"My ADHD Hellbrain": A Twitter Data Science Perspective on a Behavioural Disorder

Mike Thelwall[†], Meiko Makita, Amalia Mas-Bleda, Emma Stuart

Statistical Cybermetrics Research Group, University of Wolverhampton, UK

Abstract

Purpose: Attention deficit hyperactivity disorder (ADHD) is a common behavioural condition. This article introduces a new data science method, word association thematic analysis, to investigate whether ADHD tweets can give insights into patient concerns and online communication needs.

Design/methodology/approach: Tweets matching "my ADHD" (n=58,893) and 99 other conditions (n=1,341,442) were gathered and two thematic analyses conducted. Analysis 1: A standard thematic analysis of ADHD-related tweets. Analysis 2: A word association thematic analysis of themes unique to ADHD.

Findings: The themes that emerged from the two analyses included people ascribing their brains agency to explain and justify their symptoms and using the concept of neurodivergence for a positive self-image.

Research limitations: This is a single case study and the results may differ for other topics.

Practical implications: Health professionals should be sensitive to patients' needs to understand their behaviour, find ways to justify and explain it to others and to be positive about their condition.

Originality/value: Word association thematic analysis can give new insights into the (self-reported) patient perspective.

Keywords ADHD; Word association thematic analysis; Social behaviour; Social web; Twitter

1 Introduction

Attention deficit hyperactivity disorder (ADHD) is a common disorder for young people that can persist into adulthood (Biederman et al., 2011; Spencer, Biederman, & Mick, 2007). It has been estimated to affect 5% or 7.2% worldwide (Polanczyk

† Corresponding author: Mike Thelwall (E-mail: m.thelwall@wlv.ac.uk; Orcid: 0000-0001-6065-205X).

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et al., 2007; Thomas et al., 2015). ADHD is characterized by inattention and/or hyperactivity and impulsiveness, although ADHD symptoms seem to be more heterogeneous and subtle in adults than children (Kessler et al., 2006). For example, unlike in children, gross motor hyperactivity is relatively rare in adults whereas inattentiveness is frequent (Wilens et al., 2009). ADHD is associated with impaired social, emotional, familial, academic, and behavioural functioning (Wehmeier, Schacht, & Barkley, 2010). Those with a diagnosis sometimes blame socially undesirable behaviour on themselves (Honkasilta, Vehmas, & Vehkakoski, 2016), potentially causing additional distress and psychological harm.

A recent systematic review of 101 relevant studies has argued that "relatively little" is known about the subjective perceptions of ADHD by diagnosed children (including adolescents) and their parents (Wong et al., 2018). Relevant findings from prior research into the perspectives of adults and children with ADHD are introduced in the Discussion section. Perceptions are important because they influence ADHD medication adherence (Gajria et al., 2014) and so a better understanding may help healthcare professionals to support effective treatment regimes. More knowledge about how people with ADHD cope with, and communicate about, their disorder may also help professionals give better advice to reduce anxiety (Pliszka, 2019) and depression (McQuade et al., 2011), promote self-acceptance (O'Connor et al., 2018) and cope with daily living challenges.

Social media sites have the potential to give insights into the lives of people with ADHD because posts can be used to share life issues as they occur (Chew & Eysenbach, 2010; Gruebner et al., 2017) and show how people communicate about them online. For example, an ethnographic content analysis of postings to ADHD Facebook groups found medication advice and jokes about perceptions of the condition (Gajaria et al., 2011) and an investigation of attitudes towards cannabis in an online forum found the first evidence of a belief that it was therapeutic (Mitchell et al., 2016). Whilst surveys and interviews can more directly interrogate the patient perspective and ensure that all participants have been diagnosed with ADHD (e.g. Weisner et al., 2018), social media analysis offers a complementary approach by investigating how people communicate about ADHD in an everyday setting.

Social media use among people with ADHD seems to be similar to that of the general population, at least for teens (Dawson et al., 2019), although possibly with fewer online friends (Mikami et al., 2015). People with ADHD have a higher risk of Internet addiction (Evren et al., 2018; Stavropoulos et al., 2019; Yen et al., 2007) and social media addiction (Andreassen et al., 2016), such as Facebook overuse (Gul et al., 2018; Settanni et al., 2018). Twitter is a logical choice for social media

analysis because ADHD is one of the two most common health topic conditions tweeted about by users under the age of 18 (Sadah et al., 2016; Weeg et al., 2015). Tweets from users with ADHD discuss causes and use the pronoun "they" (indicating that the users frequently tweet about others, perhaps because of the importance of others' reactions) and tentative language more often than average for people with nine other mental health conditions (Coppersmith et al., 2015), and common themes include, "emotional dysregulation, self-criticism, substance abuse, and exhaustion" (Guntuku et al., 2019).

