Evaluation of the Redthread Youth Violence Intervention Programme at the East Midlands Major Trauma Centre: An Analysis of Impact on Re-injury and Re-attendance Rates

Full Report October 2021

Evaluation Report - October 2021	
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CI	Confidence interval
ED	Emergency Department
GCP	Good Clinical Practice
GDPR	General Data Protection Regulations 2018
HR	Hazard Ratio
HRA	Health Research Authority
HDU	High Dependency Unit
ICU	Intensive Care Unit
IG	Information Governance
IQR	Interquartile Range
ISS	Injury Severity Score
MTC	Major Trauma Centre
OR	Odds ratio
PI	Principle Investigator (relating to NHS Research authorisation)
SD	Standard Deviation
TARN	Trauma Audit & Research Network
YVIP	Youth Violence Intervention Programme

TABLES

FIGURES

1. INTRODUCTION

Youth violence and injury presents a major burden on the UK healthcare system with an impact seen across the entire spectrum of health and social care. For victims of assault and violent injury the impact can be life changing and for perpetrators there may be far-reaching consequences following judicial sentencing. Efforts to break this cycle and prevent a young person from spiralling into a life of repeated violence and recidivism requires a multidisciplinary approach. Preventative measures delivered at an individual level offer the greatest opportunity to reduce youth violence (Matjasko, Vivolo-Kantor et al. 2012). This report analyses the impact of the Redthread Youth Violence Intervention Programme delivered at the Queen's Medical Centre in Nottingham. It highlights the outcomes of young persons who engage with the programme and serves to evaluate its effect on repeated injury and re-attendance to hospital.

1.1. Trends in Youth Violence

According to the Home Office Serious Violence Strategy (HM Government 2018) crime and violence within the UK has seen a statistical shift towards younger victims and perpetrators despite an overall fall across all age groups. In particular, knife crime has seen a rise of 51% for individuals under the age of 18 compared to 2012/13 (**Error! Reference source not found.**). In contrast, for those aged over 18 knife crime rose by around 10%. These findings are reinforced by data demonstrating that weapons carrying and self-reported violence peaks at the age of 15. In particular, young males are disproportionately involved in both youth violence and the criminal justice system (Ministry of Justice, 2018) and there has been significant media attention focussed on this (Wortley and Hagell 2020). However, many young women find themselves affected both directly and indirectly through acts of sexual assault or as friends or partners of young males involved in the cycle of violence and recidivism (Brooks et al. 2019). Exploitation due to gang involvement has also seen an

exponential rise in both inner cities and now in more rural communities, often through organised crime links and the so called ‘county lines’ drugs trade (Glover Williams and Finlay 2019).

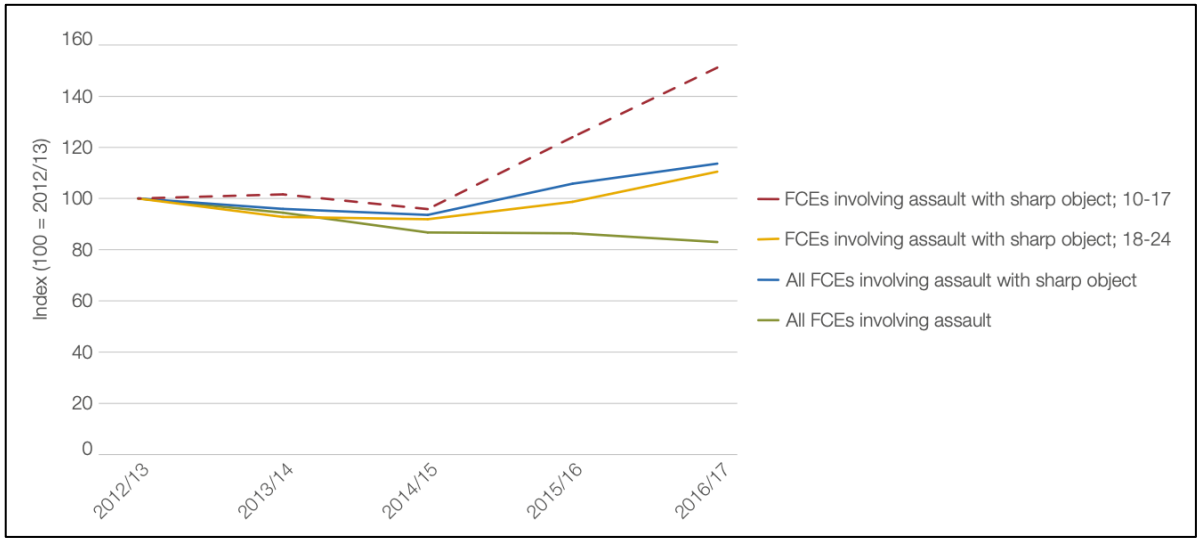

Figure 1 - NHS episodes for all assaults and assaults with a sharp object by age. Adapted from the Home Office Serious Violence Strategy (2018). FCE - finished consultant episodes.

1.2. Aetiology of Youth Violence

Many authors choose to describe violence akin to a disease process being transmitted from peer to peer (Bellis 2012) There is increasing awareness and recognition that adverse childhood experiences contribute to the risk of violence in later life. Indeed, links between increasing adverse childhood experiences (ACEs) and episodes of violence, mental illness and substance misuse have been demonstrated in meta-analysis (Hughes, Bellis et al. 2017). The management of risk factors for serious violence among young persons requires a coordinated and holistic approach encompassing the individual, their support group, their environment and education (Figure 2.) Early exposure to violence and other associated risk factors may be linked to serious violence in later life (Loeber and Farrington 2000). In particular, one UK study found that 20% of males convicted of homicide in later life had been linked to offences when they were under the age of 13 (Dobash, Emerson Dobash et

al. 2007). Such individuals had also experienced significant levels of physical and sexual abuse during childhood.

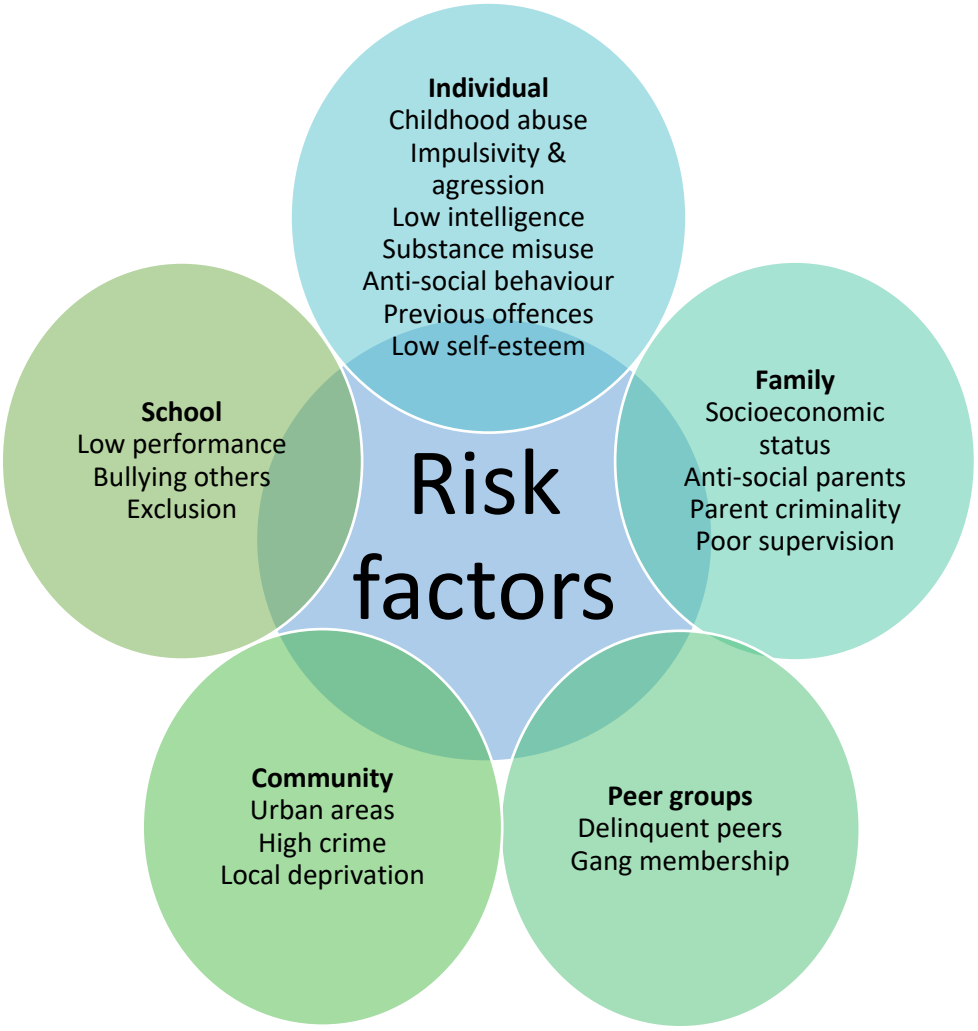

Figure 2 – Risk Factors for violence among young persons – Adapted from the Home Office, Serious Violence Strategy, 2018

1.3. The Redthread Youth Violence Intervention Programme

Redthread's Youth Violence Intervention Programme (YVIP) has been implemented in several Major Trauma Centres across the United Kingdom. Sites were first located at King's College Hospital (2006), St Mary's Hospital (2014) and St George's Hospital (2015) in London, but the programme expanded to the Midlands in 2018. In March 2018 the service opened at the East Midlands Major Trauma Centre at the Queen's Medical Centre in Nottingham. This was shortly followed by expansion to University Hospitals Birmingham at the Queen Elizabeth Hospital and Heartlands Hospital in July 2018 and further sites since then. The Redthread YVIP aims to reduce youth violence by meeting with young people in hospital, following a violent experience such as an assault, exploitation or mental health crisis. The eligible patient age range includes individuals from 11-24 years. A data sharing agreement exists between Nottingham University Hospitals and Redthread workers. Referrals can come directly from clinicians and auxiliary staff themselves or via the proactive search for eligible patients by the Redthread team. In some cases, Redthread workers may attend the most critically injured patients at trauma calls where they offer additional support to individuals during what can be an intensely emotional situation. Many members of the Redthread team carry prior experience in youth and social work or mental health services. The team is embedded within emergency departments and aim to meet with these young people as early as possible in their time of vulnerability following a violent experience. This is known as the 'Teachable Moment', an opportunity for behaviour change (Flocke, Clark et al. 2014). In this 'Teachable Moment', it is believed that young people are more receptive to working with youth workers to make positive choices and changes in their lives to avoid violence and re-injury (Lawson and Flocke 2009). As part of the Redthread YVIP, youth workers further engage with young people on a ward post-injury and offer tailored support with the goal of moving the young person away from current and future violence and exploitation. Research has suggested that young people who have been

involved in violence might have trust issues with those perceived to be in positions of power, such as doctors, (Snider, Jiang et al. 2015) and therefore Redthread youth workers are in a valuable and well-placed position to work with young people towards positive change.

Following verbal consent to the YVIP, an assessment and safety plan is formulated encompassing a holistic approach to a young person's physical and mental health in addition to their social needs. This may involve simple and immediate measures ('crisis support') such as the provision of clean clothes after a traumatic injury, compassionate presence at bedside, explaining medical treatment, supporting with emergency accommodation, safe travel, advocacy and signposting with specialist hospital and community agencies. Or they could extend to engagement in a full, longer programme, usually up to 12 weeks, although it can be longer. These measures are provided in the hospital and / or following discharge. They undertake a comprehensive risk and needs assessment of the young person with a co-produced action plan. They include involvement with safeguarding teams, support with navigating systems (e.g. criminal justice or welfare), advocacy work with statutory partners and community agencies, and relational referrals for ongoing specialist support. This may involve assisting individuals during future meetings with police, social workers, housing officers, health providers, youth offending or other services. It can include casework around healthy relationships and managing difficult emotions, support to (re-)engage with education, training and employment, securing longer term accommodation or accessing mental health or substance misuse support. Ultimately providing tailored support for whatever the young person needs help with to make them safer and to empower them to make positive life changes.

1.4. Outcomes from Violence Intervention Programmes

Without intervention repeat attendance rates following violent injury are estimated to occur in 22-44% of individuals (Snider, Kirst et al. 2010). Young persons seeking medical attention for a violence related injury are twice as likely to return to the Emergency Department within two years of their index injury compared to those attending for non-violent injury (Cunningham, Carter et al. 2015). US studies have shown that hospital based violence intervention programmes can decrease violent injury recidivism (Chong, Smith et al. 2015) (Cooper, Eslinger et al. 2006), although level 1 evidence is lacking for the UK. Limited data from US-based hospital violence intervention programmes has also demonstrated a long-term reduction in both overall recidivism rates and repeat injury severity among service users (Bell, Gilyan et al. 2018). However, again there is a dearth of research looking at UK-based hospital youth violence intervention programmes and an evaluation of impact is key for these services to support their growth and development. It is therefore important to identify whether Redthread's programme of work based within UK emergency departments can offer similar outcomes to US based studies. We want to evaluate the impact of this service and demonstrate whether the work of the YVIP reduces rates of re-injury and re-attendance in young people, reducing disability and saving lives, and therefore producing a long-term cost-saving to the NHS. Outcomes from this project may add to the evidence-base for this YVIP to be embedded within additional emergency departments in the United Kingdom.

1.5. The Cost of Youth Violence

It is known that violent incidents and the effects of violence result in substantial costs for healthcare systems (Bellis 2012). Therefore, a programme that reduces youth violence may be an extremely valuable tool for both individuals' health and wellbeing, and for healthcare services and society. Youth violence carries a significant cost to both victims and

perpetrators either related to healthcare services, lost output due to injury, policing costs or victim services (Heeks 2018). The most comprehensive evidence evaluating the cost benefit of violence intervention programmes comes from the USA (Strong, Shipper et al. 2016). Here, authors found that through a reduction in violent injury recidivism cost savings were made in healthcare and the criminal justice system. In addition, reductions in youth violence may ease demand on drug and substance misuse intervention services, again leading to a reduced public expenditure (Sharp, Prosser et al. 2014). Encouragingly, a recent cost benefit analysis of the Redthread YVIP has concluded an annual cost avoidance of £1,225,874 based on 2018-19 costs. This translates to an economic and social cost benefit of £4.90 per £1 spent on the YVIP (Riley 2020). Redthread, as a charity, seeks funding to be able to provide and run their YVIP in emergency departments. Despite the positive findings of this cost-benefit analysis future funding for the service still requires negotiation and justification of expenditure. For this reason, an analysis of impact on re-injury and hospital re-attendance rates for young persons engaged with the Redthread YVIP is important to justify costs.

2. METHODOLOGY AND RATIONALE

The aim of this research is to review retrospective electronic hospital data to evaluate the impact of the Redthread YVIP on repeat instances of violent injury or exploitation. We hypothesise that young people who choose to engage with Redthread youth workers and the full programme of support are less likely to be involved in violence in the future. These individuals therefore have lower rates of re-injury and re-attendance to emergency departments than those young people who decline to engage with the full YVIP. The YVIP is considered to be a part of standard care at the East Midlands Major Trauma Centre, and patients are free to choose to engage with the service or not. They were not contacted to provide additional information to the study team and no prospective data was captured.

2.1. Ethical and Regulatory Approval

The study was approved by the London –Bromley NHS Research Ethics Committee (reference 20/LO/0691) and the Health Research Authority. Study sponsorship was provided by Nottingham University Hospitals NHS Trust. In addition, consent was sought to access the Trauma Audit and Research Network (TARN) database to allow cross referencing of retrospective data held on the most severely injured patients. All study activities were undertaken according to the ICH Guidelines for Good Clinical Practice (CPMP/ICH/135/95), July 1996.

2.2. Data Collection

We conducted a retrospective case note review of all young persons referred to the Redthread YVIP from when the service was introduced at the Queen's Medical Centre in March 2018 to March 2020. Eligibility for the YVIP included age 11-24 years and an emergency department attendance due to violent injury, sexual assault, exploitation,

substance misuse or self-harm. The records of all individuals referred to the service were also examined for attendances two years prior to their approach by a Redthread team member. Notes were then reviewed until March 2020 covering a period of two years after the service was introduced. Data collection involved the use of hospital electronic records and anonymised data held by the Redthread team in line with their data sharing agreement with the Trust. A member of the research team who also held clinical responsibilities undertook the case note review. All data were anonymised at the earliest opportunity prior to analysis. The study sample size was dictated by the number of individuals referred to Redthread. Only re-attendances to the Emergency Department at Queen's Medical Centre, Nottingham were available for analysis. Data from the University Hospitals Birmingham sites were not able to be part of the evaluation as research approval by the Trust was delayed due to the Covid-19 pandemic and the requirement for all research to be Covid-19 related only. This meant data was not available during the data analysis process.

2.2.1. Trauma Audit and Research Network Data

A request was submitted to the Trauma Audit and Research Network (TARN) to access their data for all 11–24-year-olds with injuries due to assault or intentional harm who attended the East Midlands Major Trauma Centre from March 2018 – March 2020.

To be eligible for TARN patients can be any age but must have a traumatic injury specified in the TARN Procedures Manual (TARN 2020). In addition, they need to meet any of the following criteria:

- Trauma admissions whose length of stay is 3 overnight stays or more.
- Trauma patients admitted to a High Dependency Area regardless of length of stay.
- Deaths of trauma patients occurring in the hospital including the Emergency Department.

- Trauma patients transferred to other hospital for specialist care or for an ICU/HDU bed.

2.2.2. Injury Severity Scoring

An Injury Severity Score (ISS) was calculated for each patient attendance during the study period. The ISS is based on a catalogue of 1500 injuries based on anatomical site and is calculated on discharge or death. A higher ISS is associated with an increased risk of mortality. Injury is categorised according to the following body regions

- Head, neck, or cervical spine
- Face
- Chest or thoracic spine
- Abdomen, pelvic contents or lumbar spine
- Extremities or bony pelvis
- External injuries or burns

Further information on ISS scoring is available via the TARN Procedures Manual (TARN 2020). ISS scores were compared before and after young persons engaged with the YVIP to identify and variation in injury patterns.

2.2.3. Emergency Department Attendance Records

A request was submitted to the Emergency Department audit group at the Queen's Medical Centre to obtain anonymised data reporting attendances due to assault from March 2018 – March 2020. This data provided information on patient demographics along with information related to their assault such as location, time and date of injury, type of assault and discharge status. This database was compared to referral data obtained via Redthread workers at the trust to form the basis of an analysis of the referral pathway. Patterns in

attendance and factors leading to a referral to the YVIP were identified to help streamline resources and provide recommendations for future practice.

2.3. Outcome Measures

2.3.1 Primary

The primary outcome measure for the study was to assess re-attendance rates to the Emergency Department for young persons eligible for the YVIP who choose to engage with the full programme following their index hospital attendance. The index attendance was defined as the attendance leading to a referral to the Redthread YVIP due to violent injury, exploitation, or a safeguarding concern. Re-attendance was defined as any return to the Emergency Department following a new or recurrent episode of further violent injury or exploitation. Repeat episodes of substance misuse, injury due to safeguarding concerns and mental health crises such as self-harm or overdose were also recorded in the analysis. Time to re-attendance and number of re-attendance episodes were compared between individuals who engaged with the full YVIP with those who did not

2.3.2 Secondary

Secondary outcome measures included a subgroup analysis of re-attendance rates of those young persons experiencing physical violence or assault only. For those individuals experiencing recurrent attendances in the two years prior to their attendance a change in frequency of admissions and time to readmission after approach by the Redthread team was also undertaken. All analyses involved a comparison between individuals who engage with the full YVIP to those who do not. Where individuals had re-attended data were collected on subsequent injury severity score, length of stay and medical interventions received. Finally, to mitigate the potential limitation of a young person re-attending at

another hospital we compared a subgroup of individuals living at addresses only within the Nottingham City and Nottinghamshire County area. As the Queen's Medical Centre is a tertiary centre for trauma it is expected that individuals living outside of this catchment may have presented to a more local hospital in the event of a more minor injury, hence falsely reducing the overall re-attendance rate.

In addition, an evaluation of the effectiveness of the current referral service was also undertaken. Here, hospital electronic records were reviewed to identify all young persons aged 11-24 years attending the Emergency Department since the service was introduced. Those identified as eligible for the YVIP were cross referenced with actual referral figures. Data on timing and method of referral were also examined to identify patterns of attendance among young persons. An analysis of the characteristics held by patients who do and do not engage with the full Redthread YVIP was also made to identify patterns in engagement and to inform potential changes to the current referral strategy. Patient demographics, social characteristics, reasons for attendance and previous episodes of attendance were factored into this analysis. Lastly, patterns of injury including geographical location and clustering of events were recorded to assist in the targeted intervention or potential prevention of further incidents. For the purpose of confidentiality only postcode prefixes were recorded. For this analysis data were mapped using Maptive® software (San Francisco, CA).

2.4. Statistics

Categorical data is presented with number and percentages. Continuous data is presented with mean and standard deviation (SD) for normally distributed data, and median and inter-quartile ranges (IQR) for skewed data. Data distribution was examined visually for skewedness. Both univariable and multivariable logistic regression were used to compare the odds of engagement with the full YVIP based on patient characteristics and factors

related to the mode and timing of referral. An analysis of patients who did and did not engage with the full YVIP was performed using the Pearson chi-square test for categorical variables and using the Mann-Whitney U test for continuous variables. Re-injury or re-attendance was defined according to the outcome measures stated. Rates of attendance are presented as an event rate alongside their hazard ratios and 95% confidence intervals.

