HEDONIC PURSUITS, PHYSICAL ACTIVITY FOR PLEASURE: IDENTIFYING AFFECT AND MOTIVATIONAL HEALTH BEHAVIOR CHANGE FACTORS WITH PHYSICAL ACTIVITY SOCIAL MEDIA CONTENT

by

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ABSTRACT

ALEXIS DANIELLE MITCHELL. Hedonic pursuits, physical activity for pleasure: Identifying affect and motivational health behavior change factors with physical activity social media content. (Under the direction of DR. SARA LEVENS)

Physical activity offers a range of health benefits but can be difficult to initiate and maintain. Self-regulatory processes are one route to understanding health behavior change. While affective mechanisms like positive affect and reward processing provide a valuable neurobiological pathway to elucidate individual motivations for physical activity. Theories and models that emphasize the role of affect and intrinsic and extrinsic motivations are applied in the current study to deepen our understanding of physical activity behaviors. Psychosocial sources of individual motivations, such as improving mood or changing one's physical appearance, can provide insight into ways to alter affective-cognitive mechanisms to encourage sustainable physical activity behaviors. The present study applied a mixed-method approach to elucidate themes of affect and motivation in social media content. A sample of 2,585 Twitter posts were collected in mid-July 2022. A motivational and health behavior change qualitative codebook was first developed to guide thematic coding analyses. Thematic coding results revealed a high frequency of extrinsic motivation and goal and change-oriented facilitators of physical activity. Intrinsic motivation included the highest percentage of positive attitudes compared to other motivation types. Health-oriented themes, satisfaction, dissatisfaction with physical appearance, and weight loss were also relevant. LIWC-22 analyses supported the role of positive affect and informed health themes. BERT topic modeling

analyses provided overarching physical activity topic themes for motivation and physical activity. Interpretations of the current results were presented, and future directions were suggested.

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CHAPTER 1: INTRODUCTION

Health behaviors are important yet difficult to maintain among multiple competing priorities people face day to day. As rates of chronic illness increase, it has become more important to identify effective strategies for promoting health and well-being. Health behaviors represent important determinants to overall health, but research has yet to identify primary mechanisms through which behavioral change is facilitated. Physical activity has wide-ranging, transdiagnostic benefits (Warburton & Bredin, 2016) but can be especially challenging to initiate and maintain given effort requirements and multiple sociocultural, lifestyle, and neurobiological factors. To increase rates of physical activity engagement, intervention research asserts a need to focus efforts on affective and motivational components underlying physical activity promotion and engagement (Ekkekakis et al., 2018; Knittle et al., 2018; Werner & Milyavskaya, 2018). For example, evidence indicates that physical activity behavior is highly influenced by affective experiences (Rhodes & Kates, 2021), whether it is experienced as pleasurable or not, and whether motivations to engage in physical activity are internally driven (autonomous) or externally driven (extrinsic) (Ntoumanis et al., 2021; Teixera et al., 2012).

It is important to consider first-person perspectives in relation to theoretically bound constructs, as there is a disconnect between findings from controlled research settings testing theoretical constructs and translation to public health and clinical settings for effective implementation (Bauman et al., 2019). One strategy to improve public health is to better understand public perceptions of motivation for physical activity

through social media. The present study aims to contribute to exercise psychology and physical activity promotion literature by examining associations between affect, motivation, and physical activity using naturalistic data, through the lens of social media users. More specifically, the present study proposes the use of affective and motivational models to identify and interpret themes related to physical activity content discussed on social media.

CHAPTER 2: LITERATURE REVIEW

Chronic illnesses, such as heart disease and cancer, continue to be the leading causes of death in industrialized countries (World Health Organization [WHO], 2019). Most chronic illnesses have complex etiologies that involve a range of environmental, genetic, and behavioral antecedents (Mulle & Vaccarino, 2013). With increasing rates of chronic illnesses, presence of systemic inflammation (Furman et al., 2019), and metabolic risk factors (Roth et al., 2020) has come a public health paradigm shift away from a focus on acute illnesses (e.g., infections, viruses) toward a focus on preventative medicine. More recent, shifts toward health promotion have increased awareness of the biological, social, and psychological intersecting determinants of health (Whitman et al., 2022). That is, healthcare systems now prioritize prevention, for example screenings for cancer, regular vaccinations, inclusion of 'wellness visits,' early detection of Alzheimer's disease, and even promotion of behavioral changes as an alternative or supplement to medications for illness prevention and management.

Health promotion elevates the preventative health paradigm by first acknowledging that health encompasses much more than simply the absence of illness, and secondly, that individual health is determined by intersecting factors, including sociocultural context. For example, through a health prevention perspective, positive health behaviors are a means to prevent or protect against illness, whereas a health promotion perspective conceptualizes behavioral changes as a means for promoting greater quality of life and (Corbin et al., 2021). Positive health behaviors and health

behavior change are essential to both prevention and promotion and are emerging as central foci for health-related research, policy, and clinical practice as a means to intervene on chronic health issues. Health behaviors are actions taken by individuals that affect health or mortality; examples include tobacco and alcohol use, substance use, diet, physical activity, sleep, risky sexual activities, health care seeking behaviors, and adherence to prescribed medical treatments. Critically, research demonstrates that engaging in positive health behaviors, such as physical activity, eating nutrient dense foods, not smoking, and limiting alcohol, can increase one's life expectancy by up to 14 years, compared to people who engage in unhealthy behaviors (Khaw et al., 2008).

From a holistic perspective, positive health behaviors are also a viable intervention to reducing negative mental health symptoms, increasing well-being, and reducing stress in both non-clinical and clinical populations (Gómez-Gómez et al., 2020; Teychenne et al., 2020). In addition, mental health challenges are associated with less health behavior engagement (Walsh et al., 2013), whereas improvements in mental health are also shown to contribute to greater ability to engage in and maintain positive health behaviors (Sin et al., 2015). A health promotion paradigm shift, advancing health behavior technologies (e.g., fitness trackers, smartphone applications), and increased access to social media, have all contributed to an increased awareness of and access to positive health behavior information. However, despite increased access to information (Webb et al., 2010), engagement in health behavior information (Johns et al., 2017) and mobile applications for health behaviors (Kanstrup et al., 2018) remain low and lack evidence for their effectiveness (Milne-Ives et al., 2020). Addressing what contributes to

low rates of health behavior engagement is an important effort for both preventing chronic illnesses and promoting optimized health across the lifespan.

Importantly, a range of individual, social, environmental, and cultural factors contribute to low rates of population level positive health behavior engagement. One factor is that health behavior change is a dynamic process comprised of daily decisions that are often self-directed, representing a cognitively demanding feat for most humans (Neal et al., 2017). To address the challenges of health behavior change, theories have been developed to outline the determinants of health behavior change to better understand what techniques and/or processes facilitate changes at an individual level. Some health behavior change theories explain change through identifying which *stage of change* someone is in, whereas others focus more heavily on the psycho-behavioral *processes* underlying determinants. For instance, the transtheoretical theory of change (Prochaska et al., 1992) includes five distinct stages pre-contemplation (no intention to change), contemplation (realizing there is a problem and thinking about change, but not ready to act), preparation (has set an intention), action (engage in desired behavior), and maintenance (committing to the new behavior, habit formation) stages. Whereas the social cognitive theory, for example, explores how attitudes, self-efficacy and sociocultural determinants influence health behavior change (Bandura, 1998) and others focus more on aspects of self-control (Carver & Scheier, 1982) and goal setting (Locke & Latham, 2006).

Health behavior change theories provide basic frameworks for how to structure interventions for research and clinical settings to test whether the intervention is effective

at increasing the specific health behavior (Sheeran et al., 2017). Despite an extensive literature base of health behavior change theories with some compelling evidence toward their application in structured intervention research designs (Byrne, 2020) there is a lack of effective translation between research findings of health behavior change interventions and implementation into clinical practice (Bauman et al., 2019; Keyworth et al., 2020). For instance, evidence demonstrates that providing patients with only educational information on a positive health behavior is insufficient at facilitating change, particularly if motivation to engage in change is low. This science to translation to implementation gap has led to calls for research focused on identify underlying mechanisms of health behavior change to facilitate development of more effective and scalable approaches to increasing positive health behavior engagement (Nielsen et al., 2018).

One positive health behavior that has been a center of focus for testing the effectiveness of translating health behavior change theory into interventions is physical activity. There have been recent calls throughout interdisciplinary research advocating for improvements in physical activity intervention effectiveness, scalability (Luszczynska, 2020) and inclusivity (Pickett & Cunningham, 2017) and for efforts to identify specific intervention targets that can be individualized across varied life contexts and phases (Rebar & Taylor, 2017; Schwartz et al., 2019). Despite decades of physical activity intervention research, interventions have been heterogenous in nature in terms of what health behavior change theory constructs are represented as intervention targets and mixed findings regarding whether a target is what led to increased physical activity. Importantly, no isolated strategy or construct has been shown to be superior to another,

suggesting that optimal physical activity promotion and change occurs through using a variety of theory-grounded strategies that can be individually tailored (Schwartz et al., 2019). This has resulted in issues with identifying primary 'ingredients' or facilitators for physical activity engagement (McEwan et al., 2019; Nielsen et al., 2018). Physical activity interventions have also tended to be costly to develop, recruit for, administer, and test, which has created additional burdens for translating research findings to effective interventions (Reis et al., 2016).

In addition, physical activity is difficult to prescribe and promoting physical activity has been described as a "complex intervention" to deliver (Faulkner & Taylor, 2009). Given these challenges, and difficulties that underlie health behavior change more generally, it is not surprising that more than half of the United States population report insufficient levels of physical activity (i.e., < 150 minutes/week of moderate-to-vigorous physical activity [MVPA]) (National Center for Health Statistics, 2022) and nearly 1 in 3 adults in industrialized countries do not meet similar global recommended levels of physical activity (WHO, 2022). Accordingly, it is important to explore factors that influence physical activity promotion because of the wide-ranging, transdiagnostic health benefits.

More specifically, physical activity refers to any bodily movement by the skeletal muscles that requires energy expenditure (Caspersen et al., 1985). Physical activity can confer benefits across all bodily systems (i.e., nervous, cardiovascular, endocrine, etc.) and does so through various psychophysiological mechanisms. Evidence indicates that regular physical activity may facilitate systemic and long-term cellular and epigenetic

changes (Marino et al., 2021; Fabre et al., 2018; Steele et al., 2019), with potential reproductive benefits (Denham et al., 2015), suggesting that increasing rates of physical activity can have implications for the health of future generations. Compared to individuals who are sufficiently active, insufficient levels of physical activity are associated with a 20% to 30% increased risk of early death (Strain et al., 2024), increased metabolic (Chomiuk et al., 2024; Jans et al., 2011) and inflammatory risks (Pedersen et al., 2009), increased incidence of depressive episodes (Berk et al., 2013; Walsh et al., 2013), and generally higher prevalence of chronic illnesses (Strain et al., 2024).

Further, physical activity contributes to effective prevention and management of cardiovascular diseases, certain cancers, diabetes, and depression. For example, acute bouts of physical activity are shown to provide immediate benefits to metabolic regulatory processes like insulin sensitivity (Huang et al., 2021), cardiorespiratory fitness (Swift et al., 2013), and subjectively experienced enhancements to affect and cognitive functioning (Basso et al., 2017). Meta-analytic evidence supports physical activity as an effective supplemental tool and even replacement to psychotherapy for depression (Kvam et al., 2016; Schuch et al., 2018). In addition, regular physical activity is shown to improve underlying physiological functioning by reducing levels of an inflammatory biomarker (corticotropin-releasing hormone; CRF) that underlies etiology of both depression and cardiovascular diseases (Kandola et al., 2019), among other health issues.

Increasing physical activity has the potential to address some of the most pervasive and impairing health issues. Because of its unique links to both mental and physical health, increasing physical activity may also facilitate improved adaptation to

challenges individuals face across the lifespan. More specifically, increasing physical activity may help individuals cope with and improve their quality of life amidst sociopolitical and cultural challenges that also contribute to current rates of chronic illness (Short & Mollborn, 2015). For instance, regular physical activity is shown to improve stress-management and distress tolerance (Stults-Kolehmainen & Sinha, 2014), shows some beneficial evidence for coping with anti-Black racism that permeates U.S. institutions (Jacob et al., 2022), and has the potential to enhance concentration and attention (Best et al., 2010) among overwhelming access to information and stimulation on a daily basis. These challenges associated with current sociocultural contexts are exacerbated by economic stressors, pervasive inequities, and ultimately, a lack of perceived autonomy in one's life. Physical activity is a health behavior that can exert short-term and long-term benefits toward health and functioning and therefore represents an essential behavioral determinant of health. Engaging in physical activity offers a large reward toward health but involves a concert of complex processes that require individual effort. Therefore, it is key to find solutions that will empower and support individuals to engage in physical activity.

Self-regulation and Physical Activity

Previous physical activity interventions have shown modest effects on initiation of physical activity and highlight a lack of long-term maintenance outcomes (Howlett et al., 2019; Rhodes & Rebar, 2017). That is, interventions tend to not include follow-up past 6 months to identify whether changes were sustained. To date, interventions have explored a myriad of constructs through testing the effectiveness of physical activity

interventions. One set of constructs drawn from various health behavior change theories encompass self-regulatory actions. Self-regulation involves a set of approach actions that aid in the self-management of physical activity behaviors (Schwarzer, 2011). For instance, goal-setting, action planning, self-monitoring, and behavioral practice present behavior change techniques that involve executive functions (Suchy, 2009). A goal represents an aim of a specific action (goal-setting theory; Locke & Latham, 2006) and review evidence of goal-setting interventions supports the process of goal-setting as a positive behavior change technique to facilitate physical activity engagement (McEwan et al., 2016).

While comprehensive reviews across various types of physical activity interventions indicate that goal-setting as an intervention target appears to be the most effective when it is clustered with other behavior change techniques, like self-monitoring, and intervention characteristics that cannot necessarily be translated to applied to real-life scenarios, like having high contact with research team and receiving feedback on performance (Rhodes et al., 2017). Similar to goal-setting, action planning (i.e., steps to facilitate action), self-monitoring (i.e., record keeping/tracking behavior), and behavioral practice (i.e., rehearsal to develop competency) (Control theory; Carver & Scheier, 1982) seem to be most effective when clustered together in the intervention structure and/or paired with a fitness tracking device, like a pedometer (Howlett et al., 2019; Rhodes & Pfaeffli, 2010; Rhodes et al., 2017). Of note, recent reviews demonstrate that more than a quarter of participants in action planning interventions do not actually form any plans when instructed to (Sniehotta et al., 2009) and that both specific behavioral cues and

flexibility around actions (i.e., what activity to do) are key characteristics to the success of an action plan (Fleig et al., 2017; Rhodes & Pfaeffli, 2010).

In addition, the capacity for self-regulation varies widely across individuals and can be comprised in the exact contexts in which physical activity engagement could be particularly beneficial. For instance, evidence suggests that the capacity for individual self-regulation is likely to be limited for individuals experiencing heightened stress, depressive symptoms (Diamond et al., 2013; Joormann & Gotlib, 2010), coping with chronic pain and disabilities (Malfliet et al., 2017), and who are constrained by their socioeconomic status (Hao & Farah, 2020). While self-regulatory strategies have clear implications for increasing physical activity (McEwan et al., 2017; Murray et al., 2017), it is clear through converging meta-analytic intervention data that physical activity behavior change represents a dynamic process that is certainly not one-size-fits-all (Howlett et al., 2019; Knittle et al., 2018; McEwan et al., 2019; Rhodes et al., 2009). Criticisms have emerged as well toward an emphasis on will-power and self-control that can underly assumptions about self-regulation; That is, narratives that push self-control as a determinant for weight and activity level can perpetuate internalization of negative self-related cognitions (Rhodes et al., 2016; Tylka et al., 2014). For instance, an inactive individual who is told “Your weight problem is because you don’t exercise enough” by a medical provider may internalize a self-perception that they are inherently morally flawed because of this emphasis on self-responsibility to control behavior (e.g., Teixeira et al., 2015). This emphasis on self-control is not consistent with health promotion and body size inclusive frameworks, such as physical activity (Mansfield & Rich, 2013) and

health (Bacon & Aphramor, 2011) at every size, that advocate for empowering individuals to make healthy changes in their life.

Dual Process Models of Physical Activity

Importantly, self-regulation is critical to adaptation and survival, yet humans are not emotionless robots who aways carry out the most rationale and healthy behaviors. A considerable number of theories and models developed to outline the underlying neurobiology of human decision making (Smith & DeCoster, 2000; Metcalfe & Mischel, 1999; Reynolds, 2006). That is, physiological data provide evidence for the competing forces within the nervous system that help explain findings demonstrating self-regulatory challenges with carrying out actions one intends to carry out intend to (Brain & Ekkekakis, 2018; Hofmann et al., 2008). For example, someone can intellectually know and be told by a medical provider that physical activity might seriously relieve their back pain and even be provided with exercise bands and a detailed action plan, yet not complete the activities and remain sedentary (Geneen et al., 2017). To account for the challenging nature of self-regulation, experts in exercise psychology have begun to shif away from classically tested health behavior change theories that emphasize intention as a direct correlate to behavior (Hagger et al., 2002; Rhodes & Rebar, 2017), toward a broader emphasis on the push and pull mechanisms at play influencing physical activity related affect, cognitions, and behaviors.

Specifically, neurobiological dual-process models (Brand & Ekkekakis, 2018; Hofmann et al., 2008; Phipps et al., 2021) account for the reward related neurobiological processes that influence self-regulation of physical activity health behavior. Dual-

processing models illustrate competing forces in shaping physical activity engagement and underscore the neurobiological complexities underlying momentary behavioral decisions and habit formation. At a basic level, dual process models as applied to health behaviors (Hoffmann et al., 2008; Phipps et al., 2021) outline that there are two neurobiological systems at play that can each override activation of the other systems neural signals: 1) reward-processes that emphasize the role of impulses, positive reinforcement, automatic affective and implicit associations, instant gratification in driving behavior, and involve the dopaminergic and limbic brain circuits and 2) regulatory processes that emphasize the role of self-regulation, self-control, rational and conscientious reflective thinking (in contrast to impulse and automaticity of reward), and rely on prefrontal and related executive function brain circuits that can be difficult to activate when the nervous system is stressed or taxed by threat perception and heightened stress (Diamond, 2013). Heightened stress and mental health symptoms (e.g., anxiety, depression, trauma) can lead to activation of fear-related neural circuits that interrupt executive functioning (Price & Drevets, 2012) and generally tax the body's systems, leaving less capacity for positive adaptations and logical, future based thinking that may be needed to facilitate behavior change (Hallford et al., 2018). Dual process perspectives outline the interplay between impulses and future consequences as essential process underlying human decision making.

Further, the affective-reflective dual process theory of physical inactivity (Brand & Ekkekakis, 2018) asserts that in the face of an exercise-related stimulus, one's negative affective valuation of exercise will act as a restraining force that may counteract any

positive cognitive motivational drives toward action (or, on the other hand, if the affective valuation is positive, it will present a driving force and thus make it more likely that the person will change his or her current state of physical inactivity). This affective-reflective approach is supported by the theory of cost optimization (Cheval et al., 2019) outlining that humans have an evolutionary inclination to avoid unnecessary physical exertion, and that this represents a restraining force that may hinder the ability to translate conscious intentions to physical activity engagement. The theory of cost optimization theorizes that the more cognitive resources an individual has (i.e., greater activation of executive functions) the easier it will be to override this evolutionary tendency toward effort minimization. To add, supporting the evolutionary inclination to minimize effort is a multifaceted phenomenon that occurs during sleep that is essential for the health of cells and neurons and subsequently, cognitive functioning. For instance, evidence also demonstrates that relatively common chronic sleep problems (e.g., insomnia) can lead to negative physiological adaptations that reduce cognitive resources and increase behavior to minimize effort as a means to prioritize a physiological need for sleep and restoration (an essential aspect of sleep that is important for the health of neurons and cells and homeostasis) (Banks & Dinges, 2007; Driver & Taylor, 2000; Noakes, 2012). This provides further evidence that there are restraining interconnected forces that can contribute to physical inactivity beyond what is within conscious, regulatory control.

Affective Influences of Physical Activity

Further, numerous studies have investigated self-reported affective responses to physical activity and show that negative affect during exercise is associated with

avoidance, especially in contexts when remaining sedentary and avoiding potential discomforts of physical activity may be a more immediately rewarding decision and in turn associated with pleasure, and therefore preferred (Rhodes & Gray, 2015; Brand & Ekkekakis, 2018; Conroy & Berry, 2017). Individuals are coping with a myriad of health issues that may or may not impair daily functioning (Mokdad et al., 2018) and may have varied capacities for self-regulation (Gross, 2002; Detweiler-Bedell et al., 2008), suggesting that affective experiences are an important force underlying physical activity behavior. Through these perspectives, engagement in physical activity is contingent on neurobiological processes, associative reward learning and implicit, automatic associations, cognitive resources, and a willingness to experience endure discomfort of physical activity.

Positive affective experiences paired with a specific behavior play an influential role in facilitating positive reinforcement and reward learning. Affect is a lived, embodied state in which mood state and emotion can be experienced through consciousness but may originate from a more primitive, nonreflective feeling, regarded as 'core affect' (Russell, 2003). Affect can involve anticipatory affect and affective forecasting of physical activity, affect experienced during engaging in physical activity, and affect judgements toward physical activity that represent "judgements about the overall pleasure/displeasure, enjoyment, and feeling states expected from enacting physical activity" (p. 81, Rhodes et al., 2009). Ultimately, affective associations act on unconscious processes to create implicit negative or positive associations with physical activity (e.g., exercise-stimuli creates automatic evaluation of discomfort which

perpetuates attitude of I don't like, this is unpleasant) and on conscious processes to influence general attitudes toward physical activity and motivational forces.

Core affective valence (e.g., good/bad feelings) in response to physical activity are posited as an important determinant of future physical activity behavior (Rhodes & Kates, 2015; Williams & Evans, 2014). Subjective affect and sensations derived from physical activity can range from feeling refreshed, energetic, joyful, accomplished, satisfied, pleased, inspired to feeling worn-out, drained, tired, bored, uncomfortable, and irritated (e.g, Gauvin & Rejeski, 1993). Learning theory assumes that repeatedly pairing a specific behavior with positive stimuli (e.g., feeling joyful) can shift evaluations of that behavior in a positive direction; however, being physically inactive can make it difficult to experience the contingencies of positive reinforcement. For example, evidence suggests that the less opportunity there is for positive affective experiences (i.e., remaining mostly inactive, sedentary) the more negative implicit associations individuals can have which may create a cycle of avoidance and low self-efficacy and in turn insufficient physical activity (Hilbert et al., 2014; Pearl et al., 2015). Therefore, associative reward learning can be a mechanism that may reduce negative implicit associations which in turn may facilitate physical habit formation (Hagger, 2019; Stevens et al., 2020) and mitigate perceptions of anticipatory discomfort. This perspective underscores the importance of identifying strategies for facilitating rewarding aspects of physical activity in underactive individuals.

Further, implicit and explicit affective associations serve as a central focus for research exploring how to moderate reward processes to increase physical activity

(Stevens et al., 2020; Brand & Ekkekakis, 2018; Conroy & Berry, 2017). This is supported by the affect and health behavior framework which asserts that future behavior is influenced both through learned automatic associations (e.g., automatic evaluations, affective associations) and through reflective motivational processes such as affective judgments (e.g., affective forecasting, affective attitudes) (Williams & Evans, 2014). Experimental manipulations demonstrate that strengthening automatic associations between positive affect and exercise in individuals with negative automatic associations can lead to immediate changes in lab-based exercise behavior (Antoniewicz & Brand, 2016), including increasing intensity of the exercise, suggesting a role in potentially increased willingness to experience discomfort. It is important to note that in situations when self-regulatory capacity is lower, behaviors are much more likely to be government by automatic, affective-laden processes (Brand & Ekkekakis, 2018). Moreover, positive affect and attitudes toward physical activity have the potential to provide an explicit target for change that over time may increase positive implicit associations (Rhodes & Gray, 2015; Stevens et al., 2020) which in turn can facilitate optimal self-regulation resulting in greater ease with behavior initiation, engagement, and habit formation.

The upward spiral theory of lifestyle change illustrates the specific role of positive affect for reinforcement of health behaviors (Van Cappellen et al., 2018). This theory evolved from the broad and build theory of positive emotions. In brief, the broaden-and-build theory posits that experiences of positive affect (e.g., joy, gratitude, interest, pride, serenity) momentarily broaden people's mindsets in ways that, over time, accumulate and compound to build biological resources (e.g., cardiac vagal tone) as well as cognitive

(e.g., mindfulness), psychological (e.g., purpose in life), and social (e.g., positive relations with others) resources (Frederickson, 2013). The upward spiral of lifestyle change builds on this and supports the role of positive affect in addressing implicit associations with physical activity. For instance, this theory asserts that experiencing positive affect while forming a new health behavior provides the foundation for associative networks to form nonconscious motives that over time, and in turn with more positive experiences comes increases in personal resources that further facilitate enhanced self-regulation, leading to improvements in other life domains (similar to broaden-and-build theory). Interestingly, physical activity and positive affect have a mutually beneficial relationship through on influences on cardiac vagal tone (Thayer & Sternberg, 2006), suggesting that positive experiences with physical activity have implications for optimizing decision making and cardiovascular health.

Recent research has pursued intervention, experimental, and cross-sectional designs to better understand affect in the context of physical activity. A systematic analysis of 24 studies concluded that pleasant affect experienced during physical activity positively influences future physical activity (Rhodes & Kates, 2015). Of note, the predictive effects of positive affect felt during activity engagement hold even among initially sedentary adults at 6-and 12-month follow-up (Williams et al., 2008; Williams et al., 2012). Physical activity is more likely to be maintained if associated with reward which can be facilitated through positive reinforcements of experiencing physical activity as pleasurable and satisfying actions (Flack et al., 2019; Stevens et al., 2020; Van Cappellen et al., 2018). The same review demonstrated that affect experienced following

physical activity relate to affective judgements about future physical activity, which in turn contributed modest effect sizes in predicting behavioral engagement (Rhodes & Kates, 2015). Although dependent on individual physiological factors (e.g., cardiorespiratory fitness), physical activity when completed at certain intensities and durations may increase positive affect and pleasurable sensations, facilitating release of beta-endorphins associated with reduced pain sensations - the colloquial term 'runner's high' (Boeker et al., 2008), evidence is lacking and the experience of a 'runner's high' may not be achievable for individuals with lower cardiorespiratory fitness. Of note, increased intensity levels above threshold, where lactate begins to accumulate in the blood, are shown to universally facilitate some degree of reduced pleasure and negative affect (Rose & Parfitt, 2007).

Further, there also appears to be a supportive role of affective judgements specific to satisfaction following physical activity that can improve outcome expectancies and in turn intentions to be active in the future (Huffman et al., 2021; Sala & Baldwin, 2018; Stevens et al., 2020). For instance, anticipating/forecasting affect during physical activity before it has occurred is influenced by automatic associations with the experience formed from prior learning, and expecting to feel satisfied following the activity can be a mechanism that can reduce negative outcome expectancies. This is particularly relevant in contexts of low levels of physical inactivity. These findings converge with evidence that individuals who 1) anticipate discomfort and high negative affect during physical activity and 2) expect the outcome to be less rewarding than the effort inputted, are much

more likely to avoid physical activity (Ekkekakis et al., 2016; Cheval et al., 2021; Williams & Bohlen, 2019).

A model linking self-regulation of health behaviors with emotion regulation processes (Sheeran et al., 2018; Gross, 2002) demonstrates that anticipated affect, such as satisfaction, can be regulated through if-then implementations plans. More specifically, findings that support this model suggest that if-then related cognitions (i.e., if I feel bored, I will do this) could facilitate down-regulation of negative affect during physical activity and be one route to promote physical activity. It is important to note that it is common for individuals to experience a degree of 'feeling bad,' discomfort and unpleasant experiences during physical activity, and these experiences can be a strong deterrent for individuals initiating a behavior (Brand & Ekkekakis, 2018). It can also be particularly difficult for individuals to down-regulate negative affect when an automatic association may be that physical activity is important (e.g., grew up in a physically active social context) but their behaviors (e.g., avoid physical activity) are incongruent with this automatic association, reflecting a state of cognitive dissonance (Elliot & Devine, 1994; Festinger, 1957) that can increase negative affect. There is also pervasive weight-related and body size stigma and discrimination that individuals can experience when attempting to engage in physical activity (Ekkekakis et al., 2016; Pearl et al., 2020) within physical activity spaces that are psychologically harmful. These experiences serve to strengthen negative automatic associations, including the implicit anti-fat attitudes toward physical activity (Frederick et al., 2016). When internalized to affect one's self-image, these automatic negative associations lead to decreased self-efficacy toward change (Meadows

& Bombak, 2019), that results in fewer opportunities for individuals to experience and therefore associate physical activity with enjoyment, satisfaction, and pleasure.

Approach and Avoidance Motivation

Anticipatory affect is strongly linked with motivation theories in which continued behaviors are thought to be determined by basic operant conditioning processes involving pleasure and displeasure (Elliot, 2006; Lochbaum et al., 2017), in line with polarity among restraining and driving forces outlined in dual process models (Brand & Ekkekakis, 2018). The approach and avoidance model of motivation provides an excellent illustration for the basic human drive to seek what brings pleasure and avoid what does not bring pleasure (Elliot, 2006). This is an essential aspect to evolutionary understandings of what motivates behavior. Approach motivation is related to the energization of behavior by, or the direction of behavior toward, positive stimuli (objects, events, possibilities), whereas avoidance motivation can be viewed as an energization away from negative stimuli. When applied to physical activity, individuals can approach physical activity through energization of psychological and physical movement. Such approach motivation toward physical activity would include a drive toward more conscious cognitions (psychological movement) related to physical activity (e.g., “where will I walk later?”) that in turn strengthen associative networks and behavioral enactment (Brand & Ekkekakis, 2018). The approach and avoidance model of behavior also support evidence that humans are evolutionarily designed and therefore neurobiologically wired to quickly detect negative stimuli with subsequent physiological and reflexive

mechanisms that automatically facilitate movement away from a stimulus (LeDoux, 1995).

The guiding implication of approach and avoidance motivations are that avoidance motivation is designed to facilitate survival, whereas approach motivations are designed to facilitate thriving, and increased positive affective experiences. Importantly, despite the benefits of avoidance in providing short-term relief, through facilitating a brief absence of what is unpleasant, it is posited to lead to greater negative affect, problematic outcomes, and reduced approach orientation leading to less pursuits of what is pleasurable (Elliot, 2006; Williams & Bohlen, 2019). For instance, avoidance can undermine performance goals in physical activity when an individual is focused on avoiding a negative outcome (e.g., don't walk for 10 minutes straight) versus adopting an approach orientation toward a positive outcome (e.g., run at least 10 minutes) (Lochbaum et al. 2017). At a broad level, a paradox is presented in which physical activity is necessary to improve metabolic health, but this is contrary to evolutionary cost optimization and automatic tendencies to avoid unpleasant experiences – and physical activity in the context of health behavior change is likely to bring some discomfort (Ekkekakis et al., 2016).

Hedonic Motivation Perspective

In line with approach and avoidance includes frameworks related to psychological hedonism underlying behavioral pursuits (Sobel, 2002). Psychological hedonism is a descriptive, explanatory theory rather than a prescriptive theory, which aims to understand why individuals are motivated to behave as they do (i.e., have the desires that

they do), rather than about how individuals *should* be motivated (Williams, 2018). This approach is in align with health promotion and physical activity inclusivity efforts that encourage motivations for physical activity centered around 'life-enhancement' (Mansfield & Rich, 2013; Pickett & Cunningham, 2017) instead out of a prescriptive, problem-focused motivation to lose weight and/or solely because they should because they are told to by a physician (Teixera et al., 2015; Bombak, 2014). Hedonic theorists outline that individuals are motivated to approach what is pleasurable, coined the 'hedonic response,' and thereby conceptualize hedonic motivation as synonymous with neurobiological concepts of reward and 'wanting' (Berridge, 2007), with implications for understanding approach and avoidance motivations. 'Wanting' refers to the neurobiological underpinnings of incentive salience (Berridge, 2007; Smith et al., 2011), a specific kind of motivation that is mediated by reward-laden processes in the mesolimbic dopaminergic system.

Further, in line with hedonic motivation, incentive salience theory demonstrates that 'liking' and 'wanting' are distinct reward processes. Such that, 'liking' represents the pleasurable response to a stimulus and may present as automatic affective reactions to stimuli (e.g., pleasure from taste of food) and influence outcome expectancies of future pleasure, where an individual will anticipate that the future experience will be as or more pleasurable as the present experience (Berridge, 2007). Although more evidence is needed to support these assumptions, generally speaking, previous 'liking' of physical activity can lead to future 'wanting,' which is consistent with dual process models that support the role of automatic, reward activation processes in influencing future behaviors.

In addition, ‘liking’ can determine salience toward physical activity, which determines the level of value that a specific behavior has – based on the degree of pleasure-displeasure experienced in response. Overall, the more personally salient a behavior is, the more an individual will pursue it. This mechanism supports why self-regulatory processes can still be engaged to motivate goal-directed behavior that does not bring immediate pleasure, such as when someone helps a neighbor by mowing their lawn – this does not facilitate immediate pleasure, but it can still be associated with long-term positive affect (Williams, 2018). Interestingly, the motivational underpinnings of ‘wanting’ have been applied in the context of physical activity to align with a seminal motivation and humanistic based theory: self-determination theory (SDT; Deci & Ryan, 2006).

Self-Determination Theory

Approach and avoidance and psychological hedonism provide useful frameworks for grounding understandings of basic motivations as related to positive affective experiences with physical activity. Given evidence in this literature review regarding the competing forces and complexities of physical activity promotion and behavior change, it is important to draw associations between neurobiological and affect based frameworks with motivation constructs that have empirical evidence for influencing behavior. Broadly, SDT views motivational forces as involving a pursuit to satisfy universal psychological human needs, which are conceptualized as a need for competency, a need for autonomy, and a need for relatedness. A need for autonomy reflects the need to

experience ownership and responsibility over one's behaviors (Ryan & Deci, 2006; Teixera et al., 2020).

Autonomous self-regulation is the perception that behavior is completed volitionally and by choice and is postulated to be an essential mechanism through which health behavior changes can be maintained (Hagger & Chatzisarantis, 2015; Ng et al., 2012; Ryan & Deci, 2017; Teixeira et al., 2012). Individuals are autonomously motivated when they engage in an activity or cease an activity for reasons that come from within oneself and are freely chosen. Autonomy is relevant across the lifespan (Sebire et al., 2013) and cross-culturally (Chen et al., 2015) as a determinant for positive psychological outcomes, including enhanced self-esteem and self-worth (Ryan & Deci, 2000), improvements in mental health (Vogel, Singh, & Accurso, 2021), and increased frequency of positive affect (Schweder & Raufelder, 2022). Autonomous self-regulation has gained some empirical support as a key mediator of health behavior change (Ng et al., 2012; Ntoumanis et al., 2021) and physical activity specifically (Knittle et al., 2018). For instance, evidence demonstrates that individuals Importantly, health behavior interventions based in SDT have shown to be efficacious in promoting motivation toward, and actual participation in, health behaviors across multiple populations, contexts, and behaviors (Emm-Collison et al., 2019; Ntoumanis et al., 2021; Teixera et al., 2012).

SDT: Intrinsic and Extrinsic Motivation

Autonomous self-regulation toward physical activity is in line with psychological hedonism perspectives in which the goal of research is to understand the why, the

underlying reasons, of motivation toward a specific behavior. Further, SDT describes that motivational forces underlying health behaviors are either self-determined or controlled, reflecting the degree to which health behaviors are fully autonomous and self-endorsed (Ryan & Deci, 2017). In the context of physical activity, these forces can be understood as being on a continuum between autonomous, intrinsic motivation and controlled, extrinsic motivations and amotivation (i.e., no motivation or intention to engage in physical activity). Intrinsic motivation is conceptualized as a similar process to 'wanting' (Werner & Milyavkaya, 2018) and 'liking by doing' as described in incentive salience (Locke & Schatkke, 2019).

In a physical activity context, individuals and patients are intrinsically motivated if they choose to initiate physical activity for enjoyment and/or out of a personally held value toward physical activity. Extrinsic motivations for physical activity can range in the degree that they are controlled and not autonomous, while more controlled motivations place a strain on an autonomy and psychological needs satisfaction (Ryan & Deci, 2017). In this way, intrinsic motivation involves pursuing physical activity because they "want to." Whereas extrinsic motivations represent attachment to external reasons to engage in physical activity that are more often than not, done to *avoid* disapproval or guilt (either internal or externally derived) and/or receive social approval and acceptance (Ryan & Deci, 2017; Werner & Milyavkaya, 2018). Some of the most robust findings in motivation literature predicting the success of goal-pursuits are with distinctions between 'want to' and 'have to' motivations (Ryan & Deci, 2017; Teixera et al., 2020), but there

is a lack of evidence exploring underlying mechanisms or associations between the two within physical activity interventions specifically.

More research is needed to better understand strategies for facilitating intrinsic motivations ('want to') to engage in physical activity, addressing challenges with extrinsic motivations ('have to'), and to understand the links between positive affect and intrinsic motivation for physical activity specifically. For instance, evidence from physical activity interventions support the role of autonomy and show that individuals are more likely to engage in a physical activity when they have options to self-select their exercise, and that self-selection of exercise is related to more pleasant affect during sessions and longer and more intense durations (Williams et al., 2016). Endorsement of intrinsic motivations to engage in physical activity is also postulated to enhance anticipatory positive affect toward physical activity, increase enjoyment during, and satisfaction following (Teixera et al., 2020; Werner & Milyavkaya, 2018). Importantly, there is evidence that supports intrinsic motivation as an essential component toward physical activity habit formation, through indirect associations of enhanced positive affect (Meyer et al., 2021; Ntoumanis et al., 2021).

In contrast, having more extrinsic motivations, lacking intrinsic motivation and 'wanting' physical activity, may be represented as an experience of 'dread' which the individual then has to overcome to engage in physical activity (Williams & Bohlen, 2019). An individual who is extrinsically motivated to engage in physical activity may do so because they 'have to' out of a need to belong or be desired by others, an obligation to lose weight, or to a less externally controlled degree, because they should because they

were instructed to, and they intellectually know it is beneficial and that increases motivation. Through an understanding of avoidance, even regular physical activity engagement can be maintained through external motivations if the pursuit is motivated by a desire to avoid pain – including the experience of social evaluative pain, which can occur in instances of weight and body size stigma. However, evidence indicates that extrinsic motivations are less likely to be associated with physical activity behavior and maintenance (Ntoumanis et al., 2021; Werner & Milyavkaya, 2018).

Sources for Motivation

Accordingly, physical activity and weight bias internalization literature indicate that social standards of beauty, body size, and weight. These social standards are also reinforced in medical settings and public health narratives that equate weight with health and equate physical activity's purpose with losing weight (Tylka et al., 2014). Appearance based motivations for physical activity, that is exercising to change or modify the look of one's body (often with cisgender women), are associated with increased body dissatisfaction and body image concerns and in turn lower levels of physical activity engagement (Cox et al., 2019; Meadows & Bombak, 2019). Whereas engaging in physical activity to lose weight for health-focused motivations, even if somewhat externally driven, are associated with higher body satisfaction (Vartanian et al., 2012). Although it is unrealistic to assume individuals can just abandon deeply engrained implicit associations of physical activity for weight loss, it is important to acknowledge the unsustainable, controlled nature of this narrative and how it influences

individual physical activity engagement (Ekkekakis et al., 2016; Mansfield & Rich, 2013).

An alternative perspective is to promote physical activity because of its benefits to mental health. Findings demonstrate that intrinsic motivations toward physical activity can be a moderating factor to increasing physical activity engagement among populations living with chronic pain (Teixera et al., 2012) and mental health conditions (Vancampfort et al., 2015). In addition, an online intervention for depression demonstrated success through enhancing intrinsic motivations (Lambert et al., 2018). Because intrinsic motivations are linked with positive mood and affect towards physical activity, it is reasonable to suggest that engaging in physical activity to benefit one's mood and mental health could serve as a positive motivation for physical activity, yet this has not been empirically examined.

Moreover, external motivating factors in considering the larger sociocultural context of physical activity health promotion and health behavior change, it is important to identify factors that underlie intrinsic and extrinsic motivation and affect in relation to physical activity. It is clear that extrinsic motivations are less sustainable than intrinsic motivations and when physical activity is less autonomous, it can be more difficult for individuals to cope with barriers with physical activity (Ryan & Deci, 2017; Werner & Milyavskaya, 2018). Intrinsic motivation is also closely linked with automatic associative networks also underlying approach and avoidance orientations, suggesting that it could be a viable mechanism to target positive affect and automatic associations and physical activity engagement. For example, research suggests that techniques included in

motivational interviewing interventions, an approach often employed in clinical settings to facilitate change, involving identification of personal values for engaging in a behavior can be an effective route to promoting physical activity (Ryan & Deci, 2017).

Across decades of physical activity, research has emerged calling for a need to identify innovative and novel approaches to targeting the mechanisms involved in facilitating change. Affect and motivational perspectives and findings corroborate to outline a need for autonomy supportive interventions that target intrinsic motivation for those more likely to avoid and experience discomfort during physical activity. In addition, because of measurement and data collection challenges with physical activity interventions, there is a general lack of qualitative, person-centered data that can shed light on heterogenous evidence and individual differences across intervention outcomes. Such that, physical activity interventions encounter issues with self-selection (people recruited for such studies may already be motivated), self-report assessments of physical activity data, and ecological validity challenges with translating lab-based or controlled intervention study affect related outcomes to real-life in which affect is complex, dynamic, and context-based (Baumen et al., 2019; Reis et al., 2016). There has also been an unfortunate disconnect between different fields of study within physical activity, where public health information and messaging based intervention findings are not integrated with empirical and theoretical data that emphasize the need for affect and motivation focused interventions (e.g, Nielson et al., 2018).