Although the studies mentioned above have reported themes found in the tweets of people reporting an ADHD diagnosis, a more detailed exploration and different methods may gain additional insights into this complex disorder. This study addresses this possibility with the following research questions. The first is a general exploratory question whereas the second addresses ADHD tweets from a different perspective that may give complementary insights. The second method is the novel methodological contribution of this paper (the first time it has been applied to ADHD), and the first method is included to assess whether the second method applied to the same dataset gives genuinely different results.

1. What are the main themes of personal ADHD discussions on Twitter?
2. How are ADHD discussions different from other medical discussions on Twitter?

2 Methods

The research design was to gather a large sample of tweets relating to lived experiences of ADHD and use thematic analysis to develop core relevant themes (RQ1). Thematic analysis, described in more detail below, is an iterative qualitative method that identifies relevant themes from sets of texts (Braun & Clarke, 2006). It is suitable for exploratory analysis as a relatively theory-free qualitative method. For RQ2, personal tweets about a range of other disorders and diseases were gathered and compared with the ADHD tweets using a word association analysis (which identifies words used statistically significantly more in one set of texts than another, as explained below) to identify themes unique to ADHD.

This study was exempt from ethical approval at the University of Wolverhampton because it analysed only fully public (searchable, no logon required) texts so the tweeters have no reasonable expectation of privacy (Eysenbach & Till, 2001; Wilkinson & Thelwall, 2011). Nevertheless, the original tweets will not be shared, and exact quotes are avoided so that no individuals can be identified from this paper.

2.1   Data: Tweets

Tweets related to ADHD and 99 other conditions were gathered in parallel from Twitter from July 9, 2019 to February 3, 2020 using a curated set of queries. This date range gave a sufficiently large volume of ADHD-related tweets (58,893) and spanned summer holidays and school term time, which present different challenges for children with ADHD. The quoted query "my ADHD" (not case sensitive) was used to identify tweets that were likely to be discussing the tweeter's condition. Omitting the "my" would match tweets from researchers, parents, and the media, which are not relevant here. It captures an incomplete sample of disorder discussions because there are many ways in which a person can discuss their condition without using the phrase "my ADHD". A person claiming to have ADHD may not have been diagnosed with it and therefore the tweets are from Twitter users that implicitly claim to have the disorder.

For the set of related tweets needed for RQ2, 99 other queries for doctors or common disorders and diseases were submitted as phrase searches starting with the word "my" (e.g. "my depression", "my doctor", "my allergies", "my flu", "my acne", "my cancer") (see Appendix for a list). Tweets matching these were combined to create a reference set of personal health-related tweets (n=1,341,442) for comparison with the ADHD tweets. Whilst this is not an exhaustive list, it encompasses a wide range of common conditions.

Two analyses were carried out and written up independently and blinded from each other to give method (and investigator) triangulation. The results were compared only after both had been completed (see the Discussion section for the comparison).

2.2   Analysis 1: Random tweets thematic analysis

For analysis 1, three researchers (the last three authors) conducted a standard thematic analysis (Braun & Clarke, 2006, 2013) on a random set of 200 tweets. The tweets were analysed separately rather than in the context of users' timelines because each tweet may appear separately on the timeline of readers rather than forming a coherent whole with any prior tweets. When a tweet was a reply to a previous message, Twitter was searched to find that message and add context, when necessary.

Rooted within social constructionism, this thematic analysis followed an inductive approach based upon Braun and Clarke's (2006) six-phase method. In phase 1, the three researchers read and re-read the dataset to become familiar with the content. In phase 2, the researchers independently generated initial codes, paying close attention to patterns of similarities and variation. At this stage, emerging topics and sub-topics were discussed. For instance, medication and coping tools were considered

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topics within a broader theme: "managing my ADHD". This coding and classification of topics into themes is subjective and relies on the researchers' interpretation of each tweet and their knowledge of the general subject area. Initial coding was informed by current literature on ADHD research (e.g. Frigerio & Montali, 2016; Ringer, 2020) and then guided by the tweets. In phase 3, the three researchers independently assigned one or more tentative themes to each tweet. In phase 4, the complete set of codes across all data were reviewed and combined, disagreements among the researchers were discussed until reaching a consensus on the themes and sub-themes assigned to each tweet. In phase 5, themes and sub-themes were further defined and named, here the aim was to identify the core message of each theme; according to Braun and Clarke (2013), this exercise allows for the development of "a concise, punchy, and informative name for each theme". In phase 6, thematic narratives and examples (rephrased quotes to respect Twitter users' anonymity) were discussed among the researchers and written up.

