

Title: High volume repeaters of self-harm: Characteristics, patterns of emergency department attendance and subsequent deaths based on findings from the Multicentre Study of Self-harm in England

Running head: High volume repeaters of self-harm

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COMPETING INTERESTS

None to declare.

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Abstract

Background: Repetition of self-harm is common and is strongly associated with suicide. Despite this there is limited research on high volume repetition.

Aim: To investigate individuals with high volume repeat self-harm attendances to the Emergency Department (ED), including their patterns of attendance and mortality.

Method: Data from the Multicentre Study of Self-harm in England were used. High volume repetition was defined as ≥ 15 attendances within four years. An attendance timeline was constructed for each high volume repeater (HVR) and the different patterns of attendance were explored using an executive sorting task and hierarchical cluster analysis.

Results: A small proportion of self-harm patients are HVRs (0.6%) but they account for a large percentage of self-harm attendances (10%). In this study, the new methodological approach resulted in three types of attendance patterns. All of the HVRs had clusters of attendance and a greater proportion died from external causes compared to non-HVRs.

Conclusions: The approach used in this study offers a new method for investigating this problem that could have both clinical and research benefits. The need for early intervention is highlighted by large number of self-harm episodes per patient, the clustered nature of attendances and the higher prevalence of death from external causes.

BACKGROUND

Suicide is a major public health concern globally, accounting for more than 800,000 deaths per annum (World Health Organisation 2014). International data on non-fatal suicide (self-harm) is limited, but it is estimated to be up to 40 times more common than suicide (Hawton & Harris 2008). In England, self-harm accounts for approximately 200,000 emergency department (ED) attendances every year, with it being one of the top five reasons for acute medical admission in the UK (Hawton *et al.* 2007).

Repetition of self-harm is common (Owens *et al.* 2002, Bergen *et al.* 2010, Bilen *et al.* 2011) and is strongly associated with further self-harm and suicide (Zahl & Hawton 2004, Kapur *et al.* 2006, Haw *et al.* 2007, Bergen *et al.* 2012), especially in multiple repeaters of self-harm (Zahl and Hawton, 2004). Despite this there is surprisingly little research on high volume repetition of self-harm.

To date, studies on repetition of self-harm have tended to use similar methodology to investigate characteristics and outcomes associated with repetition. Self-harm patients are often classified as repeaters/ non-repeaters or by the number of repetitions, with often the most frequent repeaters grouped together in a single wide ranging category e.g. all people with three or more episodes (Kreitman & Casey, 1988, Zahl & Hawton 2004, Haw *et al.* 2007). There is currently no agreed definition of “frequent” repetition in relation to self-harm and patients grouped together within such a category may not only differ in the number but in the pattern of self-harm behaviour. For example, two individuals may both have five known instances of self-harm within a year, but one individual’s ED attendances may be spread out over the entire year, while the other individual’s attendances may be concentrated within one month. Such variations in self-harm behaviour suggest differences in the underlying causes and triggers of their self-harm and therefore interventions that are likely to be successful. An alternative way of identifying groups or “types” of repeater, and thereby perhaps increasing our understanding of repeat self-harm, could be to study patterns of self-harm as opposed to the number of episodes alone.

To explore the prevalence of high volume repetition of self-harm presenting to the Emergency Department (ED) and use an alternative methodology to investigate frequent repetition based upon the pattern of patients’ ED attendances. Through the construction and analysis of ED attendance timelines for the patients presenting most frequently to the ED, we sought to explore whether there are any identifiable subgroups. We also investigated their clinical characteristics and subsequent deaths.

METHODS

Sample

We have used a subset of the self-harm patient data collected as part of the Multicentre Study of Self-harm in England (Bergen *et al.* 2010). Data were collected on all individuals who presented with self-harm to one of six general hospital EDs in Oxford (1), Manchester (3) and Derby (2), between 1st January 2000

and 31st December 2007. Self-harm was defined as any act of intentional self-poisoning or self-injury, regardless of degree of suicidal intent or other types of motives (Hawton *et al.* 2003).

The subset of the multicentre study data used in the present study consisted of: all self-harm episodes occurring within four years of a patient's first episode since entering the multicentre study for all patients known to the study for at least four years. This subset included 16,386 persons and 28,468 self-harm episodes. This subset was used to ensure that equivalent lengths of time for each person were being compared.

Deaths

All individuals were followed up until 31st December 2009 for all-cause mortality or exit from the NHS (e.g. emigration, entry to armed forces) and censored from the date of exit. Deaths were identified through the Health and Social Care Information Centre, which traced individuals through the Central Health Register Inquiry System for patients within England and Wales and the equivalent in Scotland.

Identification of highest volume repeaters

The highest volume repeaters of self-harm were defined as individuals with 15 or more ED attendances within the four-year study period. This threshold was chosen in the absence of an agreed definition and in light of more general ED research proposing frequent attendance to be four or more a year (Bryne *et al.* 2003, Locker *et al.* 2007).

Attendance timelines

An ED attendance timeline in the format of a simple scatterplot was constructed for each of the high volume repeaters within the sample. For each individual, every ED attendance due to self-harm was plotted along a linear time axis, so as to visually depict the pattern of their repeat self-harm behaviour over the four-year period.

Executive sorting task

Twelve clinicians (five from Derby, four from Oxford and three from Manchester general hospitals) who had professional clinical experience of self-harm were individually asked to sort the high volume repeater's attendance timelines into groups, based upon any similarities or differences that they could see between them. The clinicians could create as many groups as they wished, of any size and definition. They were only given three rules to adhere to whilst completing the sorting task: 1). they could allocate each timeline to only one group; 2). they needed to provide a clear rationale or criterion for each group; 3). the criteria for each group had to be consistent within the entire group and exclusive to it.

Data Analysis

Similarity matrix and cluster analysis

All the groupings that the 12 individual clinicians created were entered into a computer program (created in Borland Pascal) that implemented Burton's Algorithm (Burton, 1972). The program calculated how many times a patients' attendance timeline had been grouped with each of the others for all 98 of the high volume repeaters e.g. how many times the attendance timelines of patient's 1 and 2 were grouped together, how many times the attendance timelines of patient's 2 and 3 were grouped together, how many times the attendance timelines of patient's 1 and 3 were grouped together, and so on for all of the high volume repeaters. The program produced a similarity matrix which showed the frequency with which each individual timeline had been grouped with each of the others.