One route through which public health perceptions and public health research can be combined with scientific frameworks of physical activity, is through data collection

with social media data. There is support for using Twitter, a microblogging platform with estimates of over 300 million users worldwide, to collect data on health perceptions, beliefs, and track health behaviors based on location (Olanoff et al., 2015; Sinnenburg et al., 2017). For instance, a wide range of health-centric studies have emerged in the past decade yielding important findings on health trends, including real-time historical responses of day to day experiences and health behavior promotion (e.g., Korda & Itani, 2013). Research has been conducted to monitor physical activity levels based on geographic location (Nguyen et al., 2016; Liu et al., 2019) and access to green spaces (Roberts et al., 2019) and perceptions based on changing health policies (in Canada; Meah et al., 2020) and physical activity for specific health conditions (Robert et al., 2021) but has yet to specifically focus on physical activity motivations and affect. In addition, Twitter can be an effective tool for addressing limitations in physical activity research, linking public health and empirical research, and promoting a deeper, bottom-up understanding of what motivates individuals to engage in physical activity and how affect influence motivations that is not bound by prescriptive narratives of physical activity. Therefore, personal user content posted on Twitter can provide an ecologically valid option for exploring specific individual perceptions and experiences of physical activity but has yet to be examined in the context of an integrated understanding of affect and motivation. To explore first-person perspectives of physical activity as discussed on social media, the present study conducted a mixed-method approach to identify presence of intrinsic motivation, extrinsic motivation, affect, attitudes toward physical activity, and physical appearance and factors related to mental health.

The Present Study

The overarching inspiration for this study is a deeper understanding of the mechanisms that contribute to sustainable, positive experiences with health behaviors. This dissertation is part of a larger collaborative project aimed at advancing understanding of health behavior motivations to inform development of a just-in-time recommender system that can be applied to mobile health interventions. To reach a deeper understanding of these mechanisms, the primary goal of the present study is to obtain a first-person perspective of motivation and affect toward physical activity by adopting an exploratory and data-driven approach to identifying themes of Twitter posts pertaining to physical activity.

This dissertation consisted of a multi-step, multi-level content analysis with a secondary dataset of Twitter posts that were collected for the purposes of a larger collaborative Health Communication and Recommender Systems study. The Health Communication and Recommender Systems study's purpose is to use human coding and data-driven topic modeling techniques to identify topic factors that could be easily interpreted and applied within a recommender system. The present study involved development of a theory supported qualitative codebook to use for manual coding and by presenting a series of specific research questions to guide a more in-depth thematic exploration of motivation and affective factors linked with physical activity.

This dissertation study utilized a subset of the Health Communication and Recommender Systems study data to pursue the following study aims: Aim 1) development of a health behavior change and motivational factors codebook that

provides a thematic framework for interpreting physical activity related social media posts (See Appendix A for developed codebook). Aim 2) Ensure that the codebook is theory and data-driven, that it aligns with theoretically grounded conceptualizations of motivation and affect but is also responsive to unique themes that emerge in the data. Aim 3) Implement a mixed-method thematic analysis to identify themes and associations among Twitter posts that contain physical activity, and affective and motivational content.

To target study Aims 1 and 2, the present study developed a content codebook that draws upon multiple theories, specifically 1) affect and motivational psychobehavioral processes described in self-determination theory (Ryan & Deci, 2006), 2) incentive salience theory (Smith et al., 2011), 3) approach and avoidance models of behavior (Elliot, 2006), 4) dual-process model as applied to physical activity (Affective-reflective; Brand & Ekkekakis, 2018) and 5) the upward spiral theory of lifestyle change (Van Cappellen et al., 2018). Of note, the development of this theory and data-driven codebook (Aim 2) is essential to the Health Communication and Recommender Systems study's purpose and provides the method and analysis opportunities for implementing the codebook to identify themes and associations among Twitter posts that contain physical activity, and affective and motivational content (Aim 3).

While Aim 1 and 2 focus on the development, developmental requirements, and testing of the codebook, Aim 3 delves more into thematic analysis techniques to understand health behavior motivation mechanisms. Accordingly, within Aim 3, there are 4 independently developed research questions that guide thematic analysis on the specific

areas of my program of research, including motivational and affective mechanisms of physical activity, including factors that underlie intrinsic and extrinsic motivation. The exploration of thematic content allows for an in-depth, first-person perspective of how motivation and affective experiences are discussed in the context of physical activity on social media. Overall, the goal of Aim 3 is to identify themes and associations among Twitter posts containing physical activity, and affective and motivational content to advance understanding of *person-centered* and *motivating* mechanisms physical activity health promotion and behavior change. Accordingly, to address Aim 3, four Research Questions (RQ) were developed.

The first two RQs explore associations among affective and behavioral indicators of motivation and affect identified in physical activity related Twitter content, with a specific focus on intrinsic motivation. Evidence finds the positive affective experiences with physical activity not only facilitate future physical activity behavior (Rhodes & Kates, 2015), but positive affective for physical activity is also an underlying mechanism for both development and maintenance of intrinsic motivations (Sebire et al., 2013) for physical activity (Hagger & Protogerou, 2018; Ryan & Deci, 2017; Teixera et al., 2012) and health behaviors more generally (Ntoumanis et al., 2021).

Evidence also finds that in contrast to extrinsic motivation, intrinsic autonomous motivation for physical activity is more likely to facilitate behavioral maintenance and habit formation (Gardner & Lally, 2013; Kaushal & Rhodes, 2015) while also amplifying the mental health benefits of physical activity (Meyer et al., 2021; Van Cappellen et al., 2018) and enhancing self-regulatory ability for other health behaviors (Hagger &

Protogerou, 2018; Ryan & Deci, 2017). Relatedly, motivation theorists indicate that intrinsic motivations 'wanting' and 'liking' are distinct processes implicated as underlying forces for motivation, and in contrast, that 'dreading' and 'disliking' can be an antithesis for motivation, and in turn lead to behavioral avoidance (Elliot, 2006; Williams & Bohlen, 2019). The present study explored whether emerging content themes and patterns align, expand, or differ from theoretical and empirical understandings of the interconnected nature of positive and negative affect, motivation, and physical activity behavior.

RQ 1) How do different types of intrinsic and extrinsic motivation identified in physical activity related Twitter posts compare in terms of frequency and affective content?

RQ2) more specifically, what unique affective related themes emerge with intrinsic motivation physical activity content?

The next set of RQs explore potential underlying sources of intrinsic and extrinsic motivational content through thematic analysis of physical appearance and health factors. Evidence demonstrates that social standards of beauty and body size and misconceptions that equate weight with health may serve as external motivating factors to engage in physical activity (Vartarian et al., 2012; Meadows & Bombak, 2014). Motivations for physical activity grounded in this paradigm can be based in social desirability and low self-worth, perpetuate body dissatisfaction, and in turn may be maladaptive for mental health and quality of life (Cox et al., 2019; Bombak, 2014; Pearl et al., 2015). Because exclusive standards for weight and body size permeate physical activity and exercise

culture, physical appearance may be a common motivating factor for physical activity that may have unique associations with affect (Boepple et al., 2016; Prichard & Tiggerman, 2008). It could be that there are contexts in which physical appearance related motivations are facilitators or inhibitors of physical activity engagement, and it is important to understand whether there are certain affective and cognitive evaluations toward oneself or others' physical appearances that influence motivations. Underlying reasons or affective experiences with engaging in physical activity for physical appearance have not been explored in this way with social media data.

RQ3) Does Twitter post content related to aspects of physical appearance emerge as related to motivation content themes? In other words, is physical appearance described as a motivating factor for engaging in physical activity?

Mental health represents another factor that may have differential influences on motivation and affect toward physical activity engagement. For example, meta-analytical evidence demonstrates that physical activity engagement is associated with reduced risk for depression (Schuch et al., 2018), incident anxiety (Schuch et al., 2019), and promotes better general mental health (White et al., 2017). Sub-clinical symptoms and normative experiences of increased stress can also incur unique challenges on motivations and physical activity engagement; However, this is often not discussed in the context of general health behavior change theories (Rebar & Taylor, 2017) despite the presence of sub-clinical mental health symptoms among the general population (Vahratian et al., 2021). To contribute to an inclusive understanding of physical activity behavior engagement, thematic coding provided the opportunity to identify whether associations

emerge between motivation and affective factors with potential mental health related thematic content in Twitter posts.

RQ4) Does mental health emerge as a relevant theme in the context of content themes attitude toward physical activity, health factors, motivation type and details, and sub-themes? In other words, is mental health described as a motivating factor for engaging in physical activity?

Overall, the four research questions are designed to contribute to 1) a greater understanding of health behavior motivations and 2) assess alignment of content themes with theoretical constructs. Coding frameworks to identify relevant themes have been systematically developed to capture representation of theoretical constructs related to affect and motivation and facilitate exploration into the present study's research questions. Of note, social media has been a central force toward influencing societal perceptions of health and is more recently a medium through which physical activity interventions can be delivered (Johns et al., 2017). Twitter more specifically offers the opportunity to collect first-person perspectives, reflections of inner thoughts, emotions, or descriptions of experiences, toward physical activity (Roberts et al., 2021; Sinnenberg et al., 2017; Turner-McGrievy et al., 2015). The present dissertation study aims to provide unique contributions to a growing field of physical activity social media research by conducting a novel, in-depth analysis of naturalistic Twitter content focused on motivation and affect, two nuanced factors implicated as essential to physical activity behavior change.

To further assess affective experiences for RQ1 and RQ2, individual Twitter posts coded as containing motivation content were compared with attitude toward physical activity and motivation details content themes. This allowed for identification of associations between intrinsic motivation (motivation type), positive affect and readiness and other motivation details, and positive sentiment (attitude toward physical activity). The final step for addressing RQ1 and RQ2 includes computerized text analysis. To converge, contrast, and expand on content and inductive coding results, computerized text analysis methods will be employed across all Twitter posts to identify topics themes not otherwise identified through human coding. Computerized text analysis will be used to identify affective themes endorsed across Twitter content relating to the four types of motivation. This will facilitate comparison of which types of motivation are more often described on Twitter and in terms of positive and/or negative affective experiences. Computerized text analysis will be completed using Linguistic Inquiry and Word Count (LIWC) data dictionaries (Pennebaker et al., 2022) related to affect and psychological processes.

To identify potential underlying sources of intrinsic and extrinsic motivational content, and answer RQ3) do specific motivation type and details content themes relate to Twitter post content related to aspects of physical appearance? To address this question, physical appearance thematic content was compared for frequency across different motivational categories. In addition, a question underlying the unstructured topic modeling is whether physical appearance would emerge as a topic theme, particularly within extrinsic motivation content. To identify whether mental health may be an

underlying motivating factor for physical activity, LIWC computer text analysis in addition to frequencies of qualitative themes were conducted to answer RQ4: does mental health emerge as a relevant theme in the context of content themes attitude toward physical activity, health factors, motivation type, and sub-themes? To identify motivation mental health related themes for motivation, LIWC text analysis will be conducted with all Twitter content in the present study's total dataset with correlations for each motivation type and health and physical appearance theme to detect themes that may elucidate potential links between physical activity, affect, overall health and mental health, and motivations for physical activity for mental health.

CHAPTER 3: METHODS

Qualitative Sample

Twitter is a microblogging service social networking site with over 300 million users worldwide (Olanoff, 2015) that provides a cost-efficient platform to study the distribution and determinants of information relevant to public health and public policy (Sinnenberg, 2017). Our Health Communication and Recommender Systems project team developed a corpus of tweets relating to physical activity posted between July 15– July 21, 2022. The collected data included the following query terms to identify potentially relevant Twitter posts: 'workout,' 'fitness,' 'gym,' 'running,' 'biking,' and 'swimming.' This process yielded approximately 22,000 Twitter posts that comprised the raw data set. Twitter posts were collected from Twitter users through an application programming interface (API) for academic research using the query terms above to identify Twitter posts with physical activity and/or exercise related content (Shaw et al., 2017). Next, Twitter posts with 0 followers and 0 following accounts (n = 154) and greater than 1,200 followers (n = 5, 452) were excluded. We also excluded users with over 1,200 followers, because at that follower count level, a Twitter account reaches influencer status. Influencers use social media platforms differently than the standard users (revenue driven, micro-branding, business promoting, etc.), so users who qualify as influences based on their follower count were excluded from the dataset for future use. We also excluded duplicated posts as well as posts that contain images or html links as discourse content in those posts cannot be adequately assessed or compared with text only posts.

After cleaning the data our final dataset consisted of approximately 13,000 Twitter posts eligible for initial coding preparation steps.

During preparation of the current study's dataset, exclusion criteria included advertisements, posts by an influencer and/or posted primarily for self-advertising/self-promotion purposes (i.e., posts related to a product with monetary incentive), included only an image or link without text content to be analyzed, or were clearly not related to physical activity or health, were uninterpretable (i.e., posts that included confusing sentence structure) or included only hashtags (see Appendix B for examples of Twitters posts excluded for each of the exclusion criteria). Advertisements are typically posted repeatedly, with daily variations, from business, organizations, or corporate accounts, geared towards revenue, including them in the coded data is not recommended. Second, posts that contain content irrelevant to physical activity were also separated. It is common to encounter Twitter posts that are not relevant to target topics but were included due to matching a specific search criterion entered in API software (Tomeny et al., 2017). Twitter posts were primarily identified as ineligible during the data extraction process and not included for thematic coding or were extracted and then coded as ineligible by coders. Twitter posts that were extracted and coded as non-relevant/ineligible were excluded from all analyses for the current project ($N = 64$; 34% = advertisement, 36% = not related to physical activity or uninterpretable, 27% = influencer/self-promotion, 2% = duplicate content).

Codebook Development Procedure

Codebook development guidelines presented by Reyes and colleagues (2021) as a 'living codebook' were used to guide iterative codebook development. As indicated, the current dissertation followed recommendations to document codebook changes, hold in-depth discussions between coders about coding schemes and specific examples, and complete iterative revisions to coding scheme to improve codebook organization and ensure scheme captures target conceptual concepts (i.e., deductive) and richness of data (i.e., inductive) (Reyes et al., 2021). Further, to establish coding schemes and frame, a mixed inductive and deductive approach was employed (Braun & Clark, 2006; O'Connor & Jaffe, 2020). The procedure followed for developing the codebook largely followed these steps: 1) conducted literature review and familiarize self with constructs, 2) identified content areas of focus (potential themes), 3) established content analysis process and coding scheme frameworks, while revising the codebook as needed (Aim 1). The fourth step completed involved developing a first draft of the codebook to test feasibility and make revisions based on team discussions, 5) prepare for and train graduate RA in pilot coding phase and engage in ongoing pilot coding, while revising the codebook as needed, 6) continue to pilot code and refine near finalized codebook, 7) establish appropriate intercoder reliability estimates for primary themes, and 8) initiate thematic coding using a codebook with finalized coding frameworks (i.e., expected to not change), while adding examples and descriptions to the living codebook and process notes as needed (Aim 2).

A deductive approach was used to establish initial themes for the codebook for thematic content analysis by completing a broad literature search on motivational and

health behavior change frameworks. Given the larger study and current dissertation are exploratory and preliminary in nature, the literature review focused on frameworks, theory, and empirical data linking motivation and health behavior change with physical activity. Next, a list of potential themes and constructs were then identified through summarizing and extracting relevant constructs from the literature search. Through discussions with the larger study team, it was determined that the codebook and therefore initial thematic content analysis would include use of quantitative coding frameworks for content analysis, otherwise described as conceptual analysis. Quantitative coding schemes in which themes are captured through numeric representations are an appropriate and viable option in the case of manual coding (i.e., human content analysis) with a large volume of data units, multi-level themes, and two coders (e.g., Ryan & Bernard, 2000). During the initial drafting process, I also spent time becoming familiar with the full dataset of Twitter posts build a broad mental framework of the types of discourse posted on Twitter.

Further, constructs and content themes were then transformed into coding frameworks and described in detail in the initial codebook. With the initial series of themes and coding schemes, I engaged in a preliminary practice coding to test the representativeness of content themes and ability for theory grounded themes to identify content in Twitter posts. Feedback on this process was discussed with the research team and then the first full version of the codebook was drafted for pilot coding. Related to Aims 1 and 2, following each round of pilot coding, coders engage in discussions about disagreements and ease of interpreting coding schemes to guide revisions made to the

codebook. Edits to the codebook were also logged via process note documents and by archiving previous versions of the codebook (Reyes et al., 2021). Several revisions have been made throughout the codebook development and pilot coding, some of which include refinement of coding scheme frameworks, content qualifiers, and thematic descriptors. For example, each content theme in the codebook contains a broad definition, further theme descriptions and examples for qualifying the theme, and the numeric coding scheme framework(s) for that theme. Throughout the development process, coding frameworks have been adjusted to provide greater specific to improve content coding. For example, in one of the first versions of the codebook, health factors and physical appearance represented a single content category meant to capture overall perceptions of health, body functioning, and appearance.

Similarly, coding frameworks throughout the codebook have been designed and revised to assist coders in accurately identifying qualifiers for the content theme and respond to themes present in Twitter content (Aim 2). For example, content themes about details of physical activity engagement that were initially included as a response to frequently used descriptors in posts were eventually removed to improve time efficiency and reduce cognitive load for coders, which included use of technology (e.g., activity tracker), intensity, duration, distance, frequency, timing (i.e., morning/evening, weekday/weekend), weather, landscape/general environment of physical activity, and valence associated with each theme. Themes were then added as sub-themes to be coded when directly linked to the content of the post. Valence for social support was removed and instead, lack of support, was added to the coding structure to capture social support

related content that was previously coded with negative valence. Another notable change involved improvements to the organization of sub-themes, which are described in detail in the sub-theme section below.

Motivational and Health Behavior Change Factors Qualitative Codebook

The current dissertation developed a comprehensive qualitative codebook with notes and detailed interpretation guidance so that it may be utilized in future research studies. See Appendix A for the final version of the Motivational and Health Behavior Change Factors Qualitative Codebook. See Appendix C for a representative sample of Twitter posts that were coded for each of the primary themes.

Thematic Coding Schemes

In the section below, *motivational themes* are first described and include physical activity engagement, motivation type, motivation details, health factors and valence, physical appearance, and sub-themes (i.e., which include mental health, mood, and positive internal factors relevant for RQs). Second, although not a focus for the present study's research questions, *behavior change themes* are described and include: self-efficacy and valence, social support, habit formation/consistency and valence, and goal setting and valence. The third section includes *supplemental, secondary themes*, including: physical activity type, content source, and information context. Themes are also described in the final qualitative codebook presented in Appendix A.

Motivational Themes

Physical Activity Engagement. This theme is included to differentiate content that references the action or behavior of engaging in physical activity from content that

does not reference behavioral aspects of physical activity. It is a primary category of interest that was required to be coded for all eligible Twitter posts. The two levels of this theme include 1) physical activity engagement (i.e., conveys, describes, or alludes to completed physical activity or 2) other content related to relevant factors to physical activity or other health behaviors but the focus is not on the behavior of physical activity (e.g., supplement that increases muscle mass) and/or health relevant content (e.g., diet for weight loss).

Attitude toward Physical Activity or Health Behavior. Attitude captures evaluation, sentiment, and overall valence of attitude toward either physical activity or another health behavior/action (e.g., choosing not to engage in physical activity, sleep, diet/nutrition) and is an important construct to understanding health behavior change processes (Conner, 2018). Emojis were included in interpretation of theme, such that smiling or celebratory emojis were interpreted as having positive sentiment. Attitude was captured through five thematic levels: 1) positive sentiment (e.g., satisfaction, excitement, feeling good), 2) negative sentiment (e.g., disappointment, dissatisfaction), 3) mixed sentiment with both positive and negative attitude included in the content (e.g., sarcasm, humor, dissatisfied with parts of a performance but satisfied with others), 4) neutral or matter of fact included content where a sentiment or tone could not be detected (e.g., discuss results of a race, “Completed a 5k today.”), and 5) unclear sentiment to capture all other content where an evaluation may be present or engagement is coded but the attitude could not be determined or inferred within the content.

Motivation Type. Motivation type is a primary category that was coded for all relevant Twitter posts. The purpose of this category was to identify motivational content representing either 1) Intrinsic motivation, 2) Extrinsic motivation, 3) Mix of both Intrinsic and Extrinsic content, and 4) Unclear or motivation type could not be determined. Definitions for intrinsic and extrinsic were based on self-determination theory research (Deci & Ryan, 2000; Werner & Milyavskaya, 2019) and all members of the coding team were required to review additional notes and literature on motivation constructs to enhance understanding and improve accuracy of thematic coding. Intrinsic motivation is defined as autonomous, fully self-determined and internalized motivation for engaging in a behavior, such as for the enjoyment/satisfaction of doing the activity, alignment with personal values, and wanting to engage in an activity versus having to. The purpose of the intrinsic motivation category was to separate content distinctly related to behavioral engagement because of positive affect, satisfaction, and enjoyment that is not contingent on an outcome.

Extrinsic motivation, on the other hand, is defined as motivation that is derived from external validation or forces, such as a desire to avoid a consequence, perform for another person, achieve an outcome decided by others, achieve a socially visible outcome (e.g., winning a race), or process of introjection which includes taking on ideals from external sources and internalizing them into the self. Content that included elements of introjection may also be coded as included elements of both intrinsic and extrinsic motivation; for example, content discussed wanting to continue training for a marathon (intrinsic) to achieve a specific place in a race (extrinsic). Mixed intrinsic and extrinsic

also includes content involving personal desire toward pursing or achieving a goal, like weight loss or marathon training. Unclear motivation was coded when the content was lacking additional information to interpret motivational sources, for example, content that included "#motivation" or there is engagement or change discussed that implies motivational force is present but further details are not provided.

Motivation Details. Motivation details was included to capture themes underlying motivation type. This thematic category included six specific thematic codes such that multiple codes could be coded to capture if there were multiple motivational elements present. The themes were also based on research supporting specific forces as motivating for health behavior change and self-determination theory details of intrinsic and extrinsic motivation. The six levels included 1) positive affect, readiness, or wanting, 2) motivation by a goal, change, different outcome, or perceived need, 3) low or amotivation, dread, or avoidance, 4) motivated by social forces/others, 5) motivated by things (e.g., equipment, mobile apps) or places (e.g., location, gym), or 6) motivation details could not be determined (i.e., if this theme was coded it would not be coded with other motivation details codes).

Health Factors with Valence. Health is a primary thematic category meant to capture a broad range of health and mental health related content to determine if health related factors emerge as a relevant theme to physical activity and motivation content. There is support for the adaptive nature of engagement in health behaviors when motivations are focused on body's functionality rather than appearance (Gilchrist et al., 2018). Health factors included mentions of overall health, mental health, mental health

treatment, mindset (e.g., balanced thinking), thoughts, emotional health, relaxation, health biomarkers (e.g., heart rate, blood pressure), injury or recovery from an injury, health condition, function of the body (e.g., soreness, labored breathing, stamina), use of health professions (e.g., physical therapist), food/diet/nutrition, supplements or other recovery methods, weight management, health prevention (e.g., hydration to avoid dehydration), healthcare, etc. This category was not coded if health content was not present. If present, coders were instructed to code as either 1) present with certainty, which captured content in which a health factor was a central theme or 2) somewhat present, which captured content in which a health factor was mentioned but not discussed with detail or as a central theme (e.g., #health, energy levels, vague mention of a healthy lifestyle). For ease of interpretation, present and somewhat present coded results were combined to represent whether a health factor was present at all or not at all. If the health theme was coded as present, valence toward the health factor was also coded (e.g., positive, negative, mixed positive and negative, and neutral/unclear valence. For example, if an injury occurred as a result of physical activity, then the valence would likely be negative.

Physical Appearance. Physical appearance is a primary thematic category meant to capture a range of physical appearance themes relating to the evaluation or reference to one's own body or other's bodies. Weight bias and stigma research indicates body dissatisfaction as an influential factor for physical activity (Boepple et al., 2016; Meadows & Bombak, 2019) and purports external motivators such as a drive to achieve a thin ideal standard as potentially antithetical to behavior change maintenance (Gonçalves

& Gomes, 2012). The purpose of this theme was to determine if physical appearance emerge as a relevant theme in physical activity and motivation content. This theme included six specific thematic codes that allowed for coding of multiple levels: 1) satisfaction with appearance (i.e., positive evaluation of outward appearance), 2) dissatisfied with appearance (i.e., negative evaluation of outward appearance), 3) dissatisfied with appearance and motivated to change (i.e., notes plans, desires, actions to change), 4) notice/acknowledge a change in appearance without specific evaluation (i.e., appearance has changed but evaluation/sentiment is not included), 5) weight loss, fat loss, weight management or maintenance, 6) muscle gain (i.e., references result of building, gaining muscle or appearance in relation to muscles).

Sub-themes. This is an open-text, secondary thematic category that was refined throughout the initial qualitative coding phase. The sub-theme category began as open for any description or additional theme detected without a preset coding scheme. Throughout codebook changes, sub-themes served the purpose of providing additional context for the content in the post. As coding developed and common sub-theme categories were identified, a list of overarching themes were included in the codebook in which coders were directed to first list the overarching theme followed by other descriptive terms (as appropriate) that were iteratively listed in the codebook; coders were encouraged to first use descriptive terms that were already listed and to add new ones as needed. Example Tweets that were coded for each of the overarching sub-themes analyzed in this study are presented in Appendix D.

The overarching sub-themes of focus in the present study include several themes that add context for the health theme specifically 1) mental health benefits/positive (e.g., mood benefits, stress relief, positive thinking), 2) mental health harms/negative, 3) physical health benefits/positive, 4) physical health harms/negative (e.g., illnesses, pain, fatigue), 5) diet/nutrition (e.g., keto, paleo, limit alcohol, etc.) 6) positive internal factor/influence (e.g., acknowledge personal progress, self-confidence, self-acceptance), 7) negative internal factor/influence (e.g., shaming self, harmful comparison to others), 8) identify/pride (e.g., identity or internalization of a group is mentioned such as age, race, gender, sexuality, as a runner), 9) external social factor/influence to expand on social support (e.g., use of trainers, coaches, group fitness, aspects of social environment), 10) external non-social factor/influence (e.g., music, animals, podcasts, location/scenery), 11) reference of body part/area (e.g., chest, belly, etc.), 12) influence of weather (i.e., added because of frequent mention, involved heat or other weather factors), 13) use of tools/equipment (e.g., Couchto5k, kettlebell, etc.), 14) time/planning (i.e., morning, evening, weekday, weekend).

Behavior Change Themes

Self-Efficacy and Valence. Self-efficacy is a frequently discussed construct in health behavior change literature (e.g., Sheeran et al., 2016) and is derived from social cognitive theory (Bandura, 1997). This primary thematic category was defined as reference to an individual's belief in their capacity or skills to engage and/or execute a behavior and reflects one's confidence in their ability to exert control over their own motivation, behavior, and social environment, such as overcoming challenges or barriers

or believing a desired outcome is possible. To capture whether elements of self-efficacy were relevant and to what degree, two thematic codes were included (similar to the health theme): 1) present (i.e., explicit mention of skills, acknowledgement of competency, and/or overcoming a challenge or 2) somewhat present (i.e., implies or alludes to self-efficacy processes but more context is needed). For ease of interpretation, present and somewhat present coded results were combined to represent whether self-efficacy was present at all or not at all. If present, valence was then coded (e.g., positive valence might suggest overcoming a barrier, whereas negative valence might suggest lacking self-efficacy or confidence in skills).

Social Support. Social support is a construct relevant to health behavior change and physical activity engagement (Cao et al., 2023; Olander et al., 2013). Social support was included as a primary theme meant to capture references to social support with five themes that allowed for coding multiple themes as needed: 1) seeking support or advice in content or in one's own life (e.g., asking a question with expectation of responses to the post), 2) mentions social support, team, or online or physical community but not how they use it (e.g., #UKrunchat), 3) use of social support (e.g., discusses how implications of social support), 4) lacking social support, 5) offer support, encouragement, and/or advice to others (e.g., expectation of content is to help those who would be consuming it, discusses attending an event to support a spouse), 6) relating to someone else's experience (e.g., mentions own experience as similar or different from another's).

Habit Formation/Behavior Maintenance and Valence. Habit formation and maintenance of behaviors are pivotal to understanding processes that facilitate behavior

change and are posited to be influenced by mechanisms like intrinsic motivation and positive affect (Kashual & Rhodes, 2015; Lally & Gardner, 2013; Rhodes & Sui, 2021). Habit formation is included as a primary theme meant to capture habit building, behavior consistency or maintenance or lack thereof, routine through five themes that allowed for inclusion of multiple codes as necessary: 1) broke consistency and has returned (e.g., first time returning to a behavior after a gap or break), 2) consistency has been broken, has not returned, but intends to (e.g., expresses intentions to return to an activity), 3) consistency broken, habit is absent, and unsure if they will return (e.g., acknowledges has not engaged in some time but doubts or dreads return), 4) takes action to build and/or implies building habit or routine (e.g., describes initial period of habit building, 4 weeks or less, just starting a training routine), 5) maintains consistency or habit (e.g., consistency described as more than 4 weeks, level of performance suggests maintenance), 6) habit content included but vague and would need more context (e.g., mention of lifestyle, #training without other contextual information). If present, valence was then coded; for example, positive valence might suggest satisfaction with level of habit formation, whereas negative valence might suggest dissatisfaction with level of maintenance or not returning to behavior, such as if they did not enjoy physical activity and routine is described in negative terms (e.g., forcing oneself).

Goal setting and Valence. Goal setting can be an important aspect for self-regulation and behavioral initiation and maintenance of physical activity (McEwan et al., 2016). Goal setting is included as a primary theme meant to capture the process of pursuing and/or achieving a desired outcome, retrospective mention of prior outcomes or

reference to future outcomes, or explicit mention of goals. This theme was represented by three theme categories with multiple codes included as necessary: 1) working towards a specific health or physical activity related outcome (e.g., actions involved in training, becoming healthier), 2) achieving an outcome that is unclear if the outcome was a goal (e.g., personal best, evaluation of an outcome), 3) explicit mention of a goal or goal setting in which the word "goal" is included in the content. If any goal setting code was present, valence was then coded. For example, positive valence would suggest positive evaluation whereas negative valence would indicate difficulties or dissatisfaction with goal processes.

Supplemental, Secondary Themes

Physical Activity Type. Physical activity type is a secondary, open-text theme that is included to capture common forms of physical activity that is described in posts in the dataset. All posts that were coded for physical activity engagement had to be coded for physical activity type. Content that may not include the behavior of physical activity but nonetheless still reference a type of physical activity were also coded for this category. Multiple text entries were permitted for this theme (e.g., if running and swimming were referenced, both were coded). For ease of interpretation, categories of physical activity were combined for final frequencies. For example, sports were combined into one category (i.e., sports-based), CrossFit or circuit activity was coded as both strength-based and cardio, and body building, power lifting, weight lifting, and strength training were combined into one strength-based category.

Content Source. Content source is a secondary thematic category added during the codebook development process to capture whether the content in the Tweet references intra or interpersonal source. A broader goal of this category was to have additional context for whether the content appeared to self-referential or about an individual experience ("I" statements) or pertained to others. This category was coded for all relevant posts and included four specific thematic codes: 1) self-referential without reference to social/other, 2) self-referential with a social/other component (e.g., "we," includes self and family, friend, social event), 3) without self-referential component and only social/other (e.g., "you," includes information meant for others, like workout instructions, quotes), or 4) without self-referential or identifiable social/other source and is in reference to a macro-level process, such as healthcare, government policies, environmental issues).

Information Context. Similar to content source, information context is a secondary thematic category added during the codebook development process to capture what type of information is portrayed in relevant content. This category was coded for all relevant Twitter content and allowed for multiple codes as necessary. Information context included eight thematic codes: 1) accurate fact (i.e., information references common knowledge), 2) partial or could be accurate information, which included information that is not determined to be false but the coder would need to fact check to confirm accuracy (e.g., health information that could be true in some but not all contexts), 3) false information (i.e., coder is confident information is false), 4) information based on a personal experience (i.e., content relates to a personal experience in their own life and

can be reasonably linked to the poster's own life), 5) Opinion or general evaluation about physical activity or health content (e.g., opinions about group fitness, specific sports, other people without reference to self), 6) workout or physical activity instructions or information that is meant for others, 7) quotes or inspirational/motivation comments meant for others (e.g., content that is a quote by a famous person or person posting is attempting to motivate others), 8) Vague, impersonal information not categorized by other themes (i.e., lacks context to determine, minimal words with mostly hashtags).

Qualitative Coding Training and Phases

Two phases of coding were completed with two separate groups of trained coders. All coders were required to first review the codebook in entirety and read relevant literature provided about health behavior change theory underlying the codebook schematics and motivational factors (e.g., Deci & Ryan, 2000).

The first phase included a graduate level research assistant with expertise in fitness training that assisted with codebook development and completing the first 19 rounds of thematic coding. A practice round of qualitative coding was completed with a sample of Tweets prior to initiating coding that is included in the analyses for this project. In addition, Twitter posts that required reconciliation between coders were documented and Tweets that were considered more difficult to code and/or included disagreement between coders were also added as examples to guide future coding. Regular project meetings (approximately 2 times per month) were structured to facilitate reflection and discussion of the qualitative coding process. For example, discussions included considerations of the time required to code a single Tweet and the cognitive load of

themes with multi-level code structures, introspection required to justify codes for nuanced or complex content and adapting to new coding structures. Coders were encouraged to take intentional breaks from coding to reduce the likelihood of mistakes and ensure quality coding.

To ensure intercoder agreement in the first phase of coding, a total of 521 Tweets were double coded with the graduate assistant, which encompassed 7 rounds of coding that are included in the final analyses for the current project. Cohen's kappa analyses were completed to assess agreement between coders for relevancy (i.e., to include or exclude content based on exclusion criteria) and physical activity engagement, the first primary codebook coding schemes that dictate whether further coding is completed (e.g., if a Tweet is determined to be not relevant then coding concludes after the reason for exclusion is coded). Cohen's kappa provides values of 1 - 0, with values of 1 implying perfect agreement, values 0.75 or above representing excellent agreement, values .40-.75 implying fair to good agreement, and values below .40 indicating poor agreement. Double coding continued until kappa values reached .60 or higher. Literature evaluating complex qualitative coding suggests that Cohen's kappa becomes increasingly less accurate in providing interpretable kappa values when thematic coding involves multiple levels and diverse content themes (Lovejoy et al., 2016; Zhao et al., 2013). Tweets were double coded until moderate kappa levels for relevancy (two-level coding scheme) and physical activity engagement (two-level coding scheme) and above 75% agreement for other coding schemes were established. As prior qualitative research suggests (Miles & Huberman, 1994; Roberts, Dowell, & Nie, 2019), inter coder reliability can be

established through identifying the percent agreement of presence and absence of themes between coders when thematic variables contain multiple schematic levels. At round 7, kappa agreement for relevancy achieved excellent agreement ($\kappa = .80$, $p < .01$) and physical activity engagement achieved good agreement (.60, $p < .01$). At round 7, percent agreement for primary categories included: attitude toward physical activity (75% agreement), motivation type (95% agreement), health factors (85% agreement), and physical appearance (75% agreement). Each coder then proceeded with coding separate Tweets and continued to meet at regular intervals to discuss and reconcile any individual Tweets that the coder was uncertain about. A total of 2,085 relevant Tweets were coded in this first phase of coding and are included in final analyses.

The second phase of coding included an initial training phase with two graduate level and five advanced undergraduate level research assistants. First, I met with coders over Zoom to discuss the codebook in detail and this meeting was recorded for coders to reference as needed. Second, each coder independently coded the same 3 Tweets, selected and determined to be relevant, with the entire qualitative codebook. Final codes were discussed, questions were answered, and differences were reconciled, and majority agreement was established (e.g., at least four of seven coders needed to agree with finalized codes). Six coders were then split into pairs based on expertise and comfort level with the qualitative codebook (e.g., coders with less agreement with the other team members were paired with a more consistent coder). Pairs then proceeded to double code 60 Tweets while one of the graduate level assistants assisted with managing and reviewing coding completed by each of the pairs. Coding pairs were required to meet

weekly and establish at least 75% agreement between primary codebook categories (i.e., physical activity engagement, attitude, motivation type, health factors, and physical appearance) before sending their finalized codes to myself. To reduce the likelihood of coding mistakes with determining eligibility and improve time efficiency, coders were only provided eligible/relevant Tweets.

Across the two phases, 36 rounds of qualitative coding were completed. Each round of thematic coding included 30-150 Twitter posts in an Excel spreadsheet with the codebook thematic categories and coding schemes included across columns in the spreadsheet in which coders would work across a row, starting with the Tweet, and indicate the number or numbers (if the category allowed for multiple codes) that best captured the content in the cell below each coding scheme. If a category theme was not present, for example if a post did not include content related to physical appearance, the coder included a 0 for that column in the row of the Twitter post being coded. The coder would proceed across a row to code subsequent categories using the coding schematics included in the spreadsheet while referencing the current study's MHBCF qualitative codebook for guidance. In the second phase of coding, each round provided to the coder pairs consisted of 30 Tweets that coders split and submitted for review and approval by a graduate level team member before moving on to another round. This resulted in a final sample of 500 Tweets that were then added to the final dataset for analyses (N = 2,585, 20% of the larger dataset). Qualitative coding concluded in April 2024.

Analysis

As Aim 1 and 2 focused on codebook development and completion of qualitative coding, Aim 3 represents the central focus of the analysis and results. The first step was to prepare the final dataset for analyses. Accordingly, the completed, fully coded data set (including Tweets and codes) was reviewed, quality checked, and cleaned. For example, during the review process codes were included that may have originally been missed by coders or corrected for errors in entry by coders (e.g., including "44" instead of "4"). In addition, thematic coding schemes included in earlier rounds in which the coding scheme changed during codebook development to improve time efficiency and reduce number of themes (e.g., motivation details were reduced from eight to six themes) were recoded to match the final codebook coding schemes. Aim 3 includes four specific research questions that guide data analysis: RQ1) How do different types of intrinsic and extrinsic motivation identified in physical activity related Twitter posts compare in terms of frequency and affective content? RQ2) Further, what unique affective related themes emerge with intrinsic motivation physical activity content? RQ3) Does Twitter post content related to aspects of physical appearance emerge as related to motivation content themes? In other words, is physical appearance described as a motivating factor for engaging in physical activity? RQ4) Finally, does mental health emerge as a relevant theme in the context of content themes attitude toward physical activity, health factors, motivation type and details, and sub-themes? In other words, is mental health described as a motivating factor for engaging in physical activity? To address Aim 3, an innovative mixed-method data analysis approach was used that included frequencies of thematic

codes and chi-square analyses, a linguistic analysis technique, and unstructured topic modeling.

Descriptive Frequencies. To address RQ1 (*How do different types of intrinsic and extrinsic motivation identified in physical activity related Twitter posts compare in terms of frequency and affective content?*) and RQ2 (*What unique affective related themes emerge with intrinsic motivation physical activity content?*), frequencies and percentages for thematic coding of *motivational* themes were conducted by the total sample $N = 2{,}585$ and by PA engagement sample $N = 2, 085$ (i.e., includes physical activity behavior content) and the non-engagement sample $N = 503$ (i.e., includes content related to other actions or factors not indicative of physical activity engagement) to facilitate comparisons. In addition, RQ1 and RQ2 were addressed by exploring the attitude theme and sub-themes related to mood among intrinsic and extrinsic motivation. A series of chi-square tests of independence were conducted to examine the differences between intrinsic and extrinsic motivation frequencies for the physical appearance theme to address RQ3 (*Is physical appearance described as a motivating factor for engaging in physical activity?*) and frequencies for the health theme to address RQ4 (*Is mental health described as a motivating factor for engaging in physical activity?*). Of note, frequencies and percentages were also calculated for behavior change (e.g., self-efficacy) and related secondary themes (e.g., PA type) to illustrate the application of the codebook and the variety of qualitative themes observed.

To prepare data for chi-square analyses, intrinsic and extrinsic motivation, and the health theme and physical appearance theme were each recoded as dichotomous variables

(1 = present and 0 = not present). To examine whether physical appearance was a motivating factor for physical activity engagement (RQ3), frequencies and percentages for the physical appearance theme were also conducted for each motivation type and attitude themes. In addition, sub-themes are presented for the physical appearance theme with focused interpretations of weight loss and shaming sub-themes. Finally, to examine whether mental health emerged as a motivating factor for engaging in physical activity (RQ4), frequencies and percentages were conducted for the health theme for each motivation type and attitude themes as well as for sub-themes relevant to mental health (i.e., mental health benefits, mood, positive internal influence).

Linguistic Inquiry and Word Count-22 (LIWC-22). LIWC-22 is a sophisticated text analysis tool used to quantify the emotional tone, cognitive style, linguistic features, and psychosocial constructs present in written content (Pennebaker et al., 2022). LIWC-22 analyzes written content by categorizing words into pre-defined dictionaries. The current project focused descriptive and correlational analyses on dictionaries relevant to affect, health, and motivational and psychological processes. All 2,585 Twitter posts were entered into the LIWC-22 dictionary program. See Appendix E for descriptors, word count, and internal consistency for categories of focus: health, illness, wellness, mental health, positive tone, positive emotions, negative tone, negative emotions, psychological processes of reward, need, want, fulfill, and the cognitive time orientation of future thinking. Scores for each variable range from 1-99. A score of 99 in LIWC signifies that the text falls on the 99th percentile for that particular summary measure.