2.3   Analysis 2: Word association thematic analysis

For the comparison between ADHD tweets and other health-related tweets, a word frequency test was used with the social media data analysis software Mozdeh to identify words that were more common in ADHD tweets than in tweets about the other conditions. This is a qualitative big data method that avoids the face validity and understanding limitations of quantitative big data approaches (Mills, 2018) with a final qualitative stage. A 2x2 chi-square test was used for each word to check if it was in a higher proportion of ADHD tweets than non-ADHD tweets. For example, the word *blame* was in 0.8% (443) of ADHD tweets compared to 0.3% of the remaining medical tweets. Although this difference of 0.5% is probably too small to be noticeable by humans reading the tweets, a chi-square test revealed it to be highly statistically significant. In this example, the percentage is small and might be thought irrelevant but given that these tweets can discuss any aspect of the disorder, low prevalence overall does not equate to irrelevance.

Since the above procedure gives a huge number of simultaneous statistical tests, false positives (words that seem to have an association with ADHD but do not) are highly likely. A Benjamini-Hochberg (Benjamini & Hochberg, 1995) adjustment (in Mozdeh) was therefore used to protect the familywise statistical false positive rate. Terms were retained only if they were judged to be statistically significant with p≤0.001 after the Benjamini-Hochberg procedure. Thus, the probability that there are no errors in the set of terms found to have a word association is at least p=0.999.

Over 1,000 words occurred statistically significantly more often in ADHD tweets than in the other health-related tweets. These words were put into themes using

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thematic analysis with a single coder (the first author), different from the coders used for the first analysis to give investigator triangulation. The coder read a random sample of tweets containing each term to check its context for the thematic classification. This continued until saturation was judged to have been achieved (i.e. no new themes were emerging), after 200 terms. After this, the codes were revisited, clustered into major themes and reclassified when necessary to produce a set of meaningful themes.

A loophole in this process is that a term might be judged statistically significant because it had been used repeatedly by one or more users, violating the assumptions behind the chi-squared tests. To check for this this, the test was run again after filtering out multiple posts from the same user (choosing one at random). Although some words failed this second test (@usernames and event-related #hashtags), all themes were still supported. Thus, the results are robust against repeated use of a term by one or more users.

3   Results

The results of the two investigations are reported separately, as they were conducted, and are contrasted in the second half of the Discussion.

3.1   Analysis 1: Random sample thematic analysis

Four main themes were generated by the thematic analysis of a random sample of 200 tweets matching the query "My ADHD": (1) My ADHD feels like; (2) Managing my ADHD; (3) Understanding, Support & Awareness of ADHD; and (4) Embracing my ADHD. Four subthemes were also identified for the second theme. Quotes given below are substantial paraphrases of the original tweets.

3.1.1   Theme 1: My ADHD feels like

Within the sample of tweets, *My ADHD feels like* was the most recurrent theme and overlaps with the other themes developed in Analysis 1. *My ADHD feels like* includes tweets that comment on the symptoms, emotions, mental state, triggers and struggles that people with ADHD experience on a day-to-day basis. In talking about how having ADHD makes them feel, Twitter users give quite detailed and personal accounts of their inability to focus, memory issues, hyperactivity, getting easily distracted, issues with their organisation and time-management skills, impulsiveness, or experiencing depression and anxiety. Most of these accounts shared a negative narrative of what ADHD is and feels like; the following modified tweets illustrate this dominant theme:

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- *I have no situational awareness and serious memory problems because of my adhd.*
- *I'll always have adhd but if it wasn't for my adhd maybe I wouldn't be artistic. Still, it makes me feel crap!*
- *my adhd mixes up with my depression and anxiety symptoms making my stress-eating worse.*

In contrast, in some instances Twitter users seem to articulate a more positive narrative, often conveyed in a humorous way, in which they differentiate or try and *detach* themselves from ADHD. In their accounts they construct their ADHD as a separate entity:

- *I just colored my hair. I don't want to color it again. My ADHD goes mad at me.*
- *The thing about choosing a major is that my ADHD will always say NO to any kind of work.*
- *My ADHD won't let me be great and finish this paper…*

3.1.2   Theme 2: Managing my ADHD

Tweets under the theme *Managing my ADHD* are concerned with describing and explaining the tweeter's way of coping with ADHD and ways to help mitigate the consequences of ADHD. The theme was divided into four sub-themes: medication; coping tools or mechanisms; coping with humour; and seeking medical help.