It is recognised that individuals who fail to engage with Redthread may differ in their characteristics to those who do engage with the service. We used prior event rate ratio adjustment analysis to compare these groups and reduce confounding bias. The prior event rate ratio (PERR) adjustment method offers a means of reducing the bias that results from residual confounding. The PERR relies on the fact that individuals in both the engaged and non-engaged groups were not exposed to the YVIP before the index date of the service – that is the date Redthread was introduced at Nottingham University Hospitals. Consequently, assumptions are made that the differences in outcomes between engagers and non-engagers before being approached by Redthread reflect the combined effect of confounders independent of any effect of the YVIP. The PERR is estimated by the ratio of two unadjusted hazard ratios: the unadjusted hazard ratio for re-attendance during the time since the YVIP was introduced to the engaged group vs the non-engaged group (HR.post) and the unadjusted hazard ratio for re-attendance before the YVIP was introduced for the engaged group vs non-engaged group (HR.prior). The PERR is then calculated from the ratio of HR.post/HR.prior. As such, the prior event rate ratio provides an estimate of the effect the Redthread YVIP has had on the hazard ratio of further hospital attendances whilst adjusting for both known and unknown confounders (Figure 3).

Event rates were calculated by dividing the total sum of all attendances by the number of days within which they occurred. We have chosen to present event rates of re-attendance per 100 patient years. For example, an event rate of 10 re-attendances per 100 patient years would mean that if we observed a group of 100 patients for 1 year, we would expect

10 of them to re-attend within that year. All statistical analyses were undertaken with SPSS Version 25 (Armonk, NY: IBM Corp).

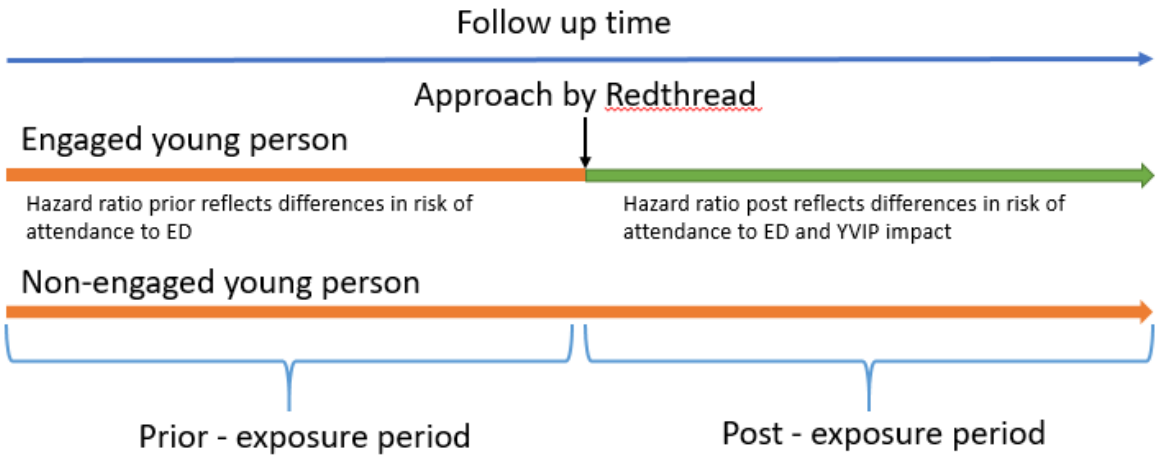

Figure 3 - Prior event rate ratio adjustment method. Prior period means time before index date (approach by Redthread) for engaged cohort and matched date for non-engaged patients; post period means time after approach by Redthread.

3. THEORY OF CHANGE

The Redthread YVIP aims to offer intervention for young persons following a traumatic or adverse event at the earliest opportunity. Even a brief intervention at this stage can offer an opportunity for change. The term ‘teachable moment’, defined as a “naturally occurring life transition or health event thought to motivate individuals to spontaneously adopt risk-reducing health behaviours” (McBride and Ostroff 2003) is not unique to violence reduction. It has been used widely as a mechanism to promote change across a range of health and social care fields (Demark-Wahnefried, Aziz et al. 2005). In addition, the Redthread YVIP builds its foundations on the Health Belief Model (Rosenstock 1974) which explains that engagement in health promoting behaviour or lifestyle change is often subject to a person’s in-built beliefs surrounding benefits or barriers to change. Further, the model also describes the need for a trigger or catalyst to promote this change (Janz and Becker 1984). Much of the efforts by Redthread youth workers are focussed around supporting young persons by building trust and rapport in order to positively emerge from an adverse incident and form an action plan for their future. Ongoing engagement then serves to reinforce this change and prevent a relapse into old behaviours (Figure 4). This concept draws on aspects of the Transtheoretical Model (Prochaska and DiClemente 1983) which explains the process of intentional behaviour change. The model describes the stages prior to a behaviour change, notably pre-contemplation (not ready), contemplation (getting ready) and preparation (ready). Redthread workers must adapt to young persons presenting at each stage of this theoretical model and work to support them through this process of change.

Finally, maintenance of these new behaviours is key, and the ongoing support provided by Redthread over the YVIP seeks to reinforce positive change. The potential benefits of this are not only seen within the young person and their immediate peers but a significant societal impact may also be seen. The application of this theory of change requires evaluation to understand its effectiveness and impact. This should occur not only at a local

level but on a national scale. Such assessments bring many challenges both ethically and logistically. However, this work should be structured according to standardised endpoints allowing meaningful comparisons to be drawn and for future data synthesis to occur.

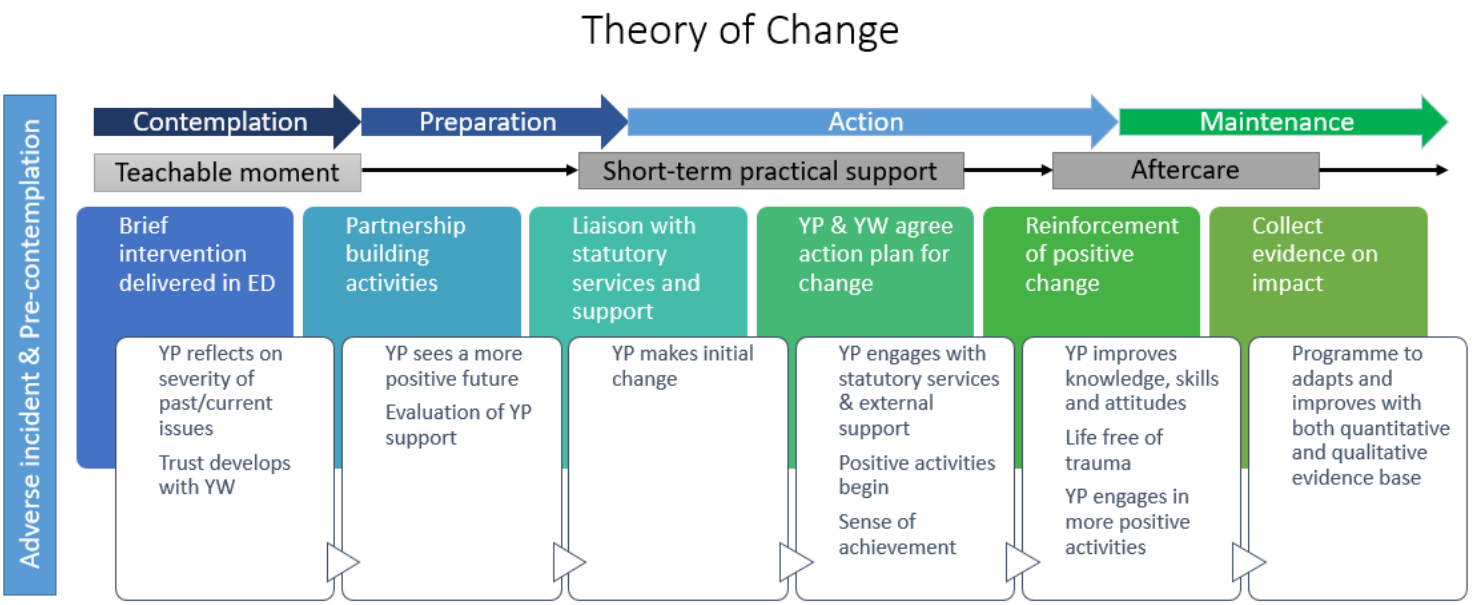

Figure 4 - Redthread Theory of Change. Adapted from “Young victims of youth violence: using youth workers in the emergency department to facilitate ‘teachable moments’ and to improve access to services” (Wortley and Hagell 2020). YW, youth worker; YP, young person.

4. RESULTS

4.1. Profile of the Study Cohort

From March 2018 to March 2020 a total of 647 referrals to the YVIP had been made. From these, 609 had been eligible for the YVIP comprising of 573 individuals presenting to the Emergency Department in Nottingham. Redthread made successful initial contact with 287 young persons with 57% (n=164) of these engaging in a full programme of support and 43% (n=123) receiving crisis support. Unsuccessful contact occurred in 286 cases (Figure 6). The commonest reasons for this included incorrect details (n=69), no response from the young person (n=60), contact made with next of kin only (n=18) or lack of safe contact details (n=16). There were also 32 young persons who did not want to engage with the YVIP and a further 43 who were deemed to have adequate existing support in place.

During the two years of the YVIP in Nottingham additional requirements were implemented relating to how young persons could be approached by Redthread. Specifically, from December 2018 onwards, the Redthread team were not allowed to contact young persons >18 years old without prior consent.

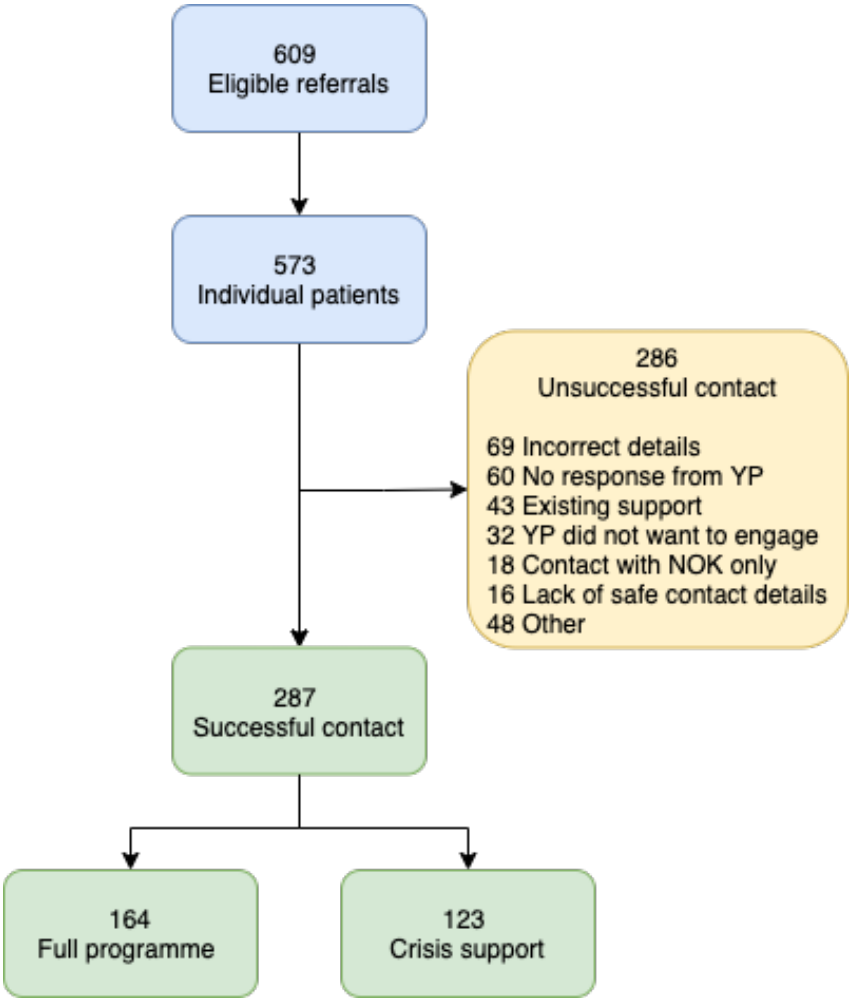

Figure 5 - Flow diagram for referrals to the YVIP

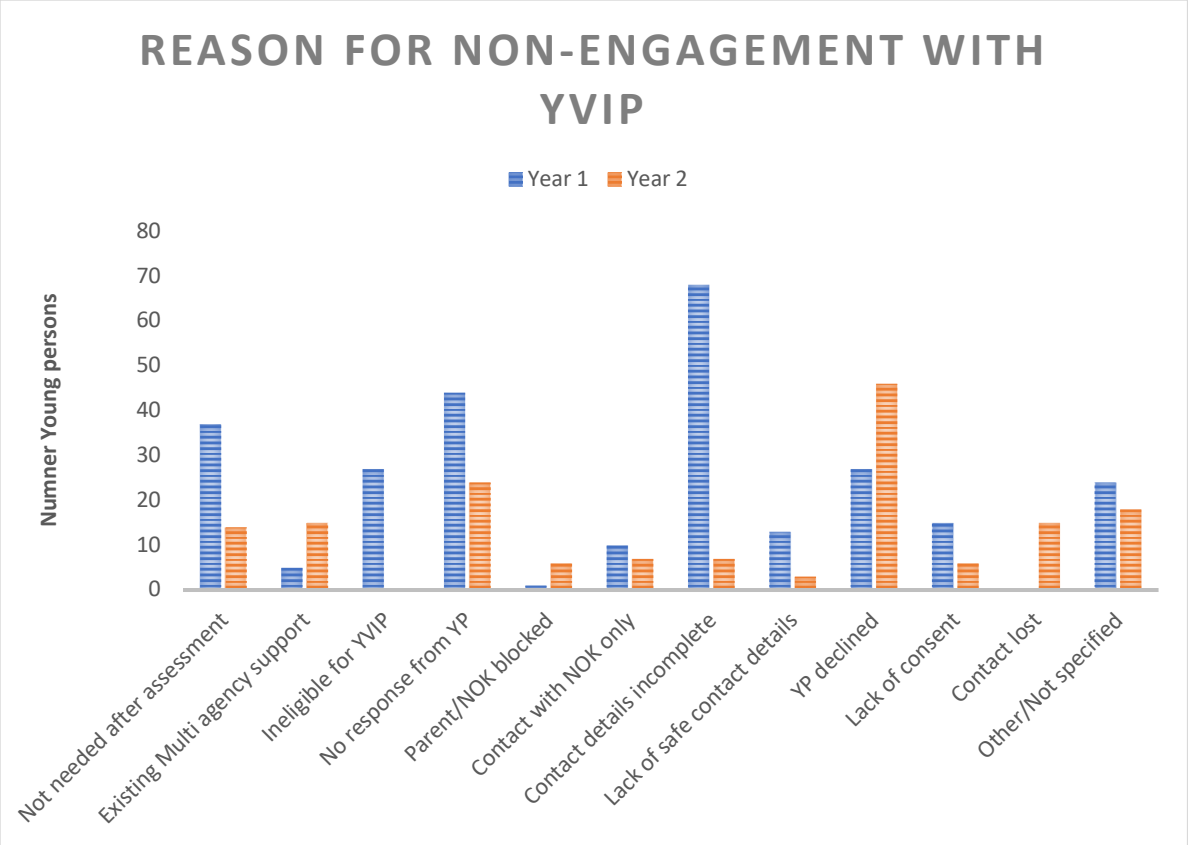

Figure 6 - Reason for non-engagement with the YVIP as recorded by Redthread worker. Year 1 March 2018-March 2019; n=222, Year 2 March 2019-March 2020; n=188. Reasons classed as 'other': Young person (YP) taken into police custody, YP transferred to other Redthread service.

4.1.1. Demographics

Among all referrals 77% (n=439) were male and 23% (n=134) were female. Year 1 of the service saw a male to female referral ratio of 2.8: 1 and year 2 saw an increased male to female ratio of 4.6: 1. A total of 303 referrals had ethnicity data documented on hospital records. Among those 66% (n=200) were White British with 61 of these young persons being referred in year 1 and 139 in year 2. A breakdown of the other 103 young persons with documented ethnicity is shown in Figure 7. Among non-white British ethnicities the majority of these referrals were made for males (Figure 8). There were 565 young persons with an age recorded within the eligible bracket of 11-24 years. The majority of referrals

were clustered around the 15-21 age bracket. The second year of the YVIP (March 2019 onwards) saw an almost universal drop in referrals apart from the 13- & 14-year-old group. The biggest decrease occurred in 19-year-olds with a 52% reduction in referrals. These figures may reflect the refinement of the referral criteria and pathway as the service developed at Nottingham University Hospitals and an increasing focus being placed on the quality of appropriate support rather than quantity. Indeed, from April 2019 to March 2020 the proportion of eligible referrals increased. In addition, some individuals may have also had a pre-dated referral to the YVIP. The impact of patient demographics on engagement with the YVIP is further analysed in section 4.8

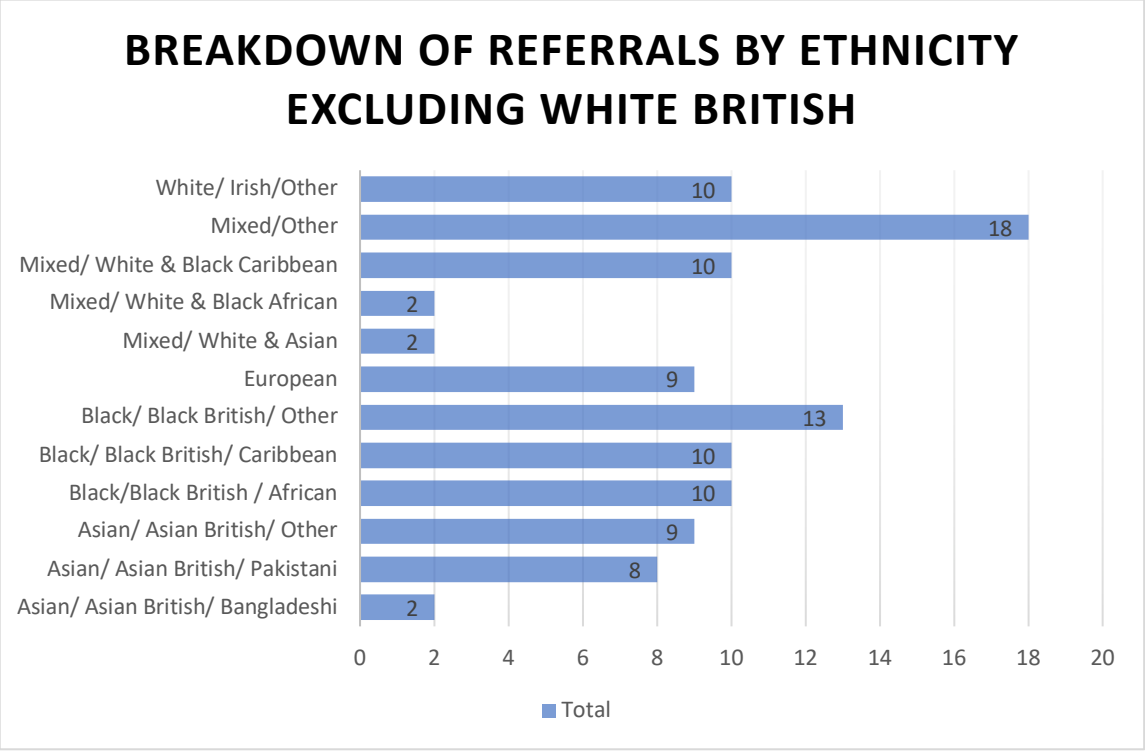

Figure 7 - Breakdown of ethnicity of non-white British individuals referred to the Redthread YVIP (n=103).

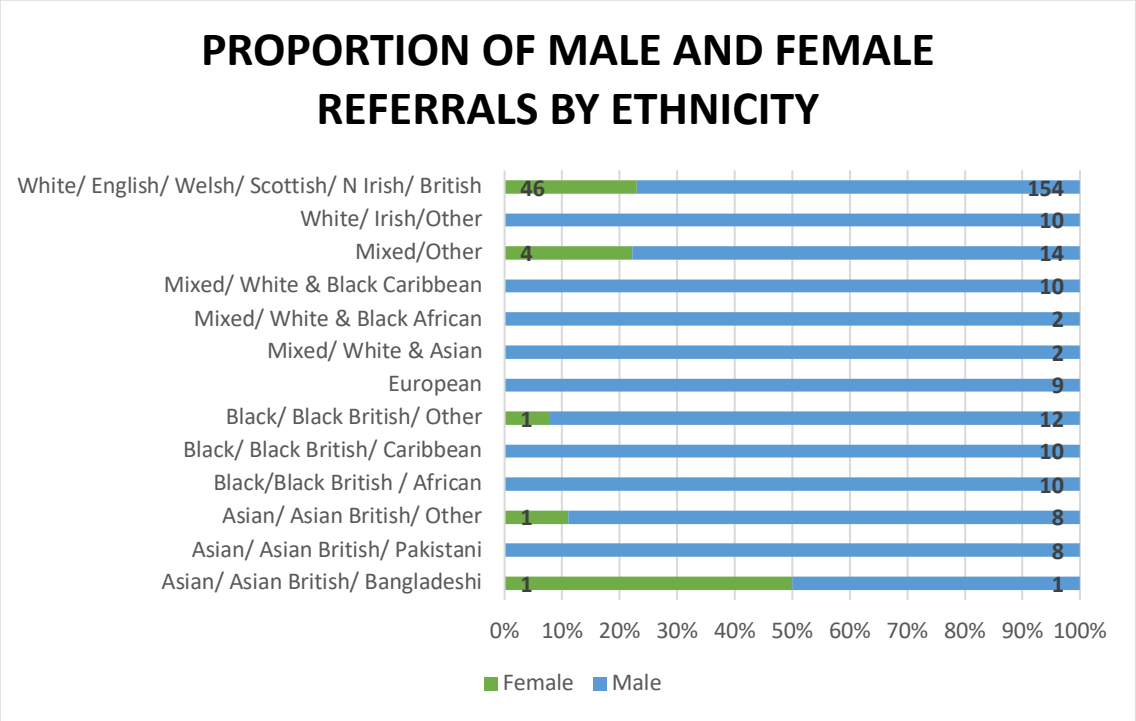

Figure 8 - Distribution of male and female young persons referred according to ethnicity. Numbers to the left of chart denotes total number of females and numbers to the right denotes total number of males.