The similarity matrix was then subjected to a hierarchical cluster analysis using Ward's minimum variance (cluster membership assessed by calculating the total sum of squared deviations from the mean of a cluster) and squared Euclidean distance methods of clustering. This created the final groups based upon the most common groupings made by the clinicians (as identified by the similarity matrix).

Group Differences

Each group of high volume repeater attendance timelines created by the cluster analysis were then examined by the researchers in light of the descriptive group criteria/rational for groupings given by the clinicians during the sorting task.

Deaths

The proportion and cause of death within the high volume repeaters group was compared to that of the non-high volume repeaters. The proportion and causes of death within the high volume repeater attendance timeline subgroups were also compared. Deaths with an "external cause" were those that received an accidental, intentional or undetermined (i.e. open) coroner's verdict (ICD-10 codes V01-Y89, U509). Deaths in all major remaining diagnostic categories (ICD-10 codes A00-R99) were classified as 'natural'. As is conventional in UK suicide research and clinical practice, individuals receiving both suicide and open verdicts at inquest were considered to have died by suicide (Linsley, Schapira and Kelly, 2001).

Statistical analyses

The similarity matrix was constructed using a Borland Pascal programme (i386-win32), developed from that used by Neal et al. (2000). The Chi Square and Hierarchical cluster analyses were conducted using SPSS v.19.

Ethical Considerations

The self-harm monitoring systems in Oxford and Derby have ethical approval from local health research ethics committees to collect data for both local and multicentre projects. In Manchester the monitoring is conducted as part of a clinical audit system, ratified by the local research ethics committee. All centres

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4 have approval under section 251 of the NHS Act (2006) to collect patient identifiable data without patient
5 consent and to send patient details to the Data Linkage Service of the NHS for the purposes of mortality
6 follow up.
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9 10 **RESULTS**

11 A total of 98 (0.6%) individuals out of 16,386 met the criteria for being high volume repeaters, (i.e. they
12 had 15 or more ED attendances within the 4 year study period (Table 1). These 98 individuals accounted
13 for 10% of all self-harm attendances within the study period. The majority of the high volume repeaters
14 had between 15 and 21 ED attendances (Figure 1). A greater proportion of self-harm episodes by the
15 high volume repeaters involved self-injury than in the non-high volume repeaters. Psychosocial
16 assessment following self-harm was also less frequent in the high volume repeaters compared to non-
17 high volume repeaters. (Table 2) A higher proportion of the high volume repeaters were female and of
18 white ethnicity. Mean age at first attendance was similar.
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25 *(Table 1 Here)*
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28 *(Figure 1 Here)*
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31 Five of the high volume repeaters died within the four year study period (four from external causes, one
32 from natural causes). Consequently, they were excluded from the attendance timeline grouping analysis
33 on the basis that they did not have the same exposure period during which to present to hospital and
34 therefore would not have comparable attendance timelines. They are however included in some of the
35 death analyses.
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40 *(Table 2 Here)*
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43 The high volume repeaters sample subjected to further analysis consisted of 93 individuals, with 2,835
44 self-harm attendances (66.9% self-poisoning, 27.8% self-injury and 5.3% both methods). The mean
45 number of attendances for self-harm was 30.5 (SD 28.6, median 21, range = 15 to 209).
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49 **Executive sorting task**

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51 Twelve clinicians individually sorted the 93 High volume repeaters attendance timelines into between four
52 and 12 groups (mean 7.7). The criteria the clinicians chose to use to create their groups appeared to
53 centre around five themes: 1). Clustering, intensity and position e.g. “clear evidence of clustering”,
54 “several periods of very frequent attendance”; 2). Continuity and regularity e.g. “Regular and very
55 frequent”, “Spread across time period: low to moderate frequency of presentation”; 3). Gaps, including the
56 number and length of non-attendance e.g. “One or two long gaps between attendances”, “No
57 presentation between 400 and 750 days”; 4). Point of cessation e.g. “Stopped presenting after fairly
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regular use”, “Died within 2 years of presentation” (NB. none of the sample did actually die within the four years - this was the clinicians assumption); 5). Volume e.g. “Frequent attendees with 20+ presentations”, “Less than 6 presentations in the first 200 days”.

Without prompt, several of the clinicians commented that they could relate the different patterns of self-harm ED attendances to particular patients they had seen within their clinical practice. Two clinicians in particular offered context or explanations for the different attendance pattern types, e.g. “....suggests self-harm was in response to situational stress that was resolved”, “....suggests something was going on in their lives that distracted them from/provided them with an alternative”, “.....suggesting natural decline, or effective treatment.”

Hierarchical cluster analysis

The hierarchical cluster analysis process started with each of the 93 high volume repeaters as a separate cluster and then combined them sequentially, until only one cluster resulted. This clustering method used dissimilarities between the high volume repeaters attendance timelines (as identified by the similarity matrix) when forming the clusters.

The dendrogram produced by the clustering process suggested that there may be up to eight significantly different cluster groups (Figure 2). The coefficients of each cluster created at each sequential step of the process indicated that the optimum number of clusters was four (Table 3). Additional clusters added less to distinguishing between the high volume repeaters’ timelines, demonstrated by the reduced degree of change between the coefficients before the four cluster solution. In other words, the four cluster solution resulted in the most statistically different groups of the high volume repeater attendance timelines.

(Figure 2 here)

(Table 3 here)

Groups based upon types of self-harm attendance pattern

There were clear visual differences in the attendance timelines within each of the four groups identified by the cluster analysis. The four self-harm ED attendance pattern types (Figure 3 and Table 4) were as follows:

(Figure 3 Here)

Group 1. Intermittent attendance with few clusters (N=21)

The attendances within this group were intermittent in nature and for the majority of patients spanned the whole four-year study period. Every individual had at least one cluster of attendances, with the majority of clusters being short in duration. All patients within this group had significant periods of non-attendance.

Group 2. Intermittent attendance with multiple clusters (N=46)

This was the largest of the four groups. Similar to those in group one, individuals within this group had intermittent attendances spread out across most of the time period. There was a higher frequency of clustered attendances, often much more intense and longer in duration than those of group one. Again, all patients had significant periods of non-attendance.

