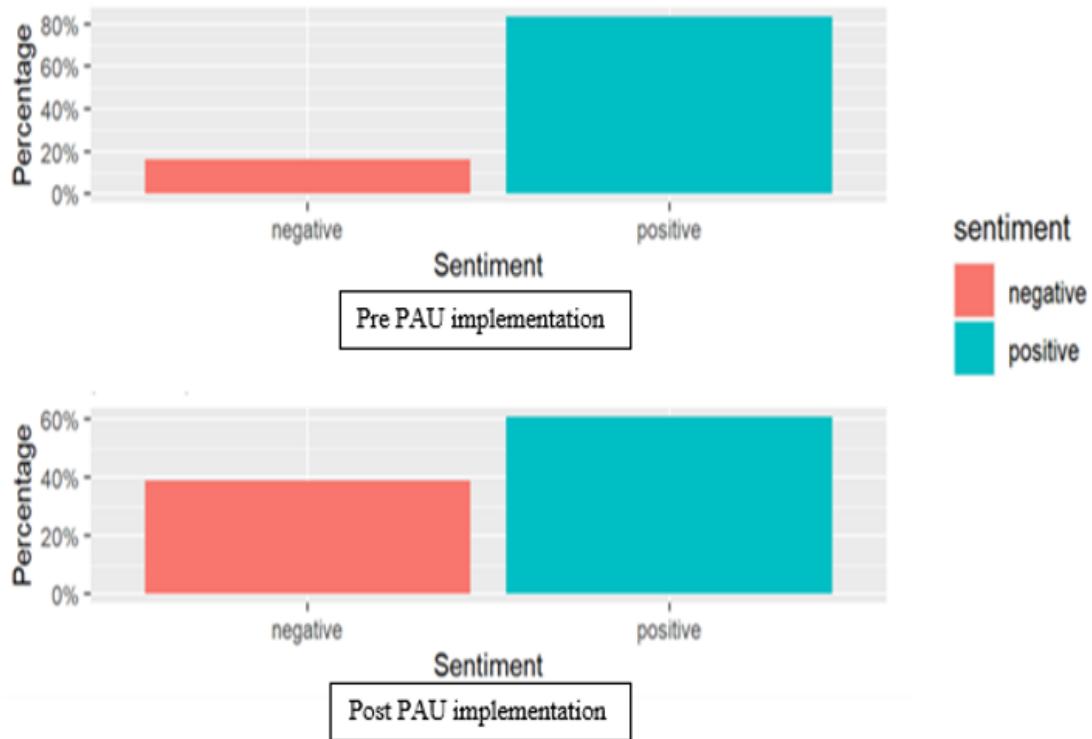


Figure 30. Polarities of Word for Bing Dictionary for Paediatrics

Comparison word cloud for the most negative and positive dominant words

After evaluating the level of sentiment analysis, plotting a Word Cloud containing negative and positive dominant words was next. Figure 31 represents a comparison between the most frequent positive (blue, orange) and negative (black) words. As for the A&E, the most mentioned negative words are delay, complaints, and some negative feelings of stress. However, positive words reflect a friendly, helpful, and improved service, as illustrated in figure 31. On the other hand, for the paediatrics inpatient, there have been concerns about frustration, stress, complaints, and delays, whereas others expressed a friendly, efficient, good, attentive, prompt, and comfortable experience.



Emergency Department



Paediatrics

Figure 31. Word Cloud Contrast negative and positive

Overall, patients' experience has been satisfactory, as shown by the result from the sentiment analysis. There is a tendency from reviewers to make outstanding positive comments. Therefore, services such as PAU help improve the number of positive patients' experiences.

5. Limitations and future research

During this project, there were two data resources, one that was provided by SWFT team and the other collected through an open-source website. These two have been the backbones for the analysis and conclusions for this dissertation. However, potential limitations and future research alternatives were considered. A compilation of them are as follows:

- It is advisable to carry out this project later, during a post-pandemic period since the data presents biases and is highly affected by these extreme circumstances. COVID affected data collection practices, then the waiting times increased significantly. As explained in the previous sections, the reasons for increased waiting times include the rise in the number of patients visiting the hospital and the diversions put in place as part of COVID-19 measures.
- In the future, more profound research including the staffing, operational capacity and operational performance of the PAU is required to assess the performance of PAU. For example, a study focusing on the impact of having one more nurse rostered would be a more precise approach to make strategic decisions. As described in the literature review, several studies have found this practice effective. These practical approaches make it possible to obtain visible and relevant results for health care services.
- There were additional concerns about potential dubious data. The awareness of what data is available within the department should be considered periodically. The disconnections within the operation area and information system department result in unreliable and delayed data collection.
- Concerns about the data capability were also identified. Since a considerable amount of valuable information is handwritten, it limits the possibility of a short-term study. As a result, manual data collections are needed to maximize data availability. This limits the level of detail reached on the analysis and requires a longer time scope project.
- Lastly, operationally speaking, the evaluation of the PAU is complicated since it admits COVID patients. Patients diagnosed with COVID hold a spectrum that can cause serious health issues due to its nature. In this case, pediatrics patients could have received

treatment in an isolated zone. Operational measures are severely impacted when it comes to extreme circumstances such as COVID symptoms.

6. Conclusion

Since the SWIFT established a PAU, it was necessary to determine the contributions that the PAU made to the A&E department and emergency paediatrics service. As a result, the evaluation of having a PAU was done by performing several approaches to understand, assess and identify relevant insights. Likewise, reviews were collected using sentiment analysis techniques to determine patient's experience regarding the service offered. Having had those, the identification and analysis of results explained the significant role of the PAU for infants and children while trying to cope with increasing waiting times.

Starting with statistical analysis, the mean in waiting times for paediatrics at the A&E did not significantly improve post PAU implementation. It was likely to be due to external factors. However, can be concluded that the PAU:

- Admits around 20% of A&E pediatric patients.
- Assists patients coming from the A&E and GP referrals.
- Focuses on assisting predominantly infants (0-1 year of age) and toddlers (2-4 years old) presenting with high PEWS scores.
- Treats patients who are diagnosed with the most common conditions, respiratory and viral infections.
- Improves patient feedback that has been positive overall.
- Opens when the A&E receives the highest number of visits.
- Is yet to increase the number of staff, therefore extending service availability and discharging patients more rapidly.
- And is a resilient unit that has been dealing with COVID unforeseen consequences due to the COVID pandemic.

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8. Appendix

8.1 Meetings and discussions with staff

(RJC) Research Nurse

- Paediatric units: Ward Macgregor is open 24 hrs (used if children require to stay longer than 24 hours, possess 17 total beds while PAU 5 Beds.
- Children's PAA Assessment Record (Pilot) form keeps prominent level of details about the patients. However, for data handling purposes is tedious no to have it on digital since once a patient is discharged from the PAU the nurse in charge scans and uploads this filled form on evolve.
- COVID infection data: Needed for the study from infection prevention team will have local data about prevalence of the infection in Warwick
- Unique Patient ID to assess re-admissions
- Check LOS in PAU:
 - Was the LOS higher or short? Were patients being discharged rapidly
 - Was the PAU just serving as a bedding facility for higher LOS patients or functioning as an assessment unit
- A&E referrals and admissions If a person is admitted from nursing home – check how that changes the LOS Investigate diagnosis
 - Does the LOS vary for similar diagnosis?
 - Staffing and bedding capacity in ED/PAU

[A&E resources daily](#)

DAY (07:30-19:30)

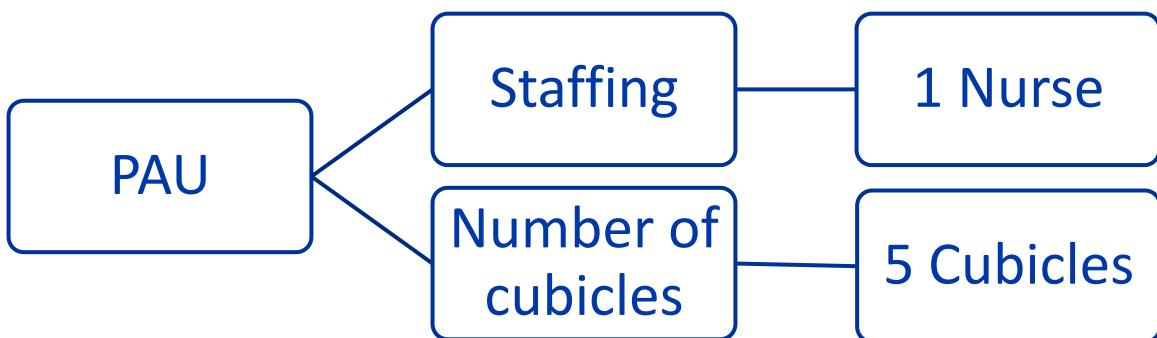
Area	Number of cubicles	Staffing
Triage	2	2 nurses
Ambulance triage	Space for 2 trolleys	1 nurse, 1 clinical support worker
Majors	19	4 nurses, 4 clinical support workers
Paeds	4	1 nurse, 1 clinical support worker

Resus	3	1 nurse, 1 CSW
Minors	6	1 GP, ENP (3x morning, 2x afternoon) (08:30-10:00)

NIGHT (19:30-07:30)

Area	Number of cubicles	Staffing
Triage	1	1 nurse
Ambulance triage	Space for 2 trolleys	1 nurse, 1 clinical support worker
Majors	19	4 nurses, 4 clinical support workers
Paeds	4	1 nurse, 1 clinical support worker
Resus	3	1 nurse

PAU Resources:



- PAU: Mental health problems are especially important and can change LOS (in fact it is a huge reason to stay longer), so mental health and safeguarding issues might mean they can't go home soon

- Find a way to explain the KPI are increasing why (give reasons) talk to people why treatment time increase sits with the team and talk to them ... staffing or beds in ED and see if it changed in this time
- What has the SAU (Surgical Assessment Unit) & PAU achieved? What are the gaps? What are the issues (staffing, capacity, opening hours, flow assessment)?
- David to confirm when Solihull hospital stops taking Acute admissions

Reply from (rjc) ward Manager MacGregor Ward Swark-FT 14/07/2022

- Question 1. What are the stages a patient from the PAU or the Ward goes through and what is the estimate time for each of them?

Like Initial triage, first doctor check-up, and/or specialist/senior Paediatrics. Patients are referred from GP or ED. When arrives on PAU will be seen and admitted by nurse within 15-30 minutes and triage. When seen by a dr will depend on how sick the patient is and the workload of doctors.

- Question 2. As far as my understanding is that the PAU admits patients with minor illnesses. May I please know what other roles play the ward apart from receiving patients from the PAU who need to stay overnight?

Ward will accept sicker patients who we have no chance of getting home that same day. They will be on the ward for ongoing treatment CAMHS (Child and Adolescent Mental Health Services) patients will not be admitted to PAU.

- Question 3. If a child tests positive for COVID-19, which unit or ward would he/she be sent?

It depends on if we think we can get the patient home – both ward and PAU accept COVID patients

- Question 4. Could you please confirm if the ward has 17 beds to stay while the PAU has 5? And whether the PAU officially started to operate in 2021 JAN as a bedding unit?

Yes, all correct

- Question 5. Is there any time when the PAU (within its opening hours 10 AM to 10 PM (last admittance 8PM) does not have staff available (staff, Paediatrics)?

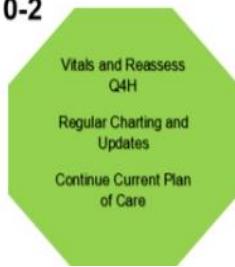
If we have staff vacancies / sickness that cannot be covered by agency staff or if the ward staffing is exceptionally low and the pau nurse is needed on the ward.

Discussion with Consultant 18/07/2022 PAU (focus)

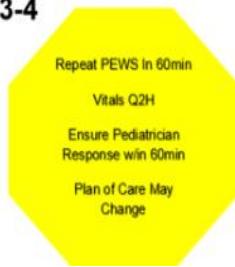
Suppose for example you have someone come to hospital with chest infection, if you are not careful a chest infection is a wide spectrum (from being ill to being mild) so what we must do is for example take patients with chest infection, age, severity of symptoms (PEWS SCORE) . Severity include if need oxygen, if blood pressure is low, ask ross if it is possible to check chest infection so all people who came with a chest infection on the PAU , and then I need to compare things that are remarkably similar (similar age group and severity,LOS same units minutes) before the PAU is open/ or the hours when there is no PAU.

SCORE

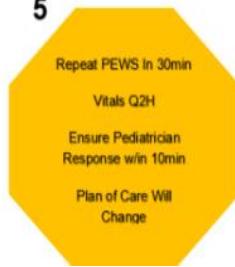
0-2



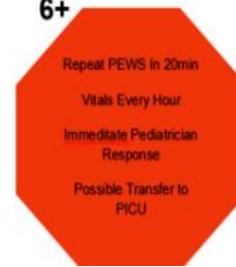
3-4



5



6+



There are patients ill stayed more than a day in the PAU

What trust wants project background info ED, variation on PAU admission, assess the context of the PAU (more detailed) so it means any data that we present we must analyze in the context of what was happening in the ED for all admissions, and for pediatric admissions. The ED is especially important (pediatric admissions) and the situation of the ED with COVID. Has this pau

been effective? Has it (information technology) provided good quality of care??what would happen if we had more resources? What would it be beyond it?

What happens if it becomes fully operational?

How effective it has been (good flow, block of staff??

Would it be worse if we didn't have PAU?