To examine differences in affective content between intrinsic and extrinsic motivation (RQ1) as well as identify unique affective themes within intrinsic content (RQ2), LIWC-22 descriptive analyses and zero-order correlations were conducted for affect variables (positive/negative tone, positive/negative emotions) and motivational-oriented variables (reward, need, want, fulfillment, and future orientation) among intrinsic and extrinsic motivation samples. LIWC-22 variables of interest, including health, illness, wellness, and mental health, were also organized by motivation type.

Topic Modeling. To identify and compare emergent topics among motivation type themes (RQ1) and identify if affective topics emerged for intrinsic motivation (RQ2), unstructured topic modeling was conducted for each motivation sample. Topic modeling is a data-driven technique that allows for language processing algorithms to discover hidden thematic structures and latent topics in a collection of documents or texts. The current study evaluated the fit and benefits between Latent Dirichlet Allocation (LDA) modeling (Blei, Ng, & Jordan, 2003) and Bidirectional Encoder Representations from Transformers (BERT) modeling (Ma et al., 2022) techniques to identify what method best fit the data and research questions. BERT topic modeling was selected as it is ideal for capturing subtle nuances within diverse text formats like social media posts, especially Twitter (e.g., Odlum et al., 2020). A series of unstructured topic model analyses were completed to identify thematic features that supplement and add context for understanding physical activity discourse in the current sample. To prepare content for topic modeling, Twitter posts were separated by qualitatively coded motivation type categories and by physical activity engagement or non-engagement to elucidate topic

themes for specific motivation themes that may emerge for physical activity behaviors. Unstructured topic modeling also served to identify whether physical appearance related themes would emerge as topics for extrinsic motivation among PA engagement and non-engagement samples (RQ3). Similar to physical appearance, unstructured topic modeling was employed to identify if mental health oriented themes would emerge as topics for intrinsic motivation or other motivation types (RQ4).

CHAPTER 4: RESULTS

First, to examine differences in affective content between intrinsic and extrinsic motivation (RQ1) as well as identify unique affective themes within intrinsic content (RQ2), frequencies and percentages were conducted for thematic codes and interpreted across motivation types. Second, to identify whether relationships emerge for intrinsic and extrinsic motivation themes with the physical appearance and health themes (RQ3 and RQ4) and to facilitate a comparison across the two motivation types (RQ2), a series of chi-square tests of independence were conducted. Next, LIWC-22 descriptive statistics and zero-order correlations were conducted with relevant LIWC-22 categories across motivational themes to elucidate linguistic representations of affective, motivational, health, and mental themes. The final analysis method included a series of stepwise, unstructured topic model analyses to identify potential topic differences across motivational themes (RQ1 and RQ2) and content samples (i.e., total sample, PA engagement content, and non-engagement). Topic modeling was also employed to specifically explore whether positive affective topics would emerge for intrinsic motivation content (RQ2) and whether physical appearance (RQ3), health and mental health topics (RQ4) would emerge and if so, for which motivational theme.

Results are presented in order of analyses conducted and research question. First, frequencies of relevant codes are discussed. Frequency findings (Tables 1-9) are presented in Table 1 for the total sample of coded tweets, physical activity (PA) engagement only tweets, and non-engagement tweets. Frequency results are then

presented by motivation type for PA engagement only tweets in Table 3 (i.e., to facilitate interpretation of themes in relation to content coded for *physical activity behaviors*). Behavior change themes for the total sample and by PA engagement and non-engagement content (Table 2) and secondary themes (Table 4; type of physical activity and Table 5 content source and information context). Frequencies are also presented for attitude (i.e., attitude toward physical activity or other health behavior) among the physical appearance and health themes in Table 6 to demonstrate comparisons in attitude among these two distinct themes. Sub-theme frequencies are then presented in Table 7 by total sample of coded tweets, PA engagement only tweets, and non-engagement tweets, by motivation type for PA engagement only tweets in Table 8, and for the physical appearance and health theme coded tweets in Table 9. Chi-square analyses that examine different frequencies between intrinsic and extrinsic motivation and health and physical appearance themes are then presented following discussion of thematic frequencies (see Table 10).

Next, LIWC-22 means, standard deviations, and ranges for LIWC-22 variables by total, PA engagement, and non-engagement samples (Table 11) and for the PA engagement sample separated by motivation type (Table 12) are presented. To address affective and motivational factors, zero-order correlations for LIWC-22 results are first presented for the total sample (Table 13), motivation type (Tables 14-17), physical appearance content (Table 18) and health factors content (Table 19). Finally, topic model results featuring latent topics and cluster maps for each motivation type (RQ1 and RQ2; motivation theme differences) are organized by the total sample, PA engagement, and

non-engagement (Figures 1 - 11). Results, tables and figures will be presented and discussed by section.

Frequencies for Thematic Codes

Frequencies for *motivational themes* (Table 1) *behavior change themes* (Table 2) are presented for each of the total (N = 2,585), physical activity (PA) engagement (N = 2,082), and non-engagement (N = 503) samples. Content coded as related to PA engagement are presented as separate from non-engagement content to link thematic content with physical activity behaviors (see Table 1 and 2). Non-engagement content commonly included other health-oriented behaviors (e.g., nutrition choices) or factors discussed in relation to physical activity (e.g., weight loss, workout clothing) but did not explicitly describe the PA behaviors (see Appendix C for example tweets for both themes). For example, 80.6% of the total sample was coded as including PA engagement content which allows for a sufficient sample size to focus the presentation of results and illustrate findings specific to physical activity behaviors (see Table 3 for motivational themes presented for the PA engagement sample). Among Tweets including a physical activity (PA) type theme (see Table 4), running was coded most frequently, followed by general references to "workout," strength-based exercise (e.g., weight lifting, body building), and cycling (see Table 4 for frequencies for all PA type categories).

Twitter is a diverse platform that allows for the dissemination of a range of blog type content, from individuals wanting to share their personal experiences, opinions, or brief reflections (e.g., sharing about their day, random events) and social organizations or groups sharing information. As such, frequency data for themes that capture

supplemental information including content source and information context are presented in Table 5. For example, results indicated that 45.7% of the Twitter content source in our sample appeared to capture individual perspectives (i.e., self-referential) and 60.8% of information captured personal, lived experiences (e.g., "I did 5 miles for my run today"). These data indicate that this sample provides an appropriate opportunity to understand discourse about physical activity that may apply to the general population and provide value to informing health behavior change processes on an individual basis.

Motivational Themes

Extrinsic motivation was the most frequently coded motivation type, representing 46% of the total sample (see Table 1). The motivation type theme representing content that included a mix of both intrinsic and extrinsic motivation was the second most common motivation type (33% of total sample) and intrinsic motivation alone was the least frequent (8% of total sample). To address RQ1 (i.e., differences between intrinsic and extrinsic motivation), frequencies for the motivational themes are presented by motivation type for the PA engagement content (see Table 3). Interestingly, 91% of intrinsic motivation content was coded for PA engagement compared to extrinsic motivation theme representing 60.6% of the total non-engagement sample. The mixed intrinsic and extrinsic theme was coded close to seven times more frequently within the PA engagement sample (n = 752) than the non-engagement sample (n = 111).

In terms of the motivational detail theme across the total sample (see Table 1), working towards or achieving a goal or desired outcome was the most represented theme (61.2% of total, 62% of PA engagement, 57.7% of non-engagement), potentially

suggesting that the prospect of *change* and *accomplishment* is a motivator for engaging in physical activity and actions or discourse indirectly related to physical activity. Positive affect, readiness, and wanting was most frequently coded for PA engagement content (38.4%) and less frequently coded for the non-engagement content (15.5%), suggesting this theme is uniquely linked to physical activity behavior. Motivation from social sources was another common theme for the physical activity engagement sample (27%), whereas experiences of amotivation or low motivation was less likely to be posted about (< 2% of PA engage and non-engage samples). This finding is reasonable given users on social media may be more likely to post/share content about positive experiences. For example, positive attitude was coded for 61.5% of the PA engagement content whereas negative and mixed attitude sentiment each represented 1.7% and 10.2%, respectively.

To identify unique affective themes within intrinsic content (RQ2), attitude themes are also presented across each motivation type for the PA engagement sample (Table 3). To illustrate affective themes related to intrinsic motivation (RQ2), positive attitude accounted for 93.6% of the intrinsic motivation sample (n = 189) and 83.5% of the mixed intrinsic and extrinsic motivation sample (n = 752). As might be expected, given the overlap between the themes, 100% of intrinsic motivation coded Tweets were also coded for the positive affect, readiness, and wanting motivational detail theme. Content involving a mix of both intrinsic and extrinsic motivation included close to equal representation of the positive affect, readiness, wanting theme (n = 663) and the working towards or achieving a goal or desired outcome theme (n = 698), likely suggesting these

themes were frequently coded together which supports alignment between these two detail themes with intrinsic and extrinsic motivation, respectively.

Overall, when comparing affective themes for intrinsic and extrinsic motivation (RQ1), intrinsic motivation content included a higher percentage of positive attitude and positive affect, readiness, and wanting compared to extrinsic motivation content. Although extrinsic motivation included about 49% positive attitude, extrinsic motivation also had the highest percentages of negative, mixed negative and positive, and neutral attitude themes when compared to the attitude themes for the other three motivation types. These results support literature indicating the strong association between positive attitude and affect and intrinsic motivation for physical activity behaviors.

Health and Physical Appearance

Given that the health theme coding scheme included both mental health and broader health themes, the health theme assists with beginning to address RQ4 (i.e., describe whether mental health as a motivating factor for physical activity) and drawing comparisons between the health theme and physical appearance theme, which is relevant to RQ3 (i.e., describe whether physical appearance is a motivating factor for physical activity). Across the total sample and PA engagement sample (see Table 1), the health theme was coded close to twice as frequently compared to physical appearance. While the health theme was more prevalent in PA engagement content compared to physical appearance, it still constituted a significant portion of non-engagement content, appearing in 60.6% of the non-engagement sample. A consideration is that the health theme was coded more often (n = 997) than the physical appearance theme (n = 532). This could be

expected given the health theme was meant to capture a broader range of themes whereas physical appearance contained a more specific coding scheme.

Additionally, physical appearance may have been less represented in our sample compared to the health theme due to the exclusion of fitness influencer accounts from the dataset. Since our study excluded influencer status accounts, social media users in our sample may be less inclined to express thoughts or feelings related to physical appearance or body image, considering the sensitive nature of these topics for the general population. For example, a post-hoc text analysis indicated the "#fitspiration," a community often examined in the context of body image and fitness social media research (e.g., Tiggerman et al., 2018) only appeared in one Tweet in the total sample of 2,585 posts. Further, results might suggest that physical appearance themes are more commonly associated with non-engagement factors related to physical activity (e.g., steps to increase muscle gain, weight loss) and less related to the experience or behavior of physical activity. For example, physical appearance was coded for 16.9% of the physical activity engagement sample and 25.8% of the non-engagement sample (see Table 1). Nonetheless, physical appearance still represented 16.9% of the PA engagement content.

The health theme was also coded in regard to valence. Valence specific to the health theme content included 51% as positive, followed by mixed valence (22.5%), neutral (15.4%), and negative (10% of total sample; 9% of PA engagement sample). For health and physical activity attitude (see Table 6), results indicated less presence of negative attitude toward PA and/or health behaviors in comparison to the frequency of negative valence describing the health thematic content. This finding would support that

negative health valence was more directed toward injuries or bodily functions than an overall negative evaluation of PA engagement (see Table 1 and 3). Among the PA engagement sample, 59% of the health theme included positive PA attitude, while 49% of the physical appearance theme was coded with positive PA attitude (see Table 6). This could potentially signal less positive affective components among content referencing physical appearance.

In relation to motivation themes for PA engagement for physical appearance (RQ3) and the health theme (RQ4), the physical appearance theme was coded the most for extrinsic motivation (representing 39% of the total PA engagement extrinsic sample) with almost half of physical appearance content coded for weight loss and/or muscle gain themes (see Table 3). In addition, a greater proportion of the codes were for dissatisfaction with appearance with motivation to change appearance compared to satisfaction with appearance. The health theme was coded as present in 55% of extrinsic motivation sample, 45.5% of the intrinsic motivation sample (of note, intrinsic was a much smaller sample compared to extrinsic), 47.9% of mixed intrinsic and extrinsic coded content, and 10% of the unclear/vague motivation coded content. Similar to findings with positive attitude and valence, health related content included more intrinsic motivation themes (e.g., and more mixed intrinsic and extrinsic) compared to physical appearance focused content (see Table 3).

To further address RQ4 (i.e., mental health as a motivator), the mental health benefits and positive internal influence/factors sub-theme frequencies are interpreted in relation to motivation types (Table 8) and the health theme (Table 9). Frequencies for

each sub-theme for the total sample are presented in Table 7. Of the PA engagement sample that was coded for a sub-theme, the *mental health benefits* sub-theme was represented across intrinsic, extrinsic, and mixed intrinsic and extrinsic motivation themes (see Table 8). In addition, 34% of intrinsic content with a sub-theme included the *mental health benefits* sub-theme with higher frequency of "mood" being mentioned compared to extrinsic, but less than mixed intrinsic and extrinsic. The *positive internal influence/factors* sub-theme was the most frequently coded sub-theme for all motivation themes. Relevant to RQ3 (i.e., physical appearance as a motivator), results revealed that extrinsic motivation was coded for the *physical health benefits, shaming self or other, weight loss/weight-management,* and *diet/nutrition* sub-themes more often than the intrinsic and mixed intrinsic and extrinsic themes (see Table 9).

In regards to differences between health and physical activity themes, *mental health benefits, positive internal factors, mood,* and *physical health benefits* sub-themes were more frequently coded among health theme content compared to physical appearance content (see Table 9). Results appear consistent with prior research suggesting that health oriented motivations are less likely to be associated with positive affect, mood benefits, and positive mental health (Cox et al., 2019; Meadows & Bombak, 2019). Sub-theme comparisons suggest that internal processes (e.g., acknowledging progress, self-acceptance, encouraging discipline and determination) may be employed in combination with intentions for change, goals, or working towards an outcome (e.g., to be healthier) to enhance motivation when internal, autonomous motivations are less present (e.g., wanting to be active for enjoyment, self-fulfillment).

Finally, chi-square tests of independence were conducted to examine the likelihood of an association between frequency of intrinsic motivation and health factors (RQ4) and between extrinsic motivation and health factors (RQ4). Chi-square tests were also conducted between intrinsic motivation and physical appearance and between extrinsic motivation and physical appearance (RQ3). Health themes were significantly more frequent with extrinsic motivation than intrinsic motivation, $\chi^2(1, N = 491) = 6.42$, $p \leq .01$ (see Table 10). Results also revealed that physical appearance was coded significantly less for intrinsic $\chi^2(1, N = 30) = 31.48$, $p < .001$, than extrinsic motivation, $\chi^2(1, N = 307) = 83.27$, $p < .001$ (see Table 10). These findings support literature illustrating intrinsic motivation as more representative of internal regulations (e.g., making a choice to be active because one *wants* to not because they feel like they *should*) independent of how one might appear to others or, for example, level of satisfaction or dissatisfaction with one's appearance.

Summary. In addressing RQ1 (i.e., comparison of intrinsic and extrinsic motivation), extrinsic motivation was the most frequent theme. Intrinsic motivation content was primarily representative of PA engagement, whereas more extrinsic motivation content was linked to non-engagement. Common motivational themes linked to PA engagement included goal achievement and positive affect. In terms of unique affective theme for intrinsic motivation (RQ2), positive PA attitude and positive affect, readiness, and wanting were among the most frequent themes, with mixed intrinsic and extrinsic motivation equally incorporating positive affect and goal achievement themes.

In addressing whether physical appearance emerged as a motivator for physical activity (RQ3), results show physical appearance themes were less frequent than health themes and more present in non-engagement content, suggesting physical appearance may not be explicit motivators for physical activity behaviors. In addition, extrinsic motivation was frequently linked to physical appearance, particularly in relation to weight loss and muscle gain. Chi-square analyses demonstrated extrinsic motivation was significantly more frequently coded for physical appearance than intrinsic motivation. In relation to mental health as a motivator for physical activity (RQ4), the *mental health benefits* and *positive internal factors/influence* sub-themes were represented across all motivation types, and the *mood* improvement sub-theme was notable among for intrinsic motivation and mixed intrinsic and extrinsic motivation. Overall, findings support that intrinsic motivation is closely tied to positive affect and mood benefits and less with physical appearance, while extrinsic motivation is linked to external factors like health and physical appearance.

In terms of noteworthy behavior change themes relevant to physical activity within our sample, the self-efficacy theme and habit formation/behavior maintenance thematic content were more frequently coded for PA engagement content than non-engagement content and more often with positive valence. Social support was also relevant to PA engagement, with majority of social support coded as offering and providing support to others. Lastly, the broad theme of goal setting was coded more often for PA engagement and with a positive valence toward the goal setting code. Of the specific goal setting thematic codes, reference to specific goals using the world “goal”

was infrequently coded compared to content that represented themes of working towards a goal or achieving a positive outcome.

Linguistic Inquiry and Word Count-22 (LIWC-22)

To explore affective components and differences among motivation types (RQ1 and RQ2), descriptive statistics for the total sample, physical activity engagement, and non-engagement samples are presented in Table 11 and by motivation type for the PA engagement sample in Table 12. Zero-order correlations for each of the total sample and by motivation type are presented in Tables 13-19 and by physical appearance (Table 18) and the health theme (Table 19). Descriptive means for each motivation type (Table 12) reveal intrinsic motivation content as having the highest means for positive tone (*M* = 5.11) and positive emotion (*M* = 2.44) linguistic content compared to the other motivation types. For example, extrinsic motivation data show a mean of 2.72 for positive tone and .60 for positive emotions. Results indicate that intrinsic motivation (M = 1.12) included a slightly higher mean for negative tone than extrinsic motivation (1.08), which could either suggest that human coding may have missed some affective elements for intrinsic motivation or that when viewed in context of the entire tweet, the negative tone was viewed by human coders differently.

Unexpectedly, data revealed mental health language is lacking within the current data sample. For example, intrinsic motivation had a mean of 0 for mental health, whereas other motivation types ranged from means of .03 - .05 (see Table 12). Intrinsic motivation had the lowest means for the health (*M* = 5.49), illness (*M* = .45), and wellness (*M* = 3.41) categories. Extrinsic motivation on the other hand has the highest

means for health (M = 6.38), illness (M = 1.47), and wellness (M = 4.16). Means for the reward category were also highest for extrinsic motivation followed by the mixed intrinsic and extrinsic content. These findings do not align with literature suggesting reward as more relevant to themes of intrinsic motivation, which could reflect how the LIWC-22 dictionary operationalizes reward as focused on rewarding outcomes including words such as win, gain, benefit, opportunity instead of the pursuit or affective process of reward seeking and fulfillment.

In terms of the affect and motivational processes associated health and mental health across the total sample (N = 2,585; Table 13), negative emotions were positively associated with health (r(2,585) = .06, p <.001) and mental health (r(2,585) = .13, p <.001), suggesting that when negative emotions were mentioned it tended to be in the context of discussing health processes or mental health (e.g., more oriented toward states of stress, fear, or confusion versus coping mechanisms like relaxation, meditation). Positive tone was negatively correlated with illness (r(2,585) = - .15, p <.001) and positively correlated with reward (r(2,585) = .17, p <.001) but was not significantly associated with the want category. The want category was positively related to having a future orientation (r(2,585) = .13, p <.001), while need was also positively associated with having a future orientation (r(2,585) = .17, p <.001). The results suggest that within the total sample physical activity related content, health-oriented content with positive affective processes (i.e., positive tone) were associated with perceptions of reward as well as both “have to” (i.e., need) and “want to” (i.e., want) motivations for future outcomes (see Table 13).

Motivation Type Themes. LIWC-22 variables for the intrinsic motivation sample (Table 14) were examined to further elucidate RQ2. Wellness and mental health were significantly correlated with each other, ($r(208) = .15$, $p < .05$), as were health and mental health ($r(208) = .16$, $p < .05$) and health and wellness ($r(208) = .90$, $p < .001$). Given that the wellness category captures aspects of positive health and well-being (e.g., healthy, strong, fit, energetic, relaxation, yoga, mindfulness), this combination of findings suggests that mental health content may be an intrinsic motivator for physical activity and/or physical activity may facilitate well-being to mitigate negative mental health (e.g., stress, depression). Positive tone was also negatively associated with illness ($r(208) = -.15$, $p < .05$) which aligns with the broader understanding that intrinsic motivation is often rooted in the joy and satisfaction derived from physical activity, rather than a response to health concerns. In contrast, the want category was positively correlated with illness ($r(208) = .26$, $p < .05$) and negative tone ($r(208) = .14$, $p < .05$), which could possibly suggest that illness related factors (e.g., pain) are more likely be discussed in a preventative manner (e.g., "hope" to avoid pain) or that within intrinsic motivation physical activity may occur even if there is presence of an illness process. Finally, future orientation language was positively associated with negative tone, ($r(208) = .26$, $p < .001$) and need ($r(208) = .40$, $p < .001$). Because of the positive affect tone underlying intrinsic motivation, these findings might indicate that when physical activity is done for intrinsic reasons it may represent an attempt to prevent negative future health outcomes.

For the extrinsic motivation sample (see Table 15), health and illness were found to be negatively associated ($r(1,192) = -.21$, $p < .001$) in addition to illness and wellness ($r(1,192) =$

$-.21$, $p < .001$), while health and wellness were strongly positively related ($r(1,192) = .90$, $p < .001$). In addition, results indicate that when health processes were discussed (e.g., energy, pain) it was less likely to be mentioned in relation to a specific illness. A negative relationship emerged between health and the want variable ($r(1,192) = -.13$, $p < .001$), whereas the health variable was positively related to the fulfillment variable ($r(1,192) = .10$, $p < .001$). Given that the fulfillment variable represents satisfaction and completion related stages, these findings could support extrinsic motivation as involving more physical activity behaviors that are driven by health goals.

In terms of affective variables for extrinsic motivation, mental health and negative emotions were positively associated ($r(1,192) = .14$, $p < .001$). Although the strength of this correlation is small, these findings suggest mental health states were more likely to reference negative experiences, such as engaging in physical activity to reduce or prevent mental health symptoms or highlight the absence of positive mental health. while positive tone was positively associated with health ($r(1,192) = .10$, $p < .001$). In conjunction with the negative relationship between health and illness, these results could signify that health content was more likely to be discussed in relation to positive (e.g., “healthy”) or less severe health factors compared to illness which captures specific symptoms or illness states (e.g., “pain,” “sick,” “cancer”). Results indicate mental health did not have a significant correlation with any other LIWC-22 variables. Positive tone was also

positively associated with reward (r(1,192) = .24, p <.05). Whereas negative emotions were also associated with greater need (r(1,192) = .16, p <.001) and having a future orientation (r(1,192) = .13, p <.001). In addition, having a future association was also positively related to the want variable (r(1,192) = .10, p <.001). Findings between negative emotions and need and future orientation may support literature suggesting extrinsic motivation tends to involve perceptions that one *has to* (i.e., need) engage in physical activity now to achieve a desired (i.e., want) future outcome.

Among the mixed intrinsic and extrinsic motivation sample (see Table 16), health and illness were also found to be negatively associated (r(863) = - .12, p <.001) as were the health and the want variables (r(863) = - .09, p <.05). Health was also positively associated with the wellness variable, (r(863) = .90, p <.001), suggesting content centered around positive health experiences or improvements to health to achieve positive outcomes. Mental health and health were positively related (r(863) = .13, p <.001) and to a lesser degree wellness (r(863) = .07, p <.05). This finding is unique and suggests that within content coded with both intrinsic (e.g., positive affect focused) and extrinsic (e.g., goal, change, outcome focused) motivation, mental health was more likely discussed in context of overall health and possibly in relation to well-being.

Interestingly, for affective variables, mental health was positively associated with both negative emotions (r(863) = .17, p <.001) and negative tone (r(863) = .13, p <.001), adding nuance to the finding described prior. These nuanced findings align with this content including two motivation themes in relation to the LIWC-22 mental health variable as capturing more symptoms and conditions. Still, it is interesting that mental

health and health were correlated and suggests even if there is negative affect present, mental health was discussed as a factor related to overall health. Positive tone was also associated with the reward variable ($r(863) = .13$, $p < .001$). No other significant relationships between mental health, positive tone, or positive emotions emerged with other LIWC-22 variables (see Table 16). Lastly, having a future orientation was positively related to both the need variable, ($r(863) = .25$, $p < .001$), and to a lesser degree the want variable, ($r(863) = .09$, $p < .05$). This finding aligns with the interpretation for extrinsic motivation that future goals may be referenced as something someone *has to do* versus explicitly *wants to do*.

To clarify processes underlying the unclear/vague motivation theme, zero-order correlations were also conducted among LIWC-22 variables with this sample (see Table 17). Health and illness were negatively related, ($r(322) = -.19$, $p < .001$), which is similar to the extrinsic and mixed intrinsic and extrinsic motivation samples, and unlike the intrinsic motivation sample. Health was also positively associated with wellness, ($r(322) = .85$, $p < .001$) yet was not significantly related to any other LIWC-22 variables. Results revealed positive tone as negatively associated with illness, ($r(322) = -.12$, $p < .05$) and positively associated with wellness ($r(322) = .15$, $p < .001$). Positive tone was also correlated with mental health ($r(322) = .15$, $p < .001$), which is noteworthy given the three other motivation types did not show significant relationships for positive tone and mental health. In addition, the reward variable was significantly related to positive tone ($r(322) = .23$, $p < .001$) and positive emotions ($r(322) = .15$, $p < .001$). Results also demonstrated mixed affective processes with each positive tone ($r(322) = .18$, $p < .001$), positive

emotions ($r(322) = .38$, $p < .001$), and negative tone ($r(322) = .15$, $p < .001$) variables significantly associated with the fulfillment variable. Lastly, having a future orientation and the want variable were related, and at a stronger degree when compared to *r* values for the three other motivation types ($r(322) = .28$, $p < .001$). It could be that the unclear/vague motivation category included more elements of intrinsic motivation that were missed during qualitative coding or could not be fully identified with the current coding scheme due to lack of textual content (e.g., limited word count, high use of hashtags) for this sample of Tweets.

Physical Appearance Theme. Correlation results within the physical appearance theme sample (see Table 18) revealed a comparatively stronger correlation between health and illness than the motivation and health samples ($r(532) = -.44$, $p < .001$), see below and Table 19 for health theme correlation results. A positive association emerged between wellness and illness ($r(532) = -.40$, $p < .001$) and illness and mental health ($r(532) = .11$, $p < .05$). Positive tone was only significantly correlated with reward ($r(532) = .21$, $p < .001$) and the fulfillment variable ($r = .16$, $p < .001$). Interestingly, the negative emotion variable was positively associated with the need ($r = .11$, $p < .05$) and the future orientation variables ($r = .14$, $p < .001$). While having a future orientation was also correlated with need ($r = .17$, $p < .001$) and want variables ($r = .15$, $p < .001$). These findings could indicate greater negative emotions around perceiving a need to change one's appearance (i.e., indicating possible lacking, dissatisfaction with current appearance) out of a perceived need or want to achieve a specific appearance status (e.g., weight loss, muscle gain) in the future.

Health Theme. Zero-order correlations with the sample of Twitter posts coded with the health theme present (see Table 19) revealed significant relationships between health with illness and wellness and between wellness and illness LIWC-22 variables. These findings are consistent with what was observed across the motivation samples (see Tables 14-17). The LIWC-22 health variable was positively associated with mental health ($r(997) = .09$, $p < .001$), albeit a small correlation, suggesting confirmation that mental health content was captured during qualitative coding with the health theme coding scheme. While the want variable was positively related to illness ($r = .17$, $p < .001$), it was negatively related to the health ($r = -.15$, $p < .001$) and wellness variables ($r = -.13$, $p < .001$), indicating a theme that change among illness states were desired whereas health might have been more related to a state that has already been achieved or actions are already being taken (e.g., wanting is not present because a plan is in place). The illness variable was negatively related to positive tone ($r = -.20$, $p < .001$) and positive emotions ($r = -.09$, $p < .001$) and positively related to negative tone ($r = .16$, $p < .001$) and negative emotions ($r = .07$, $p < .05$). Positive tone was correlated with reward ($r = .21$, $p < .001$) while positive tone ($r = .10$, $p < .001$), positive emotions ($r = .20$, $p < .001$), and negative tone ($r = .14$, $p < .001$) were all positively associated with the fulfillment variable. This result captures mixed affective processes around health outcomes or the pursuit of health, which is consistent with the mixed valence findings found in qualitative coding. Findings may also suggest that discussions about health content were realistic, encompassing both positive and negative aspects, rather than being overly positive and shielded, which could reflect a tendency towards socially desirable presentation. Lastly, the future orientation

variable revealed a negative relationship with illness, ($r(997) = -.07$, $p < .05$) and positively related to negative emotions ($r = .10$, $p < .001$) as well as the need ($r = .17$, $p < .001$) and want variables ($r = .14$, $p < .001$) (see Table 19). This finding may suggest a theme of health symptoms (e.g., pain) or specific illness (e.g., cancer) as referenced in past tense, such as reflecting on overcoming or the experience of having a symptom or condition.

Summary. Among LIWC-22 analyses, intrinsic motivation posts showed higher positive tone and emotions but also a surprising presence of negative tone. Intrinsic motivation was not significantly linked to mental health themes, contrary to literature expectations, but did show associations with wellness. Extrinsic motivation posts were more frequently linked to health and wellness themes and less to illness, suggesting a focus on achieving positive health outcomes. Physical appearance was a significant motivator, with negative emotions associated with perceived need suggesting perceptions of needing to change one's appearance for future goals. Mental health emerged as a less prominent theme overall, indicating a potential gap in the data sample. Overall, findings suggest intrinsic motivation content tends to focus on positive experiences, while extrinsic motivation is more goal-oriented, involving health and appearance-related outcomes.

Topic Modeling

Topic modeling results are separated by motivation type and by PA engagement and non-engagement content. Data were filtered by motivation and PA engagement coding and then entered into the Python program software to complete BERT topic

analysis. Filtering the data beforehand offers a guided, stepwise approach to topic modeling to identify additional topic themes across the coded data. Data are presented in topic model bar graphs and cluster maps. The bar graph for each topic (e.g., Figure 1A) depicts the most significant words for each topic identified by our BERT model (i.e., top words for each identified topic). These words are the ones that contribute the most to defining the topic. For the bar graphs, the x-axis represents the words, while the y-axis shows their frequency or relevance score within the topic.

The cluster maps illustrate the relational distance between the topics that emerged (e.g., Figure 1B). For the cluster maps, the further apart the topics are from each other spatially, the further apart they are relationally and the greater spread the topics have the greater diversity of content there is in that single topic. Topics are organized numerically with 0 (i.e., notated as the "first" topic in results below) being the most representative of the specific sample entered into the model. As the topic number increases (e.g., Topic 4) the less representative that topic is of the sample. To facilitate creation of topic models, the Tweets for each topic were interpreted in relation to the words that emerged as representing each topic. A sample of Tweets for each topic are presented in Appendix F.

First, topic model results are presented for the total sample (i.e., includes both PA engagement and non-engagement coded content) and for each qualitative motivation type theme (intrinsic, extrinsic, mixed intrinsic and extrinsic, and unclear/vague motivation) in Figures 1-4. Then results are separated by PA engagement (presented in Figures 5-8), and non-engagement content (presented in Figures 9-11) to illustrate differences between content representing physical activity behavior (i.e., PA engagement) and content

representing factors related to but were not coded as involving physical activity actions/behavior (i.e., non-engagement). As such, results are presented for the PA engagement sample only across each motivation type theme then for the non-engagement sample only across each motivation type followed by a summary of topic modeling results.

Total Sample by Motivation Type

Intrinsic Motivation. Across the total sample for content coded with intrinsic motivation, three distinct topics emerged (see Figure 1A for the top words identified for each topic). The first topic was interpreted as involving Satisfaction and Enjoyment from Running and Swimming. This topic illustrates the satisfaction and enjoyment individuals derive from activities like running and swimming, highlighting intrinsic motivations related to these physical activities. The second topic was interpreted as involving the Impact of Physical Activity Engagement on Well-Being. Discussions in this topic centered around how engaging in physical activities impacts overall well-being, emphasizing intrinsic benefits such as improved mental and physical health. The second topic was interpreted as involving the Impact of Physical Activity Engagement on Well-Being. The third and final topic was interpreted as Satisfaction and Enjoyment from Cycling Outside. This topic focused on the pleasure and satisfaction derived from cycling outdoors, illustrating intrinsic motivations associated with outdoor physical activities, specifically cycling. Cluster graph depictions of these topic results are presented in Figure 1B and illustrate Satisfaction and Enjoyment from Running and Swimming as capturing a broad, significant amount of intrinsic content and similar but separate to

Physical Activity Well-being. Whereas, Satisfaction from Cycling Outside emerged as a smaller, concentrated, and distinct theme, suggesting no overlapping content with other topics.

Extrinsic Motivation. Across the total sample for content coded with extrinsic motivation, four distinct topics emerged (see Figure 2A for the top words identified for each topic). The first topic captured a broader theme of Physical Activity Outcomes as Motivators, in which this topic highlighted how outcomes such as physical fitness performance and improvements serve as external motivators for engaging in physical activity. The second topic focused on Running Routine Progress, which captured discussions centered around the progress and milestones achieved through regular running routines, illustrating external motivators for maintaining physical activity habits. The third topic was interpreted as Facilitators of Cycling and specifically captured external factors that facilitate cycling, such as supportive environments or infrastructure designed for cyclists. The final topic highlighted the Use of Programs Facilitate Running and Walking. This topic discussed programs and tools used to facilitate running and walking activities, primarily use of the Couchto5k mobile application, emphasizing external supports for physical activity engagement. Cluster graph results (see Figure 2B) illustrate topics Physical Activity Outcomes as Motivators and Running Routine Progress as having slight overlap with Physical Activity Outcomes as capturing majority of extrinsic content. In addition, Use of Programs represents markedly less content but appears distinct yet related to Running Routine Progress. Similar to intrinsic motivation,

Cycling as Facilitators is a distinct, concentrated topic with some connection to running progress and physical activity outcomes topics.

Mixed Intrinsic and Extrinsic. Across the total sample for content coded with mixed intrinsic and extrinsic motivation, two topics emerged (see Figure 3A for the top words identified for each topic). The first topic was interpreted as illustrating the Impact of Running and Community on Well-Being. This mixed topic highlighted both intrinsic benefits of running and the external influence of community support on overall well-being. The second topic was interpreted as Overcoming Challenges of Physical Activity and illustrated discussions that addressed both intrinsic motivations to overcome challenges, and external factors influencing physical activity engagement, such as access to a gym, group fitness, and weight loss journeys.

The cluster graph (see Figure 3B) demonstrated how these two topics included a diversity of content within the specific topic, as evidenced by the spread of each topic. In addition, the cluster graph suggests topics as being distinct with slight overlap, indicating the impact of running and community on well-being as not including much content related to overcoming challenges, and instead is focused primarily on aspects of positive affect and derived benefits from running.

Unclear/Vague Motivation. Across the total sample for content coded with unclear/vague motivation, two topics emerged (see Figure 4A for the top words identified for each topic). The first topic highlighted aspects of Dedication to Physical Activity Engagement Outside, suggesting a broader topic of ambiguous motivations related to maintaining dedication to physical activity engagement (with a focus on running) outside

despite influences of weather (e.g., increased heat from July 2022 heat wave). The second topic was interpreted as Diverse Online Health and Fitness Community, as it depicted unclear motivations related to participation in diverse online health and fitness communities, including sharing information from a diverse range of subjects. The cluster graph (Figure 4B) demonstrates the distinct yet comparable in size representation of each of these topics.

Motivation Type for PA Engagement

Intrinsic Motivation. Topic areas for physical activity engagement and intrinsic motivation emerged as highly overlapping to the total sample for intrinsic motivation, with content fitting two topics for PA engagement (see Figure 5A for the top words identified for each topic) instead of three for the total sample. This is fitting given that 91% of total coded intrinsic motivation content was represented by physical activity engagement. The first topic was Satisfaction and Enjoyment from Running and Swimming, whereas the second topic was Satisfaction and Enjoyment from Cycling Outside. Overall, the topic overlap between the total and PA engagement sample indicates a consistent theme of satisfaction and enjoyment from physical activities like running, swimming, and cycling. A cluster graph depicting the topic areas are presented in Figure 5B.

Extrinsic Motivation. Across the physical activity engagement sample for content coded with extrinsic motivation, five topics emerged (see Figure 6A for the top words identified for each topic). The first topic was interpreted as Motivation from Results of Physical Activity Engagement and captured content that frequently highlighted

personal achievements, improvements in fitness levels, and aspects of empowerment from performance and fitness outcomes. The second topic revealed a theme that highlighted the process of Initiation and Maintenance of Running, with a focus on motivations for beginning running, such as health goals or personal challenges, as well as strategies or external goals (e.g., training for a race) for maintaining consistency for running practices. The third topic was interpreted broadly as Social and Environmental Influences on Cycling, which overlapped with the third topic for extrinsic motivation within the total sample. Content for this topic discussed group rides, community support for cycling initiatives, and the impact of weather and geographic features on cycling experiences. The fourth topic also overlapped with the fourth topic in the extrinsic motivation total sample, Use of Programs to Facilitate Running and Walking. The similarities between PA engagement and the total sample topics highlight the strength, consistency, and relevancy of PA engagement content across the entire sample. However, the final topic was unique and interpreted as Organized Sports Training. Content in this theme included discussion of team practices, coaching strategies, and the dedication required for participating in organized sports events. The cluster graph is displayed as Figure 6B and demonstrates the concentrated nature of content around cycling and sports training from the spread of content representing motivation derived from results of physical activity and initiation and maintenance of running routines.

Mixed Intrinsic and Extrinsic Motivation. Across the physical activity engagement sample for content coded with mixed intrinsic and extrinsic motivation, two topics emerged (see Figure 7A for the top words identified for each topic). The first topic

was interpreted as Motivating Self and Others for Physical Activity Enjoyment which collectively convey a theme centered around personal motivation, community engagement, overcoming challenges, and the holistic benefits of physical activity, most often running, for both physical and mental well-being. The second topic that emerged included Overcoming Challenges and Staying Motivated for Physical Activity in which content revolved motivation, discipline, personal growth, and the commitment required to achieve fitness goals. The cluster graph (see Figure 7B) demonstrates that each of these topics are distinct, with little overlap. This finding suggests that processes to *create, encourage, or maintain motivations* may be more relevant when there are *perceived challenges* to physical activity engagement (e.g., discomfort/pain of physical activity, low energy and motivation, maintaining a routine) than in situations in which the focus is on highlighting the enjoyment of physical activity (i.e., engagement for intrinsic, autonomous reasons). For example, content that highlights enjoyment from physical activity may indicate prior positive experiences and therefore intrinsic motivations that limit perception of experiences as challenges, generate anticipatory positive affect that increases self-efficacy to overcome challenges, and/or generally supports positive outcome expectancies.

Unclear/Vague Motivation. Across the physical activity sample for content coded with unclear/vague motivation, two topics emerged (see Figure 8A for the top words identified for each topic). The first topic was interpreted as Impact of Environment on Physical Activity Engagement and highlighted content related to how environmental conditions, ranging from weather and landscapes to social contexts and personal

challenges, shape the engagement, experiences, and ambiguous motivations for physical activity engagement. The second theme was described as Motivating and Connecting with Others on Physical Activity and include a wide range of content that largely demonstrate diverse fitness interests, including beginning the day with physical activity, and illustrate how people use social media to motivate themselves and connect with others on potential shared experiences. The cluster graph presented as Figure 8B provide a visual representation of the broad and distinct nature of these two topics, further supporting the spread of content included in the unclear/vague motivations sample.

Motivation Type for Non-Engagement

There is no topic model data the intrinsic non-engagement sample because the sample was too small (N = 19) for program software to generate topics.

Extrinsic Motivation. Among content coded as extrinsic motivation and involving non-engagement related content, four topics emerged (see Figure 9A for the top words identified for each topic). The first topic was interpreted as Health and Fitness Inspiration and encompassed a range of content centered around a holistic approach to health, including motivational statements, diverse range of physical activity, and health and injury prevention (see Appendix F for a sample of tweets for this topic and all others). The second topic was interpreted as Gym, Appearance, and Weight Loss and found to include content related to gym routines, weight loss/reducing “belly fat,” and body image (e.g., achieving desired physical appearance). The third topic supported a theme related to Nutrition/Diet Inspiration for Health and Weight and emphasize diets for weight loss and reducing “belly fat,” metabolic health, with resources integrated

throughout the content. The final theme described Optimizing Physical Health and discussed broad concerns about health through content about fat loss and muscle building to more specific health concerns like the influence of hormones and menstrual cycle as well as specific environmental factors in gyms on fitness.

As illustrated in the cluster graph (see Figure 9B), health and fitness inspiration content are depicted as the most representative topic in this sample with a great deal of diversity within the content (i.e., why the interpretation title is broad and not specified further). In addition, the gym, appearance, and weight loss topic appear to be a central, specific topic that overlaps with nutrition/diet content and health and fitness inspiration. Much of the gym, appearance, and weight loss topic content centered around the gym (e.g., frequent use of #gym), suggesting that the gym is a place where physical appearance is discussed more often than in the context of strategies to optimize physical health. This finding supports that motivations for physical activity and fitness are notable for motivations toward weight loss and changes or perceived improvements to physical appearance. This topic also highlights the influence of gym culture for physical appearance related content that were not captured in qualitative thematic coding. Interestingly, there is no overlap between diet/nutrition topic content and the optimizing physical health topic content, which includes content that would have likely been qualitatively coded for the health theme. Results signify that tips and insight around diet/nutrition were frequently discussed as separate from strategies for optimizing health and fitness performance (e.g., preventing fatigue, science underlying muscle gain) within

content coded as not directly related to physical activity behaviors (i.e., non-engagement).