Group 3. Most frequent attendees (N=13)

This group had the greatest number of self-harm attendances, although there was a very large range (mean: 75.9, SD: 55.4, range: 35 to 209 attendances). All individuals had prolonged and intense periods of attendance across the majority of the time period. However, as with the other groups, all individuals had notable periods of non-attendance. The shortest period of non-attendance for any one individual within this very frequent attendance group was ~55 days.

Group 4. Attendances stop (N=13)

This was a mixed group in terms of attendance patterns, with the main grouping criterion distinguishing it from the other groups being that attendances stopped before the end of the study period. We are unable to account for why attendances stopped. We know that none of these individuals died during the study period. It is possible that the patients moved out of the catchment area of the study. As we are unable to account for why attendances stopped, this group was excluded from the subsequent between group comparative discussions.

Deaths

High volume repeaters vs non high volume repeaters

Death was more common in the high volume repeaters (11.2%, n=11) compared to the non-high volume repeaters (7.6%, n=1202), although this difference was not statistically significant ($\chi^2 = 1.83$, $p = 0.18$). Death from external causes was significantly more common in for the high volume repeaters compared to the non-high volume repeaters (7.1%, n=7 vs. 2.4%, n = 398, $\chi^2 = 9.00$, 2df, $p<0.05$).

Differences between three high volume repeater groups

Death appeared to be most common in Group 2 (intermittent attenders with significant clusters, 8.7%, n=4), there was one death within Group 1 (intermittent attenders with few clusters, 4.8%) and no deaths in Group 3 (the most frequent attenders). However, these differences were not statistically significant ($\chi^2 = 1.42$, 2 df, $p=0.49$).

DISCUSSION

High volume repeaters of self-harm (defined by us as patients with 15 or more attendances to ED within four years) constituted a very small percentage of the self-harm population presenting to the general hospitals in this study, just 0.6%. Yet they accounted for a large number (10%) of all ED self-harm attendances (98 individuals with 2942 attendances). There were a greater proportion of females within the high volume repeaters compared to non-high volume repeaters (72.0% and 57.6% respectively) and slightly more were of White ethnicity. Self-injurious acts were significantly more prevalent in the high volume repeaters (27.8% vs. 15.8% respectively) but psychosocial assessment following an act was less frequent (38.9% vs. 57.1% respectively). While the overall difference in the occurrence of death between the high volume repeaters and non-high volume repeaters (11.2% vs. 7.4%, respectively) was not significant, a greater proportion of high volume repeaters died from external causes.

Differences between the ED attendance patterns of the high volume repeaters were evident and three repeater “types” were identified by the clinicians in this study: 1) Intermittent attendance with few clusters; 2) Intermittent attendance with multiple clusters; 3) Most frequent attendees. A fourth group in which attendances ceased well before the end of the study period was excluded from further consideration because the reason for the attendances stopping was not known (we know they did not die). All of the high volume repeaters were found to have periods of clustered attendances as well as notable periods of non-attendance.

Clinical Implications

There is often a misconception among clinicians that high frequency repetition is a common characteristic of self-harm behaviour. This can contribute to some clinical staff believing that any treatment or intervention will inevitably fail with this patient group. This has been shown to lead to feelings of frustration, demotivation and general negative attitudes towards patients who self-harm, especially in general hospitals (Hopkins 2002, National Institute for Clinical Excellence, 2004, Saunders *et al.* 2012). Yet in the present study we have found high volume repetition to be relatively uncommon. Training needs to be made available to frontline staff to address such misconceptions and highlight the potential impact each and every ED attendance could have on each patient’s risk and future wellbeing.

For the vast majority of high volume repeaters in this study, attendances were intermittent in nature, with all having clusters of attendances and periods of non-attendance. “They were also found to have a higher frequency of death from external causes, as well as a higher incidence of self-injury, which is associated (contrary to common belief) with increased risk of further repetition and suicide (Cooper *et al.* 2005, Hawton *et al.* 2012, Karasouli *et al.*, 2015). Furthermore, despite this increased risk, the high volume repeaters were found to be less likely to receive a psychosocial assessment, which has been shown to

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4 have a protective effect (Bergen et al. 2010, Kapur et al. 2013) and which official guidance recommends
5 should occur following every self-harm act (National Institute for Clinical Excellence 2004, 2011). This
6 may indicate missed opportunities for engagement and low level intervention. However, it is important
7 that assessments do not require the person to have to re-tell the same story repeatedly (which may lead
8 to feelings of frustration and entrapment), but focus on exploring what is still causing the person distress
9 and whether their circumstances or emotional state have changed.
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15 Once it is apparent that a patient is becoming a high volume repeater it would be sensible to hold a case
16 review to explore potential contributory factors and options for intervention or risk mitigation. Attendance
17 timelines like those used in the present study could be used in real time to monitor changes in a patient's
18 self-harm behaviour, clinical need and risk. It may be beneficial to explore reasons for clusters of self-
19 harm or periods of non-attendance with the patient in order to better understand potential trigger factors,
20 protective factors and support networks for patients, as well as their coping strategies.
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25 Targeted interventions could have a significant impact on the high clinical demand currently being placed
26 on front-line services. Interventions successfully used with patients with borderline personality who
27 repeatedly self-harm may also be appropriate for this patient group. There are encouraging results of
28 mentalization (Bateman & Fonagy 2008, 2009) and dialectical behaviour therapy (Linehan 1993) for
29 individuals who repeatedly self-harm. Pharmacological treatments (e.g. lithium; Cipriani *et al.* 2013) might
30 also be considered but the risk of overdose would have to be assessed.
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36 Three types of attendance patterns were identified by the clinicians in this study (excluding those whose
37 self-harm presentations ceased before the end of the four-year study period). Two out of the three groups
38 were characterised by intermittent clusters of attendance, with the majority of the high volume repeaters
39 falling into the group with a higher number of and longer lasting attendance clusters. This highlights the
40 importance of early intervention in order to prevent multiple repetitions within a short time and the risks
41 associated with periods of concentrated repetition. The other group identified consisted of the most
42 intense repeaters, highlighting that there is a further subgroup of high volume repeaters that are likely to
43 have very complex needs, (e.g. comorbid psychiatric or substance misuse problems) and that will
44 therefore require more intensive and comprehensive interventions.
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51 **Research Implications**

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53 More in-depth studies of the clinical characteristics, personal histories and circumstances of individuals
54 engaged in high volume repetition of self-harm (together with enquiry about factors related to the onset of
55 both clusters and cessation of self-harm) would be beneficial for the development of clinical and social
56 interventions.
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One fundamental finding here is that high volume repeaters of self-harm are not a homogenous group and differ in their patterns of self-harming behaviour. While three groups of attendance patterns emerged from this study, there may be other patterns within these and we hope that the novel methodology used here may inform future research and encourage further expansion from the traditional numerical classification of individuals who repeat self-harm (Kreitman & Casey 1988, Zahl & Hawton 2004, Haw *et al.* 2007).