Managerial staff at PAU meeting 21/07/2022

- PAU once admitted they receive medical attention immediately (no waiting times design)

Business Information Manager

1. Pandemic buy messy there was no database in such a rush,

2. Quality of data ----dubious data quality

3. Concern about data format

4. Quality and awareness of what data is available

5. Knowledge of the quality of data credible data

6. Disconnection within the operation area and information system department

7. Inpatient data exactly waiting times is not recorded as such detailed because at PAU once is admitted they get seen immediately, there is no waiting times

General Manager Family Health Division 26/07/2022 and Nurse at Paeds A&E

- To be hired and approved business plan Advanced care practitioner (two for PAU and one for A&E paediatric) make diagnosis, assess patients work in line with medics
- Fracture lessons or no needed watching out many patients go to MINORS DEPARTMENT

- Unit at Paeds A&E is for patients that need to see a doctor quiet quickly for the doctor and we believe GP are not the best because need long term care be watched

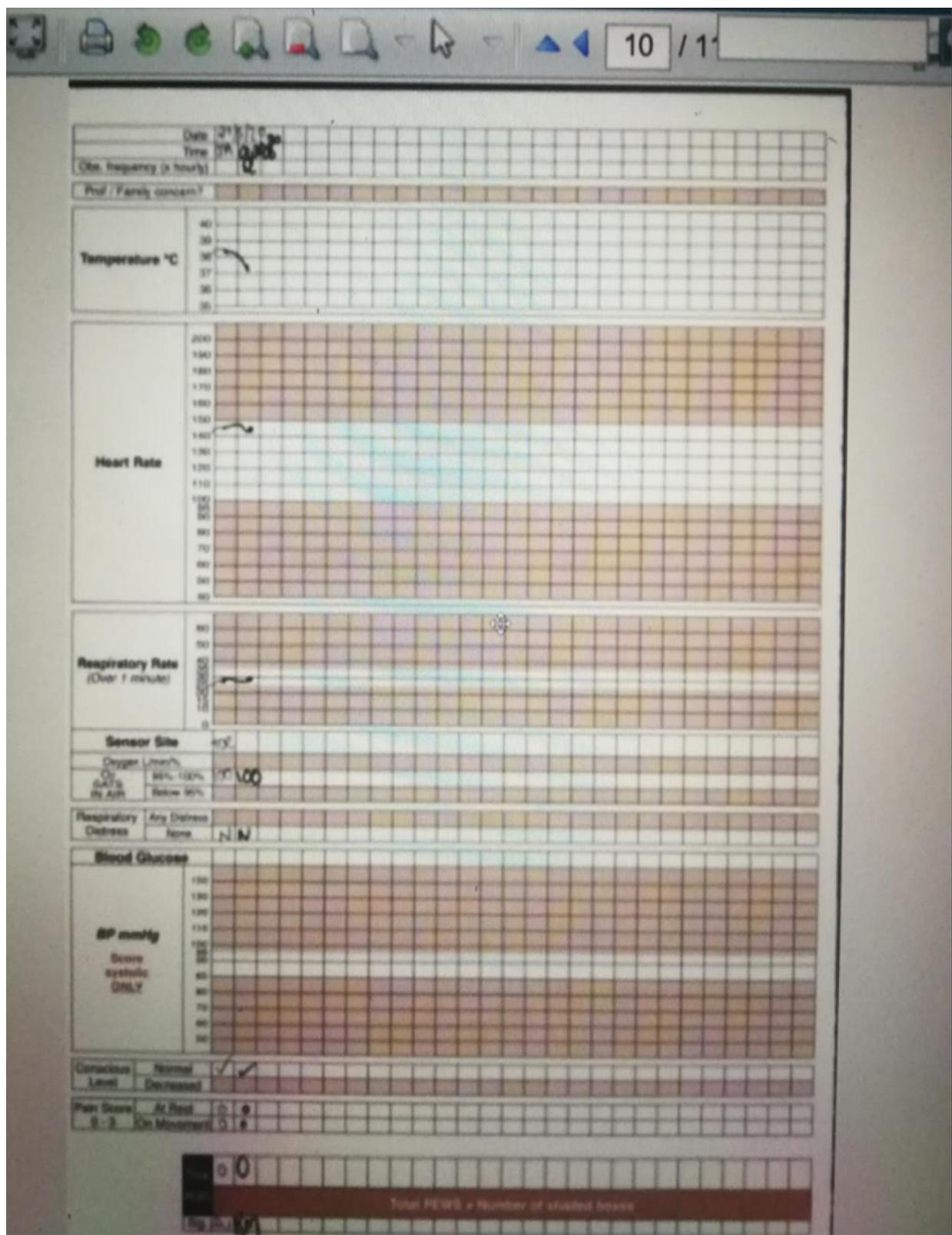
Management Trainee

Explanation on variability in the number of patients attending to A&E between JAN 2019 to MARCH 2022: This would probably be due to the pandemic. Each time the UK went into lockdown attendances decreased. Have a look at the dates of the nationwide lockdowns and this will probably coincide with the dips in the graph

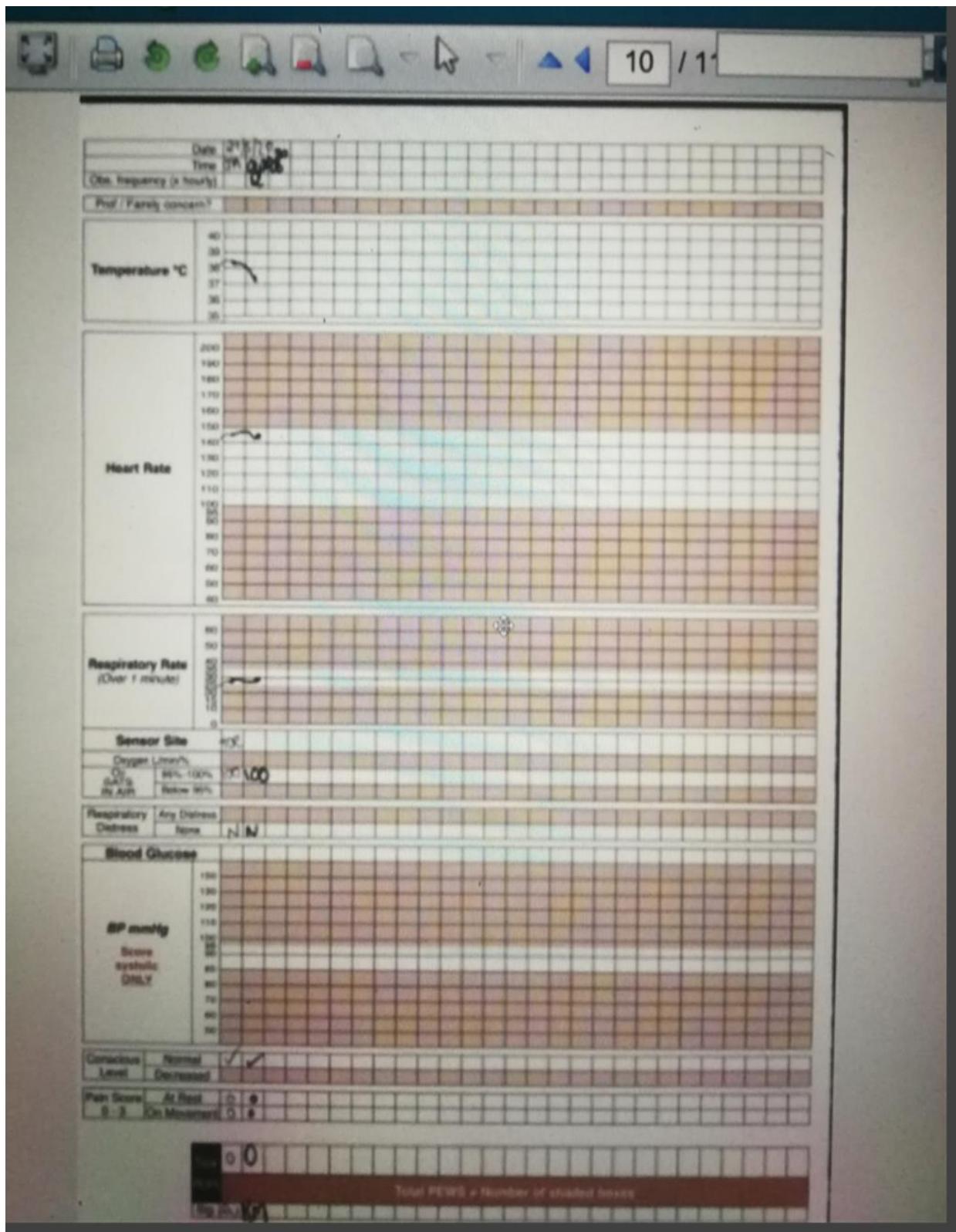
8.2 PEWS Score for patients

Sample template for PEWS form (Patients 2,5 and 16 did not register filled form on the system)

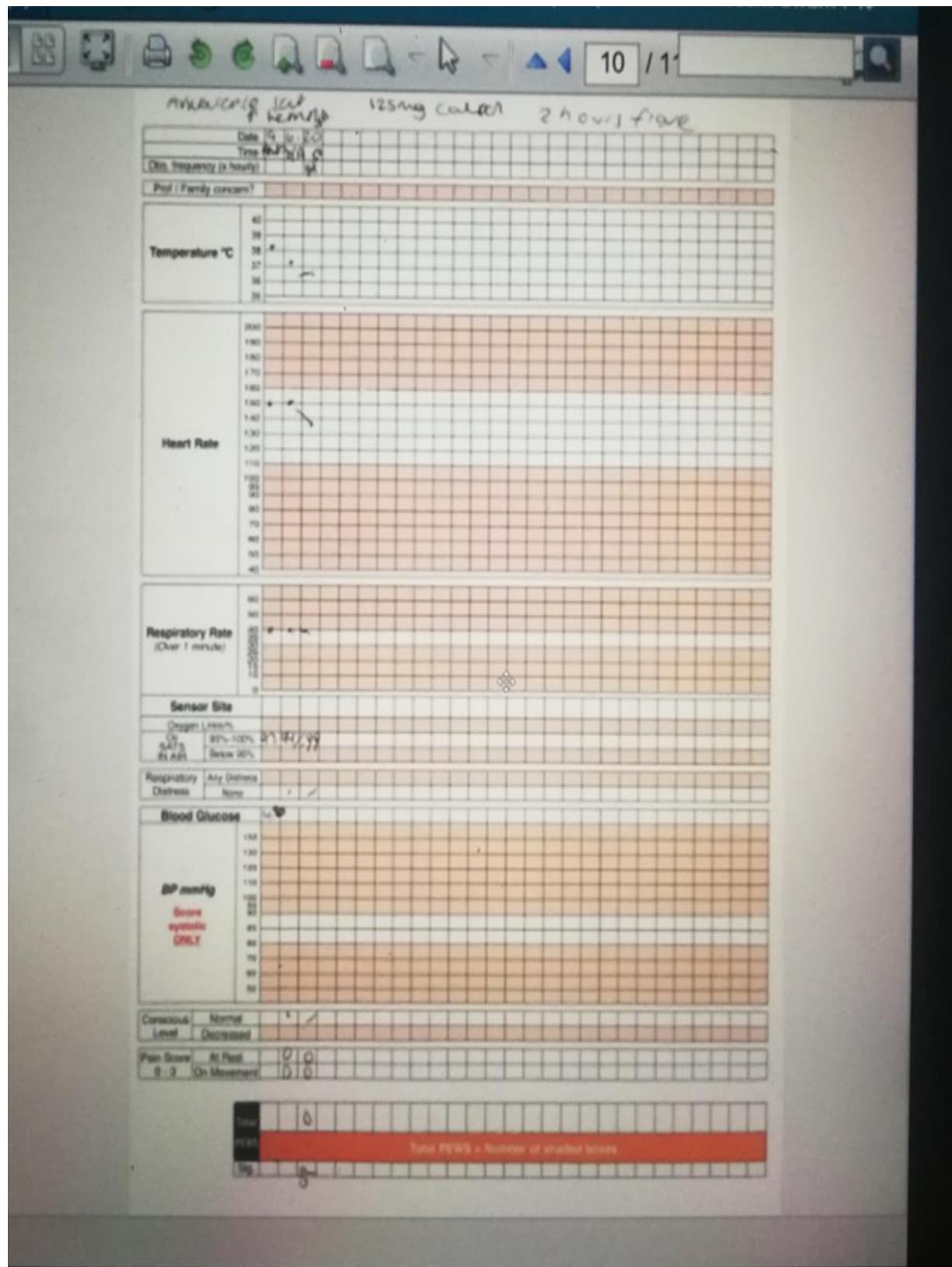
Patient 1



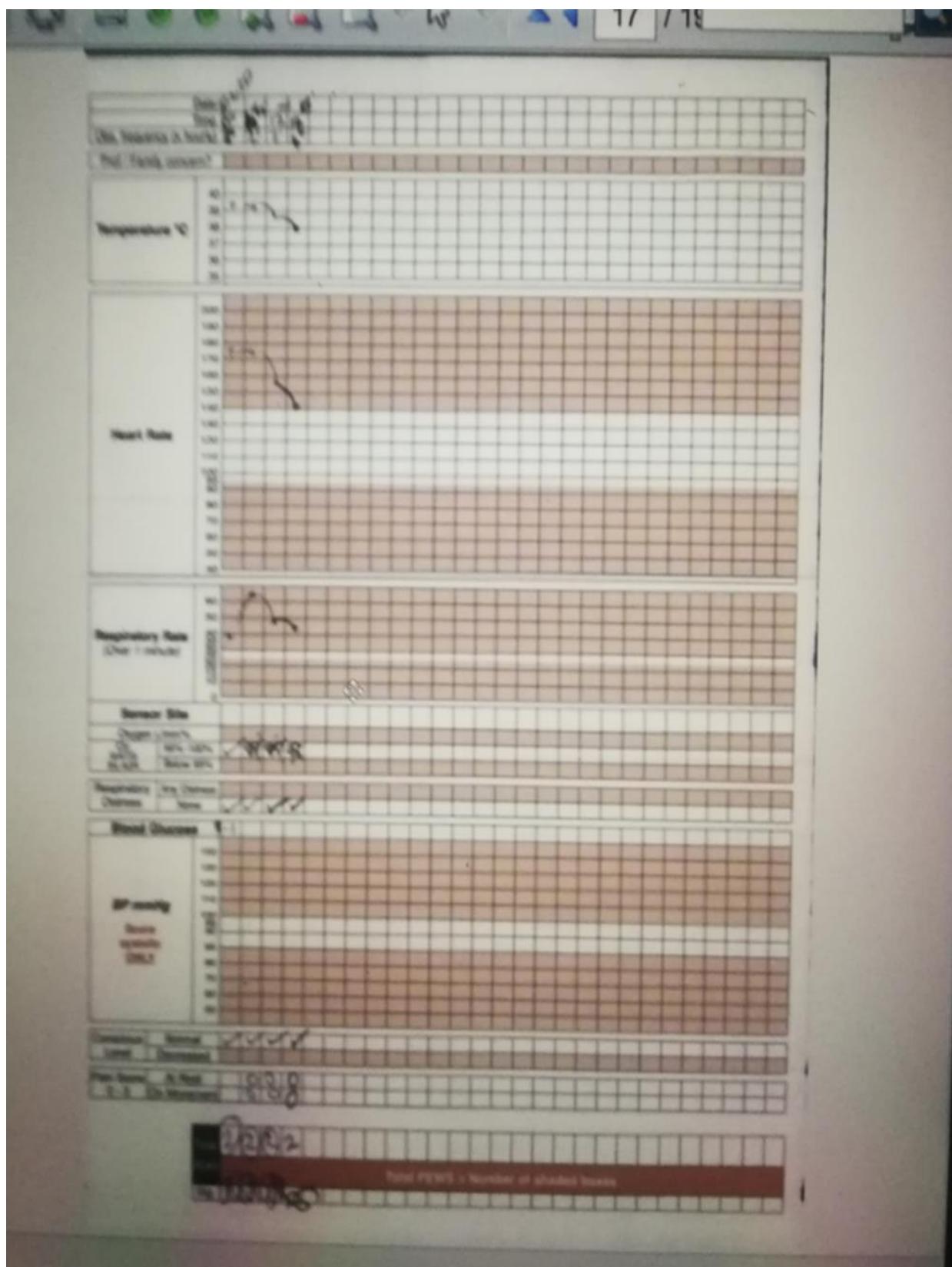
Patient 3



Patient 4



Patient 6



Patient 6

Date 2/2/10
Time
Obs. frequency (x hourly)
Prot / Family concern?