Mixed Intrinsic and Extrinsic Motivation. Among content coded as mixed intrinsic and extrinsic motivation and involving non-engagement related content, three topics emerged (see Figure 10A for the top words identified for each topic). The first topic was interpreted as Motivating Healthy Lifestyle and Nutrition Choices and focus on the importance of balanced nutrition, effective weight loss strategies like the smoothie diet, maintaining a healthy mind and body, and understanding personal motivations for pursuing health and fitness goals. The second topic broadly described a theme of Finding Satisfaction in Pursuit of Health and Fitness Goals and emphasize self-belief, motivation, perseverance, and the importance of enjoying the journey towards personal goals, while highlighting themes of positivity, progress, and the mindset needed to overcome challenges. The final topic is Staying Commitment to Self-Improvement in which content included themes of progress, self-improvement, and the importance of dedication in fitness and personal growth, while also emphasizing individuality and self-expression within the gym and fitness communities. The cluster graph in Figure 10B illustrates the content diversity within each of the topics (i.e., depicted by the spread of each topic area), the near equal distribution between the topics (i.e., depicted by the similar size of topic clusters), and the overlap particularly between the healthy lifestyle/nutrition theme with satisfaction in health/fitness goals and the self-improvement themes.

Unclear Motivation. Lastly, among content coded as unclear/vague motivation and involving non-engagement related content, two topics emerged (see Figure 11A for

the top words identified for each topic). The first topic that emerged was interpreted as Sharing Health and Fitness Information and Motivation in which content emphasized the importance of motivation, self-improvement, and maintaining a healthy lifestyle, while also highlighting tools and tips for achieving personal health and fitness goals. The second topic was labeled as Sharing Gym Experiences to Motivate Self and Others. The content in this was broad but focused largely on gym-related activities, fitness tips, motivation, personal experiences, and the role of BCAAs in muscle building and repair. The cluster graph (see Figure 11B) demonstrated a large spatial distance within each topic, suggesting a diverse range of content that comprised each topic. It also appears to represent the largest spatial spread when compared to cluster graphs for the other motivation types. This observation likely supports qualitative coding that indicated this sample as including a difficult to characterize motivation type, and otherwise ambiguous, unclear motivational mechanisms.

Summary. Overall, topic model results provide another layer of data to support our qualitative coding and highlight distinct and overlapping themes with respect to each motivation type. There were remarkable similarities between content for intrinsic motivation, including an overall emphasis on positive affect derived from running, swimming, cycling, and other physical activities and explicitly described positive experiences of physical activity engagement, such as enjoying a run, feeling good after a workout, appreciating the scenery in addition to enjoying the experience of cycling. In addition, intrinsic motivation topic themes also highlighted intrinsic benefits of physical activity on well-being and mental health. Extrinsic motivation topic model results

highlight the social influences on physical activity (e.g., sports training, use of coaches and structured mobile app programs like Couchto5k), motivation derived from results and positive outcomes achieved through physical activity, as well as support the high frequency of health content that uncovered themes specific to optimizing physical health, discourse around ideal body image, inspiration for an overall healthy lifestyle, and specific and holistic/broad methods for weight loss and healthy nutrition choices. The mixed intrinsic and extrinsic and unclear/vague motivation topics included a unique emphasis on the use of community, including social media, to motivate health and fitness actions and illustrate self and other motivational phrases and sentiments that discuss perseverance, progress, and general importance of maintaining *some form of motivation* toward better (health and fitness) outcomes.

CHAPTER 5: DISCUSSION

Overview

The overarching inspiration for this study is a deeper understanding of the mechanisms that contribute to sustainable, positive experiences with health behaviors. This inspiration is rooted in a broader scientific need to address what contributes to low rates of health behavior engagement. Processes that underly decisions about health behavior engagement from a holistic perspective, positive health behaviors are a viable intervention to reducing negative mental health symptoms, increasing well-being, and reducing stress in both non-clinical and clinical populations (Gómez-Gómez et al., 2020; Teychenne et al., 2020). To reach a deeper understanding of these mechanisms, a primary goal of the present study was to obtain diverse, first-person perspectives of motivation and affect toward physical activity by adopting an exploratory and data-driven approach to identifying themes of Twitter posts pertaining to physical activity.

Study Aims

The primary aims for this study were largely achieved through use of a mixed-methods data analysis approach. For Aim 1, a motivational factors and health behavior change codebook was developed that provides a thematic framework for interpreting physical activity related social media posts. This dissertation demonstrates how qualitative research can be leveraged and applied to a rich dataset and can lead to greater insight into diverse individual and population-level perspectives of motivations, affect and attitude, and processes that influence physical activity engagement.

In regard to Aim 2, the codebook drew from reputable health behavior and motivation literature, including theories and research that inform self-regulatory processes such as self-efficacy (Bandura, 1986; Sallis et al., 1988), habit formation (Kaushal & Rhodes, 2015; Wood, Mazar, & Neal), social support (McNeill, Kreuter, & Subramanian, 2006), and goal setting research (Locke & Latham, 2006). Research considering the limitations of self-regulation during heightened stress and mental health symptoms (Hallford et al., 2018; Price & Drevets, 2012) and benefits of physical activity for mental health were also applied in the conceptualization of the codebook. In addition, intrinsic and extrinsic motivational constructs were included from self-determination theory (Ryan & Deci, 2017) and considered in relation to dual-process models and research that support the role of positive affect and automatic associations with reward for facilitating behavior change (Brand & Ekkekakis, 2018; Hoffmann et al., 2008; Phipps et al., 2021).

The foundation of this dissertation and qualitative codebook was also informed by incentive salience research with recognition of human nature's underlying proclivity toward hedonistic pursuits (Berridge, 2007; Locke & Schatkke, 2019; Smith et al., 2011) and the value of employing positive psychological (Van Cappellen et al., 2018) and humanistic approaches to health behavior change (i.e., respect for choice, autonomy as described in the clinical approach of Motivational Interviewing, Miller & Rollnick, 2023). Codebook development and basis for research questions were also informed by research supporting the mental health benefits of physical activity (Meyer et al., 2021). The exploration of physical appearance themes was guided by the consequences of

prescriptive approaches to physical activity for weight loss, alongside broader sociocultural emphasis on thin ideal body sizes that fosters avoidance, thereby perpetuating health inequities to the diverse health benefits offered by physical activity. (e.g., Meadows & Bombak, 2019; Pearl et al., 2020). Lastly, the qualitative codebook was data-driven such that it was developed to be responsive to themes and the conversational, informal context of Twitter content and shifted accordingly to improve the quality and structure of coding schemes.

For the current dissertation, Aim 3 was achieved through the mixed-method thematic analysis of inductive and deductive qualitative coding, LIWC-22 text analysis with correlations across motivation types and health and physical appearance themes, and topic modeling that facilitated comprehensive identification of themes and associations among Twitter posts that contain physical activity, and affective and motivational content. This dissertation discusses the findings related to intrinsic and extrinsic motivations in physical activity Twitter posts, exploring affective content and themes related to physical appearance and mental health.

Comparison of Motivational Themes (RQ1 and RQ2)

The results shed light on several key research questions (RQs) that aim to understand the motivational factors and affective dimensions associated with physical activity engagement on social media. To address how intrinsic and extrinsic themes differ in terms of frequency (RQ1), thematic frequencies revealed extrinsic motivation was the most prevalent type across the sample, followed by a mix of intrinsic and extrinsic motivation, and intrinsic motivation alone being the least frequent. In elucidating how

intrinsic motivations differs in terms of affective themes (RQ2), intrinsic motivation was significantly more associated with positive affect and readiness for physical activity engagement compared to extrinsic motivation, which exhibited a broader range of affective content including negative and mixed attitudes. The LIWC-22 analysis further supported these findings, highlighting that intrinsic motivation tweet content had higher positive affect and emotional content compared to extrinsic motivation posts.

Topic modeling results supported the prevalence of external factors and health themes within extrinsic motivation and positive affective experiences and the influence of physical activity on well-being within intrinsic motivation. These findings align with literature that supports differences in affective-cognitive foci between intrinsic and extrinsic motivation (Ryan & Deci, 2017; Teixeira et al., 2012). For example, self-determination theory describes motivational regulations as representing the "why" underlying behavior, and further indicate that intrinsic goal contents such as for health, mental health, and personal growth are more likely to lead an individual to satisfy psychological needs (Deci and Ryan, 2000; Vansteenkiste & Ryan, 2013). It is possible that the current study's intrinsic motivation coding scheme theme captured motivations purely for pursuit or achievement of positive affect and the mixed intrinsic and extrinsic theme may have captured intrinsic goals geared toward improvements to health and achievement of personal growth outcomes.

The topic modeling analyses revealed distinct patterns between intrinsic and extrinsic motivations within physical activity-related Twitter content that support thematic comparisons (RQ1). For example, results elucidate unique affective themes of

intrinsic motivation (RQ2), predominantly centered around specific activities such as running, swimming, and cycling. These activities were consistently associated with positive affective content, emphasizing the pleasure and personal fulfillment derived from engaging in these physical activities. In comparison, extrinsic motivations were more varied, encompassing themes such as performance and achievements with physical activity as motivators, acknowledgement of progress of running behavior formation and maintenance, steps to achieve an ideal body image, and use of tools and programs like Couchto5k to facilitate physical activities like running and walking.

Overall, extrinsic motivation themes often highlighted external factors like performance outcomes, structured routines, and environmental facilitators that drive individuals to participate in physical activities. Results also demonstrated how positive affect with intrinsic motivations may be paired with external factors. For example, mixed motivations, combining intrinsic and extrinsic elements, revealed themes that illustrated how personal enjoyment and external influences like community support and environmental factors synergistically motivate individuals to maintain physical activity routines.

Regarding affective themes for intrinsic motivation (RQ1), posts focused on intrinsic motivation predominantly highlighted positive attitudes and affective readiness, emphasizing enjoyment and self-fulfillment as key motivating factors for physical activity. These findings align with literature suggesting that internal enjoyment and personal fulfillment are strong drivers of sustained physical activity (Rhodes & Kates, 2015; Williams & Evans, 2014). In sum, the LIWC-22 findings for intrinsic motivation

provide a nuanced understanding of the affective themes underlying intrinsic motivation for physical activity. The significant correlations between wellness, health, and mental health suggest that intrinsic motivation is closely tied to promoting overall well-being and positive mental health. The negative association between positive tone and illness indicates that intrinsic motivation is more likely driven by a positive outlook on health and fitness rather than illness prevention.

In exploring unique affective themes related to intrinsic motivation through topic modeling, results demonstrated two primary topics: satisfaction and enjoyment from specific activities like running, swimming, and cycling, and the impact of physical activity engagement on well-being. These themes underscored how intrinsic motivations are closely tied to personal enjoyment, satisfaction, and the overall positive impact on mental and physical well-being. Notably, satisfaction and enjoyment from cycling outside emerged as a distinct and concentrated theme, highlighting specific *person-centered* preferences within intrinsic motivational content.

Physical Appearance (RQ3) and Mental Health (RQ4) as Motivators

Results yielded a broader understanding of whether appearance-focused motivations are motivating factors for physical activity engagement (RQ3). As such, physical appearance, especially in the context of social media posts, may depict motivation geared toward a desire for external motivation and/or validation derived from others and less autonomous reasons for physical activity. Regarding physical appearance, while it emerged less frequently compared to health-related themes, it was still noted in both engagement and non-engagement contexts. Content related to physical appearance

often reflected motivations driven by dissatisfaction and a desire for change, weight loss, or muscle gain, rather than satisfaction with appearance, and these themes were more prevalent in contexts of non-engagement. These findings suggest that while physical appearance can motivate physical activity, its impact may vary depending on if it is a direct motivator for engagement in physical activity and more research would be needed to explore this theme further. Of note, body image (e.g., "figure out how you wanna look. Then figure out what you need to do to get the looks you want") and weight loss emerged from topic model analyses for extrinsic content that did not include physical activity behavior (non-engagement) and appeared particularly salient within gym contexts. Further, results from chi-square demonstrated that physical appearance was coded significantly more frequently for extrinsic motivation than intrinsic motivation. Overall, findings converge to indicate physical appearance as a motivating factor relevant to less autonomous motivations (i.e., extrinsic motivation).

In regard to whether mental health motivations for physical activity (RQ4), mental health emerged as a frequent theme in qualitative coding, specifically in content related to intrinsic motivation and mixed intrinsic and extrinsic motivation. Across LIWC-22 and topic model results, positive mental health benefits, such as mood enhancement and implications of stress reduction, were frequently associated with these motivations, underscoring the role of mental well-being in motivating physical activity. Mental health emerged as a notable motivating factor within both intrinsic and extrinsic motivation contexts. Key topics from the topic modeling highlighted how engaging in physical activities like running and cycling positively impacts mental well-being and

provides overall emotional health benefits. This underscores the dual role of physical activity in enhancing both physical fitness and mental health outcomes. Results from chi-square analyses indicated that health theme codes were significantly more frequent for extrinsic than intrinsic motivation. These findings demonstrate possible limitation of the health theme in detecting mental health factors, as well as potentially less explicit mental health content within the entire sample given the nature of query terms used to collect data (e.g., physical activity related not mental health terms). In regard to themes of intrinsic motivation, it is encouraging that satisfaction and other positive affective processes consistently emerged across various the various data approaches.

Overall, results provide valuable insights into the motivational factors and affective dimensions present in physical activity-related discourse on Twitter. It underscores the importance of intrinsic motivation and positive affect in fostering sustained engagement in physical activity, while also acknowledging the roles of extrinsic motivation, physical appearance, and mental health in shaping attitudes and behaviors. These findings contribute to understanding how social media platforms like Twitter can influence health behaviors and inform targeted interventions aimed at promoting physical activity and well-being. Topic modeling results inform our understanding of the multifaceted nature of motivations, ranging from personal enjoyment and mental health benefits to external factors like performance outcomes and community support. These insights can inform targeted interventions and strategies aimed at promoting sustained physical activity participation among diverse populations.

Implications and Future Directions

The present study employed an innovative mixed-method research design and analysis to advance understanding of the mechanisms that contribute to sustainable, positive experiences with health behaviors, contributing to the science of health behavior change. This study includes the design of a multilevel, theoretically grounded qualitative codebook manual that could be potentially applied in future health behavior, motivation, and physical activity related research. Further, the developed qualitative codebook is essential to not only the success of this dissertation, but also the goals of the Health Communication and Recommender Systems collaborative project between Dr. Levens and Dr. Shaw to leverage both psychological methods and expertise, and computational data driven methods and analysis. This dissertation contributes to this collaborative study's goal to develop a thematically coded dataset that can be used to build and test algorithms for just-in-time recommender systems to enhance mobile health applications. As such, this thematic analysis study demonstrated use of an in-depth, informative, and innovative approach that has not been employed within physical activity behavior change literature.

The present study provides an example of a potentially more inclusive and humanistic, person-centered health promotive approach for understanding physical activity health behavior change that may be utilized across clinical and research settings. More specifically, this dissertation demonstrated a consistent relationship between intrinsic motivation and positive affect across data approaches. These findings can be applied to inform strategies for optimizing life-enhancing, autonomy-supportive processes involved with physical activity. Given presence of chronic illness and a need to

increase physical activity, it is beneficial to consider strategies for helping individuals identify, develop, and maintain motivations for physical activity that are more self-concordant (i.e., I'm doing this because I want to for myself), individualized (i.e., doing what I want and can do for movement), affectively anchored (i.e., exercising because it decreases stress during a busy week), and potentially more self-compassionate and reward-based (i.e., my intention is to go to Zumba because it helps me release stress and the music is really enjoyable) versus judgmental and punishment-based (i.e., I sat all day, feel my weight is an issue, and make myself go to the gym and do a stair master that I dread, when I'd rather go swimming). Our findings provide support these applications and contribute to a larger scientific pursuit for effective approaches to improving population-health.

Importantly, social media continues to influence social standards and public opinion, and therefore offers a rich opportunity to obtain first-person, real-time historical data (Sinnenberg et al., 2017). In addition, Twitter content is a primarily text-based communication platform that also includes tagged hashtags that provide additional social information (e.g., affiliation with a group, an event, a specific movement, etc.), which make Twitter posts ideal data units for understanding general population perceptions through in-depth qualitative analyses. Although studies have explored beliefs and perceptions of physical activity (Robert et al., 2021; Zhang et al., 2013), methods have yet to explore motivation and affect specifically, utilize manual human coding procedures, or produce a qualitative guide that could be replicated and used for social media health behavior change based content analysis. In addition, the present study

demonstrates use of an integrative theoretical approach based in humanistic, neurobiological, and positive psychology to understand physical activity promotion through enhancing intrinsic motivational forces.

This dissertation contributes to health behavior change research that emphasizes intrinsic motivation and affect (Teixera et al., 2012), and thereby promoting physical activity for well-supported mental health benefits (Rodriguez-Ayllon et al., 2019). This is contrary to prescriptive, frameworks singularly focused on self-regulatory processes and emphasize the self-responsibility of individuals to engage in physical activity for weight loss and ultimate reduce the public health burden of 'obesity' (Puhl & Heuer, 2009). Results support the role of positive affect, satisfaction, enjoyment as common themes among personal experiences related to physical appearance. In addition, results demonstrate broader themes related to the pursuit of healthy lifestyles, engaging in physical activity to support health optimization and engagement in physical activity as concordant to other health behaviors, like healthy eating, and illness prevention and recovery (e.g., physical activity to improve blood pressure, hormonal function, remaining active during recovery from an injury).

As expected with the study's focus on physical appearance as a proposed theme, weight loss emerged in relation to progress to weight loss, diet/nutrition for weight loss, and dissatisfaction with one's appearance as a motivator for weight loss. As such, this research can contribute to informing future social media research that narrows in on physical appearance, body dissatisfaction, and the process of social comparison and implications on disordered eating, mental health and physical activity within body image

research (e.g., Holland and Tiggermann, 2016; McComb, Vanman, & Tobin, 2023), particularly among young women. For example, there is a need for continued research that contributes to dismantling the harmful effects of weight stigma that permeate social, cultural, and institutional structures (e.g., healthcare). Research demonstrates weight stigma is prevalent across different racial and ethnic groups (Puhl & Telke, 2020), indicating weight stigma as contributing to health inequities among groups with intersecting marginalized identities (Tomiyama et al., 2018). Given that this dissertation did not collect identifying data on racial and ethnic identities, a future research direction could employ this qualitative codebook with interviews or secondary data including diverse identity representation to explore the intersection of weight stigma and race/ethnicity on intrinsic and extrinsic motivations and affect toward physical activity engagement.

Overall, results yield meaningful themes that contribute to a rapidly evolving and important area of physical activity research that is lacking qualitative data with nuanced constructs such as motivation. For instance, the present study expanded on physical activity literature by exploring how physical activity motivations are discussed on social media and identify whether positive affect and approach oriented behaviors related to 'liking' 'wanting' emerge as underlying themes of intrinsic motivation. Results related to the strong presence of positive affect among unprompted, naturalistic data could help to improve physical activity promotion in clinical contexts. Our findings highlight the role of positive affect in promoting self-concordant motivations, which aligns with motivational interviewing techniques that are taught to primary care medical and mental

health providers (Miller & Rollnick, 2023) to promote person-centered, sustainable behavioral changes. Further, results have implications for providing direct recommendations for promoting physical activity within just-in-time mobile interventions. In addition, results contribute to literature suggesting that optimal physical activity interventions may benefit from being individualized in nature and including affective components (Knittle et al., 2018).

At a translational level, it is a hope of this dissertation to contribute to a broader societal and healthcare shift toward an emphasis on the biopsychosocial nature of health and advocacy for physical activity as a life-enhancing health behavior (Mansfield & Rich, 2013; Webb et al., 2017), resulting in a deidentification with stigmatizing weight narratives, emphasis on mental health benefits, and a shift towards cultivating personal desires toward volitional physical activity behaviors that are sustainable. In all, thematic findings identified from first-person social media posts allowed for a greater understanding of how individuals motivate themselves for personal physical activity, which can then inform key 'ingredients' to autonomy-supportive processes for health behavior change interventions (i.e., how to help others help individuals promote physical activity within themselves). More specifically, results indicate that health factors may be more personally motivating for physical activity than weight loss and support physical activity interventions that focus on eliciting feedback from individuals about potential activities that are enjoyable to them (i.e., versus trying to create enjoyment from an otherwise dreadful physical activity). For example, if an individual has enjoyed swimming in the past, an intervention could focus on problem-solving any potential

barriers and planning a realistic starting point for initiating this activity (e.g., identify a swimming pool). A key ingredient underlying motivation may be physical activity completed in preferred environments, such as cycling to explore an outdoor area/location, in a park or locating an online community if someone desires community, or locating beginner workout videos to watch at home if someone has competing priorities or financial restraints. Autonomy-supportive interventions may also build on findings that indicate physical activity motivations related to healthy lifestyles and pursuit of well-being, consider exploring ideal future outcomes, or the benefits to mental health derived from overcoming challenges (e.g., increased self-confidence) or returning to a routine after time off, instead of viewing these experiences as personal failures or a lack of self-discipline.

Further, this dissertation is the first application of the developed qualitative motivational and health behavior change codebook. As such, future directions for this research include continuing thematic coding on the larger Twitter dataset. The codebook would benefit from being applied to Twitter data collected at time points prior to or after July 2022, when the current data was collected. July 2022 involved a pronounced heat wave in the United States and Europe that may have strongly influenced the physical activity content of data collected (e.g., rising temperatures as a common challenge for physical activity behaviors). This would allow for cohort comparisons (e.g., July 2022 vs. December 2023), content within different seasons and therefore temperatures/weather patterns, and analyses of content that might better represent factors occurring in the zeitgeist at that time, for example, implications of changing healthcare policies or

influence of the stress of elections on physical activity engagement. For instance, while not a direct focus of this dissertation, Twitter content in our dataset included posts about returning to physical activity after having COVID-19, highlighting the influence of public health issues on physical activity engagement. In addition, given the everchanging narrative and fads around fitness and health content on social media, analyzing social media content across different time periods may capture how societal paradigms change and evolve, or devolve.

In addition, the developed codebook can continue to be applied to additional qualitative datasets centered on diet, nutrition, and physical activity health behaviors to identify motivational factors in different contexts (e.g., open-text survey responses at a healthcare facility or weight loss clinic, social media datasets) and elucidate how physical activity promotion may differ at different levels of stages of change (e.g., initiation needs may be different than maintenance needs). Findings revealed physical appearance and diet/nutrition as prominent themes, suggesting that another future direction may include a more direct focus on body image concerns and mental health factors. This direction would contribute to a growing body of literature on social media as an influencing body image and disordered eating (e.g., Holland & Tiggermann, 2016). The present codebook could be expanded to include more themes related to body image and eating behaviors in the context of PA engagement.

It is also important to note the importance of query terms in social media analyses. Query terms define the dataset, so the inclusion of additional terms could radically change the dataset and the research questions that could be explored. Different

query terms could be applied to obtain a future secondary dataset of social posts that may capture more specific concerns to eating, dieting, and weight and body perceptions in regard to PA engagement. Query term use can also be used to explore concurrence of social media topics. For instance, since the current study focused on elucidating mental health themes within a physical activity focused dataset, future research could explore whether physical activity emerges as a relevant theme within a mental health centered dataset. For example, our results illustrated well-being as an important theme with intrinsic motivation but there were limitations regarding the broad nature of the health factors theme (e.g., mental health was coded with other health factors).

Given the prevalence of the sub-theme positive internal influence/factors, that included processes representative of positive self-talk, another future direction might be to analyze the current data further to detect themes of self-compassion. Self-compassion is a relevant construct within both mental health and physical activity research (Wong, Chung, & Leung, 2021) and has been shown to have protective or buffering effects. Given the intersection between self-compassion and physical activity on mental and physical health (Philips & Hine, 2021) and a lack of qualitative analyses with social media exploring these relationships, a future study would benefit from expanding on positive affect findings to explore whether self-compassion factors serve to benefit motivational processes for physical activity. Finally, this study found future orientation conversation content as related to psychobehavioral processes of “need” and “want” as defined by the LIWC-22 dictionary (Pennebaker et al., 2022). Episodic future thinking is an area of research previously explored by the author of this dissertation (Mitchell et al.,

2021) and could be included in the existing qualitative codebook to further explore themes that underly future goals, outcomes, and orientation toward the future more generally. Episodic future thinking would align with self-regulatory processes of behavior change. It has yet to be explored with social media datasets, suggesting a valuable direction for future research.

Limitations and Considerations

A first consideration for this dissertation includes the inherent limitations of human, qualitative coding, which can include subjectivity, confirmation bias, and risk of missing important themes that enhance richness of data analysis (Belotto, 2018). There are specific limitations known to qualitative coding with Twitter data, including loss of important contextual details within tweets (hashtags, mentions, replies) that might be overlooked during coding, or difficult to contextualize with text content. Importantly, our study included emojis and hashtags when interpreting thematic codes and conducting analyses, but we were unable to interpret images during qualitative coding. Excluding images may have led to missing potential theme interpretations. In addition, the overall cognitive load of qualitative text coding with a large set of thematic categories and a detailed codebook might have caused the coding team to overlook some thematic content or nuances.

Another potential consideration relevant for the present study is the risk for confirmation bias. For instance, because there was an existing coding structure developed that provided examples and descriptors for each theme, this might have led coders to focus on confirming the coding structure and goals for the study. However, the current

study attempted to mitigate this limitation by including codes in the codebook that capture nuance and uncertainty (e.g., "somewhat present," unclear/vague motivations, unclear physical activity attitude) to prevent coders from potentially over-estimating the presence of a particular code. Subjectivity is an ever-present concern for qualitative coding. For example, the current study worked to improve inter-coder reliability and focus coder interpretations by developing detailed and flexible coding schemes to best work with the informal nature of Twitter data. We also conducted pilot coding and used frequent coding team discussions and codebook refinements, as well as agreement calculations and reliability estimates in initial phases of coding. We also employed a mixed-method approach with sentiment text analysis and computer programming to identify topics to attempt to mitigate limitations of qualitative coding of Twitter data. This study was also a cross-sectional study. Given that motivational processes can be dynamic and change over time, changes for within-person motivations may be possible that were not captured.

There are also noteworthy considerations to the coding scheme developed for our primary motivation themes. For example, there are a spectrum of motivational processes that underlie the conceptualization of extrinsic motivational regulations (Deci & Ryan, 2000) that were not explicitly defined in this study's motivation theme coding scheme. This included introjected regulations (i.e., avoiding guilt and shame includes elements of intrinsic motivation to boost self-esteem) and integrated regulation (i.e., behaviors that are integrated into sense of self and personal identity), while identified regulation was captured in the motivational details theme (i.e., specific alignment with goals and values).

Accordingly, it is possible that the present study was unable to fully capture the nuances of motivational processes. Of note, there are limitations within LIWC-22 data analyses, including the subjective judgement that was required to interpret means and correlational results and limitations of LIWC-22 to capture complex, nuanced language given its reliance on predefined word categories. There are generally limitations to each data analysis method, however, this dissertation aimed to reduce those potential limitations by using a multi-method analysis approach. As such, this dissertations use of multiple methods that demonstrated largely confirmatory findings is a strength.

Conclusion

To conclude, this dissertation has explored the intricate motivations and affective dimensions underpinning physical activity engagement through a comprehensive analysis of Twitter data. By integrating qualitative coding, LIWC-22 text analysis, and BERT topic modeling, this study has illuminated nuanced insights into how individuals perceive and articulate their motivations for physical activity in digital spaces. The findings underscore the dominance of extrinsic motivations across social media, alongside the profound impact of intrinsic motivations on fostering positive affect and sustained engagement. Positive affect, mood and mental health, and well-being emerged as more intrinsic motivations for physical activity while more extrinsic motivations centered on physical appearance, weight status, and health outcomes. The social and physical environment also emerged as relevant to physical activity, supporting the aim of this qualitative, mixed-method approach to promote a biopsychosocial model for conceptualizing physical activity behaviors.

In summary, results support social media as a space for diverse conversations about physical activity. Importantly, this research highlights the multifaceted roles of mental health and physical appearance in shaping attitudes towards physical activity, emphasizing the need for tailored interventions that resonate with individual motivations and well-being. By advancing theoretical frameworks and methodological approaches in health behavior research, this study contributes to a deeper understanding of the biopsychosocial dynamics influencing physical activity behaviors. Moving forward, these insights can inform the development of targeted interventions and policies aimed at promoting more inclusive, person-centered approaches to health promotion and behavior change.

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Table 1. *Frequencies: Attitude, Motivation, Health, Appearance for Total Coded and by Engagement.*

	Total Sample	PA Engagement	Non-Engagement
Theme	Freq (% of Total)	Freq (% of Eng)	Freq (% of Non-Eng)
PA Attitude	2151 (83.2%)	2082 (100%)	69 (3.3%)
Positive	1302 (50%)	1281 (61.5%)	21 (4.2%)
Negative	39 (1.5%)	35 (1.7%)	4 (0.8%
Mixed	217 (8.4%)	213 (10.2%)	4 (0.8%)
Neutral	521 (20%)	496 (23.8%)	25 (5%)
Unclear	72 (2.8%)	57 (2.7%)	15 (3%)
Motivation Type			
Intrinsic	208 (8%)	189 (9.1%)	19 (3.8%)
Extrinsic	1192 (46%)	887 (42.6%)	305 (60.6%)
Mixed Int/Ext	863 (33%)	752 (36%)	111 (22.1%)
Unclear	322 (12.5%)	255 (12.2%)	68 (13.5%)
Motivation Details			
Pos Affect/Wanting	878 (33.9%)	799 (38.4%)	78 (15.5%)
Goal/Outcome	1581(61.2%)	1291 (62%)	290 (57.7%)
Amotivation	37 (1.4%)	32 (1.5%)	5 (1%)
Others	617 (24%)	563 (27%)	54 (10.7%)
Things/Places	314 (12%)	251 (12%)	63 (12.5%)
Unclear	245 (9.5%)	188 (9%)	57 (11.3%)
Health	997 (38.6%)	699 (33.6%)	298 (59.4%)
Health Valence			
Positive	510 (19.7%)	370 (17.8%)	140 (27.8%)
Negative	102 (3.9%)	61 (2.9%)	40 (7.6%)
Mixed	224 (8.7%)	180 (8.6%)	44 (8.7%)
Neutral	154 (6%)	76 (3.7%)	78 (15.5%)
Appearance	472 (18.3%)	306 (14.7%)	166 (33%)
Satisfied	43 (1.7%)	30 (1.4%)	13 (2.6%)
Dissatisfied	19 (0.7%)	7 (0.3%)	12 (2.4%)
Dissatisfied/Change	82 (3.2%)	56 (2.7%)	26 (5.2%)
Notice change	27 (1%)	23 (1.1%)	4 (0.8%)
Weight loss	163 (6.3%)	90 (4.3%)	73 (14.5%)
Gain Muscle	198 (7.7%)	146 (7%)	52 (10.3%)

Note. Total Tweets coded, *N* = 2,585. PA Engagement only (Content related to physical activity engagement), *N* = 2,082 (80.6%), Physical activity or health content not related to engagement, *N* = 503 (19.4%). All Physical Activity Engagement coded Tweets were coded for PA Attitude, whereas PA Attitude was only coded if attitude toward physical activity was identified as present in Non-Engagement Tweets. Health not present for All, *N* = 1,509 (58.4%). Appearance not present for All = *N*, 2,053 (79%). Mixed = Mixed valence with both positive and negative sentiment present.

Table 2.
Frequencies: Behavior Change Factors for Total Coded and by PA Engagement.

	Total Sample	PA Engagement	Non-Engagement
Theme	Freq (% of Total)	Freq (% of Eng)	Freq (% of Non-Eng)
Self-efficacy	749 (29%)	666 (32%)	83 (16.5%)
Valence			
Positive	596 (23%)	523 (25%)	63 (12.5%)
Negative	69 (2.7%)	63 (3%)	6 (1.2%)
Mixed	60 (2.3%)	56 (2.7%)	4 (0.8%)
Neutral	24 (0.9%)	18 (0.9%)	6 (1.2%)
Social Support	1,172 (45.3%)	868 (41.2%)	304 (60.4%)
Seeking	55 (2.1%)	39 (1.9%)	16 (3.2%)
Support w/out application	212 (8.2%)	201 (9.7%)	11 (2.2%)
Using support	128 (5%)	110 (5.3%)	18 (3.6%)
Lacking	8 (0.3%)	6 (0.3%)	2 (0.4%)
Offer/Provide to others	721(27.9%)	476 (22.9%)	245 (48.7%)
Relating to others	48 (1.9%)	36 (1.7%)	12 (2.4%)
Habit/Behavior Maintenance	1,163 (45%)	1,099 (52.8%)	64 (12.7%)
Broken/Returned	132 (5.1%)	123 (5.9%)	9 (1.8%)
Broken/Intend to return	46 (1.8%)	45 (2.2%)	5 (1%)
Broken/Unsure to return	14 (0.5%)	13 (0.6%)	1 (0.2%)
Building/Beginning	295 (11.4%)	275 (13.2%)	20 (4%)
Maintaining	420 (16.2%)	409 (19.6%)	11 (2.2%)
Habit w/ Unclear stage	211 (8.2%)	174 (8.4%)	37 (7.4%)
Valence			
Positive	948 (36.7%)	894 (42.9%)	54 (10.7%)
Negative	18 (0.7%)	14 (0.7%)	4 (0.8%)
Mixed	106 (4.1%)	100 (4.8%	6 (1.2%)
Neutral	91 (3.5%)	80 (3.8%)	11 (2.2%)
Goal setting	1,594 (61.7%)	1,329 (63.8%)	265 (52.7%)
Working outcome	791 (30.6%)	658 (31.6%)	133 (26.4%)
Achieving outcome	927 (25.9%)	855 (41%)	72 (14.3%)
Explicit goal	82 (3.2%)	63 (3%)	18 (3.6%)
Valence			
Positive	1294 (50%)	1142 (54.6%)	152 (30.2%)
Negative	26 (1%)	14 (0.7%)	12 (2.4%)
Mixed	105 (4.1%)	93 (4.5%)	12 (2.4%)
Neutral	169 (6.5%)	130 (6.2%)	39 (7.6%)

Table 2 Cont'd.

Note. Total Tweets coded, *N* = 2585, PA Engagement only, *N* = 2082, Physical activity or health content not related to engagement, *N* = 503 (19.4%). Mixed Valence = Both positive and negative sentiment present.

Table 3.
Frequencies: Attitude, Motivation, Health, Appearance Themes by Motivation Type for Physical Activity Engagement Sample.

	Intrinsic	Extrinsic	Intrinsic and Extrinsic	Unclear
Theme	Frequency for Motivation Type (% of Motivation Sample)			
PA Attitude				
Positive	177 (93.6%)	434 (48.9%)	628 (83.5%)	69 (27.2%)
Negative	1 (0.5%)	27 (3%)	1 (0.1%)	10 (3.9%)
Mixed	4 (0.19%)	94 (10.6%)	89 (11.8%)	30 (11.8%)
Neutral	6 (3.2%)	335 (16%)	43 (5.7%)	132 (52%)
Unclear	1 (0.5%)	47 (37.8%)	7 (0.9%)	14 (5.5%)
Motivation Details				
Pos Affect/Wanting	198 (100%)	10 (0.4%)	663 (25.6%)	6 (2.4%)
Goal/Outcome	17 (9%)	892 (34.5%)	689 (26.7%)	44 (17.3%)
Amotivation	0	24 (0.9%)	8 (0.3%)	3 (1.2%)
Others	1 (0.5%)	126 (4.9%)	133 (5.1%)	23 (9%)
Things/Places	8 (4.2%)	169 (6.5%)	100 (3.9%)	15 (5.9%)
Unclear	0	13 (0.5%)	0	232 (91.3%)
Health	68 (36%)	491 (55.4%)	361 (48%)	77 (30.3%)
Health Valence				
Positive	52	217	207	34
Negative	4	69	16	12
Mixed	6	93	112	12
Neutral	6	110	26	19
Appearance	8 (4.2%)	307 (34.6%)	124 (16.5%)	33 (13%)
Satisfied	3	24	14	2
Dissatisfied	1	14	2	2
Dissatisfied/Change	0	66	14	2
Notice change	0	16	10	0
Weight loss	0	113	43	5
Gain Muscle	2	113	60	23

Note. Percentages represent the percentage of the theme was coded for motivation type (e.g., 3.2% of the Intrinsic, PA Engagement sample were coded as including a physical appearance theme present). PA Engagement only (Content related to physical activity engagement), N = 2,082. Intrinsic (*N* = 189), Extrinsic (*N* = 887), Both = Intrinsic and Extrinsic (*N* =752), Unclear Motivation (*N* = 254).

Table 4.

Frequencies: Physical Activity Type for Total Sample.

Physical Activity Type	Frequency
Running	945
Cycling	245
Walking/Hiking	59
Swimming	67
Strength-based	417
Workout or Cardio	488
Yoga/Pilates/Barre/Stretch	108
Sport based	49
Marital Arts/Boxing	21
Dancing	17
Other	15

Note. Sample coded as including reference to physical activity, N = 2,274; this included all the PA engagement sample (N = 2,085) and a portion of the non-engagement sample (N = 503). Strength-based = weightlifting, strength training, body building, power lifting; Workout/Cardio = exercise, workout, gym, fitness, jump roping, circuit with cardio; Sports based = wrestling, gymnastics, tennis, football, soccer, basketball, baseball, etc.); Other = gardening, climbing, skateboarding, kayak, chores, playing, skating

Table 5.
Frequencies: Content Source and Information Context Themes for Total Sample.

Theme	Frequency (% of Total)
Content Source	
Self-referential	1,183 (45.7%)
Self-referential with Social Influence	731 (28.3%)
No self with Social Influence	659 (25.5%)
No self/Other with Macro Social	12 (0.5%)
Information Context	
Accurate Fact/Common Knowledge	13 (0.5%)
Partially Accurate	166 (6.4%)
False Information	4 (0.2%)
Personal Experience	1,572 (60.8%)
Opinion/Evaluation	265 (10.3%)
Instructions/Advice for Others	250 (9.7%)
Motivational/Inspirational Comment/Quote	404 (15.6%)
Vague	139 (5.4%)

Note. Total Sample N = 2,585. No self/Other with Macro Social theme = Other/Not Self (Other = system, institution) without proximal social influence/component but with reference to a macro-level systemic process (e.g., healthcare). Information Context could include multiple codes to capture if more than one theme was present.

Table 6.
Frequencies: Health and Physical Appearance Themes by Attitude Themes for PA Engagement.

	PA Attitude Sentiment			
	Positive	Negative	Mixed	Neutral
Theme	Frequency			
Health	405	18	111	127
Physical Appearance	172	3	26	82

Note. PA Engagement = Physical Activity Engagement present. Mixed = Mixed valence with both positive and negative sentiment present. Unclear attitude toward physical activity not included in this table. PA Engagement with Positive Attitude, N = 1281; PA Engagement with Negative Attitude, N = 35; PA Engagement with Mixed Attitude, N = 213; PA Engagement with Neutral Attitude, N = 496.

Table 7.
Frequencies: Primary Sub-themes by Total and Physical Activity Engagement.

Sub-theme	Total Coded	PA Engagement	Non-Engagement
	Frequency		
Mental Health Benefits/ Positive	202	173	29
Positive Internal Factor/Influence	345	268	77
Mood	57	54	3
Identify/Pride	129	112	17
Mental/Mind Health Harms/Negative	4	3	1
Negative Internal Factor/Influence	24	16	8
Shaming Self or Other	32	20	12
Physical Health Benefits/Positive	174	132	40
Physical Health Harms/ Negative	41	30	11
Weight loss/management	62	37	27
Diet/Nutrition	162	62	92
External Social Factor/Influence	312	230	82
External Non-Social Factor/Influence	93	82	11
Reference of Body part/area	88	76	12
Influence of Weather	236	230	6
Use of Tools/Equipment	99	91	8
Time/Planning	103	98	5

Note. Total sample coded for a sub-theme N = 1,811 of 2,585. PA Engagement coded for a sub-theme, N = 1,448 of 2,082. Non-Engagement coded for a sub-theme, N = 363 of 503.

Table 8.
Frequencies: Relevant Sub-themes by Target Motivation Types for Physical Activity Engagement sample.

Sub-theme	Intrinsic	Extrinsic	Mixed Intrinsic/Extrinsic
	Frequency (% of Total PA Engagement w/ sub-theme)		
Mental Health Benefits/Positive	43 (25%)	45 (26%)	106 (61%)
Positive Internal Factor/Influence	33 (12%)	135 (50%)	156 (58%)
Mood	15 (28%)	8 (15%)	30 (56%)
Identify/Pride	9 (8%)	46 (41%)	50 (45%)
Mental/Mind Health Harms/Negative	0	1 (33%)	2 (67%)
Negative Internal Factor/Influence	0	5 (31%)	2 (13%)
Shaming Self or Other	0	4 (20%)	1 (5%)
Physical Health Benefits/Positive	9 (7%)	105 (80%)	87 (66%)
Physical Health Harms/Negative	1 (3%)	6 (20%)	5 (17%)
Weight loss/management	0	23 (62%)	14 (38%)
Diet/Nutrition	11 (18%)	28 (45%)	15 (24%)

Note. Intrinsic with a sub-theme, n = 126, Extrinsic with a sub-theme, n = 521, Mixed Intrinsic and Extrinsic, n = 498. Percentages are calculated from the total of each sub-theme of the total physical activity engagement sample.