Strengths and Limitations

High volume repeaters were defined based upon emergency department attendances following an act of self-harm, so episodes of self-harm not resulting in a hospital attendance, or attendances not classified as self-harm (but possibly due to a related co-morbid disorder), were not included. Moreover, individuals who frequently engage in self-harm, yet rarely attend ED, will also be excluded. Nonetheless, it is important to study individuals and acts which do result in an ED attendance as they present numerous opportunities for clinical engagement and intervention which need to be exploited.

As the multicentre data used within the present study were derived from six hospitals within three cities in England of varying socio-economic status and service provision, the findings should be generalizable to self-harm populations who present to Urban EDs more broadly within the country.

The use of the executive sorting task to group the high volume repeaters ensured the retention of a human element within the grouping of patients. Indeed we hope that as the attendance patterns were judged and grouped by clinicians, this type of methodology could be generalizable and transferable to clinical settings. It would be interesting to see whether the same types or number of groups would be identified, and similar rules and explanations offered, if a different set of clinicians or indeed patients themselves completed such a sorting task.

Conclusions

High volume repeaters of self-harm make up a very small proportion of those presenting to ED following self-harm, yet they account for a large percentage of all attendances. They are at increased risk of death from external causes. The high clinical demand experienced by front-line services could be greatly alleviated by targeting this relatively small proportion of the self-harm population. Raising awareness within the clinical profession will also help to reduce potential negative attitudes towards self-harm patients generally, as well as feelings of frustration and failure. High volume repeaters of self-harm are not a homogenous group in terms of their behaviour; they differ in the frequency and pattern with which they engage in and present with self-harm and therefore are likely to differ in responsiveness to interventions. The intermittent and clustered nature of attendances highlights the need for early

intervention and for each self-harm act to be viewed as a separate event within the context of a patient's whole life.

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Table Legends

Table 1. Emergency Department attendances following self-harm episodes within the 4 year study period, grouped by number per patient

Table 2. Comparison of high volume repeaters and other self-harm patients

Table 3. Hierarchical cluster analysis agglomeration schedule (stages 92 to 86) and the number of high volume repeaters belonging to each subgroup

Table 4. Characteristics of patients in the four groups of high volume repeaters at their first assessed episode

Figure Legends

Figure 1

Distribution of patients who had 15 or more ED attendances following self-harm within the 4 year study period

Y axis = "Number of patients"

X axis = "Number of attendances to the Emergency Department following self-harm"

Figure 2. Dendrogram produced by the hierarchical cluster analysis using ward's minimum variance and squared Euclidean distance

Y axis = "High volume repeaters"

X axis = "Rescaled linkage distance between clusters"

Figure 3. High volume repeaters of self-harm ED attendance timelines, grouped by pattern of attendance over four years. *Each row represents an individual and each circle a self-harm episode.*

Group 1. Intermittent attendance with few clusters (N = 21)

Y axis = "High Volume Repeaters"

X axis = "Day of Emergency Department Attendance"

Group 2. Intermittent attendance with multiple clusters (N = 46)

Y axis = "High Volume Repeaters"

X axis = "Day of Emergency Department Attendance"

Group 3. Most frequent attendees (N = 13)

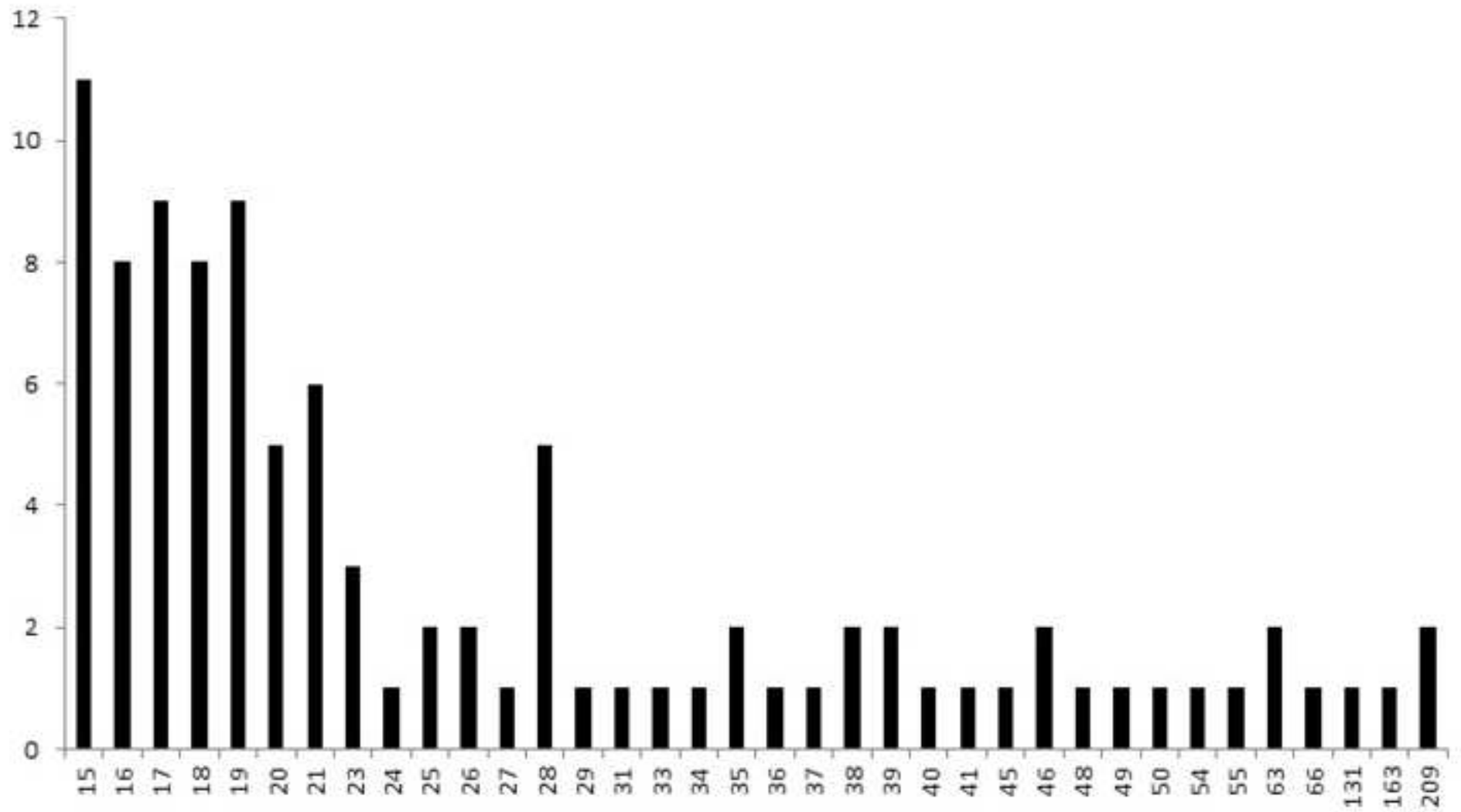
Y axis = "High Volume Repeaters"

