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ORIGINAL ARTICLE

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ABSTRACT

Sustainable addiction recovery is determined in part by how social and community resources can be mobilised to support long-term identity change. Given the current growth in technology, we ask what the role of online social interactions is in supporting long-term identity change for people in recovery. The paper also explores the relationship between the evolution of online social networks and key events that members experience in the outside world, based on a project examining changes in online participation over eight months among members of a UK addiction recovery community built around a social enterprise for employment and housing. The social enterprise had an open Facebook page that was used by staff, clients and by a diverse range of individuals not directly involved in the organisation. Based on an analysis of naturally occurring online data on the Facebook page, social network analysis (SNA) and computerised linguistic analysis that quantified emotion and belonging language in posts and subsequent 'likes', we found that variations in the structure of the online social network and the content of communication are consistent with 'core' members' experience of those events. Our findings indicate that strong recovery networks supported by positive social interactions can contribute to achieving long-term identity change that supports sustaining engagement in recovery communities.

Introduction

While addiction is regarded as a chronic and relapsing condition (O'Brien and McLellan 1996), there is mounting evidence that the majority of those who experience addiction problems will eventually overcome these issues to achieve sustained recovery (Groshkova et al. 2013; Sheedy and Whitter 2013). This process is a personal and individual journey of transformation (White 2009); however, there are a number of common socially embedded phenomena that are associated with the transition from addiction to recovery.

Two of the most widely researched of these phenomena are *changes in social networks* and *changes in identity*. There is considerable evidence from cohort research showing that when individuals change their social networks from networks supportive of substance use to networks supportive of recovery, their abstinence outcomes are significantly enhanced (Longabaugh et al. 2010). In a clinical trial to assess the importance of recovery support after specialist detoxification treatment, Litt and colleagues (Litt et al. 2009) randomly assigned a cohort of recovering alcoholics to either standard aftercare or to 'network support'. Those assigned to network support, which basically meant attempting to add at least one abstinent person to the individual's social network, were 27% less likely to relapse to alcohol use in the year after the detoxification than those in the standard condition.

The importance of social networks is also central to the primary method of measuring recovery which has been termed 'recovery capital' (Cloud and Granfield 2008).

This model differentiates between personal, social and community components of recovery capital (Best and Laudet 2010), as a means of operationalising the resources available to support the individual in their recovery journey. The centrality of social support and social networks is evidenced by the critical role that social capital (e.g. Putnam 2000) plays in the evolution and growth of the concept and operationalisation of recovery capital. Social capital refers to the social supports and commitments that individuals can draw on and includes both *bonding capital* (the strength of the bonds to peers – an intragroup context) and *bridging capital* (the capacity to reach out to new social networks and groups to create new social resources – an intergroup context).

A second major area of exploration in the recovery literature has been around *identity change*, with studies showing that recovery from addiction problems is based on the transformation of personal identity (e.g. Biernacki 1986). This theme was developed by McIntosh and McKeganey (2000) who have argued that recovery is predicated on the 'restoration of a spoiled identity', on the basis of in-depth interviews with 70 recovering addicts in Glasgow. More recently, Radcliffe (2011) argued that a group of mothers derived motivation for their recovery in the context of an emerging 'maternal' identity, with pregnancy providing a turning point, or 'second chance', allowing them to construct a "normal, unremarkable, and un-stigmatised motherhood" (collective) identity that supported their transition to recovery (Radcliffe 2011, p.984).

This evidence from the addiction field resonates well with recent findings from social psychology that highlight the role of *social identity* in improving and maintaining well-being. For instance, in ageing adults, it was found that identification with multiple social groups is associated with improved well-being as well as cognitive ability (Haslam et al. 2014; Haslam et al. 2016; Steffens et al. 2016). A recent review of evidence regarding the relationship between social identity and depression (Cruwys et al. 2014) found evidence that lower depression is predicted by social identification with meaningful groups, and that the more meaningful groups a person identifies with, the lower the likelihood of developing depression. This evidence clearly shows that social groups (in terms of numbers of social connections, and importantly quality of those connections as identification with positive and supportive groups) play a key role in developing and maintaining wellbeing. In vulnerable populations, this means that recovery can be significantly supported through nurturing positive connections or social identities. In those populations, the quality of their social identities is particularly important as connections with 'old' dysfunctional social identities can in fact undermine the process of recovery (e.g. Jetten et al. 2015).

The model of identity-based recovery also overlaps strongly with the literature on desistance from offending, with Maruna's (2001) Liverpool Desistance study showing that, to desist from crime, ex-offenders needed to develop a coherent, pro-social identity for themselves. In this study, which compared persisting and desisting offenders, the desisters from offending were much more optimistic in their narratives and were much less likely to characterise themselves as 'doomed to deviance', than persisters (those who continued to be involved in offending). However, McNeill (2014) has argued that it is the social framing of the identity change that is critical and that it is the acceptance of the desisting identity by those around the former offender that will determine its impact and durability. McNeill embedded this within a staged model where personal endeavours at achieving a new identity are determined initially by the response of the immediate social networks and subsequently by the response of the wider society, in terms of access to good quality accommodation, employment and training opportunities, and other assets in the community.

And it is this social quality of identity change that has led to the emergence of the Social Identity Model of Identity Change (SIMIC; Jetten et al. 2012). This model has been supported by evidence showing that internalised group memberships become personal resources that support positive adaptation to change in times of life transition. Haslam and colleagues (Haslam et al. 2008) found that life satisfaction among patients recovering from stroke was greater for those who belonged to more social groups before their stroke, and who retained more of those group memberships following their stroke. In addition, the formation of new group memberships following a traumatic event has been found to predict fewer symptoms of traumatic stress over time, after controlling for individual differences in posttraumatic symptoms at baseline (Jones et al. 2012).