Table 9.
Frequencies: Sub-themes for Health and Physical Appearance for Physical Activity Engagement sample.

Sub-theme	Health	Physical Appearance
	Frequency (% of Total PA Engagement w/ sub-theme)	
Mental Health Benefits/Positive	111 (64%)	18 (10%)
Positive Internal Factor/Influence	93 (35%)	48 (18%)
Mood	28 (52%)	6 (11%)
Identify/Pride	46 (41%)	28 (25%)
Mental/Mind Health Harms/Negative	3 (100%)	0 (0%)
Negative Internal Factor/Influence	9 (56%)	6 (38%)
Shaming Self or Other	9 (45%)	9 (45%)
Physical Health Benefits/Positive	112 (85%)	44 (33%)
Physical Health Harms/Negative	17 (57%)	1 (3%)
Weight loss/management	30 (86%)	29 (83%)
Diet/Nutrition	50 (81%)	25 (40%)
External Social Factor/Influence	82 (36%)	26 (11%)
External Non-Social Factor/Influence	17 (21%)	7 (9%)
Reference of Body part/area	26 (34%)	41 (54%)
Influence of Weather	85 (37%)	11 (5%)
Use of Tools/Equipment	27 (30%)	5 (5%)
Time/Planning	30 (31%)	25 (26%)

Note. PA Engagement coded for a sub-theme, N = 1,448. Health coded sample with physical activity engagement and a sub-theme, N = 561 of 687. Physical Appearance coded sample with physical activity engagement and a sub-theme, N = 258 of 352. Percentages are calculated from the total of each sub-theme of the total physical activity engagement sample.

Table 10.

Chi-square Test of Independence for Intrinsic and Extrinsic Motivation on Health and Physical Appearance.

	Health				Physical Appearance			
Motivation Type	Present	Not Present	χ 2	ϕ	Present	Not Present	χ 2	ϕ
Intrinsic	68 (80)	140 (127)	3.30	- .04	8 (30)	200 (170)	31.48**	- .11
Extrinsic	491 (460)	701 (732)	6.42*	.05	307 (220)	885 (974)	83.27**	.18

Note. Total sample, $N = 2{,}585$. Observed count is presented first. Expected count is presented in parentheses. $^{**}p = <.001$, $^{*}p <.05$.

Table 11.

LIWC-22 Descriptives: Total, Physical Activity Engagement, and Physical Activity Non- Engagement.

LIWC Variable	All Tweets		PA Engagement		Non-Engagement	
	M (*SD*)	Range	M (SD)	Range	M (SD)	Range
Physical						
Health	6.92 (9.75)	0–60	6.23 (9.33)	0–60	9.82 (10.87)	0–57
Illness	1.32 (3.93)	0–36	1.06 (3.60)	0–36	2.37 (4.90)	0–33
Wellness	4.60 (7.48)	0–60	4.01 (7.08)	0–60	7.01 (8.51)	0–47
Mental	.05 (.59)	0–15	.04 (.46)	0–8	.09 (.94)	0–14
Affect						
Pos. tone	3.56 (4.89)	0–50	3.51 (4.89)	0–50	3.79 (4.87)	0–31
Pos. emo	1.16 (2.70)	0–29	1.11 (2.67)	0–29	1.34 (2.85)	0–19
Neg. tone	1.18 (2.76)	0–33	1.14 (2.78)	0–33	1.34 (2.71)	0–17
Neg. emo	.30 (1.31)	0–22	.28 (1.28)	0–22	.36 (1.42)	0–12
States						
Need	.24 (1.10)	0–15	.22 (1.03)	0–11	.33 (1.36)	0–15
Want	.35 (1.29)	0–17	.32 (1.27)	0–17	.44 (1.37)	0–10
Fulfill	.18 (1.18)	0–33	.19 (1.28)	0–33	.12 (.64)	0–6
Motives						
Reward	.41 (1.48)	0–18	.35 (1.39)	0–18	.64 (1.82)	0–13
Cognition						
Future	.78 (2.20)	0–24	.77 (2.17)	0–17	.87 (2.34)	0–24

Note. Total Relevant Twitter posts coded N = 2,585. PA Engagement only (Content related to physical activity engagement) N = 2,082, Non-Engagement (Physical activity or health related content not directly related to engagement) N = 503. Scores for each variable range from 1-99. A score of 99 in LIWC signifies that the text falls on the 99th percentile for that particular summary measure. Pos = Positive. Neg = Negative. Future = Future oriented statements/thinking.

Table 12.
LIWC-22 Descriptives: Physical Activity Engagement by Motivation Type.

	Intrinsic		Extrinsic		Intrinsic and Extrinsic		Unclear Motivation	
LIWC Variable	M (SD)	Range	M (SD)	Range	M (SD)	Range	M (SD)	Range
Physical								
Health	5.49 (10.02)	0–57	6.38 (9.16)	0–57	6.36 (8.83)	0–57	5.78 (10.73)	0–60
Illness	.45 (2.26)	0–20	1.47 (4.23)	0–36	.63 (2.70)	0–28	1.41 (4.18)	0–33
Wellness	3.41 (6.96)	0–43	4.16 (7.25)	0–43	4.10 (6.53)	0–33	3.71 (8.08)	0–60
Mental	.00	0	.03 (.46)	0–8	.05 (.52)	0–8	.04 (.45)	0–6
Affect								
Pos. tone	5.11 (6.46)	0–33	2.72 (4.15)	0–27	4.41 (4.90)	0–40	2.42 (5.17)	0–50
Pos. emo	2.44 (4.75)	0–29	.60 (1.85)	0–29	1.52 (2.62)	0–20	.72 (2.55)	0–25
Neg. tone	1.12 (3.18)	0–30	1.08 (2.69)	0–29	1.10 (2.30)	0–22	1.45 (3.85)	0–33
Neg. emo	.24 (1.12)	0–8	.24 (1.07)	0–9	.37 (1.52)	0–22	.61 (1.23)	0–17
Motives								
Reward	.15 (.79)	0–6	.45 (1.62)	0–18	.36 (1.32)	0–18	.14 (.90)	0–10
States								
Need	.13 (.98)	0–11	.23 (1.04)	0–10	.25 (1.08)	0–9	.14 (.87)	0–8
Want	.16 (.78)	0–5	.36 (1.30)	0–11	.26 (1.14)	0–13	.48 (1.78)	0–17
Fulfill	.11 (.74)	0–8	.18 (1.55)	0–33	.22 (1.00)	0–9	.21 (1.26)	0–11
Cognition								
Future	.54 (1.89)	0–11	.76 (2.20)	0–17	.85 (2.15)	0–14	.68 (2.29)	0–17

Note. PA Engagement only (Content related to physical activity engagement), $N = 2082$. Intrinsic ($N = 189$), Extrinsic ($N = 887$), Intrinsic and Extrinsic ($N = 752$), Unclear Motivation ($N = 254$). Scores for each variable range from 1-99. A score of 99 in LIWC signifies that the text falls on the 99th percentile for that particular summary measure. Pos = Positive. Neg = Negative. Future = Future oriented statements/thinking.

Table 13.

Correlations among LIWC-22 Variables for Total Sample.

LIWC-22 Variable	1	2	3	4	5	6	7	8	9	10	11	12
Physical												
1. Health	--											
2. Illness	- .17**	--										
3. Wellness	.89**	- .18**	--									
4. Mental	.08**	.01	.03	--								
Affect												
5. Pos.tone	.03	- .15**	.04*	.03	--							
6. Pos.emo	.02	- .08**	.03	.01	.63**	--						
7. Neg.tone	.00	.11**	- .02	.06**	- .05**	.02	--					
8. Neg.emo	.06**	.04	.02	.13**	.02	.02	.48**	--				
Motives												
9. Reward	.05**	- .02	.07**	- .02	.17**	.02	.02	.01	--			
States												
10. Need	- .02	- .03	- .02	- .02	- .02	- .01	.03	.07**	- .00	--		
11. Want	- .10**	.12**	- .08**	- .02	- .04*	- .00	.00	- .01	- .02	.00	--	
12. Fulfill	.03	- .01	- .02	- .01	.04*	.09**	.09**	- .02	- .01	.01	- .02	--
Cognition												
13. Future	- .02	- .04	- .03	.01	- .003	- .01	.04	.06**	.03	.17**	.13**	.00

Note. $N = 2{,}585$ of Total coded sample. ** Indicates significance at $p < .001$. *Indicates significance at $p < .05$.

Table 14.

Correlations among LIWC-22 Variables for Tweets with Intrinsic Motivation.

LIWC-22 Variable	1	2	3	4	5	6	7	8	9	10	11	12
Physical												
1. Health	--											
2. Illness	- .12	--										
3. Wellness	.90**	- .12	--									
4. Mental	.16*	- .02	.15*	--								
Affect												
5. Pos. tone	- .04	- .15*	- .02	.06	--							
6. Pos. emo	.06	- .10	.07	.11	.79**	--						
7. Neg. tone	- .10	.22**	- .11	.08	- .12	- .10	--					
8. Neg. emo	.05	.02	.03	.29**	.05	.11	.36**	--				
Motives												
9. Reward	.04	- .04	.02	- .01	.01	- .00	.10	.10	--			
States												
10. Need	.01	- .01	- .02	- .01	- .04	- .01	.03	- .00	- .03	--		
11. Want	- .10	.26*	- .11	- .02	- .02	- .07	.14*	.04	.02	- .04	--	
12. Fulfill	- .08	- .04	- .07	- .01	.06	- .05	- .04	- .03	- .03	- .02	- .03	--
Cognition												
13. Future	- .04	- .05	- .02	.01	.01	- .06	.26**	.11	- .05	.40**	.12	- .04

Note. Intrinsic ($N = 208$). ** Indicates significance at $p < .001$. *Indicates significance at $p < .05$.

Table 15.

Correlations among LIWC-22 Variables for Tweets with Extrinsic Motivation.

LIWC-22 Variable	1	2	3	4	5	6	7	8	9	10	11	12
Physical												
1. Health	--											
2. Illness	- .21**	--										
3. Wellness	.90**	- .21**	--									
4. Mental	.03	.03	.00	--								
Affect												
5. Pos. tone	.10**	- .16*	.08**	- .01	--							
6. Pos. emo	.07*	- .05	.06	- .02	.55**	--						
7. Neg. tone	.00	.07*	- .02	.04	- .03	.13**	--					
8. Neg. emo	.05	.00	.02	.14**	.06*	.04	.40**	--				
Motives												
9. Reward	.05	- .04	.08**	- .02	.24*	.05	.01	- .00	--			
States												
10. Need	-.01	- .04	.00	- .01	- .00	- .00	.06	.16**	.00	--		
11. Want	- .13**	.26*	- .10**	- .02	- .02	.05	.00	.00	- .01	.02	--	
12. Fulfill	.10**	- .04	.00	- .01	.01	.07*	.12**	- .01	- .03	- .02	- .02	--
Cognition												
13. Future	- .00	- .03	- .02	.04	.00	- .01	.07*	.13**	.05	.11**	.10**	- .02

Note. Extrinsic (N = 1,192). ** Indicates significance at $p < .001$. *Indicates significance at $p < .05$.

Table 16.

Correlations among LIWC-22 Variables for Tweets with Mixed Intrinsic and Extrinsic Motivation.

LIWC-22 Variable	1	2	3	4	5	6	7	8	9	10	11	12
Physical												
1. Health	--											
2. Illness	- .12**	--										
3. Wellness	.90**	- .14**	--									
4. Mental	.13**	.04	.07*	--								
Affect												
5. Pos. tone	- .04	- .11**	- .03	- .01	--							
6. Pos. emo	- .04	- .06	- .04	.00	.61**	--						
7. Neg. tone	- .02	.26**	- .08*	.13**	- .08*	- .03	--					
8. Neg. emo	.10**	.14**	.02	.17**	- .01	- .04	.61**	--				
Motives												
9. Reward	.06	.00	.06	- .02	.13**	.00	.03	.03	--			
States												
10. Need	-.04	- .01	- .04	- .03	- .05	- .03	- .01	.01	- .02	--		
11. Want	- .09*	.08*	- .08*	- .03	- .04	.01	.02	- .03	- .04	- .01	--	
12. Fulfill	- .03	.05	- .05	- .02	.04	.07	.04	- .03	.02	.06	- .00	--
Cognition												
13. Future	- .05	- .07*	- .04	- .04	- .01	.01	- .03	.02	.00	.25**	.09*	.04

Note. Mixed = Both Intrinsic and Extrinsic Motivations (N =863). ** Indicates significance at $p < .001$. *Indicates significance at p <.05.

Table 17.

Correlations among LIWC-22 Variables for Tweets with Unclear Motivation.

LIWC-22 Variable	1	2	3	4	5	6	7	8	9	10	11	12
Physical												
1. Health	--											
2. Illness	- .19**	--										
3. Wellness	.85**	- .18**	--									
4. Mental	.06	- .03	- .03	--								
Affect												
5. Pos.tone	.09	- .12*	.15**	.15**	--							
6. Pos.emo	.06	- .05	.11	- .03	.65**	--						
7. Neg.tone	.09	.01	.10	- .03	- .02	.01	--					
8. Neg.emo	.03	- .02	.03	- .02	- .06	- .02	.55**	--				
Motives												
9. Reward	.03	- .05	.05	- .02	.23**	.15**	- .02	.00	--			
States												
10. Need	-.10	- .03	- .09	- .01	.02	.05	.08	- .03	.02	--		
11. Want	- .06	.01	- .04	- .02	- .06	- .03	- .05	- .01	- .05	- .04	--	
12. Fulfill	- .07	.04	- .06	- .01	.18**	.38**	.15**	- .01	- .03	.04	- .04	--
Cognition												
13. Future	- .01	.01	- .02	.07	- .01	.02	- .03	- .05	- .05	.05	.28**	.04

Note. Unclear = Motivation Type was vague/unclear to coders (N=322). ** Indicates significance at $p < .001$. *Indicates significance at $p < .05$.

Table 18.
LIWC-22 Means, Standard Deviations, Correlations by Physical Appearance Theme.

LIWC Variable	M (SD)	1	2	3	4	5	6	7	8	9	10	11	12
Physical													
1. Health	10.38 (10.38)	--											
2. Illness	2.79 (5.53)	- .44**	--										
3. Wellness	7.30 (8.68)	.90**	- .40**	--									
4. Mental	.09 (.82)	- .03	.11*	- .03	--								
Affect													
5. Pos.tone	2.82 (4.08)	.07	- .25**	.08	- .04	--							
6. Pos.emo	.85 (2.20)	.06	- .11*	.07	- .02	.59**	--						
7. Neg.tone	1.37 (2.63)	- .07	.07	- .13**	.09	- .04	.04	--					
8. Neg.emo	.29 (1.26)	.03	- .08	.02	.05	.04	.02	.42**	--				
Motives													
9. Reward	.78 (2.12)	.08	- .11*	.12*	- .02	.21**	.05	- .00	.01	--			
States													
10. Need	.28 (1.19)	.01	- .04	- .00	- .02	- .01	- .02	.04	.11*	- .04	--		
11. Want	.53 (1.61)	- .19**	.08	-	- .02	- .01	.02	.00	- .04	- .04	.00	--	
12. Fulfill	.09 (.52)	- .04	- .08	- .06	- .01	.16**	.06	- .05	- .03	- .03	- .00	.05	--
Cognition													
13. Future	.93 (2.61)	- .03	- .04	- .05	- .02	.03	.01	.09	.14**	.00	.17**		.06

Note. Physical Appearance Sample, $N = 532$. ** Indicates significance at $p < .001$. *Indicates significance at $p < .05$. Scores for each variable range from 1-99. A score of 99 in LIWC signifies that the text falls on the 99th percentile for that particular summary measure. Health range = .00 - 50, Illness range = .00 – 33.33, Wellness range = .00 – 42.86, Mental range = .00 – 5.88, Positive tone range = .00 – 27.27, Positive emotion range = .00 = 14.29, Negative tone range = .00 – 13.64, Negative emotions range = .00 – 12.50, Reward range = .00 – 18.18, Need range = .00 – 15, Want range = .00 – 11.11, , Fulfill range = .00 – 4, Future thinking range = .00 – 25.53. Pos = Positive. Neg = Negative. Future = Future oriented statements/thinking.

Table 19.
LIWC-22 Means, Standard Deviations, Correlations by Health Theme.

LIWC Variable	M (SD)	1	2	3	4	5	6	7	8	9	10	11	12
Physical													
1. Health	8.72	--											
2. Illness	1.89 (4.51)	- .22**	--										
3. Wellness	5.32 (7.73)	.91**	-	--									
4. Mental	.09 (.82)	.09**	.02	.03	--								
Affect													
5. Pos.tone	3.80 (4.49)	.10**	- .20**	.10**	.00	--							
6. Pos.emo	1.21 (2.54)	.08*	- .09**	.10**	- .01	.60**	--						
7. Neg.tone	1.61 (2.95)	- .07*	.16**	-	.08*	- .05	.01	--					
8. Neg.emo	.48 (1.67)	.07*	.07*	.00	.15**	.03	- .01	.53**	--				
Motives													
9. Reward	.47 (1.47)	.04	- .03	.04	- .02	.21**	.04	.02	.01	--			
States													
10. Need	.30 (1.19)	- .02	- .04	- .02	- .03	- .04	- .00	.03	.07*	- .02	--		
11. Want	.33 (1.41)	- .15**	.17**	- .13**	- .03	- .04	- .01	.05	- .03	- .01	.02	--	
12. Fulfill	.18 (.91)	- .05	.00	- .04	- .02	.10**	.20**	.14**	- .02	.01	- .02	- .02	--
Cognition													
13. Future	.83 (2.06)	- .04	- .07*	- .05	- .01	.05	.01	.06	.10**	.03	.17**	.14**	.03

Note. Health Factors Sample, $N = 997$. ** Indicates significance at $p < .001$. *Indicates significance at $p < .05$. Scores for each variable range from 1-99. A score of 99 in LIWC signifies that the text falls on the 99th percentile for that particular summary measure. Health range = .00 - 57.14, Illness range = .00 – 27.27, Wellness range = .00 – 47.62, Mental range = .00 – 14.71, Positive tone range = .00 – 30.77, Positive emotion range = .00 = 19.23, Negative tone range = .00 – 30, Negative emotions range = .00 – 22.22, Reward range = .00 – 16.67, Need range = .00 – 15, Want range = .00 – 11.11, Fulfill range = .00 – 11.11, Future thinking range = .00 – 25.53. Pos = Positive. Neg = Negative. Future = Future oriented statements/thinking.

Figure 1.

A. *Topics for Total Sample with Intrinsic Motivation.*

Note. Topics are presented in ascending order. Topic 0 = Satisfaction and Enjoyment from Running and Swimming; Topic 1 = Impact of Physical Activity Engagement on Well-Being; Topic 2 = Satisfaction and Enjoyment from Cycling Outside.

B. *Cluster Graph for Topics Across the Total Sample with Intrinsic Motivation.*

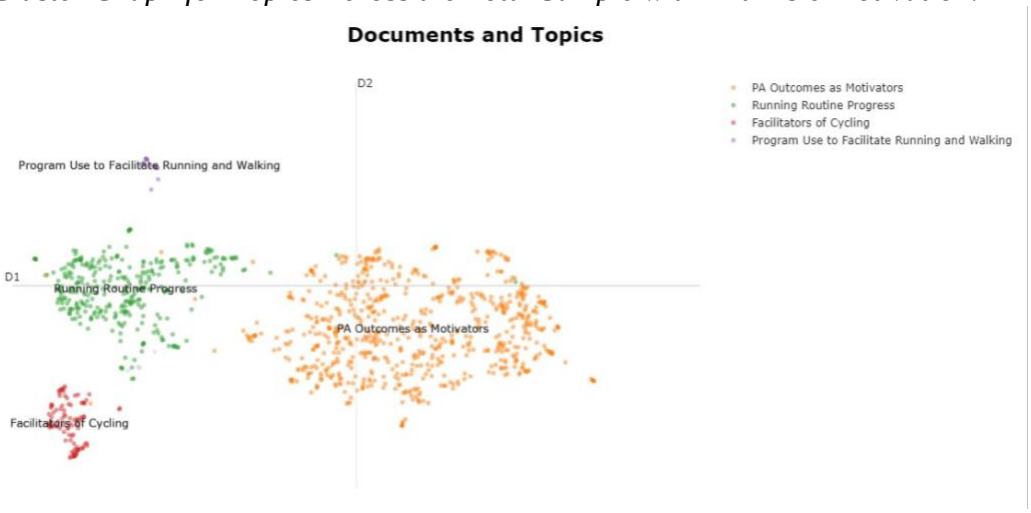
Note. Topic 0 = Satisfaction and Enjoyment from Running and Swimming; Topic 1 = Impact of Physical Activity Engagement on Well-Being; Topic 2 = Satisfaction and Enjoyment from Cycling Outside.

Figure 2.

A. *Topics for Total Sample with Extrinsic Motivation.*

Note. Topics are presented in ascending order. Topic 0 = Physical Activity Outcomes as Motivators; Topic 1 = Running Routine Progress; Topic 2 = Facilitators of Cycling; Topic 3 = Program Use to Facilitate Running and Walking.

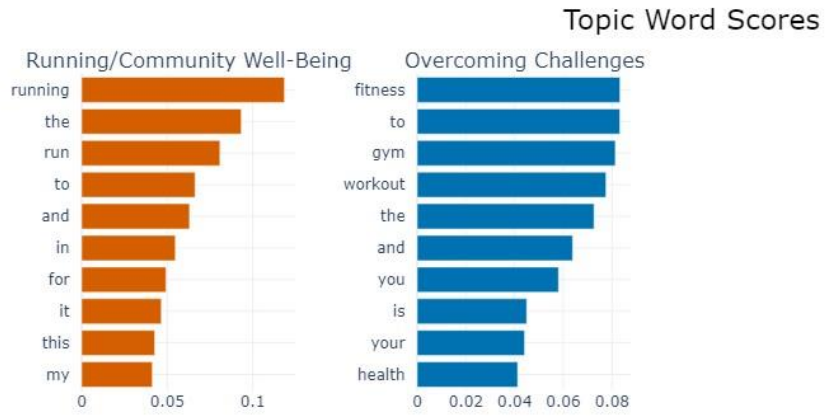
B. *Cluster Graph for Topics Across the Total Sample with Extrinsic Motivation.*



Note. Topic 0 = Physical Activity Outcomes as Motivators; Topic 1 = Running Routine Progress; Topic 2 = Facilitators of Cycling; Topic 3 = Program Use to Facilitate Running and Walking.

Figure 3.

A. *Topics for Total Sample with Mixed Intrinsic and Extrinsic Motivation.*



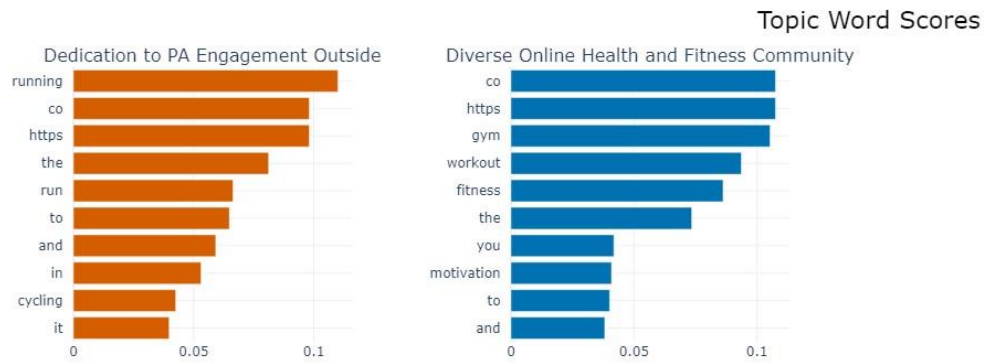
Note. Topics are presented in ascending order. Topic 0 = Impact of Running and Community on Well-Being; Topic 1 = Overcoming Challenges of Physical Activity.

B. *Cluster Graph for Topics Across the Total Sample with Mixed Intrinsic and Extrinsic Motivation.*

Note. Topics are presented in ascending order. Topic 0 = Impact of Running and Community on Well-Being; Topic 1 = Overcoming Challenges of Physical Activity.

Figure 4.

A. *Topics for Total Sample with Unclear/Vague Motivation.*

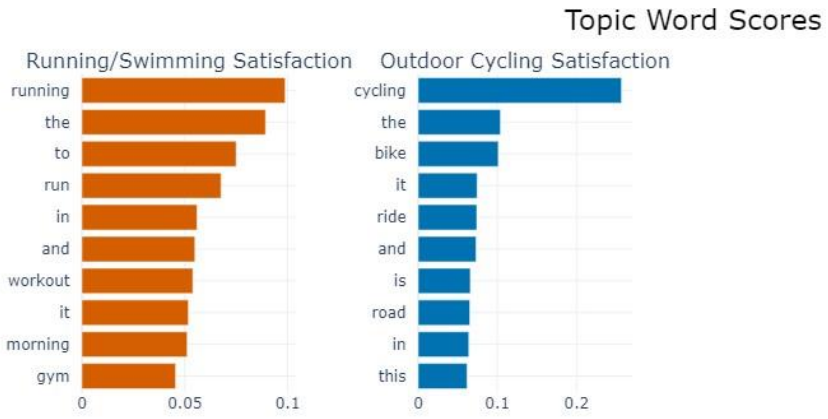


Note. Topics are presented in ascending order. Topic 0 = Dedication to Physical Activity Engagement Outside; Topic 1 = Diverse Online Health and Fitness Community.

B. *Cluster Graph for Topics Across the Total Sample with Unclear/Vague Motivation.*

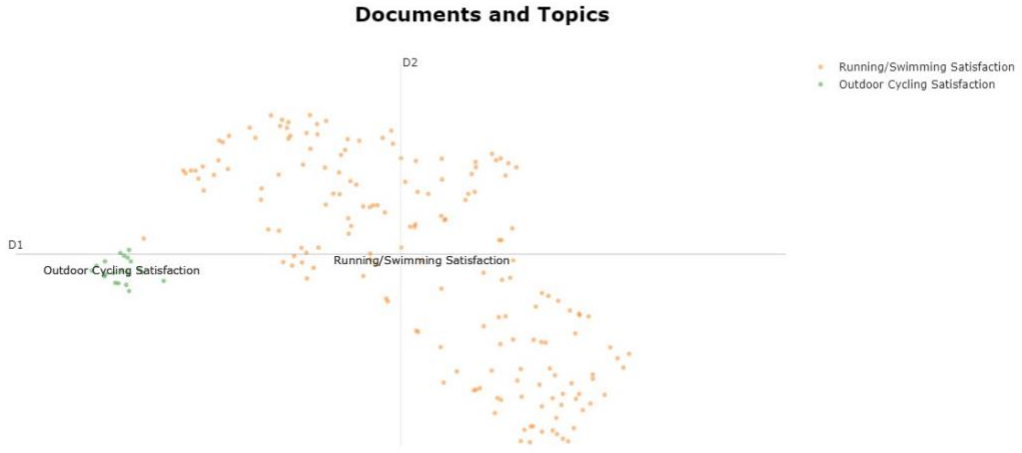
Note. Topics are presented in ascending order. Topic 0 = Dedication to Physical Activity Engagement Outside; Topic 1 = Diverse Online Health and Fitness Community.

Figure 5.
A. *Topics for PA Engagement with Intrinsic Motivation.*



Note. Topics are presented in ascending order. Topic 0 = Satisfaction and Enjoyment from Running and Swimming; Topic 1 = Satisfaction and Enjoyment from Cycling Outside.

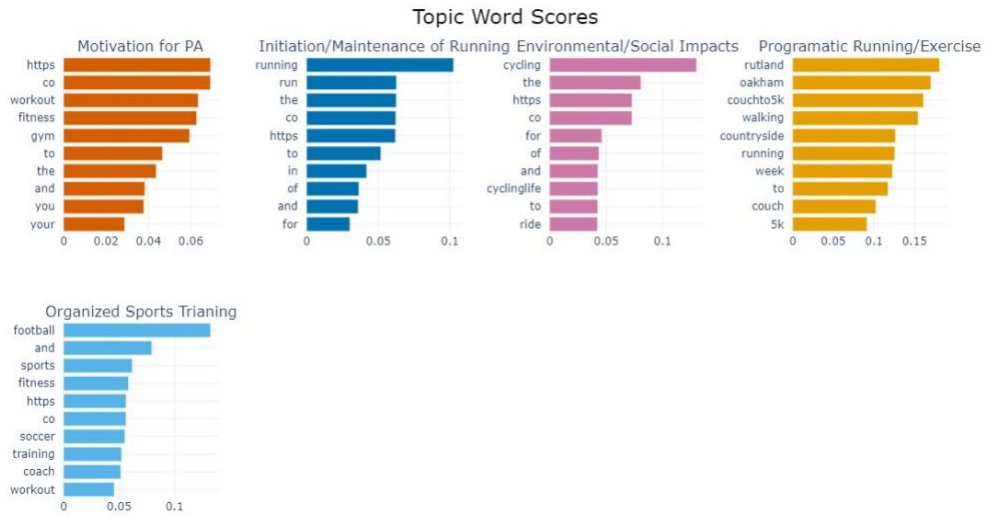
B. *Cluster Graph for Topics Across PA Engagement with Intrinsic Motivation.*



Note. Topic 0 = Satisfaction and Enjoyment from Running and Swimming; Topic 1 = Satisfaction and Enjoyment from Cycling Outside.

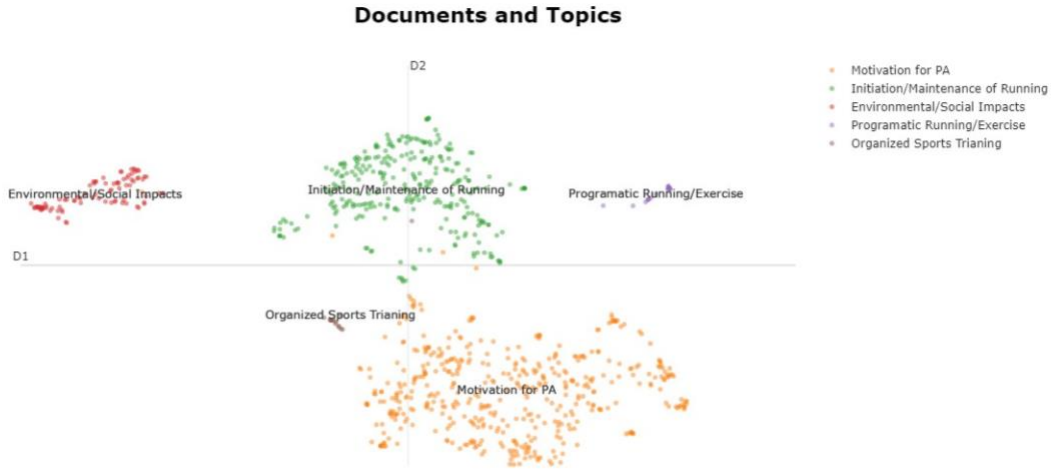
Figure 6.

A. *Topics for PA Engagement with Extrinsic Motivation.*



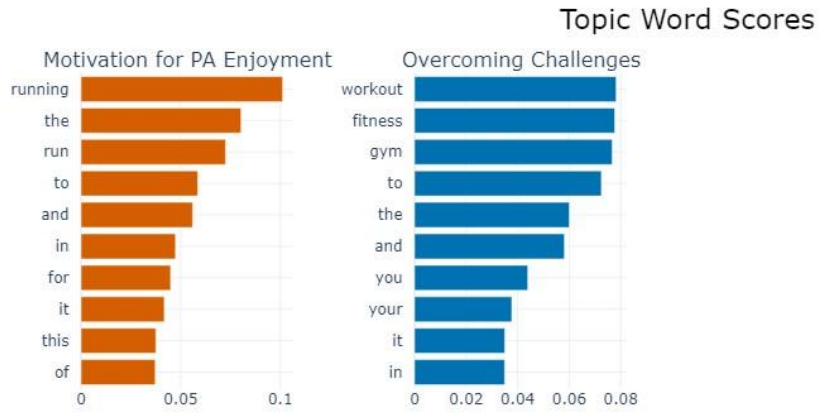
Note. Topics are presented in ascending order. Topic 0 = Motivation from Results of Physical Activity Engagement ; Topic 1 = Initiation and Maintenance of Running; Topic 2 = Social and Environmental Influences on Cycling; Topic 3 = Program Use to Facilitate Running and Walking; Topic 4 = Organized Sports Training.

B. *Cluster Graph for Topics Across PA Engagement with Extrinsic Motivation.*



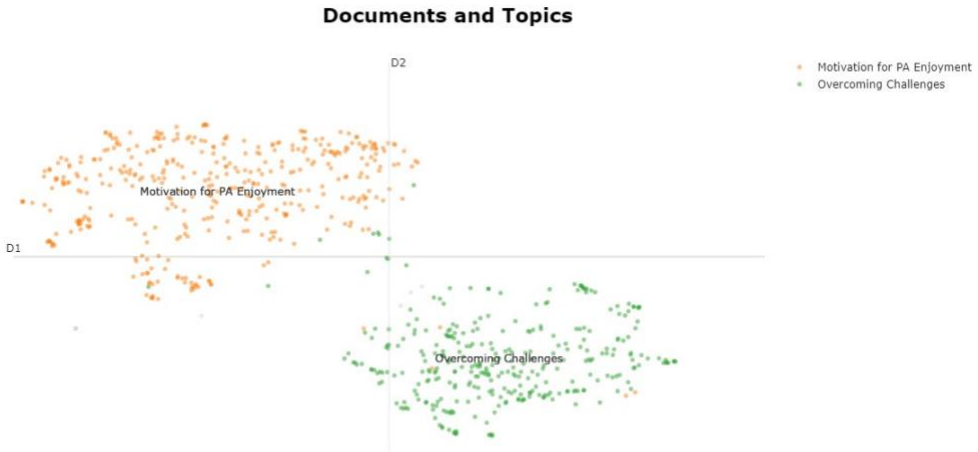
Note. Topic 0 = Motivation from Results of Physical Activity Engagement ; Topic 1 = Initiation and Maintenance of Running; Topic 2 = Social and Environmental Influences on Cycling; Topic 3 = Program Use to Facilitate Running and Walking; Topic 4 = Organized Sports Training.

Figure 7.
A. *Topics for PA Engagement with Mixed Intrinsic and Extrinsic Motivation.*



Note. Topics are presented in ascending order. Topic 0 = Motivating Self and Others for Physical Activity Enjoyment; Topic 1 = Overcoming Challenges and Staying Motivated for Physical Activity.

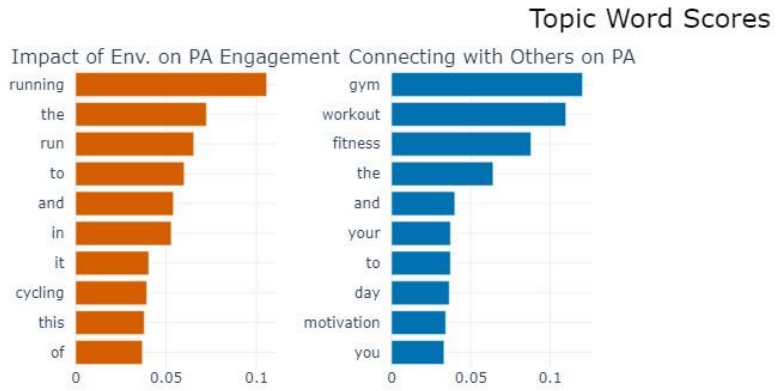
B. *Cluster Graph for Topics Across PA Engagement with Mixed Intrinsic and Extrinsic Motivation.*



Note. Topic 0 = Motivating Self and Others for Physical Activity Enjoyment; Topic 1 = Overcoming Challenges and Staying Motivated for Physical Activity.

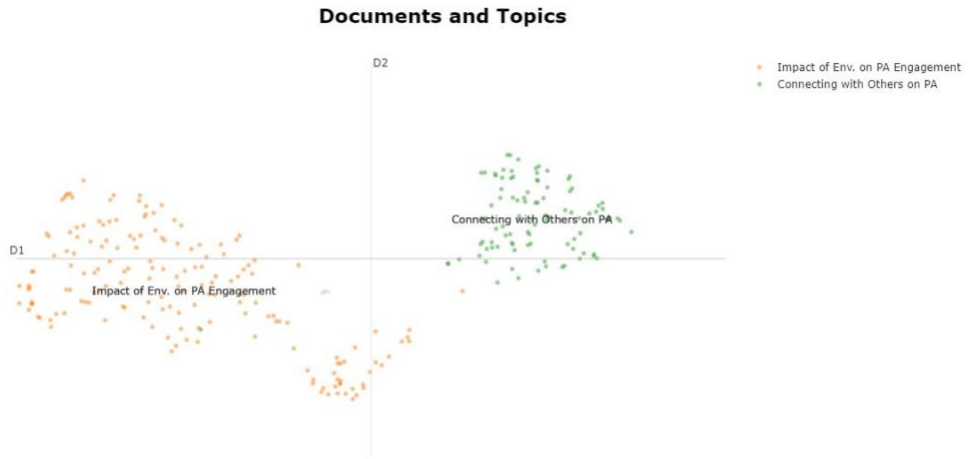
Figure 8.

A. *Topics for PA Engagement with Unclear/Vague Motivation.*



Note. Topics are presented in ascending order. Topic 0 = Impact of Environment on Physical Activity Engagement; Topic 1 = Motivating and Connecting with Others on Physical Activity.

B. *Cluster Graph for Topics Across PA Engagement with Unclear/Vague Motivation.*



Note. Topic 0 = Impact of Environment on Physical Activity Engagement; Topic 1 = Motivating and Connecting with Others on Physical Activity.

Figure 9.

A. *Topics for Non-Engagement with Extrinsic Motivation.*

Note. Topics are presented in ascending order. Topic 0 = Health and Fitness Inspiration; Topic 1 = Gym, Appearance, and Weight Loss; Topic 2 = Nutrition/Diet for Weight and Health; Topic 3 = Optimizing Physical Health.

B. *Cluster Graph for Topics Across Non-Engagement with Extrinsic Motivation.*

Note. Topic 0 = Health and Fitness Inspiration; Topic 1 = Gym, Appearance, and Weight Loss; Topic 2 = Nutrition/Diet for Weight and Health; Topic 3 = Optimizing Physical Health.

Figure 10.

A. *Topics for Non-Engagement with Mixed Intrinsic and Extrinsic Motivation.*

Note. Topics are presented in ascending order. Topic 0 = Motivating Healthy Lifestyle and Nutrition Choices; Topic 1 = Commitment to Self-Improvement; Topic 2 = Finding Satisfaction In Pursuit of Health and Fitness Goals.

B. *Cluster Graph for Topics Across Non-Engagement with Mixed Intrinsic and Extrinsic Motivation.*

Note. Topic 0 = Motivating Healthy Lifestyle and Nutrition Choices; Topic 1 = Commitment to Self-Improvement; Topic 2 = Finding Satisfaction In Pursuit of Health and Fitness Goals.

Figure 11.

A. *Topics for Non-Engagement with Unclear/Vague Motivation.*

Note. Topics are presented in ascending order. Topic 0 = Sharing Health and Fitness Information and Motivation; Topic 1 = Sharing Gym Experiences to Motivate Self and Others.

B. *Cluster Graph for Topics Across Non-Engagement with Unclear/Vague Motivation.*

Note. Topic 0 = Sharing Health and Fitness Information and Motivation; Topic 1 = Sharing Gym Experiences to Motivate Self and Others.

