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Every year, more children and youths are sent to Secure Children’s Homes while moving through the criminal justice system. Aggressive and violent incidents in these settings are common, and staff are often required to intervene and restrain violent individuals. The research literature has many examples of aggression and violence questionnaires and measures; however, for staff in communal areas it is the observable behaviours that they react to most. The current research, therefore, analysed observable behaviours leading-up to violent episodes, and used Behaviour Sequence Analysis to highlight the typical chains of behaviours that tend towards violence. The outcomes of this research show pathways to violence that staff can use to highlight potential spirals of aggression and violence. The current results show the links between non-confrontational behaviours (e.g., talking) through to more confrontational (staring, approaching, and pushing others). Overall, the research forms the foundation for future investigation into these and similar settings and outlines a novel approach to understanding violence escalation in a way that can be interpreted and used by service staff.

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Behaviour Sequence Analysis of Violent Episodes in Forensic Youth Homes

Every year, youths who have broken the law are sent to Secure Children’s Homes (SCH), akin to adult prisons. While these homes are meant as a safe place for youths to be placed while working through the criminal justice system, the individuals within these homes may have suffered a number of traumatic life events and not have developed coping skills that overcome frustration and aggression (Eltink et al., 2018; Van den Tillaart, Eltink, Stams, Van der Helm, & Wissink, 2018). A large proportion of children within SCH settings have a history of violence, with many having directly acted violently towards SCH staff members (Browne, Falshaw, & Hamilton, 1995). As such, violent outbursts and episodes are relatively common and place a further strain on an already overworked and understaffed system. Although the United Kingdom Department of Health has provided guidance and protocols on the use of physical restraint in SCH, the guidelines remain open to interpretation in terms of how and, perhaps more importantly, when to use physical restraint (Epps, Moore, & Hollin, 1999). There is also a lack of recent research directly focusing on this topic. Given the needs for SCH managers to balance the care of the children, their duty to protect their staff under the Safety at Work Act (1974) and to not be perceived as oppressive by the children or external parties, there is an obvious requirement for further research into the process of violence in SCH (Epps, 1997).

Understanding the antecedent precursors to violent outbursts is something that would be helpful to workers in the systems, especially newer workers who may not have the work experience and implicit awareness of those with longer careers. The aim of the current study, therefore, was two-fold: first, to use an applied approach to understanding interpersonal dynamics in the escalation towards violence, and second to offer a meaningful outcome that can be used as a future training and awareness raising tool to those in the Forensic Youth system. The current
A study was based in the United Kingdom. Youths in these homes were placed there following arrest and imminent police questioning; remand by a criminal court; a sentence of detention following conviction for an offence; or as a result of a Section 25 Accommodation Order made by a family court judge.

A large corpus of research has shown that some forms of physical violence do not spontaneously erupt, without any precursors (Felson & Massoglia, 2012; Leclerc & Wortley, 2014), while other forms may be more implicit or automatic (Keatley, Allom, & Mullan, 2017). Models such as the aggression-frustration hypothesis (Berkowitz, 1989; Dollard, Miller, Doob, Mowrer, & Sear, 2013) suggest that when needs or goals are thwarted by real or perceived blocks, then individuals become frustrated. If the frustration cannot be reduced or vented in some way, then this may lead to aggression. In men, this is more likely to lead to physically violent outbursts, as either a means of attempting to attain the goal or as a way of demonstrating the feeling of frustration (Björkqvist, 2018). Women are typically more likely to display their aggression through non-physical, indirect means (Björkqvist, 2018). Research has typically attempted to understand the relationship between frustration, aggression, and violence through self-report measures, such as the aggression questionnaire (Buss & Perry, 1992). These scales are useful in ascertaining individuals’ self-perceptions of the causes of their violence; however, these measures are almost always post-hoc and are open to obvious biases – such as individuals not having reliable or valid self-perception and demand characteristics.