The application of this model to the addiction field is gathering momentum. Research in this area has shown that both explicit and implicit identification (implicit identification is measured using a response time design to test association that is not consciously considered) with a recovery identity was associated with significantly enhanced outcomes for a cohort of problem alcohol users engaged in specialist treatment (Buckingham et al. 2013). Two studies assessing drug and alcohol users recruited in a Therapeutic Community (TC) reported that the growth of a recovery identity and the diminution of an addict identity in Australia were associated with better retention in the treatment service (Beckwith et al. 2015). A follow-up study of the same population post-treatment reported significantly better alcohol and drug use outcomes among those who reported stronger social identification with recovery (Dingle et al. 2015). This has culminated in the development of the Social Identity Model of Recovery (SIMOR: Best et al. 2016) which argues that the transition from use to recovery is associated with a gradual change in social networks that prompts a change in both personal and social identity. This is one of two emerging theories of addiction recovery based on social identity theory. In the second model, Social Identity Model of Cessation Maintenance (SIMCM), Frings and Albery (2015) have focussed on the transition from an 'addict' to a recovering addict' identity in the context of group treatment and support.

The growth of recovery identities and recovery communities does not occur exclusively face-to-face as there have been significant increases in online help-seeking and participation in online recovery communities (Savic et al. 2013). Although the evidence around the impact of online addiction recovery groups is limited, there is stronger evidence in other areas. Participating in a range of online groups has been linked to improvements in general wellbeing, and to positive psychological outcomes through providing participants with a sense of belonging and empowerment (Bakardjieva 2003; Barak et al. 2008). This also provides opportunities for new research methodologies that explore online communities as a means of tracking changes in social networks and social identity (Bliuc et al. 2016). Participation in online recovery does not occur in isolation from the offline context (which indeed is likely to play a significant role in relation to the outcomes of the recovery journey).

Therefore, the aims of the current research are to examine changes in connections (within a social network) and identity markers in a recovery community taking into consideration key external events for the group over time, to assess the growth of social recovery capital. It captures these changes through an analysis of the online social interactions of the group using a novel integration of different methodologies. There is a second research aim that is to assess the impact of 'real-life' (offline) events on engagement in an online recovery community in particular around markers for social recovery capital.

Context of research

We examine changes in a recovery community (as captured by their online interactions) over a period of eight months

in Jobs, Friends and Houses (JFH), a UK addiction recovery community based on a social enterprise for employment and housing for marginalised populations. JFH is an innovative social enterprise in many aspects, but of particular interest here is their approach to supporting recovery through providing their clients with a 'ready-made', visible positive social identity, that can help the transition to living and contributing to the broader society (Best et al. 2016). Participants in the programme are given the opportunity to join the JFH community that in turn means being able to perform community-oriented work, i.e. renovating derelict houses in the Blackpool area of the north-west of England. Initially established as part of a prison 'gateways' model for supporting post-release resettlement of ex-offenders with substance problems, JFH has grown to include a diverse range of vulnerable populations. Individuals volunteer to establish their suitability and then undertake an apprenticeship, primarily in one of a range of building trade skills, such as joinery or plumbing. JFH will also provide access to a range of wellbeing and recovery support resources and will support a housing pathway, often into houses that are built or renovated by JFH, and they will then also provide landlord support for the apprentices.

The JFH social identity has a strong visual presence in the local community – an explicit strategy used to increase identification with the group is making use of identity markers such as easily recognisable logos on vans and JFH-branded clothing that are worn by all apprentices and staff. There has been a considerable focus on creating a visible presence in the community (Best et al. 2016) and in creating a community that is strong and supportive for participants, and that they can feel proud to be a part of. This community engagement has included the establishment of an open JFH Facebook page to provide information about support events and to keep individuals informed about new activities in JFH. Since its start at the beginning of 2015, the Facebook page has grown into a core part of the identity and support system for JFH apprentices.

The present research

The present research builds on existing evidence of the role of social connectedness in recovery, but with a focus on online indicators of recovery. In particular, it explores the level of social engagement with an online recovery community, and links key aspects of social engagement and participation in the online recovery with 'real life' (offline) events affecting the group. To understand the dynamic process of acquiring and developing a new (highly functional) social identity in an online social network, we examine variations in two key dimensions derived from the literature on social identity and recovery including:

- *Social identity (identification with the recovery community)*: as reflected by qualitative markers of a recovery social identity, i.e. recovery identity as meaningful and highly valued social identity;

- *Recovery capital*: in the form of bonding and bridging capital, as reflected by levels of social connectedness within an online group.

