Abstract
It is generally accepted that physical activity has a multitude of health benefits. Despite this, inactivity remains a national issue both in the UK and world-wide. Nurses have an important health promotion role in advocating the potential benefits of PA to the general public. However, research suggests that nurses may not be getting enough PA themselves, despite the active nature of the job. A vast array of potential reasons for this exist, one being the lack of value that PA may have beyond its health benefits. The purpose of this article is to provide an evidence-based review of literature on the potential of increased PA improving the wellbeing of nurses. While it is recognised that PA may benefit various indicators of wellbeing, this article provides evidence pertaining to three of the most significant influencers of wellbeing: feeling states (affect, mood and emotion), depression, and sleep.

Introduction
Physical activity (PA) is any bodily movement produced by skeletal muscles that requires energy expenditure (Biddle et al., 2015). This is diametrically opposed to inactivity (the relative absence or lack of movement) and contrasted with sedentary behaviour (sitting or lying during waking hours) (Biddle et al., 2015; Caspersen et al., 1985). Physical activity includes sub-components such as exercise (a more structured and repetitive form of movement with the objective of increasing physical fitness) and sport (a rule governed, structured and competitive form of activity that uses gross motor movement) (Biddle et al., 2015; Caspersen et al., 1985). Therefore, it encapsulates various types of human activity that take people beyond resting metabolic rate.
There is substantial evidence of the multifaceted benefits of PA. Much of that evidence has outlined the potential for PA to improve health-related factors such as cardiorespiratory fitness, muscular fitness and bone health, while reducing the risk of non-communicable diseases such as coronary heart disease and type 2 diabetes (Department of Health and Social Care, 2019; Reiner et al., 2013). The World Health Organisation (WHO) state that such benefits can be achieved by meeting a prescribed guidelines for the dosage of PA. These guidelines state that adults between the ages of 18-64 should do: at least 150 minutes of moderate-intensity aerobic PA throughout any given week, or at least 75 minutes of vigorous-intensity aerobic PA, or an equivalent combination of moderate- and vigorous-intensity activity (WHO, 2020). This is in addition to strength building and balance improving exercise at least two days a week.

Physical inactivity and the nurse agenda

Despite clear guidance, and evidence of the benefits of PA, inadequate amounts of physical inactivity remain a significant global issue (Hallal et al., 2012; WHO, 2020). In the UK for example, an average of 39% of adults engage in an inadequate amount of PA, which costs the NHS approximately £7.4 billion pounds a year (NICE, 2018; NHS, 2016). Thus, it is understandable that increasing PA levels is, and has been, a national agenda for over a decade (Biddle et al., 2015).

The nursing workforce has an important role in this agenda and should be considered key agents of change (Blake et al, 2017). Nurses have good quality contact time with patients, enabling the development of rapport, and allows more opportunities to offer advice on lifestyle choices that may contribute to health problems, such as inadequate PA (Ross et al., 2017). Furthermore, the rapport and familiarity that has been built can increase the receptiveness of any advice offered
by nurses (Blake et al., 2017; Blaber, 2005). However, the PA levels of nurses themselves are increasingly considered of great importance too (Blake et al., 2011; Blake and Harrison, 2013; Hawker, 2012).

The most obvious reason for this is that nurses face the same health-related concerns as the population they serve (Perry et al., 2015), so inadequate PA levels by nurses could further contribute to the burden on the NHS. The PA of nurses is also of interest because it may impact their effectiveness as professional healthcare providers. Previous research has found that the health of medical staff, such as nurses, can have a direct impact on the quality of care provided to patients (Healy and McSharry, 2010; Eposito and Fitzpatrick, 2011). This is because it may impact; health-related productivity (Letvak et al., 2013), absenteeism (Blake and Harrison, 2013) and the longevity of employment, thus the pool of experience available to the profession (Perry et al., 2015). Furthermore, patients are more likely to deem healthcare providers as credible, thus follow their advice, if they are perceived to follow their own health promotion advice such as remaining active and exercising regularly (Lobelo et al., 2009; Fie et al., 2013; Blake et al., 2017). This means that it can impact credibility and the ability to deliver effective and quality care (Perry et al., 2015). For these reasons previous research has asked the important question, are nurses suitably physically active? Or in other words, do nurses ‘practice what they preach’?