Temperature °C
36 37 38 39 40

Heart Rate
40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200

Respiratory Rate
(Over 1 minute)
60 70 80 90 100 110 120 130 140 150 160 170 180 190 200

Sensor Site
Oxygen: 94%
SpO₂: 95% - 100%
ECG: Below 90%

Respiratory Distress
Any Distress
None

Blood Glucose
140 130 120 110 100 90 80 70 60 50 40 30 20 10

BP mmHg
Systolic ONLY
140 130 120 110 100 90 80 70 60 50 40 30 20 10

Conscious Level
Normal ✓
Decreased

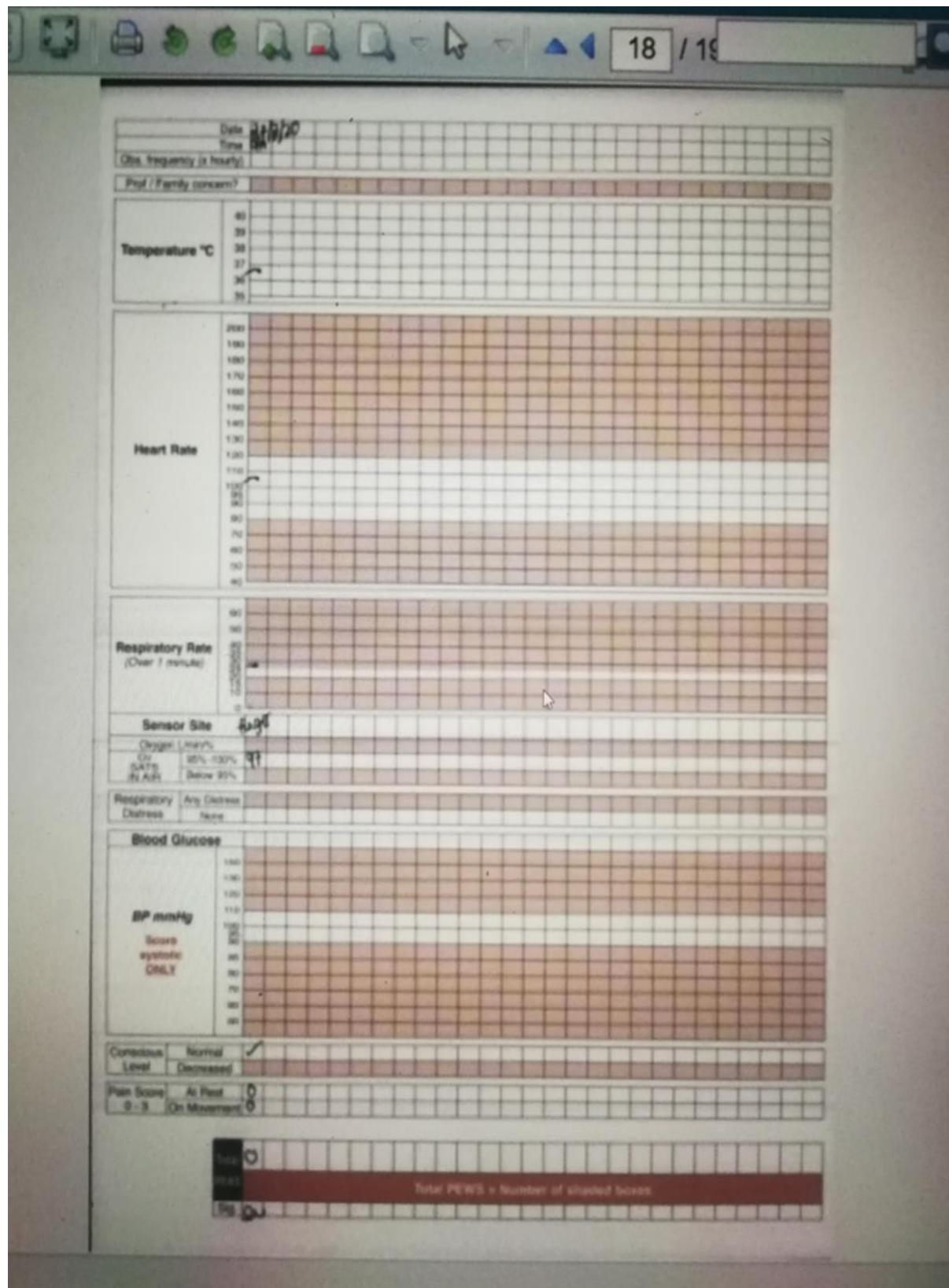
Pain Score
At Rest: 0
0-3 On Movement: 0

Total PEWS = Number of shaded boxes

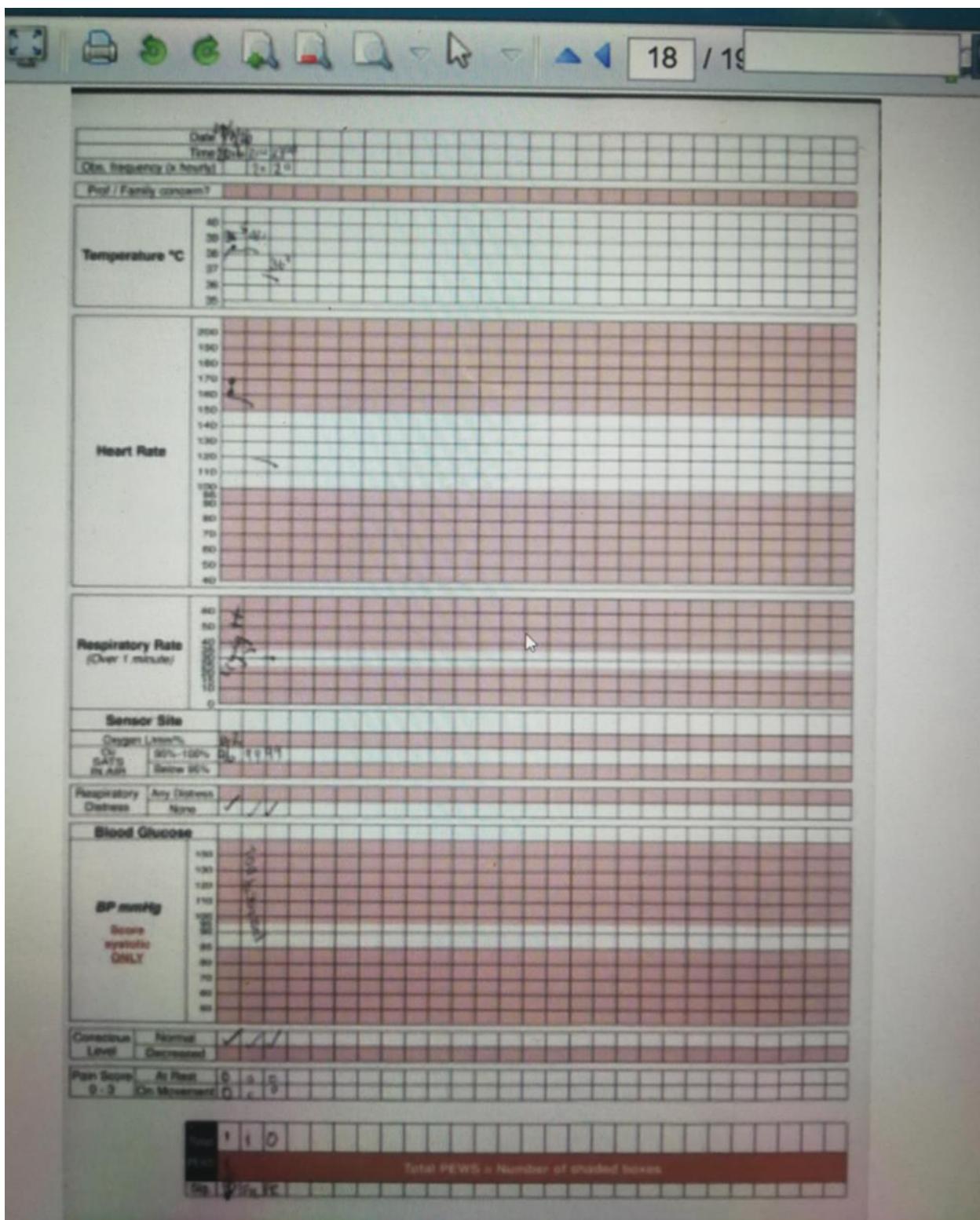
The screenshot shows a medical software interface for monitoring patient vital signs. The top bar includes icons for file operations and navigation, along with a page number '18 / 19'. The main content area is organized into several sections:

- Temperature °C:** A grid from 36 to 40.
- Heart Rate:** A grid from 40 to 200.
- Respiratory Rate (Over 1 minute):** A grid from 60 to 200.
- Sensor Site:** Displays oxygen levels (94%) and ECG status (95% - 100%).
- Respiratory Distress:** Options for 'Any Distress' or 'None'.
- Blood Glucose:** A grid from 10 to 140.
- BP mmHg:** A grid from 10 to 140.
- Conscious Level:** Options for 'Normal' (checked) or 'Decreased'.
- Pain Score:** Options for 'At Rest' (0) or 'On Movement' (0).
- Total PEWS:** A summary box indicating the total PEWS score based on the number of shaded boxes.