More recent research into aggression has focused dispositional aggression as a predictor across an individual’s lifespan (Chester & West, 2020). Chester and West (2020) highlight that while the Buss-Perry Aggression model (1992) is widely used in the research literature and applied settings, it focuses primarily on cognitive and affective processes, while aggression
typically relates to behaviours. Indeed, in an applied setting, it is the behaviours that are in many ways more important to accurately detect, as they may serve as a clearer indicator of aggressive, violent attacks. Chester and West (2020) suggest that aggression is related to antagonism, the counter-point of ‘Openness’ in classic personality constructs (Lynam & Miller, 2019). By conceptualizing aggression as being correlated with antagonism, explanation of behavioural traits observed in aggressive outbreaks can be gained. For example, the aggressors callous, immoral, or combative approach to social interactions. Other researchers have suggested that neuroticism is more closely correlated with trait aggression (Berkowitz, 1989). Within forensic youth homes, it may be that the type of youth entering into these settings are by nature more antagonistic and prone to aggression. It is important, however, to understand how these traits map on to observable behaviours, so that staff can be better prepared to de-escalate situations.

There is a lack of research looking at behavioural markers and predictors of future violence in forensic health settings. There is an abundance, however, of research on aggression and violence, from a more cognitive and social psychological perspective. Traditionally this research has focused on self-report measures of violence and aggression (Keatley, Allom, & Mullan, 2017). Recently, researchers have attempted to overcome the potential self-report biases of violence by using implicit measures, such as the implicit association test (Keatley, Chan, Caudwell, Chatzisarantis, & Hagger, 2014). Keatley and colleagues (2017), for example, investigated the role of self-control as a means of managing violent outbursts. They used an IAT to measure implicit self-control and found that those individuals with increased self-control showed reduced violence. Clearly, cognitions are an important part of violent outbursts, and measuring the cognitive scripts or rationale for violence can help caregivers to understand why people become violence, it is less useful in observational prediction. However, while these
measures provide conceptual and empirical support for models of aggression and violence, they have extremely limited use in real-world settings. It is unlikely forensic youth homes would want to test everyone with an implicit measure, and it would not be wise to do so either, given the recent criticism of such measures (see Fiedler, Messner, & Bluemke, 2006, for review).

A further issue with many studies into aggression and violence is that the ‘violent outcome’ is often construed as a single isolated behaviour, such as “shouts” or “punches”. While this approach to researching violence is clearly important and provides an understanding of individuals’ psychological predispositions towards violence, the fact remains that operationalising the outcome variable as an isolated behaviour without any antecedent behaviours is overly simplistic and a large reason why statistical models of this kind are limited in their predictive validity (Epps et al., 1999). A method that maps the complex chains of behaviours that build towards a violent incident can clearly fill this gap in the literature and provide a much needed addition to our understanding of how and why violence escalates.

In relation to forensic settings, Papadopoulos and colleagues (2012) conducted a systematic review of 71 studies into the antecedents of violence and aggression in psychiatric in-patient settings. Staff interactions that were performed to limit in-patient freedoms were seen as a major predictor of future violent episodes. The review also showed that many staff record in-patients physical behaviours (rather than emotional states or mood). In-patient behaviours are more readily observable and easier to discriminate, so it is no surprise that they featured more in reports and research. Taking this approach further, a method that uses the observed behaviours and captures the dynamic processes underpinning antecedents of violent episodes would complement existing approaches and offer staff a new way to predict when a violent outburst might occur (Keatley, 2018).
Behaviour Sequence Analysis

Focusing on violent outbursts as isolated events provides a basic approach to understanding precursors of violent episodes; however, a more useful approach when attempting to understand real-world, dynamic behaviours is Behaviour Sequence Analysis (BSA; Clarke & Crossland, 1985; Keatley, 2018). BSA has been used in a number of applied settings, especially in the area of Forensic Psychology and Criminology (Keatley, Walters, Parke, Joyce, & Clarke, 2019; Taylor et al., 2008). BSA is underpinned by statistical analysis of the interdependence between individual behaviours and events. While many approaches in psychological and criminological research assumes independence of variables, BSA takes the opposite approach of analyzing interdependence between variables by measuring transitions between events (e.g., family do not come to visit) and behaviours (e.g., youth is pushed out of the way). Complex, dynamic chains of real-world episodes can therefore be built, and repeated chains are highlighted in the output as occurring above the level expected by chance (calculated by statistics).

