

# Understanding Non-Fixed Ligatures amongst Adolescents: A Human Factors and Ergonomics Approach

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## ABSTRACT

The Children's and Adolescents Mental Health Service (CAMHS) in-patient unit scoping exercise was a qualitative exploration to understand the increase in Non-Fixed Ligaturing (NFL) incidents at an NHS Mental and Community Health Trust. This exercise aimed to answer 3 questions: (1) What are the reasons behind NFL on the CAMHS unit? (2) When does NFL behaviour occur? and (3) How can staff better respond to and reduce NFL incidents? A Resilience Engineering approach by understanding safety-I (increased incidents of NFL) and extracting examples of Safety-II was combined with an insight to how work processes on the unit were carried out in line with "Work as Imagined" (policy) vs "Work as Done" (procedure). A triangulation of methods was used which consisted of analyses of incident reports, an observation of a shift, and semi-structured interviews with 9 members of staff. The highest number of incidents occurred between 16:00 and 19:59. The semi-structured interviews revealed a psychological underpinning behind NFL through the theme of *the act of ligating*. Seeing Work as Done (observation) resulted in an instant change of staffing. Safety-II was evident in effective workarounds such as accommodating unfamiliar staff through a succinct induction. The methods aligned with the safety management mode of guided adaptability providing a novel approach to produce usable tools and interventions in sensitive, volatile, and emotionally charged work environments. The CAMHS unit scoping exercise provides insights, implications, practical applications, and improvement opportunities to reduce and better respond to NFL across CAMHS units by adopting a HF/E approach.

## KEYWORDS

Non-Fixed Ligatures, Resilience Engineering, Work as Imagined vs Work as Done

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## Introduction

This paper presents the findings of a scoping exercise to identify priority actions to help reduce and better respond to Non-Fixed Ligature (NFL) incidents on the in-patient Children's and Adolescents Mental Health Service (CAMHS) Unit. This exercise was a collaboration between the Patient Safety Team (PST) and front-line staff to co-design inclusive and bottom-up learning to provide the highest standards of care to patients. A Human Factors and Ergonomics (HF/E) lens was applied because a better understanding of work practices which influence both staff experience and patient care was required in this volatile, traumatic, and complex area of work.

## Background

The care of adolescents is identified as a distinct speciality (World Health Organisation, 2015), in-patient mental health environments that provide care for adolescents are unique and demanding care

settings (Matthews & Williamson, 2016), which pose distinctive challenges for patient safety (Thibaut et al., 2019). Self-harm is commonly used to describe a wide range of behaviours and intentions including attempted hanging, impulsive self-poisoning, and superficial cutting, burning, head-banging, tying ligatures, taking overdoses, and attempted hanging in response to intolerable tension (Paediatric Foamed, 2018; Skegg, 2011).

Self-harm behaviours are most common during adolescence and young adulthood (Plener et al., 2015). Self-harm by tying is commonly referred to as ligaturing, in which parts of the body are tied tightly and blood flow is stopped or impeded. Ligaturing is most dangerous when it is around the neck, because blood flow to the brain can quickly lead to unconsciousness and death. Governmental guidance focuses on fixed point ligatures and these have been addressed across the Trust effectively.

Causes behind ligaturing include the patient's deteriorating mental health state and difficulties in safely managing trauma or emotional distress (NHS Health Education England, n.d.). Ligaturing is a suicide risk. The Care Quality Commission (2020) reported that three-quarters of people who take their own lives while on a psychiatric ward do so by hanging or strangulation, and published guidance on fixed ligature points. However, the risk on the CAMHS unit is complex; it is a result of ligaturing by using patients' own clothing or accessories known as Non-Fixed Ligatures.

### **Human Factors and Ergonomics**

Gathering soft intelligence is intertwined with the HF/E theory of "Work as Imagined" vs "Work as Done". Work as Imagined (WAI) is typically presented in guidelines and policies and is what designers, managers, regulators, and authorities believe happen, or should happen in the work environment in comparison to "Work as Done" (WAD) which is what actually happens in the work environment (Chuang & Hollnagel, 2017).

The situation at the CAMHS Unit was unique, because incidents were reported from the "sharp end" (where the work is carried out: WAD) and decisions and actions in response to the incidents were suggested by managers (the blunt end: WAI) during weekly Incident Review Meetings. Martin et al. (2015) reported that there are difficulties in senior managers and leaders forming an accurate picture of the quality of care delivered at the sharp end of care, hence the need for observation.