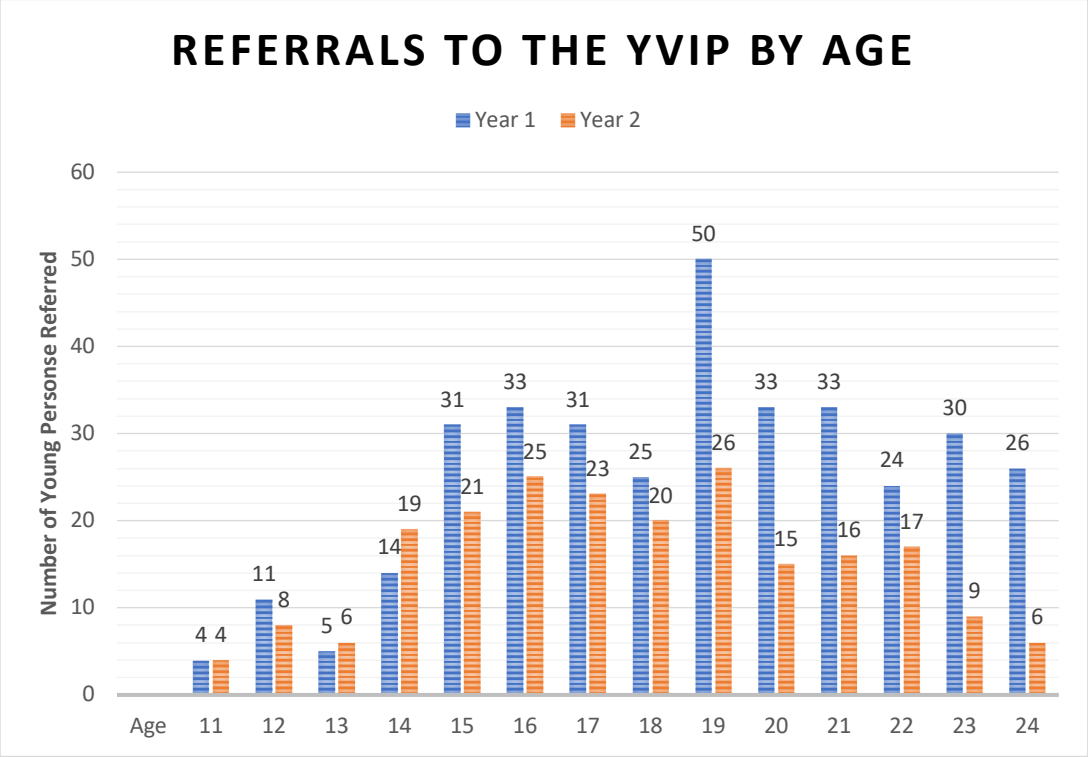

Figure 9 – Age of young person at time of referral to the Redthread YVIP. Year 1 – March 2018-19, Year 2 – March 2019-20.

4.1.2. Patterns of Attendance

Index attendances by young persons referred to the YVIP were clustered around the weekend (Friday-Sunday) with 55.1% (n=330) occurring over these 3 days. Saturday was the commonest day for presentation with 26.7% (n=160) index attendances (

Figure 10). Assault related injury was evenly shared between weekday and weekend with 87.2% (n=287) and 88.4% (n=290) attendances, respectively. There was a marginally higher proportion of assaults with a weapon (blunt, bladed or gunshot) at the weekend contributing to 39% (n=128) of assaults on these days. Weekdays saw 35% (n=115) of their violent assaults due to a weapon. The timing of index attendances to the Emergency Department saw the lowest attendance rate at 0700 hours followed by a steady upward trend towards a peak at 1700 hours. This attendance rate was broadly maintained during evening and night-time hours before a further decrease by 0500 hours (

Figure 11 - Hour of attendance to the Emergency Department by young persons referred to the YVIP

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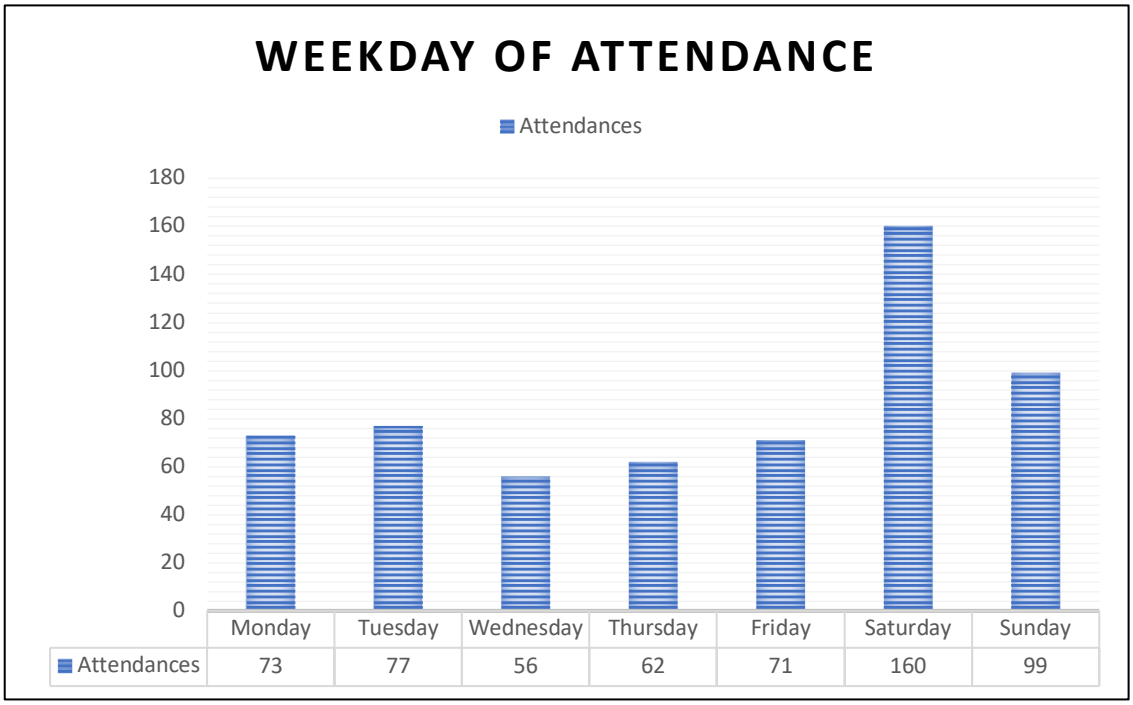


Figure 10 - Day of the week attendances for all referrals to the YVIP.

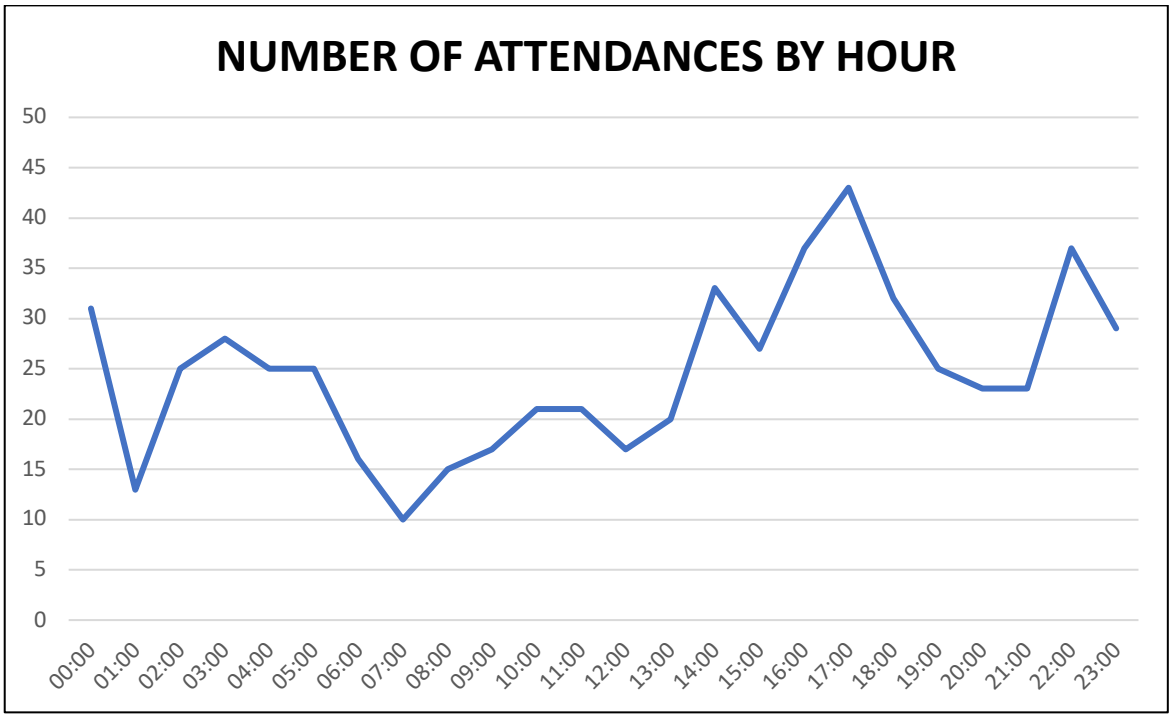


Figure 11 - Hour of attendance to the Emergency Department by young persons referred to the YVIP

4.2. Impact of the YVIP on Re-attendance and Re-injury

Within the 2 years prior to their index admission and referral to Redthread 20.2% (n=116) of all patients had previously attended the Emergency Department according to the study criteria. Among those who engaged with the full YVIP 29.9% (n=49/164) had attended in the two years prior to their approach by Redthread for an injury secondary to violence, mental health, or exploitation. This attendance had occurred at a median of 256 days (IQR 62-479, range 7 - 703) before their referral to the YVIP. For the non-engagers 16.4% (n=51/409) had record of a prior attendance. For those who had attended previously the median time from last attendance to their index attendance was 282 days (IQR 144-477, range 2-723). The frequency of prior admissions for both groups is shown in Figure 12. For those with a history of prior attendances the median number of visits was 1 for both groups (engagers range 1-22 visits; non engagers 1-5).

Following a referral to Redthread at their index admission 18.1% (n=104) of all individuals re-attended the Emergency Department until the close of the dataset on 3/3/20. Re-attendance rates had dropped to 18.2% (n=30) for full YVIP engagers and increased to 18.1% (n=74) for non-engagers. This translated to an absolute reduction in the percentage of individuals attending the Emergency Department of 11.8% for the engaged group and an increase of 1.8% for non-engagers. Median duration from index attendance and approach by Redthread to subsequent re-attendance was 137 (IQR 77-288, range 7-647) for engagers and 216 days (IQR 66-370, range 5-605) for non-engagers. The frequency of attendances after approach by Redthread for both groups is shown in Figure 13. For those with a history of attendances after approach the median number of visits was 1 for both groups (engagers range 1-10 visits; non engagers 1-7).

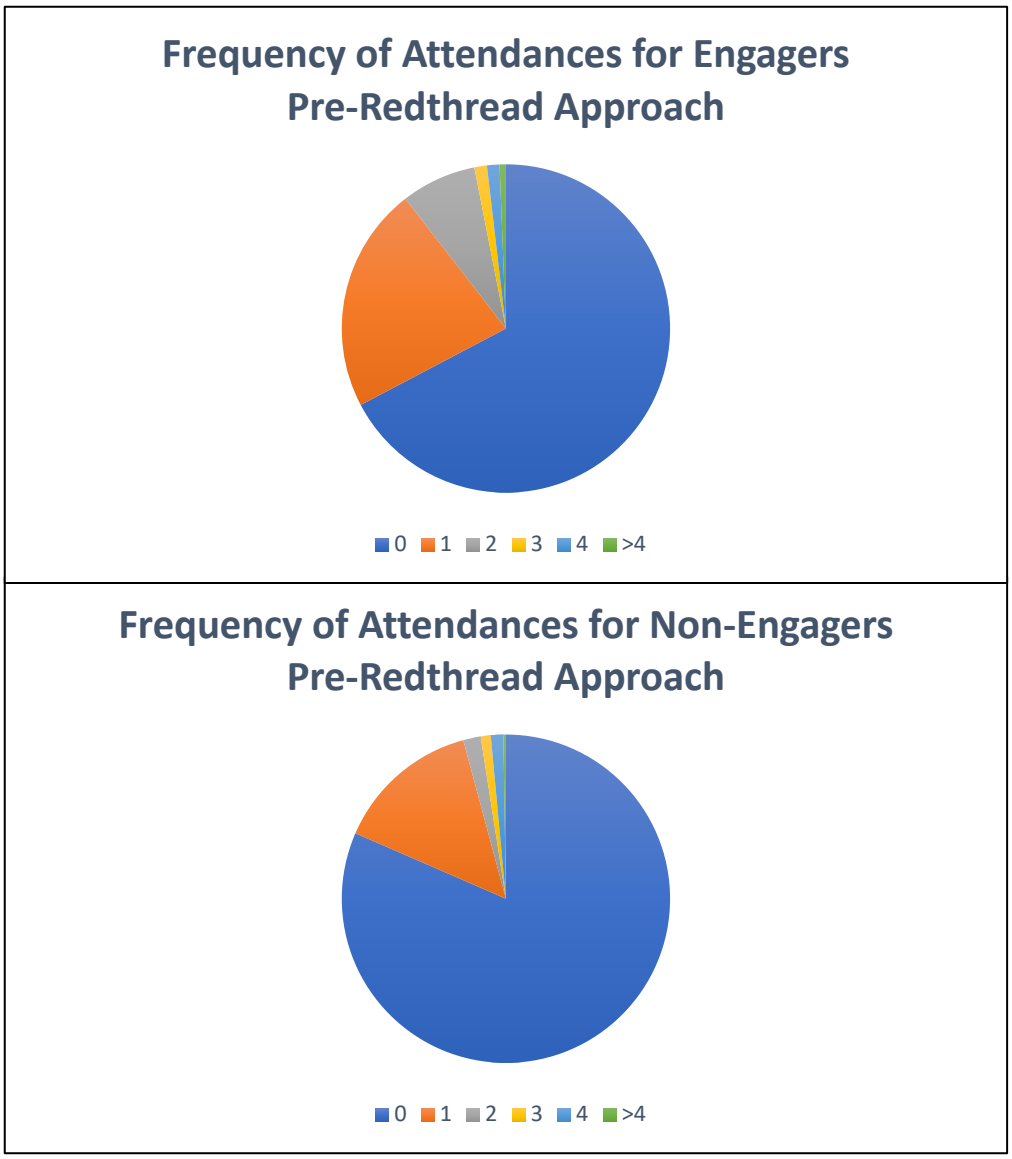
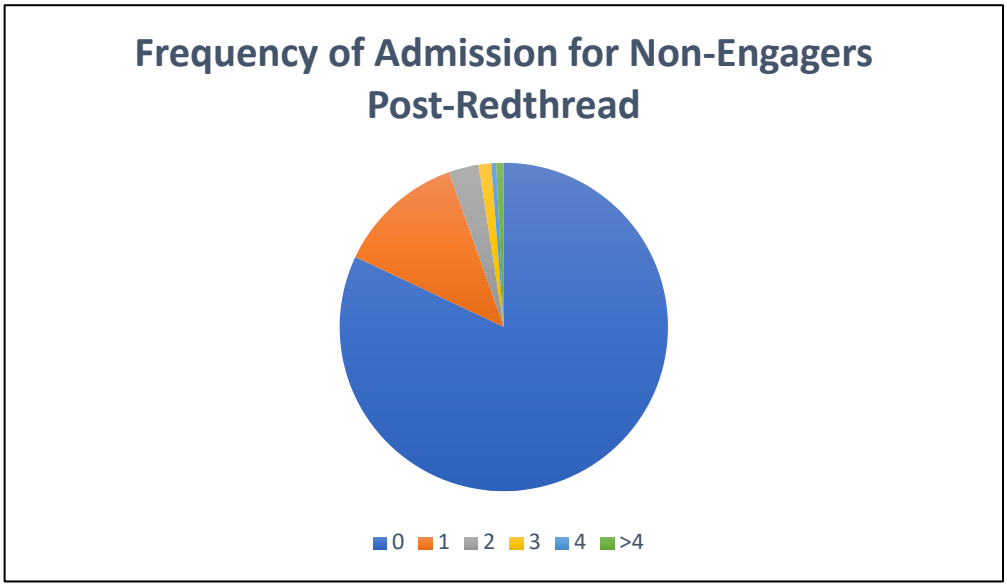


Figure 12 - A comparison of number of Emergency Department attendances for young persons prior to their index attendance and approach by Redthread.



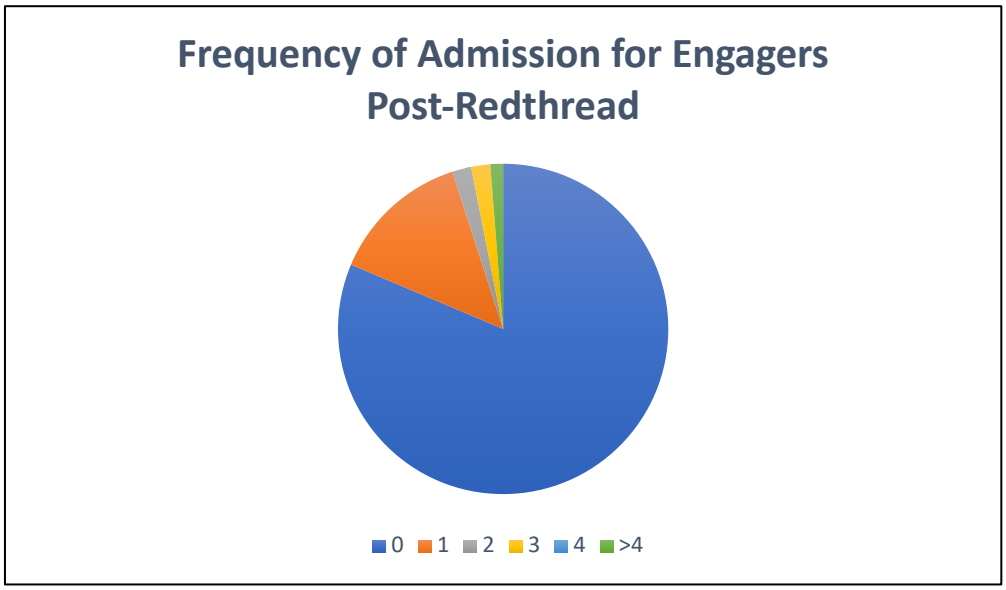


Figure 13 - A comparison of number of Emergency Department attendances for young persons after their index attendance and approach by Redthread.

4.3. Patterns of Attendance and Re-attendance

Cases were examined to identify patterns in attendance and to assess how re-attendances to the Emergency Department were distributed at a patient level. Of the 164 individuals engaging with the full YVIP 57.9% (n=95) had recorded an attendance neither 2 years prior to nor after their index admission. For the 331 non-engaged group who were eligible for the YVIP 67.4% (n=223) had no attendances in the 2 years prior to or after their index admission. 36% (n=22) of engagers and 12.4% (n=41) of non-engagers had recorded a prior attendance only. A total of 8.5% (n=14) of engagers and 6.9% (n=23) of non-engagers had recorded both prior and post attendances. Finally, 11.6% (n=19) of engagers and 13.3% (n=44) of non-engagers had recorded attendances solely after their index attendance and approach by Redthread (

Figure 14). Among those only attending after their index admission the median number of repeat visits was 1 for both YVIP engagers and non-engagers (engagers IQR 1-1, range 1-3; non-engagers IQR 1-2, range 1-5).

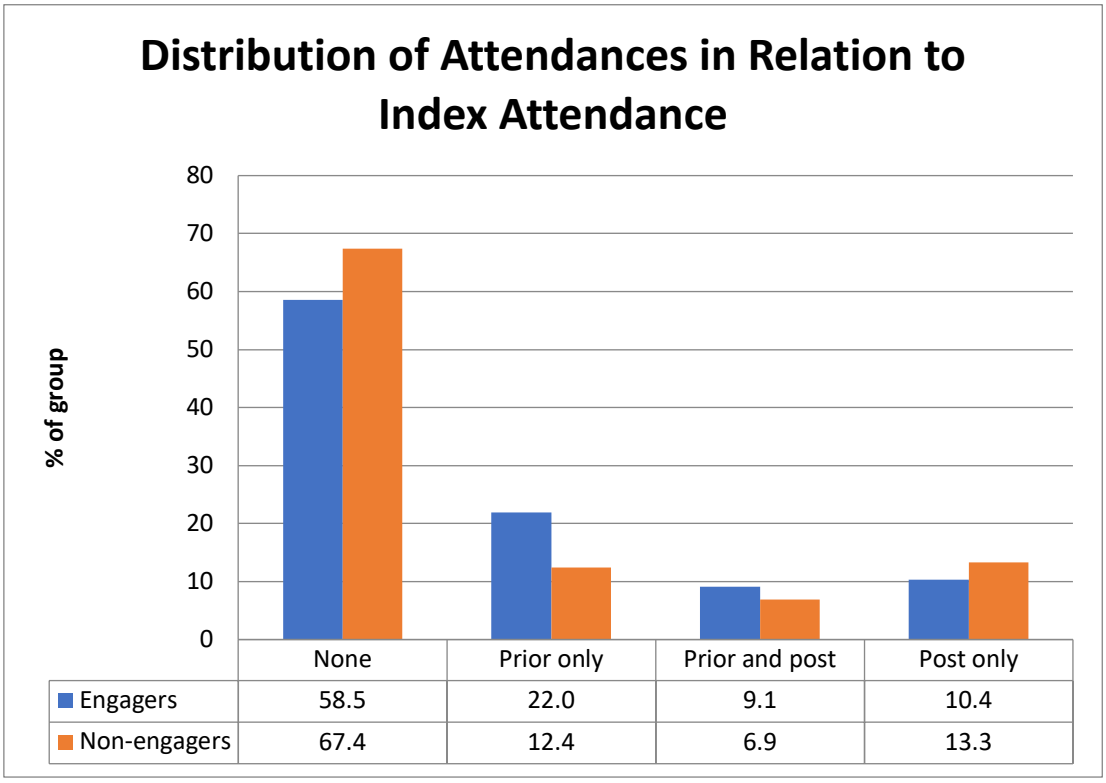


Figure 14 - Distribution of patterns of attendance surrounding the index admission and approach by Redthread among those who engaged and those who did not engage with the YVIP. Engagers n=164, non-engagers n=313.