APPENDIX A

Motivational and Health Behavior Change Factors Qualitative Codebook (MHBCF-QC)

Instructions to coders:

- **Note to Levens Lab Research Assistants: THIS IS A SHARED DOCUMENT. PLEASE DO NOT MAKE EDITS (UNLESS TO SUB-THEME LIST AT END OF CODEBOOK) WHILE COMPLETING CODING FOR ALEXIS'S PROJECT UNLESS DIRECTED TO. ****
- Take reflective notes on codes that are challenging or difficult: be able to justify codes based on information in this codebook
- Document additional themes: For each Tweet consider additional relevant themes (words, phrases, be as succinct as possible), add utilized sub-themes to this document at the bottom. In the final column of the coding spreadsheet document what other themes/details describe this Tweet:
    - Microthemes can provide us more detail on and can help guide codebook changes
        - understanding physical activity behavior change, engagement/experience
        - Nuances, added context of PA behaviors and attitudes that may not be captured with Main themes, or are captured but needs to be described further in Sub-themes

ORGANIZATION OVERVIEW

SECTION 1: DETERMINING RELEVANCY

- Relevancy → continue to code

SECTION 2: PHYSICAL ACTIVITY ENGAGEMENT

- Physical activity engagement → engagement present then code attitude toward physical activity and physical activity type, always code motivation type
- Physical activity content not related to engagement → code all relevant aspects, including physical activity type and attitude, if present, and always code motivation type
    - Type (Open-text)
- Attitude toward PA

SECTION 3: MESSAGE SOURCE

- Self/Other

SECTION 4: INFORMATION CONTEXT

- Indicate type of information conveyed content

SECTION 5: MOTIVATIONAL FACTORS

- Motivation Type
- Motivation details
- Physical Appearance → facilitator, barrier
- Health factors → valence → facilitator, barrier

SECTION 6: BEHAVIOR CHANGE FACTORS

- Self-efficacy → valence → facilitator/barrier
- Social support

SECTION 6.1: BEHAVIOR CHANGE REGULATORY BASED

- Planning → facilitator/barrier
- Habit formation/consistency
- /maintenance → valence
- Goal-setting → valence

SECTION 7: Sub-themes → ADDITIONAL THEMES
SECTION 1: DETERMINING RELEVANCY

Relevance for coding
Coding:
0 = Not Relevant → Code reason
1 = Relevant → Relevant: Includes body text and hashtags relevant to physical activity → proceed to PA engagement

Coding Guidance:
****Consider the following while determining Relevant/Not Relevant and in cases of challenging Tweets:**
IMPORTANT: In cases where Tweets provide minimal or hard to interpret physical activity and/or related health content - weight, diet, healthy lifestyle etc. you will
Code as Relevant IF you can identify one part of the Tweet where there is a **Primary category present**: Engagement, PA Type, Attitude toward PA engagement, Motivation Type, Self-efficacy, Social Support, Body Health, Habit/Consistency, Goal-setting

Ask yourself - Is there at least one Primary category I could code? And use the following guiding rules:

(1) **When in some doubt, code the health-oriented Tweets** (in addition to PA, exercise**)**. If it is vague but there are several hashtags and perhaps one part that makes logical sense to you (e.g., "Health tips") then mark as Relevant and code.
(2) If there is more than 1 PA related hashtag (#gym) and it is interpretable than code even if a primary category isn't present and PA content only in hashtags (added 8/31)
(3) We will not open/view links with Tweets.
(4) Google unknown terms to a reasonable degree, use judgment on whether knowing the term will aid your interpretation of Tweet. Example where Googling the term changed the interpretation (Véloroute):

> Sunflowers, lavender, gorgeous views and even managed to get a baguette home in my back pocket .... Also bumped into @kc_43 on the Véloroute .. it's a small world #cycling #france #provence

0 = Not Relevant Reasons: (Tertiary)
1 = Advertisement
2 = posted by influencer or is mostly self-advertising/self-promotion
- Includes #viral or politically charged hashtags
- Themes related to - Monetary or social media incentive, money, offers/deals on material items, order, buy, purchase, hashtags with

business names and brief/low quality PA content (e.g., “time to workout #adidas #sale”)
- Tweet is majority promotion, incentivize to purchase something
- it was clearly created for promotion then we wouldn't code it
- *Still relevant if majority of content is interpretable content and includes, e.g., “follow me for more”
- Example) #EuroTrack22 ıт Mattia Predomo interview 🥇 Men Jr Sprint @Federciclismo #cycling #portugal #trackcycling #velodrome #cyclingtrack #ciclismo #cyclisme

3 = Image or link only
4 = Not relevant to PA, uninterpretable due to only hashtags, lack of PA info (e.g., only one relevant hashtag but other content irrelevant), and/or confusing sentence structure/content and lacking in quality

Notes on Filtering process and coding of Non-Relevant Tweets: First, the larger dataset is reviewed and Tweets are highlighted red that meet one or more of the following criteria: (a) have poor face validity for eligibility (i.e., Advertisement) and/or contain non-relevant content such as sexual content, content in a different language that is not easily translatable by coders or language content that was not translated in a comprehensible manner, advertise a social media page only with no other valuable/quality content, NFT and crypto ad-related, are retweets or replies to other Tweets, only refer back to an image without quality physical activity content (e.g., “photos of the day #cycling” = non-relevant vs. “Post-workout pic to show my muscle definition #hardwork #runnersofinstagram” = relevant). This study is not interested in content that is posted solely for the purpose of influencing individuals to purchase something or follow someone, especially if there is no health benefit for the person (e.g., free workouts). For example, tweets that are related to an advertisement to purchase something are more than likely non-relevant, including for items, classes, books. Tweets that advertise a product or informational content that may be related to physical activity engagement may still be non-relevant, such as news streams of sports coverage, content only related to a professional athlete and/or sporting event results that happen at a macro-level, and/or personal products, such as art or memorabilia related to an athlete or event - these examples are likely to be coded as non-relevant. Tweets that contain covert political and/or offensive content will not be considered eligible, even if there are physical activity related hashtags and content. Special considerations include Tweets that advertise or announce for more local appearing events that individuals could reasonably attend and include some element of health or physical activity; however, if the content includes hashtags that are focused on marketing the business and not people attending the event then it may be considered non-relevant.

SECTION 2: PHYSICAL ACTIVITY ENGAGEMENT

Physical activity Engagement (Primary)

1 = Physical activity engagement = conveys, describes, expresses the act of engaging in physical activity; Mentions DOING PA
<u>Coding Guidance</u>
- includes a planned activity, completed activity, reference to act of exercising/physical activity (includes verb, sporting event where others are engaging in PA, watching people do PA)
- *If the Tweet includes words like Sweat and workout and perform*

- Does not need to be the Tweeter who is engaging in PA (can be talking about someone else or organization)

- Examples with engagement that may be less obvious as engagement
  - "What motivates you to workout/go to the gym?"
    - "Anime."
    - #anime
    - #BERSERK
    - #workout #exercise #gym
- My problem is I wanna be the only one at the gym when I go . #gym
- Whether you're a recreational and competitive runner, you may have been told that #running is bad for your joints. In this #blog, we explore the question: Does running cause #arthritis and should you be worried? Click the link below to learn more.
- My Hobbies Include, trying to be funny, looking at #memes, #drawing, #running, #drumming, #cooking, #swimming, #gaming, and #reading.
- You are becoming a shirtless #runner if #7:... your runmates observe that you are more often bare than not! #running #runchat #sportsbrasquad
- #stitch with great question! Can you lift the breasts through exercise? #exercise #lift #workout
- With the Tour de France now well and truly underway, here's some #MondayMotivation from Eddy 'The Cannibal' Merckx, reminding us to persevere when times get tough!
  - #eddymerckx **#cycling** #tourdefrance #grandtour #motivationalmonday #motivation

2 = Other relevant physical activity factor

Factor of physical activity but does not involve Physical activity w/out engagement or related content w/out engagement - Focus of Tweet may be on an aspect of physical activity (e.g., how to stay cool) but main focus is not the act of doing PA, contains a different focus, does not reference "doing" physical activity/exercise

<u>Coding Guidance</u>

- Examples without engagement
  - Best foods to eat after a #workout. #FoodAfterWorkout #voiceofhealth #voh #Medicine #doctors #DoctorsIndia #health #healthylifestyle #healthy #musclefood #muscle #fitness #musclebuilding #healthyfood #protein #musclegain #healthylifestyle #bodybuilding #eatclean #fitfood
- I've come a long way. #fitness #gym #health #trainer #growing

- It's getting pretty warm out there - so here are our top tips to keep enjoying the trails this summer!
- Branched-chain amino acids (BCAAs) play an important role in the building and repairing of #muscles...#fitness #amino #protein #muscle
- #Workout #FatLoss You should utilize this kind of daily diet method if you want to bring down bodyweight quickly and especially re-establish wellbeing
- "Finding the Route Around the Washout" https://t.co/oVMSfUJEYb #beyondthehorizon #bicycle #biking #cycling #forest #photog #photography #rural
- ↓Ask me anything ! ↓ Your chance each week , every Thursday to ask me anything on health , fitness , fat loss , nutrition , exercise , mindset etc etc Comment below or dm your questions 👌 #qandathursday #health #fitness #fatloss #weightloss
- Example from SL Round 9)
- BREAKING - We've just found out that @TfL are cutting funding for #cycling training to ZERO. #heatwave
    - #Thunderstorm #cycletraining #bicycles #cyclinglife #bicyclelife #cyclinginstructor
    - https://t.co/ENEScFxh2X…
    - @willnorman @Chris_Boardman @SebDance @grantshapps
- Example from SL Round 11)
    - On the hottest day in the UK ever recorded, Swindon's well loved Lagoon pool at the Oasis remains closed. #Scandalous #Swindon #Oasis #SwindonOasis #Heatwave #Recordtemp #40c #ukweather #swimming

RULES for PA Engagement:

- **If PA Engagement Code 1 is indicated, Motivation Type must be coded** (and if Type is coded, then Motivation Details also must be coded)
- **If PA Engagement Code 2 (Other relevant factor to PA) is indicated, Motivation Type also must be coded,** Code unclear if motivational component is not obvious or you need more context (same rule applies to coding Motivation Details)

PA ENGAGEMENT DETAILS

PA_Type ***(Primary)***

- To capture types of physical activity that is mentioned in discourse about physical activity or related to physical activity content

0 = Not relevant (Type of physical activity is not indicated and/or coded as non-engagement; physical activity type MAY still be coded if a type is mentioned but it is not coded as physical activity engagement)

Type of Physical Activity (Indicate type):

- **Code multiples as needed!**

In most cases you will code whatever specific type of PA the Tweet describes - use language in Tweet (e.g., workout or exercise)

- Reference to a specific body part/area will be coded as a sub-theme

OR

Workout [without other context mentioned, OK to put "workout"]

→ use in cases where it is vague, you cannot specify further, OR the following terms are mentioned EXERCISE, FITNESS, GYM

Example: "Working out on a Wednesday.
Of course, instead of working out, I could have just walked outside to break a sweat today.
How's your midweek going?
#workout #sweat #wednesdaymotivation

To capture Crossfit, HIIT workouts, interval workouts, circuits, boot camp class, etc.

May code as "Cardio, Strength training"

Examples of PA Types)

Running = speed workout, tempo run, sprinting, interval running, track workout, wind sprints, jogging
Swimming
Gardening
Rowing
playing with children/ playing with others
household chores
Cycling
Cardio [without other context mentioned, OK to put "cardio"]

→ use in cases in which the Tweet references Cardio explicitly or is implied through use of elliptical machine, jump rope, HIIT or interval workout mention and is implied cardio included

Mobility [Mobility exercises]
Resistance training
Strength training
Weight lifting

Powerlifting
Bodybuilding
Walking
Gymnastics
hiking
Yoga
Pilates
Stretching
Zumba
Tai chi
Dance
Martial Arts - Judo
Boxing
Plyometrics (Box jumping)
Indoor Cycling
Rock climbing
Sports - Notate which sport

ATTITUDE TOWARD PHYSICAL ACTIVITY

Attitude toward PA *(Primary)*

****Always code if PA Engagement is coded, Code if there is sentiment/evaluation towards PA, body movement, or a identifiable health behavior even if not PA Engagement****

Attitude toward PA - cognitive and/or affective reactions or evaluations toward engaging in physical activity, <u>performance</u> and/or <u>experience</u>:
Pertains to Tweets where PA engagement is referenced. Person provides a label, evaluates their own or others' experience with PA, PA engagement, or health behavior/action

- **USE EMOJIS AND PUNCTUATION TO CODE**

Conditions:

- Category reserved for capturing how people feel about physical activity, their specific PA or others or PA in general

CODING SCHEME

0 = Not relevant	Attitude toward physical activity or health behavior/action not included

1 = Positive sentiment toward PA	Describes positive affect and evaluation toward physical activity person completed, will complete, or others' PA or PA in general (e.g., sport) Satisfaction, excitement, readiness, eager Good run, good workout, hype/ready to complete (let's get it!) "That sweaty glow of #satisfaction when warming down after a good #run is a feeling that's hard to beat" ***Consider this if there is an exclamation point*** ***If this is coded then consider likely code intrinsic or mixed intrinsic/extrinsic for Motivation Type***
2 = Negative/somewhat negative sentiment toward PA	Describes negative affect and evaluation toward physical activity person completed, will complete, or others' PA or PA in general (e.g., sport) Dissatisfaction, ambivalence (don't want to but obligated), dread, disappointed, hurt/injured, did not meet expectations of self or others "I could have done better. Why did my leg have to cramp up." "It was a tough run today"
3 = Mixed positive/satisfaction + negative/dissatisfaction	Attitude that seems sarcastic, humorous, and irreverent Includes both positive and negative affect/attitude "Not the time I wanted. But will get back at it the next round!"
4 = Neutral, matter of fact	Describes and/or evaluates PA in a matter of fact manner without emotion or evaluation **"**Today I completed my 5th run of the week" "Tomorrow is my first 5k" "The route today will go through

	freedom park" "Completed my 5k in 24 minutes. Afterwards had some pizza."
5 = Unclear	Catch all category for Tweets where attitude/evaluation is completely unclear - not enough emotion words or evaluation tone to detect, not enough context to determine, and is not matter of fact

SECTION 3: MESSAGE SOURCE

INTRA/INTERPERSONAL CONTENT (Secondary)

Self/other: Aim is to determine whether the Tweet is related to the individual Tweeting, related to how they perceive, experience, describe, etc. physical activity/exercise, related to self/coming from self somehow and also another person/group/social event, or is not self referential at all

Coding:

1 = Self-referential without social influence/component ("I statements")
2 = Self-referential with social influence/component
3 = Other/Not Self with social influence component
4 = Other/Not Self without social influence/component

Description for social influence/component (outside self):

- Content involves or describes other people
- Content involves engagement with other person, inspiration from others, follow other person workout plan, family/social/friend involvement with physical activity/exercise, participation in a social event
- Uses "You"
- Will infer general statements as having social influence/component unless the "other" part of content is not related to broader, systemic level social influences
    - Broader, systemic level: Racism, Healthcare, Accessibility/Disability related issues, education system

1. **Self-referential without social influence/component:** mentions "I" and/or clearly tied to self/personal experience, does not mention anyone else/social aspect/other involvement in physical activity

2. **Self-referential with social influence/component:** mentions "I" or clearly tied to self/personal experience AND linked to someone else via engagement with other person, inspiration/follow other person workout plan, family/social/friend involvement, participation in a social event, social component can be inclusion of "you" as if addressed to their social network who will view their Tweet, "We"

3. **Other/Not Self with social influence component:** Not linked to self/personal experience AND includes information meant to be shared with others/link to others' lived experiences, or not reference self but related to other people, inspiration from others/follow other person workout plan/attempt to inspire and/or motivate others (including Twitter users), family/social/friend involvement, participation in a social event
    - **Includes:** quotes, news information, sports statistics that are shared, information about professional athletes, inspirational statements, information/guidance/vague content that is shared but is NOT clearly related to self/how it applies to them as an individual but with intent to inspire/motivate/inform others (infer this because they shared on social media)
    - social component can be represented by inclusion of "you" as if addressed to their social network who will view their Tweet
        - Information that is shared not clearly tied to self but is shared to inform others: Vague tweet with workout instruction as example - "As many rounds as possible in 5 minutes - 3 Deadlifts per side, 6 Push Press per side #kettlebell #fitness #kettlebellworkout #workout #gym"
        -

4. **Other/Not Self (Other = system, institution) without proximal social influence/component but with reference to a macro-level systemic process:** Not linked to self/personal experience and not linked to someone else via engagement with other person, inspiration/follow other person workout plan, family/social/friend involvement, participation in a social event (e.g., posts information)

a. ***** If includes reference to SELF and a SYSTEM then code both 1 or 2 AND 4 (1, 4)*****
   - "Other" part of content must be related to broader, systemic level of social influence (larger than a person's relative personal social network) or political, institutional, interconnected influences
     - For example can include content related to issues/processes/experiences with:
       - Racism, Sexism, Ableism, Healthcare / Approaches to Health (e.g., prevention, biomedical, weight loss focused) / Specific Health Issues at a population level Education system and approaches (e.g., how people are taught physical activity, health information, issues with physical activity or sports within school systems - at county and state level OK but not an individual school), Accessibility/Disability related issues, Transgender rights in sports, Human (women's) rights, Access to Nutritional foods, Broader issues related to access to clean air, water, green spaces, parks, places to exercise

SECTION 4: INFORMATION CONTEXT

INFORMATION / CONTENT DESCRIPTION (Secondary)

***Informational*:** Tweet content includes content that serves the purpose of informing/sharing with others

***Code multiples as needed**

1 = Accurate fact
2 = Partially/somewhat accurate information
3 = False information
4 = Info based on personal experience (most common): Tweet can be linked back to their own experience - likely will code this often, describes activity they completed in detail, provides information/advice/description based on personal experience
5 = Opinion/general evaluation or statement about physical activity or health factor, behavior/action
6 = Provides physical activity/workout instructions explicitly meant for others

7 = General motivational, **inspirational quote or comment** (not clearly a fact, not an opinion, not clearly based on personal experience)
8 = "Other" category → Information not personal and vague - the Voice/person/entity behind the content in the Tweet is unclear **- does not refer to a personal experience and does not fit in any other information category.**

1. **Accurate fact (Common Knowledge)** - Coder can support content with confidence. This category is meant for more common knowledge, established facts, established evidence (has been replicated, fact related to basic human bodily processes) ("Choosing activities you enjoy is important to keep consistent with physical activity" "Hydration is essential to summer workouts!")
    - Do not need to code for the accuracy of the article shared but if someone reviews an article finding in a Tweet then would be accurate fact if they clearly state: "Researchers at XYZ University found that with XX participants that XX" would be partially accurate if did not include study citation information and just gave findings/presented as if it is a fact "People who XX are found to XX"

2. **Partially accurate (Potential to be Accurate)** - could be accurate but is not an established fact that has evidence base supporting it, could be partially accurate, may even include article to information but coder should use judgment to determine whether data from article is an established fact (e.g., "lots of water and carbs before a race is beneficial!"→ Adequate hydration is a fact, but necessity of carbs is not entirely fact); or "static stretches before a workout can cause an injury" → it is possible but may not be true in all instances
    a. Statement would be considered accurate for most/ part of the population, but not ALL of the population
    b. Sports/News information that we aren't sure if it is true but likely to be true can be coded under this category
    c. **Includes article findings that do not include a citation or attached article**
        i. E.g. → *An online survey of 1,486 Americans aged 18 & older reveals that, as of April 2020, an astounding 53% of respondents have been exercising about the same as usual. #TuesdayThoughts #healthcare #fitness*

3. **False information** - Coder can with confidence identify info as false, or with confidence cannot confirm with evidence (e.g., “It is impossible to gain muscle after the age of …”)

4. **Information/Opinion/Evaluation based on personal experience** - Content in Tweet is related to a person’s own personal experiences in general, their own life, and tied to them in some way, that have already happened or will happen as long it is information related to their life experiences specifically.
    a. As if someone is telling “story”
    b. Like someone retelling something that happened to them.
    c. Describes activity they completed or their experience with activity, event etc.
    d. Provides information/Advice based on personal experience (Do not recommend XYZ race in the summer, wow i run so much faster when I am angry, Be mindful of the heat today!)
    e. E.g., Well thus was an unexpected result. Thanks to everyone who contributed.
    f. An easy 10k to start the day 👌 I'm so glad it's cooled down.

5. **Opinion/general evaluation or statement about physical activity or other health content:** NOT inspirational, motivational, helpful to others) negative - “Fat people shouldn’t exercise at gyms”, positive - “physical activity is the best thing someone with multiple sclerosis can do for their health”
    a. Example: @lucullus It’s asking you not to ride on the footpath. You can cycle on the road.Making something out of absolutely nothing. It must be a slow day for Twitter worthy #cycling content.
    b. Self-removed
    c. “More people should cycle”
    d. “You should create a training plan before thinking you will be successful in marathon training”
    e. “Physical activity should be a focus for everyone wanting to improve their health”

6. **Workout/Physical Activity instructions, Information about a future class/event (at a local level and/or virtual, cell phone app) posted generally or meant for others/ (NOT own completed workout or planned workout)** - Explicitly meant for others or not clear it was their own workout

they did - “Do a circuit of burpees and pushups then run 30 miles” if unclear = “10x 130 lbs deadlifts, 2x lunges, 30 sec rest”

- Includes when information includes a gym, class, or specific social event offering/information -

  Example Tweet) If you are a woman of CDW join us for #workoutwednesday July 20th at 4:30pm at SoulCycle Inc. in Chicago Il for a fantastic workout. Registration is below. #cdw #womenempowerment2022 #womensempowerment #bike #cycling #strongwomen #workout

a. Example Tweet) How to burn belly fat workout!!
   For more Visit: https://t.co/AbncrkuWIW
   #health #healthylifestyle #healthydiet #gymtraining #fitness #workout #supplements #USAfitness https://t.co/5nNxOm3Gw5

7. **Quote, inspirational comment:** Not fact, not opinion, not clearly related to personal experience; includes motivational statements about PA, health, lifestyle, etc.

8. **Information not personal and vague:** Content in Tweet does not refer to a personal experience and does not fit in any other information category.
   a. “Zumba” included with several fitness/PA hashtags
      i. Can’t know that it’s a personal experience, not enough info to determine whos voice is behind the Tweet

SECTION 5: MOTIVATIONAL FACTORS

MOTIVATION FACTORS

- Includes: Motivation Type, Motivation Details, Physical Appearance Factors, and Health Factors

MOTIVATION TYPE *(Primary)* <u>Motivation detailed notes</u> W/ examples

Motivation_Type_Code: ***Motivational:*** Tweet content includes motivation-related content (driven, motivated, pursue, persist, goal is explicitly stated, implied or described, outcome working towards)

Motivational: Tweet content includes motivation-related content; Category aims to capture some of the primary aims of this codebook- to gain a deeper understanding of motivation factors related to physical activity or health action/behavior that could be used to improve mHealth apps aimed at increasing healthy behaviors.

Background notes for motivation (Removed, See V1 version)

Code Motivation Type for every Tweet; Type and Details motivation categories must be coded. If it is UNCLEAR what Type of motivation you can also code UNCLEAR for Details.

Motivation Type

1= Intrinsic motivation is detected (only)	Motivated by self-endorsed reasons for engaging in physical activity, Reflects an internal wanting, positive attitude and eagerness to be active (or retrospectively) Example of internal reasons: enjoyment, anticipatory positive affect (relief, can't wait, looking forward to, going to enjoy XYZ later), reach towards a goal because one wants to (doing it not to meet a standard or qualify or to challenge oneself but because there is a wanting) emojis with smiles and identity factors as indication (#runner) of more intrapersonal motivation and somewhat present self-efficacy "Wanting" *Internal validation*
2 = Extrinsic motivation is detected (only)	Motivated by external forces (most things outside of wanting to and being driven by internal desires) Example of external forces that can drive exercise: weight loss (can code positive readiness) goals, avoid negative health consequences, being registered for a race/event, complete a specific type of workout (e.g., "Leg day") Mention of "Should" "Have to" *External validation*

3 = A mix of both extrinsic and intrinsic is detected	**Motivated by both internal and external forces** **Use this code liberally when unsure if intrinsic is fully present but thematic elements are there, If there is positive sentiment/attitude but unclear if extrinsic or intrinsic then use this category** Example: wanting to meet a goal, being glad they reached a goal, satisfaction present with some sort of external validation, view healthy eating as important to personal goals such as losing weight, gaining more energy, and feeling less lethargic
4 = Unclear what specific motivation type is present	**#use for vague hashtags** This category is coded when there is an element of drive, motivation but the source is unclear or in cases where you would have otherwise coded motivation type as Not Relevant-- if there is some change theme present but motivation is not described then select this category

ADDITIONAL MOTIVATION TYPE NOTES:

1= Intrinsic motivation is detected

- **Intrinsic, Autonomous, Self-concordant motivation**
  - **Definition:** Autonomous motivation reflects self-endorsed reasons for engaging in a behavior or pursuing a particular goal, **such as for the enjoyment/satisfaction of doing the activity**
  - Individuals acting for autonomous reasons experience their actions as freely chosen and consistent with their genuine sense of self, values, and personal goals, and feel that they are the origin of their actions
- If a tweet has an ambiguous health hashtag (health, healthyliftstyle, etc.) but clearly leans to towards intrinsic, or vice versa then it would be coded under this code. Example below:

- Walking is a great exercise . However, by doing it mindfully, we have learned that we should walk slowly and patiently, breathe deeply and enjoy the natural environment around us.#walk #exercise #healthulife #healthylifestyle #ecm #goodhealth #workout #dailyexercise #ecm https://t.co/GOYoj4XvdF

2 = Extrinsic motivation is detected

- **Definition:** Controlled motivation reflects reasons for acting that are not self-endorsed. Individuals citing controlled reasons for action view their behavior as originating outside their self and feel that their actions are controlled by external contingencies (Deci & Ryan, 2006; Ng et al., 2012)

- This can include attempts to target others' motivations - by providing solutions to barriers that might otherwise deter from physical activity

  For example) Short on time??? We have you cover with this quick, 7-minute workout.#LiveHealthyIowa #workout

- **Example of Extrinsic Motivation**) Mens Health - My struggle with Cancer and Weight loss #fuckcancer #cancersurvivor #hodgkinslymphoma #Weightloss #workout #cancersucks #keto #healthylifestyle

  - After 30 hot km. on the road >> the baker is closed for the holidays. OK, then we cycle home again. #cycling #summer #cake

- Type of extrinsic that may seem like intrinsic at first read
  - Integrated regulations - represents behavioral enactment that aligns with one's identity and core values (hard to distinguish from intrinsic but is external, e.g., health, being healthy as a mother)
  - Identified regulation - motivation that stems from personal values or endorsement of behavior and outcome (hard to distinguish from intrinsic, behavior makes self better version of self because of valuing being a good partner/social role)
- Description: **Motivations that are outside the self** ("I'm going to go on this hike with my mom but only because she bought me new hiking boots"), Behavior externally motivated done to avoid disapproval ("I

don't want my trainer to be mad at me" "Don't want my sister to think I've given up"), receive social reward/approval ("Pushing myself so hard for my team, if I log xx miles we can win"), or complete a competition or requirement others have set ("I'll be at our intramural game on friday whether I like it or not"), content of tweet is linked to "have to" motivations for physical activity, appearance for others ("Need to gain muscle now that I am single")

- Consider this category when mention of races, sporting events - if there's positive readiness then can code both

3 = A mix of both extrinsic and intrinsic is detected

- This category should be used when both extrinsic and intrinsic motivation is detected. This can be when the tweet seems to be intrinsically motivated, but has hash tags or other key words that seem to be extrinsic, or vice versa. Examples are below:
    - #goodmorning don't start the day down! #happy #picoftheday #selflove #mondaythoughts #mindset #inspirationalquotes #gym #entrepreneur #health #mondaythoughts #selfcare #motivational #fashion #goodmorning #fit #positivity #business #fitfam #gymmotivation #motivationalmonday
- If a tweet is health related, but not clearly extrinsic or intrinsic, code under this code.
- If there is positive sentiment/attitude but unclear if extrinsic or intrinsic then use this category

4 = Motivation Type is Unclear

- This category is coded when or in cases where you would have otherwise coded motivation type as Not Relevant there is an element of drive, motivation but the source is unclear -- if there is some change theme present but motivation is not described then select this category
- Hashtags, words like ***healthy lifestyle, discipline, motivation, goals, believe, strive, reach towards, fat loss, working on gains/muscle changes***
- Example) #Workout #FatLoss You should utilize this kind of daily diet method if you want to bring down bodyweight quickly and especially re-establish wellbeing

    - Self-control is the deciding factor. #wellness #faith #fitness #healthylifestyle #healthandwellness #runner #relationships #believer #structure #order #discipline #cardio #running #walking #humble #selfcontrol

Notes on Intrinsic and Extrinsic:

- In the context of healthy eating, individuals who adopt autonomous motives like INTRINSIC motivation (e.g., they enjoy and value healthy eating itself)
- identified regulation = Code as Mix of both Intrinsic and Extrinsic (e.g., they view healthy eating as important to personal goals such as losing weight, gaining more energy, and feeling less lethargic) are more likely to experience enjoyment, satisfaction, and positive emotions as a consequence of the behavior.
- In contrast, individuals adopting more controlled (EXTRINSIC) reasons such as introjected regulation (e.g., eating healthily out of obligation to others) are likely to feel increased negative affect such as guilt and frustration (Hagger & Protogerou, 2018 in *Affective Determinants of Health Behavior*)

****Code multiples as needed**

Motivation_Details_Code (Secondary)

1 = Positive affect/readiness/ <u>wanting</u> [internal forces]	Expresses anticipatory positive affect ("can't wait") about activity (can capture readiness to complete the activity, return to the activity after a period of time off) - *usually intrinsic* Desire, includes exclamation points implying positive valence, excitement, eagerness Can be retrospective - person completed activity and there was indication of positive readiness, **genuine desire to complete the activity** **Includes enjoyment towards activity**, was fun, evaluating a positive outside of a positive performance Extrinsic motivation ⇏ do not code positive readiness, select Mix of Both if applicable

2 = Motivated by a goal, change and/or different outcome, and/or perceived need [can be external and internal forces]	Activity is related to meeting, working towards, striving, planning, satisfying, achieving a change, goal or personal need Change: be healthier, stronger, more balanced, beat a personal record, challenge oneself Content is related to motivation toward a goal, behavior change, gaining muscle (#gainz), beat a personal record, have a more balanced healthier lifestyle Focus on change, progress, training *could be intrinsic or extrinsic* Example of perceived need) "start day off right with a workout" → workout is therefore making it so that their day starts off "right" which is a need or want that they have; going to the gym to get alone time, clear their mind, release stress, challenge self) - c*ould be intrinsic or extrinsic* Includes cycling for transportation
3 = Low/Amotivation/Dread and Avoid [low internal motivation]	Describes the experience and/or captures ambivalence, lack of wanting, dread, and meant to detect negative affect toward PA engagement Can be implied or explicit that they avoided and did not engage in PA because of low motivation and/or dread Content depicts and/or can be reasonably interpreted as no (amotivation) or low motivation, low drive, ambivalence may or may not explicitly want to, may do it anyway even if not motivated - *likely low intrinsic motivation/amotivation could be low extrinsic if external factors just no longer motivate person/matter*
4 = Motivated by others, to engage in activity with others [external force]	Motivation, drive to complete activity seems to stem from a desire to engage in the social aspect of the activity or to please/impress someone else Includes when someone is completing an activity with someone - think when we would previously code extrinsic if activity was tied to another person (e.g., excitement about a race, being on a team, wanting to impress someone else, fundraising/charity + PA) - Going to yoga because a friend is going - Running group encouraged me to exercise *extrinsic, and maybe intrinsic*
5 = Motivated by things or	Reason and interest for doing is to be around others, visit a specific place, compete in an event, try a piece of equipment

places [external force] - **External forces = not quotes unless there is an identifiable source and target for the motivation**	***Would include positive affect and/or significance of a specific location*** (place), piece of equipment (thing) (e.g., shoes, nutrition supplement, clothing, a prize, a reward, watches, apps) Think when we would code extrinsic before "Don't know what I would do without Couch to 5k" *extrinsic and maybe intrinsic*
6 = Motivation Details unclear	*** If "4" unclear is selected for Motivation Type and you cannot find a category below that captures theme then code "6" for Details. **** May include general advice-giving, quotes that do not have an identifiable source and/or target for the motivation Examples) - "A small after #workout picture. #puppy #puppyplay" - "Where is your running going to take you this weekend? #ABSOLUTE360 #running #weekend" (could have coded as motivated by things or places but we don't have enough context to say that the place is what it motivating the activity) - "Running, through a heat wave, forming new calluses, on my feet as well as my mind. Again. #cinquain #poetry #running #mindfulness #lifestyle" - "Saturday morning trot #run #running #fitness" - "Tad warm outside, went #cycling, met a group of #Geocaching people, and stopped for #icecream

	@ Gelateria Sole, Berlin" (again, we don't have enough context to say motivation to cycle was to meet people or get ice cream, that would be an inference/assumption)

PHYSICAL APPEARANCE (Primary) **Code Multiples As Needed**

- **Physical appearance evaluations/reference:** Tweet references physical activity in the context of a comment about self or others appearance (way body LOOKS, not behaves/functions unless about gaining muscle mass)
    - **Definition:** Content that references personal or others' physical, outward appearances, including muscles
    - References a specific body part on self or others. Not related to what body part can do. Body dissatisfaction and satisfaction influence physical activity, particularly those with disordered eating or living with larger bodies. Involves evaluation, commenting, sentiments related to physical/body appearance (Not Capability) related to self, others, physical activity in general

0 = Not relevant	**Does not mention appearance factors** Note about vague mention of fitness, #fitness - only consider as relevant if there is additional context for appearance, do not code here on its own if fitness not tied to appearance
1 = Satisfaction with appearance	Includes a positive description of one's appearance, may be related to working out or not "Feeling like a hot girl" "feeling good and looking good"
2 = Dissatisfaction with appearance	Includes a negative description of one's appearance, may be related to working out or not; Body not appearing how they would like it to be appear (not meeting goals, expectations of self or others) - "Skinny people with instagram usernames like "fit_varsha" and "fitnesswithabhi" are perfect example for "inko attention ki nahi, nutrition ki

	zaroorat hai" #fitness #skinny”
3 = Dissatisfied and motivated to change appearance	Includes a negative description of one’s appearance and ALSO notes plans, desires, actions already taken to make a change “Working to get rid of this baby fat!” #burningfat
4 = Notice/Acknowledge a change in appearance (neutral, unclear on satisfied or dissatisfied)	Describes change in appearance without negative or positive evaluation - change without sentiment “Today I am 20 lbs lighter than I was 1 year ago” Example Tweet from Round 11) Did you know a good #workout  is good for your #skin? It delivers oxygen and nutrients to your skin making your #exercise even more beneficial!
5 = Weight loss more generally	May code with 1, 2, 3 as well Mentions weight loss Vague mention of weight loss, fat loss, becoming thinner Includes weight management and dieting - process of maintaining weight already lost
6 = Gain muscle (#gains # lift #muscles)	May code with 1, 2, 3 as well Mentions muscle gain, leaner Either the process of gaining muscle/building muscle and strength or result “I love the gainz I see in the mirror” = 1, 6

- **Code for Facilitator/barrier**
  - 1 = Facilitator
  - 2 = Barrier
  - 3 = Mentions as Both a Facilitator and Barrier
  - 4 = Challenge but not a barrier
  - 5 = Unsure (select this if you need more info but seems like it could be one or other)

HEALTH FACTORS ***(Primary)***

- **Health Factors:** Tweet references health condition, mental health, a factor of mental health (e.g., stress, depression, thinking more positively, self-talk), factors related to health (diet, nutrition, medication, doctors/healthcare) or

related to physical activity and health, a function of the body, physical capabilities and/or physical experience of PA/exercise.

- Use hashtags for interpreting coding if more than 1 hashtag is used/and is related to a specific theme
    - E.g., if #healthy is one single hashtag do not necessarily consider when deciding on thematic coding
    - #Healthy #Gym #FitnessAddict Many clients ought to lose fat deposits in a flash just by implementing the foregoing concept

Health Factors Primary Coding Scheme

0 = Not Relevant, Not Present	Coder with certainty can state no health factors are present
1 = Present with certainty	Content related to **overall health, mental health, a health condition**, body or specific body part's ability to complete activity and/or how it influences experience of activity (soreness, injury, recovered/healed) Mention of food, diet, "indulgences" and weight together (if just weight loss and appearance then appropriate to use Somewhat present) → rationale is that although we don't perceive weight loss as the only component of health, most the population does so we want to capture that Mention of well-being or mind or balance in life, "taking care of my body and mind" "taking care of my mind" ● Mindset ● Power of the mind ● Thoughts ● Emotions What the body does, can or cannot do, has done Related to stamina, endurance, a body giving up/becoming injured/losing steam/losing endurance stamina
2 = Somewhat present	*It is better to code than not code* *Code used when thematic elements related to health are not obvious

	and vague, catch all category to make sure we don't miss health factor information* Select this code in cases in which implied precautions to protect health during exercise/stay safe during intense temperatures Includes a vague reference to health factors, health, healthy lifestyle, body capacity → content more general less specific to PA Includes #Healthylifestyle, Health-related hashtags without additional context INVIGORATING Includes Vague mention of energy or fatigue - e.g., "A new Day to give all my energy" Includes content related to health enhancing items - products, ingredients, items related to enhancing health (note in Sub-theme as necessary) **If mentioned in context of how or if it affects person's actual health then fully present but if content focused on the item (e.g., taste of protein powder) then code somewhat Example Tweet) The weather has changed, a welcome downpour, almost felt ***invigorated*** as the rain washed over me! Wet but enjoyable 3.25 miles in 30 mins 49 seconds. 🌧 @UKRunChat #running #runners

- You may code additional factors as SUB-THEMES

- **Code for Valence**
  a. 1 = Positive, 2 = Negative, 3 = Both Positive and Negative, 4 = neutral/unclear

- **Negative Valence for Health**

a. Fear of pain, getting hurt, injury
b. Tore an ACL
c. Disordered eating, fat loss if it is discussed as a PROBLEM

- **Code for Facilitator/barrier**
  1 = Facilitator
  2 = Barrier
  3 = Mentions as Both a Facilitator and Barrier
  4 = Challenge but not a barrier
  5 = Unsure (select this if not convinced, need more info but seems like it could be one or other)

Example Tweet for Health Valence (Neutral/Unclear, and Unsure Fac/Barrier)

- #Healthy #Gym #FitnessAddict Many clients ought to lose fat deposits in a flash just by implementing the foregoing concept

Previous coding scheme used for Tweets pulled before 7/28:

- Positive physical capability: Mentions positive comment/evaluation of physical ability ("Getting stronger on the mat everyday! Time to celebrate with a protein shake!" "A strong core makes everything easier" "Been focusing on toning my legs - pretty pleased with the results!" "I did the stairmaster for 30 mins! So proud of what my body can do now" "My physical gains make me feel like I could thru-hike the AT" "It's been a full transformation and a long journey but I'm grateful for what my body can do now" "My injured bicep is healing quickly. Ready to go back to lifting"
- Negative physical capability: "Stupid weak arm muscles make doing a plank even harder" "My body can't do what it used to since becoming XYZ/having XYZ happen to me" Both - "On one hand i'm glad i can squat 200 lbs but my arms are so weak!"
- May or may not be a facilitator or barrier
- Does not mention appearance - This theme is not about how the body looks, pertains to what the body can or can't do (belief or based on experience)
- Can code under both Physical appearance and this category if body capability has to do with looks AND function
  - Code under Physical Appearance ONLY IF:
    - weight loss tied to way body looks and appears, fits in certain clothing

SECTION 6: BEHAVIOR CHANGE FACTORS

Relevant Behavior Change Factors that may or may not serve as barriers and/or facilitators to physical activity

SOCIAL SUPPORT *(Primary)*

****Code multiples as needed**

- **Social support/community:** tweet references some social or community involvement in their activity engagement or others' activity engagement (e.g., Olander et al., 2013)
    - **Definition:** Friend(s), mentor, colleague, family, network of individuals or a group/community of people that either engage in physical activity together or support one another in some way - support can be derived from individual to community level
    - Includes emotional support, informational support (provide info, education, advice), instrumental support (things like driving someone somewhere)

    - **Coding scheme:**

        1 = Seeking support and/or advice
        2 = Mentions support/team/community but does not mention how they use (e.g., #runchat, includes participation in a race or mention of online community)
        - Includes mention of team sport "#mensgymnastics"
        - "#TeamAST"
        - Can include participation in "games" "races"

        3 = Use of support (e.g., mentions benefits from being around others, includes when mention appreciation for others - thanking others)
        4 = Lack of support
        5 = Offers support, encouragement, and/or advice to others (through actions or *sharing information*, includes praise toward others, evaluating others performances as positive, providing information that seems to be offered to help others/inform others)
            E.g., "Now matter how hard it gets, just keep pushing and keep on trying. You will reach your goals."
        6 = Relating to someone else's experience

        - No Facilitator/barrier
        - No Valence
    - ***Includes RunChat***
    - Interpretation used for coding started before 7/28: Valence Description:
        - Positive support - Different types of support that may be described, instrumental support - help with necessary tasks, like driving someone to and from gym, training them, paying for new equipment; emotional support - encouragement, Behavioral support by engaging in activity together ("The gym is much less anxiety provoking for me when my partner joins") ("What would I do without my [running club/online community/gym] - they keep me going!")
        - Negative support/lacking social support: Describes lack of support, loneliness while exercising/dissatisfaction with exercising/activity alone and/or describes negative interactions from others - others negatively affect person or group ability to be physically active ("Maybe I could workout more if my friends wanted to") ("If my dad didn't call me fat so much I'd go to the gym more") ("There's no one at my work that likes being active..most people just drink after work" / "I wish I had other people to do XYZ with")

SELF-EFFICACY *(Primary)*

- **Self-efficacy:** Tweet references **one's belief in one's ability and one's actual ability to overcome barriers to physical activity** and **to engage in physical activity/complete whatever action they desire to complete**
    - **Definition:** an individual's belief in their capacity and demonstration of capacity to engage in physical activity and overcome barriers to physical activity (Bandura, 1997; Sheeran et al,, 2016) → by completing activity despite challenges or barriers they did so by believing in their abilities
    - Self-efficacy refers to an individual's **belief in capacity to execute behaviors** necessary to p**roduce specific performance attainments** (Bandura, 1977, 1986, 1997). Self-efficacy **reflects confidence in the**

ability to exert control over one's own motivation, behavior, and social environment.