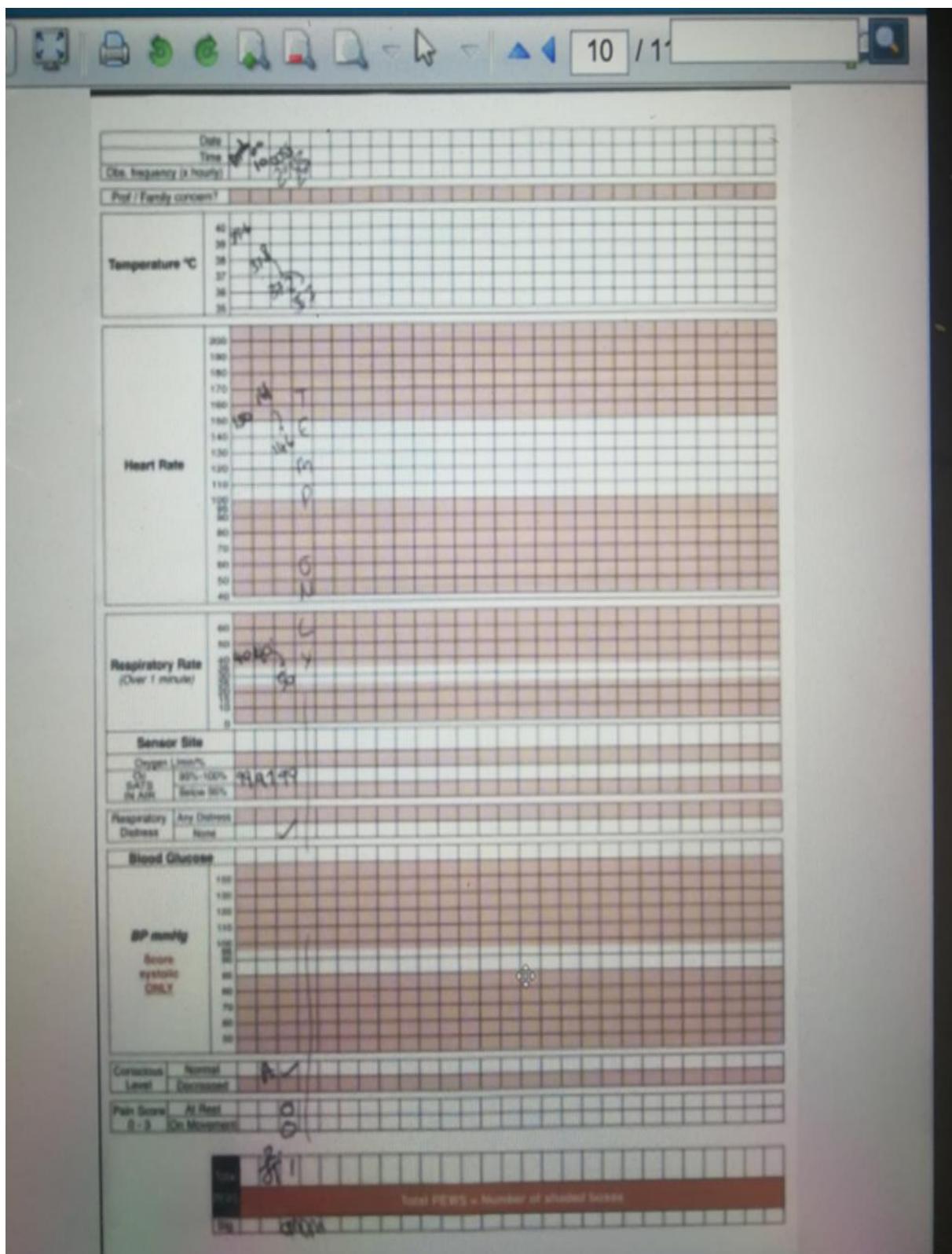
Patient 7



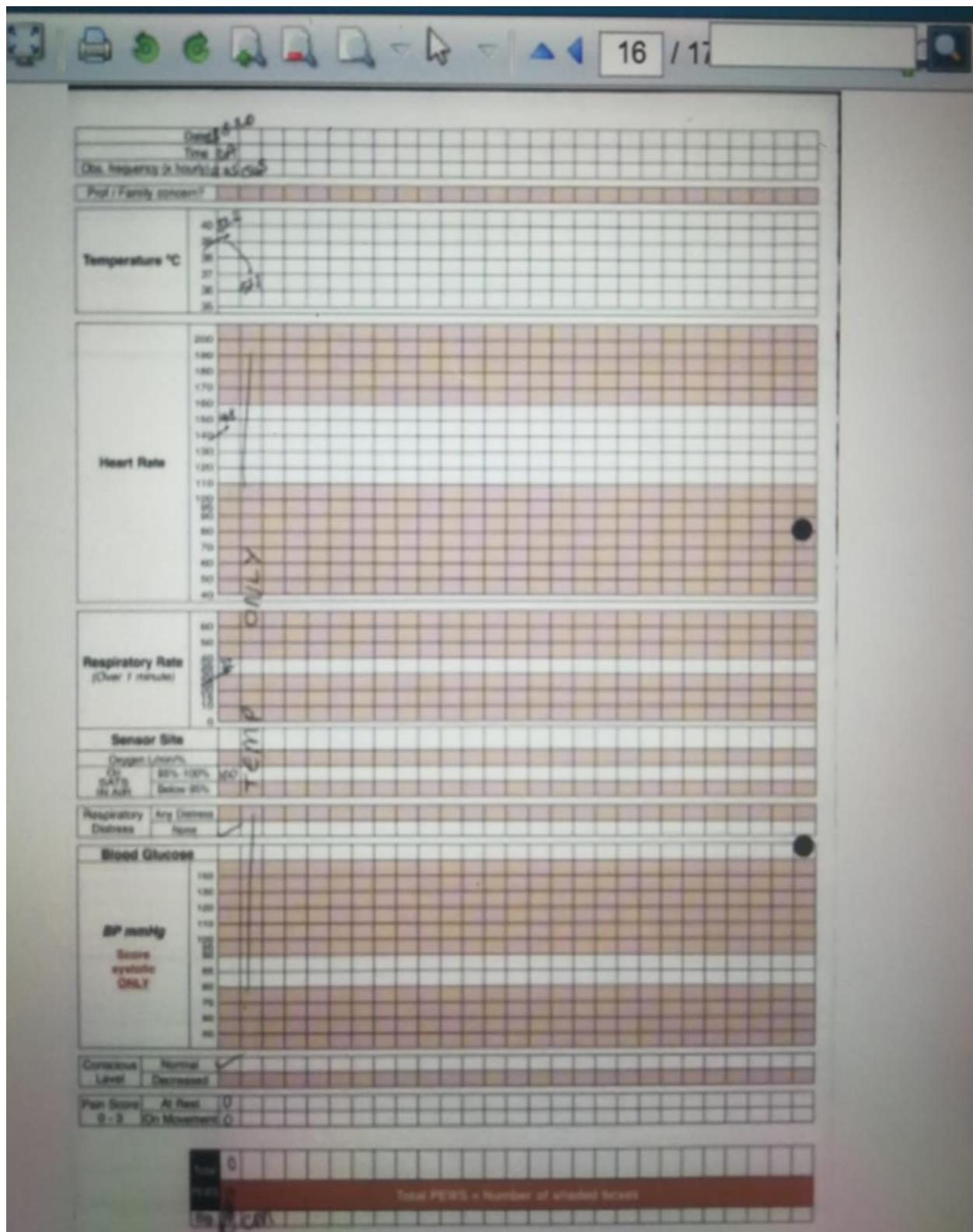
Patient 8



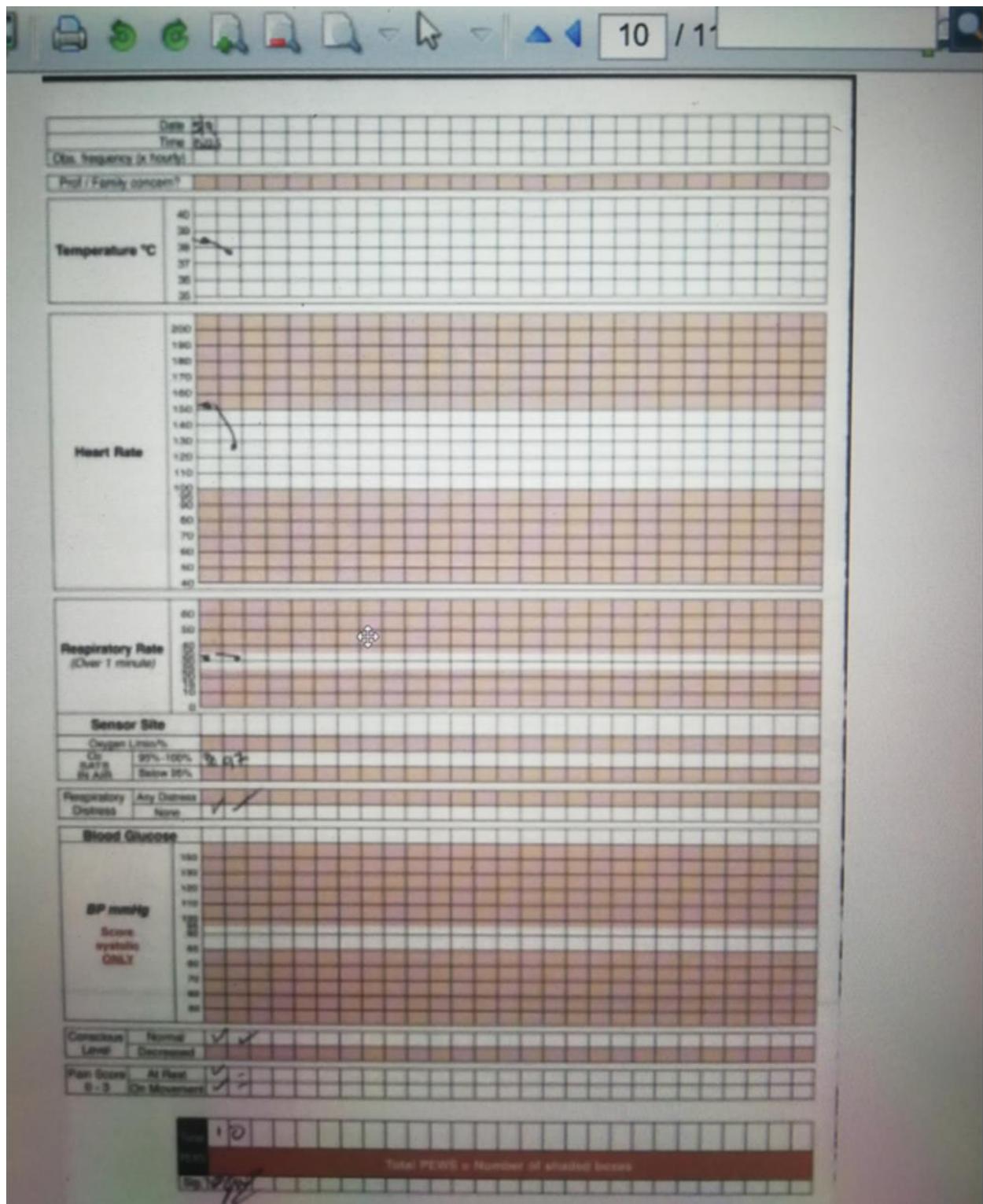
Patient 9



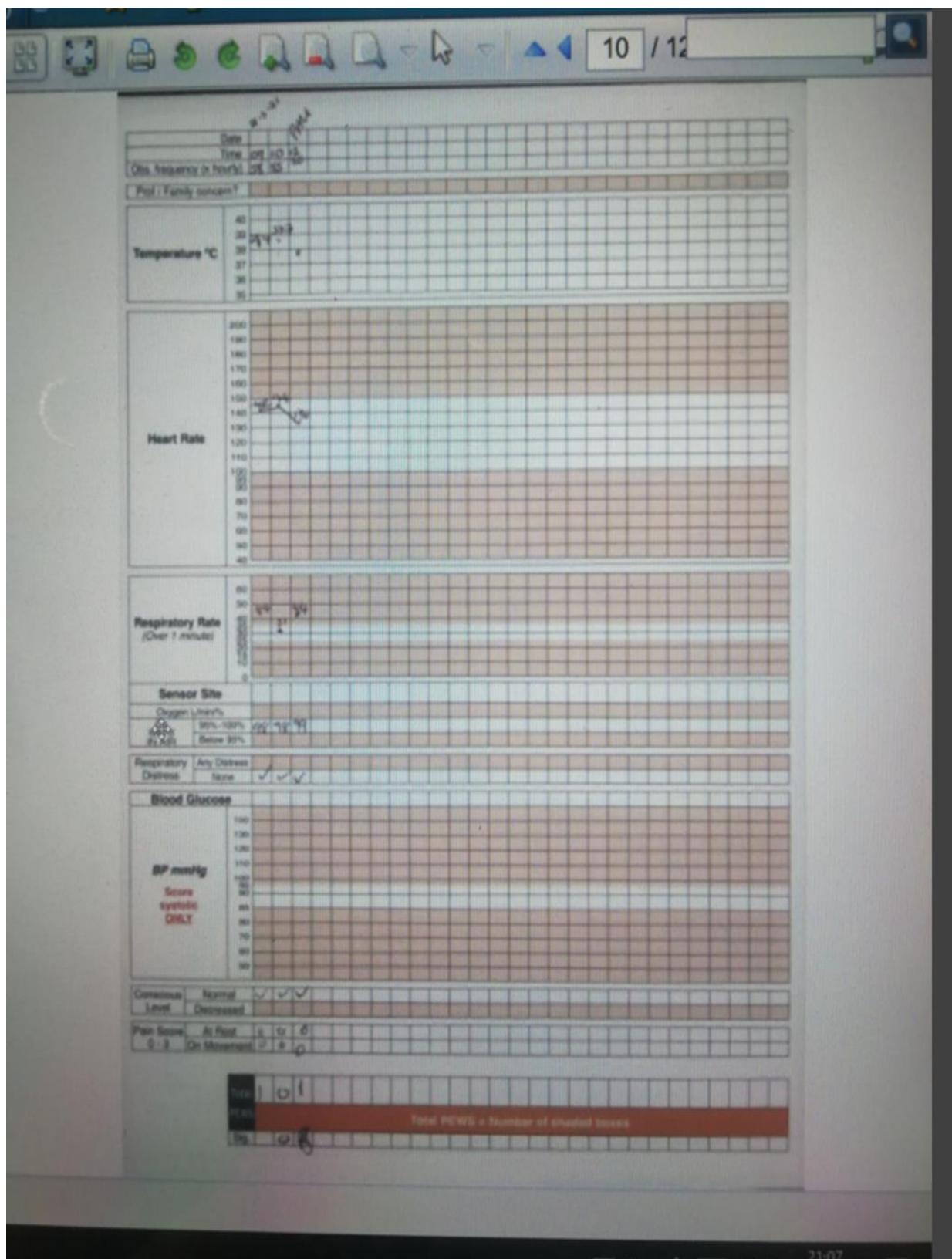
Patient 10



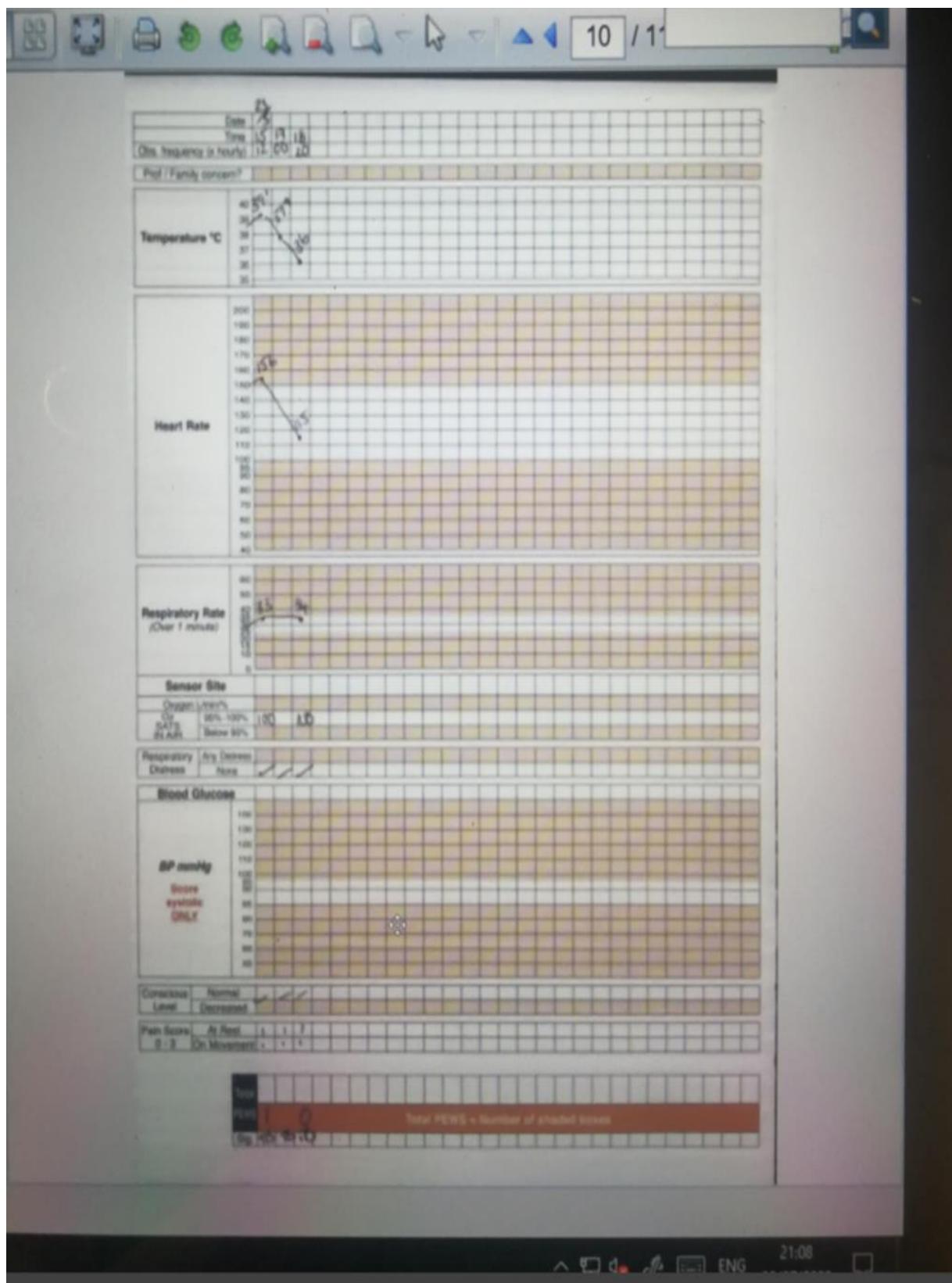
Patient 11



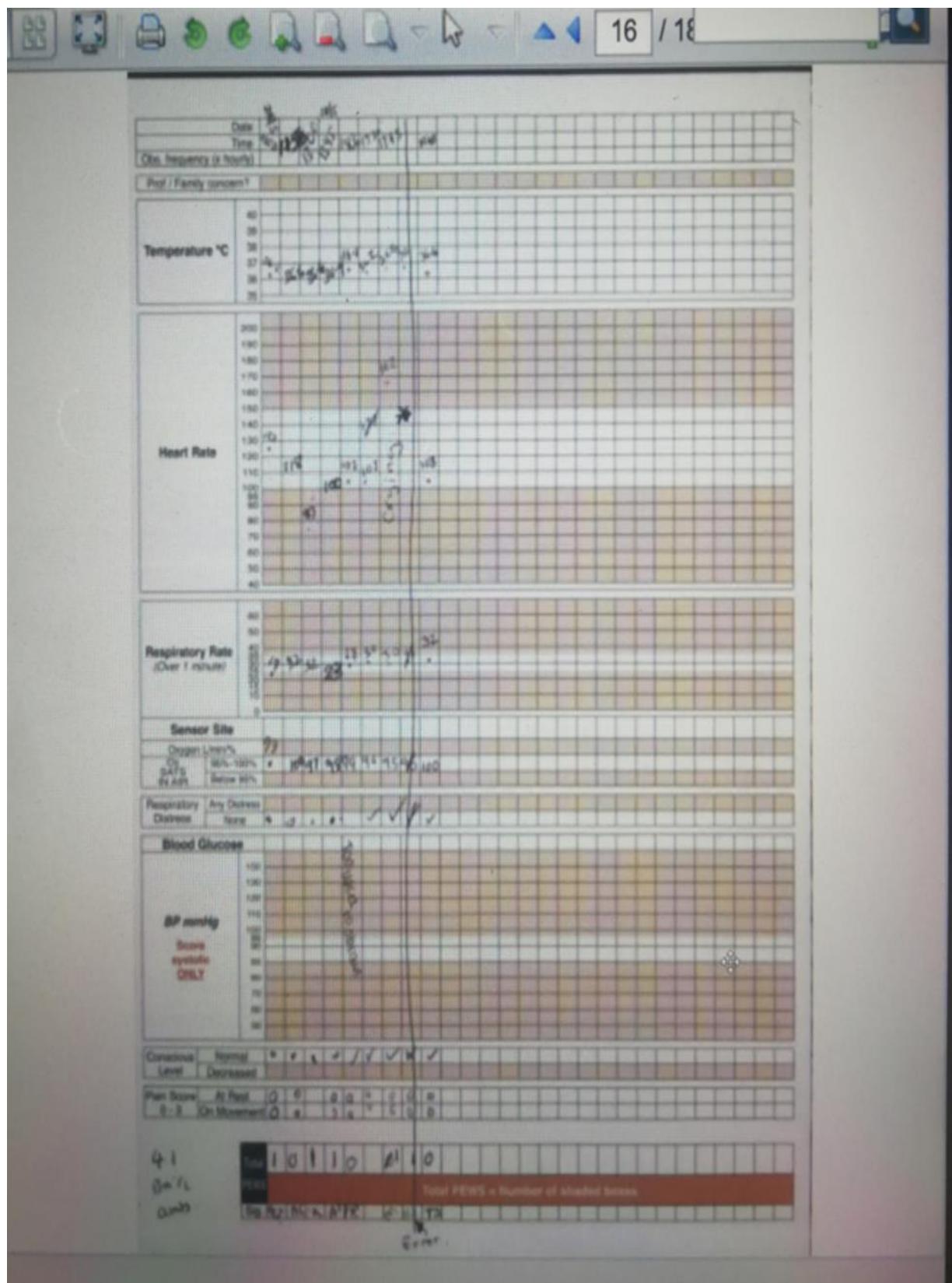
Patient 12



Patient 13



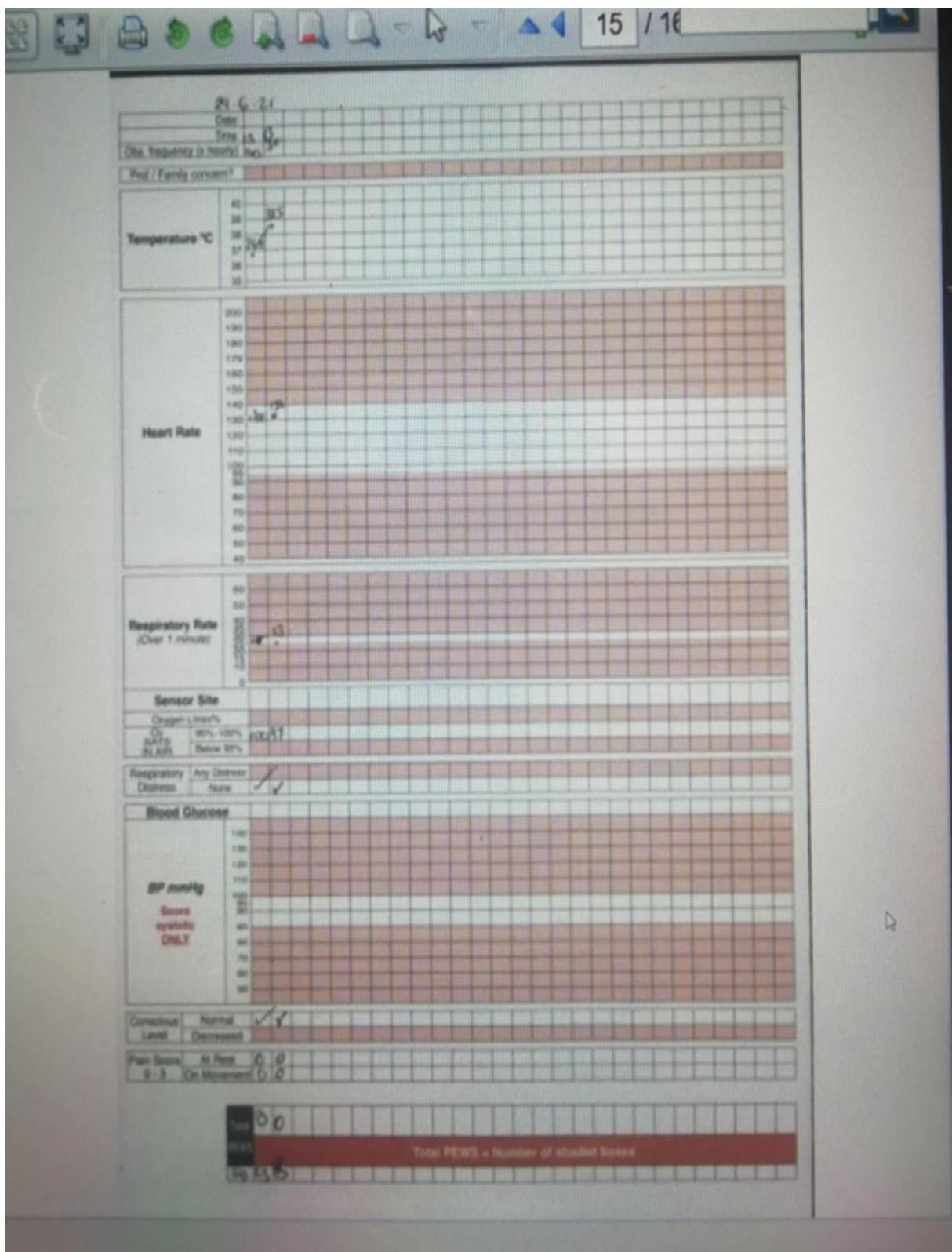
Patient 14



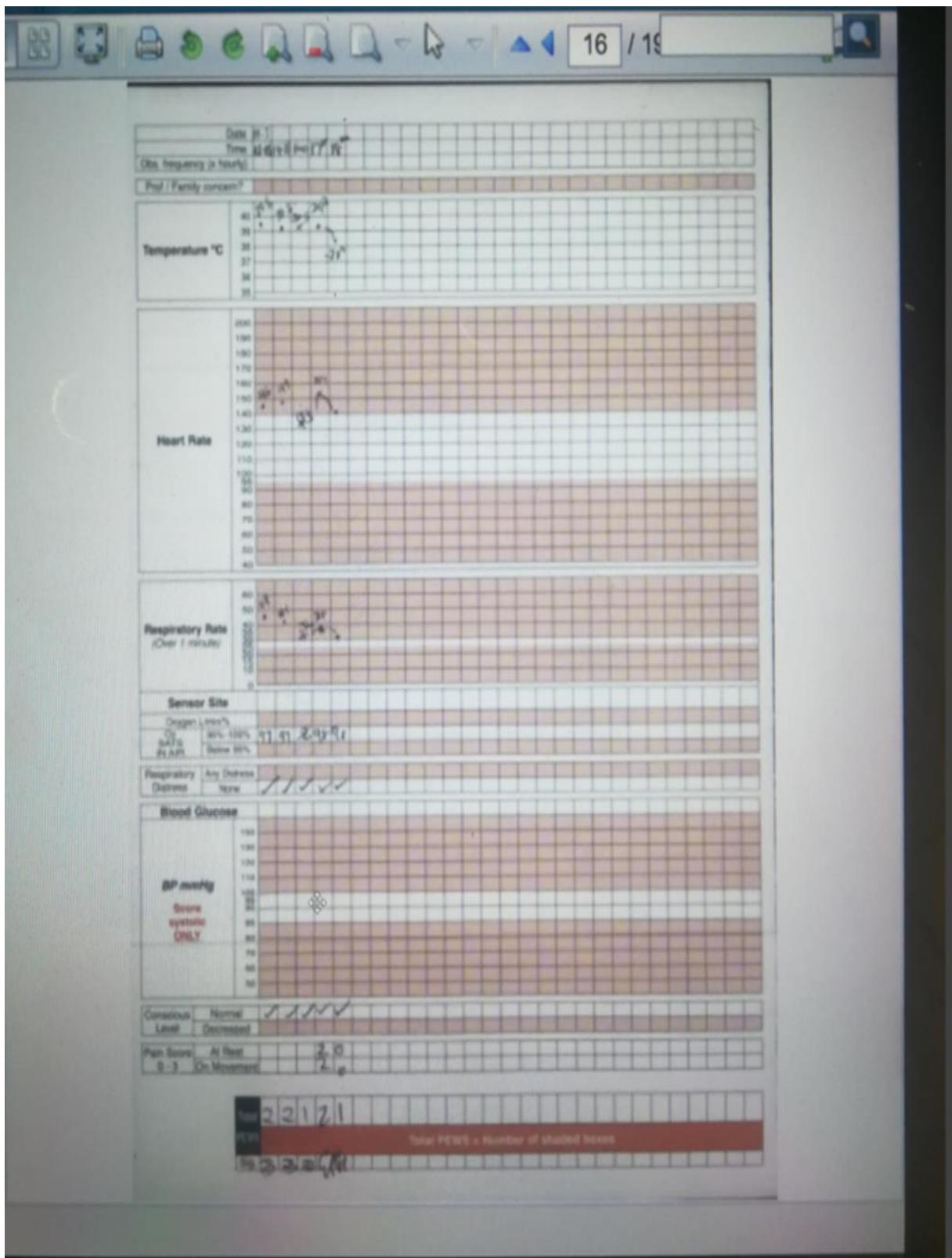
Patient 15

4-4-21	
Date	4-4-21
Time	14:52
Obs. Frequency (X hours)	4
Ref / Family consent?	✓
Temperature °C	38.6 37.3 37.3 37.3
Heart Rate	143 135 135 135
Respiratory Rate (Over 1 minute)	24 24
Sensor Site	O ₂ Sats: 96% - 100% SpO ₂ : Baseline 98%
Respiratory Distress	Any Distress: ✓ None: ✓
Blood Glucose	
BP mmHg	Score systolic ONLY
Connexions	Normal: ✓ Decreased: ✓
Pain Score 0 - 3	At Rest: 0 0 0 0 0 0 0 On Movement: 0 0 0 0 0 0 0
Total PEWS	0 0 1 1 0 1 0 0 1 0 1
PEWS Total	10
Total PEWS = Number of shaded boxes	