4.4. Index Admission

We saw a range of presentations triggering an initial referral to Redthread. It was recognised that on case-by-case analysis many attendances may be multifactorial and might involve aspects of substance misuse and/or mental health concerns alongside episodes of injury or assault. However, for the purpose of this analysis cause for attendance was reported according to the primary presenting complaint listed on hospital records. Here, injury due to assault was the commonest cause for attendance either though use of body parts (34.9%, n=200) or through stabbing (29.8%, n=171). Mental health crises and substance misuse accounted for 12.7% (n=73) of all cases. There were 10 cases of sexual assault and 16 cases referred due to exploitation, safeguarding or illness (

Table 1).

Table 1 - Reason for attendance triggering referral to the Redthread YVIP at index admission

Mechanism	Total (n=573)	Full programme engagers (n=164)	Non- full programme engagers (n=409)
Assault			
Blunt object	7.5% (n=43)	6.7% (n=11)	7.8% (n=32)
Burns	0.9% (5)	1.2% (2)	0.7% (3)
Body parts	34.9% (200)	31.1% (51)	36.4% (149)
Glass/Bottle	3.1% (18)	1.8% (3)	3.7% (15)
Gunshot	2.1% (12)	3% (5)	1.7% (7)
Knife or bladed object	29.8% (171)	33.5% (55)	28.4% (116)
Vehicle	0.5% (3)	0	0.7% (3)
Sexual assault	1.7% (10)	3.7% (6)	1.0% (4)
Exploitation	0.5% (3)	1.2% (2)	0.2% (1)
Mental Health			
Intentional overdose	2.6% (15)	2.4% (4)	2.7% (11)
Self-harm	2.1% (12)	1.8% (3)	2.2% (9)
Suicidality	1.0% (6)	1.2% (2)	1.0% (4)
Other	1.4% (8)	0.6% (1)	1.7% (7)
Substance			
Alcohol	1.6% (9)	2.4% (4)	1.2% (5)
Drugs	4.0% (23)	6.1% (10)	3.2% (13)
Accident			
Self-inflicted	3.0% (17)	2.4% (4)	3.2% (13)
Road traffic collision	0.9% (5)	0	1.2% (5)
Illness/safeguarding	2.3% (13)	0.6% (1)	2.9% (12)

from total referrals. Categories are presented as percentages

4.5. Prior Event Rate Ratio Analysis

4.5.1. Re-injury and Re-attendance among Eligible Young Persons

Primarily we undertook an analysis of young persons who engaged with the full YVIP compared to the group who were eligible for support but did not fully engage as this offered the most accurate reflection of the impact of the YVIP. Those who were ineligible, usually due to age, and those deemed to not require support from the YVIP were not included in this primary analysis. This left 164 engaged and 331 non-engaged young persons for analysis. Reasons for non-engagement with the YVIP have previously been illustrated in Figure 6.

In the two years prior to their approach by Redthread the event rate of Emergency Department attendances was higher in the group who chose to later engage with the full YVIP. Here, these 164 patients had recorded 83 prior Emergency Department attendances between them over 99,297 patient days. This gave an event rate of 30.5 attendances per 100 patient years. Those 331 patients who were eligible for support but did not engage with the YVIP recorded 72 attendances over 221,123 days giving an event rate of 11.9 attendances per 100 patient years.

Therefore, if we chose to observe 100 of the full programme engaged patients for 1 year prior to their approach by Redthread we would expect 30.5 of them to have attend for an eligible visit. For the non-engaged group, the same number of patients would be expected to attend for 11.8 eligible visits. When event rates were compared this gave an unadjusted prior event hazard ratio (HR.prior) of 2.56 (95% CI 1.91-3.48) for previous attendance in the engaged group.

After approach by Redthread the 164 patients who chose to engage with the full YVIP recorded 54 further attendances up until the close of the dataset on 3/3/20 over 76,209 patient days. This led to an event rate of 25.8 attendances per 100 patient years. Those

who chose not to engage with the full YVIP recorded a total of 72 attendances until the close of the dataset over 129,344 patient days giving an event rate of 20.3 attendances per 100 patient years. When event rates were compared this gave an unadjusted post event hazard ratio (HR.prior) of 1.27 (95% CI 0.93-1.83) for re-attendances in the engaged group.

Overall, this led to a prior event rate ratio (HR. post / HR.prior) of 0.49 (95% 0.28-0.64). Based on this analysis a relative reduction of 51% was observed in the rate of re-attendances for those engaging with the YVIP when compared to the rate of attendances among those who chose not to engage (Table 2).

Table 2 - Event rates and unadjusted hazard ratios for Emergency Department attendances with 95% confidence intervals among those who engage and all eligible patients for the YVIP who did not engage with the full Redthread YVIP

Parameter	Engaged in full programme	Not engaged in full programme
No of patients	164	331
Before approach by Redthread		
No (%) patients with prior attendances in 2yr before approach	49 (29.8%)	62 (18.7%)
Incidence of attendances per 100 person years (95% CI)	30.5 (24.6-37.8)	11.9 (9.4-14.9)
Unadjusted hazard ratio (engaged/non-engaged) (95% CI)	2.56 (1.91 to 3.48)	
After approach by Redthread		
No (%) patients with attendances after approach up to database lock	30 (18.2%)	66 (19.9%)
Incidence of attendances per 100 person years (95% CI)	25.8 (19.8-33.7)	20.3 (16.1-25.5)
Unadjusted hazard ratio (engaged/non-engaged) (95% CI)	1.27 (0.93-1.83)	
Prior event rate ratio (95% CI)	0.49 (0.28-0.64)	

4.5.2. Re-injury and Attendance among Total Referrals

A further analysis was undertaken of re-attendance rates among all patients who did not engage with the full YVIP either through choice, or lack of requirement as deemed by the assessment of a youth worker. Prior to their Redthread referral at their index admission this non-engaged group of 409 patients had recorded 93 visits across 272,762 patient days leading to an event rate of 12.4 attendances per 100 patient days.

Therefore, if we chose to observe 100 of these non-engaged patients for 1 year prior to their Redthread referral we would expect 12.4 of them to have attended for an eligible visit. When compared to the previously calculated prior attendance event rate of 30.5 attendances per 100 days for the engaged group this gave an unadjusted prior event rate hazard ratio (HR.prior) of 2.45 (95% CI 2.2 to 3.67).

Since their approach by Redthread those 409 non-engaged patients recorded 115 further attendances until the close of the dataset on 3/3/20 over 157,673 patient days giving an event rate of 26.6 attendances per 100 patient years. When compared to the equivalent event rate for the engaged group of 25.8 attendances the unadjusted post event rate hazard ratio (HR.post) was 0.96 (95% 0.67-1.40).

Overall, this led to a prior event rate ratio (HR. post / HR.prior) of 0.39 (95% 0.22-0.51). Based on this analysis a relative reduction of 61% was observed in the rate of re-attendances for those engaging with the full YVIP when compared to all of those who did not engage, regardless of reason. (Table 3).

Table 3 - Event rates and unadjusted hazard ratios for Emergency Department attendances with 95% confidence intervals among those who engage and all-comers who do not engage with the full Redthread YVIP.

Parameter	Engaged in full programme	Not engaged in full programme
No of patients	164	409
Before approach by Redthread		
No (%) patients with prior attendances in 2yr before approach	49 (29.8%)	67 (16.3%)
Incidence of attendances per 100 person years (95% CI)	30.5 (24.6-37.8)	12.4 (10.1-15.2)
Unadjusted hazard ratio (engaged/non-engaged) (95% CI)	2.45 (2.2 to 3.67)	
After approach by Redthread		
No (%) patients with attendances after approach up to database lock	30 (18.2%)	74 (18.1%)
Incidence of attendances per 100 person years (95% CI)	25.8 (19.8-33.7)	26.6 (22.1-31.9)
Unadjusted hazard ratio (engaged/non-engaged) (95% CI)	0.96 (0.67-1.40)	
Prior event rate ratio (95% CI)	0.39 (0.22-0.51)	

4.5.3. Injury due to Violence and Assault

We undertook a sensitivity analysis to assess only individuals who presented initially with a violent injury or sexual assault. This subgroup included 139 of those who later engaged with the full YVIP and 332 who did not.

In the 2 years prior to their Redthread referral at their index admission the engaged group primarily presenting with a violent injury recorded 45 attendances over 87,544 patient days. This gave an event rate of 18.7 attendances per 100 patient years. Over the same timeframe the equivalent non-engaged group of 332 young persons had recorded 69 attendances over 244,391 patient days leading to an event rate of 10.3 attendances per 100 patient years. When the two event rates were compared this gave an unadjusted prior event rate hazard ratio (HR.prior) of 1.81 (95%CI 1.31-2.50).

For those who engaged with the full programme recidivism dropped from 27.3% to 13.6% giving a relative reduction of 49.8%. In contrast, for the non-engaged group recidivism remained consistent at 15.3%. Since their approach by Redthread the 139 engaged young persons recorded 25 further attendances up until the close of the dataset on 3/3/20 over 67,080 patient days giving an event rate of 13.6 attendances per 100 patient years. For the non-engaged group, the event rate was 20.2 attendances per 100 patient years. When these two event rates were compared this gave an unadjusted post event rate hazard ratio (HR.post) of 0.67 (95% CI 0.44-1.07).

Overall, this led to a prior event rate ratio (HR. post / HR.prior) of 0.37 (95% 0.19-0.58). Based on this analysis the group primarily presenting for a violent injury during their index admission saw a relative reduction of 63% in their rate of attendances after engaging with the full YVIP after when compared to the rate of attendances among of those who did not engage (Table 4).

Table 4 - Event rates and unadjusted hazard ratios for Emergency Department attendances with 95% confidence intervals among those eligible for the YVIP who engaged and did not engage with the full Redthread YVIP presenting with a violent injury or assault only.

Parameter	**Engaged in full programme**	**Not engaged in full programme**
No of patients	139	332
Before approach by Redthread		
No (%) patients with prior attendances in 2yr before approach	38 (27.3%)	51 (15.3%)
Incidence of attendances per 100 person years (95% CI)	18.7 (14-25.1)	10.3 (8.1.-13)
Hazard ratio (engaged/non-engaged) (95% CI)	1.81 (1.31-2.50)	
After approach by Redthread		
No (%) patients with attendances after approach up to database lock	19 (13.6%)	55 (15.3%)
Incidence of attendances per 100 person years (95% CI)	13.6 (9.2 – 20.1)	20.2 (16.2-25.2)
Hazard ratio (engaged/non-engaged) (95% CI)	0.67 (0.44-1.07)	
Prior event rate ratio (95% CI)	0.37 (0.19-0.58)	

4.5.4. Mental Health and Substance Misuse

Individuals presenting due to substance misuse or a mental health crisis as their primary issue accounted for 12.7% (n=73) of index admissions. This group showed a high frequency of prior attendances to the Emergency Department with 42.4% (n=31) having attended in the 2 previous years. Of the 176 prior attendances by our total cohort 35.2% (n=62) had been made by those seeking help for substance misuse or a mental health issue.

24 young persons who engaged with the full YVIP following an index attendance for a mental health or substance misuse concern had recorded 38 attendances in the 2 previous years. This gave an event rate of 118 attendances per 100 patient years. 49 young persons who did not engage with the full YVIP following an index attendance due to their mental health or substance misuse recorded 24 attendances in the 2 previous years. This gave an event rate of 30.2 attendances per 100 patient years. Following approach by Redthread those who chose to engage with the full YVIP re-attended the Emergency Department on 29 occasions resulting in an event rate of 115.9 attendances per 100 patient years. Those who chose not to engage recorded 37 further attendances resulting in an event rate of 86.7 attendances per 100 patient years.

Among this subgroup the hazard ratio for attendance before their index admission (HR.prior) was 3.9 (95% 2.99-5.18). The hazard ratio for repeat attendance after approach by Redthread (HR.post) was 1.33 (95% CI 0.94-1.79). This led to a prior event rate ratio of 0.34 (95% CI 0.14-0.63).

Based on this analysis a relative reduction of 66% was observed in the rate of re-attendances for those who chose to engage with the with the full YVIP when compared to those who chose not to engage among patients with an index presentation due to their mental health or substance misuse (Table 5).

Table 5 - Event rates and unadjusted hazard ratios for Emergency Department attendances with 95% confidence intervals among those eligible for the YVIP who engage and do not engage with the full Redthread YVIP presenting due to a mental health crisis or substance misuse.

Parameter	Engaged in full programme	Not engaged in full programme
No of patients with an index presentation due to mental health or substance misuse	24	49
Before approach by Redthread		
No (%) patients with prior attendances in 2yr before approach	11 (45.8%)	16 (32.7%)
Incidence of attendances per 100 person years (95% CI)	118 (85.9-162.1)	30.2 (20.3-45.1)
Unadjusted hazard ratio (engaged/non-engaged) (95% CI)	3.9 (2.99 to 5.18)	
After approach by Redthread		
No (%) patients with attendances after approach up to database lock	11 (45.8%)	19 (38.8%)
Incidence of attendances per 100 person years (95% CI)	115.9 (80.6-166.8)	86.7 (62.9-119.8)
Unadjusted hazard ratio (engaged/non-engaged) (95% CI)	1.33 (0.94-1.79)	
Prior event rate ratio (95% CI)	0.34 (0.14-0.63)	

4.5.5. Re-injury and Re-attendance for Nottinghamshire Residents

To mitigate the limiting factor of re-attendances occurring at a trust other than Nottingham University Hospitals we undertook a final PERR analysis of patients with a Nottinghamshire postcode. This aimed to explore the effect of the YVIP on young persons who would re-attend to Nottingham University Hospitals even in the event of a minor injury. This is therefore more likely avoid missing re-attendances due to the young person presenting to a more local Emergency Department.

We identified 458 young persons referred to the YVIP with a postcode within Nottingham City or Nottinghamshire (136 engagers, 322 non-engagers). Those engaging with the full YVIP had recorded 56 attendances over 81,168 patient days prior to their index admission and referral to the YVIP. This gave an event rate of 25.2 attendances per 100 patient years. The 322 non-engagers registered 77 prior attendances over 212,071 patient days giving an event rate of 13.3 attendances per 100 patient years. The unadjusted HR.prior was 1.90 (95% CI 1.38 to 2.60).

After their approach to enrol in the YVIP those who engaged with the full programme registered a further 45 attendances over 71,235 patient days giving an event rate of 23 attendances per 100 patient years. Those who did not engage recorded a further 95 attendances over 135,290 patient days giving an event rate of 25.6. The unadjusted HR.post was 0.89 (95% CI 0.62-1.29). This gave a prior event rate ratio of 0.46 (95% CI 0.29-0.65).

Based on this analysis in those with a Nottinghamshire or Nottingham City Postcode we observed a relative reduction of 54% in the rate of re-attendance among those who chose to engage with the full YVIP compared to rate of re-attendance in those who did not engage with the programme. (Table 6).

Table 6 - Event rates and unadjusted hazard ratios for Emergency Department attendances with 95% confidence intervals among those eligible for the YVIP who engage and do not engage with the Redthread YVIP living in a Nottingham City or Nottinghamshire postcode.

Parameter	Engaged in full programme	Not engaged in full programme
No of patients with a Nottingham City or Nottinghamshire postcode	136	322
Before approach by Redthread		
No (%) patients with prior attendances in 2yr before approach	44 (32%)	59 (18.3%)
Incidence of attendances per 100 person years (95% CI)	25.1 (19.4-32.7)	13.2 (10.5-16.5)
Unadjusted hazard ratio (engaged/non-engaged) (95% CI)	1.90 (1.38 to 2.60)	
After approach by Redthread		
No (%) patients with attendances after approach up to database lock	29 (21%)	60 (18.6%)
Incidence of attendances per 100 person years (95% CI)	23 (17.2-30.8)	25.6 (20.9-31.3)
Unadjusted hazard ratio (engaged/non-engaged) (95% CI)	0.89 (0.62-1.29)	
Prior event rate ratio (95% CI)	0.46 (0.29-0.65)	

4.5.6. Crisis support

For those receiving crisis support 23% (n=29) of these individuals had recorded a previous attendance with 38 attendance events in total (range per person 1-4 attendances). From these attendances 71% (n=27) had been due to violence or assault, 16% (n=6) were due to a mental health crisis and 13% (n=5) were alcohol or drug related.

After crisis support 17.8% (n=22) of individuals re-attended up to March 2020 giving a relative reduction of 22.3%. A total of 29 re-attendances were recorded in total (range per person 1-4 attendances). Of these re-attendances 55% (n=16) were violence related, 32% (n=7) had been due to a mental health crisis and 27% (n=6) had been due to drug or alcohol intoxication.

4.6. The Geography of Assaults and Violence

4.6.1. Location of Violent Injury Incidents

Available injury location data were analysed for all patients referred to Redthread regardless of further engagement. This included 498 index attendances as well as the 114 incidents recorded by patients prior to their referral and 94 incidents after referral giving a total of 706 incidents of violent injury or assault. From these 59% (n=415) of incidents had sufficient data on hospital electronic records to accurately map their location. Nottingham city centre and its suburbs accounted for 81% (n=335) of these events followed by Leicester with 5.1% (n=21), Ilkeston 4.8 % (n=20), Derby city 4.3% (n=18), and Mansfield 1.2% (n=5) (Figure 15). Overall, there were 6 cases of violent injury at locations outside of the East Midlands (notably Birmingham, York, and Barnsley).

In Nottingham city centre and its suburbs, most incidents were located within a 5.6Km radius of the city centre and a total of 50.8% (n=211) incidents occurred within the city centre or its immediate suburbs (Figure 16). The postcode sectors with the highest incidence of violent assault were, NG5 5; Bestwood, NG5 9; Top Valley, NG7 3; Radford, NG8 5; Aspley, NG3 1; St Ann's, NG2 2; The Meadows and NG2 4; Sneinton sharing 25% (n=105) of all incidents of violent injury or assault between them (

Figure 17). The city centre itself saw the highest proportion of incidents with 77 events of assault with the majority occurring within a 750-metre radius (Figure 18).

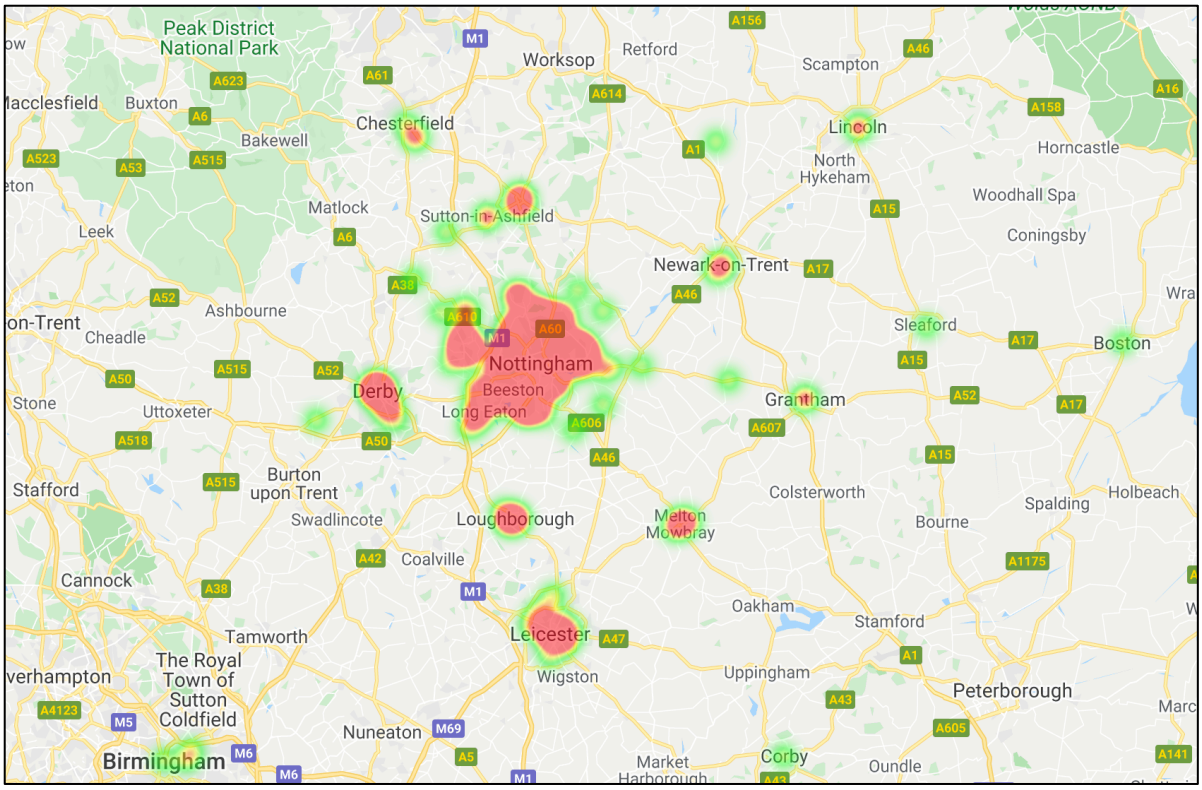


Figure 15 - Heat map of the East Midlands and wider region demonstrating location of violent assault and injuries during the 2 years prior and 2 years since the introduction of the Redthread YVIP.