This exercise also implemented resilience engineering principles in terms of Safety-I and Safety-II, with safety-I managing safety by ensuring "*As few things as possible go wrong*" presenting a reactive risk management principle. The proactive safety-II approach ensures "*As many possible things go right*" which highlights humans as a necessary resource in the system who provide flexible solutions to potential problems to succeed (Hollnagel et al., 2015).

### **The CAMHS Unit**

The CAMHS unit cares for male and female patients aged 13 to 18 with mental health needs such as depression, anxiety, psychosis, emotional dysregulations, and Autism Spectrum Disorder. The patient capacity for this unit is 10 and the level of observations for patients is variable from multiple level 1:1 to general observations. The staff structure consists of 1 Matron during the day Monday to Thursday, ward manager Tuesday to Friday, charge nurse throughout all shifts, 13 nurses, and 15 Healthcare Support Workers (HCSW). The care focus of this ward is to provide therapeutic care and transition back into the community. Due to the Covid-19 pandemic, there was a transfer from another hospital base to the current CAMHS unit which occurred in April 2020. In terms of shifts patterns, there are three shifts (1) 07:30-15:00, (2) 15:00-20.30, and (3) 20:00- 08:00). The current structure of handover is 3 handovers per-day which is carried out by the Nurse in Charge (NIC) of the shift each time.

### Non-Fixed Ligature on the CAMHS Unit

Figure 1 (p.2) illustrates the number of ligaturing incidents as a Statistical Process Chart (SPC) from August 2019 to September 2020. SPC can help understand the scale of problems (NHS Improvement, 2017). The SPC illustrates a clear increase in NFL on the CAMHS Unit.

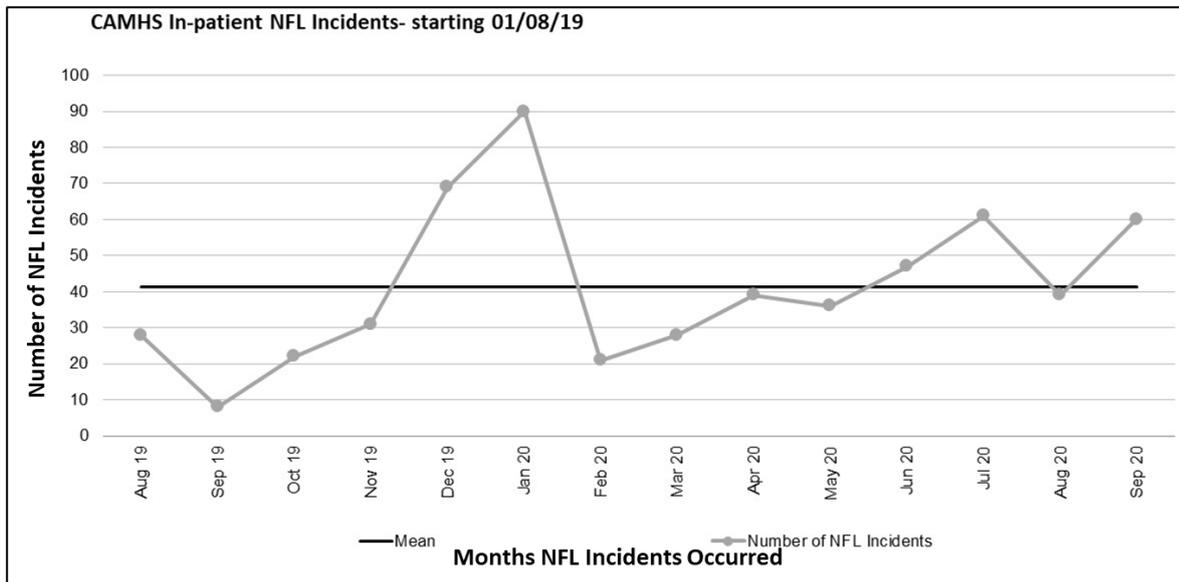


Figure 1: SPC of CAMHS in-patient ligatures: No Ligature points used

### Method

A triangulation of methods was used through analysing incident reports to ascertain when non-fixed ligature behaviours occur. An observation of a shift by a member of the PST with an academic background in Healthcare HF/E to observe WAD which incorporated semi-structured interviews with 9 members of staff (Table 1: those who participated in this exercise were referred to as contributors) on the CAMHS when it was safe were carried out. Field notes were made and were then transcribed and analysed using Thematic analysis (Clarke & Braun, 2017) to establish themes. Themes then contributed as bottom-up evidence for local recommendations for improvement.