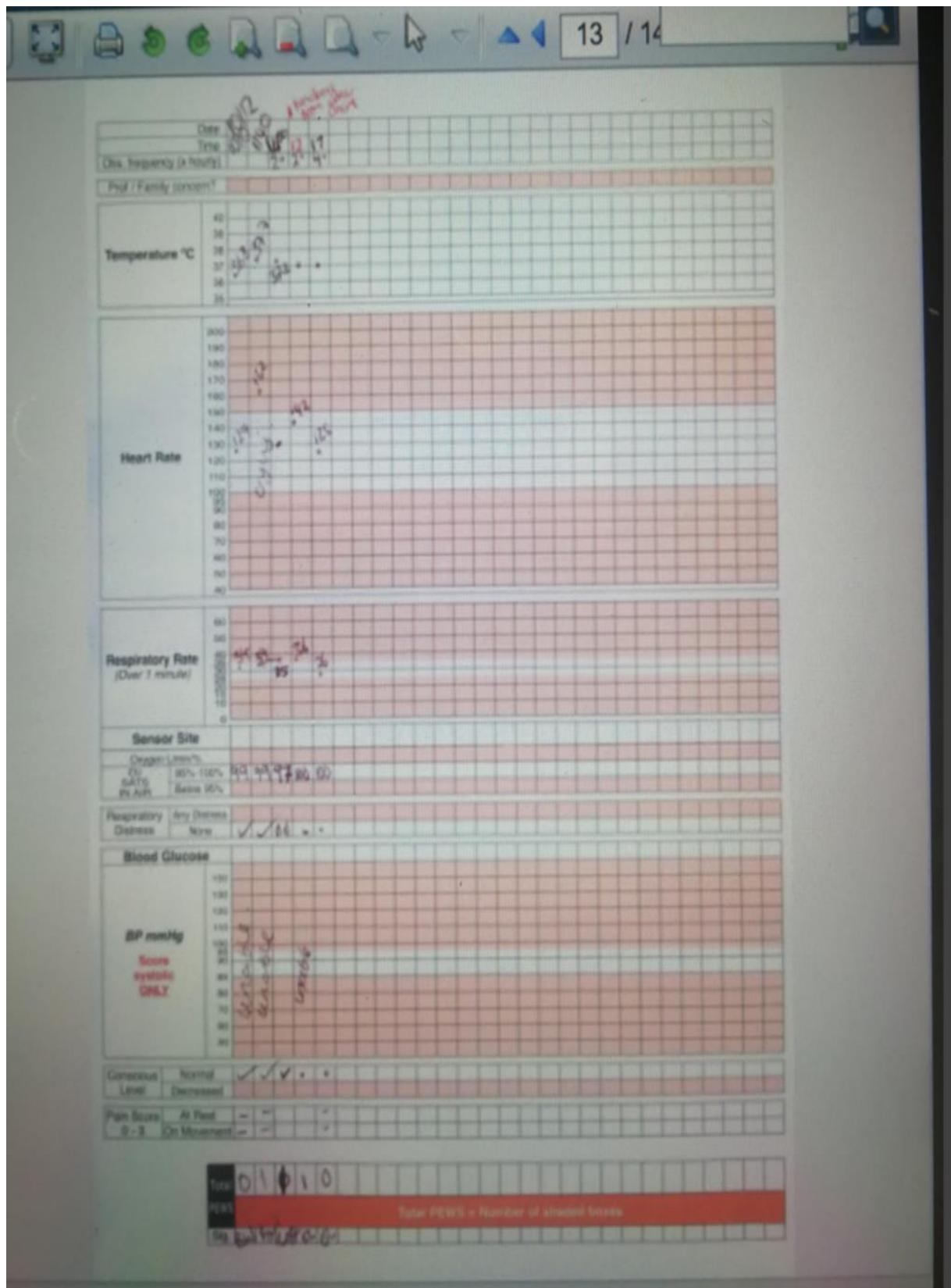
Patient 17



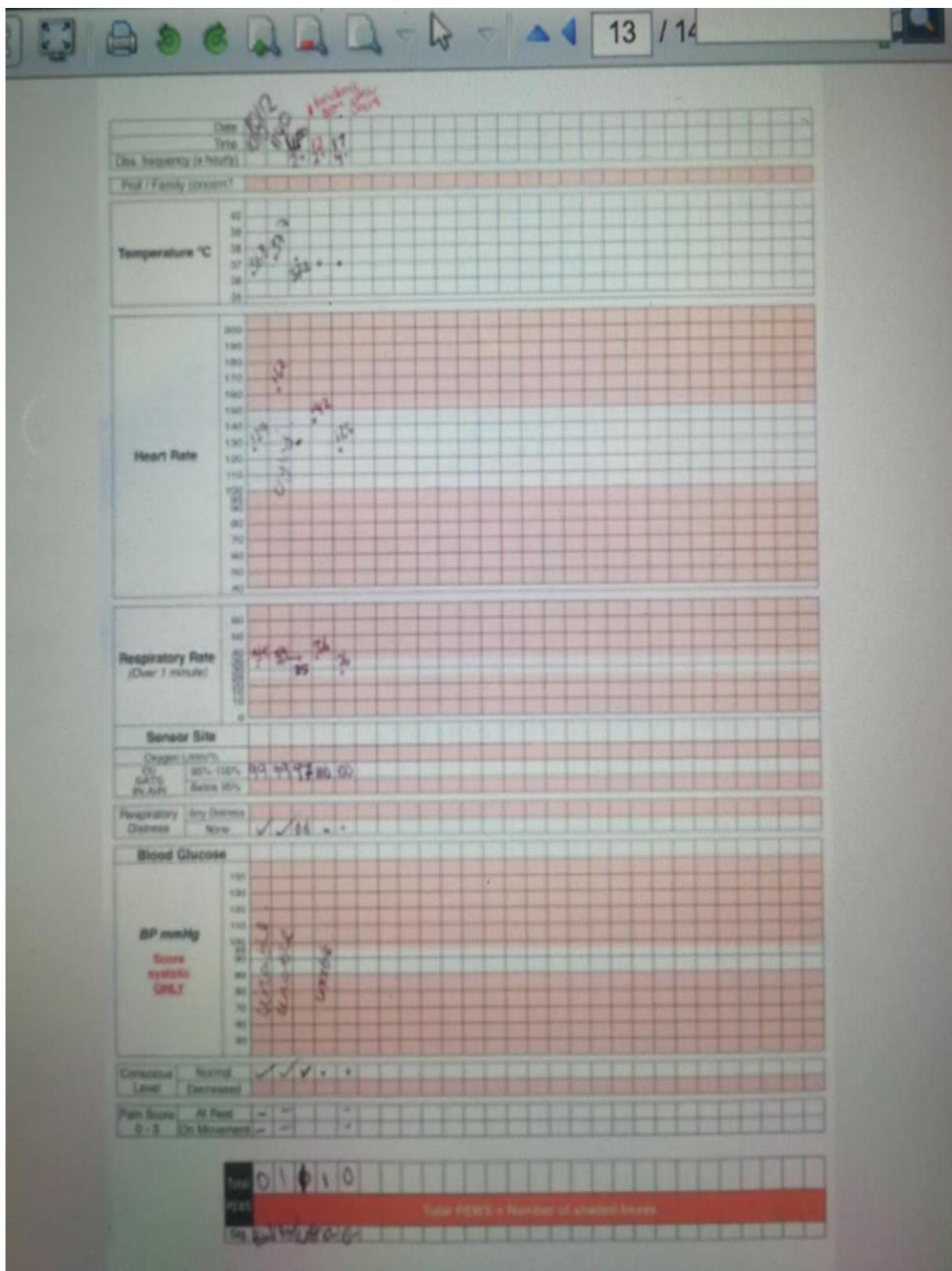
Patient 18



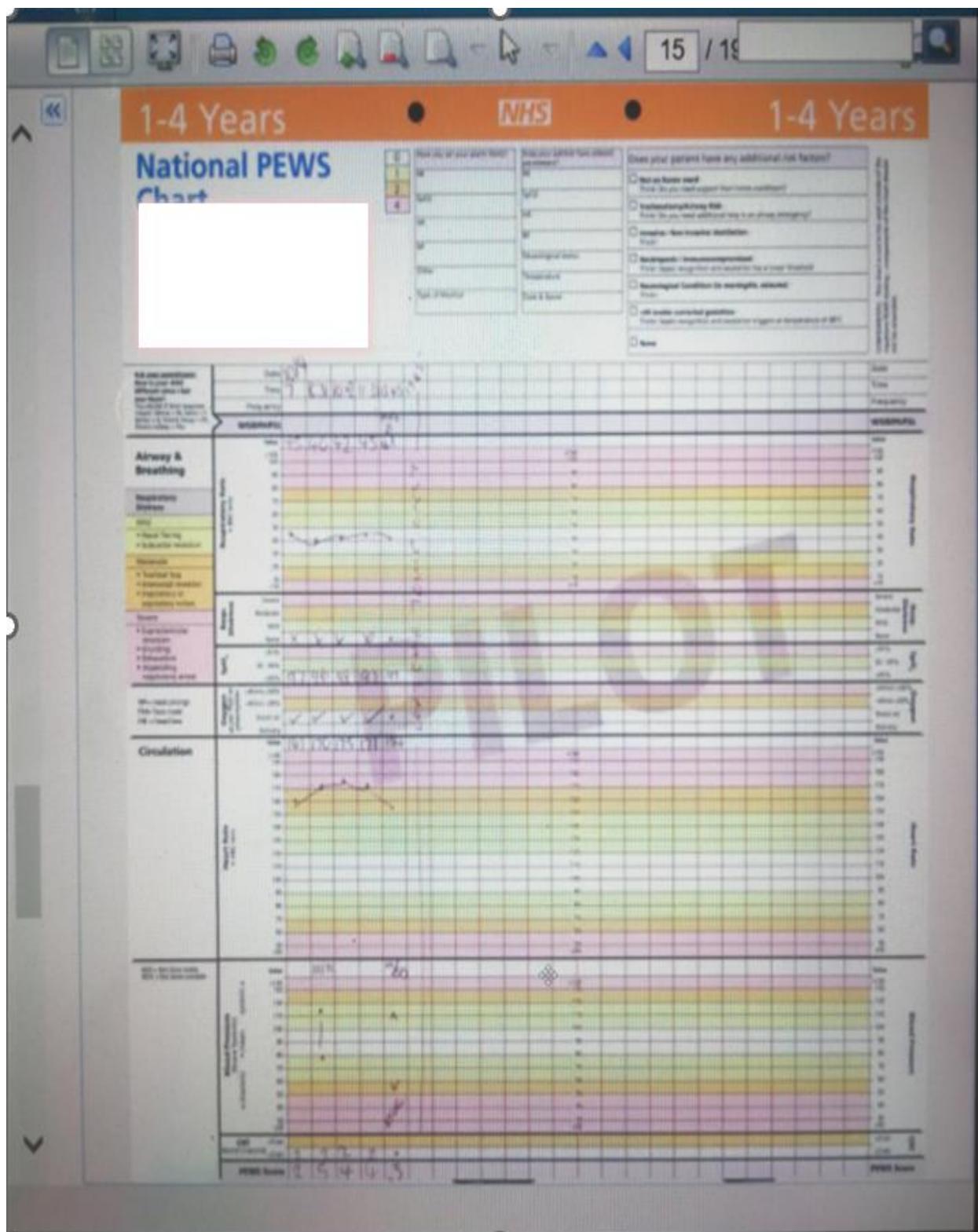
Patient 19



Patient 20



Patient 21



Patient 22

1-4 Years		NHS	1-4 Years	
National PEWS Chart				
		What do you think is wrong? 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 8010 8011 8012 8013 8014 8015 8016 8017 8018 8019 8020 8021 8022 8023 8024 8025 8026 8027 8028 8029 8030 8031 8032 8033 8034 8035 8036 8037 8038 8039 8040 8041 8042 8043 8044 8045 8046 8047 8048 8049 8050 8051 8052 8053 8054 8055 8056 8057 8058 8059 8060 8061 8062 8063 8064 8065 8066 8067 8068 8069 8070 8071 8072 8073 8074 8075 8076 8077 8078 8079 8080 8081 8082 8083 8084 8085 8086 8087 8088 8089 8090 8091 8092 8093 8094 8095 8096 8097 8098 8099 80100 80101 80102 80103 80104 80105 80106 80107 80108 80109 80110 80111 80112 80113 80114 80115 80116 80117 80118 80119 80120 80121 80122 80123 80124 80125 80126 80127 80128 80129 80130 80131 80132 80133 80134 80135 80136 80137 80138 80139 80140 80141 80142 80143 80144 80145 80146 80147 80148 80149 80150 80151 80152 80153 80154 80155 80156 80157 80158 80159 80160 80161 80162 80163 80164 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80331 80332 80333 80334 80335 80336 80337 80338 80339 80340 80341 80342 80343 80344 80345 80346 80347 80348 80349 80350 80351 80352 80353 80354 80355 80356 80357 80358 80359 80360 80361 80362 80363 80364 80365 80366 80367 80368 80369 80370 80371 80372 80373 80374 80375 80376 80377 80378 80379 80380 80381 80382 80383 80384 80385 80386 80387 80388 80389 80390 80391 80392 80393 80394 80395 80396 80397 80398 80399 80400 80401 80402 80403 80404 80405 80406 80407 80408 80409 80410 80411 80412 80413 80414 80415 80416 80417 80418 80419 80420 80421 80422 80423 80424 80425 80426 80427 80428 80429 80430 80431 80432 80433 80434 80435 80436 80437 80438 80439 80440 80441 80442 80443 80444 80445 80446 80447 80448 80449 80450 80451 80452 80453 80454 80455 80456 80457 80458 80459 80460 80461 80462 80463 80464 80465 80466 80467 80468 80469 80470 80471 80472 80473 80474 80475 80476 80477 80478 80479 80480 80481 80482 80483 80484 80485 80486 80487 80488 80489 80490 80491 80492 80493 80494 80495 80496 80497 80498 80499 80500 80501 80502 80503 80504 80505 80506 80507 80508 80509 80510 80511 80512 80513 80514 80515 80516 80517 80518 80519 80520 80521 80522 80523 80524 80525 80526 80527 80528 80529 80530 80531 80532 80533 80534 80535 80536 80537 80538 80539 80540 80541 80542 80543 80544 80545 80546 80547 80548 80549 80550 80551 80552 80553 80554 80555 80556 80557 80558 80559 80560 80561 80562 80563 80564 80565 80566 80567 80568 80569 80570 80571 80572 80573 80574 80575 80576 80577 80578 80579 80580 80581 80582 80583 80584 80585 80586 80587 80588 80589 80590 80591 80592 80593 80594 80595 80596 80597 80598 80599 80600 80601 80602 80603 80604 80605 80606 80607 80608 80609 80610 80611 80612 80613 80614 80615 80616 80617 80618 80619 80620 80621 80622 80623 80624 80625 80626 80627 80628 80629 80630 80631 80632 80633 80634 80635 80636 80637 80638 80639 80640 80641 80642 80643 80644 80645 80646 80647 80648 		

Patient 23

Patient 24

University of Warwick
Drats (2)

11 / 13

0 to 11 months NHS 0 to 11 months

National PEWS Chart

Score

Do you patient have any additional risk factors?

- Are you female?** Female do you patient appear more fatigued?
- Neuroleptic/drug risk?** Risk do you patient appear less alert or confused?
- Medications/other medication?** Risk do you patient appear less responsive?
- Neurological condition - e.g. fits, stroke, infection?** Risk do you patient appear less responsive?
- All under 1 month old?** Risk basic recognition and reaction trigger a fever threshold.

Airway & Breathing

Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Score	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54																																														

Disability & Exposure																	
<p>If you believe your child has a disability or condition that affects their development, please tick all that apply:</p> <ul style="list-style-type: none"> <input type="checkbox"/> I am worried about my child's development <input type="checkbox"/> I am worried about my child's behaviour <input type="checkbox"/> I am worried about my child's health <input type="checkbox"/> I am worried about my child's speech <p>If a doctor writes an invoice for clinical services, make sure it includes words like:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Health visitor <input type="checkbox"/> Paediatrician <input type="checkbox"/> Doctor <input type="checkbox"/> Consultant <input type="checkbox"/> Specialist 																	
<p>Health Concerns</p> <p>If you feel your child is not growing right or seems unwell, please tick all that apply. Only tick boxes on the right side of the chart.</p>		<table border="1"> <thead> <tr> <th colspan="2">Global Indicators</th> </tr> </thead> <tbody> <tr> <td>Age-related</td> <td>Developmental</td> </tr> <tr> <td>Child is not growing well</td> <td>Child is not developing well</td> </tr> <tr> <td>Child is not sleeping well</td> <td>Child is not learning well</td> </tr> <tr> <td>Child is not drinking well</td> <td>Child is not talking well</td> </tr> <tr> <td>Child is not toileting well</td> <td>Child is not walking well</td> </tr> </tbody> </table>				Global Indicators		Age-related	Developmental	Child is not growing well	Child is not developing well	Child is not sleeping well	Child is not learning well	Child is not drinking well	Child is not talking well	Child is not toileting well	Child is not walking well
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Communication & Response Time <small>(NHS Framework)</small> <p>Medical plan for mobilisation and discharge will be developed including:</p> <ul style="list-style-type: none"> • specific actions to be taken • timescales • resources required • escalation if mobilisation plan fails <p>Medical review date:</p> <p>Medical Discharge Planning</p> <p>Medical Discharge Planning</p> <p>Medical Discharge Planning</p>	<p>1-6</p> <p>Child uses voice that suggests the child can understand what is being said or information supplied by the last 100 words</p> <p>Parent/carer concern that patient speaks in unclear voices irrespective of how much they try</p> <p>Medical Review in Charge</p> <p>Medical Review in Charge</p> <p>Medical Review in Charge</p> <p>Medical Review in Charge</p>		<p>3-12</p> <p>Child uses voice that suggests the child can understand what is being said or information supplied by the last 100 words</p> <p>Parent/carer concern that patient speaks in unclear voices irrespective of how much they try</p> <p>Medical Review in Charge</p> <p>Medical Review in Charge</p> <p>Medical Review in Charge</p> <p>Medical Review in Charge</p>		<p>13+</p> <p>Child uses voice that suggests the child can understand what is being said or information supplied by the last 100 words</p> <p>Parent/carer concern that patient speaks in unclear voices irrespective of how much they try</p> <p>Medical Review in Charge</p> <p>Medical Review in Charge</p> <p>Medical Review in Charge</p> <p>Medical Review in Charge</p>												
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<p>Initial Communication Tools</p> <p>A - Identity</p> <p>Identify: You, Doctor, Patient to the Dr: _____ This is Dr. This is Mrs. Last name on card: _____ I am calling about Dr. David Jones</p> <p>B - Situation</p> <p>Situation: Why are you calling? I am calling because e.g. Total PTHS of 0 Res. No. _____ Sat. _____ H. Delivery. _____ Temp. _____ Incent. No. _____ Urinary Output. _____ ASD/PD or complex child</p> <p>C - Background</p> <p>Background: What is the relevant background? They are _____ years old Admitted for _____ Recent surgery or procedures _____ Known past medical/trauma history _____ They have been to hospital _____ e.g. A family member with _____</p> <p>D - Assessment</p> <p>Assessment: When do you think the problem?</p> <p>1 week e.g. They are hyperactive - you can spot this if you are not clear what is wrong</p> <p>More than 1 year e.g. come and take me outside Is there anything else you would like me to know before you get here?</p>																	
<p>Original design from Birmingham Children's Hospital with contributions from other English trusts and amendments from National Child Protection Working Group. Copyright pending. NCP (2006). This document is for testing version 1.1 (December 2007)</p>																	
<p>0 to 11 months</p> <p>0 to 11 months</p>																	

Patient 25

National PEWS Chart

0 to 11 months **NHS** **0 to 11 months**

Does your patient have any additional risk factors?