Coping tools or mechanisms is the most common sub-theme within *Managing my ADHD* and includes tweets explaining the types of things people use or rely on other than medication that helps to reduce symptoms. Popular coping mechanisms include music, video games, art, diet, and exercise. Tweeters also talk about specific thought processes and strategies that they use to help manage symptoms:

- *One of the things that helped with my ADHD attention span was the family computer games.*
- *I asked for deadlines for this work as that helps my adhd brain do it.*
- *By being a part of this group, I've developed coping mechanisms to control my #ADHD, such as checklists.*

Medication is the second most common sub-theme within *Managing my ADHD* and is related to people asking for advice concerning types of medications, people's experience with certain medications and tweets describing the side effects of certain medications:

- *My gp is prescribing me [meds name] has anyone used it?*

- *This is the first time my ADHD is being medicated with something that works. I'm on []. I used [] before and it didn't work.*
- *I think I accidentally took my #adhd meds twice today. My heart is racing!*

Coping with humour is the third most common sub-theme and includes a mix of direct jokes about ADHD and using humour to make light of the effects of ADHD. Some tweets have a sarcastic undertone about the disorder:

- *Forgot my ADHD meds in my Toyota corolla. It turned into a Toyota aygo.*
- *My adhd meds v. my love of coffee v. my reflux acid!*
- *My adhd doesn't have enough to play with so I'm back on twitter.*

Seeking medical help has the fewest tweets within the overarching theme of *Managing my ADHD* and these tend to focus on people seeking a diagnosis for their condition, chasing up medical assessments or about attending doctors' appointments for conditions associated with ADHD:

- *My gp asked me loads of questions and diagnosed me very quickly. What a relief!*
- *I'm going to chase-up my ADHD assessment and see how long the waiting list is.*
- *When I mentioned it to my gp she said my nightmares could physically affect the brain!*

3.1.3   Theme 3: Understanding, Support, & Awareness of ADHD

Tweeters sometimes mention a lack of understanding from family and friends but also from society in general. Many ADHD tweeters feel that their family does not understand their disorder and how it affects them, despite their efforts to explain this; resulting in frustration when their parents blame the disorder on their children.

- *I explain my ADHD, but family still see me as spacey and unable to focus on conversations.*
- *My mum got crazy I'm not interested in management. She said I was hiding behind my adhd.*
- *Someone told me I was using my ADHD as an excuse to not do some things, and that is sooooo far from the truth.*

Within this theme, some tweets also reflect instances of poor treatment or lack of support from teachers and medical professionals and the resulting consequences, whereas some tweets also reveal how society's reaction can impact on a person's self-perception.

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- *Some teachers treated me badly because of my adhd and I have a lot of issues because of it.*
- *I can't get my adhd treated because doctors think I'm drug seeking.*
- *If you bully me because of my ADHD, I will call you out, then forget and internalize the shame.*

Some tweets are positive, showing how ADHD support and awareness should look like or how ADHD-related issues should be discussed or talked about more.

- *Communicate with your ADHD child without being passive aggressive about it.*
- *We need more discussion about [] which is a symptom of my ADHD.*

3.1.4   Theme 4: Embracing my ADHD

This theme is the least common within the sample and includes posts that reflect positive perceptions of ADHD, such as seeing it as a strength or superpower, and acceptance of ADHD or another co-morbid disorder, as part of everyday life or the ability to do something in a successful way despite the disorder.

- *It has taken me a long time to see my ADHD as a strength.*
- *I'm running on sugar, adrenaline, my adhd and joy.*
- *Even with my ADHD and other difficulties, I think I'm doing a good job.*

3.2   Analysis 2: Word association thematic analysis

The word association thematic analysis is based on 200 words that are in a statistically significantly higher percentage of tweets matching the query "My ADHD" than in the set of the comparable health-related tweets, and 19 themes were identified from them. Fifteen of these themes are listed below, together with an associated substantially modified quote, a description of the theme and examples of the terms that were classified as part of that theme. The final four themes are of little interest and are named but not described.