Table 1: Contributor Work Experience

Contributor	Role	Type of employment	Mental health experience	CAMHS experience
CAMHS 1	Aspirant nurse	Substantive	5 years	5 years
CAMHS 2	Health Care Assistant	Substantive	Approx. 7 years	3 months
CAMHS 3	Health Care Assistance	Bank	5 months	5 months
CAMHS 4	Occupational Therapy Assistant	Substantive	4 years	4 years
CAMHS 5	Health Care Support Worker	Agency	10 years	10 years
CAMHS 6	Occupational Therapy Assistant	Substantive	6 years	6 years
CAMHS 7	Psychologist	Substantive	1 year	1 year
CAMHS 8	Health Care Support Worker	Bank	6 months	6 months
CAMHS 9	Matron	Substantive	10 years	4 years

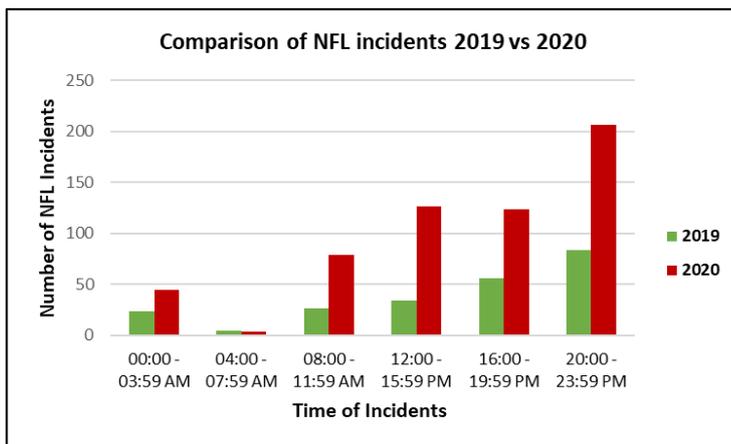
## Results

Multiple sources of information were combined to establish an increase in NFL behaviours within specific timeframes, how Work was Done on the unit, as well as establish themes for bottom-up improvements.

### *Analyses of Incident Reports*

Patient safety incident officers collated and analysed NFL incident reports from the CAMHS unit comparing 1<sup>st</sup> January 2019-30<sup>th</sup> November 2019 with 1<sup>st</sup> January 2020-30<sup>th</sup> November 2020 (Figure 2):

Table 2: Number of non-fixed ligatures



Time	Year	
	2019	2020
00:00 - 03:59 AM	24	45
04:00 - 07:59 AM	5	4
08:00 - 11:59 AM	26	79
12:00 - 15:59 PM	34	126
16:00 - 19:59 PM	56	124
20:00 - 23:59 PM	84	206
<b>Total</b>	<b>229</b>	<b>584</b>

Figure 2: Comparison of timeframes for NFL on the CAMHS unit

Figure 2 shows that incidents had doubled in almost all-time bands, and tripled between 12:00-15:59 in 2020. The period between 04:00 and 07:59 was when the least number of non-fixed ligature incidents occurred on CAMHS unit, with a minute decrease in 2020 (Table 2). The greatest increase in ligature incidents between 2019 and 2020 was between 20:00-23:59, with an increase by 122 non-fixed ligatures in 2020.

### **Observation**

A day shift was observed in September 2020. Handovers, activities, and observations on the ward social areas were carried out. Three handovers were observed at 7:30, 09:00, and 14:00. Masks were worn by staff so it was difficult to understand what was being said. To counteract this, written summaries of the patients and significant events during the night shift was provided to staff covering the day shift. There were four bank members (HCSW). Bank staff and agency staff were given a succinct (10-15) minute induction to the ward and potential risks. This was done in a very coherent way and was considered as an area of innovative practice.