These dimensions are operationalised by using a range of indicators captured through an integration of methodologies from several disciplines. Specifically, as indicators of a salient recovery social identity we used *linguistic markers* identified in the online language through the use of a computerised linguistic software, that is, Linguistic Inquiry and Word Count (LIWC). LIWC is software developed by social psychologists Pennebaker and colleagues (Pennebaker et al. 2007, 2015) designed to search text for words or word stems that have previously been categorised into over 80 different linguistic categories that are relevant in psychological research. In their early forms, computerised linguistic tools in psychology were derived from *content-analysis techniques* used to detect Freudian themes in texts resulted from patients in therapy using stream of consciousness talk (Tausczik and Pennebaker 2010). The categories in LIWC include standard function words such as personal pronouns, articles, verbs, conjunctions that can be used to 'profile' texts by identifying different patterns of word usage, and also to detect psychological states (e.g. attentional focus, Rude et al. 2004). Going beyond function words, LIWC's dictionaries include a range of categories that capture more complex psychological states such as affect (e.g. positive and negative emotions, anger, sadness), cognitive processes, social processes, personal concerns (e.g. work, leisure, religion, money, death), core drives and needs (including affiliation, achievement and power), time orientation, informal speech, etc. LIWC then calculates the rate that each word category is used in each text, with these categories being validated (e.g. Pennebaker et al. 2007; Bantum and Owen 2009), and widely used in research in social and personality psychology (for a review see Tausczik and Pennebaker 2010). LIWC is a tool for conducting (computerised) content analysis so it has the limitations inherent to quantitative analyses of complex text (it is not designed to capture and account for subtleties of language). However, it includes several relevant categories that we use to assess belonging around the use of 'I' and 'we', and language that embeds positive or negative affect. From the latest dictionary (released in 2015), in the current research we focussed categories that we assessed as the most relevant in relation to a specific *recovery social identity*; these include the use of pronoun 'we'(as capturing a sense of common cause and collective selfhood), affect (as shared positive emotions), affiliation (as a supplementary indicator of identification with the recovery community), and achievement (as an indicator of positive self-esteem in the particular context of this group; this category includes words such as win, better, success, etc.).

The quantitative aspects of social connectedness have been captured by conducting Social Network Analysis (SNA) and examining relevant network centrality coefficients. In this context, SNA represents an ideal methodology enabling us to map and visualise online interactions between the members of the recovery community. Furthermore, given that SNA captures relationships between members of the

groups of 'actors', it allows for detailed investigation of relational and dynamic data (Otte and Rousseau 2002). A description of SNA that illustrates particularly well its benefits in the present context of research was provided by Wetherell, Plakans, and Wellman:

> Most broadly, social network analysis (1) conceptualises social structures as a network with ties connecting members and channelling resources, (2) focuses on the characteristics of ties rather than on the characteristics of individual members, and (3) views communities as 'personal communities', that is, as networks of individual relations that people foster, maintain, and use in the course of their daily lives (Wetherell et al. 1994, p. 645).

Therefore we use SNA to help us identify intra-group dynamics that are relevant for supporting (or potentially hindering) positive change in a recovery community. As a strategy that captures social connections between members of a network or a group, SNA is particularly useful here as it can provide us with insights into how different forms of social recovery capital are exchanged between group members (Putman, 2000). This is a particularly important point here as we can visualise how these exchanges evolve over time in the online recovery community, and how these variations are associated with relevant external events.

By examining *network centrality indicators* we can identify "how well positioned an individual is to receive and disseminate information" (Haythornthwaite 2001, p. 216) that is relevant to the whole group. In terms of centrality indicators, we examine *degree centrality* (i.e. the number of ties a node or an actor has), and *betweenness centrality* (i.e. the number of times that a node requires engagement with a given node to reach another node, or as the number of shortest paths that pass through a note). We used degree centrality as a measure of *bonding capital* (the higher the number of connections a group member has, the higher the degree centrality, and subsequently the bonding recovery capital of that group member). On the other hand, *bridging capital* is effectively captured by betweenness centrality indicators as group members in the network that have high betweenness centrality play the role of the gatekeepers of the community (Otte and Rousseau 2002). According to the classic text on SNA by Freeman (1978), betweenness reflects network centrality "(…) to the degree that they [n.a., the group members] *stand between others* and can therefore facilitate, impede or bias the transmission of messages" (p. 36).

We propose that a cohesive social network should support the development of a strong online support community for recovery, thus we examine how this community is affected by external (positive) events in the life of the group. We make the following predictions:

1. Positive events taking place in the recovery community will result in increased identification with the recovery community reflected by more participation in the online community, and an increase in linguistic identity markers in the form of the use of 'we', shared positive affect, affiliation, and achievement (Hypothesis 1).
2. There will be a strong association between key positive events involving the group and the activity in the online network reflecting recovery capital growth. We expect that SNA will show changes in network cohesiveness, specifically, over time there will be an increase in bonding capital (as levels of degree centrality of the social network), and bridging capital (as levels of betweenness centrality) which should become particularly apparent when positive events occur (Hypothesis 2).
3. We expect that all these effects will be particularly strong for the participants in the programme who are highly committed to the recovery community and represent the 'core' of the group (i.e. those members who joined the group prior to the specific positive event occurred, and also by the time when 50% of the member base was already established) (Hypothesis 3).

Method

Participants

67 clients of the JFH community that were involved in online interactions on the group Facebook page in the eight months were included in our analysis. We used the term 'recovery community' in a more inclusive sense, that is, the JFH community is made up of participants in the programme ($N = 67$), staff members ($N = 5$), and supporters of the recovery process (drawn from the broader community, $N = 746$). This definition of a group (recovery community in this context) is applied in a similar way as in research on collective action on behalf of disadvantaged groups, where action is not only taken by the disadvantaged group per se but also by its supporters (see Bliuc et al. 2007).

Procedure and data analysis

Based on the group's online social interactions extracted from its Facebook page, we conducted SNA to identify changes in the structure of the network in terms of communication between members (i.e. commenting on posts, liking posts, and liking comments were classified as links or network edges). We calculated network centrality coefficients using the 'SNA' package as an add-on to R software.

To capture changes in the content of communication on Facebook page of the group over a period of eight months, SNA was complemented by the computerised linguistic analysis using LIWC. This analysis enabled us to identify markers of a salient recovery social identity and changes in these markers in relation to key events in the timeline of the group.