- Not at home user:** Has the patient been staying at home overnight?
- Reduced mobility/immobility risk:** Has the patient had additional help in an emergency?
- Incapacitated:** Has the patient been unable to move or communicate?
- Neurological condition:** Has the patient had a stroke or transient ischaemic attack?
- Neurological condition in meningitis, sepsis and/or fits:** Has the patient had a fit or fits?
- All weather corrected gestation:** Has the patient been recognised and evaluated as being at a temperature of 38°C or above?
- None:**

	Score	Score	Score	Score
Airway & Breathing	0	1	2	3
Respiratory Status	0	1	2	3
Circulation	0	1	2	3
Gastrointestinal	0	1	2	3

PEWS score: **0** Date: **10/01/2010**

Patient 26

National PEWS Chart

0 to 11 months		NHS		0 to 11 months	
Has your patient been admitted?	No	Has your patient been admitted previously?	No	Does your patient have any additional risk factors?	
1	Yes	2	Yes	<input type="checkbox"/> Has an older child? Please do you need support from home carer?	
2	Yes	3	Yes	<input type="checkbox"/> Inadequate respiratory rate? Please do you need additional help in an emergency?	
3	Yes	4	Yes	<input type="checkbox"/> Hypoxia - Need intubation ventilation? Please	
4	Yes	5	Yes	<input type="checkbox"/> Management - Infection complicated? Please advise hospital and escalation for a lower threshold	
5	Yes	6	Yes	<input type="checkbox"/> Seizures - Convulsions in overnight, unwell? Please	
6	Yes	7	Yes	<input type="checkbox"/> All systems abnormal presentation? Please advise hospital and escalation trigger at temperature of 38°C	
7	Yes	8	Yes	<input type="checkbox"/> None	
Airway & Breathing Respiratory distress <ul style="list-style-type: none"> 0 Normal 1 Nasal flaring 2 Subcostal recession Motility <ul style="list-style-type: none"> 0 Head bobbing 1 Head lag 2 Abnormal posture 3 Hypoxia or cyanosis (not respiratory related) Skin <ul style="list-style-type: none"> 0 Dry skin 1 Dunting 2 Edema 3 Impaired capillary refill ABG - blood gas <ul style="list-style-type: none"> 0 No acid base disorder 1 Metabolic acidosis 2 Respiratory acidosis 3 Metabolic alkalosis 4 Respiratory alkalosis 					
Circulation Heart Rate <ul style="list-style-type: none"> 0 100-110 1 111-120 2 121-130 3 131-140 4 141-150 5 151-160 6 161-170 7 171-180 8 181-190 9 191-200 10 201-210 11 211-220 12 221-230 13 231-240 14 241-250 15 251-260 16 261-270 17 271-280 18 281-290 19 291-300 20 301-310 21 311-320 22 321-330 23 331-340 24 341-350 25 351-360 26 361-370 27 371-380 28 381-390 29 391-400 30 401-410 31 411-420 32 421-430 33 431-440 34 441-450 35 451-460 36 461-470 37 471-480 38 481-490 39 491-500 40 501-510 41 511-520 42 521-530 43 531-540 44 541-550 45 551-560 46 561-570 47 571-580 48 581-590 49 591-600 50 601-610 51 611-620 52 621-630 53 631-640 54 641-650 55 651-660 56 661-670 57 671-680 58 681-690 59 691-700 60 701-710 61 711-720 62 721-730 63 731-740 64 741-750 65 751-760 66 761-770 67 771-780 68 781-790 69 791-800 70 801-810 71 811-820 72 821-830 73 831-840 74 841-850 75 851-860 76 861-870 77 871-880 78 881-890 79 891-900 80 901-910 81 911-920 82 921-930 83 931-940 84 941-950 85 951-960 86 961-970 87 971-980 88 981-990 89 991-1000 					
ABG - arterial oxygen saturation <ul style="list-style-type: none"> 0 95-100 1 96-101 2 97-102 3 98-103 4 99-104 5 100-105 6 101-106 7 102-107 8 103-108 9 104-109 10 105-110 11 106-111 12 107-112 13 108-113 14 109-114 15 110-115 16 111-116 17 112-117 18 113-118 19 114-119 20 115-120 21 116-121 22 117-122 23 118-123 24 119-124 25 120-125 26 121-126 27 122-127 28 123-128 29 124-129 30 125-130 31 126-131 32 127-132 33 128-133 34 129-134 35 130-135 36 131-136 37 132-137 38 133-138 39 134-139 40 135-140 41 136-141 42 137-142 43 138-143 44 139-144 45 140-145 46 141-146 47 142-147 48 143-148 49 144-149 50 145-150 51 146-151 52 147-152 53 148-153 54 149-154 55 150-155 56 151-156 57 152-157 58 153-158 59 154-159 60 155-160 61 156-161 62 157-162 63 158-163 64 159-164 65 160-165 66 161-166 67 162-167 68 163-168 69 164-169 70 165-170 71 166-171 72 167-172 73 168-173 74 169-174 75 170-175 76 171-176 77 172-177 78 173-178 79 174-179 80 175-180 81 176-181 82 177-182 83 178-183 84 179-184 85 180-185 86 181-186 87 182-187 88 183-188 89 184-189 90 185-190 91 186-191 92 187-192 93 188-193 94 189-194 95 190-195 96 191-196 97 192-197 98 193-198 99 194-199 100 195-200 					

PEWS Score: 100

21:42 28/07/2022

Disability & Exposure						
<p>If you believe there is a problem, describe it in your own words.</p> <p>1 = Response to injury 2 = Response to event 3 = Response to threat 4 = Threat</p> <p>If you have the same or similar concerns for other children in your care (e.g. regular visits to hospital)</p>						
<p>Initial Concern:</p> <p>If an initial concern is present, right or wrong, what were you worried about the child experiencing currently?</p>		<p>Clinical Indicators:</p> <p>Signature _____ Date _____ Time of interview _____ NDISC _____ Child ID _____ Date of record _____</p>				
Initial Concern: 1 = for the problem, 2 = for the response, 3 = for the child, 4 = for the family Specific concern: Injury, illness, mental health, behaviour, social, developmental, educational, nutritional, etc. Lower Question: Medical indication: Communication & response case (MRC framework): Medical plan for stabilisation: Identified medical plan for the child including: 1. symptoms 2. medical history 3. medication 4. treatment 5. outcome Communication & response case (MRC framework): Medical review findings: Medical Communication Recording (Medical Reference guide) plan:	1-4 		5-8 		9-12 	
	13+ 		13+ 		13+ 	
<p>THINK: Could this be urgent? There is a possibility in any child's life, regardless of score.</p> <ul style="list-style-type: none"> None or no apparent indicator Especially if temperature ($>38^\circ\text{C}$ or $<35^\circ\text{C}$) Increasing danger sign Unexplained tachypnoea Unexplained tachycardia Unexplained fever (e.g. immediately following a reduced temperature and returning to normal) Reduced perfusion and pallor (including cyanosis) Respiratory or immunocompromise (child medical professional for immediate advice) 						
<p>Comments:</p> <p>_____</p>						

THREE Communicative Rule

I - Identify	S - Situation	B - Background	A - Assessment	R - Recommendations
Identify: You, Doctor, Patient 0-6m CA: _____ This is _____ (e.g. This is Mary. I am a nurse and want to ask) I am calling about _____ (e.g. Child's name)	Situation: Question Why are you calling? e.g. Total PQRST of 15 Reg Rate: _____ Lungs: _____ Delivery: _____ Temp: _____ Heart Rate: _____ BP: _____ Urinary Output: _____ STOMA: _____ or continuous feed: _____	Background: What is the relevant background? They are _____ years old Admitted for _____ Recent surgery or procedures. Relevant past medical/physical history They currently have _____ e.g. Vomiting, Diarrhoea, Rash, etc.	Assessment: What do you think is the problem? I think _____ (e.g. She ate too much — you can skip this if you are not clear what is wrong)	Recommendations: What do you recommend? I would like you to _____ (e.g. come and review him please) Is there anything you would like me to before you get here?

0 to 11 months

Original design from Birmingham Children's Hospital with contributions from other English trusts and commissioners from National Paediatric Progression Working Group. Copyright pending, 2017 Kite Standard. This document is for testing, version 1.1 (December 2017).

0 to 11 mont

Patient 27

NHS

0 to 11 months **NHS** **0 to 11 months**

National PEWS Chart

PEWS score calculation
Score = (Age - 1) x 0.1 + (Score A + Score B + Score C + Score D + Score E + Score F + Score G)
e.g. Age = 10 months, Score A = 1, Score B = 1, Score C = 1, Score D = 1, Score E = 1, Score F = 1, Score G = 1
Score = (10 - 1) x 0.1 + (1 + 1 + 1 + 1 + 1 + 1 + 1) = 8.1

Score A	Score B	Score C	Score D	Score E	Score F	Score G
0	0	0	0	0	0	0
1	1	1	1	1	1	1
2	2	2	2	2	2	2
3	3	3	3	3	3	3
4	4	4	4	4	4	4

Has your patient been sick?
Yes
No
Not applicable
Not applicable
Not applicable
Not applicable
Not applicable
Not applicable

Has your patient had diarrhoea?
Yes
No
Not applicable
Not applicable
Not applicable
Not applicable
Not applicable
Not applicable

Does your patient have any additional risk factors?
 Has an house hold
 Does the you need support from money/food?
 Immunocompetence risk
 Does the you need additional help in an emergency?
 Immature - New immune system
 None
 Non-immune - immunocompetent
 Non-immune - immunocompetent has a known disorder
 Non-immune condition like meningitis, sepsis
 Other - known recognised and monitored trigger or long history of SEPSIS
 None

Date _____
Time _____
Frequency _____
Location _____

Airway & Breathing

Respiratory distress
Wheeze
• Nasal flaring
• Subcostal recession

Bradycardia
• Heart rate
• Chest tightness
• Abnormal respiratory pattern
• Hypoxia/cyanosis of peripheral mucous membranes

Drowsiness
• Drowsy
• Irritability
• Unconscious
• Unresponsive to painful stimuli

SpO₂ readings
95% - 100%
100% - 105%
105% - 110%
110% - 115%
115% - 120%
120% - 125%
125% - 130%
130% - 135%
135% - 140%
140% - 145%
145% - 150%
150% - 155%
155% - 160%
160% - 165%
165% - 170%
170% - 175%
175% - 180%
180% - 185%
185% - 190%
190% - 195%
195% - 200%

Circulation

BP readings
90/60 mmHg
95/65 mmHg
100/70 mmHg

HR readings
100 - 120 bpm
120 - 140 bpm
140 - 160 bpm
160 - 180 bpm
180 - 200 bpm
200 - 220 bpm
220 - 240 bpm
240 - 260 bpm
260 - 280 bpm
280 - 300 bpm
300 - 320 bpm
320 - 340 bpm
340 - 360 bpm
360 - 380 bpm
380 - 400 bpm
400 - 420 bpm
420 - 440 bpm
440 - 460 bpm
460 - 480 bpm
480 - 500 bpm
500 - 520 bpm
520 - 540 bpm
540 - 560 bpm
560 - 580 bpm
580 - 600 bpm
600 - 620 bpm
620 - 640 bpm
640 - 660 bpm
660 - 680 bpm
680 - 700 bpm
700 - 720 bpm
720 - 740 bpm
740 - 760 bpm
760 - 780 bpm
780 - 800 bpm
800 - 820 bpm
820 - 840 bpm
840 - 860 bpm
860 - 880 bpm
880 - 900 bpm
900 - 920 bpm
920 - 940 bpm
940 - 960 bpm
960 - 980 bpm
980 - 1000 bpm
1000 - 1020 bpm
1020 - 1040 bpm
1040 - 1060 bpm
1060 - 1080 bpm
1080 - 1100 bpm
1100 - 1120 bpm
1120 - 1140 bpm
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Disability & Exposure		Temperature (°C)									
		Temperature (°C)									
Injury Mechanism Associated Treatment Solutions		Temperature (°C)									
		Temperature (°C)									
If you believe someone is at risk: • Assess • Identify at risk • Alert		Temperature (°C)									
If you have the ABCs: Assess In-Response to injury P = Response to pain O = Oxygenation		Temperature (°C)									
If cold is with no major for altered sensation and/or cooling, repeat with history		Temperature (°C)									
Summing Scores: How bad is your patient? You can right or wrong. Despite a low PES score, you can identify via the PEAT evaluation pathway		Temperature (°C)									
Clinical Indicators:		Temperature (°C)									
Signature		Temperature (°C)									
Slow HR, altered blood pressure NSTEMI PEAT score		Temperature (°C)									
Communication & Response (PEAT framework):		Temperature (°C)									
Medical plan for stabilization: Stabilized medical plan (e.g. blood glucose, oxygen saturation, etc.) Specifics to the patient: 1. expected outcome; 2. evidence; descriptive 3. medication if indicated; not met by baseline.		Temperature (°C)									
Communication & Response (PEAT framework):		Temperature (°C)									
Medical plan for stabilization: Stabilized medical plan (e.g. blood glucose, oxygen saturation, etc.) Specifics to the patient: 1. expected outcome; 2. evidence; descriptive 3. medication if indicated; not met by baseline.		Temperature (°C)									
Medical outcome targets: Initial Identification Recording and Medical Review Targeting plan		Temperature (°C)									
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0 to 11 months

This document is for training. Version 1.1 (December 2007)