There was an observed division in the duties being carried out; senior staff and substantive staff were occupied with administration duties (based on the shift, such as rota observation allocation). The rotation of HCSWs was managed with the NIC allocating observation rotations amongst HCSWs. Closer observations (Level 1a and Level 1b) were being carried out by HCSWs. Although communication between HCSWs and patients varied, some conversation did occur. There was an observed sense of nervousness elicited from bank/agency staff when on increased observations. The observations were being overseen by an agency nurse.

The first ligaturing incident of the shift occurred during the afternoon handover at approximately 14:00. The emergency buzzer (handheld device which is handed to every staff member in the morning and explained how to use) was pulled. The incident consisted of a patient trying to ligature with some chocolate wrappers. Prior to the incident the NIC escalated that the patient was trying to secrete wrappers and there was a risk of tying the wrappers to form a string to ligate to the ward Matron. The team managed to obtain this wrapper. The patient managed to secrete another wrapper which resulted in the incident at approximately 14:00. Approximately four more incidents followed requiring a minimal of seven members of staff to remove the ligature. Ligature tools used were hair and clothing (jumpers). There was screaming, crying, and the use of Management of Actual or Potential Aggression (MAPA) holds.

### **Semi-Structured Interviews**

Responses from the semi-structured interviews were grouped into four themes:

#### **Advocacy, reward, and relationships**

Staff at the CAMHS unit felt that working with the patients was personally rewarding. There was insight into the positive difference they could make in the lives of these patients as stated by CAMHS 1: *“the patients are at a good age for support as I have met people who say that if only I got the support when I was younger”*. Contributors also spoke about forming trusting relationships, providing compassionate care to these patients, and trying to create a home-like environment for patients within their care.

#### **Mismatch in care needs and care provision**

Staff emphasised that there was a void in the emotional care needs of the patients and their ability and skills to meet these. Out of the 9 contributors, 5 felt that the patients were not suitable for the CAMHS unit based on their acute presentations. Staff emphasised that the patients' needs were not being met because they were ill-equipped and felt unsafe looking after these patients. Contributors had extended insight into the patients' needs. For example, they knew that counselling these patients would help, yet contributors were also understanding of the challenges the patients face in speaking to counsellors.

#### **The trauma of ligature behaviour on staff**

Besides the trauma observed mostly due to the screaming and physicality's of removing a ligature; contributors further discussed the traumatising aftermath of a ligaturing episode on the CAMHS unit. Contributors felt frightened, the tighter the ligature the scarier it was for contributors. One contributor stated that although they became de-sensitised to ligaturing behaviour *“really tight ligatures scare me because it is a higher level of risk”* (CAMHS 4). This was common amongst most contributors due to four factors: (1) Asphyxiation risk, (2) Sharp blade near the airway, (3) Adolescent fighting back, and (4) Being injured.

Most contributors stated that patients were ligaturing because they actually wanted to die. Staff reported an adrenaline rush and entirely focusing on getting the ligature off the patient and then taking these experiences home: *“go into tunnel vision, just get it off the neck, the patient is suffering – we go into tunnel vision, after it affects you. I've left work crying, and then I think I have to do it again. We had a patient on level 2 who ligated she went blue. I didn't sleep very well, I kept seeing the patients face, sometimes we forget that we're humans too, not robots”* (CAMHS 6).

#### **The act of ligating**

This theme represented personal theories of why patients were ligating and formed three sub-themes: (1) Mediated act: Patients would plan out ligating with other patients and do it gradually.

Ligating acts were also suggested to be planned to take place during handover times, (2) Patient behavioural dynamics: The term “*domino effect*” was frequently used to refer to how ligating behaviour spread throughout the unit. It was a concern that patients who did not exhibit ligating behaviour on admission would learn this from other patients, and do it to the point of no return by accident. (3) Glamorisation: There was an underlying competition amongst patients on who would be on a higher level of observation. This was referred to as “*trophy association*” (CAMHS 7) because the patients were impressionable young people who were easily influenced.

## Discussion

This exercise adopted a unique approach by combining resilience engineering principles with qualitative methods to understand the increase in NFL incidents amongst adolescents at a NHS Mental and Community Health Trust. The novelty of this work is that the methods used align with the safety management mode of guided adaptability’ Provan et al., 2020).