- **Medication**, "the dosage was upped on my meds": Medication in general is a feature of ADHD-related tweets (e.g. meds, medicine: medicine names were recorded in a separate theme).
- **Focus/distraction**, "I randomly hyperfocus": Many attention-related terms (e.g. hyperfocus, focus, impulsivity, inattentive) are used to describe ADHD symptoms.
- **Fidgeting**, "can't stop fidgeting": Many tweets discussing the need to fidget (e.g. bouncing, fidget) are used to describe ADHD symptoms.

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- **Other symptoms**: Some tweets discuss other symptoms, their associated difficulties or generalise (e.g. symptoms, hard, manage, handle, struggle).
- **Accommodation**, "they finally agreed to make some accommodations for me": Some terms related to the need for others to make accommodations for ADHD (accommodation, structure), usually at school.
- **Diagnosis**, "hope my ADHD is diagnosed": Getting a formal diagnosis seems to be important for ADHD, perhaps because some ADHD-related behaviours can be displayed by non-ADHD people (e.g. diagnosed).
- **Psychiatrists**, "my psychiatrist told me off": These are mainly mentioned in the context of treatments or diagnoses (e.g. psychiatrist).
- **Brain**, "the med is hitting the wrong bit of my brain": The workings of the brain for ADHD were discussed (e.g. executive, function, brain).
- **My ADHD brain**, "my ADHD brain told me to do something else": The phrases "my ADHD brain", "my ADHD ass" and "my ADHD hellbrain" were apparently used to distance the speaker from their actions or to explain poetically that actions were due to their ADHD (e.g. brain, hellbrain, ass).
- **Neurodivergent**, "I am starting to accept my neurodivergent status": This is typically used as a positive term.
- **Self**, "I hate myself sometimes": Personal references (e.g. I, I'm) are more common, perhaps because of the need to explain ADHD-related behaviour.
- **Blame and causation**, "I cant explain to teacher bc she does not know abt my ADHD": Words expressing blame or causation (e.g. blame, because, so) are more common, due to the need to explain personal behaviour.
- **Complex sentence construction**, involving multiple factors, "my ADHD is terrible and I am also depressed": Several conjunctions (e.g. also, and, but) are more commonly used presumably because ADHD needs more complex explanations than other disorders and diseases.
- **Responses**, "lrt me too!": terms alluding to interactions on Twitter (e.g. reply, thread) are more common, but this may be a second order effect of those with ADHD tending to be younger.
- **Co-morbidity**, "comorbid conditions and my ADHD together challenge my family": Tweeters mention that they also have related disorders (e.g. OCD, Autism, ASD, RSD, dyslexia; neither anxiety nor depression were in the list, perhaps because they are also common for the other 99 queries), presumably those known to be comorbid with ADHD.
- Several unsurprising themes also emerged: **disorder name**, **medicines**; Twitter **usernames** (of people tweeting about ADHD); and **ADHD-event-related hashtags**.

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4 Discussion

Both studies have similar limitations derived from the common data source. There is sampling bias in the sense that not all people with ADHD use Twitter, and not all tweeters with ADHD use the phrase "my ADHD" in tweets about their condition. It is also possible that non-ADHD tweeters use the phrase "my ADHD" for humour or other purposes, generating false matches. Additional method-specific limitations are highlighted below in the comparison between methods. The results are discussed separately in relation to previous literature for each of the studies and then the two analyses are contrasted in the final section.

4.1 Analysis 1: Random sample thematic analysis

The themes identified from Analysis 1 confirm, but sometimes with a different perspective, the results of prior studies. Previous research noticed the need for people with ADHD to discuss their condition (Theme 1: **My ADHD feels like**), and has mentioned several subthemes of this, such as ADHD-related behaviour (Coppersmith et al., 2015; Guntuku et al., 2019; Wilens et al., 2009).

Coping mechanisms (Theme 2: **Managing my ADHD**) are clearly important, however, and these are shared or explained on Twitter. The strategy of using **humour** to cope with ADHD has been previously mentioned (Gajaria et al., 2011; Sedgwick, Merwood, & Asherson, 2019) and it is a natural communication device in stressful situations (e.g. Tsukawaki et al., 2019). As in the case of people experiencing pain, distress or a disability (Csordas, 1997; Leder, 1990), the strategy of constructing the self and ADHD separately may help Twitter users to make sense of their own identity and their everyday life experience of ADHD. Nevertheless, ADHD is closely associated with autism, and autism spectrum disorders seem to be linked to a lack of sense of humour and reduced humour processing (Silva et al., 2017). **Medication** and seeking **medical** help were both commented on, seeming to be important to the patient perspective, as previously noted (Gajaria et al., 2011). For ADHD, this theme seems to reflect the idea that medication can be effective in changing a person's behaviour (Charach et al., 2014). This appeared to be the reason why there were tweets about the effect of medicines and whether they had been taken.