Identifying a key positive event for the group

The incident that we have selected to focus on represents a great illustration of high-profile, pro-social behaviour adopted by several members of the JFH community, behaviour that is aligned to the positive values and norms of the recovery community. The incident, described in detail in Best (2016), involves six members of the JFH community who intervened to stop a violent attack on a young woman. Called by the landlord of a neighbouring hotel to one of

their sites, six of the JFH team rushed in to stop a man from savagely beating the young woman. The team, including past violent offenders and drug users, restrained the man and pulled the young woman to safety, before leaving the money and drugs littered around the room and willingly giving statements to the police. This event occurred in week 11 in the timeline of the group. In November, 2015, Wayne Hollerin, the man who JFH team members stopped, was jailed for life after admitting attempted murder. The intervention and the role played by the JFH team in saving the young woman extensively covered by the local media www.blackpoolgazette.co.uk/news/crime/visitor-tried-to-kill-woman-on-god-s-orders-1-7562586. Four members of the JFH team subsequently receive police commendations for their part in this event.

Identifying the core group members within the broader group

Finally, we also classified old and new clients of the group based on whether they were active before or after the week when the event occurred. Specifically, old clients are those who are active within the group prior to week 11, while new clients are those who were first active after week 11. Week 11 also corresponds to the time when the majority of the current group members have already joined the group (week 10, 47% of the members who do interact textually with the group have made either a post or comment so this indicates that by this point in time the network is relatively well established).

We collapsed LIWC scores for both posts and comments on the posts. Within the JFH Facebook group, 45 clients (programme participants who are either volunteers or apprentices) were active prior to week 11 and thus classified as 'Old Clients', while 22 were first active after week 11 and thus classified as 'New Clients'. The remaining 751 non-client members fell into the 'Other' members group.

Ethical considerations

The research has been reviewed and approved by the Ethics Committee of the university where the research was conducted. Analyses of data extracted from open online forums is becoming increasingly common, however, there are several ethical issues that are unique to accessing and working with this type of data, in particular, in relation to seeking consent for the data to be used in research (and identifying the appropriate persons to be contacted for this purpose). In the case of the present research, however, this issue was resolved by having developed collaborative relationships between the research team and the organisation which is providing the therapeutic service (and moderates the online activities on the Facebook page of the group).

Results

Descriptive statistics

Figure 1 provides a timeline of variation in levels of online activity (as number of comments and posts per week on the group's Facebook page) in the timeframe that we focussed on.

To identify variations in JFH social identity markers, we examined variations in the use of those LIWC word categories that are the most significant in relation to this particular social identity. These categories include: use of 'we', affiliation, and positive affect and achievement. In Figures 2–4 below, we show variation in the use of pronoun 'we', in affect (including negative emotions), affiliation and respectively achievement words.

These descriptive statistics for the whole group point to an overall increase in the levels of identity markers over time regardless of the positive event occurring in week 11. There are differences between what happens in the posts versus what happens in comments, with the content of the comments seemingly being more responsive to the positive event in week 11. For example, Figure 3 shows a marked increase in positive emotions expressed in posts but not in comments.

Main results

We anticipated that we would find a strong association between the key positive event taking place in the recovery
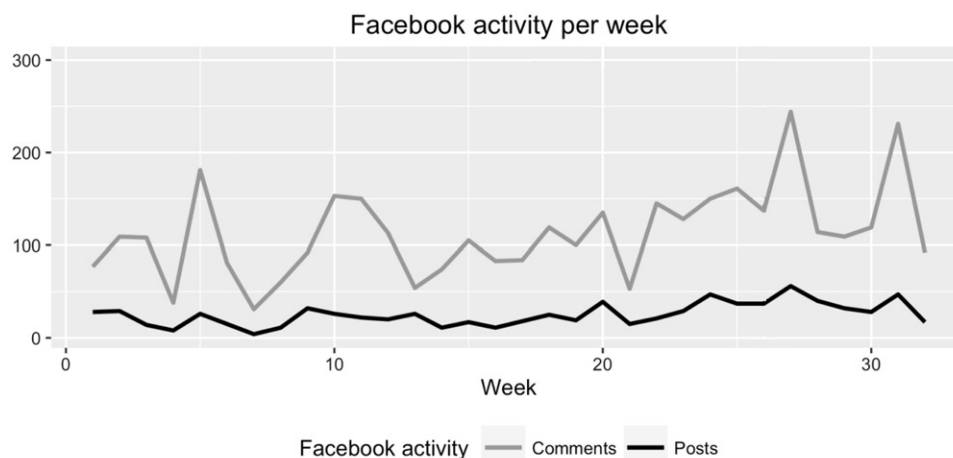