By observing everyday work both in weekly incident review meetings (Work as Imagined) and a physical observation of a shift (Work as Done), the facilitation and identification of safe adaptations was achieved. Local practices and adaptations on the CAMHS unit were supported and guided through feedback to contributors as well as trust wide. The practical adaptations made by the CAMHS unit contributors included notable Safety-II *workarounds* such as an effective handover by providing a hardcopy of the handover policy to every member of staff as well as a handover sheet implementing the Situation, Background, Assessment, and Recommendations (SBAR) tool (NHS/I, 2017a). Another example was providing a succinct and detailed induction to bank and agency staff who were unfamiliar with the unit, on a macro-system level such *workarounds* relate to the system’s ability to succeed under varying conditions (Hollnagel et al., 2015), which was regarded as praise by contributors.

Contributors involved in this exercise were assured that the semi-structured interviews and the observation were underpinned by a HF/E approach, explaining that the observer was looking at their daily work to understand the challenges they faced to make improvements with them. This resulted in an appreciation from contributors as well as reassurance that they were not under any scrutiny, contributors were then open to discuss obstacles and their experiences of NFL.

The themes from the semi-structured interviews allowed a greater understanding of problems faced by contributors as well as collective co-designed solutions. Contributors stated that they did not feel emotionally, physically, or clinically equipped to respond to NFL (*a mismatch in care needs and provision*). An organisational response to this was to create training which corresponds to the emotional needs of contributors as well as be realistic to reflect the physicality’s of responding to an NFL incident. In order to better respond to NFL, the trust formed a self-harm clinical response pathway which is a part of the self-harm policy and disseminated amongst frontline staff.

The four themes provided bottom-up evidence to provide a safer working environment for staff. The findings were in line with previous literature, particularly in terms of the behavioural dynamics of ligating behaviour, personal theories were created by contributors to explain *the act of ligating*; this theme reflected findings reported by Rouski et al. (2017) through the theme of *the nature of self-harm*. It was reported that patients were engaged in a risky game with staff, with the limiting ability of staff to manage the ward environment leaving them to feel vulnerable and exposed. The findings from the exercise were disseminated throughout the trust (facilitation of information flow, Provan et al., 2020) consequently resulting in a recommended behavioural intervention to reduce NFL (coordinate action, Provan et al., 2020).

This scoping exercise set out to answer 3 questions regarding the increase in NFL on the CAMHS unit. Reasons behind NFL on the CAMHS unit were that staff were not equipped to respond to

acutely ill patients, they had awareness of this and would like to improve. There are psychological underpinnings of ligature behaviour which render staff to feel vulnerable and highly skilled staff are not carrying out observations. The greatest number of incidents occurred between 20:00-23:59 in both years this combined with feedback from the observation resulted in structural changes to staffing by having a senior substantive nurse in the patient area at all times. The trust is currently formulating: Intervention 1: Realistic training reflective of weight and movement, which considers emotional needs of staff. Intervention 2: An intervention to distract CAMHS patients from NFL.

The findings of this scoping exercise reflect previous research, confirming that the themes identified are a realistic reflection of the challenges faced by mental health staff caring for adolescents in mental health facilities. The outcomes of this exercise are novel as their foundations are set in HF/E, resilience engineering, and co-design.

### **Limitations**

Although this scoping exercise provides an innovative and collaborative approach to improve the safety of patients and staff, it is important to acknowledge its limitations. Limitations include the observation of a unrepresentative shift. Only one day shift was observed, whereas the greatest number of NFL occurs between 20:00-23:59. Additionally, in order to have greater insight into the complexities of care provision for this patient group, doctors could have been included. Patients were not included due to their unfamiliarity with the observer/interviewer and any emotional triggering of NFL to patients was intentionally avoided.

### **Future Work**

Collaboration among healthcare professionals is essential to create a synergy in the provision of safe, and high-quality care (Wei et al., 2020). The Trust Quality Improvement team were asked to offer their expertise in Plan, Do, Study, Act (PDSA) whilst implementing the two proposed interventions.

### **Conclusion**

A novel approach has resulted through the combination of semi-structured interviews and an observation underpinned by a HF/E lens intertwined in resilience engineering principles in a sensitive and emotionally charged work environment. By adopting a HF/E stance, staff felt supported to share their experiences to provide insights, implications, practical applications, and opportunities for improvement to reduce and better respond to ligaturing behaviour in a sensitive and traumatic work environment - CAMHS units.

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