Analysing the temporal order or sequence of behaviours and events allows researchers and practitioners to understand better and anticipate more accurately the escalation of episodes that typically result in violent outcomes. Instead of attempting to spot a single precursor or ‘risk factor’ for violence, which are often not very good predictors alone (Ellis, Clarke, & Keatley, 2017), BSA allows the complexity of real-world episodes to be clearly mapped.

To conduct BSA, Clarke and Crossland (1985) and more recently Keatley (2018) have identified three main stages. First, parsing or unitization is the process by which an episode is broken-down into discrete behaviours and events. A benefit of BSA is that any episode (be it a diary entry, a police statement, a database, or a video/CCTV) can be recorded and broken down
for analysis. Once the episode has been broken down, behaviours and events are categorized or coded, such that semantically related events and behaviours are grouped together. This is often the tricky stage that requires the most attention. For example: “youth is pushed” and “youth is shoved” may be classified as Behaviour Type A. However, scholars of Psychology will be quick to note that words can have different meanings (such as the seminal work of Loftus & Palmer, 1974, showing that ‘smashed’ and ‘collided’ elicited different representations of the events). There is no dictionary of behaviours and events; therefore, this stage is open to the interpretation and agreement between researchers and practitioners. Where possible, it is always beneficial to include practitioners in the categorization stage, so that terms used by researchers have real-world meaning (Keatley & Clarke, 2020). Finally, the analysis stage is where transitions between behaviours and categories are calculated. In lag-one BSA, which is the most common approach, transitions between pairs of behaviours and events are calculated. Many BSA studies have begun to represent results in state transition diagrams, which are flow diagrams of the sequences that allow easier understanding of the findings by non-specialist audiences (Keatley, 2018).

Present Study

BSA has been used in a number of forensic and criminal research areas, including drink driving and violence in drinking establishments (Keatley, Barsky, & Clarke, 2017; Taylor, Keatley, & Clarke, 2017), stalking (Quinn-Evans, Keatley, Arntfield, & Sheridan, 2019), sexual assault and rape cases (Ellis et al., 2017; Lawrence, Fossi, & Clarke, 2010), and most recently in homicide cases (Keatley, Golightly, Shephard, Yaksic, & Reid, 2018; Marono, Reid, Yaksic, & Keatley, 2020). Therefore, applying BSA to a forensic youth home was deemed appropriate, owing to the previous supporting literature indicating the method would be effective and produce
meaningful results. While BSA has been successfully used in a number of areas related to violence, it has not been previously applied to forensic youth populations, and therefore no hypotheses were made a priori. BSA is based on observation of data (video recordings in the current study), and preconceived expectations or hypotheses may have influenced or biased interpretation; therefore, in keeping with prior studies, no hypotheses were made. However, researchers were not naïve to the context or issues, indeed [AUTHOR INITIALS BLANKED] worked at the Home were testing was conducted. Given the expertise of the research group, we therefore did not enter into the research as naïve observers. We expected there to be interpersonal interactions between youths and between youths and workers in the Home, and we ensured that we monitored and mapped these interactions as part of the research. The aim of the study was to analyse the complexity of these interactions and map how they lead to violent episodes.

Method

Subjects

The research took place in a Secure Children’s Home in the UK. Subjects in the Home were vulnerable young people aged from 13-18\(^1\) who were placed there either due to: arrest and imminent police questioning under Code C of the Police and Criminal Evidence Act (1984); remand by a criminal court; a sentence of detention following conviction for an offence; or as a result of a Section 25 Accommodation Order made by a family court judge under the Children Act (1989) and the Children (Secure Accommodation) Regulations (1991).

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\(^1\) It was agreed that no personal information relating to the Youths in the home would be recorded or published; therefore, information regarding the type of offense and the exact ages of boys was not made available.
All areas of the Forensic Youth Home are recorded, at all times. This provides researchers with an excellent source of data, without having to directly involve or contact the youths themselves (which would have incurred several ethical and moral issues). The current study initially took 81 video recordings from the most recent violent episodes at the Home, spanning the preceding several weeks. Of the original 81, 36 recordings were removed from analyses (27 had an obstructed view of the episode, rendering gaps in the sequence as observers were unable to see what occurred; 3 had playback issues; and 7 had no restraint occur). Therefore, a final sample of 45 recordings were used in the final analyses, which is commensurate sample size to other BSA research using video recordings (Marono, Clarke, Navarro, & Keatley, 2017, 2018). Although no participants were actively recruited and tested in the current study, for completion the Ethics Committee at [UNIVERSITY NAME BLANKED] approved the study.