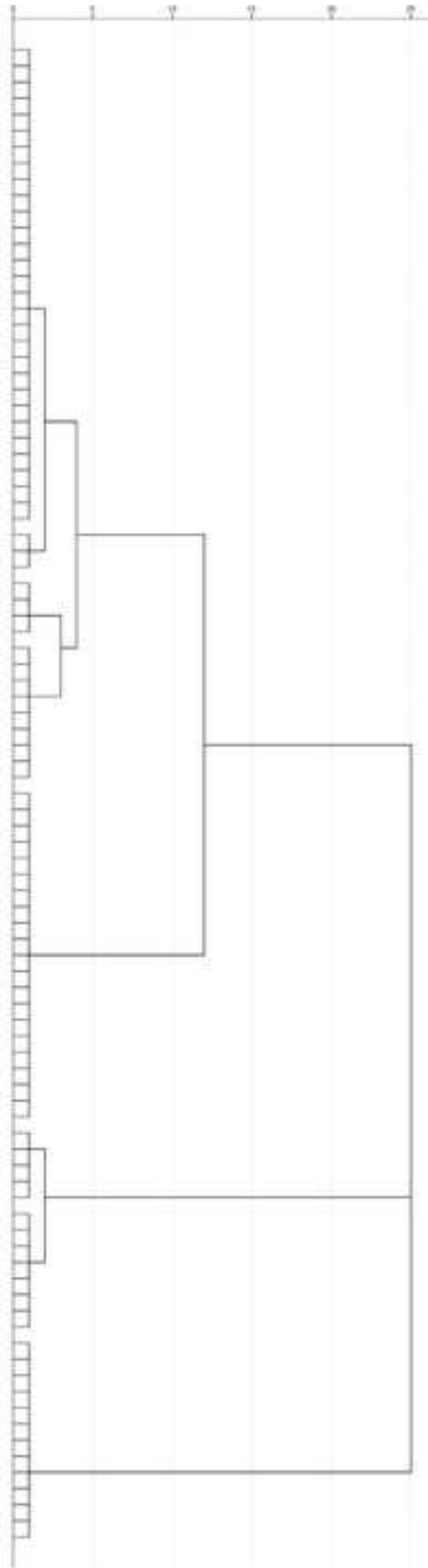
X axis = "Day of Emergency Department Attendance"

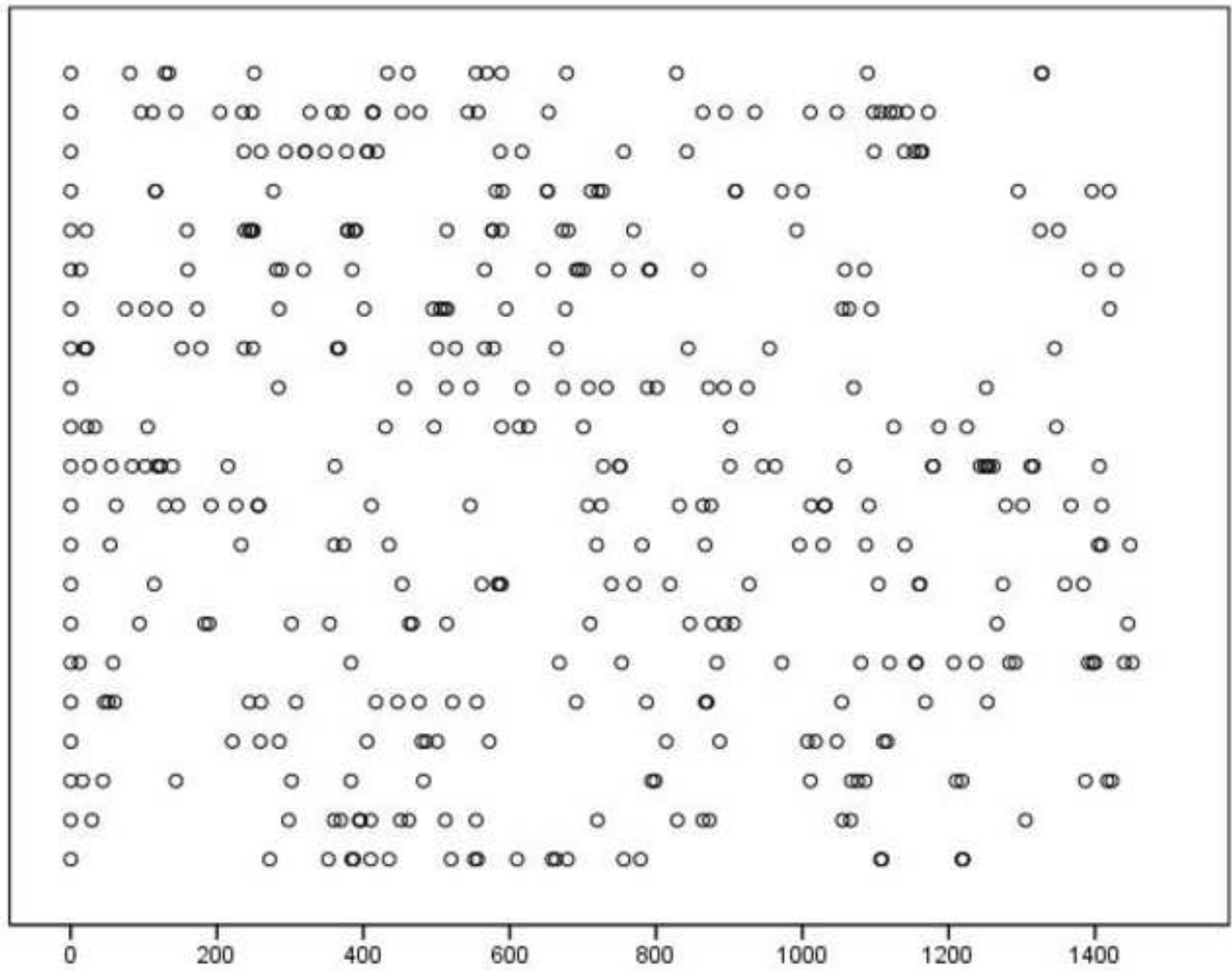
Group 4. Attendances stop (N = 13)