Figure 1. Number of posts and comments per week on the JFH Facebook page from 31 March to 4 November 2015.
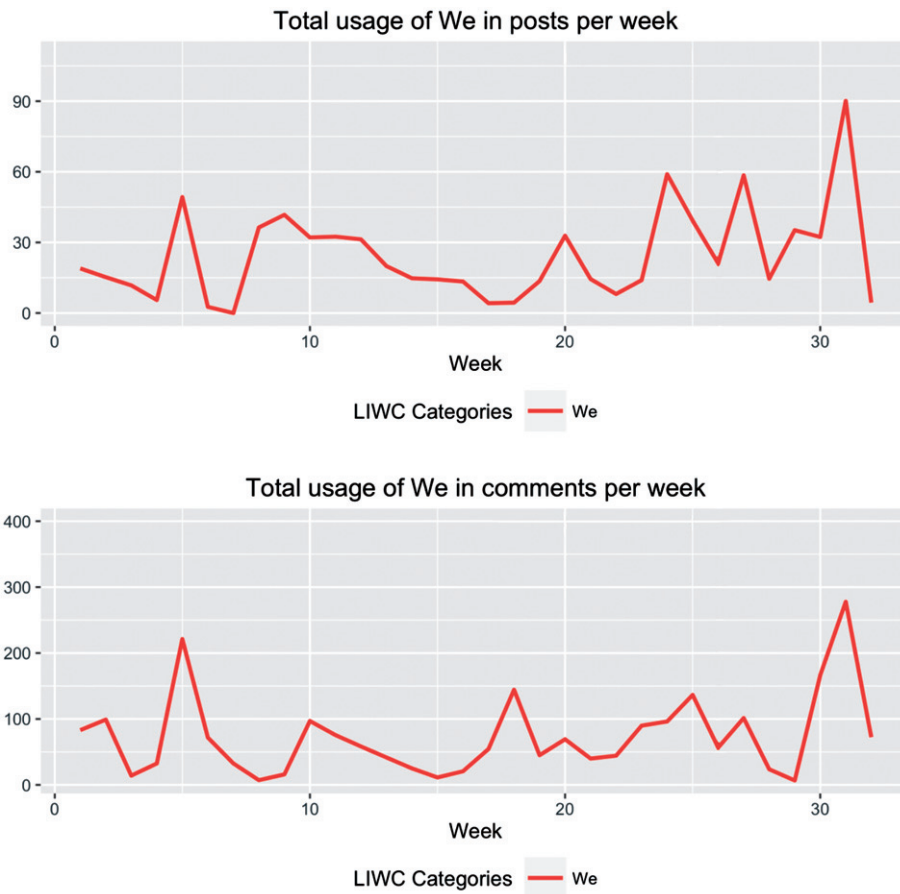
Figure 2. Variations in the use of pronoun 'we' in the JFH Facebook page in posts and comments from 31 March to 4 November 2015.
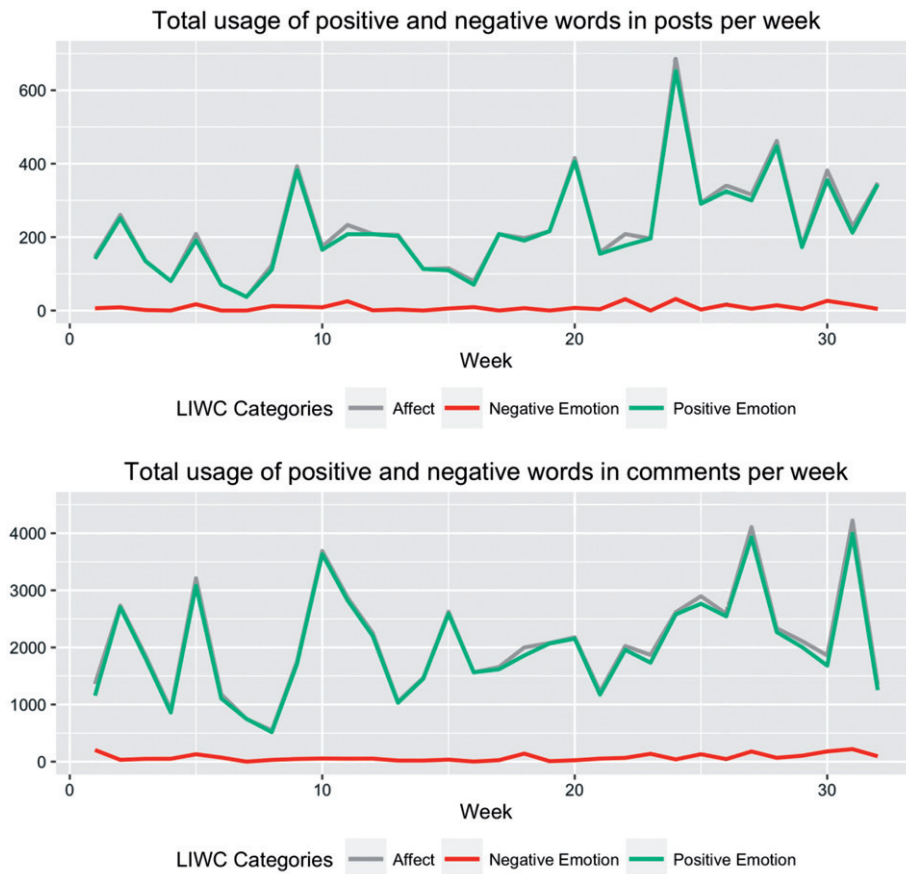

Figure 3. Variation in the use of affect in JFH Facebook page in posts and comments from 31 March to 4 November 2015.
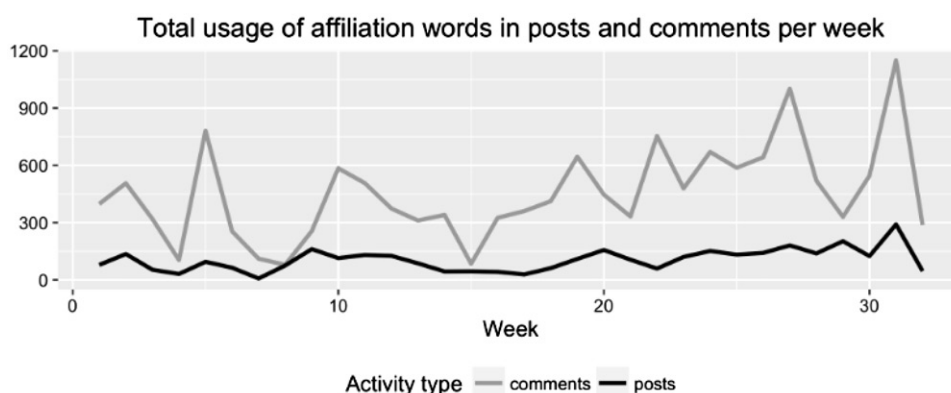
Figure 4. Variation in the use of affiliation words in posts on the JFH Facebook page from 31 March to 4 November 2015.

community and increased identification with the recovery community reflected by an increase in linguistic identity markers in the form of the use of 'we', shared positive affect, affiliation, and achievement (Hypotheses 1). We also expected that the association would be different for old members, new members, and the members of the broader community. Figure 5 below shows the LIWC scores for these categories for each of the sub-groups. As can be seen in both Figure 5 and Table 1, old members made significantly higher usage of 'we', positive affect, affiliation and achievement than other members. 'New clients' on the other hand only scored higher in their usage of affiliation words.