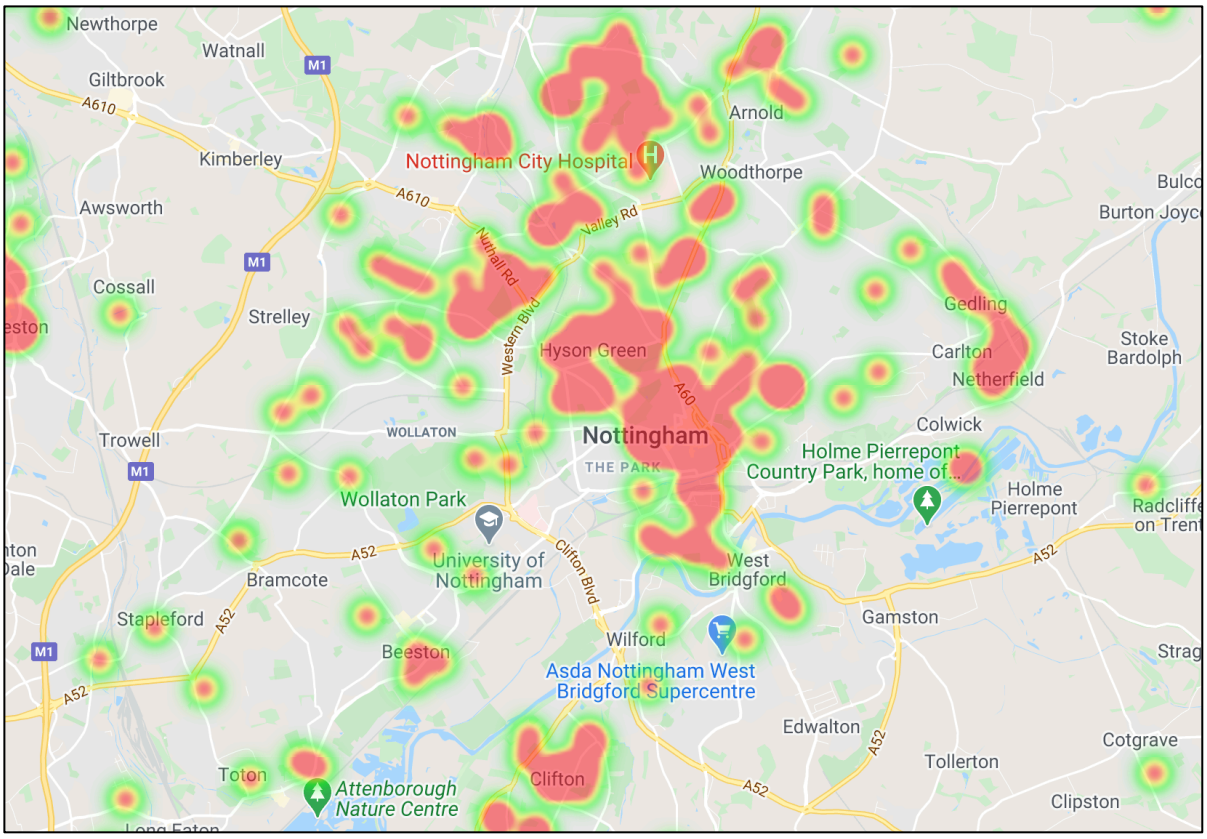


Figure 16 - Heat map of Nottingham City and wider areas demonstrating location of violent assault and injuries during the 2 years prior and 2 years since the introduction of the Redthread YVIP in Nottingham.

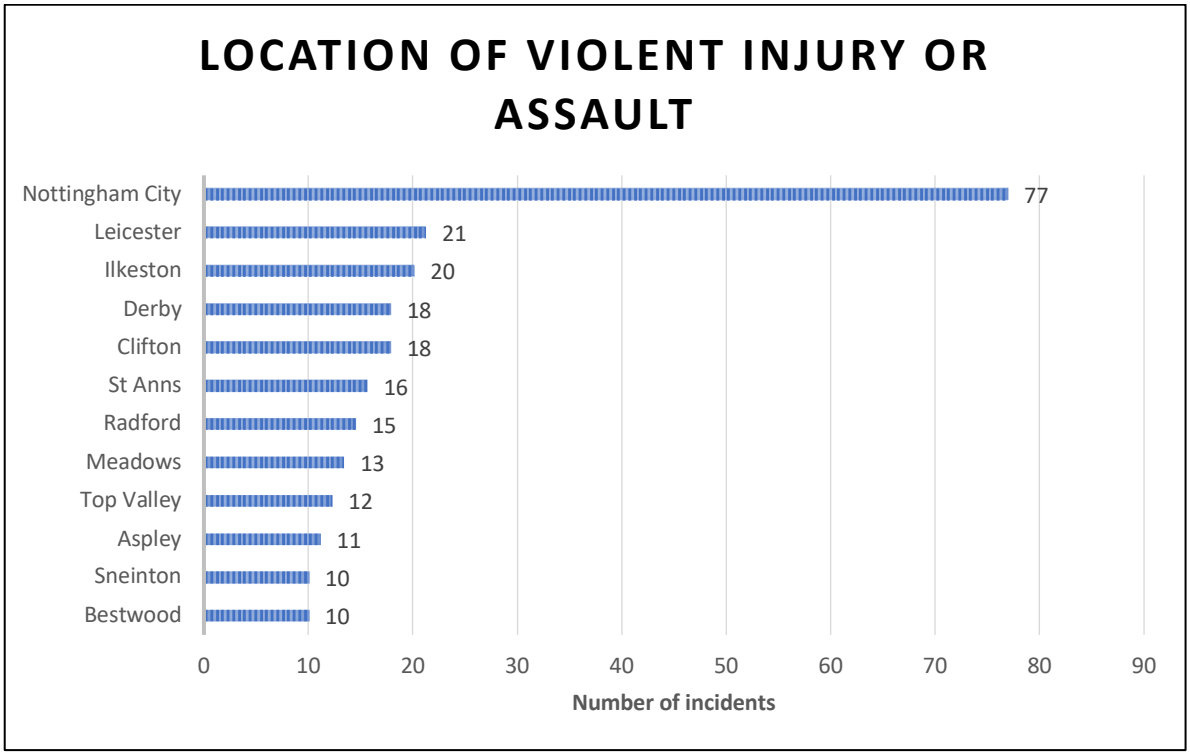


Figure 17 - Frequency of incidents of violent injury or assault among those locations recording 10 or more events.

Specific location data were available for 72% (n=56) of the 77 city centre incidents. Clustering of events was noted around entertainment and hospitality venues. The majority occurred due to blunt assault with body parts (55.3%, n=31) or with a sharp/bladed object (30.4%, n=17). Mean (SD) age of those assaulted in the city centre was 19 (3.2) years with 56 male and 21 female victims. A reduction in the incidence of city centre violent assaults was observed year on year with 42 incidents between March 2018-19 and 27 incidents from March 2019-20 assaults, although these figures are limited to those with sufficient location data recorded.

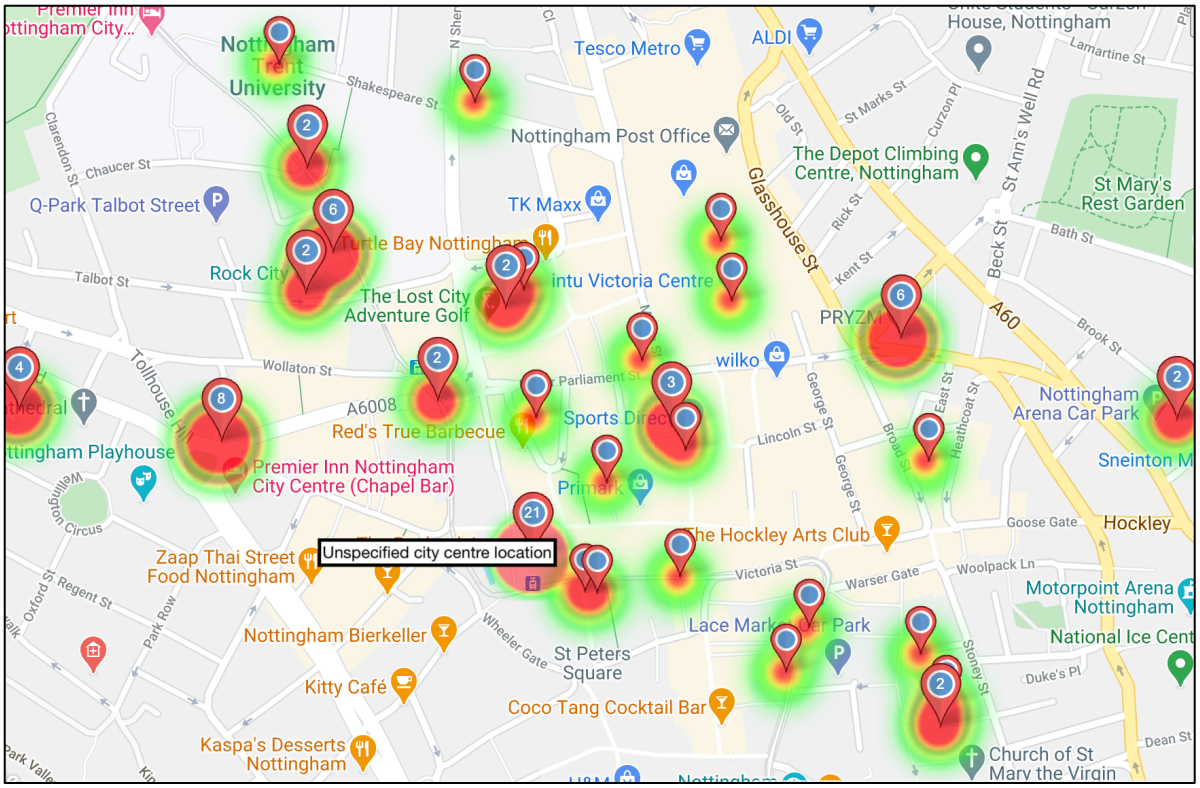


Figure 18 - Heat map of Nottingham City location of violent assault and injuries with frequencies during the 2 years prior and 2 years since the introduction of the Redthread YVIP. Scale 1cm/100m. 21 cases were noted to have occurred in the city centre at an unspecified location.

4.6.2. Night-Time Economy

Analysis of all cases of violent injury or assault occurring between the hours of 8pm to 6am was undertaken to identify incident patterns in relation to the night-time economy. This analysis was limited to the number of incidents with location information available. A total of 46 eligible events occurred within Nottingham city centre. Of these, 61.1% (n=28) involved assault with body parts, 17.4% (n=8) involved assault with a knife or sharp object, 17.4% (n=8) involved assault with a bottle or blunt object and 4.3% (n=2) involved sexual assault. In total 65% of the assaults occurred across the same 11 institutions at night. Nightclubs saw the highest number of assaults with 18 cases across 5 institutions with Pryzm

nightclub, Stealth nightclub and Rock City experiencing the highest rates of violent assault either within or outside the premises (Figure 19).

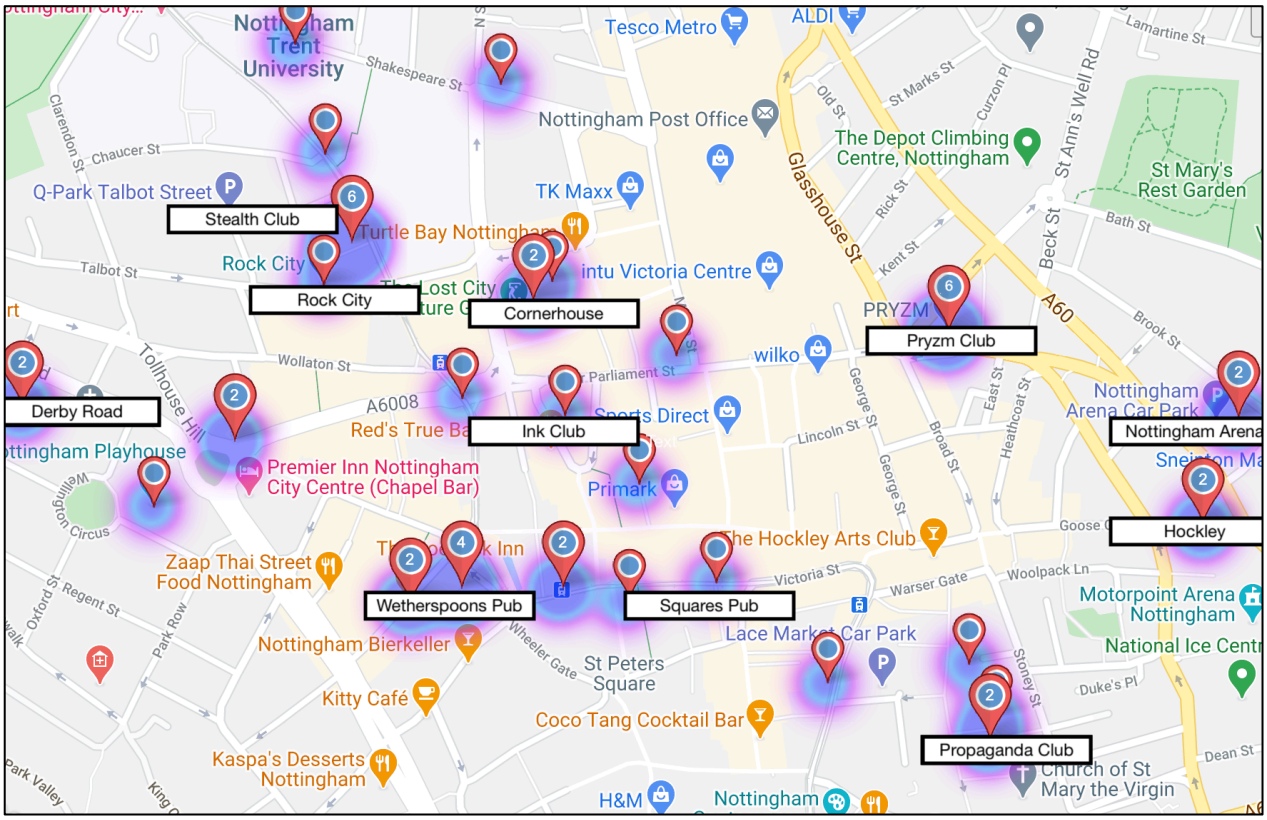


Figure 19 - Heat map of events of violent injury or assault in relation to the night-time economy within Nottingham city centre. Frequencies are shown for the 2 years prior and 2 years since the introduction of the Redthread YVIP.

4.7. Home Location of Victims

Home addresses were available for 568 of the 573 young persons referred to the Redthread YVIP. A total of 5 individuals had no fixed abode registered at the time of their index attendance to the Emergency Department and all 5 of these did not engage with the full YVIP. Analysis was limited to postcode prefixes alone. Among those who engaged with the YVIP 81.7% (n=134) were registered at a Nottinghamshire address, 8.5% (n=14) were living in Derbyshire, 4.2% (n=7) were living in Leicestershire and the remaining 9 young persons were living in the surrounding counties (notably Lincolnshire and Staffordshire) or Birmingham City (Figure 20).

Among those who did not engage with the full YVIP 78.7% (n=322) were registered as living at a Nottinghamshire postcode. A further 7.1% (n=29) were from Derbyshire, 7.6% (n=31) were from Leicestershire. Other home locations included London (n=5), the West Midlands (n=4), the North West (n=3), and the North East (n=2) (Figure 21).

Distance from home to location of attack was mapped in all cases with sufficient data. Mean (SD) distance across all incidents occurring away from a home address was 1.78 (1.3) kilometres (range 0.2 - 257km). There were 124 events reported at the young person's home address, 21 incidents had occurred at a school or college and 3 incidents had occurred in the workplace.

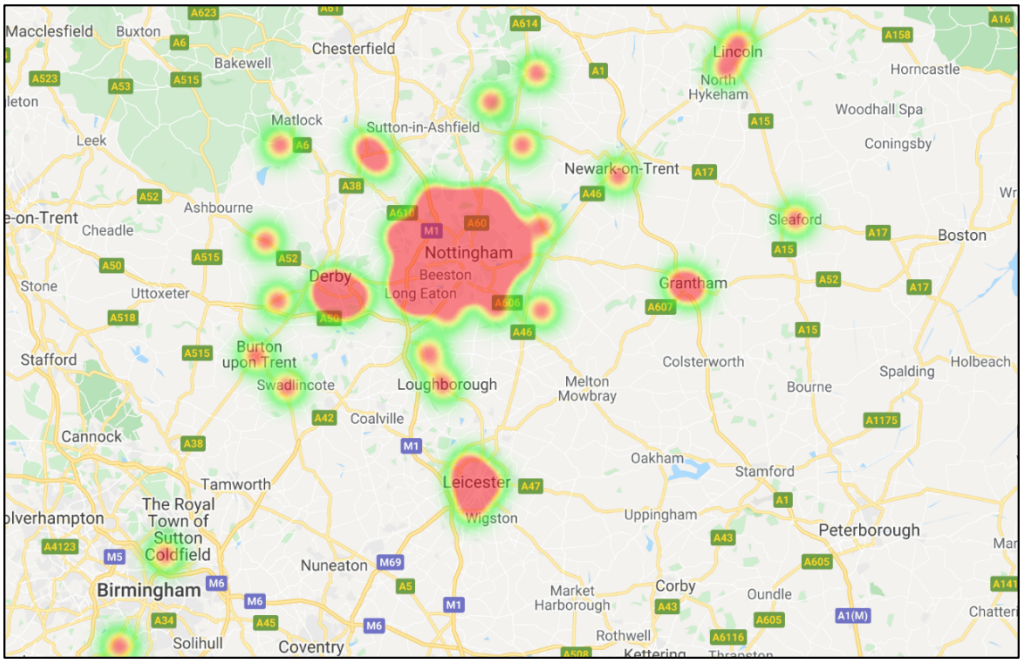


Figure 20 - Regional heat map of the home location of young persons who engaged with the full Redthread YVIP.

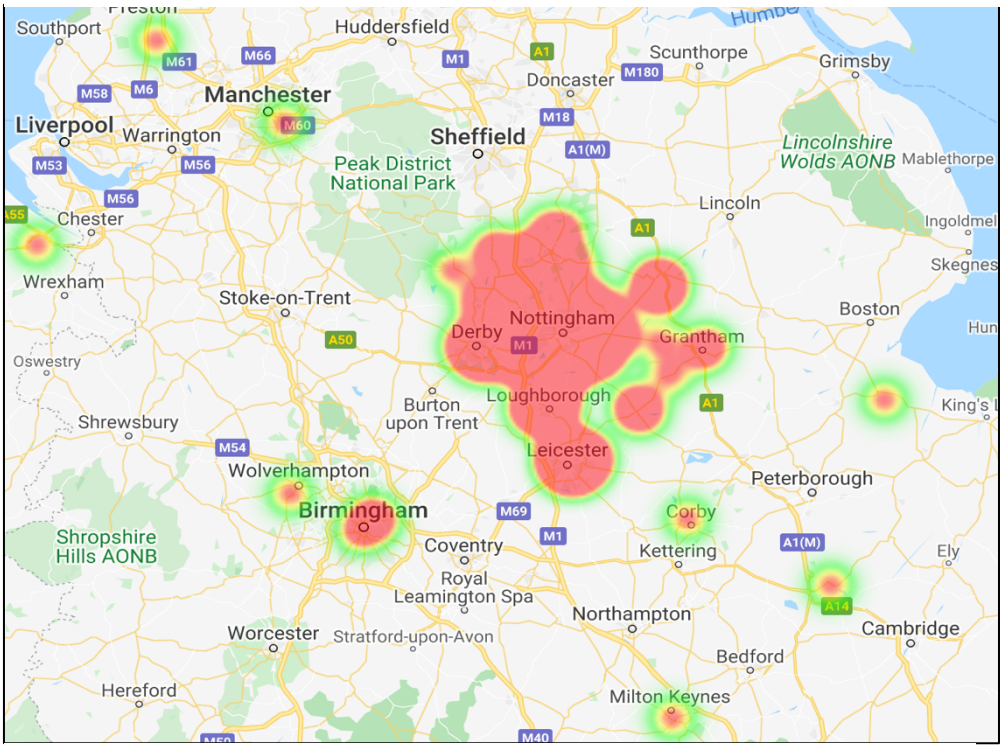


Figure 21 - Regional heat map of the home location of young persons who did not engage with the full Redthread YVIP.