Belief, confidence in self

- Acknowledges progress and/or increased competence
- Mentions <u>specific challenge</u> they overcame
- Mentions previous experience with activity (not completed activity)
- ***Can include comment about building others' confidence or the importance of confidence generally but does not include conveying or having belief, confidence in others abilities…This is a nuanced distinction we want to try to capture. I'm thinking of self-efficacy is the internalization of external encouragement.
    - <u>Includes</u> - "I want my children to believe in themselves" = building others' confidence
        - " The ingredient to success is confidence"
        - I managed to get in a nice 6 mile run this morning. It was a little warm at the start but I made sure to stay hydrated. #Running #Fitness #Training #BibChat #RunChat
    - <u>Does not include</u> - "My husband is going to do great tomorrow!"
        - & "My daughter won her match - knew she would"
        - the comments we do not want to capture this category include praise, someone else's confidence in someone else --- this would be coded in Offers support category in Social Support

CODING SCHEME DETAILS:

- **1 = Fully Present**
    - Explicit mention of confidence in self or others, overcame barrier/challenge
    - Acknowledges progress and/or increased competence

- Includes even vague mention of their competency, a belief or acknowledgement of *ability/skill level* or *changing ability/skill level*
- Needs to be a specific mention to a change in ability/skill level
    - A score better than before

- Overcoming an obstacle like foot pain
    - New skill gained, new marker reached, challenge achieved not achieved before
- Belief, confidence in self
- Mentions specific challenge they overcame
- Mentions previous experience with activity (not completed activity)
- More details about an obstacle/challenge that they've someone overcame

- **Somewhat Present = 2**
    - Include this category when you are unsure, we did before - no specific criteria
    - Mention or implication of #Discipline
    - Does not include positive evaluation of activity and/or habit alone (will code though if reference to skill/ability level)
        - Example somewhat present)
        - Life can be an uphill struggle, but if you #KeepAttacking… 💪#KeepAttackingEvents #FitnessWear #Running #FitnessChallenge
        - The weather has changed, a welcome downpour, almost felt invigorated as the rain washed over me! Wet but enjoyable 3.25 miles in 30 mins 49 seconds. 🌧 @UKRunChat #running #runners
    - Mention of an obstacle - alludes to a challenge or something vague that someone overcame

- **Not Present/Relevant = 0**
    - **example) self-efficacy not present:** Went for a short recovery run to shake off my stiff legs from Saturday's race. Felt great and the 33 degrees Celsius made it extra fun. Who else started the week strong?

- **example) <u>self-efficacy is present:</u>** My 84th #parkrun was my 1st in my new age category. I managed my 2nd fastest time at @Shieldsparkrun somehow [OVERCOME]. It was warm as oot out there [CHALLENGE] 😅Thanks to the lovely #volunteers for making it happen 👏#nhs1000miles (581.6 #running miles #ukrunchat #runthroughuk #runner #runchat

- **Full coding framework:** 0 = Not present/relevant, 1 = Present, 2 = Somewhat = 2
  - **Code for Valence**
    - 1 = Positive, 2 = negative, 3 = both, 4 = neutral/unclear

  - Key words in Tweets
    - "Being able to" "gonna keep pushing"
  - Valence description:
    - Positive valence self-efficacy - Tweet mentions confidence in one's ability to complete activity, learn new exercise, reach a goal
    - Fitness journey is looking better and better. And slowly my Achilles' tendon is naturally healing. Gotta keep pushing!
    - Negative valence / lack of self-efficacy - Tweet mentions disbelief, low confidence towards overcoming barriers and engaging in physical activity in the way they want to ("I could never do CrossFit - I'm uncoordinated!") ("Learning to rock climb - don't think I can get myself out of bed for these 7 am training sessions though")

SECTION 6.1: BEHAVIOR CHANGE REGULATORY BASED

PLANNING *(Secondary)*

****Code multiples as needed**

  - **Planning, Preparation, Implementation:** Tweet references action, evaluation of, or comment related to preparing or planning (or not planning/preparing) to engage in physical activity

    Coding Scheme:

0 = Not relevant
1 = Prep Actions
2 = Not engage
3 = Engage
4 = Disruption - Specific obligation/time commitment ("lacking time")
5 = Opportunity - More opportunity to be active ("having more time than usual")
6 = PA Plan Adjusted with Intention (bc heat, injury, reasons for PA plan)

1 = Preparation Actions - Specific actions that facilitate physical activity or make it more possible to occur

- Can include invitations to events/classes
- Scheduling, freeing up schedule
- Preparation actions (behaviors) for physical activity
- Skill/development & Training
- Preventative and recovery oriented actions - e.g., getting a steroid shot
- **Includes Skill development and information and resource gathering that will facilitate/influence future PA**
    - Seeing a trainer before a performance
    - Trying a new protein powder
    - Attending a class to be able to do on own
    - Ask questions tied to specific PA -
        - "With my first marathon coming up I want to make sure my form is good, any advice?"
- **Code under this category if content includes prep actions (even if PA is not planned):
    - Register for race "Just registered for the London marathon"
    - Prep for a future route, workout routine - "put water bottles along my route so I can find them" "Getting my bike tuned up for the weekend race"
    - Managing schedule "Told my parents I'd be late, time to get a quick run in!" "Going to go to bed early tonight so I can run tomorrow"
    - Buying equipment specifically related to PA engagement
        - "Buying a new race vest for Saturday"

2 = Not engage - Conscious decision to not engage in PA, Plan not to
- "Staying in today, it's too hot! Will make up run tomorrow"
- Intention to NOT engage in because taking a rest day, choosing note to exercise for health reasons

3 = Intention to Engage - Future or retrospective conscious decision to engage in PA
- Basically, this category represents intentions to be active ---> code even when unclear if PA engagement
- E.g, Going to the gym this afternoon, 14k for me running there and back home
- "An easy 10k to start the day 👌 I'm so glad it's cooled down"

4 = Disruption - Specific obligation/time commitment disrupt ability to do PA ("lacking time")

5 = Opportunity - More opportunity to be active ("having more time than usual")
- Would include schedule change - being on vacation, off work
- More explicit

6 = Adjustment - Plan for PA adjusted
- This includes changing PA for weather (doing in morning to avoid heat) and adjusting activity to current ability level
  - E.g., " "running a recovery run to shake off my stiff legs" (also code this motivation to satisfy a goal/need/want)
  - suggest a way to change how people do something
- Essentially doing "this instead or because" for "xyz" reasons

- **Code for Facilitator/barrier (Secondary)**

  1 = Facilitator
  2 = Barrier
  3 = Mentions as Both a Facilitator and Barrier
  4 = Challenge but not a barrier
  5 = Unsure (select this if not convinced, need more info but seems like it could be one or other)

- **Do not code valence**
- Background notes on Planning in Codebook V1.

HABIT & CONSISTENCY ***(Primary)***

- **Habit formation/Consistency/Maintenance:** Tweet references habit building, consistency, repetition, routine, maintenance of physical activity or lack of consistency, maintenance, etc., with physical activity
    - **Definition:** Physical activity/exercise **is already or is becoming** an automatic part of everyday life

      Coding Scheme:

      0 = Not relevant

      1 = Broke consistency and has returned
        - Haven't ran in 6 weeks and back at it today

      2 = Breaking consistency and have not returned yet but intends to
        - Been a while since i went to the gym ready to get back soon

      3 = Breaking consistency and have not returned and not sure will
        - Think of this as habit/consistency completely absent

      4 = Is actively building and/or implies building habit and consistency
        - Acknowledges own consistency
        - Includes beginning part of habit, just starting training (if training mentioned), new experiences
        - **Implies importance and seeking, working toward consistency**
        - May include habit less than 4 weeks - consider context of Tweets
        - Include #training, use context of Tweet to decide between code 4, 5

      5 = Maintains consistency/habit (long-term)
        - Content related to "weeks" "days" -
            - 4+ weeks would likely always code here (30+ days), maintains consistency
        - Training, explicit mention of as habit

- Clear that level of performance is indicative of training, consistency (e.g., 6 min mile)
- Include #training, use context of Tweet to decide between 4, 5

6 = Unclear, need more context

- Physical activity engagement likely coming from consistency but do not have enough evidence to code
- Journey, lifestyle, way of life, etc.
- Implies, alludes frequency
    - "Weight loss Journey"
- #healthylifestyle

- **Code for Valence**
    a. 1 = Positive, 2 = negative, 3 = both, 4 = neutral/unclear

- Habit background notes included in V1.

GOAL SETTING *(Primary)*

- **Goal setting:** Tweet references process of goal-setting, experiences of goal-setting and/or goals more generally, references already set and achieved goals, or mentions a specific goal to achieve or changing a goal based on changes in life (e.g., McEwan et al., 2016)
    - **Definition:** Important aspect for behavioral control and physical activity maintenance. **Goal setting is the act of identifying a desired outcome that one would like to and/or plans to achieve, or working toward desired outcome. Evidence in Tweet that there is a goal, represents something that physical activity/exercise is helping them to achieve.**
- Additional background notes in V1**.**

****Code multiples as needed**

Coding Scheme:

0 = Not relevant

1 = Working towards a specific health or physical activity related outcome (a goal, training, being healthier)

- May code multiples as needed (e.g., 1, 2)
- Includes #healthier
- For this code be able to justify the outcome

- Includes the process or actions involved in achieving goals, working towards an outcome - effort that person is putting in
- Consider if this category is present when you code motivation details
- Consider coding this if Habit, Planning are coded

2 = Mentions *achieving an outcome* but *unclear if it is or was a specific goal* person was or is working to achieve; can be desirable outcome that occurred without intention

- Positive experience in a race
    - "Had my best 5k in a while last Saturday!"
- Beating a time but not sure whether that was their goal in the first place
    - "Learning to celebrate the small victories everyday" (this could also be working towards something - "learning")
- Includes positive evaluations of performance via descriptives or emojis
    - E.g., check marks
- "Record"

3 = Explicit mention of a goal(s) **and/or goal-setting** (either set, achieved, not achieved, previously achieved)

- Reserve this category for more specific goal-oriented content - For now, only code this category if Tweet contains the word "goal"
- Met my goal by…
- "Reached my move goal…"
- Since #Goals seems to be less common, let's code that under this category
- "All it takes is a specific goal to work towards"
- "I am going to run 500 miles before the end of the year" → mentions miles out of a total completed this would be coded here (100 miles out of 500 complete)
- "How close are you to your fitness goals?"

- **Code for Valence**
    - 1 = Positive, 2 = negative, 3 = both, 4 = neutral/unclear

SECTION 8: ADDITIONAL THEMES

Sub-themes that emerge (Sub_Themes_Descriptors)

- Purpose to capture all additional details
- **Format: External Social Factor/Influence: Culture**

Note to coders:
Step 1. Copy paste first category from this list - always select a starred category from this list
Separate with a colon (:)
Step 2. Copy paste second, third, etc. Category listed underneath your first category; or create your own
- Coders can either use the generalized labels (if they feel it encompasses the given theme in the tweet), or use the generalized labels followed by a colon, and a more specific term to capture the sub-theme in more detail. Coders can use as many colons as desired to capture the subtheme. When adding additional sub-themes separate by semi colon.

- Examples:
  - Diet/nutrition: Weight loss: Keto
  - Use of Tools/Equipment: Distance Watch
  - Negative Internal Factor/Influence: Shaming Body: Skinny
  - Multiple sub-themes: Physical Health Harms/ Negative: Sprain; Diet/Nutrition: Healthy choices

The most important thing is to keep the main theme consistent so locating tweets with these subthemes is easier. Nuance can be captured in labels with colons.

- **Overarching categories:** Mental Health Benefits/ Positive, Mental/Mind Health Harms/Negative, Physical Health Benefits/Positive, Physical Health Harms/ Negative, Reference of Body part/area, Positive Internal Factor/Influence, Negative Internal Factor/Influence, Identify/ Pride, External Social Factor/Influence, External Non-Social Factor/Influence, Running/ Biking Length, Diet/nutrition, Influence of Weather, Use of Tools/Equipment, Exercise Event/ Competition, Location, Time/Planning

- **<u>Mental Health Benefits/ Positive:</u>**
  - Stress reduction
  - As therapy
  - Meditation
  - Mindfulness
  - Positive thinking
  - Self-care

    - Concentration
    - Yoga
    - Running
    - Fulfillment
    - Cycling
    - Swimming
    - Stretching
        - Hyperbolic
- Wellbeing
- Mood
- Runner's High
- Addiction comparison
- Self-talk
- Overcome anxiety
- Mindset

- **Mental/Mind Health Harms/Negative:**
    - Stress
    - Brain damaging

- **Physical Health Benefits/Positive:**
    - Rest Day
    - Sleep
    - Reducing pain/ injury
    - Improve form
    - Reduce effort
    - Body Recovery
        - Injury
        - Post-COVID
    - Life Quality
    - Cancer Recovery
    - Transportation
    - Weight management
        - Fat loss
    - Stretching
    - Heart rate
    - Reduce health risks
        - COVID
        - Blood pressure

- **Physical Health Harms/ Negative:**
    - Injury

        - Sprained Ankle
    - Arthritis
    - Cystic Fibrosis
    - Hip dysplasia
    - Pain
    - Cancer
    - Tired
    - Metabolic disorders

- **Reference of Body part/area:**
    - Legs
    - Arms
    - Chest
    - Stomach
    - Abs
    - Back
    - lungs

- **Positive Internal Factor/Influence:**
    - Self-Control/Discipline
    - Use of humor
    - Humor toward self
    - Self-Improvement
    - Courage
    - Self-Love
    - Thinking of future
    - Body Positivity
    - Self-pride
    - Confidence
    - Self-determination
    - Adapting to uncontrollable changes or challenges
    - Prioritize self
    - Celebrate personal wins
    - Gratitude
    - Acknowledge progress
    - Overcome doubt
    - Self acceptance

- **Negative Internal Factor/Influence:**
    - Shaming body

        - Fat
        - Skinny
    - Shaming performance
    - Shaming Self
        - Lazy
- Comparing to others

- **Identify/ Pride:**
    - Age
    - Race/Ethnicity
    - Culture
    - Religion
    - Parent
    - Sexuality
    - Gym rat
    - Women
    - Man
    - Gender
    - Runner

- **External Social Factor/Influence:**
    - Growth in participation
    - Race/Ethnicity
    - Culture
    - Prefer solitude
    - Religion
    - Social role
        - Parent
            - With child (include child in activity)
        - health coach
        - Coach/instructor
    - Team
    - Club
    - Internet Group
    - Charity
    - Environmental benefits
        - Solar power
    - Safety
        - From cars
        - Infrastructure
            - advocate
- Use of Coach/Trainer
- Group Fitness

    - Zumba class
  - Physical therapy
  - Shaming others
    - Weight bias
  - Vacation
  - Challenge
  - External social factor/influence: Internet group

- **External Non-Social Factor/Influence:**
  - Music
  - Animals
  - Podcast
  - Location/Scenery
  - Anime
  - Money
  - Job

- **Running/ Biking Length:**
  - _miles
  - Marathon
  - Half Marathon
  - Triathlon
  - 5k or ___k
  - IF WALKING or Swimming -
    - "Running/Biking Length: ___miles/k walk"

- **Diet/nutrition:**
  - No alcohol
  - Recipe/Meal prep
    - Protein
  - Weight Loss
    - Keto
    - Paleo
    - Calorie Reduction
    - Body fat loss
  - Muscle Building
    - Protein
  - Performance
  - Overall Health
  - Clean eating
  - Increased energy

- Hydration
- Repair/Recovery
    - Protein
    - Amino Acids
- Supplements
    - CBD
    - Herbal medicines
    - Hemp products

- **Influence of Weather:**
    - As a Challenge/ negative influence
    - As a Motivator/ positive influence
    - Working around heat

- **Use of Tools/Equipment:**
    - Weight loss tools
    - Couchto5k
    - Heart rate monitor
    - Distance Watch
    - Garmin Watch
    - Instruction video
    - Apps
    - Activity Tracker
    - New equipment
    - Kettlebell
    - Shoes

- **Exercise Event/ Competition:**
    - Charity
    - Tour de France
    - Marathon/5K
    - Ultra marathon
    - Fundraiser
    - Professional athlete
    - Professional team
    - Professional sport

- **Location:**
    - Home
    - Virtual

- Trails
  - Gravel
- Beach
- Neighborhood
- Off the beaten path
- Track

- **Time/Planning:**
  - Morning
  - Afternoon
  - Evening
  - Season

    writing out workout plan by day

APPENDIX B

Twitter Posts Representing Exclusion Criteria

Exclusion Criteria	Exemplar Twitter Post
Advertisement	5.0 Bluetooth 3D Stereo Earphones with Dual Microphone #fitness #meditation
Influencer/self-advertisement/self-promotion	⭐ Product link = https://t.co/GbkE66w68a ⭐ 60 second #Review of the #Arteesol 20L #Drybag ⭐ Tested out whilst #Paddleboarding on #SUP but also suitable for a variety of sports such as #Cycling #Running #Ski #Swimming #Dishing and #rafting or #Watersports ⭐Available on #Amazon
Not relevant to physical activity and/or uninterpretable for further coding	Question of the Day (Paper 1) #paper1 #comments #coach #travel #netpaper1 #instagood #study #photography #photooftheday #follow #jrfpaper1 #comment #fitness #nature #instagram #studygram #success #upsc #training #commentback #praivaeducation

APPENDIX C

Example Tweets for Primary Content Themes

PA Engagement	Today I ran 40 light minutes despite the harsh hot weather👝 #run #running #runners @RunThroughUK @UKRunChat
Non-Engagement	Your body is your most accurate journal. The more you procrastinate, the more junk food you eat, the more your body will suffer. Don't ever put yourself in a position where you're faced with deep regret that you didn't look after your body sooner.. #Motivation #Gym #Diet #Health
PA Attitude	
Positive	That sweaty glow of #satisfaction when warming down after a good #run is a feeling that's hard to beat #running #fitness
Negative	Tonight's run 🏃 was a disaster 🙈 too hot, tried carrying bottle of water, too cumbersome, music kept stopping, so I gave up 🥵😩not good !! 3.29km in 22.9 😉 #fitnessgirl #FitnessAddict #fitnessmotivation #running #runner
Mixed	Today it took me almost half an hour. Felt a little lazy. Even doubted myself, that I really wanted to go. But I guess the important thing to keep in mind is.....#PushYourself #Motivation #running #jogging #getstarted
Neutral	Friday I ran 4.16 miles. Saturday I ran 4.06 miles. #running
Unclear	Back to the #gym again today guys. Anyone have any good work out playlists?
Motivation Type	
Intrinsic	First morning run after #COVID19. Far from the usual pace, but still being able to run again made me very happy. #running
Extrinsic	Calorie burn goal achieved! 2345 calories burned on July 17, 2022 via Fitbit #fitbit, #workout, #fitness, #lifelog
Mixed Intrinsic/Extrinsic	Saturday morning with some familiar faces at park run.

	😁 #parkrun #bolton #running #fitness #runningmotivation #lovetorun #saturdaymorning #weekendvibes #runbuddies #happyday #runforwellnessmum @Boltonparkrun
Unclear/Vague	4.50 miles with an 8:47 pace #run #running
Motivation Details	
Pos Affect/Wanting	It takes some will power to go for a run at 9.30pm, after a fairly busy day of work, housework and parenting, but it is soooo rewarding! Getting ready for the #Paisley10k. I can't wait! #running #mentalhealth #wellbeing
Goal/Outcome	Pushing myself to new limits. Progression from 50 lbs to 105 lbs. Working everyday to be a better athlete on and off the court. #workout #athlete #volleyball #howbaddoyouwantit
Amotivation	I've been gaining weight and I have kinda a bit of trouble catching my breath, what or how can I get my motivation back to do my workouts 💪? #workout #Motivation #lacking
Others	Gym vibes with the girls, Meeting new friends. #Fitness #womensfitness #planetfitness #workout #squats #beautiful #gym
Things/Places	"What motivates you to workout/go to the gym?" "Anime." #anime#workout #exercise #gym
Unclear	Saturday morning trot #run #running #fitness
Health Factors	
Health - Mental health	Sometimes I run for exercise. Sometimes I run to see if I'm faster than the stress and anxiety that are forever nipping at my heels... #running
Health - General	My motivation has always been health - eating healthy and taking care of myself. #health #fitness #healthylifestyle #wellness #motivation #healthy #workout #love #gym #lifestyle #fit #fitnessmotivation #training #nutrition
Health Valence	
Positive	Take care of your body 1-2 hours a day for your body to take care of us forever. #running 🏃🏃🏃
Negative	My knee injury from a freaking year & a half ago decided to flare up last week & I've had trouble walking ever since🤬 Today it's a *teeny* bit better so I was able to get a short, low impact workout in😕 UGHHH! #tuesdayvibe #tuesdaymotivations #workout #fitness #fitbit #Health

Mixed	First run since the weekend to test the progress on an Achilles heel problem. Looks like it will be a little longer than expected before I'm back to full fitness #running #nikerunning #nikerunclub #5krun #inflames #oldguysrule #therunningcommunity #ukrunchat #runthroughuk
Neutral	Branched-chain amino acids (BCAAs) play an important role in the building and repairing of #muscles... #fitness #amino #protein #muscle
Appearance	
Satisfied	Not a bad day to get out & run, around 80, a little humid. Finally back to the fitness/shape I've been shooting for. #fitness #running #motivation
Dissatisfied	It's easier for people with medium or small breast to work out. Sigh 🤦 The struggle is real. We do it regardless. #fitness
Dissatisfied/Change	Gym again… it's where I spend my time freeing my mind and I want to have the body I want. I will in 6 months I promise you that!!! #gym #fitness
Notice change	+5kg in around 5 months #health #fitness #gym
Weight loss	Lost 9+ pounds in 9 days from 195.3 to 185.9 through #cycling, #weightlifting and only 1 binge day. My long term goal is 2 pounds of weight loss per week to achieve the target, but I'll enjoy these early rapid cut days while the last!
Gain Muscle	I rarely take pictures of my arms I'm proud of my progress & how far I've developed them. My goal is to have strong & big shoulders & arms just like John Cena it's slowly heading towards there. Never had arms like this back in the days. 💪 #workout
Self-efficacy	
	First time squatting with a belt….. Finally getting back into my routine to an extent! Recovering well and ready to keep going! Back squat 165x8 Top set 2x 175x6
Valence	
Positive	A VERY Late Run Is Better Than No Run.😆 Despite my anxiety being high lately I kicked my ass out the door.😩 No way in hell I was missing my run.👊 On Thursday I ran

	8.03 miles. Felt really good.🙂 Comfortable pace.👍 Great weather. Beyond grateful.
Negative	But like I just can't get down I'm trying to get down to between 75-80kg Anyone has some tips to help me fucking shed my disgusting skin and lose weight again
Mixed	Today it took me almost half an hour. Felt a little lazy. Even doubted myself, that I really wanted to go. But I guess the important thing to keep in mind is..... #PushYourself #Motivation #running #jogging #getstarted
Neutral	Lessons learned from my first Half Marathon #teamenertor #361europe #breakyourlimits #beyondexpecations #run #running #halfmarathon #ukrunchat
Social Support	
Seeking	I've been gaining weight and I have kinda a bit of trouble catching my breath, what or how can I get my motivation back to do my workouts 💪? #workout #Motivation #lacking
Support w/out application	Beat the heat this morning, first early morning run for ages and I earned a badge #running #strava #endorphins #garmin #TeachersRunClub
Using support	What a Sunday with friends who believe that real hangout is sweating and burning some calories together. #selfdiscipline #fitness #fitnessmotivation #exercise #exercisemotivation #motivation #workoutmotivation #discipline #fit #health
Lacking	Fitness makes me happy, even if I don't fit the gays definition of fit. I'm proud of myself, the work, and my body. #proud #fitness #gay #kansascity
Offer/Provide to others	Good luck to everyone doing the 55km Laugavegurinn Ultra Marathon in #Iceland today! My husband @everleaf_paul is doing it and I was particularly pleased not to have to get up at 3.45am when he had to leave… Photos he's sent look amazing though! #running #run #ultra #marathon
Relating to others	Saw a couple of runners last week who have progressed from tops-in-hand status to confident full converts. We shirtless #runners embrace new comrades! #running #runchat
Habit/Behavior Maintenance	

Broken/Returned	Went for a run after a gap of 2.5 weeks. Tomorrow is a 10K event, so couldn't miss today. iWatch HR measuring malfunctioned. It wouldn't measure it at all. Don't know why. So had to stop running when I felt a little out of breath. But the run turned out good 😊 #running
Broken/Intend to return	Sunrise this morning on my way to the airport. 5 straight days without a 🚴 #Withdrawal #WorkTravel #cycling
Broken/Unsure to return	I haven't worked out for a while week and I feel like shit, too much sluggish. #workout #gym #needmotivation
Building/Beginning	Started my @couch_5k this morning, stick some music on and it's a great app to get going and get fitter! Can't wait to get to week 9 😁 #running #fitness #health
Maintaining	Completed 1,000 KM of running in 2022 so far after today's short run… In 2021, it took 10 months to reach this number. Glad with the progress made.. thanks Twitter Running buddies for always being there… 😭 #Running #marathon #fitness #ukrunchat
Habit w/ Unclear stage	Crushed two bike workouts and feeling pumped…and a bit tired! But so worth it!! #biking #cycling #workout
Valence	
Positive	Last Monday rode 20 miles this Monday i did it again seeing a trend forming #workout #bikelife #fitnessmotivation
Negative	#fail haven't tried in months. Def retiring squats for good #djdredanime #gym @squats #onstorm #powerhousegym
Mixed	Day 15 of waking up at 4:45 AM… Not as hard as I thought.. Kinda… #grind #workout #AM
Neutral	Confirmed and booked my 2nd marathon @WelshMarathon #marathontraining #runningman #running
Goal setting	
Working towards an outcome	Decent 5km this lunchtime in hot conditions. Want to get back under 23 mins by the end of the year then attack my PB in 2023. #running
Achieving desirable outcome	Quickest walking/running 6k in decades. Today is the first day of the rest of my life. #running #walk Check out my activity on Strava:
Explicit goal	I reached my Move goal 252 days in a row on my #AppleWatch. That's my longest streak ever.250cal

	#DayOff #WeightLifting #Fitness #Gym #GymLife #BodyBuilding
Valence	
Positive	3 half marathons in 5 days and feel good, was worried about old injuries creeping up with only a days rest between but feel stronger than ever! Just need to add more miles and some interval training. Maybe one day I will start stretching too 😬
Negative	Another successful #fullbody lift day. It's becoming a love/hate relationship over here. But I'm trying to challenge myself and switch things up when it comes to my fitness journey. #girlswholift #teacherswholift #fitness #weightlifting
Mixed	Only did 7 first set today. Time to step it up. Side note, Legs are still sore from Sunday's 10K 😳 #chestday #weightlifting #fitness
Neutral	W20D4 Today is cool with a steady breeze and partly cloudy. I did a middle distance route focusing on form. #fitjournal #running #fitover40 #fitnessmotivation #fitnessjourney

APPENDIX D

Example Tweet for Overarching Sub-theme categories

Sub-theme	Tweet Example
Mental Health Benefits/Positive	Today's run. Felt much more humid out there this morning. But quiet, easy miles were just what I needed. Pre-travel jitters have set in. Running helps. #run #running #fitness #fitover50
Positive Internal Factor/Influence	Remember that one time I said to “respect myself!” Well ta f*cking da! Here I am! #weightloss #transformation #gym #bodybuilding #journey #weightlossjourney
Mood	FINALLY... After a long break due to heavy rains came out of rut. #cycling 30+ kms in morning. Feeling Happy 🤗
Identify/Pride	Female #Bodybuilding and #Fitness Motivation 🦿 Get motivated by these strong women who love to move some heavy weight! 🦿 Stay Strong! 💪😎
Mental/Mind Health Harms/Negative	Sometimes we get so caught up in trying to #workout hard and smash our goals and targets that we forget to enjoy ourselves. With pressure and stress coming from many areas in our lives, make sure exercising isn’t one of them
Negative Internal Factor/Influence	It felt good running today, no pressure just carefree and loving it. Definitely need to work on my breathing again and those extra pounds won't have helped either 🙄 have a good day all #running
Shaming Self or Other	Bruhs really be drawing six packs and outlining the chest while body shaming others. 🤣 #workout #fitness #bodyshaming
Physical Health Benefits/Positive	Balasana Post running - Helps in relaxation after workout. - It lengthens and stretches the spine. - This posture helps alleviate stress and feelings of anxiety. - It gives a good stretch to the ankles, thighs, and hips.

	- improves blood circulation. #yoga #workout
Physical Health Harms/ Negative	Turns out I got long bicep tendonitis, any tips other than anti inflammatory meds and stretching?#gym #fitness #tendonitis
Weight loss/management	I gotta get the 40lbs off ASAP!! Time to bring in the big guns💪🏾 Let's get it Coach💯 #FilmTeyvatIslands #Workout #running #trackcoach #weightloss
Diet/Nutrition	It's amazing how much my body had changed for the better.. I'm on the no sugar diet and wow! It's hard but achievable! #fitness #losingweight #nosugar
External Social Factor/Influence	Getting fit for yourself is great. Having a fit life that impacts the people around you like your kids, significant other, and your inner circle Unmatched #fitness #lifestyle
External Non-Social Factor/Influence	I've never been someone who listens to music whilst riding because of the obvious dangers, but I've tried some new bone conduction headphones this morning & what a game changer! Still hear the traffic coming & entertained all the way to work! 👌🚴‍♂️💨👊💥 #cyclist #cycling #pdh
Reference of Body part/area	My legs are sore from jumping squats yesterday. #Gym
Influence of Weather	Holiday run 🏃‍♂️US Humidity is a killer 🥵 #Florida #running @UKRunChat
Use of Tools/Equipment	Last Day of Week 2 of Couch to 5K Running and Walking Oakham Rutland Countryside #running #walking #oakham #rutland #couchto5k #morningrun #clouds
Time/Planning	**Workout Wednesday**! What are your plans for staying active today?🏃‍♂️ Comment below and let us know👇 #10K #Running #Run #Runner #runningcommunity #WorkoutWednesday

APPENDIX E

Linguistic Inquiry and Word Count-22 (LIWC-22) Dictionary Category Descriptions, Word Count, and Internal Consistency

LIWC-22 Category	Description/Word exemplars	Words in category	Internal Consistency: Cronbach's α
Health	related to disease, injury, health behaviors (e.g., sleep, diet, fitness, exercise), and medical terms (e.g., medic, patients, health)	715	0.79
Illness	specific words related to sickness and disease (e.g., hospital, cancer, diabetes, fever, headache, sick, unwell, pain)	259	0.52
Wellness	words associated with positive health and well-being (e.g., healthy, gym, strong, fit, energetic, relaxation, yoga, mindfulness)	118	0.31
Mental Health	typically refer to diagnoses (e.g., bipolar, depression) or behaviors (e.g., suicide, addiction).	126	0.40
Positive Tone	captures positive sentiment with positive emotions and words related to positive emotions (e.g., good, well, new, happy, birthday)	1,020	0.61
Positive Emo	Encompasses specific positive emotion labels (e.g., happy, excited, hope)	337	0.52
Negative Tone	captures negative sentiment with negative emotions and words related to negative emotions (e.g., bad, wrong, hate, funeral)	1,530	0.62
Negative Emo	Encompasses specific negative emotion labels (e.g., hate, hurt, tired, sad, nervous)	618	0.52
Reward	Broadly captures reward outcomes including words such as win, gain, benefit, opportunity	62	0.37
Need	Broadly captures psychological process of need including words such as have to, need, must	55	0.11

Want	Broadly captures psychological process of additional satisfaction above and beyond basic needs including words such as want, hope, wanted, wish	56	0.19
Fulfilled	Broadly captures words representing state of completion, satisfaction, satiation, or "having enough" (e.g., succeed, full, complete)	49	.04
Future focus	Represents words that signal a future orientation, such verbs representing future actions (e.g., plan, intend, strive) and adverbs (e.g., will, going to, next)	138	0.32

Note. All alphas are from LIWC-22 development and psychometric manual (Pennebaker et al., 2022) computed on a sample of 15,000 texts from the LIWC text corpus selected from larger samples of texts from sources such as Twitter (collected from 2016-2020), blogs, natural conversations, movies, etc.

APPENDIX F

Sample of Tweets for Topic Models by Motivation Type and Physical Activity Engagement

Intrinsic, Total Sample
Topic Label 0: Satisfaction and Enjoyment from Running and Swimming (*N* = 96)
First morning run after #COVID19. Far from the usual pace, but still being able to run again made me very happy. #running
I ran at Konoike Park in Nara last night. It was very good feeling. #running #smile #star #special
In #running, it doesn't matter whether you come in first or last. You can say, 'I have finished.' There is a lot of satisfaction in that.
A VERY Late Run Is Better Than No Run. 😆 Despite my anxiety being high lately I kicked my ass out the door. 😩 No way in hell I was missing my run. 👊 On Thursday I ran 8.03 miles. Felt really good. 🙂 Comfortable pace. 👍 Great weather. Beyond grateful. 🏃‍♂️💔 #running
Yesterday's run at River Parks was hot, humid and perfect. But the best was seeing this driver waiting patiently for the geese to cross - no horn honking or driving thru them - just allowing and respecting their space and existence. #running
It's summertime! Time to swim and kayak. #OutdoorRecreation #Swimming #Kayaking
Lovely warm #swim off the West Sussex coast yesterday. Perfect
Gorgeous morning run! Our little lake. #runchat #löplycka #runr #running #Sjunkamossa

Glad I beat the heat! Nice run this morning. Anyone else's brat the heat today? #howihammer #keephammering @hammernutrition #lovetorun #runner #running #runchat @saucony #kinvara @GarminFitness #beatyesterday
Back to #running shoes today. Really surprised I recovered so quickly from my #flyrod cross training! #howihammer #keephammering @hammernutrition #lovetorun #wearetherunners #runner #runchat @saucony #kinvara @GarminFitness #beatyesterday

Intrinsic, Total Sample
Topic Label 1: Impact of Physical Activity Engagement on Well-Being (*N* = 73)
Felt good to get back into the gym! The days off always make me miss it more haha. Looking for some new protein recipes to try, so let me know what you make!! #mfam #gym
Morning workout for a smiling and cheerful day😉✌ #hedgehogs #workout #MorningLive #animallovers
Move nude to improve your mood Having a negative self or body image can effect cognition & memory. As well as social & intimate relationships How you perceive yourself matters #yoga #nude #naked #nudeyogagirl #nakedyoga #naturist #naturism #mentalhealth #fitness #bodypositivity
Happiness is Country music 🎼 Puppy love 🐕 Dancing 🕺 (terribly) lol #bodybuilding #fitfam #fit #fitness #prep #competition #gym #gains #pump #muscle
Walking is a great exercise🦒 . However, by doing it mindfully, we have learned that we should walk slowly and patiently, breathe deeply and enjoy the natural environment around us. #walk #exercise #healthulife #healthylifestyle #ecm #goodhealth #workout #dailyexercise #ecm
These weights are going to lift themselves up…. Wait a min… one moved 😱😱😱 #nyc #gym #twitch #weights #workingout
Morning workouts are starting to feel great. #gay #selfie #gym #fitness
Best feeling ever. Only you and one other in the gym. #quiet #gym
My Hobbies Include, trying to be funny, looking at #memes, #drawing, #running, #drumming, #cooking, #swimming, #gaming, and #reading.

When you get that first bicep vein popping out during arm day! #gym

Intrinsic, Total Sample
Topic Label 2: Satisfaction and Enjoyment from Cycling Outside (*N* = 25)
Sunrise this morning on my way to the airport. 5 straight days without a 🚴 #Withdrawal #WorkTravel #cycling
I love the warm weather 🌞🌞🌞 Great 30 miles this morning 🚴 absolutely loved it #UKCycleChat #cycling
Morning bliss #rocksalt #Blackrock #cycling
Enjoy a fun, nighttime bike ride while supporting TLC! It's a great opportunity to see how bike-friendly the Crystal Lake area is. Share with your friends! #mchenrycounty #cycling #bikeride
This is what cycling in Andalucia is all about. Smooth asphalt and blue skies. Gotta love that!! #cycling #Andalucia #Spain
A delightful early evening visit to Highbury Hall and Park - and a lovely chat with Isobel and dad (whose name I've forgotten) about the beauty of the park and the simple joys of cycling (whether balance bike, road bike or cargo bike). #ShareTheJoy #Cycling
Enjoyed that. #cycling #cycle #cyclist
A great idea #cycling #activetravel @TamworthCouncil
Family Bike ride Oswestry to Ellesmere. #Cycling #StayActive #StayFit #StayHealthy #NeverGiveUp @ Oswestry
Incredible! This is why I love #cycling! 👏

Intrinsic, PA Engagement
Topic Label 0: Satisfaction and Enjoyment from Running and Swimming (*N* = 90)
First morning run after #COVID19. Far from the usual pace, but still being able to run again made me very happy. #running
I ran at Konoike Park in Nara last night. It was very good feeling. #running #smile #star #special
In #running, it doesn't matter whether you come in first or last. You can say, 'I have finished.' There is a lot of satisfaction in that.
A VERY Late Run Is Better Than No Run.😆 Despite my anxiety being high lately I kicked my ass out the door.😩 No way in hell I was missing my run.👊 On Thursday I ran 8.03 miles. Felt really good.🙂 Comfortable pace.👍 Great weather. Beyond grateful.🏃♡ #running
Yesterday's run at River Parks was hot, humid and perfect. But the best was seeing this driver waiting patiently for the geese to cross - no horn honking or driving thru them - just allowing and respecting their space and existence. #running
It's summertime! Time to swim and kayak. #OutdoorRecreation #Swimming #Kayaking
Lovely warm #swim off the West Sussex coast yesterday. Perfect
Gorgeous morning run! Our little lake. #runchat #löplycka #runr #running #Sjunkamossa
Glad I beat the heat! Nice run this morning. Anyone else’s brat the heat today? #howihammer #keephammering @hammernutrition #lovetorun #runner #running #runchat @saucony #kinvara @GarminFitness #beatyesterday
Back to #running shoes today. Really surprised I recovered so quickly from my #flyrod cross training! #howihammer #keephammering @hammernutrition #lovetorun #wearetherunners #runner #runchat @saucony #kinvara @GarminFitness #beatyesterday

Intrinsic, PA Engagement (*N* = 20)
Topic Label 1: Satisfaction and Enjoyment from Cycling Outside
Sunrise this morning on my way to the airport. 5 straight days without a 🚴 #Withdrawal #WorkTravel #cycling
I love the warm weather 🌞🌞🌞 Great 30 miles this morning 🚴 absolutely loved it #UKCycleChat #cycling
Morning bliss #rocksalt #Blackrock #cycling
Enjoy a fun, nighttime bike ride while supporting TLC! It's a great opportunity to see how bike-friendly the Crystal Lake area is. Share with your friends! #mchenrycounty #cycling #bikeride
This is what cycling in Andalucia is all about. Smooth asphalt and blue skies. Gotta love that!! #cycling #Andalucia #Spain
A delightful early evening visit to Highbury Hall and Park - and a lovely chat with Isobel and dad (whose name I've forgotten) about the beauty of the park and the simple joys of cycling (whether balance bike, road bike or cargo bike). #ShareTheJoy #Cycling
Enjoyed that. #cycling #cycle #cyclist
A great idea #cycling #activetravel @TamworthCouncil
Family Bike ride Oswestry to Ellesmere. #Cycling #StayActive #StayFit #StayHealthy #NeverGiveUp @ Oswestry
Incredible! This is why I love #cycling! 👏

Extrinsic, Total Sample
Topic 0: Physical Activity Outcomes As Motivators (*N* = 704)

It’s almost 9 pm. Long day & as I drove home I decided I was tired & just couldn’t go to the gym. Then I thought hmm if I get #COVID I need to make sure my lungs are working full blast. So 1 hr later I am done at the #gym & couldn’t resist this selfie :) Hugs!
Fitness journey is looking better and better. And slowly my Achilles’ tendon is naturally healing. Gotta keep pushing! #AKZ3RO #gymtok #tiktok #TojiFushiguro #MentalHealthAwareness #imbetter #fitness
Static Stretches – Why They’re Better At The End Of Your #Workout via #NESTAcertified LIKE ▪ SHARE ▪ COMMENT
Regular exercise is a great way to manage your blood pressure. You’ll learn this & more on our Personal Trainer Clinics. #FitForPurpose #fitness #personaltrainer #education #gym #workout #fit #training #exercise #muscle Become a personal trainer:
Always remember:The greatest wealth is a healthy lifestyle. #lifestyle #healthyfood #fitness #health #healthy #healthyliving #fitnessmotivation #motivation #fit #wellness #lifestyle #healthyeating
One of my favorite photo-op spots in this gym #gym #muscle #muscles #biceps #fit #gains #aesthetics #instafit #fitness #fitnessmotivation #gymmotivation #shredded #training #weightlifting #workout #exercise #selfie #lafitness #reels #style #fashion #lifestyle #asrv #oakley
How many squats can you do to todays song “groove is in the heart” go now none stop to the end of the song an tell me how many you did 😂😂😂 #Goodluck #workout watchers
I look worse when I try taking selfies, so I honestly hope that my mirror appearance is more accurate. #Selfie #Meme #GYM #Memes #Sport
"Exercise is so kind, that even if you do it once a week religiously, it will give you results." Madhukar Talwarkar. Read the interview >> via @staywell #health #fitness #exercise #motivation #gym #fitnessquotes
Why do I never see a fit person in any group training class in the gym?? Everyone in these classes is extremely overweight- even the instructor doesn’t seem very fit. #fitness #workout #weightloss #weightlifting

Extrinsic, Total Sample
Topic 1: Running Routine Progress (*N* = 333)

Finally went out for walk, its been raining whole days. Yesterday: #3211. #Walk with Amma 41mins 3.1kms #3212. 70 #SingleLeg #RDL A-Day #3213. #Yoga 45mins #3214. #Breathing #Meditation 15mins 6500 steps #fitness #everyday #fitnessjourney
Last week's runs. That missing 0.6 miles to make an even 30 is bugging me lol. #running #MondayMotivation @GarminFitness @goodr
When not #running I get lazy
Day 18/18 (race postponed) Adjusted training ran parkrun in 22.17. In 2020 I ran 2020 miles 🚴 #runnorwich #10k #running
Feckin knew I was guaranteed to shed a good few pounds in this unbelievable weather 🌞 horrible to train in 😑 strap up & take advantage of what feels like an outdoor sauna🚽 WHERE IS THE RAIN 🌧 #rainman #rainlover #metisgloves #boxingtraining #workout #session #heavybag
Marginally better run today. #run #running #sfrunning #instarunners #runnersofinstagram #fishermanswharf #sanfrancisco @ Fisherman's Wharf
An exercise in restraint. Aimed for an extra minute slower per mile than my target pace. Call it rehab. #run #running #instarunners #sfrunning #runnersofinstagram #sanfrancisco #fishermanswharf @ Fisherman's Wharf
Different scenery on the morning run. #running @Marine_Marathon
Saw a couple of runners last week who have progressed from tops-in-hand status to confident full converts. We shirtless #runners embrace new comrades! #running #runchat
Done! Thanks guys for your awesome job! #trail #running #HR100 "If you like what we’re doing, here are the ways you can help support @iRunFar" -

Extrinsic, Total Sample
Topic 2: Facilitators of Cycling (*N* = 96)

A little #MondayMotivation from a very dry and hot mid Wales over the weekend… but today we'll be hiding in doors tapping a key board! #UKHeatwave #mtb #cycling #Wales
If you love adventure and gorgeous scenery, a biking vacation in Europe will be one of many biking vacations. #singlespeed #cyclinglife #cyclingphotos #bicicletta #biking #instabike #mtb
How can junctions be made safer for people #walking and #cycling? This is how they do in the #Netherlands, a country with the highest (or second highest?) cycling rates in the world. Source: @FahrradClub
Thinking about what makes #biking attractive to me: I think it's a humble mode of transportation that requires effort and some amt of physical fitness and coord from the rider. It's better for the envt, and you can access certain places (usu. more natural) that cars cannot.
9 mile bike ride after a morning walk with doggie and wife before thee temperature goes into the 100s today. #walk #running #cycling #TexasHeat #DFW
Well thus was an unexpected result. Thanks to everyone who contributed. ✌ #AATR #cycling
He's right, it could be utterly brilliant! How about it @East_Riding ?@TimmyMallett 🚵 @BritishCycling #nomorepunctures #cycle #eastyorkshire #cycling
Fancy a #cycling challenge just like @TimmyMallett ?! How about this one? The kids can even come too! #realjourneys #kids #adventure
Never stop challenge #rockbros #cycling #cyclist #mtb #gravel #bike #outdoors #sport
Current #NewYork State of Mind? #Cycling! It's as if it has become THE most popular mode of transportation in this highly populated metropolis. Well done, @bikenewyork! Check this out, @MiamiBikeScene!