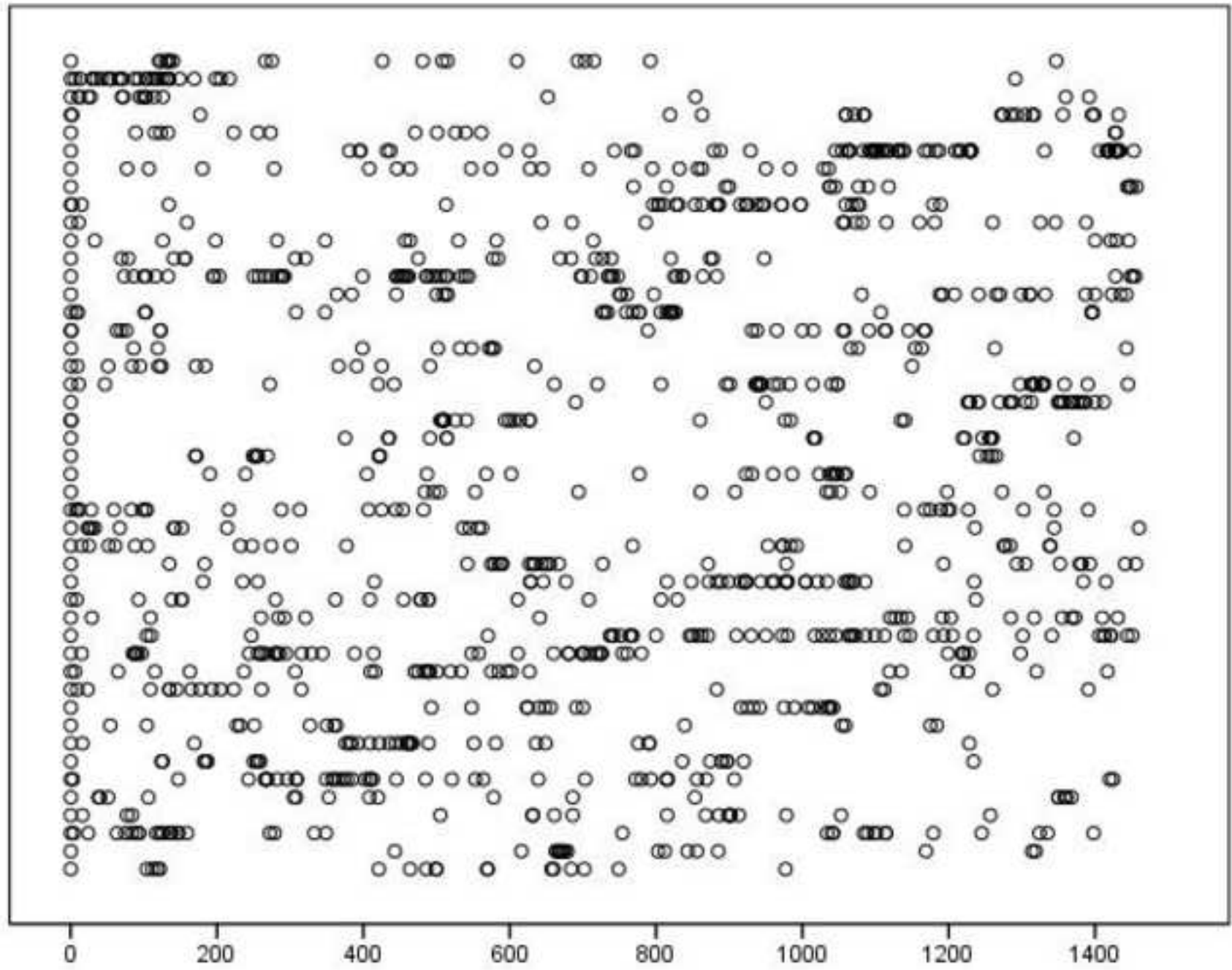
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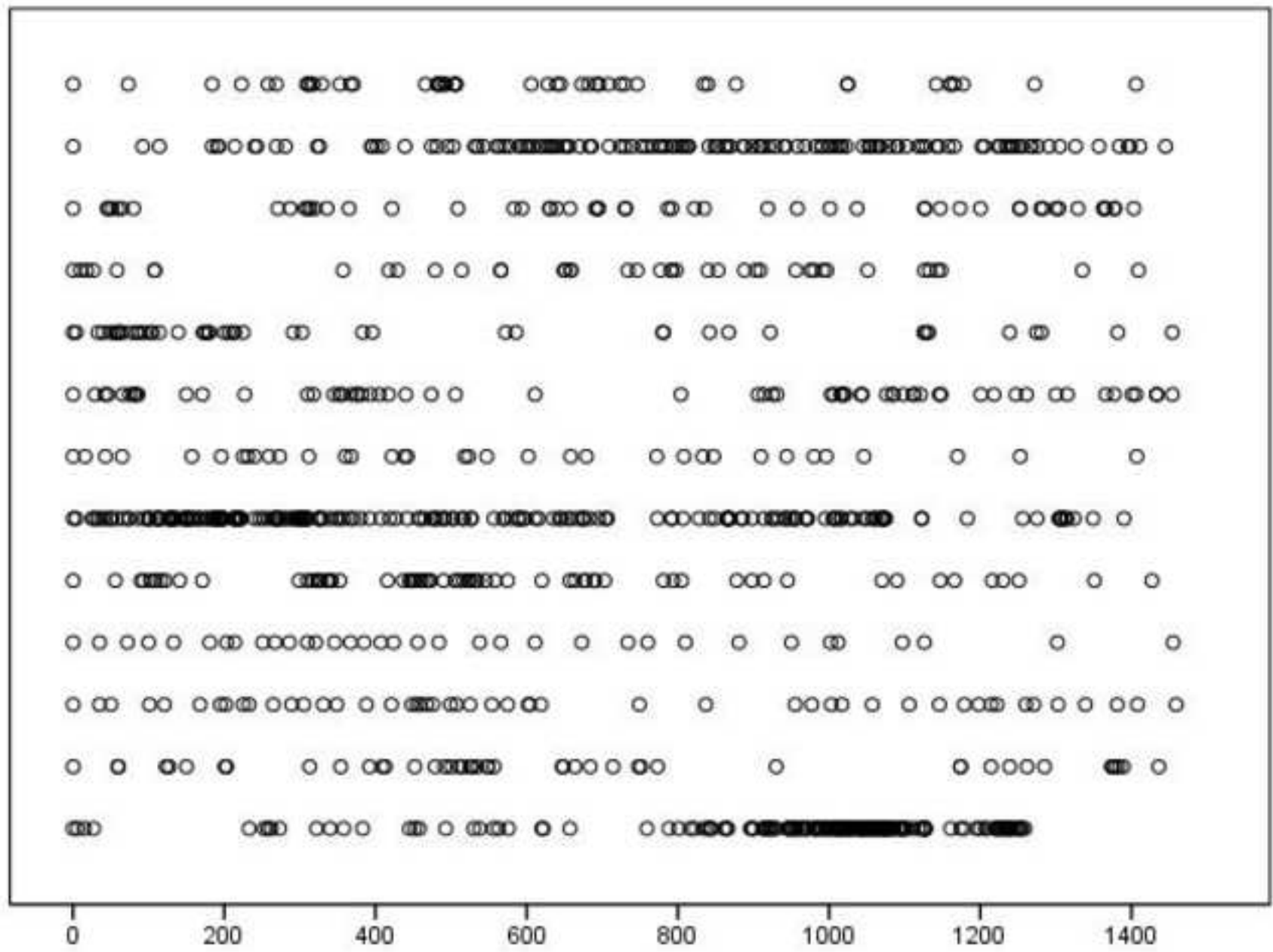