For Theme 3, **Understanding, support, and awareness of ADHD**, previous studies have found evidence of teens with ADHD feeling that family, friends, and professionals do not understand the disorder (Ringer, 2020) and that teachers do not understand ADHD or how to teach students with ADHD (Walker-Noack et al., 2013). Whilst teachers may have reasonable knowledge about ADHD symptoms, they can also have misconceptions about the causes and treatment of ADHD (Ohan

et al., 2008; Sciutto, Terjesen, & Frank, 2000). Misconceptions regarding ADHD among healthcare professionals (Julivia Murtani et al., 2020) and society (Gilmore, 2010; Pescosolido et al., 2008) have also been reported, although Twitter itself seems to be overall supportive towards mental illness (Budenz et al., 2020). This lack of understanding from others is often perceived as the most negative thing about having ADHD (Gajaria et al., 2011). Therefore, it is not surprising that feelings of acceptance and support from family, friends, healthcare professionals and society has been reported to be essential by teens with ADHD (Enggaard et al., 2020), in common with other long-term conditions (Lambert & Keogh, 2015). This lack of understanding tends to lead to ADHD being perceived as stigmatising (Mueller et al., 2012), for people with ADHD at all stages of their life span (Lebowitz, 2013).

Embracing my ADHD (Theme 4) was the least common theme within the sample but overlapped with the positivity instances within Theme 1. Previous research has shown that whilst some young people with ADHD do not perceive their condition in a positive light (Walker-Noack et al., 2013), others see some features of ADHD as part of their self-identity and not as impairments (Charach et al., 2014; Ringer, 2020). Positive attributes of ADHD are three times more likely to be discussed on ADHD-related Facebook groups than negative attributes (Gajaria et al., 2011) so Facebook groups worked as supportive networks where people with ADHD share their personal experiences and establish a positive ADHD collective identity. Whilst there is a tendency for adults with ADHD to be overly optimistic (Knouse & Mitchell, 2015), being positive about having the disorder seems to be desirable.

4.2   Analysis 2: ADHD-related word thematic analysis

Themes that are non-trivial and different from Analysis 1, or giving a different perspective, are discussed here. Not all have been noted in previous research. The need for people to understand the **Brain** does not seem to have been noticed in previous studies. For example, the brain is not mentioned in one recent meta-analysis of qualitative studies of children (Ringer, 2020). Nevertheless, the *functioning* (rather than perception) of the brain is the focus of much research into the disorder (Brown, 2019; Wehmeier, Schacht, & Barkley, 2010). For example, studies have found relationships between ADHD and executive dysfunction (Seidman, 2006) or emotional dysregulation (Beheshti, Chavanon, & Christiansen, 2020; Shaw et al., 2014).

Two previous studies have noted formation issues related to ADHD that could be used to explain the **My ADHD brain** theme (this phrase was also noticed in Analysis 1) including phrases like "my ADHD ass". These report some diagnosed children

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having problems with understanding their own identity, given that their behaviour is partly controlled by the disorder (Grant, 2009; Leyland, 2016; O'Connor et al., 2018; Ringer, 2020). In this context, the phrases might introduce some distance between the tweeter and the action, also expressing that they do not have the choice to avoid it. The phrase "ADHD brain" is used in popular explanations of ADHD, such as a video and article in *ADDitude* magazine about "neuroscience of the ADHD brain" (Silver, 2020). Thus, this or similar explanations seem to have resonated with those having the disorder to the extent that it guides how they explain themselves to others on Twitter.

The importance of a **diagnosis** is presumably tacitly or explicitly understood by professionals, for example as a gateway to mental health care (Shepherd et al., 2015). Tweeters also seemed to be concerned that people without diagnosed ADHD were claiming ADHD as an excuse for apparently bad behaviour, perhaps undermining the claims of people with ADHD.

The **Responses** theme is perhaps unsurprising given prior studies of ADHD online discussion groups (Gajaria et al., 2011), and has broad agreement with investigation of Facebook addiction that found ADHD to be a contributing factor (Gul et al., 2018). In partial contrast, technology use has been found to be similar between ADHD and other teens (Dawson et al., 2019), whereas Facebook users with ADHD seem to have fewer friends (Mikami et al., 2015). **Complex sentence constructions** might be related to the need to explain behaviour, hence leading to multi-part sentences (e.g. "I did X because of Y"), but does not seem to have been discussed before in the literature.