In addition, while the differences in word usage for most categories before and after the event for old members (compared to the rest of the groups are small), there is a significantly higher increase in positive emotion expression for the old members sub-group (see Table 2).

Secondly, we expected to find a strong association between key events involving the group and the activity in the online network reflecting recovery capital development as increases in bridging capital levels of betweenness centrality (Hypothesis 2). Similarly, we also expected that the association would be different for old clients, new clients, and the others. We conducted SNA for all weeks throughout the lifetime of this. Figure 6 below shows the betweenness and degree indicators for these groups. As can be seen, old clients have consistently higher scores of degree and betweenness than new clients (and everyone else in the online community).

The evolution of the network in key weeks (i.e. week 4 as baseline week at the start of the life of the community, week 11 immediately before the key event, week 12, immediately after the event) is represented in Figure 6. The most significant aspect is the change in the quality of support from the broader community members (not staff or actual participants or clients of the programme).

There are also significant differences within the network statistics across the three different groups (see Table 3). Old clients were found to have significantly higher scores of degree centrality and betweenness than new members and other members. Finally, we found that only in the old members' subgroup, there are marked increases in both degree and betweenness after the week of the event (see Table 4).

Discussion

Our aim was to examine variations in social identity markers and indicators of recovery capital (bonding and bridging) in a recovery community as reflected in the online interactions between group members and their engagement with the broader community in an online forum. The former was to assess bonding capital within the group and the latter to assess bridging capital, using both computerised linguistic analysis and social network analysis. We were also able to assess the impact of a major event in the group previously described (Best 2016) on social identity as captured through the online activities of a recovery group. Our expectation was to find a strong 'booster effect' in group commitment (identity markers) and recovery capital occurring after the key positive event. What we found is partially consistent with this prediction, at the same time opening some interesting avenues for discussion and further research. There was a positive impact in relation to some of the key markers of social identity, but these impacts tended to apply mostly for the sub-group made-up of 'old members', those members who joined the group before the positive event occurring.

Regarding changes in social identity markers identified in the language used in posts and comments on the group Facebook page, we found that the most sensitive indicators were shared positive emotions, and the use of pronoun 'we'. This provides support for the social identity model tenet that perceived positive status of the group (resulting from the life-saving event) increases the perceived attractiveness and desire to be a part of the group (i.e. as it contributes to the goal of achieving and maintaining a positive social identity, Turner 1982), but only for those who are established in their sense of belonging to the group (ie the 'older members').

In relation to our second prediction, we found that social recovery capital grew as reflected by centrality network statistics (degree and betweenness) with increases over time (from week 4 to 25-27) in the recovery community. However, we found that those increases in group cohesion are mostly driven by a 'core group' made up of the old group members (who joined by week 10). In this subgroup we see significant increases in the SNA centrality indicators both overall and in the timeframe after the positive event. In the language of recovery capital (Granfield and Cloud 1998), there is evidence of increased bonding capital through in the

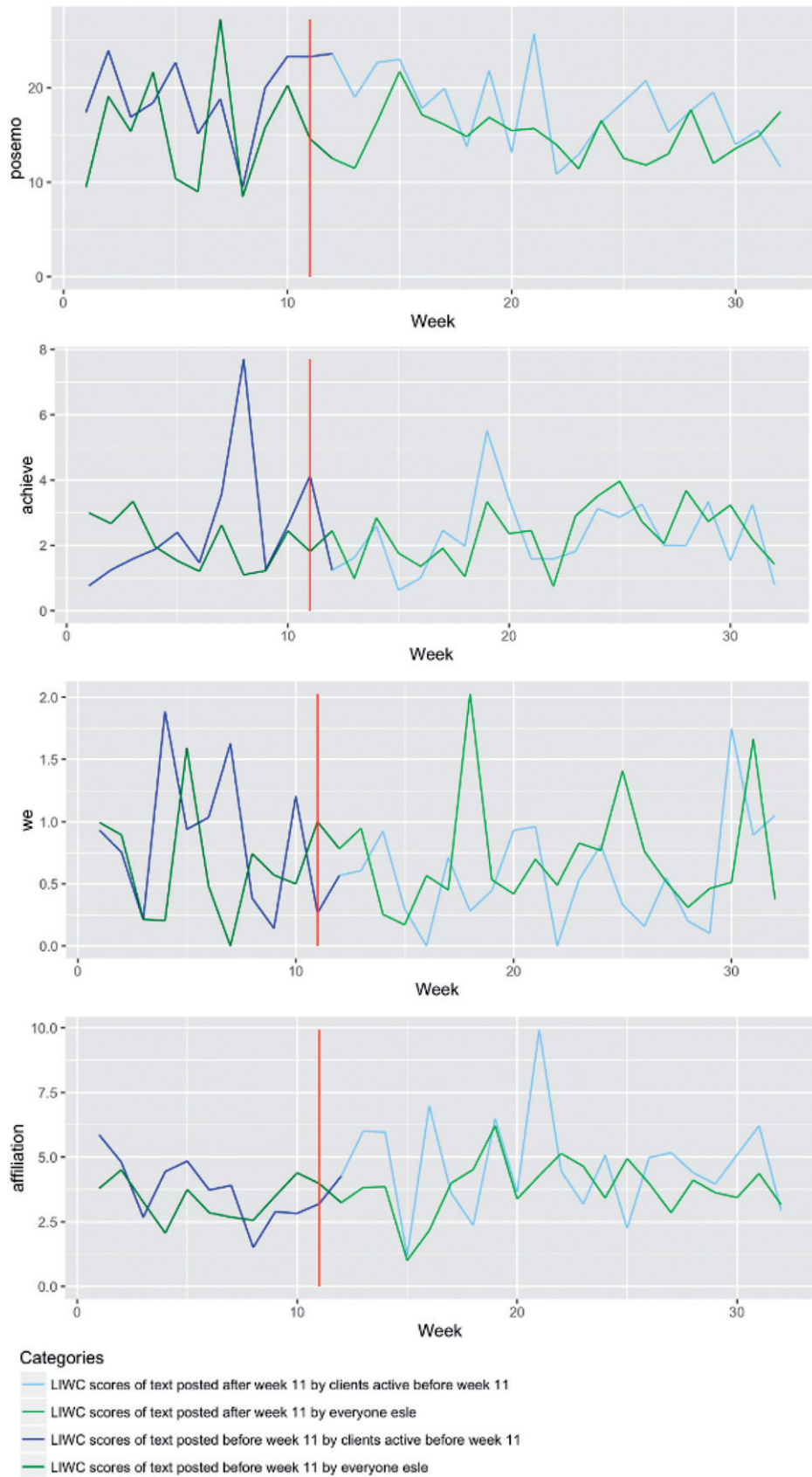**Figure 5.** Variation in the use of LIWC categories in posts on the JFH Facebook page for each sub-group.