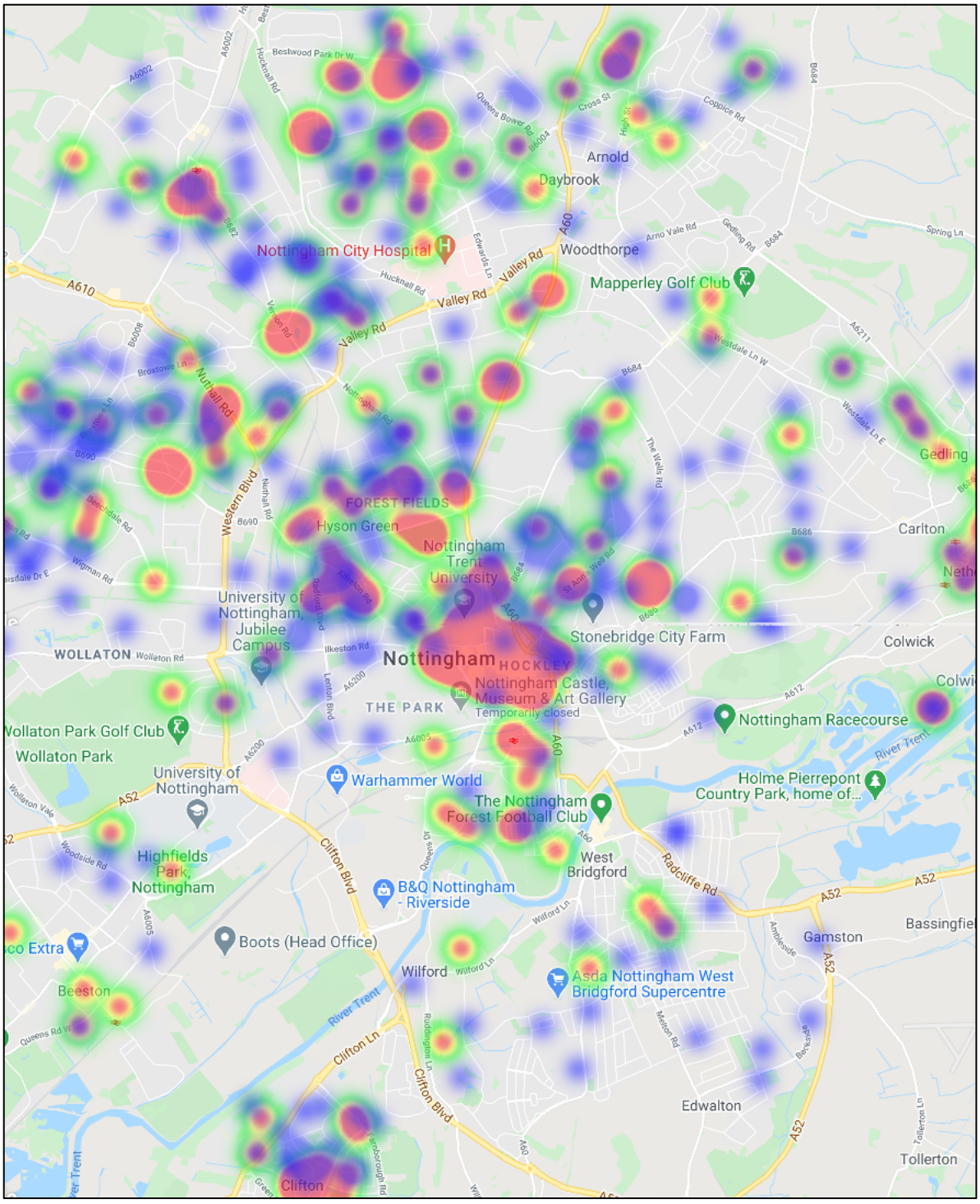


Figure 22 - Overlay heat map demonstrating registered home location of victim (blue) and the location of violent injury or assault (red) within the Nottingham city centre and local suburbs.

4.8. Referrals and Engagement with the YVIP

Patient demographics and information regarding their reason for referral were analysed for their distribution and effect on engagement with the YVIP. Most of this information had been collected after a young person had been referred to the YVIP. Missing data was later cross-referenced with Emergency Department audit data and electronic hospital records.

4.8.1. Demographic Factors Predicting Full Engagement

Analysis of these factors was limited to the young persons who were eligible for the service and had demographic data available (n=490). Univariable analysis demonstrated no statistically significant trends in engagement across gender, age, or ethnicity (Table 7). Ethnicity analysis was limited by a high level of missing data with only 62% (n=303/490) available or recorded on electronic case note review. Young persons between the ages of 16-20 were found to have a decreased unadjusted odds of engagement (OR 0.48 95% CI 0.28-0.83, P=0.008) but this association was lost on multivariable analysis. Analysis of reason for referral demonstrated increased odds ratios for engagement across gang involvement, domestic abuse, risk of harm and exploitation but none of these reached statistical significance. Social deprivation scores also demonstrated no significant impact on the odds of a young person engaging across its scale. Data were collected on education/training/employment (ETE) and accommodation status, but absent data were high at 25% and 24% respectively. Consequently, these variables were removed from the multivariable model. On univariable analysis involvement in ETE (OR 1.46, 95% CI 0.46-4.61, P=0.513) or housing with a parent/carer (OR 1.01 95% CI 0.09-11.51, P=0.992) had no effect on the odds of engagement. Further multivariable analysis of all demographic factors and reasons for referral demonstrated no significant association with engagement with the YVIP (Table 7).

Table 7 - Univariable and multivariable analysis of demographics and OR, odds ratios with 95% CI, confidence interval for full engagement with the YVIP among eligible young persons. SDS, Social deprivation score (1-most deprived, 10-least deprived) [a]White British/Irish, [b]Black British/Black Carribean/Black African/ Black Other, [c]Asian British/Asian Bangladeshi/Asian Pakistani/Asian Other, [d]Mixed White & Black British/Carribean/African/Asian, [e]European/Other. [f] Includes gang involvement and exploitation.

	Unadjusted OR (n = 490)	95% CI		p-value	Adjusted OR (n = 303)	95% CI		p-value
Gender								
Male	1.00	(Reference)			1.00	(Reference)		
Female	1.16	0.74	1.84	0.503	0.98	0.40	2.42	0.980
Age								
11-15	1.00	(Reference)			1.00	(Reference)		
16-20	0.48	0.28	0.83	0.008	0.53	0.23	1.22	0.137
20-24	1.74	0.55	2.64	0.864	0.96	0.41	2.23	0.937
Ethnicity								
White[a]	1.00	(Reference)						
Black[b]	1.57	0.69	3.72	0.298	1.99	0.73	5.38	0.173
Asian[c]	0.66	0.24	1.81	0.426	0.83	0.28	2.48	0.745
Mixed[d]	0.64	0.20	2.00	0.443	0.49	0.14	1.78	0.281
Other[e]	0.50	0.143	1.84	0.296	0.28	0.56	1.45	0.129
Home Location								
Nottingham City	1.00	(Reference)						
Nottinghamshire	1.26	0.78	2.04	0.330	0.87	0.37	2.08	0.765
Derbyshire	1.16	0.59	2.30	0.658	1.39	0.47	4.13	0.545
Leicestershire	0.63	0.26	1.53	0.314	0.87	0.26	2.91	0.822
Lincolnshire	1.63	0.35	7.47	0.527	0.90	0.49	16.92	0.947
Other	0.96	0.40	2.32	0.941	0.97	0.25	3.78	0.971
Reason for Referral								
Assault	1.00	(Reference)						
Domestic abuse	1.31	0.64	2.71	0.451	2.89	0.74	11.32	0.126
Risk of harm[f]	1.93	0.89	4.18	0.094	1.43	0.39	5.23	0.206
Other	1.48	0.41	5.37	0.544	1.40	0.20	9.49	0.731
SDS								
1-3	1.00	(Reference)						
4-7	0.73	0.46	1.17	0.190	1.15	0.52	2.55	0.727
8-10	0.67	0.36	1.29	0.679	1.46	0.49	4.33	0.493

4.8.2. Referral Factors Predicting Engagement

Factors relating to how and when a young person was referred to the YVIP and how they were approached to engage with the YVIP were analysed for their influence on levels of engagement (Table 8). Across univariable analysis face-to-face referrals offered the best chance of full engagement. Electronic referrals were associated with over a 50% reduction in the success rate (OR 0.47, [95% CI 0.25-0.89], P=0.02) and identification via the hospital database reduced the odds of engagement by 75% (OR 0.24 [95% CI 0.13-0.46], P<0.001) when compared to a face-to-face referral. The odds of full engagement were also dependent on the person referring an individual to the YVIP with referrals from the hospital database and, interestingly, self-referrals showing reduced odds of full engagement when compared to a referral from a doctor. Referrals from nursing staff and the hospital safeguarding team had no significant impact on engagement. A weekend attendance was also associated with a 78% reduction in the odds of engagement when compared to attending on a weekday (OR 0.22, [95% CI 0.14-0.34], P<0.001). Young persons who were discharged by a clinician directly from the Emergency Department or those who self-discharged or did not wait to be seen were also significantly less likely to engage with the full YVIP. A face-to-face approach by a member of the Redthread team was an important factor predicting odds of engagement. Those who were approached via a phone call or text message/letter were less likely to engage with reductions of 79% and 83% respectively when compared to a face-to-face approach. Delays of >24 hours from attendance to referral showed a strong association with decreased odds of engagement on univariable analysis (OR 0.38 [95% CI 0.21-0.71], P=0.002). Previous attendances by the young person and multiple prior referrals to the YVIP were also shown to increase odds of full engagement. Having multiple previous referrals increased full engagement over 3-fold (OR 3.39, [95%CI 1.59-7.24], P=0.002).

On our adjusted analysis factors relating to mode of referral, referring individual, patient discharge, referral delays and previous attendances no longer significantly impacted odds of engagement with the YVIP. However, an association between weekend attendance (OR 0.26, [95% CI 0.15-0.44], p<0.001), multiple previous referrals (OR 2.82 [95%CI 1.07-7.42], P=0.035) and method of approach (phone call OR 0.25 [0.14-0.47], P=0.001, text message/letter OR 0.18 [0.33-0.96], P=0.045) all significantly impacted on the odds of full engagement with the service.

Table 8 : Univariable and multivariable analysis of factors related to referral. OR, odds ratios with 95% CI, confidence intervals relate to odds of engagement with the Redthread YVIP. ED, Emergency Department [a]djusted for all other variables within table. [b]paper referrals dropped due to predicting failure perfectly.

	Unadjusted OR (n = 490)	95% CI		p-value	Adjusted OR (n = 388)	95% CI		p-value
Mode of referral								
Face to face	1.00	(Reference)			1.00	(Reference)		
Electronic	0.47	0.25	0.89	0.02	0.79	0.35	1.80	0.581
Hospital database	0.25	0.13	0.46	<0.001	0.49	0.56	4.28	0.520
Telephone	0.65	0.32	1.32	0.238	0.64	0.27	1.53	0.316
Paper[b]	-	-	-	-	-	-	-	-
Weekend attendance								
No	1.00	(Reference)			1.00	(Reference)		
Yes	0.22	0.14	0.34	<0.001	0.26	0.15	0.44	<0.001
Referrer								
Doctor	1.00	(Reference)			1.00	(Reference)		
Nurse	0.68	0.38	1.22	0.197	0.68	0.32	1.41	0.295
Safeguarding team	1.11	0.25	4.85	0.893	0.93	0.16	5.39	0.941
Self	0.26	0.10	0.65	0.004	0.32	0.03	3.34	0.346
Hospital database	0.33	0.17	0.625	0.001	0.91	0.10	8.21	0.930
Other	0.36	0.07	1.98	0.245	0.14	0.12	1.51	0.104
Discharge outcome								
Admitted	1.00	(Reference)			1.00	(Reference)		
Discharged from ED	0.44	0.29	0.67	<0.001	0.84	0.45	1.54	0.836
Did not wait	0.18	0.40	0.84	0.029	0.21	0.02	2.29	0.210
Previous attendances								
Yes	1.00	(Reference)			1.00	(Reference)		
No	0.59	0.38	0.94	0.026	0.63	0.34	1.15	0.627
Method of contact								
Face to face	1.00	(Reference)			1.00	(Reference)		
Phone call	0.21	0.13	0.32	<0.001	0.25	0.14	0.47	0.001
Text message or letter	0.17	0.36	0.78	0.023	0.18	0.33	0.96	0.045
Time to referral								
≤24 hours	1.00	(Reference)			1.00	(Reference)		
>24 hours	0.38	0.21	0.71	0.002	0.83	0.38	1.79	0.642
Multiple referrals								
No	1.00	(Reference)			1.00	(Reference)		
Yes	3.39	1.59	7.24	0.002	2.82	1.07	7.42	0.035

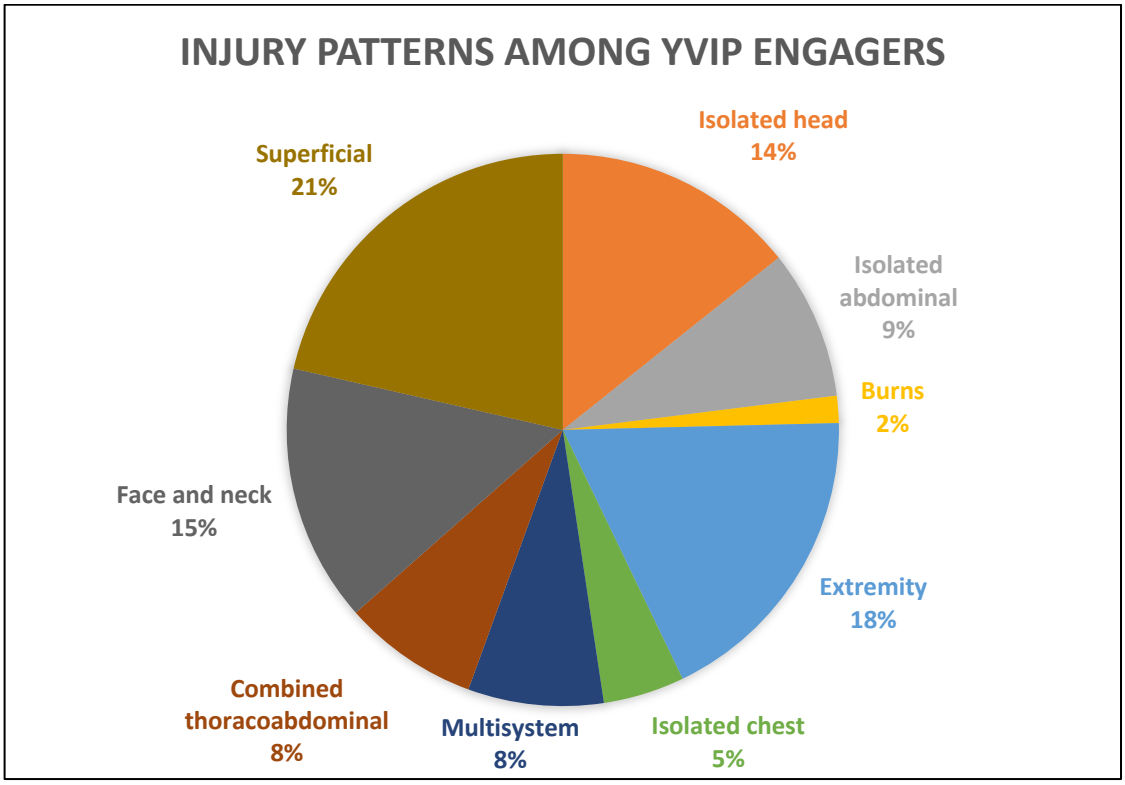
4.9. Injury Patterns and Severity Scoring

Injury severity scores (ISS) were analysed for each attendance due to assault or injury across the entire cohort. Across all index admissions median ISS was 2 (IQR 1-4, range 1-50). Among those admitted median ISS was 9 (IQR 4-14, range 1-50). There were no deaths due to traumatic injury or violent assault in the entire cohort of Redthread referrals. There was 1 case of suicide in the non-engaged cohort. This occurred 17 months after their index admission.

Those who chose to engage with the full YVIP had a median ISS score of 2 (IQR 1-9, range 1-50) following an assault or violent injury. 63% (n=104) of engagers were discharged from the Emergency Department. Median length of stay for those admitted was 3 days (IQR 1-6, range 1-37). 77% (n=127) attended with a traumatic injury. The remaining 23% (n=37) of YVIP engagers either had no evidence of traumatic injury recorded in their case notes, or they attended for a reason other than traumatic injury such as overdose or a mental health concern. In the group who were admitted median ISS score was 9 (IQR 5-18, range 1-50). 13.4% (n=22) patients required surgical intervention in theatre and a further 22% (n=36) required closure of traumatic wounds in the Emergency Department under local anaesthetic. Within the 25 further attendances registered by young persons after engagement with the full YVIP just one patient required emergency surgical management of their injuries. Median ISS score for repeat injury in those who re-attended after their YVIP engagement was 1 (IQR 1-4, range 1-22). 5 patients required inpatient admission for their injuries and median length of stay was 5 days (IQR 4.25-5, range 1-8).

Discharge directly from the Emergency Department occurred in 77.7% (n=318) of patients who did not engage with the YVIP (all-comers). Median length of stay in those admitted was 5 days (IQR 2-9, range 1-34) and median ISS score was 2 (IQR 1.75-4, range 1-34). A breakdown of injury patterns is shown (Figure 23). Among those re-attending after their index admission median ISS was 2 (IQR 1-2, range 1-27). In total, 8 were admitted with a

median length of stay of 5 days (IQR 3.5-4.5, range 2-14) and 3 needed surgical management of their injuries.



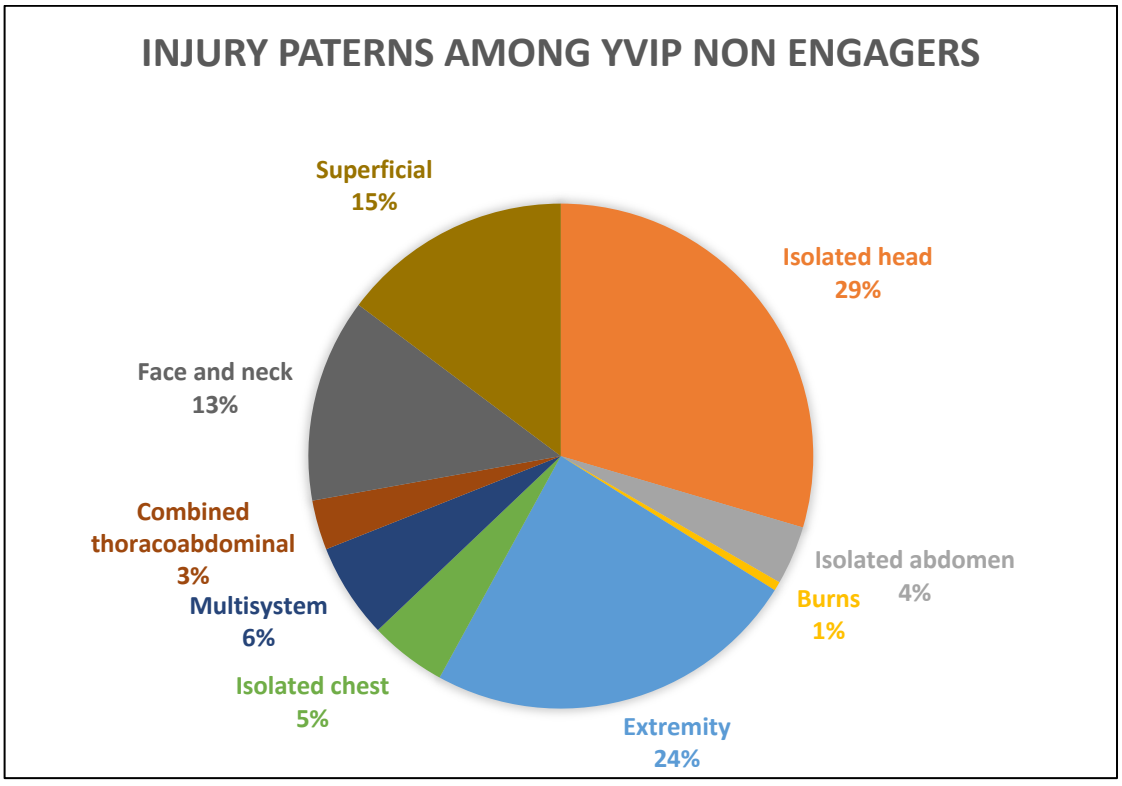


Figure 23 - Breakdown of injury pattern among young persons referred to the YVIP from the Emergency Department for assault or violent injury.

4.10. Analysis of the Referral Pathway

Since the introduction of the Redthread service in Nottingham from March 2018 and March 2020 there were 1992 attendances at the Queen's Medical Centre Emergency Department by young persons aged 11-24 years with an injury secondary to assault or adversity. An analysis of these patients was undertaken to identify patterns in attendance to allow for future resource planning for Redthread. As Redthread workers do not provide a 24/7 in house service (the team covers 7am – 9pm on weekdays with some weekend cover) this analysis was undertaken to identify where efforts may be placed to ensure the most effective method of referral. The analysis was not intended to identify negative behaviours through missed referrals. It must also be acknowledged that not all of these young persons attending would be suitable for the Redthread YVIP and a young person can only be deemed appropriate after assessment by a Redthread worker.

Assault with a Sharp or Bladed Object

Those injured with a sharp or bladed object registered 234 attendances. 103 patients had attended between March 2018-19. March 2019-20 saw a 27% increase in assaults with a bladed object with 131 incidents presenting to the Emergency Department. Of the total 243 patients 65.8% (n=160) had been referred to the Redthread service. 64 of the 83 patients not referred to Redthread had been discharged directly from the Emergency Department. 61.4% (n=51) of these assaults had attended at a weekend and 84% (n=70) had attended between the hours of 1900 to 0700. Yearly comparison showed 27.8% (n=28/103) had not been referred in 2018/19 compared to 41.9% (n=55/131) in 2019/20.

Assault with Body Parts

There were 1263 attendances due to assault with body parts with 21% (n=266) of these being referred to the Redthread service. A total of 714 young persons had attended

between March 2018-19 and 549 had attended between March 2019-20 translating to a 23.2% reduction in cases. Among the 997 not referred 722 had isolated head injuries with 92.2% (n=666/722) being discharged directly from the Emergency Department. 52.3% (n=569) of the non-referrals had attended at a weekend and 76.8% (n=735) had attended between the hours of 1900 to 0700. For those not being referred 53.7% (n=536/997) had attended between March 2018-19 and 46.3% (n=461) had presented between March 2019-20.

Blow from a Blunt Object

There were 308 cases of assault or injury with a blunt object with 136 attending between March 2018-19 and 172 attending from March 2019-20 representing a 26% year on year increase. Among these 308 cases 31.4% (n=97) were referred to the YVIP. Those not referred had been discharged directly from the Emergency Department in 95.7% (n=202) of cases and 51.1% (n=108) had attended at a weekend. Only 9.9% (n=21) of these cases had attended between the hours of 0700-1900.

Injury from Gunshot

There were 12 gunshot injuries attending the Emergency Department during the two years since the introduction of the YVIP all of which were referred to Redthread. 5 of these patients had minor injuries and were discharged. One patient was admitted and required emergency surgery with a 10 day stay.