The likelihood of **Co-morbidity** is in line with previous research showing that comorbidity is a distinct clinical feature of both childhood and adult ADHD, with mood and anxiety disorders, substance use disorders, and personality disorders being the most frequent comorbid psychiatric conditions (Katzman et al., 2017; Kessler et al., 2006; Sobanski, 2006; Spencer et al., 2007). The new information here is that people with ADHD also talk about this online more than those with other disorders and diseases.

4.3 Comparison between analyses 1 and 2

The themes emerging from the two analyses overlap to some extent but not completely (Figure 1). From Analysis 1, the broad Theme 1 (**My ADHD feels like**) matches several symptom-related Analysis 2 themes: **Focus/distraction; Fidgeting; Other symptoms**. It also matches the theme **Self** to some extent (Figure 1). Both analyses identified articulations of separation from the disorder. This was characterised as detachment from ADHD within Theme 1 (**My ADHD feels like**), matching the distancing characteristic of the Analysis 2: **My ADHD brain** theme.

From Analysis 1, the broad Theme 2 (**Managing my ADHD**) only primarily matched in terms of the **Medication** subtheme, which matched Analysis 2, **Medication** and **Medicines**. **Coping** tools and mechanisms were not identified as a theme in Analysis 2, but there is some commonality with the **Accommodation** and **Psychiatrists** themes. Coping with **humour** was not identified as a theme in the second analysis, although the **My ADHD brain** theme contained non-serious tweets. **Seeking medical help** was also not identified in Analysis 2, but matched **Diagnosis** to some extent.

The third and fourth Analysis 1 broad themes seemed to match some of the Analysis 2 themes in all respects. The term **neurodivergent** seemed to be used in the context of accepting ADHD in a positive sense.

Several of the remaining Analysis 2 themes did not match Analysis 1 themes. The relatively trivial themes can be ignored (**Disorder name**, **Twitter usernames**, **ADHD-event hashtags**). The **Brain** theme, focusing on the mechanisms behind the disorder, is a theoretical dimension not found in Analysis 1. In fact, the Analysis 1 coders had discussed a possible "brain talk" theme but did not include it in the final set of themes. It could therefore have been identified by the Analysis 1 methods. The **Complex sentence construction** linguistic theme is something that seems unlikely to be identifiable from a standard thematic analysis because it would not be the type of pattern that a coder would be looking for. The likelihood of **co-morbidities** had been noticed in Analysis 1, but not selected for a theme. The Analysis 1 random sample identified 13 other disorders, with depression (13% of the random sample tweets), anxiety (8%), and autism (3%) being the most common. The **Responses** theme might also have been identified by a standard thematic analysis but seems easy to overlook in the absence of benchmark data from other conditions.

Based on the above comparison, the standard thematic analysis method is able to identify some themes that do not translate into language use differences, for example due to language use variations within the theme (e.g. perhaps many different words are used to create humour or express positivity). In addition, the standard thematic analysis method may identify themes that are important but not unique to the topic. For example, the two coping themes found (humour and other tools/mechanisms) seem likely to be important for many health conditions and may therefore not produce words unique to ADHD. Thus, word association thematic analysis may overlook generic issues. In contrast, the word association method is better able to identify linguistic themes and can identify themes that may be overlooked without benchmark data to compare against.

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Analysis 1 broad theme Subtheme	Analysis 2 theme
	Focus/distraction
	Fidgeting
My ADHD feels like	Other symptoms
	Self
	My ADHD brain
Coping tools or mechanisms	-
Medication	Medication
	Medicines
Coping with humour	-
Seeking medical help	Diagnosis
	Psychiatrists
Understanding, Support & Awareness of ADHD	Accommodation
	Blame and causation
Embracing my ADHD	Neurodivergent
	- ADHD-event hashtags
	- Brain
	- Complex sentence construction
	- Co-morbidity
	- Disorder name
	- Responses
	- Twitter usernames

(Managing my ADHD spans "Coping tools or mechanisms", "Medication", "Coping with humour", "Seeking medical help")

Figure 1.   Matching themes between thematic analysis (analysis 1) and word association thematic analysis (analysis 2).