Categories

— LIWC scores of text posted after week 11 by clients active before week 11

— LIWC scores of text posted after week 11 by everyone esle

— LIWC scores of text posted before week 11 by clients active before week 11

— LIWC scores of text posted before week 11 by everyone esle

Table 1. Mean comparisons of LIWC categories between the 3 sub-groups.

LIWC Category	Old members N = 45	New members N = 22	Other members N = 751
Positive emotions	16.54 ± 13.64^a	8.92 ± 10.37^b	5.77 ± 12.41^b
We	0.36 ± 0.51^a	0.29 ± 0.62^{ab}	0.09 ± 0.57^b
Achieve	2.13 ± 2.09^a	0.95 ± 1.52^b	0.52 ± 2.16^b
Affiliation	4.06 ± 5.38^a	3.16 ± 5.71^a	0.81 ± 3.44^b

Within rows, different superscript letters are significantly different at $p < .05$.

Table 2. Mean comparisons of LIWC categories between subgroups made of old members and other members before and after the positive event.

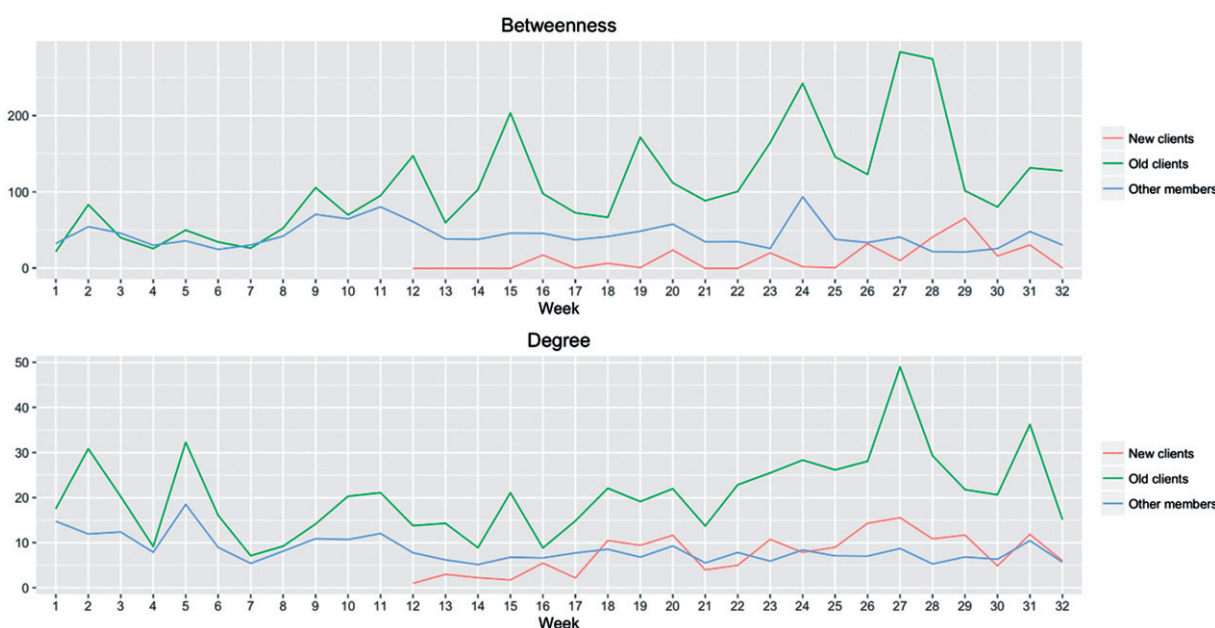|	Old members		Other members	
LIWC Category	Before week 11	After week 11	Before week 11	After week 11
Positive emotions	15.27 ± 19.16	18.70 ± 23.22	16.67 ± 18.58	15.51 ± 18.33
We	0.63 ± 2.88	0.73 ± 3.57	0.77 ± 3.95	0.82 ± 2.89
Achieve	2.43 ± 7.12	2.42 ± 7.62	2.24 ± 5.50	2.03 ± 5.25
Affiliation	4.61 ± 9.79	4.14 ± 9.49	3.21 ± 7.20	3.41 ± 7.33

Figure 6. Variation in mean betweeness and degree scores for all members from week 1–32.