0 to 11 months

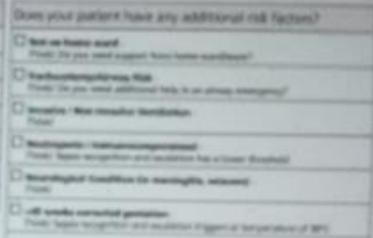
Patient 28

1-4 Years		NHS		1-4 Years	
National PEWS Chart					
<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Uncertain <input type="checkbox"/> Don't know <input type="checkbox"/> Not applicable		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Uncertain <input type="checkbox"/> Don't know <input type="checkbox"/> Not applicable		<input type="checkbox"/> No <input type="checkbox"/> Yes	
Date: 20/07/2012 Time: 12:30 Temperature: 36.5°C		Date: 20/07/2012 Time: 12:30 Temperature: 36.5°C		Date: 20/07/2012 Time: 12:30 Temperature: 36.5°C	
Airway & Breathing Respiratory Distress Mild <input checked="" type="checkbox"/> No stridor <input checked="" type="checkbox"/> No respiratory distress Moderate <input checked="" type="checkbox"/> Nostril flaring <input checked="" type="checkbox"/> Intercostal recession <input checked="" type="checkbox"/> Respiratory or respiratory distress		Heart Rate Normal Slow Fast		Skin Color Normal Pale Mottled Cyanotic Jaundiced	
SpO₂ Normal Low		Breath Sounds Normal Diminished		Consciousness Alert Drowsy Unconscious	
Circulation BP Normal Low High		Capillary Refill Normal Slow		Perfusion Normal Poor	
Abdomen Normal Tenderness Distension Hypotension Hypotension + respiratory distress		Extremities Normal Cool		PEWS Score 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	
Does your patient have any additional risk factors? <input type="checkbox"/> Not at home alone <input type="checkbox"/> Does s/he need regular home support? <input type="checkbox"/> Home emergency plan <input type="checkbox"/> Does s/he have additional help in an emergency? <input type="checkbox"/> Isolation - Non-essential visitors <input type="checkbox"/> None <input type="checkbox"/> Non-urgent - Non-acute medical <input type="checkbox"/> Does s/he have any acute or non-acute medical condition? <input type="checkbox"/> Neurological condition (e.g. stroke, seizure) <input type="checkbox"/> Non-acute - Non-urgent <input type="checkbox"/> Does s/he have any non-acute or non-urgent condition? <input type="checkbox"/> Non-acute - Non-urgent					

Patient 29

Patient 30

Patient 31

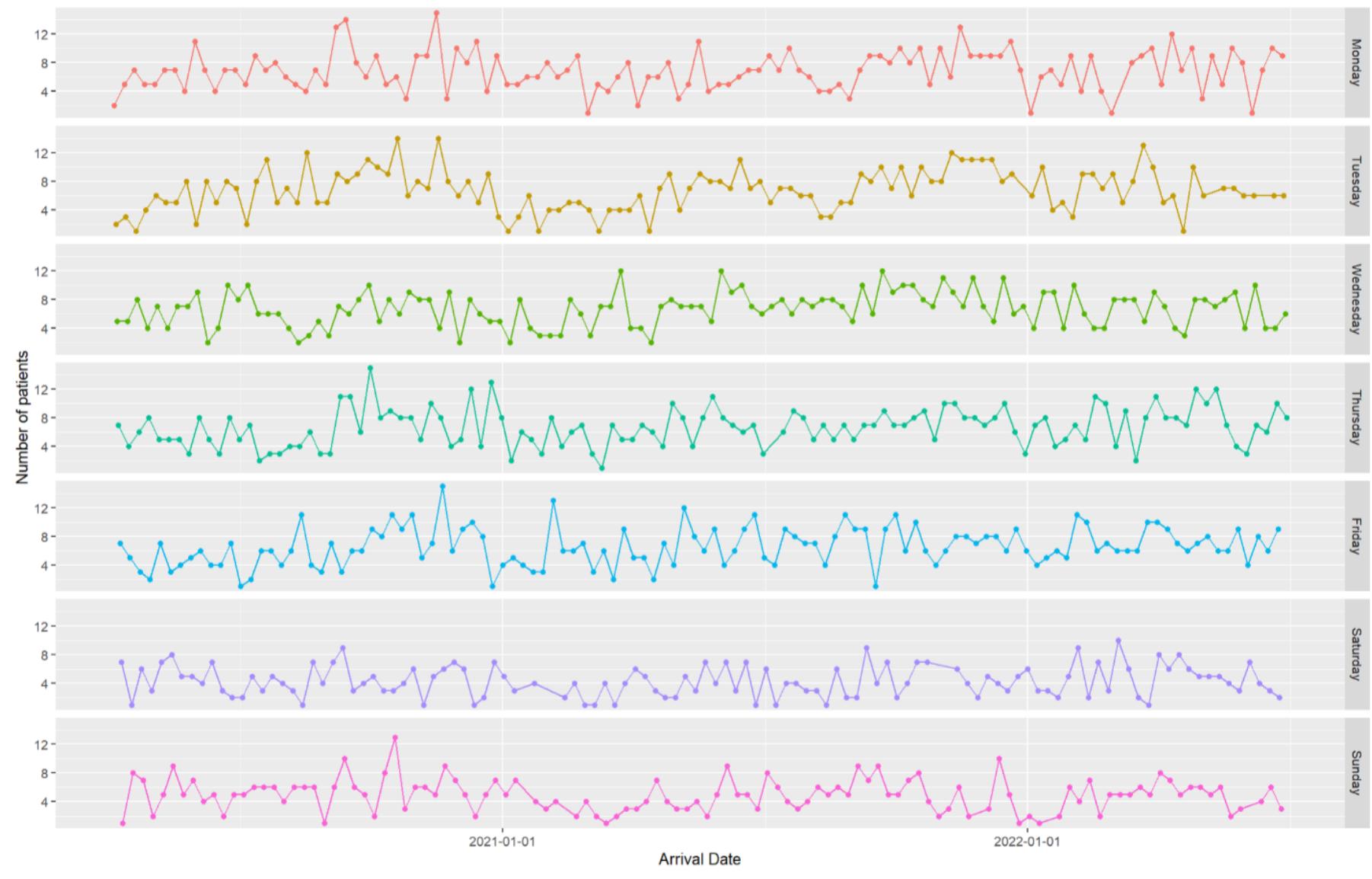
0 to 11 months		NHS		0 to 11 months	
National PEWS Chart 		 <small>17/08/13 07:58:13</small>			
Airway & Breathing Respiratory Score 0-100 + Visual Signs + Subcostal recession Symptoms + Chest wall movement + Cyanosis + Indrawing + Respiratory distress + Stridor Screening + Abnormal appearance + Crying + Drowsiness + Unresponsive Other 0 = normal range 100 = very poor 50 = poor		Temperature Score 0-100 + Axilla + Rectal + Oral Temperature 30-39°C 36°C 37°C 38°C Heart Rate Score 0-100 + Heart rate + Pulse Pulse 0-100 100 Respiratory Rate Score 0-100 + Respiratory rate + Pulse Respiratory Rate 0-100 100 Circulation Score 0-100 + Skin perfusion + Capillary refill Capillary Refill 0-100 100 PEWS Score 0-100 100		Does your patient have any additional risk factors? <input type="checkbox"/> Non-acute fracture <small>Provide for you need support from fracture specialist?</small> <input type="checkbox"/> Transported by air ambulance <small>Provide for you need additional help in an air ambulance emergency?</small> <input type="checkbox"/> Emergency - Non-traumatic ventilation <small>Provide</small> <input type="checkbox"/> Neurologically impaired <small>Provide. Brain recognition and reaction has a lower threshold</small> <input type="checkbox"/> Neurological condition (e.g. meningitis, sepsis) <small>Provide</small> <input type="checkbox"/> Urticaria associatedগগন <small>Provide. Skin recognition and resolution of hives or temperature of 38°C</small> <input type="checkbox"/> None	
				<small>Copyright © 2013 NHS Digital. All rights reserved. This chart is for clinical use. It is not suitable for use in a legal context.</small>	

Patient 32

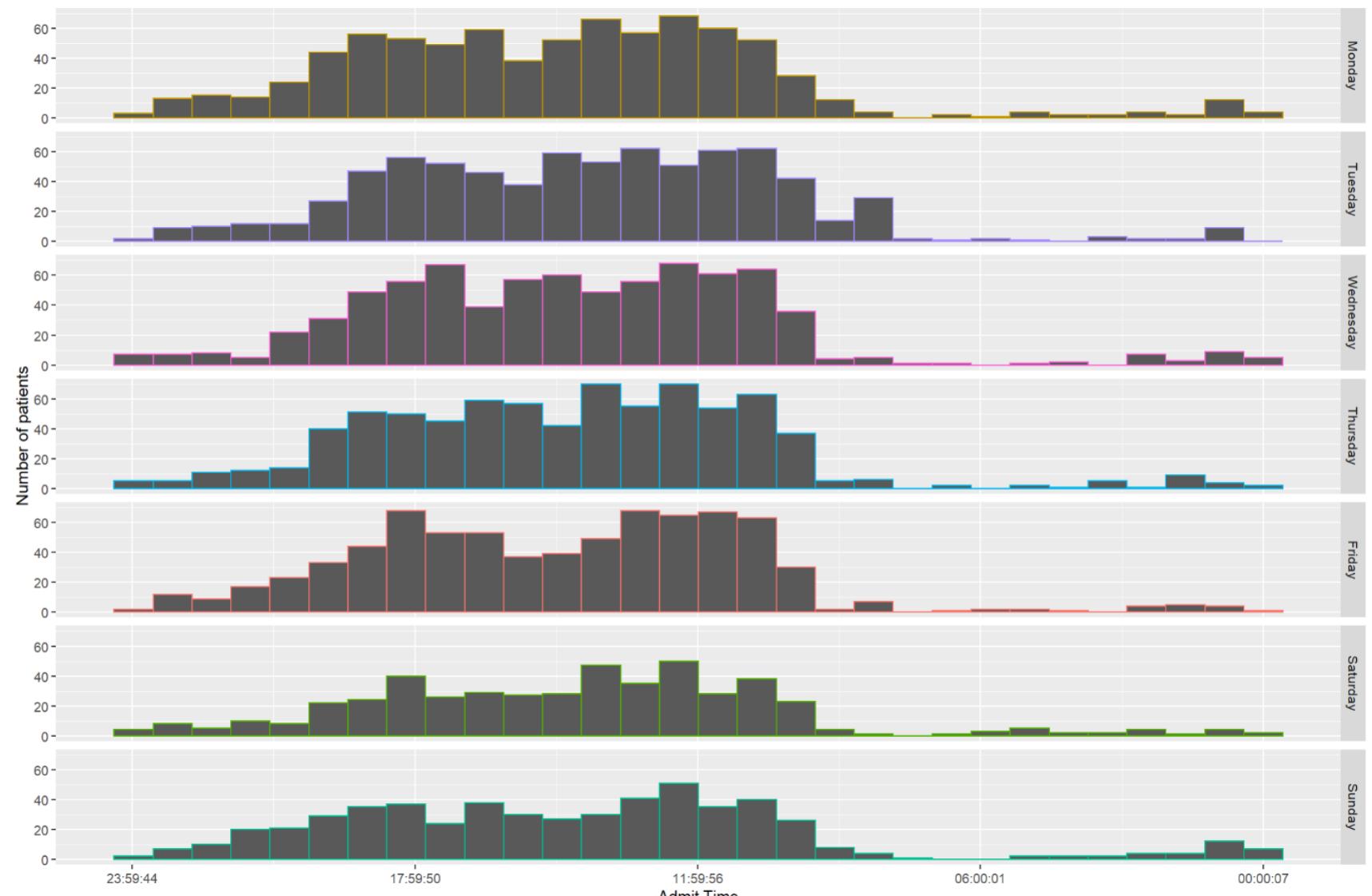
0 to 11 months		NHS		0 to 11 months	
National PEWS Chart 					
				</	

8.3 Extra graphs

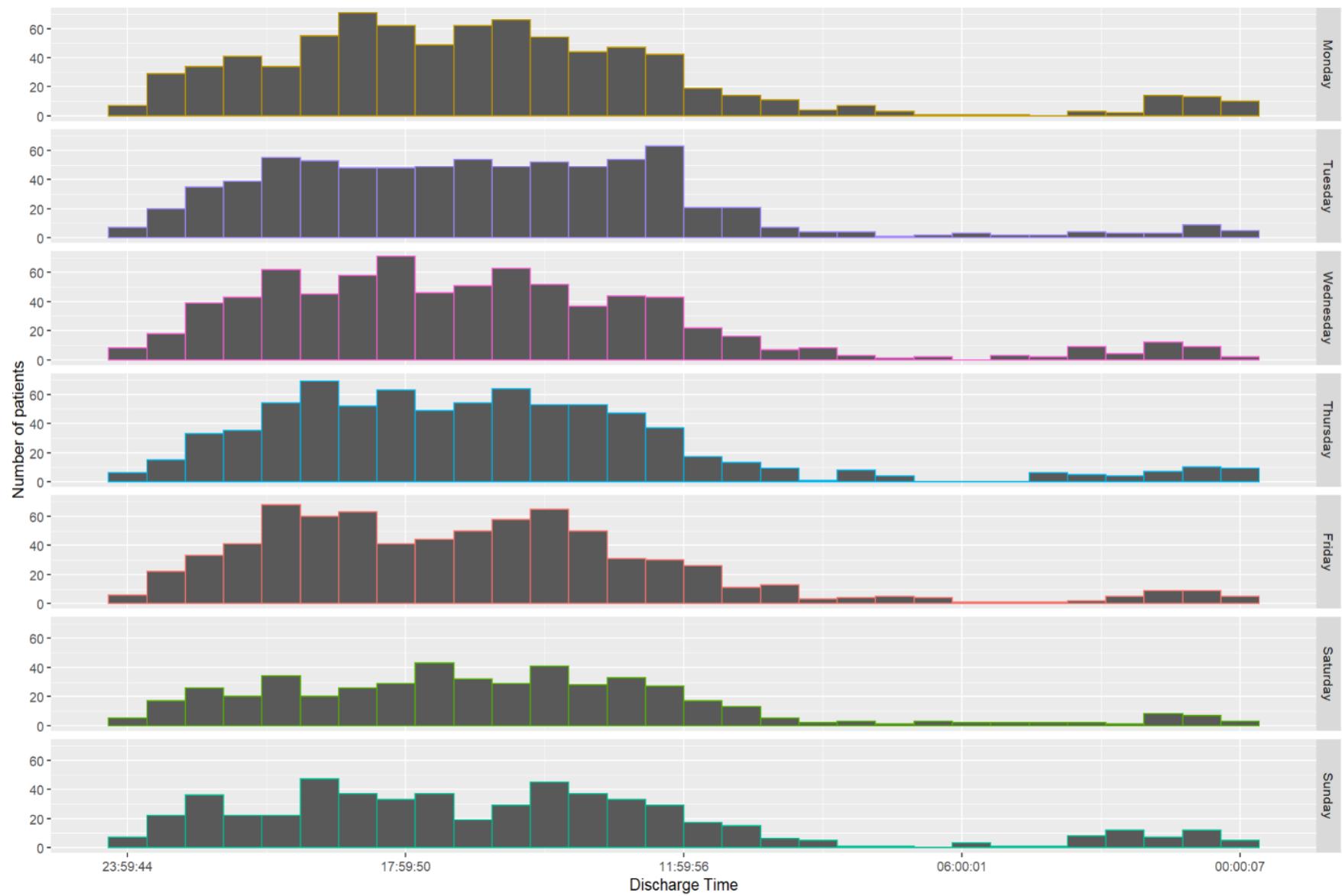
Several admission at the PAU is stable over the months and across days. Weekdays are expected to be the busiest time.



Number of patients from 2020 to 2022 at PAU by wee



Distribution of the number of patients at each Arrival Time by weekday for PAU



Distribution of the number of patients at each Discharge Time by weekday for PAU