4.10.1. Trauma Audit and Research Network (TARN) Data

Data from TARN which is collected for the most severely injured trauma patients being admitted for inpatient care were analysed from March 2018 - March 2010. A total of 82 TARN eligible admissions due to assault experienced by a young person aged 11-24 who survived until discharge were reviewed. Of these 66% (n=54) had been referred to the Redthread YVIP. Here, 37 patients had been the victim of assault with penetrating trauma carrying a median ISS of 10 (IQR 9-18, range 5-35) and a median length of stay of 5 days (IQR 3-7.25, range 1-40). All but one of these cases of penetrating trauma involved a male victim with a mean age of 19 (SD 2.7). Those TARN eligible patients admitted for blunt trauma who were referred to Redthread had a male: female ratio of 17: 2. Blunt trauma carried a median ISS of 22 (IQR 8-26, range 4-50) with a median length of stay of 5 days (IQR 4-11.25, range 2-38).

Of the 28 TARN patients admitted due to assault who were not referred to Redthread 21 had attended in year 1 of the service with 7 in year 2. Mean age was 20 (SD 2.9) and a total of 46% (n=13) had been victims of penetrating assault with 54% due to blunt assaults. Among the 28 TARN eligible assaults not referred to Redthread the median ISS was 16.5 (IQR 9-25, range 4-38) and median length of stay was 6 days (IQR 3-10, range 2-33). There were a further 39 TARN patients aged 11-24 with injuries consistent with self-harm and high-risk behaviour (notably vehicle collisions). It was not possible to determine whether these patients would have been eligible for the Redthread YVIP with the information available on hospital records and therefore these patients were not included in this analysis.

5. DISCUSSION

5.1. Re-injury and Re-attendance

The key outcome measure for this report concerns the impact of the YVIP on re-attendance rates. There are several challenges when trying to address this outcome. Firstly, all data obtained was retrospective and therefore all analyses are subject to the accuracy of this. In addition, as this study involved analysis of data at a single site there may have been re-attendances at peripheral hospitals. However, to partially mitigate this, we have offered an analysis solely of Nottingham City/County residents. Events may also have occurred, such as minor assaults, where medical attention was not sought and subsequently not captured by this study. Therefore, the societal impact of the YVIP on youth violence may have been under reported. Indeed, only through direct patient contact and questioning might this be accurately measured. Nevertheless, this report does offer data on the impact of the YVIP on healthcare resource at the Queen's Medical Centre for young persons re-attending following violent injury or adversity. For this reason, we chose to report attendances according to the event rate of those who engage and do not engage with the YVIP as this offers the clearest estimation of impact on healthcare resource utilisation. An illustration of how the rate of attendance among a group of young persons has changed before and after the intervention of the YVIP allows readers to quantify this impact. The prior event rate ratio takes this analysis a step further by comparing this change in event rate before and after the YVIP between engagers and non-engagers with the YVIP offering a relative reduction in attendance rate. In a non-randomised study, as we have presented, this change in rate of attendances has been adjusted for confounding factors across both groups using the PERR.

Across all aspects of our analysis, it was apparent that those who chose to engage with the YVIP had higher rates of attendance prior to their index admission and referral to Redthread. In our primary analysis involving only those who were referred and eligible for

the YVIP the previous attendance rate had been nearly two and a half times higher for the group who chose to engage. Similarly for our analysis of physical assaults and violence only and for those with a Nottingham postcode this rate of prior attendances was also nearly double that of the non-engagers. Perhaps most notable was the hazard ratio for prior attendances among those presenting with a mental health or substance misuse concern. Here, rates of attendance were nearly four times higher in those who later engaged with the YVIP. For a minority of this subgroup, we found a recurrent and prolonged pattern of attendances among some individuals before their index attendance. This serves to highlight the cyclical character of substance misuse and recurrent mental health crises experienced by certain individuals. In some cases, we found individuals with up to 22 attendances prior to a Redthread referral. These findings suggest that recurrent previous admission may in fact be a catalyst for engagement with the YVIP. This links back to the notion of the 'teachable moment' where individuals are at their most vulnerable, in this case, due to repeated prior admissions.

The most striking observation found was the increase in further admissions for those choosing not to engage with the YVIP. Since their approach by Redthread this group saw their rates of attendance double (11.9 attendances per 100 patient years vs 20.3) in those who would have been eligible for the YVIP. In the case of the mental health and substance misuse subgroup the rate of re-attendances nearly tripled in non-engagers. This serves to illustrate the relapsing trends of youth violence in young persons who lack support for change.

Although injury severity scores were similar across both engagers and non-engagers, we did observe a higher proportion of individuals who had no attendances either pre- or post-referral. This may suggest that their index presentation was an isolated incident and the young person concerned may not feel that support from the YVIP is necessary.

The difference in outcome for those re-attending is also important to consider, particularly from a healthcare resource utilisation viewpoint. The non-engaged cohort had a higher incidence of surgical intervention on their repeat attendances. A higher proportion were also admitted (fully engaged n=5, non-engaged n=8) and ISS was also marginally higher in this group.

In all cases of our analysis, we observed a drop in attendances after engagement with the full YVIP. When we examined this decrease in isolation the largest reduction was seen in those engaging with the programme after a violent injury. Here, these individuals recorded around 28% fewer attendances (Table 4). It is important to mention that in both groups around 18% of individuals who engaged with the YVIP subsequently re-attended which falls just below the estimate of 22-44% in the literature (Snider, Kirst et al. 2010). However, the group who never engaged with the programme also recorded similar levels of re-attendance. Despite this it is important to place these findings in the context of a reduction from existing rate of attendance prior to engagement with the Redthread programme. In this case the engaged group recorded an important relative reduction of 49.8% in the proportion of individuals re-attending whereas within the non-engaged group there was no change at all. When we examined re-attendance event rates for all-comers a drop of around 15% was seen, yet in our Nottingham borough subgroup the decrease was only 8.4%. Likewise, in the mental health and substance misuse subgroup there was little change with only a 2% reduction. However, as previously noted, these standalone figures require comparison with the event rate of our non-engaged group to reduce and bias from residual confounding factors. By using the prior event rate ratio analysis to adjust for these confounders we have shown that the relative rate of re-attendances fell in the cohort who engaged with the YVIP. For eligible patients only and for all-comers this relative reduction was 51% and 61% respectively. For Nottingham borough residents a decrease of 54% was seen. When we isolated those attending with a violent injury only the relative reduction was higher, at 63%. Finally, for the mental health and substance misuse group we saw the

highest relative reduction at 66%. These findings demonstrate that although isolated reduction rates in attendance were modest for those who engage with the full YVIP the relative reduction was over 50% in all cases compared to the non-engaged cohort.

5.2. The Referral Pathway

Year-on-year we observed a reduction in referrals since the YVIP was introduced despite the increase in incidence of violent injury secondary to stabbing or blunt objects. There may be several factors contributing to this. Firstly, as the Redthread service has evolved in Nottingham there has been an increased awareness of who may benefit from the YVIP. This is reflected in a reduction in referrals for young persons not needing the service after youth worker assessment and an increase in the completeness of contact details (Figure 6). Fewer referrals in year 2 may also be due to the fact that a higher proportion of recurrent attenders are already engaged with the YVIP therefore reducing the incidence of new referrals. An increased understanding of eligibility among clinical staff might also explain the significant reduction in ineligible referrals for year 2 of the service.

Attendance figures were subject to the expected ‘weekend effect’ which mirrored existing data from the Emergency Department. The distribution of reasons for attendance showed little variation from weekday to weekend with assaults posing the majority of the workload. Interestingly, attendances peaked in the late afternoon rather than out of hours suggesting that injury linked to the night-time economy may be less of a dominant factor. This is important to consider when interpreting the analysis of the referral pathway.

It is evident from both univariable and multivariable analysis that there are important factors predicting the odds of success when referring a young person to the YVIP. Face-to-face contact with a young person offered odds of full engagement that were 5-fold higher when compared to a phone call, text message or letter. Approaching a young person more than 24 hours after attendance also reduced the odds of full engagement by 60% on univariable

analysis but this effect was lost when adjusted for other factors in our multivariable model. Another significant predictor for full engagement was day of attendance. Those attending at a weekend had a quarter of the odds of engagement when compared to weekday attenders. This factor remained significant in our multivariable model. One explanation may be a lack of opportunity for face-to-face discussion with a young person at a weekend and the idea of a 'teachable moment' may be lost in this case. Further evidence is provided via the impact of discharge outcome on odds of engagement. When analysed independently those who were discharged directly from ED had less than half the odds of engagement with the YVIP compared to those who were admitted. However, in our multivariable model the significance of this factor was lost. Finally, multiple referrals appeared to significantly impact the odds of engagement with those who had been referred on more than one occasion seeing engagement increase nearly 3-fold. This emphasises the importance of continuing to offer support to young persons who recurrently attend the emergency department. Encouragingly, it shows that decisions towards engagement can change over time for a young person. This important message should be transmitted to those referring to the YVIP who may otherwise see a previous lack of engagement with the YVIP as a lasting barrier to support from Redthread.

Across our analysis of demographic factors affecting odds of engagement it was surprising to conclude that none of the variables analysed in our multivariable model affected chance of engagement. This analysis was subject to considerable missing data, particularly relating to ethnicity, which may have impacted the generalisability of results. However, even on univariable analysis only age showed a significant association with engagement where we saw the 16–20-year-old group demonstrating reduced odd of programme participation. Indeed, none of the other demographic factors including gender, ethnicity and social deprivation score proved to be influential factors. Further analysis with a larger sample size, perhaps collating nationwide data from Redthread may offer a more definitive conclusion. This sample size effect is particularly evident in the analysis of referral factors which

presented large confidence intervals for both adjusted and unadjusted odds ratios. However, the wide variation in demographic data and reasons for referral is perhaps testament to the adaptability of Redthread youth workers when supporting young persons. A lack of variance in odds of engagement between young persons with potentially different social and cultural characteristics may in fact be a positive reflection of this.

5.3. Location of Assault

Through our mapping of location data, we have demonstrated some important findings for injury prevention and targeted interventions which could be relevant to the wider community. There was a strong association with city centres both in Nottingham and its neighbouring cities of Leicester and Derby. Within Nottingham city and its suburbs there was also a higher incidence of events in the north-east around its more deprived areas such as St Ann's, Radford, and The Meadows all with indices of multiple deprivation in the lowest 20% deciles (HM Government 2019.) Clifton, as a more isolated hotspot, in fact saw the highest incidence of assaults of all the surrounding suburbs suggesting that there may be benefits to directing more targeted support to tackle youth violence in this area.

The home location data for young persons also offers important insights to allow more localised support to the communities. These actions may fall outside of the remit of Redthread workers, but they might allow collaborative action if shared with other organisations. Again, we have observed clustering around the most deprived suburbs of Nottingham particularly around the areas of Broxtowe, Aspley and Bestwood. Unlike data on location of assaults there was almost a complete dataset available for the home locality of our cohort which adds to the strength of our findings.

Finally, the night-time economy mapping demonstrated a strong association between violent incidents and Nottingham's busiest nightclubs and pubs. Although the ultimate aim of the Redthread programme is to prevent further violence due to the findings in this report

we would advocate that these institutions are offered enhanced support with initiatives such as the ‘Stop the Bleed’ course (American College of Surgeons 2020) to allow for effective first-aid management of violent injuries should these occur.

5.4. Summary

This study has reviewed a cohort of 573 young persons referred to the Redthread service at the East Midlands Major Trauma Centre located at the Queen's Medical Centre in Nottingham. We analysed the case notes of 164 young persons who engaged with the full programme and found that among all young persons who engage with the YVIP a reduction in the proportion of young persons re-attending due to violence and assault was 28% with and a relative risk reduction of between 50-60% when compared those who do not engage with the YVIP. Among the 123 individuals who received crisis support only a relative reduction of 22.3% in attendances was seen. Factors significantly increasing the odds of full YVIP engagement included a face-to-face approach with the young person, recurrent referrals, and a weekday attendance. Violent assault disproportionately involved white British males but apart from age we did not identify any patient demographic or assault related factors that influenced chances of engagement. Information gained from mapping the home and incident locations of victims of assaults highlighted clustering around Nottingham city centre and its most deprived suburbs. Data obtained from TARN for the most severely injured patients has demonstrated that the number of young persons not referred by staff to the YVIP reduced by 67% (year 1 n=21, year 2 n=7) suggesting that awareness of the YVIP had improved. We would urge all clinical staff to consider a referral to Redthread if they are presented with a young person attending Queen's Medical Centre due to an injury, risk of harm or exploitation, even in individuals with no previous history of attendance. An early, face to face approach should be encouraged wherever possible for the best chance of engagement.

References

Bell, T. M., D. Gilyan, B. A. Moore, J. Martin, B. Ogbemudia, B. E. McLaughlin, R. Moore, C. J. Simons and B. L. Zarzaur (2018). "Long-term evaluation of a hospital-based violence intervention program using a regional health information exchange." J Trauma Acute Care Surg **84**(1): 175-182.

Bellis, H., Perkins, Bennet (2012). Protecting People Promoting health.

Chong, V. E., R. Smith, A. Garcia, W. S. Lee, L. Ashley, A. Marks, T. H. Liu and G. P. Victorino (2015). "Hospital-centered violence intervention programs: a cost-effectiveness analysis." Am J Surg **209**(4): 597-603.

Cooper, C., D. M. Eslinger and P. D. Stolley (2006). "Hospital-based violence intervention programs work." J Trauma **61**(3): 534-537; discussion 537-540.

Cunningham, R. M., P. M. Carter, M. Ranney, M. A. Zimmerman, F. C. Blow, B. M. Booth, J. Goldstick and M. A. Walton (2015). "Violent reinjury and mortality among youth seeking emergency department care for assault-related injury: a 2-year prospective cohort study." JAMA pediatrics **169**(1): 63-70.

Demark-Wahnefried, W., N. M. Aziz, J. H. Rowland and B. M. Pinto (2005). "Riding the crest of the teachable moment: promoting long-term health after the diagnosis of cancer." Journal of clinical oncology : official journal of the American Society of Clinical Oncology **23**(24): 5814-5830.

Dobash, R. P., R. Emerson Dobash, K. Cavanagh, D. Smith and J. Medina-Ariza (2007). "Onset of Offending and Life Course Among Men Convicted of Murder." Homicide Studies **11**(4): 243-271.

Flocke, S. A., E. Clark, E. Antognoli, M. J. Mason, P. J. Lawson, S. Smith and D. J. Cohen (2014). "Teachable moments for health behavior change and intermediate patient outcomes." Patient Educ Couns **96**(1): 43-49.

Glover Williams, A. and F. Finlay (2019). "County lines: how gang crime is affecting our young people." Archives of Disease in Childhood **104**(8): 730.

Heeks, M. R., S; Tafsiri, M; Prince, M (2018). The economic and social costs of Crime Second edition. H. Office.

Hughes, K., M. A. Bellis, K. A. Hardcastle, D. Sethi, A. Butchart, C. Mikton, L. Jones and M. P. Dunne (2017). "The effect of multiple adverse childhood experiences on health: a systematic review and meta-analysis." The Lancet Public Health **2**(8): e356-e366.

Janz, N. K. and M. H. Becker (1984). "The Health Belief Model: A Decade Later." Health Education Quarterly **11**(1): 1-47.

Lawson, P. J. and S. A. Flocke (2009). "Teachable moments for health behavior change: a concept analysis." Patient Educ Couns **76**(1): 25-30.

Loeber, R. and D. P. Farrington (2000). "Young children who commit crime: Epidemiology, developmental origins, risk factors, early interventions, and policy implications." Development and Psychopathology **12**(4): 737-762.

Matjasko, J. L., A. M. Vivolo-Kantor, G. M. Massetti, K. M. Holland, M. K. Holt and J. D. Cruz (2012). "A systematic meta-review of evaluations of youth violence prevention programs: Common and divergent findings from 25 years of meta-analyses and systematic reviews." Aggression and violent behavior **17**(6): 540-552.

McBride, C. M. and J. S. Ostroff (2003). "Teachable moments for promoting smoking cessation: the context of cancer care and survivorship." Cancer Control **10**(4): 325-333.

Prochaska, J. O. and C. C. DiClemente (1983). "Stages and processes of self-change of smoking: Toward an integrative model of change." Journal of Consulting and Clinical Psychology **51**(3): 390-395.

Riley, P. e. a. (2020). Cost Benefit Analysis of the Redthread YVIP.

Rosenstock, I. M. (1974). "Historical Origins of the Health Belief Model." Health Education Monographs **2**(4): 328-335.

Sharp, A. L., L. A. Prosser, M. Walton, F. C. Blow, S. T. Chermack, M. A. Zimmerman and R. Cunningham (2014). "Cost analysis of youth violence prevention." Pediatrics **133**(3): 448-453.

Snider, C., D. Jiang, S. Logsetty, T. Strome and T. Klassen (2015). "Wraparound care for youth injured by violence: study protocol for a pilot randomised control trial." BMJ Open **5**(5): e008088.

Snider, C. E., M. Kirst, S. Abubakar, F. Ahmad and A. B. Nathens (2010). "Community-based Participatory Research: Development of an Emergency Department–based Youth Violence Intervention Using Concept Mapping." Academic Emergency Medicine **17**(8): 877-885.

Strong, B. L., A. G. Shipper, K. D. Downton and W. G. Lane (2016). "The effects of health care-based violence intervention programs on injury recidivism and costs: A systematic review." J Trauma Acute Care Surg **81**(5): 961-970.

Wortley, E. and A. Hagell (2020). "Young victims of youth violence: using youth workers in the emergency department to facilitate 'teachable moments' and to improve access to services." Archives of disease in childhood - Education & practice edition: edpract-2019-318251.

APPENDICES

Study Protocol

Evaluation of the Redthread Youth Violence Intervention Programme in Acute Hospitals: An Analysis of Impact on Re-injury and Re-attendance Rates

Short title: Evaluation of Redthread Youth Violence Intervention Programme

Protocol version 1.0 – 1st April 2020

This protocol has been designed to ensure regard for the HRA guidance

FULL / LONG TITLE OF THE STUDY

Evaluation of the Redthread Youth Violence Intervention Programme: An Analysis of Impact on Re-injury, Re-attendance Rates

SHORT STUDY TITLE / ACRONYM

Evaluation of Redthread Youth Violence Intervention Programme

PROTOCOL VERSION NUMBER AND DATE

Protocol draft version 1.0 1st April 2020

RESEARCH REFERENCE NUMBERS

IRAS Number:	277604
SPONSORS Number:	20TR001
FUNDERS Number:	Not applicable

OTHER RESEARCH REFERENCE NUMBERS

SPONSOR: **Nottingham University Hospitals**

SIGNATURE PAGE

The undersigned confirm that the following protocol has been agreed and accepted and that the Chief Investigator agrees to conduct the study in compliance with the approved protocol and will adhere to the principles outlined in the Declaration of Helsinki, the Sponsor's SOPs, and other regulatory requirement.

I agree to ensure that the confidential information contained in this document will not be used for any other purpose other than the evaluation or conduct of the investigation without the prior written consent of the Sponsor

I also confirm that I will make the findings of the study publicly available through publication or other dissemination tools without any unnecessary delay and that an honest accurate and transparent account of the study will be given; and that any discrepancies from the study as planned in this protocol will be explained.

For and on behalf of the Study Sponsor:

Signature: Date:

..../...../.....

Name (please print):

.....

Position:

.....

Chief Investigator:

Signature: Date:

..../...../.....

Name: (please print):

.....

KEY STUDY CONTACTS

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Sponsor	Nottingham University Hospitals Research & Innovation Derby Road Nottingham NG7 2UH researchsponsor@nuh.nhs.uk
Joint sponsor(s)/co-sponsor(s)	Not applicable
Funder(s)	Health Foundation grant awarded to Redthread for evaluation of their Youth Violence Intervention Programme
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ABBREVIATIONS

CI	Chief Investigator
CRF	Case Report Form
DMC	Data Monitoring Committee
GCP	Good Clinical Practice
ISF	Investigator Site File
ISRCTN	International Standard Registered Clinical Study Number
NHS R&D	National Health Service Research and Development
PI	Principal Investigator
REC	Research Ethics Committee
SDV	Source Data Validation
SOP	Standard Operating Procedure
TMG	Trial Management Group
TSC	Trial Steering Committee
TMF	Trial Master File
TARN	Trauma Audit and Research Network
YVIP	Youth Violence Intervention Programme

STUDY SUMMARY

Study Title	Evaluation of the Redthread Youth Violence Intervention Programme: An Analysis of Impact on Re-injury and Re-attendance Rates
Internal ref. no. (or short title)	Evaluation of Redthread YVIP
Study Design	Retrospective cohort study
Study Participants	Patients who meet the criteria for the Redthread Youth Violence Intervention Programme (YVIP) - Young persons aged 11-24 attending for treatment at the East Midlands Major Trauma Centre and University Hospitals Birmingham with a violence or exploitation related injury
Planned Size of Sample (if applicable)	All patients who meet the criteria for the Redthread YVIP who have attended the East Midlands Major Trauma Centre and University Hospitals Birmingham
Follow up duration (if applicable)	Not applicable
Planned Study Period	10 months
Primary Research Question/Aim(s)	Has the Redthread YVIP reduced re-injury and re-attendance to hospital among 11–24-year-olds?
Secondary Research Question/Aim(s)	Do patients who fail to engage with the Redthread YVIP experience higher rates of violent re-injury An evaluation of patient engagement in longitudinal follow up for the Redthread YVIP An evaluation in change of patient risk score among patients who engage with the Redthread YVIP A comparison of characteristics held by patients who do and do not engage with the Redthread YVIP An analysis of the current referral pathway. Are all eligible patients being referred?