**Coding Procedure**

Data were already recorded by the Home, and were handed over to the researcher to begin parsing and categorizing. A list of possible behaviours was developed based on previous literature into violence. All researchers agreed on the behaviours that were coded from previous literature, ensuring there was no doubling of behaviours (i.e., ‘punch’ and ‘hit’ were coded as one item), thus the behaviour code list was *mutually exclusive*. This provided a baseline of behaviours likely to be observed; however, this list was only prepared as a guide and any

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2 An inclusion criteria was that the violent episode ended with a restraint being made. This was an operational decision as staff at the Home were more interested in understand and predicting those violent episodes that required staff intervention, as opposed to those episodes that did not.
additional behaviours observed during the viewing of episodes was added to the list, and agreed on by all researchers. Clips were slowed down and viewed frame-by-frame to ensure that everything was recorded accurately. The coding categories were exhaustive and mutually exclusive, which are prerequisites of BSA (Keatley, 2018). The list has to be exhaustive to ensure that no information is lost, leading to false chains. Similarly, categories need to be mutually exclusive so that clear sequences can be formed. The behaviour list and coding of the videos was agreed on by two researchers without disagreement, therefore, further researchers were not called upon to settle any ambiguities. As a means of double-checking the coding, however, back-translation was performed on the sample (Ellis et al., 2017). This means that once a video has been coded and put into a chain (e.g., A→B→C...) it is then written back out and checked against the video to ensure there is no undue loss of information and the episode is accurately recorded in the sequence chain. To make results easier to comprehend, coding was conducted such that the aggressor was made the agent of focus in the wording (e.g., ‘pulls away from staff’ refers to the violent individual’s actions). Staff were labelled and staff, and the person who received the violence was referred to as the ‘target’.

Statistical Analysis

After videos were coded and transcribed into sequential format, the data were input into a script the researchers wrote in the statistical software R (R Team, 2013), which runs through the

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3 Typically in BSA research, multiple researchers code and agree on the coding. Owing to the constraints of the current study, however, only one researcher was allowed to view the source materials (due to the researcher working at the Home). Therefore, the coding scheme was agreed upon a priori and any discrepancies that arose during the coding process were discussed post hoc to ensure the correct code was used. Therefore, full agreement was reached. We appreciate this is not a ‘perfect’ approach, however, it was necessary to comply with requirements from the Home.
sequence chains and completes the analysis. The script begins by providing a count of each
individual behaviour and event in the dataset. This provides a representation of which behaviours
and events are more frequently occurring. In the next stage, the script reads through the sequence
chains and counts the transitions between codes (i.e., how many times does A lead to B, B to C
and so on). This provides a transition frequency matrix, which is useful; however, the final stage
of BSA is to calculate whether these frequency counts are occurring above the level of chance,
calculated reported with standardized residuals, which are a measure of the strength of the
difference between observed and expected values, and are more informative than raw frequency
counts (see Keatley, 2020 for full explanation).

Results

Frequency Counts

The first part of the analysis most readily related to existing literature and provides an overview
of the type of behaviours and events seen in violent episodes, and how frequently they occur. A
total of 138 unique behaviours and events were observed in the current dataset. Clearly, not all of
the behaviours are important in understanding violent escalation, and therefore only the most
frequently occurring ones and the most theoretically important ones are included in further
analyses (See Keatley, 2020 for further explanation). In the current study, interaction (talking to
staff was the most frequently observed behaviour in the dataset (n = 62), followed by speaking to
target of aggression (n = 51) and the individual stepping backwards (n = 51). Looking towards
staff (n = 37) and looking away from staff (n = 36) also occurred frequently. Clearly, none of
these behaviours, in isolation, are reliable indicators of future violence. This supports the
position that it is the sequence of these behaviours that is more important to understand, if we want to map violent episodes.