4.4   Comparison between methodologies

Comparing the word association thematic analysis to the standard thematic analysis from a methodological perspective may shed light on any differences between the two methods. Whilst only one standard theme or subtheme (Medication) was identical to a word association theme, most themes overlapped to some extent. In general, the first method found more general themes and the second found more themes. In principal a standard thematic analysis could have produced more themes, making them more specific, perhaps by analysing additional texts. In contrast, the focus on words in the second method probably makes it difficult to generate larger themes because each word-based theme is relatively discrete, based on a set of words, and therefore relatively different from other themes based on different sets of words. Thus, standard thematic analysis may be inherently better at detecting general themes. In contrast the word association thematic analysis found more specific themes that could easily be overlooked without a benchmark collection or that may have been overlooked because they did not occur often enough to be recognised from reading texts. An advantage of the word association method here is in finding differences that are statistically significant and need to be explained

(put into a theme), drawing the attention of the analyst to information that might otherwise be overlooked.

Despite the above argument, the differences between the two analyses cannot be conclusively shown to be methodological rather than accidental or due to different coders. It would be unreasonable to use the same coders with the two methods to compare the methods directly, however, since they could not forget the first method results when applying the second. Thus, the results suggest, but do not prove, that the novel method (in this context) can give novel insights compared to existing methods.

5 Conclusions

The themes found by the two analyses point to a wide variety of dimensions from which to view the perspective of those that implicitly claim to have ADHD on Twitter. This list of themes may help professionals to get insights into the patient perspective in a way that may enrich an understanding of the symptoms, or support discussion-based interventions (e.g. Gisladottir & Svavarsdottir, 2017).

The themes that do not seem to have been explicitly remarked on in previous analyses of patient perspectives are particularly important. The tendency of people with ADHD to distance or detach themselves from their brains as a strategy to understand their behaviour or explain it to others seems to be widely adopted, suggesting that it is a useful coping strategy. Communicating about behaviour to others, particularly in terms of the appropriate target of blame—the disorder or "hellbrain", also seems important and a useful strategy. Finally, the concept of neurodivergence seemed to help people with ADHD to be positive about their condition.

Author contributions

Mike Thelwall (m.thelwall@wlv.ac.uk): Conceptualization, Data curation, Methodology, Writing-original draft, Writing-review & editing; Meiko Makita (MeikoMakita@wlv.ac.uk): Methodology, Writing-original draft, Writing-review & editing; Amalia Mas Bleda (Amalia. Mas@wlv.ac.uk): Methodology, Writing-original draft, Writing-review & editing; Emma Stuart (emma.stuart@wlv.ac.uk): Methodology, Writing-original draft, Writing-review & editing.

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Appendix: Twitter queries used

"my acne", **"my ADHD"**, "my AIDS", "my allergies", "my allergy", "my anaemia", "my anorexia", "my appendicitis", "my arthritis", "my asthma", "my atopic eczema", "my autism", "my bipolar disorder", "my bowel cancer", "my breast cancer", "my bulimia", "my bunion", "my cancer", "my chest infection", "my cystitis", "my depression", "my dermatitis", "my diabetes", "my disease", "my doctor", "my doctor told", "my dysphagia", "my dystonia", "my eczema", "my epilepsy", "my fibroids", "my flu", "my gastroenteritis", "my generalised anxiety disorder", "my glandular fever", "my gout", "my hay fever", "my heart attack", "my heart disease", "my hepatitis", "my hernia", "my HIV", "my Huntington%27s disease", "my hyperglycaemia", "my hypoglycaemia", "my IBS", "my illness", "my impetigo", "my infection", "my kidney cancer", "my kidney stones", "my laryngitis", "my leukaemia", "my liver disease", "my lung cancer", "my lupus", "my malaria", "my measles", "my meningitis", "my miscarriage", "my MS", "my multiple sclerosis", "my mumps", "my norovirus", "my obesity", "my osteoporosis", "my osteosarcoma", "my ovarian cancer", "my pancreatic cancer", "my pancreatitis", "my panic disorder", "my pleurisy", "my prostate cancer", "my psoriasis", "my rheumatoid arthritis", "my scabies", "my scarlet fever", "my scoliosis", "my sepsis", "my shingles", "my sinusitis", "my skin cancer", "my soft tissue sarcoma", "my sore throat", "my stomach bug", "my stomach cancer", "my stomach ulcer", "my stroke", "my sunburn", "my testicular cancer", "my tonsillitis", "my tuberculosis", "my tumour", "my ulcer", "my Urticaria", "my UTI", "my varicose veins", "my whooping cough", "my yellow fever", "told my doctor"