FUNDING AND SUPPORT IN KIND

FUNDER(S) (Names and contact details of ALL organisations providing funding and/or support in kind for this study)	**FINANCIAL AND NON FINANCIALSUPPORT GIVEN**
Health Foundation grant awarded to Redthread for operational and evaluation activities Redthread 3rd Floor, 158 Buckingham Palace Road London SW1W 9TR info@Redthread.org.uk The Health Foundation info@health.org.uk	Funds provided to Nottingham University Hospitals by Redthread to support this evaluation project £40,466.12

ROLE OF STUDY SPONSOR AND FUNDER

Nottingham University Hospitals is the sponsor of this study and assumes overall responsibility for the initiation, and management of the study.

Funding for the study has been provided by Redthread. Redthread was awarded funds by the Health Foundation to embed its youth work team and Youth Violence Intervention Programme in hospitals. Part of this funding includes a requirement for a research evaluation which this protocol aims to address.

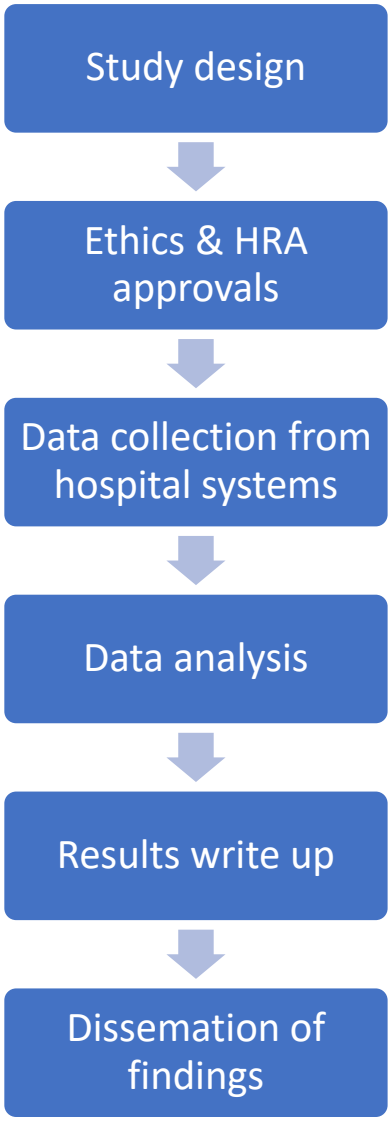
Protocol contributors

The study design, conduct, data analysis and interpretation, manuscript writing, and result dissemination will be the responsibility of the research team, overseen by the sponsor.

The protocol will be reviewed by Redthread prior to ethics submission but they will not be involved in the study conduct, data analysis or interpretation.

KEY WORDS: Youth violence, Redthread, major trauma, stabbing, teachable moment, young people, violence

STUDY FLOW CHART



STUDY PROTOCOL

Evaluation of the Redthread Youth Violence Intervention Programme: An Analysis of Impact on Re-injury and Re-attendance Rates

1. BACKGROUND

Redthread's Youth Violence Intervention Programme (YVIP) has been implemented in several Major Trauma Centres across the United Kingdom. This programme aims to reduce youth violence by meeting with young people in hospital, following a violent experience such as an assault, stabbing or sexual exploitation. Redthread youth workers are embedded within emergency departments and aim to meet with these young people in their time of vulnerability following a violent experience, during what is known as the 'Teachable Moment', an opportunity for behaviour change (Flocke et al, 2014). In this 'Teachable Moment', it is believed that young people are more receptive to working with youth workers to make positive choices and changes in their lives to avoid violence and re-injury (Lawson & Flocke, 2009). As part of the Redthread YVIP, youth workers engage with young people in emergency departments post-injury and offer tailored support with the goal of moving the young person away from current and future violence and exploitation. Research has suggested that young people who have been involved in violence might have trust issues with those perceived to be in positions of power, such as doctors, (Snider et al, 2015) and therefore Redthread youth workers are in a valuable and well-placed position to work with young people towards positive change.

It is known that violent incidents and the effects of violence result in substantial costs for healthcare systems (Bellis et al 2012), therefore a programme that reduces youth violence may be an extremely valuable tool for both individuals' health and wellbeing, and also for healthcare services and society. Sharp et al (2013) suggested that reducing violence may have a further cost-saving for related healthcare services such as drug use interventions, and also reduce criminal justice costs, thus any associated reduction on these services is economically beneficial.

Studies have shown that violence intervention programmes can decrease violent injury recidivism (Chong et al 2015) however it is not known if Redthread's specific programme of work based within emergency departments produces similar outcomes. Limited data has shown that US-based hospital violence intervention programmes have a positive impact on recidivism rates (Bell et al 2018); patients who took part in an intervention programme in Bell et al's study (2018) had reduced recidivism rates and injuries post-intervention were less

severe than the initial injury. There is a dearth of research looking at UK-based hospital youth violence intervention programmes, and this project will add to the evidence-base for such a service to be embedded within emergency departments in the United Kingdom.

Initially based in London, Redthread has now widened its service to other Major Trauma Centres in other areas of the UK including Nottingham University Hospitals and University Hospitals Birmingham. Studies have demonstrated that young people who attend an emergency department after a violent injury are high risk for a further injury (Cunningham et al 2015). We want to evaluate the impact of this service and demonstrate whether the presence of the YVIP in emergency departments reduces rates of re-injury and re-attendance in young people, reducing disability and saving lives, and therefore producing a long-term cost-saving to the NHS.

2. RATIONALE

As a charitable organisation, Redthread seeks funding in order to be able to provide and run their YVIP in emergency departments. There is currently little data demonstrating that the presence of this service in hospitals reduces rates of re-injury and re-attendance.

The aim of this research is to review hospital data to evaluate the impact of the Redthread YVIP; it is expected to show that young people who choose to engage with Redthread youth workers and the service are less likely to be involved in violence in the future, and therefore have lower rates of re-injury and re-attendance in emergency departments than those young people who decline to engage with YVIP.

An understanding of the characteristics held by patients who do and do not engage with the Redthread YVIP will help build strategies to improve the service and widen access among patients. An evaluation of the patient follow up undertaken by Redthread will also aim to improve retainment among patients and service users in the future.

3. THEORETICAL FRAMEWORK

The YVIP is considered to be part of standard care at the hospitals involved in this research, and patients are free to choose to engage with the service or not.

This research will be a retrospective analysis of existing data only. There will be no randomisation of young people to intervention (YVIP) or no intervention (no engagement with YVIP) as this would be considered unethical. All data collected will be anonymised.

4. RESEARCH QUESTION / AIM(S)

4.1 OBJECTIVES

This study will evaluate whether the Redthread service has an impact on young people attending hospital as a result of violent injury or exploitation, and if the YVIP can affect rates of re-injury and re-attendance in hospitals.

This research will also be able to provide data on uptake rates of the YVIP with young people who are eligible to engage with it and the effectiveness of the current structure of the programme

4.2 PRIMARY OBJECTIVE

Does engagement with the Redthread Youth Violence Intervention Programme reduce 1 year re-injury and re-attendance rates in the Emergency Department at Nottingham University Hospitals and University Hospitals Birmingham?

4.3 SECONDARY OBJECTIVES

- Does engagement with the Redthread Youth Violence Intervention Programme reduce re-injury and re-attendance rates for up to 2 years?
- How do re-injury & re-attendance rates to the Emergency Department since the introduction of Redthread YVIP compare to the 2 years prior to introduction?
- Do patients who fail to engage with the Redthread YVIP experience higher rates of violent re-injury?
- An evaluation of patient engagement in longitudinal follow up for the Redthread YVIP?
- Do the characteristics held by patients who engage with the Redthread YVIP differ from those who do not?
- Do patients who engage in the Redthread YVIP undergo a reduction in their patient risk scores?
- An analysis of the current Redthread referral pathway to determine whether all eligible patients are being referred.

4.4 OUTCOME

If it is demonstrated that young people who engage with the Redthread YVIP have reduced rates of injury and re-attendance in emergency departments, this will provide supporting

evidence to continue funding this service and to introduce it in additional hospitals across the UK.

5. STUDY DESIGN, METHODS OF DATA COLLECTION AND ANALYSIS

A retrospective analysis of hospital electronic records will be undertaken. Data will also be verified and validated alongside data held in the Trauma Audit and Research Network (TARN). An access request will be submitted to TARN as is standard practice to access this national anonymised data. All patients eligible for the Redthread Youth Intervention Programme since the service was established at Nottingham University Hospitals and University Hospitals Birmingham will be analysed in conjunction with data held on the Redthread user database. The Redthread youth worker service is considered to be part of the hospital standard care, and a data sharing agreement is in place between the hospital and Redthread. Participants will not be contacted to provide additional information to support the study outcomes and only existing data will be used. Data will be collected by the clinical team and all patient identifiable information will be anonymised at the earliest opportunity. Data will be stored on an electronic database which will be password protected and accessible only by the direct members of the clinical team involved in data collection and the research team involved in data analysis.

Groups who do engage with the Redthread YVIP will be analysed for events of re-injury and re-attendance at the Emergency Department. This data will be compared to re-injury and re-attendance rates among those who decline or do not engage with the programme. In addition, re-attendance and re-injury rates for both engagers and non-engagers will be analysed for the 2 years prior to the YVIP. Further, the patient characteristics of engagers and non-engagers will be compared to identify factors that correlate with engagement in the intervention programme. These characteristics will include patient demographics, social deprivation scores, type of injury, injury location and history of prior injury or exploitation. Paired risk scores before and after engagement with the programme will also be compared. Factors affecting dropout from the follow up period will be identified and characterised to identify patterns in longitudinal user engagement.

It is recognised that individuals who fail to engage with Redthread may differ in their characteristics to those who do engage with the service. We will use prior event rate ratio adjustment analysis to compare these groups and reduce confounding bias.

To understand how effective the current referral pathway is we will identify all patients who would potentially meet the Redthread criteria from Emergency Department attendance rates

in Nottingham and Birmingham. Any patterns of non-referral or missed referrals will be identified to help improve the current pathway.

All data will be collected from NHS electronic records in accordance with local information governance regulations. Any data transferred from University Hospitals Birmingham and Nottingham (host centre) will be anonymised prior to transfer. All data transfer will be undertaken via the secure nhs.net email system using password protected databases. Existing data held by Redthread relating to their patients according to the data sharing agreement with the NHS will be analysed to inform the outcome measures of the study. Additional data will be requested from TARN to validate data supplied by NHS electronic records on the most severely injured patients.

5.1 STATISTICS

Numbers and percentages will be presented for categorical data, with mean and standard deviations for normally distributed continuous data, and median and inter-quartile ranges for skewed data. A comparison of patients who did and did not engage with the Redthread YVIP will be performed using the Pearson chi-square test for categorical variables and using the Mann-Whitney U test for continuous variables. Re-injury requiring re-attendance will be defined as any physical harm secondary to violence or exploitation requiring attendance at the Emergency Department at the two study centres (Nottingham and Birmingham) after a prior attendance, regardless of severity or duration of attendance.

The prior event rate ratio (PERR) adjustment method will be used compare re-injury and re-attendance rates among those who do and do not engage with the Redthread YVIP. This analysis offers a means of reducing the bias that results from residual confounding. The PERR relies on the fact that individuals in both the engaged and non-engaged groups were not exposed to the YVIP before the index date – that is the date Redthread was introduced at each centre. Consequently, assumptions are made that the differences in outcomes between engagers and non-engagers before being approached by Redthread reflect the combined effect of confounders independently of any effect of the YVIP. The PERR is estimated by the ratio of two unadjusted hazard ratios: the unadjusted hazard ratio for re-injury/re-attendance during the time since Redthread was introduced for the engaged group vs the non-engaged group (HR.post) and the unadjusted hazard ratio for re-injury/ re-attendance before Redthread was introduced for the engaged group vs non-engaged group (HR.prior)—prior event rate ratio adjusted hazard ratio=HR.post/HR.prior. Therefore, the

prior event rate ratio provides an estimate of the effect the Redthread YVIP had on the hazard ratio adjusted for confounding.

In addition, Cox proportional hazards modelling will be used to estimate hazard ratios for re-injury and re-attendance in young persons who engage with the Redthread YVIP, adjusted for potential confounders. Confounders will be included in the model if they modify the hazard ratio by more than 10%.

5.2 STUDY SETTING

Data will be collected from Nottingham University Hospitals and University Hospitals Birmingham via electronic case note review in addition to data individual on service users held by the Redthread team and the TARN database.

There will be no direct contact with patients in relation to this research project. All data from the Birmingham site collected as part of the study will be anonymised at the earliest opportunity prior to secure transfer to the host site at Nottingham University Hospitals.

6. SAMPLE RECRUITMENT

Young people who are eligible to use the Redthread YVIP (11-24 years of age, attending emergency department as a victim of an assault, stabbing, gun crime, sexual assault or domestic violence).

6.1 SAMPLING

All young people who meet the above criteria and who are approached by Redthread will be included in the study.

6.2 SIZE OF SAMPLE

As this is a retrospective study the sample size will not be predefined but will comprise of all patients who fit the eligibility criteria for Redthread.

6.3 SAMPLING TECHNIQUE

Data collected for all patients will be undertaken from hospital data systems and Redthread databases.

6.4 RECRUITMENT

Data will be collected from hospital systems and databases on patients that meet the Redthread YVIP eligibility criteria. Patients will not directly be approached to consent for this. Data will be collected by a researcher who is also member of the clinical team usually seeing these patients. All patient identifiable information will be anonymised at the earliest opportunity. The Emergency Department data analysis team will provide historical re-attendance rates prior to the introduction of Redthread as outlined in the study outcome measures.

The main research team will be based at Nottingham University Hospitals. Birmingham data will be sent to the team in Nottingham to be included in the main analysis. This data will be anonymised before being shared with Nottingham researchers as described in Section 5.

6.5 SAMPLE IDENTIFICATION

Patients who meet the Redthread YVIP eligibility criteria during the two years since the service was introduced will be included in the data analysis; their data will be extracted from hospital systems for inclusion in this study and the TARN database where applicable. The Redthread team hold a data sharing agreement with Nottingham University Hospitals and University Hospitals Birmingham. Their anonymised data held on service users will be analysed to inform the secondary outcome measures of the study.

A researcher that is also a clinician who would see these patients as part of clinical care will be responsible for reviewing and analysing the data.

6.6 CONSENT

This research project will be an analysis of existing hospital data that was collected as part of standard patient care alongside anonymised data held on the national TARN database. Due to the sensitive nature of the patient data, it has been decided that it would be inappropriate to retrospectively request consent from each patient who has been

approached by Redthread youth workers or was eligible to be involved in the YVIP. Additionally, contacting all patients who have been involved in youth violence post-discharge may not be possible and previous data has shown this to be an unreliable method of data collection.

Considering the researchers will be employed by the hospital and would normally see this patient data in their day-to-day role, there is little risk involved in reviewing the patient data. It will be ensured that the rights and privacy of the patients will be protected; patient data will be anonymised after it is collected, and no patient will be identifiable to those outside of the direct care team.

7. ETHICAL AND REGULATORY CONSIDERATIONS

There is minimal risk to patients in this study as it is a retrospective analysis of patient data already held in the hospital system. All data is confidential and will only be accessed by the Major Trauma team who would already have access to this data as part of standard clinical care. We believe this data analysis will provide valuable insight into the effect of the Redthread YVIP in Major Trauma Centres in the UK and provide evidence towards the long-term uptake of this service in hospitals.

This protocol will be in line with the Data Protection Act 2018 and the General Data Protection Guideline Regulation 2018 by ensuring rights of individual patients are protected.

7.1 ASSESSMENT AND MANAGEMENT OF RISK

Due to the retrospective design of the study, there will be little risk to patients. Patient data used for the study will come from existing hospital databases and will be reviewed and collected by members of staff who would normally have access to patient data from this group of patients.

No identifiable data will be shared with persons outside of the clinical care team. The data will be stored safely and securely on hospital computers in password protected files. All anonymised data transfer from Birmingham to Nottingham will be via the secure NHS.net network.

8. RESEARCH ETHICS COMMITTEE (REC) REVIEW & REPORTS

Prior to any study activity starting, approval will be gained from a Research Ethics Committee (REC) who will review and approval all study documents. Any amendments throughout the duration of the study will also be sent to the REC for review and approval.

All correspondence from the REC will be retained in the study site file.

It will be the responsibility of the Chief Investigator to produce annual reports as required, and to notify the REC at the end of the study.

8.1 PEER REVIEW

Staff from the Redthread team and their stakeholders will review the protocol prior to submission to the NHS ethics committee.

8.2 REGULATORY COMPLIANCE

HRA approval will be requested by the Principal Investigator. No study activity will commence until this approval has been granted.

Any sites involved in the study will be required to provide confirmation of capacity and capability to conduct the study, as per the HRA approval letter.

8.3 PROTOCOL COMPLIANCE

Any protocol deviations will be documented and reported to the Chief Investigator and sponsor immediately. Recurrent deviations will be reported, and appropriate action taken. Any protocol violations will be reported to the REC as required. The Investigators will ensure that this study is conducted in full conformity with relevant regulations and with the ICH Guidelines for Good Clinical Practice (CPMP/ICH/135/95) July 1996.

8.4 AMENDMENTS

The Principal Investigator will ensure the study is conducted according to the approved protocol. If any amendments are required, the PI will inform the sponsor.

Any amendments to the protocol will be categorised by the sponsor of the study as substantial or non-substantial. All substantial amendments will be re-submitted to the REC

and HRA for review and approval. Non-substantial amendments will also be sent to the HRA for approval. It will be the responsibility of the PI to submit any amendments for approval.

All amendments will be recorded in a version control log which will be stored in the site file. Previous versions will be superseded as required.

8.5 ADVERSE EVENTS

As this study is retrospective data analysis, no adverse events are anticipated. Therefore, there will be no requirement to record AEs or report to the sponsor.

8.6 DATA PROTECTION AND PATIENT CONFIDENTIALITY

This study will be compliant with the requirements of the General Data Regulation 2018. Investigators and research staff will comply with these regulations in relation to collection, storage, processing and disclosure of personal information, and will uphold the core principals of GDPR 2018.

Patient identifiable data will be collected from hospitals systems and will be stored in a password protected files in a secure hospital computer, only accessible by a staff logon, and according to local information governance policy. These files will only be accessible by those directly working on the research project. The researchers collecting this data would usually have access to this patient data.

No personal information will be transferred to the sponsor or funder.

Any paper records will be kept securely in a locked office on the hospital campus.

After completion of the study, the data and study documents will be archived according to local policy and stored for 5 years. The Chief Investigator will be the Data Custodian of the study.

No patients will be able to be identified in any resulting publication of the study. Patient data collected from Birmingham will be anonymised and will not be identifiable to the main research site (Nottingham University Hospitals).

9. INDEMNITY

As Nottingham University Hospitals NHS Trust is acting as sponsor for this study, NHS indemnity applies. NHS bodies are legally liable for the negligent acts and omissions of their employees. Non-negligent harm is not covered by the NHS indemnity scheme. The Nottingham University Hospitals NHS Trust, therefore, cannot agree in advance to pay compensation in these circumstances. In exceptional circumstances an ex-gratia payment may be offered.

9.1 ACCESS TO THE FINAL STUDY DATASET

The Chief and Principal Investigators, as well as the research team, will have access to the final dataset.

9.2 DISSEMINATION POLICY

The study sponsor will own the data arising from the study. A Final Study Report will be generated once the study is completed. The Investigators will have the right to publish or present the findings of the study. Any results will be published following peer-review and the paper will be approved by all the investigators prior to submission for publication. Any publication will adhere to the NUH publication policy. At the end of the study a final report will be issued to the sponsor and relevant authorities including the REC. All published results will be in fully anonymised form with no patient identifiable information included.

9.3 AUTHORSHIP ELIGIBILITY GUIDELINES AND ANY INTENDED USE OF PROFESSIONAL WRITERS

Authorship of the final study report is the responsibility of the study team.

10. REFERENCES

Bell T.M., Gilyan, D., Moore, B.A., Martin, J., Ogbemudia, B., McLaughlin, B.E., Moore, R., Simons, C.J. & Zarzaur, B.L. (2018) Long-term evaluation of a hospital-based violence intervention program using a Regional Health Information Exchange *J Trauma Acute Surg* 84 (1) 175-182

Bellis, M.A, Hughes, K., Perkins, C. & Bennett, A. (2012) Protecting People Promoting Health. A Public health approach to violence prevention for England. North West Public Health Observatory at the Centre for Public Health, Liverpool John Moores University

Chong, V. E., Smith, R., Garcia, A., Lee W. S., Ashley, L., Marks, A., Liu, T. H, & Victorino, G.P. (2015) Hospital-centred violence intervention programs: a cost-effectiveness analysis. *The American Journal of Surgery* 209, 597-603

Cunningham, R.M., Carter, P.M., Ranney, M., Zimmerman, M.A., Blow, F.C., Booth, B.M., Goldstick, J. & Walton M.A. (2015) Violent re-injury and mortality among youth seeking emergency department care for assault-related injury: A 2-year prospective cohort study. *JAMA Pediatr.* 169 (1) 63-70

Flocke, S.A., Clark, E., Antognoli, E., Mason, M.J. Lawson, P.J., Smith, S. & Cohen, D.J. (2014) Teachable moments for health behaviour change and intermediate patient outcomes *Patient Educ Couns* 96 (1) 43-49

Lawson, P.J. & Flocke, S.A. (2009) Teachable moments for health behaviour change: a concept analysis *Patient Educ Couns* 76 (1) 25-30

Sharp, A.L., Prosser, L.A., Walton, M., Blow, F.C., Chermack, S.T., Zimmerman, M.A. & Cunningham, R. (2013) Cost analysis of youth violence prevention *Paediatrics* 133 (4) 448-453

Snider, C., Jiang, D., Logsetty, S., Strome, T. & Klassen, T. (2015) Wraparound care for youth injured by violence: study protocol for a pilot randomised control trial *BMJ Open* 5 (5)