4 Behaviour Sequence Analysis

BSA was conducted to show the transitions of behaviours and events across the sample of violent episodes in a Forensic Youth Home. First, a transition frequency matrix was calculated, showing the transitions between pairs of behaviours. This table was then analysed to show Standardized Residual scores, which could then be used to plot the state transition diagram (see Figure 1). Diagrams are created to provide a visual representation of the results. The results are lag-one BSA, which essentially measures $A \rightarrow B$, $B \rightarrow C$ transitions; however, these can be placed into flow diagrams to show links between behaviours. The diagram is a representation of the results, with thicker lines connecting nodes indicating larger standardized residuals. The alternative is to present all results in a table; however, this would be a large table, and understanding or following the links between behaviours would be lost.

The diagram shows a cluster of transitions around the violent individual and staff, such that looking towards staff followed by talking to staff was observed multiple times ($n = 10$, SR = 6.16). However, a key transition in the chain was the individual looking towards their target and then looking away from them again ($n = 7$, SR = 8.12), and then looking back towards their
target (n = 7, SR = 7.91). This cycle of looking at and then away from the target is important for
staff to pick-up on, to raise awareness, as one of the next transitions from looking towards target
was to walk towards target (n = 5, SR = 4.47), and from there, pushing target occurred more than
would be expected by chance (n = 6, SR = 12.11).

Other nonverbal gestures, such as shaking head while speaking to target of aggression
(n = 4, SR = 4.30) and pointing while speaking to the target of aggression (n = 5, SR = 4.81) were
also observed, though not directly related to a subsequent physically aggressive act. Here again is
a point in the sequence that staff could use to raise awareness of the following steps in the
sequence. It should be noted, however, that behaviours such as crouching (possibly to become
hidden) and breaking furniture (n = 8, SR = 23.39), to then brandish a weapon (n = 3, SR = 7.58)
were not directly, clearly linked to a subsequent violent outburst. Clearly, staff should not ignore
these behaviours; however, nor should staff hold-back until they see these behaviours, as the
more inconspicuous behaviours are more closely connected to violence. It should also be noted
that restraints typically occurred after staff were pushed past, or hit – indicating that staff were
often the target of violence.

Discussion

The aim of the current study was to use Behaviour Sequence Analysis to map episodes of
violent outbursts in a Youth Forensic Home, in the UK. A series of 45 recordings of violent
episodes resulting in the need for staff restraint of youths were coded and analysed using the
temporal method. The overarching outcome of the analysis is that these violent episodes are
complex, involving numerous behaviours not directly related to the violent encounter, and
therefore not a good predictor, in isolation. This is typical of research using BSA to map real-world episodes, which seldom happen along clear pathways (Clarke & Crossland, 1985; Keatley, 2018; Keatley & Clarke, 2020). While the results are complex, they do provide a more realistic account of violent episodes, and this research forms the basis of future research.

While previous research has focused on self-report (Buss & Perry, 1992) and implicit measures (Keatley et al., 2017) of violence, the current study used a behaviour-focused approach to map the progression of actions and events leading-up to a violent outburst. Results indicated support for findings in Popadopoulos and colleagues (2012), showing that there were a number of antecedent behaviours to violence. There was commonly a staff-youth interaction before the violent outburst. Following on from this, staff could receive de-escalation training so that they are better trained to reduce the likelihood of violence ensuing. Given that staff were typically the final node before restraints being used (either having been pushed past, or hit), this indicates staff are often the target of violence. Staff may be seen as figures of authority and regarded as controlling or stopping the attainment of goals, therefore, frustrating the youths, which supports the frustration-aggression hypothesis (Berkowitz, 1989)