Extrinsic, PA Engagement
Topic 0: Motivation from Results of Physical Activity Engagement (*N* = 453)
It's almost 9 pm. Long day & as I drove home I decided I was tired & just couldn't go to the gym. Then I thought hmm if I get #COVID I need to make sure my lungs are working full blast. So 1 hr later I am done at the #gym & couldn't resist this selfie :) Hugs!
Fitness journey is looking better and better. And slowly my Achilles' tendon is naturally healing. Gotta keep pushing! #AKZ3RO #gymtok #tiktok #TojiFushiguro #MentalHealthAwareness #imbetter #fitness

Regular exercise is a great way to manage your blood pressure. You'll learn this & more on our Personal Trainer Clinics. #FitForPurpose #fitness #personaltrainer #education #gym #workout #fit #training #exercise #muscle Become a personal trainer:
One of my favorite photo-op spots in this gym #gym #muscle #muscles #biceps #fit #gains #aesthetics #instafit #fitness #fitnessmotivation #gymmotivation #shredded #training #weightlifting #workout #exercise #selfie #lafitness #reels #style #fashion #lifestyle #asrv #oakley
How many squats can you do to todays song "groove is in the heart" go now none stop to the end of the song an tell me how many you did 😂😂😂 #Goodluck #workout watchers
Feckin knew I was guaranteed to shed a good few pounds in this unbelievable weather 🌞 horrible to train in 😑 strap up & take advantage of what feels like an outdoor sauna🚽 WHERE IS THE RAIN 🌧 #rainman #rainlover #metisgloves #boxingtraining #workout #session #heavybag
"Exercise is so kind, that even if you do it once a week religiously, it will give you results." Madhukar Talwarkar. Read the interview >> via @staywell #health #fitness #exercise #motivation #gym #fitnessquotes
The amount you sweat is NOT an indicator of a successful workout. It's completely irrelevant, in fact. Personal trainers will have you doing some unnecessary shit that only wears you out & accomplishes nothing for your body. Don't equate sweat w/a great workout. #facts #gym
Day 15 of waking up at 4:45 AM… Not as hard as I thought.. Kinda… #grind #workout #AM
315lbs x 17 reps. Getting stronger & stronger #ChestDay #BenchPress #Shorts #Reels #FYP #fitness #grind #motivation #CrossFit #Powerlifting

Extrinsic, PA Engagement
Topic 1: Initiation and Maintenance of Running (*N* = 285)
Static Stretches – Why They're Better At The End Of Your #Workout via #NESTAcertified LIKE ▪ SHARE ▪ COMMENT
Finally went out for walk, its been raining whole days.

Yesterday: #3211. #Walk with Amma 41mins 3.1kms #3212. 70 #SingleLeg #RDL A-Day #3213. #Yoga 45mins #3214. #Breathing #Meditation 15mins 6500 steps #fitness #everyday #fitnessjourney
Last week's runs. That missing 0.6 miles to make an even 30 is bugging me lol. #running #MondayMotivation @GarminFitness @goodr
When not #running I get lazy
Day 18/18 (race postponed) Adjusted training ran parkrun in 22.17. In 2020 I ran 2020 miles 🎗 #runnorwich #10k #running
Marginally better run today. #run #running #sfrunning #instarunners #runnersofinstagram #fishermanswharf #sanfrancisco @ Fisherman's Wharf
An exercise in restraint. Aimed for an extra minute slower per mile than my target pace. Call it rehab. #run #running #instarunners #sfrunning #runnersofinstagram #sanfrancisco #fishermanswharf @ Fisherman's Wharf
Different scenery on the morning run. #running @Marine_Marathon
Saw a couple of runners last week who have progressed from tops-in-hand status to confident full converts. We shirtless #runners embrace new comrades! #running #runchat
Done! Thanks guys for your awesome job! #trail #running #HR100 "If you like what we're doing, here are the ways you can help support @iRunFar"

Extrinsic, PA Engagement
Topic 2: Social and Environmental Influences on Cycling (*N* = 86)
If you love adventure and gorgeous scenery, a biking vacation in Europe will be one of many biking vacations. #singlespeed #cyclinglife #cyclingphotos #bicicletta #biking #instabike #mtb
How can junctions be made safer for people #walking and #cycling? This is how they do in the #Netherlands, a country with the highest (or second highest?) cycling rates in the world. Source: @FahrradClub
Thinking about what makes #biking attractive to me: I think it's a humble mode of transportation that requires effort and some amt of physical fitness and coord from the rider.

It's better for the envt, and you can access certain places (usu. more natural) that cars cannot.
9 mile bike ride after a morning walk with doggie and wife before thee temperature goes into the 100s today. #walk #running #cycling #TexasHeat #DFW
Well thus was an unexpected result. Thanks to everyone who contributed. ✌ #AATR #cycling
He's right, it could be utterly brilliant! How about it @East_Riding ?@TimmyMallett 🚵 @BritishCycling #nomorepunctures #cycle #eastyorkshire #cycling
Fancy a #cycling challenge just like @TimmyMallett ?! How about this one? The kids can even come too! #realjourneys #kids #adventure
Never stop challenge #rockbros #cycling #cyclist #mtb #gravel #bike #outdoors #sport
Current #NewYork State of Mind? #Cycling! It's as if it has become THE most popular mode of transportation in this highly populated metropolis. Well done, @bikenewyork! Check this out, @MiamiBikeScene!
Had far too many aggressive drivers recently. One poor chap was even pushed off his bike during our last TT - fortunately escaping relatively unscathed. Just got this @GoProUK because frankly, I don't think it's safe to ride without some sort of recording device. #cycling #uk

Extrinsic, PA Engagement
Topic 3: Program Use to Facilitate Running and Walking (*N* = 16)
Started my @couch_5k this morning, stick some music on and it's a great app to get going and get fitter! Can't wait to get to week 9 😁 #running #fitness #health
Rutland Countryside Couchto5K morning running and walking #oakham #rutland#run #running #walk #walking #countryside #couchto5k
Last Day of Week 2 of Couch to 5K Running and Walking Oakham Rutland Countryside #running #walking #oakham #rutland #couchto5k #morningrun #clouds
AF7H Hunger Gains Q3 Overall Leaderboard after Week 2. #af7hhungergains #anytimefit7hills #anytimefitness #gym #henderson #fitness #hendersonnv #cardio #myzone #fitnesstracker #competition
Last Day of Week 2 of Couch to 5K Running and Walking Oakham Rutland Countryside #running #walking #oakham #rutland #couchto5k #morningrun #hare
@WePharmacists @RayDorsey7 I'll be able to join team #PharmacyActive this year in #WeActiveChallenge. Struggling with ↓ exercise tolerance due to

↑ HR & ↑ BP 4 week post #COVID19. Have gone from #running 10K in May for @PharmaSupport in 74 min to taking 60 min to #walk 3K
Last Day of Week 2 of Couch to 5K Running and Walking Oakham Rutland Countryside #running #walking #oakham #rutland #couchto5k #morningrun #hare
Just finished week 4 day 1 of #C25K with @c25kfree #everymomentcounts #run #running #health #fitness #couchto5k
Just finished week 4 day 2 of #C25K with @c25kfree #everymomentcounts #run #running #health #fitness #couchto5k
I love seeing progress even in little steps, it helps keep me motivated to stay on track. Today I set a new pr for for 2 miles. Trying to get another PR set this week for my 5k. #progress #goals #weightloss #JourneyTo5K #weightlossjourney #health #fitness #running

Extrinsic, PA Engagement
Topic 4: Organized Sports Training (*N* = 13)
Great summer @horley_colin with hitting and fielding. Hit .441 (26-59) always working. #nextyear #nowtheoffseason #gym #soproud @premierath
Why do you need a CV as an ambitious baller? #sports #football #sport #fitness #basketball #nfl #nba #soccer #training #gym #workout #baseball #motivation #athlete #mlb #follow #love #instagood #instagram #fit #like #fashion #nike #photography #espn #hockey #life #running
Market Drayton Generators vs Brickfield Rangers - Paul Littlehales Tournament 2022 (61) #walkingfootball #TheFAForAll #ageuk #over50sfitness #thefa #fitness #footballphoto #walking
Building my base and getting ready 🏈 @GPWildcatsFB @GPAthletics1 @CoachHolmG @CoachSmith_A61 @CoachRuLopez @12markchester @RLDAVIS13 #football #fitness #workout #fitness #running https://t.co/NgAaFv6eMC
Too much honey? Get into badazz shape with my workout regimen! @Badazz_Bears @DisruptArt @jimjonescapo @RobforOHIO #workout #warmup #stretch #bears
I am making this account to document my Transformation in the gym and self motivation. I will also be posting coaching advice and videos from people doing 1-2-1 training sessions with me and giving an in-depth analysis #football #coach #england #coach #gym #FolloForFolloBack
An #allstar moment for #ClaytonKershaw. #MLB. #baseball #summer #summerfun #fan #sports #team #athlete #Dodgers #hitter #game #coach #coaching #fitness
Mid-week drop in football tonight and EVERY Thursday at Strood Sports Centre, from 4.30pm - 5.30pm ⚽ Sponsored by Child-Friendly Medway 😆

For ages 7 - 12 👭 S Don't miss out! https://t.co/Bet5HmbCPp #parksport #summerofsport22 #fitness #sports #medway #stayactive
DGSVB got after it today! Way to go players, coaches, admin & @MFCSP 💪💪💪 #dgspride #southside @ArwenLyp @DGSSports @DGSTrainers @MsBianchi99 @DGSCoachWolf #southstrong #volleyball #workout
Get moving & lose weight. Play football. #6aside #5aside #football #league #welwyngardencity #hertfordshire #fitness #exercise #getfit #soccer #MNF #FAaffiliated #photography #FAreferees #run #running #goal #goals #AllStandardsWelcome #ultimatefootballuk #weightloss

Extrinsic, Non-Engagement
Topic 0: Health and Fitness Inspiration (*N* = 87)
A little #MondayMotivation from a very dry and hot mid Wales over the weekend… but today we'll be hiding in doors tapping a key board! #UKHeatwave #mtb #cycling #Wales
Life can be an uphill struggle, but if you #KeepAttacking… 💪 #KeepAttackingEvents #FitnessWear #Running #FitnessChallenge
Some shots I like 🥊 #gym #foryoupage #TikTok #Motivation #legday
All about meniscus tears. -- #running #ukrunchat #runchat #triathlon #injuryprevention #onlinephysio
We bust the myth that a frozen shoulder will get resolved by itself over time. -- #running #ukrunchat #runchat #triathlon #injuryprevention #onlinephysio
Gym clothes or save my money? I'll let y'all decide 😉😉 #gogoskhotheni #TwitchCon #gym
Charging your bezior xf001 ebike for free using solar! 😁 . . #beziorxf001 #xf001 #beziorebike #ebike #electricbike #bestelectricbikes #cyclinglife #cyclinglifestyle #cycling #riding #mtb #bikelife #bike #bikepacking #roadbike #gogobest
#cycling #leader #healthy Men's Breathing Running Pants
Stress Support: Nature's Survival Mechanism #stresssupport #stress #planetfitness #gym #fitness #bodybuilding #lafitness #pilares #24hourfitness #exercise #health
Have you set a reminder for our spaces focused on strength and fitness 🤔 🕯 @IndiaPaulino & @HulkHusky 🗣 @bshaefit, @PallasEthena_, @Sophia_Adeline, @bunnybunny193, @Sabine_BC, & @b0ngsandbesties #fitness #gym #NFTs #NFTCommunity
A little #MondayMotivation from a very dry and hot mid Wales over the weekend… but today we'll be hiding in doors tapping a key board! #UKHeatwave #mtb #cycling #Wales

Extrinsic, Non-Engagement
Topic 1: Gym, Appearance, and Weight Loss (*N* = 45)
Why do I never see a fit person in any group training class in the gym?? Everyone in these classes is extremely overweight- even the instructor doesn't seem very fit. #fitness #workout #weightloss #weightlifting
The great equalizer is health. If you don't have it, you're screwed. #health #fitness #healthylifestyle #wellness #motivation #healthy #workout #love #gym #lifestyle #fit #fitnessmotivation #training #nutrition #life #instagood #exercise #bodybuilding #weightloss #healthyfo…
#Fit #Gym I'm going to mention skills to make sure you cut down unwanted fat successfully
#Healthy #Gym #FatLoss You could have better ability, a good body and as well , on top of that moderate fats in the event you get this type of hidden secret

#Gym You can be threatening the fitness if you are getting accumulated fat; you should preferably take a look at the following video presentation
#Gym Various women should burn fat cells readily from applying this hidden knowledge
Why aren't there more women only gyms? #gym #gymgirl #squats #bench #deadlifts #buff #strong #makeup #leggings @DeffJeff562
#Healthy #Gym #FitnessModel You get lots more capability, a stronger shape as well as , on top of that improve and even remove your excess fat in the event you adopt this kind of solution
Diet (80 % of it), busting my ass in the gym, cardio/walking, and a lot of patience. I said this in December this was going to happen. I'm STILL not getting anywhere need 10% or lower in BF. FCK THAT. 😘😘😘 #fitness #FitnessMotivation #SHIB #BONE

Extrinsic, Non-Engagement
Topic 2: Nutrition/Diet for Weight and Health (*N* = 44)
Fructose May be a Major Cause of Metabolic Disorders #Health #WeightLoss #Diet #LoseWeight #Fitness
Metabolism consists of all the chemical processes by which your body produces energy and assimilates new material to maintain, replace, and build up its cells. #metabolism #energy #health #fitness #workout #smartphysicalworkout #spw
Eat plenty of fruits and vegetables with your meals and as snacks. Read the nutrition labels on foods before you buy them. #nutrition #goodfood #goodnutrition #health #lifestyle #fitness #eatrainbow #HealthyFood
Eat plenty of fruits and vegetables with your meals and as snacks. Read the nutrition labels on foods before you buy them. #nutrition #goodfood #goodnutrition #health #lifestyle #fitness #eatrainbow #healthyfood @NagaurNyks @RajasthanNyks @Nyksindia @DmNagaur @PSameriya
Healthy food is additionally extremely scrumptious instead of well-known reasoning. We should support great dietary patterns so our people in the future will be solid and fit. #primitive #nutrition #fitness #health #healthylifestyle #healthy #healthyfood #weightloss #diet
Pinching my nose rn and chugging that protein i mixed with water. Yumm #protein #gym #proteinwithwater
Top 15 Perfect Weight Loss Smoothies👉 #fitness #health #diet #workout #weightlossjourney #loseweight #nutrition #gym
~ ✔ Scientists disvover the real root cause for belly fat ... 👇 🌐 ~ #AllStarGame #MasterChefBR #HalloweenEnds #LoveIslandUSA #WWENXT #weightloss #HealthyLiving #fatburner #fitness #health #bellyfat

HOW MUCH WATER DO YOU DRINK? 🌬 #Water #WeightLoss #Gym #Health #Healthy #Diet #Nutrition
Do you need something that will give you energy? Yummy Smoothie #Smoothie #Health #healthy #workout #yummy

Extrinsic, Non-Engagement
Topic 3: Optimizing Physical Health (*N* = 14)
What To Do If You're Not Building Muscle (It's NOT Your Genetics!) via @YouTube #health #fitness #buildmuscle #gains #fit #gym #nutrition
How to Prevent Fatigue, Boost Performance, Speed Recovery and Build-Muscle with BCAA #TeamAST #muscle #gymlife #gym
We all know that post-workout stretching is key to helping your body recover but with the aid of LacticPRO you can neutralise lactic acid build up faster than stretching alone. 🐮 Learn more and try LacticPRO: 🏋 #fitsporation #fitnessmodel #fit #workout
Understanding the Max-OT Cyclical Recuperation Period #TeamAST #muscle #gymlife #gym #fitness
Leptin mediates the regulation of muscle mass and strength by adipose tissue (in mice) #exercise #Workout #TrainHard #GymLife #GymTime #muscle #strength #lift #GetStrong #hypertrophy #gainz #gains #MetabolicSyndrome #InsulinResistance
How to Use Protein, Carbohydrate, and Creatine Timing For Maximum Gains #TeamAST #muscle #gymlife #gym #fitness
Coach joe explains how data can get a great starting point for your macros and caloric needs based on your BMR. for the full story, head to our blog: . . . . . #lawrencema #northandoverma #gym #crossfit #fitnessgoal #fitnessmotivation #personaltrainer
Turns out I got long bicep tendonitis, any tips other than anti inflammatory meds and stretching? #gym #fitness #tendonitis
Creatine Stimulates Muscle Growth by Triggering Satellite Cell Formation #TeamAST #muscle #gymlife #gym #fitness
#Gym You may have a bit more stamina, significantly greater body system and as well , besides that trim down unwanted weight should you you should utilize my strategy

Mixed Intrinsic and Extrinsic, Total Sample
Topic 0: Impact of Running and Community on Well-Being (*N* = 416)

Martes 🏃‍♂️✅🤩✨🙏💪😍 #garmin #beatyesterday #runner #runnergirl #runnerlover #running #training #LoveRunSmile #odrteam #mpm22 #meencantacorrer
Good to get out and do a bit after a break 😅very warm #running #wigan #keeponrunning Check out my run on Strava.
Nothing like starting your day with some wind sprints! Ready to get the Friday work day started now. Happy Friday everyone! #workout #running
Giving out the finish tokens at Cranbrook Parkrun, near Exeter this morning. Closest I get to finish tokens as low as these🤣. Another hot one. 14k for me running there and back home. #running #LoveParkrun
Saturday morning with some familiar faces at park run. 😁 #parkrun #bolton #running #fitness #runningmotivation #lovetorun #saturdaymorning #weekendvibes #runbuddies #happyday #runforwellnessmum @Boltonparkrun
It takes some will power to go for a run at 9.30pm, after a fairly busy day of work, housework and parenting, but it is soooo rewarding! Getting ready for the #Paisley10k. I can't wait! #running #mentalhealth #wellbeing
Speed work day 😅 Tried to get out a little earlier, but was still pretty hot by the end of today's workout. Warm up, 6 x 400m w recovery in between, cool down (8KM total). #runchat #selfcare #fitness #marathontraining
That sweaty glow of #satisfaction when warming down after a good #run is a feeling that's hard to beat #running #fitness
Preparing for next weeks DQM Run. It's been too long since last doing this great event. Hope to see you there 😷 #runforothers #dqm #chiropractor #running #oshawa 🙌🏃‍♂️
Cool enough for a run now and what a perfect, peaceful night for it. #angus #running #strava #ultraboost

Mixed Intrinsic and Extrinsic, Total Sample

Topic 1: Overcoming Challenges of Physical Activity (*N* = 416)
At the end of the day, your most fierce competition is the voice in your head. #gym #motivation #gymmotivation #sports #hockey #soccer #football #Canada #usa #btc #eth
@speedknob Funny, that's how it goes for me often....drag myself in, and have the best #workout! #gym #gymlife
Life is a series of days of living, whether you are for yourself or for your family, cherish the happy moments in life. #morning #summer #sun #healthyfood #sky #Gym #swimming #beautifulbody
Shocked to see my two year old photo .How fat i am 😂 nearly +110kg .But that period is the happiest one I could not care about the world what sh**t they were talking about me and this thing is changing now and I couldn't help it.#fat #gymlife #gym #transformation #LoveIsland
After #kata class tonight. Did a full run of #NageNoKata and taught the first two sets of #JuNoKata. It was a lot of fun and quite the #judo #workout ! en Tohkon Judo Academy
Everyone is dealt a hand in life. You gotta learn to play with the cards you are dealt instead of complaining about the cards you don’t have. It is up to you to make it a winning or losing hand. Believe in yourself and go all in. Have a day! Rattle the Cage! #gym #life
You can be enthusiastic on a daily basis but actually going out and putting in the work comes down to you. Working out for a week and then giving up because you haven't seen any progress is what will never lead you to success.. #DontQuit #Lifestyle #Rituals #Motivation #Gym
Yayyyyy!! One month straight of gym! 😛😛😂💝 #AS #W4 #bodybuilding #Gym
A week on creatine and still feeling good. Workouts have been very satisfying. The scale is definitely showing water weight. Lol, don't think I've put on an actual 4lbs in 7 days. #workout #gainz
GYM TIME 👊 #gym #life #mykonos #LoveIsland #healthylifestyle #body #island 💪💪💪

Mixed Intrinsic and Extrinsic, PA Engagement

Topic 0: Motivating Self and Others for Physical Activity Enjoyment (*N* = 408)
Martes 🏃‍♀️✅😁🌟🙏💪😍 #garmin #beatyesterday #runner #runnergirl #runnerlover #running #training #LoveRunSmile #odrteam #mpm22 #meencantacorrer
Good to get out and do a bit after a break 😭very warm #running #wigan #keeponrunning Check out my run on Strava.
Giving out the finish tokens at Cranbrook Parkrun, near Exeter this morning. Closest I get to finish tokens as low as these🤣. Another hot one. 14k for me running there and back home. #running #LoveParkrun
Saturday morning with some familiar faces at park run. 😁 #parkrun #bolton #running #fitness #runningmotivation #lovetorun #saturdaymorning #weekendvibes #runbuddies #happyday #runforwellnessmum @Boltonparkrun
It takes some will power to go for a run at 9.30pm, after a fairly busy day of work, housework and parenting, but it is soooo rewarding! Getting ready for the #Paisley10k. I can't wait! #running #mentalhealth #wellbeing
Speed work day 😅 Tried to get out a little earlier, but was still pretty hot by the end of today's workout. Warm up, 6 x 400m w recovery in between, cool down (8KM total). #runchat #selfcare #fitness #marathontraining
That sweaty glow of #satisfaction when warming down after a good #run is a feeling that's hard to beat #running #fitness
Preparing for next weeks DQM Run. It's been too long since last doing this great event. Hope to see you there 😷 #runforothers #dqm #chiropractor #running #oshawa 🙌🏃‍♀️
Cool enough for a run now and what a perfect, peaceful night for it. #angus #running #strava #ultraboost
A run before the sun! Just me a few startled rabbits, sleeping seagulls, families setting up on the river beaches and a few mighty responsible dog owners getting it done. #Heatwave2022 #running #getoutside #RiverWye #home #wellbeing

Mixed Intrinsic and Extrinsic, PA Engagement
Topic 1: Overcoming Challenges and Staying Motivated for Physical Activity (*N* = 314)

At the end of the day, your most fierce competition is the voice in your head. #gym #motivation #gymmotivation #sports #hockey #soccer #football #Canada #usa #btc #eth
Nothing like starting your day with some wind sprints! Ready to get the Friday work day started now. Happy Friday everyone! #workout #running
@speedknob Funny, that's how it goes for me often....drag myself in, and have the best #workout! #gym #gymlife
After #kata class tonight. Did a full run of #NageNoKata and taught the first two sets of #JuNoKata. It was a lot of fun and quite the #judo #workout ! en Tohkon Judo Academy
You can be enthusiastic on a daily basis but actually going out and putting in the work comes down to you. Working out for a week and then giving up because you haven't seen any progress is what will never lead you to success.. #DontQuit #Lifestyle #Rituals #Motivation #Gym https://t.co/la2kpvRXxm
Yayyyyy!! One month straight of gym! 😛😛😂💝 #AS #W4 #bodybuilding #Gym
A week on creatine and still feeling good. Workouts have been very satisfying. The scale is definitely showing water weight. Lol, don't think I've put on an actual 4lbs in 7 days. #workout #gainz
GYM TIME 👊 #gym #life #mykonos #LoveIsland #healthylifestyle #body #island 💪💪💪
Up at 5 this morning to do a 6 am Bootcamp class. I must be mad but it was great & I feel brilliant now! #Bootcamp #fitness #feelgreat
Cardio Workout #cardio_workout #weightmaintain #skinimprovement #childrenhealth #digestivehealth #hearthealth #musclegain #womenhealth #menhealth #weightmanagement #lyfestyle #workout #skincare #doctor #selfcare #nutrition #healthyrecipes #healthyeating #healthtech #weightloss

Mixed Intrinsic and Extrinsic, Non-Engagement
Topic 0: Motivating Healthy Lifestyle and Nutrition Choices (*N* = 20)

The #SmoothieDiet. The secret that makes the Smoothie Diet so effective is the Custom 3-Week Weight Loss Schedule. Learn more, clicking👉https://t.co/SsaUVsfDZ8 #weightloss #fitness #healthy #motivation #healthyfood #nutrition via @pinterest
7 signs of a healthy mind: 1. Curiosity - Learning new things 2. Rationality - Logical thinking 3. Confidence - Ability to cope 4. Optimism - Goals & Dreams 5. Empathy - Feel & express Love 6. Vision - Long term & Short term 7. Peace - Fall asleep in 30 minutes #fitness
#Gym A enormous collection of citizens observed they were able to dispose of fat cells and so revisit good health due to the following best steps
“Rice and pasta are always on the menu.” Fascinating chat with @LeTour chef James Forsyth on @FoodMattersLive #tdf #cycling #nutrition
Happy Tuesday ! Live a balanced and happy life! #healthymind #healthybody #healthylifestyle #health #mentalhealth #fitness #healthylife #wellness #healthyliving #selfcare #healthy #healthyfood #motivation #selflove #mindset #mindfulness #healthandwellness
Weight loss can be a difficult journey. It's important to understand the reasons why you want or need this. Visit: https://t.co/U0zxUr5L0J #weightloss #weightlossjourney #fitness #healthylifestyle #motivation #health #healthy #workout #diet #fitnessmotivation #healthyfood
Healthy Food #weightloss #fatloss #healthy #diet #exercise #fitness #workout #food #recipes
Healthy Diet Plan #weightloss #fatloss #healthy #diet #exercise #fitness #workout #food #recipes
Healthy bodies come in all shapes and sizes. While weight loss is not a magic bullet for health, and not everyone needs to pursue weight loss, it might be something you want to work toward to feel your healthiest. #AlphaHormones #dietplan #appetite #suppressants #trt #gym
Eat healthy to get stronger. #workout #health #StrongerTogether #life #gymlife

Mixed Intrinsic and Extrinsic, Non-Engagement

Topic 1: Commitment to Self-Improvement (*N* = 13)
Without struggle, there is no progress. - Frederick Douglas Really loving these action shots. #gym #gainz #strongman
I've come a long way. #fitness #gym #health #trainer #growing
I'm black #black #blacandproud #gym #fitness #model #african #artist #blacklivesmatter
Progress is forever! Never stop creating a better you💪 #fitness #progress #strong #oldmanstrong #olschool #youVSyou #eatclean #lovetheprocess #growth #dilf #dilfsoftwitter #dilfmag #begreat #selfcare #mindbodywealth #BDE #MOE #LetsGo
KILLED THAT ! Keep moving forward ! #fitness #fitnessmotivation #gym #wo... via @YouTube
Restless nights 🦁🔥⚡part.1 #gym #gymmotivation #KeepPounding #discipline #StrangerThings #NightShift #overtime #fyp
NOTHING WILL WORK UNLESS YOU DO. #gym #gymmotivation #gymlife #gymlover #fashion #fashionstyle #fashiondesigner #fashionblogger #model #modelshoot #modellife #modelling @instagram #instagram @GhCretors
A new week, a other week of grinding! #fitness #gym #Vtuber #ENVtuber #VTuberUprising
If the rail ain't bending, your just pretending 💪🐮 #NFTs #NFTCommunity #fitness
I hope u guy's like this pic i took today! #abs #6packs #gym

Mixed Intrinsic and Extrinsic, Non-Engagement
Topic 2: Finding Satisfaction In Pursuit of Health and Fitness Goals (*N* = 17)
Everyone is dealt a hand in life. You gotta learn to play with the cards you are dealt instead of complaining about the cards you don't have. It is up to you to make it a winning or losing hand. Believe in yourself and go all in. Have a day! Rattle the Cage! #gym #life
#goodmorning don't start the day down! #happy #picoftheday #selflove #mondaythoughts #mindset #inspirationalquotes #gym #entrepreneur #health #mondaythoughts #selfcare #motivational #fashion #goodmorning #fit #positivity #business #fitfam #gymmotivation #motivationalmonday

Maybe not today, Tomorrow is your day. Finish your goals! #plej #plejfitness #plejfitnessindia #motivation #mondaymotivation #gym #franchise #fitness #today #motivation101 #goals #tomorrow #nevergiveup
What Does A PHOENIX DO.. Rise From The Ashes SCORPION KING IS BACK💪💪💪💪 #training #bodybuilding #Motivation #workout #weightraining #muscles #health #fit #model #fitness #late #muscle #gym #gymflow #strong #beastmode #squat #haters #power #motivate #phoenix #scorpion
If you're not pushing yourself, you'll never be able to reach new levels. Your efforts are what count during the process. Don't give yourself a chance to look back and wish you had done more. The opportunity is now! #Gym #Workout #Progress #Results #Gains #Motivation #Grind
I retire with a smile on my face, in good health, and ready to spend autumns at my kids' games instead of my own. I'm excited to start the next chapter of my life. #health #fitness #healthylifestyle #wellness #motivation #healthy #workout #love #gym #lifestyle #fit #fitness…
We get so fixed on the overall goal that we sometimes forget to enjoy the process along the way.. Progress is happiness. When we see the progress we're making, it should fill us with joy. It's good to take things in their stride.. #BeProud #Gym #Progress #Happiness #Process
Swim Motivation You are tougher than you think. Faster than you know. Better than you will ever realize. Be Inspired - Chase That Smile Check out the book at #swim #swimbikerun #swimming #swimlife #swimtraining #swimminglife #triathlontraining
EVERYTHING YOU WENT THROUGH WAS FOR YOUR ADVANTAGE #motivation #lessons #live #love #laugh #grind #hustle #mindset #train #better #preach #lessons #people #fyp #foryou #healthy #health #wealth #gym #outdoors #outside #tattoos #muscle #talk #listen #classic #us
Learn from yesterday, live for today, hope for tomorrow. The important is to not stop questioning.#fashion #girl #girls #tattoos #polishgirl #girlswithtattoos #love #style #ragazzeitaliane #picoftheday #women #model #alternativemodel #fitness #fit #gym #perfect #invest #money

Unclear/Vague, Total Sample
Topic 0: Dedication to Physical Activity Engagement Outside (*N* = 13)

Without struggle, there is no progress. - Frederick Douglas Really loving these action shots. #gym #gainz #strongman
I've come a long way. #fitness #gym #health #trainer #growing
I’m black #black #blacandproud #gym #fitness #model #african #artist #blacklivesmatter
Progress is forever! Never stop creating a better you💪 #fitness #progress #strong #oldmanstrong #olschool #youVSyou #eatclean #lovetheprocess #growth #dilf #dilfsoftwitter #dilfmag #begreat #selfcare #mindbodywealth #BDE #MOE #LetsGo
KILLED THAT ! Keep moving forward ! #fitness #fitnessmotivation #gym #wo... via @YouTube
Restless nights 🦁🔥⚡part.1 #gym #gymmotivation #KeepPounding #discipline #StrangerThings #NightShift #overtime #fyp
NOTHING WILL WORK UNLESS YOU DO. #gym #gymmotivation #gymlife #gymlover #fashion #fashionstyle #fashiondesigner #fashionblogger #model #modelshoot #modellife #modelling @instagram #instagram @GhCretors
A new week, a other week of grinding! #fitness #gym #Vtuber #ENVtuber #VTuberUprising
If the rail ain’t bending, your just pretending 💪🐂 #NFTs #NFTCommunity #fitness
I hope u guy's like this pic i took today! #abs #6packs #gym

Unclear/Vague, Total Sample
Topic 1: Diverse Online Health and Fitness Community (*N* = 150)
Good morning 🌞#gym 💪™
#weights and #rowingmachine workout ✅ ready to start the day! Hope your days a great and memorable. #rowing #rowingmachine #fitness #outdoors #running #jogging #workout #fitnessmotivation #stayfit #spinning #bikechat #exercise

#hearthealth #fitnessafter50 #iphotography
So I go to the #gym 5 times a week and one thing I #HATE is a stank @ss #man. I under we sweating and working out BUT 1. You should not stink before your workout 2. While working out your BO should not be so bad you fill the gym with your Essence or your A$$ scent men #fixit! 😒
Started the day with a little yoga and some weight work. Now to start the real work in the studio. #Gym #Art #Create
Good morning, how does your Thursday start? Mine is doing legs. #gym #life #goodmorning
Heat or Ice: Which Is Better for Your #Workout Injuries? LIKE ▪ SHARE ▪ COMMENT
Workout Routine: Week14, Day6 (7-16-2022) via @YouTube #workout #fitness #exercise
A new day to give all my energy. #fitness #gym #girls #sports
You're Never too OLD to #Workout. Watch the video: LIKE ▪ SHARE ▪ COMMENT
Take the risk or lose the opportunity #motivation #fitness #inspiration #love #life #motivationalquotes #lifestyle #instagood #quotes #success #workout #gym #instagram #fitnessmotivation #goals #mindset #fit #training #positivevibes #follow #happy #selflove #bhfyp #bodybuilding

Unclear/Vague, PA Engagement
Topic 0: Impact of Environment on Physical Activity Engagement (*N* = 171)
Morning run with some walks, it was hot and humid (90º and 44% humidity). I overslept 🤦😌. #running #HotWeather #humidity #hokaclifton8
Another cool and dull day out there, but plenty 'hairstin' going on 🚴☁️🌬️□□□□□□ #Cycling #Kincardineshire
Have we had our summer? 🤔☁️🚴 #Cycling #Aberdeenshire

Did my first track workout in well over a decade. That little ellipse seemed so much bigger than I remember! #running
Today's hiking friends #hiking #running #runchat #cows
Holiday run 🏃🏻‍♀️🇺🇸 Humidity is a killer 😭 #Florida #running @UKRunChat
90° F 5 Mile #running 🏃🏻‍♀️ 2 Mile #walking 🚶🏻‍♀️ Fueled ⛽ with essentia overachiving H2O E+ 🤒😁 Get off the couch people and start running.
Yesterday's run. 15 min warm up, 5k, 3 min rest, 5k, 15 min cool down. On rolling hills. #running @GarminFitness @goodr #Hills #HealthyLiving
It's a scorcher out there today! Which early birds beat the heat, and who's holding out for cooler days? Either way, remember to stay hydrated! 🫧 #10k #running #runchesterfield #run #runningmotivation #fitness #instarunners #training #fitnessmotivation #chesterfield
Back to @erddigparkrun this morning with a run there and back. The hill at the end never gets easier! #parkrun #running #fitness #SaturdayMorning

Unclear/Vague, PA Engagement
Topic 1: Motivating and Connecting with Others on Physical Activity (*N* = 94)
Good morning 🌞#gym 💪™
#weights and #rowingmachine workout ☑️ ready to start the day! Hope your days a great and memorable. #rowing #rowingmachine #fitness #outdoors #running #jogging #workout #fitnessmotivation #stayfit #spinning #bikechat #exercise #hearthealth

#fitnessafter50 #iphotography
So I go to the #gym 5 times a week and one thing I #HATE is a stank @ss #man. I under we sweating and working out BUT 1. You should not stink before your workout 2. While working out your BO should not be so bad you fill the gym with your Essence or your A$$ scent men #fixit! 😒
Started the day with a little yoga and some weight work. Now to start the real work in the studio. #Gym #Art #Create
Good morning, how does your Thursday start? Mine is doing legs. #gym #life #goodmorning
Workout Routine: Week14, Day6 (7-16-2022) via @YouTube #workout #fitness #exercise
A new day to give all my energy. #fitness #gym #girls #sports
You're Never too OLD to #Workout. Watch the video: LIKE ▪ SHARE ▪ COMMENT
Take the risk or lose the opportunity #motivation #fitness #inspiration #love #life #motivationalquotes #lifestyle #instagood #quotes #success #workout #gym #instagram #fitnessmotivation #goals #mindset #fit #training #positivevibes #follow #happy #selflove #bhfyp #bodybuilding
Hiiiiii everyone :3!!!!!! Let's go to do some exercise today :3!! #gym #cosplay #kawaii #shortgirl #erocosplay #lingerie

Unclear/Vague, Non-Engagement
Topic 0: Sharing Health and Fitness Information and Motivation (*N* = 11)
I do not consciously ponder what other people are thinking about me. #sports #football #sport #fitness #nfl #basketball #nba #training #soccer #gym #workout #baseball #motivation
8 HABITS THAT DAMAGE YOUR BRAIN 👆 . #Pulseactivestationsnetwork #pulse #healthylifestyle #healthiswealthhealthtips #healthylifestyle #healthcoach #healthyliving #healthtips #healthiswealth #exercise #workout #workoutmotivation #motivation #motivate #physique
Just sharing posts about #Health, #Fitness and Motivation to help keep you moving Forward with the Determination to Succeed. LIKE ▪ SHARE ▪ COMMENT

Dietary Habits Worth Sticking With #TeamAST #muscle #gymlife #gym #fitness
Our new heart rate zones calculator not only works out your personalized zones, it also suggests personalized sessions based on those zones. #running #runner #marathon
Do you know this surprising Health Facts...👇👇 #VSN #health #weightgain #healthtips #fitness #diet #gymmotivation #weightlosstransformation #fitnessmotivation #gymlife #gymtime #yogalife #yogalover #fruits #VEGETABLES #HealthyLiving #gym #art
Lose Weight App for Women v1.0.44 with All premium features: #weightlosstips #weightlossjourney #LoseWeight #weightloss #fitness #diet #healthylifestyle #healthy #health #workout #motivation #weightlosstransformation #fatloss #losewe #one #nutrition #ght
A new week, a other week of grinding! #fitness #gym #Vtuber #ENVtuber #VTuberUprising
If the rail ain't bending, your just pretending 💪🐂 #NFTs #NFTCommunity #fitness
I hope u guy's like this pic i took today! #abs #6packs #gym

Unclear/Vague, Non-Engagement
Topic 1: Sharing Gym Experiences To Motivate Self And Others (*N* = 10)
Branched-chain amino acids (BCAAs) play an important role in the building and repairing of #muscles... #fitness #amino #protein #muscle
Relax 😇 🌵🌵🌵🌵🌵🌵🌵💪💪💪👆 #FelizJueves #gym #DecimeAmistad #Fit
hi my names crissy #gym #wegojim #Spirit #spritual #gymfashion
Can someone please recommend a nice gym center for me within osogbo Osun state.Thanks🙏 @InsideOsogbo @Osogbostories @Osogbo247 @osogbo #OsunDecides2022 #gym #yoga
Keep grinding💪💯 #gym
Get iiiin 💪 #fitlife #fitness #fit #lunges #gymlife #gym #gymtime #gymmotivation #aBoyFromKakamega
bare with me, i have no idea how twitter works. i really like this one #inspiration #inspirational #motivation #training #gym #workout #gymaddict

#fitness #progress #animequotes #dailymotivation #muscle #reels #explore #explorepage
Yes my head is touching my bathroom ceiling. Welcome to my world. #tallguy #muscles #bum #gym #backmuscles
#Gym and Politics together. @ArsalanGhumman @AliHZaidiPTI #PTI
Don't want to skip your workouts during hot days? Here are 3 basic tips: ◈ Exercise early in the morning ◈ Remember about hydration ◈ Make your workouts shorter and slower #DKNfitnessUK #fitness #fitnesstips #heatwave