Table 3. Differences between SNA coefficients in old members (clients who joined before the event), new members (clients who joined after the event), and other group members (broader support community).

	Old members N = 45	New members N = 22	Other members N = 751
Betweenness	38.88 ± 145.06	6.54 ± 25.37	10.02 ± 104.56
Degree	7.97 ± 17.83	3.44 ± 6.11	2.90 ± 10.94

Table 4. Differences between SNA coefficients in old members (clients who joined before the event), new members (clients who joined after the event), and other group members (broader support community).

	Old members		The rest of the members (including new members)	
	Before event	After event	Before event	After event
Betweenness	57.02 ± 199.85	142.08 ± 492.81	53.37 ± 349.79	44.08 ± 352.73
Degree	18.34 ± 28.82	22.47 ± 42.19	11.45 ± 38.80	7.27 ± 28.74

core subgroup which is both incrementally developed over time and seemingly result of external events.

Again, our final prediction regarding differences between established ('older') and new members in the recovery community in relation to both changes in levels of engagement in the online interactions and their role within the community (in terms of acquiring bonding capital and bridging capital) was partially upheld We did find significant differences in use of affect, affiliation, and achievement categories between these two types of group members (in particular reflected in the content of their online comments). This is important when discussing implications of the network centrality statistics findings, and has potentially important implications not only for research looking for evidence of prototypicality but also for clinical purposes where there is evidence that more active identification with recovery mutual aid groups is associated with better abstinence

outcomes (Kelly 2017). Thus, we know that where people are more active participants in mutual aid group activities (such as being a sponsor and taking a role at meetings) their outcomes are markedly better than among those who simply attend the meetings. Furthermore, Kelly and colleagues (Kelly et al. 2011) had previously argued that one of the key mechanisms of change in 12-step mutual aid groups is the mobilisation of an adaptive social network, although, this was not explicitly linked to a social identity approach (while entirely compatible with one).

Our findings regarding the core subgroup with members who were shown to have more connections to the other community members (reflected in higher degree centrality), and occupy more influential roles in the network, acting more often as 'bridges' between other members (reflected by betweenness centrality), are consistent with these points.

Our findings based on the analysis of both the online linguistic and social network data suggest that the community is going through a period of incremental development of identity and increased cohesion. These findings confirm reported outcomes in the offline context where JFH community has been successful in further developing itself as a highly supportive, cohesive, and functional recovery environment. That our online data confirm this should not be that surprising - and indeed it is a positive sign as it indicates that our approach of analysing online data is valid).

There are clear research opportunities that result from using online data-sources such as this to test 'real-time' changes in social networks and the resulting social capital they generate. Additionally, there is also scope for assessing the extent to which online communities themselves enhance the bonding capital within recovery communities and afford an alternative and complementary form of social support. Given the brevity of Facebook posts, it is possible that these effects would be much more evident with other forms of social media (like blogs, twitter and recovery site participation), and future research should attempt to incorporate this. The extent to which recovery and community services more generally benefit from online support activities including social media remains poorly articulated and tested and the method outlined here affords a method for examining these questions in prospective research studies. Subsequent research, including further enhancements of this work, will attempt to link engagement and network location in online recovery communities with recovery outcomes including the growth of recovery capital through connections.

In terms of limitations of the current research, we acknowledge that our approach was only applied to one case study (i.e. one recovery community) so far. We are continuing this work ourselves, but also our detailed description of the approach is meant to enable other researchers to adopt and apply our methodology (in this form or modified) in a range of therapeutic communities. LIWC is an excellent tool for the analysis of 'big data' and was successfully used in many contexts ranging from Tweets' analyses to detect mood variation in relation to work, sleep, and day-length in different cultures (Golder and Macy 2011) to emotional contagion captured via Facebook networks (Kramer et al. 2014). However, in terms of their ability to deal with nuanced language - such as

sarcasm for example - computerised linguistic tools in general are still in their infancy and these facets need to be further developed (Tausczik and Pennebaker 2010). Finally, we have assumed that the violent event was the most significant based on our own interpretation of the events, but in an emerging recovery community there are other events that may have equal or greater importance to members, and we did not test this assumption with participants. It is also not ideal that the date of the key incident overlaps with the timeline when most of the group members have joined the community (making it impossible to clearly assess the impact of the incident in newer group members).

Conclusion

The paper is highly innovative in both the methods used (linguistic analysis and social network analysis) and their application to an online community supporting addiction recovery. The paper has demonstrated that a real-like event affecting the group has had a positive but short-term effect on key markers of social cohesion and social identity, driven largely through those who are 'high identifiers' with the online community, who show strong responsiveness in terms of affiliation and acknowledgement of the group achievements and successes. The link to social and recovery capital is less clear (and appears to be less sensitive to a significant event) and further work is required to build an empirical and conceptual link between social identification and recovery capital models. There are also issues of methodology and ethics to be reconciled. Methodologically, there are real benefits in assessing 'real-time' changes in social networks and social capital without intrusion or bias through self-report. However, this comes at a potential cost of ethical clearance of accessing social media data without consent from the participants. While the study had university consent, future work in this area needs to address issues of consent and permission for the use of online data (even when anonymised). To the extent that these issues can be addressed, this model can be generalised to a diverse range of online communities and offers an innovative method for assessing social networks and social identity.

Disclosure statement

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