Importantly, the results showed that the typical chains to violent outbursts did not have any key, single, indicators that were overtly violent in nature. Most of the behaviours, if taken individually, were relatively passive (such as ‘looking at target’ and ‘looking away from target’). This adds support to the theme of the current research, that it is the sequence rather than individual behaviours that is important in predicting violent outcomes. This is similar, also, to previous BSA research in violent episodes. Taylor and colleagues (2018), for example, showed that violence occurred after a complex interaction between multiple variables, none of which alone was violent or aggressive. These results, however, do lend support to the trait aggression
approaches (Chester & West, 2020). While the focus of the current research was on behavioural analysis, given the large corpus of research focusing on personality factors related to aggression and implicit cognitive processes, it would be possible to suggest links between behaviours and cognitions. It may be the case that youths who are in these forensic centers are more likely to have individual difference factors (e.g., antagonism, neuroticism, callous disregard). These personality factors predispose the youths to perceive or interpret stimuli (e.g., other youths’ behaviours) as being threatening, disrespectful, or combative, resulting in a propensity to escalate aggression and violence. Owing to the possibility of implicit cognitions, it may be that youths’ decision to escalate a fight is largely non-conscious and a matter of trait ‘habit’, rather than reasoned action. Future research could investigate to what extent youths are able to verbalise or justify their decision for each behaviour in the sequence. It may be that certain segments of the sequence are not available for cognitive reflection. Training methods to overcome these impulsive sub-sequences may be more effective than global-level approaches that focus on the episode as a whole.

Clearly, the current research is not without limitations. First, and most notably, the episodes in the current research all ended with staff having to intervene to restrain the youth. This was a purposefully done within the current research for practical reasons. Though a ‘control’ condition of non-restrain episodes sounds like a good idea, it is difficult to impose. Clearly, staff need to intervene and restrain at a certain point, once the escalation reaches physical violence. It would be difficult to judge what a non-violent episode looks like – in one sense, any interaction or period of time wherein a violent event does not occur could represent a non-violent, non-restraint episode, but it would not make for a compelling or clear contrast condition. It would be important, however, to find episodes in which de-escalation occurred
without outside interference (such as restraint) so that staff can better judge whether an episode is escalating or not. Comparison and contrast of escalating and de-escalating scenes, through sequence matching would show points in the sequence that may predict more clearly when an episode may turn into violent outbursts. Also, as researchers we may be interested to see the difference between violent and non-violent encounters; however, staff are typically overworked and need to prioritise time. It is beneficial that they understand and learn the maps of sequences that have previously required restraint, rather than know those that do not. Given the complexity of the current results, the ‘non-violent’ condition would likely be extremely complex and require more time to understand and learn than most staff have. That said, future research could see to investigate non-violent incidents as a comparison and contrast condition. Perhaps operationalizing ‘non-violent’ as any encounter that has aggressive signs or behaviours, but does not ultimately end in restraint. This might also help researchers and practitioners to understand de-escalation pathways.

A further limitation is the fact that only young men were used in the current study, meaning results cannot be generalized to young women in similar contexts. As research has previously indicated that men and women typically exhibit different forms of physical and verbal violence (Björkqvist, 2018), the results in the current study should not be generalized to young women. Therefore, further research should be conducted on young women’s Secure Children’s Homes to measure and map the types of behaviours exhibited there. A final limitation was in the coding of the data, owing to the fact that only 1 researcher was allowed to see the source material. Ideally, multiple coders should be used and inter-rater reliability taken; however, researchers agreed on coding schemes and the coder reported no difficulties with coding.
material. This is typically the case for BSA research in which behaviours are quite clear to observe and code.

Future research should also include more developmental factors and individual difference predictors on violent outbursts. A growing wealth of research shows the cognitive, social, and developmental predictors of violence, future research could stratify the sample into individuals with different demographics or measurement scores. Taking a typology approach to BSA would be more akin to recent research (e.g., Keatley et al., 2019), in which different typologies of serial killers showed different sequences, or Marono and colleagues (2018) research into different personality clusters and deception. Therefore, measuring individual’s personality and developmental backgrounds might offer clearer sequential predictions.

Conclusions

Young people in Secure Children’s Homes are likely to engage in acts of aggression or violence. While self-report and implicit measures of aggression and violent tendencies exist, these are not clearly visible or known to staff who may have to deal with young people on a daily basis. Therefore, understanding the observable behaviours may provide a more applied approach to understanding violence. The current research provides a novel way for practitioners to understand the progression towards violence that may occur, and therefore better prepare and perhaps thwart the physically violent outburst. The findings suggest that relatively non-confrontational behaviours occur in the build-up chain towards violent outbursts that require restraining. Though there were several notable limitations in the current research, it stands as a foundational framework for future research to build upon and add towards.
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