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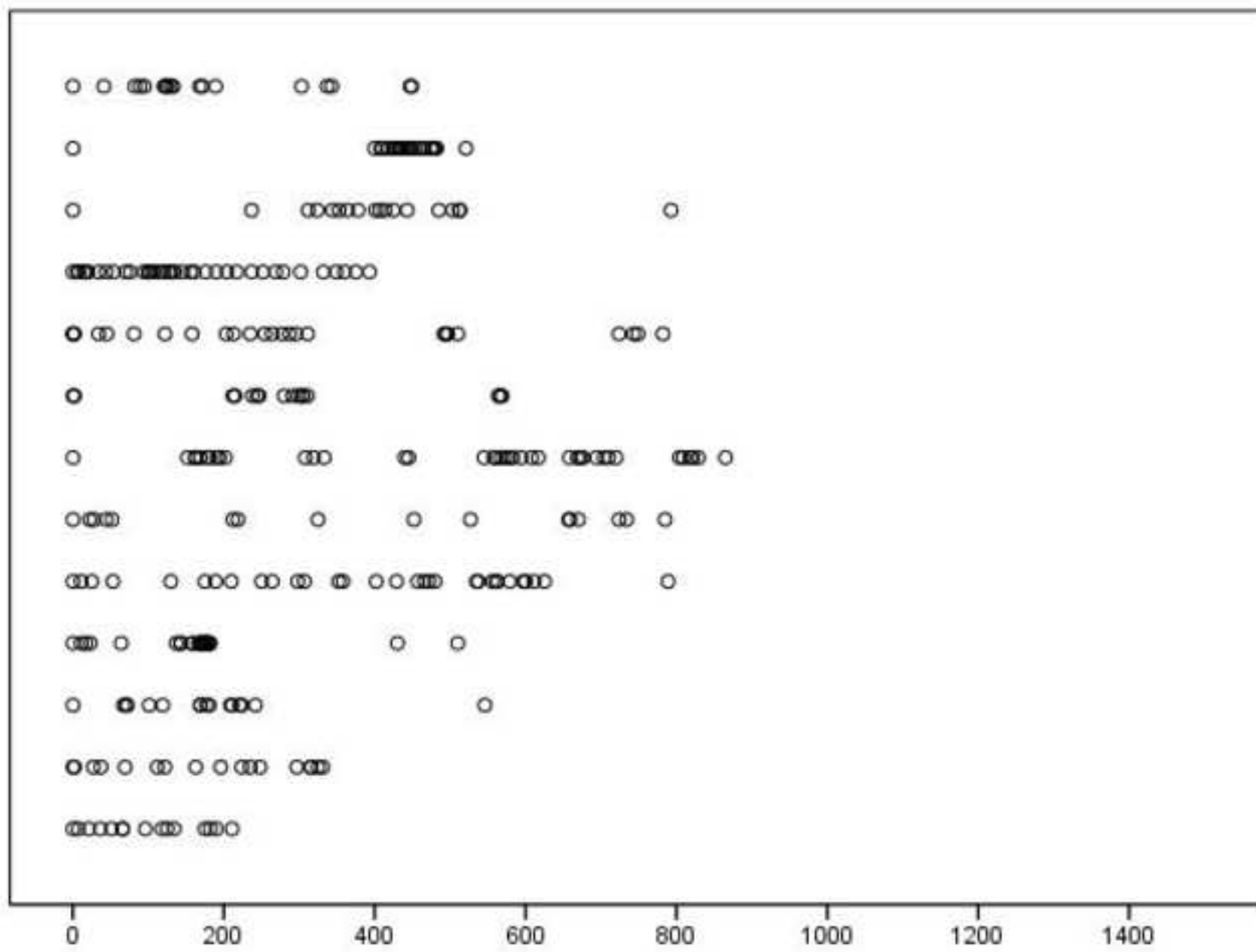












Total number of episodes	Number of patients N (%)
1	12075 (73.7)
2	2324 (14.2)
3	829 (5.1)
4	394 (2.4)
5	225 (1.4)
6	136 (0.8)
7	91 (0.6)
8	46 (0.3)
9	51 (0.3)
10	36 (0.2)
11	28 (0.2)
12	26 (0.2)
13	10 (0.1)
14	16(0.1)
15 or more	98 (0.6)

	Individuals N = 16,386	Attendances N = 28,468				Psychosocial assessment N=28,450	Methods of self-harm			Gender (Female) N = 16,382	Mean year of age at first attendance	Ethnicity (White) N=11,711
	N (%)	N (%)	Mean (SD, range)	Median	Mode	N (%)	Self-poisoning %	Self-injury %	Both %	N (%)	Mean (SD, range)	N (%)
High volume repeaters ≥ 15 attendances in 4yrs	98 (0.6)	2,942 (10.3)	30.02 (28.0; 15-209)	20.0	15.0	1,143 (38.9%)	66.7	27.8	5.5	69 (70.4)	32.4 (10.5; 14 - 61)	74 (98.7)
Non-High volume repeaters < 15 attendances in 4yrs	16,288 (99.4)	25,526 (89.7)	1.6 (1.4; 1-14)	1.0	1.0	14,558 (57.1%)	80.5	15.8	3.8	9,386 (57.6)	31.5 (13.5; 7 - 97)	10,643 (91.5)
Statistic						$\chi^2 = 349, p<0.001$	$\chi^2=308, p<0.001$			$\chi^2 = 6.51, p<0.01$	t = 0.67, p = 0.51	$\chi^2 = 4.97, p<0.05$

Clustering Stage	Number of Clusters	Clustering Coefficient	Sequential Change in Coefficient	Cluster 1 N (%)	Cluster 2 N (%)	Cluster 3 N (%)	Cluster 4 N (%)	Cluster 5 N (%)	Cluster 6 N (%)	Cluster 7 N (%)	Cluster 8 N (%)
92	2 clusters	73321	28191	80 (86.0)	13 (14.0)	-	-	-	-	-	-
91	3 clusters	46200	27121	67 (72.0)	13 (14.0)	13 (14.0)	-	-	-	-	-
90	4 clusters	32775	13425	21 (22.6)	46 (49.5)	13 (14.0)	13 (14.0)	-	-	-	-
89	5 clusters	28586	4189	21 (22.6)	13 (14.0)	33 (35.5)	13 (14.0)	13 (14.0)	-	-	-
88	6 clusters	25561	3025	21 (22.6)	4 (4.3)	33 (35.5)	9 (9.7)	13 (14.0)	13 (14.0)	-	-
87	7 clusters	23599	1962	21 (22.6)	4 (4.3)	33 (35.5)	9 (9.7)	8 (8.6)	13 (14.0)	5 (5.4)	-
86	8 clusters	22041	1558	21 (22.6)	4 (4.3)	30 (32.3)	9 (9.7)	8 (8.6)	13 (14.0)	5 (5.4)	3 (3.2)

Group Description	N (%)	Gender (female) N (%)	Age (Years)		Number of attendances	
			Mean (SD)	Range	Mean (SD)	Range
Group 1. Intermittent attendance with few clusters	21 (22.6)	13 (61.9)	35.2 (11.9)	14-61	19.1 (3.7)	15-28
Group 2. Intermittent attendance with multiple clusters	46 (49.5)	34 (73.9)	32.5 (9.9)	14-50	25 (11.2)	15-63
Group 3. Most frequent attendances	13 (13.9)	10 (76.9)	32.1 (6.9)	21-42	75.9 (55.4)	35-209
Group 4. Attendances Stop	13 (13.9)	10 (76.9)	25.3 (9.2)	15-47	22.9 (8.6)	15-40

Author Biographies for High Volume Repeaters Paper

1. **Jennifer Ness**, BSc, MSc, is a research project manager for the Liaison Psychiatry teams and Centre for Self-harm and Suicide Prevention Research at Derbyshire Healthcare NHS Foundation Trust. Her research focuses are in Liaison Psychiatry and the causes and prevention of suicidal behaviours.
2. **Keith Hawton**, DSc., DM, FRCPsych, FMedSci, is a Consultant Psychiatrist with Oxford Health NHS Foundation Trust and Professor of Psychiatry at Oxford University. He has been working in the field of research into suicide and self-harm for more than 35 years and is a National Institute for Health Research Senior Investigator. His work has resulted in over 500 publications and he has been presented with a number of awards.
3. **Keith Waters**, RMN was a Clinical Nurse Specialist and team leader with around 25 years' experience of working with self-harm and associated presentations to a general hospital. He is the Principal Investigator for the multicentre study of self-harm in England, Director of the Centre for Self-harm and Suicide Prevention research at Derbyshire Healthcare NHS Foundation Trust and clinical adviser for suicide prevention with the East Midlands Academic Health Science Network.
4. **Martin Clarke**, PHD, is a Research Fellow and Chartered Psychologist. His research interests include self-harm, follow-up studies of forensic cohorts, personality disorder, sex offenders, Circles of Support and Accountability, and stalking. He completed his PhD on the follow-up of patients discharged from a Medium Secure Unit.
5. **Nav Kapur**, MD, FRCPsych, is Professor of Psychiatry and Population Health at the University of Manchester, UK, and Honorary Consultant in Psychiatry at Manchester Mental Health and Social Care Trust. His research focuses on the causes and prevention of suicidal behaviour.
6. **Sarah Steeg**, is based at the Centre for Suicide Prevention and currently holds a National Institute for Health Research (NIHR) Doctoral Research Fellowship. Her current research area concerns the clinical management and follow-up care received by people who attend hospital having self-harmed and how these relate to future risk of self-harm and suicide.
7. **Helen Bergen** PHD, was a postdoctoral researcher in the Centre for Suicide Research at the University of Oxford, and previously was Project Coordinator of the Multicentre Study of Self-Harm Project, England. Her research interests were in novel statistics and the epidemiology of self-harm and suicide.
8. **Jayne Cooper**: Dr Jayne Cooper's background is in mental health nursing. As postgraduate Senior Research Fellow at the Centre of Suicide Prevention, University of Manchester, UK she was Principal Investigator on the Multicentre Self-Harm Project, England. Her research involved working in the fields of psychiatric liaison, emergency medicine and mental health nursing.