Nurses have various advantages which ought to encourage participation in health-related behaviours like PA. This includes being well educated, particularly on health and wellbeing, while having the socio-economic advantage of employment, which may enhance the availability, choice and feasibility of PA pursuits (Perry et al., 2015). However, such benefits do not always translate into the lifestyle choices of nurses (Blake et al., 2017; Bakshi et al., 2015). On the contrary there
is evidence that a significant proportion of nurses do not get enough PA (Kumbrija et al., 2007), and some studies have found that as many as 50% (e.g. Albert et al., 2014; Tucker et al., 2010; Blake and Harrison 2013), to 70% (e.g. Nahm et al., 2012) of nurses are not sufficiently active. Considering such evidence, the purpose of this article is to encourage further participation by providing an evidence-based overview of how PA may positively contribute to the wellbeing of nurses, focusing less on the commonly discussed physiological benefits, and more on some of the psychological benefits of PA.

**Psychological Benefits of Physical Activity**

When its benefits are considered purely in relation to the prevention of disease, PA can be viewed as little more than a way to add years to an individual's life (Biddle et al., 2015). However, PA has been associated with health and wellbeing outcomes beyond the pathogenic and clinical focus of protection against disease. Research consistently outlines the role of PA in yielding "statistically significant, clinically meaningful improvements in wellbeing and quality of life outcomes" (Focht, 2012, p.110). This includes enhanced subjective wellbeing, increased life satisfaction and reductions in the symptoms of anxiety and depression (Ekkekakis, 2013; Elavsky et al., 2005). Therefore, there is strong evidence that PA is not just a way to add more years to a person's life, but also a way to add more life to a person's years.

The 'life' added to one's years is typically explained in relation to psychological concepts like psychological wellbeing, global wellbeing, life satisfaction, quality of life and health related quality of life. These terms are interlinked, but inconsistently defined and the subject of much debate (Karimi and Brazier, 2016). It is not the purpose, neither is it within the scope of this article to enter this debate. Consequently, in considering the benefits of PA, these terms will be conjoined under the global heading of wellbeing, and wellbeing will be considered a broad term
to explain objective and subjective factors of healthy human functioning that impact: self-acceptance, positive relationships, autonomy, environmental mastery, personal growth and sense of purpose (Karimi and Brazier, 2016; Hawker, 2012).

It is important to note the multiplicity of psychological benefits of PA which may directly or indirectly improve wellbeing. For example, regular strength and aerobic exercise can lead to significant improvements in cognitive functioning and a slowing of mental decline in older adults (Dishman et al., 2013; Colcombe and Kramer, 2003). Similarly, there is a small but significant relationship between PA and self-esteem, which can improve wellbeing by enhancing physical self-perceptions, body satisfaction and physical self-worth (Elavsky, 2010; Biddle et al., 2015). However, this article will focus on evidence of the role that PA may have on three of the most significant influencers of wellbeing: feeling states (affect, mood and emotion), depression, and sleep.

**Affect, Mood and Emotion**

Affect is the most generic, consciously accessible feeling state that one may experience (i.e. positive or negative, good or bad) (Lochner, 2016). ‘Affective states’ are commonly used as an umbrella term for moods and emotions to describe non reflective feeling that is not always available to consciousness (Lochner, 2016). Within this, mood is considered a global set of affective states that may or may not have originated from a clearly identifiable stimulus, and emotion a specific feeling state following a cognitive appraisal of an eliciting event that is comparatively intense, shorter in duration and has behavioural implications (Lochner, 2016; Biddle et al., 2015).
The notion that PA ‘makes us feel good’ is a common and relatively uncontroversial view (Emerson and Williams, 2015). The release of “feel-good” neurotransmitters like endorphins and serotonin are often accredited as the reason that research has found that PA is positively associated with increased feelings of happiness, and subjective wellbeing in general (Pucci et al., 2012). Research generally supports the notion that exercise can enhance the experience of positive affective states (Biddle, 2000; Helfer et al., 2014). However, the relationship between them is not as straightforward as is often portrayed (Emerson and Williams, 2015). Not all PA will elicit such responses. As such, research in this area has focused on understanding the exact circumstances that elicit the strongest positive response.

Comparisons have been made between types (e.g. aerobic vs resistance), intensity (e.g. high vs low vs medium) and longevity (e.g. acute vs chronic) of exercise. In terms of activity type and intensity, results are mixed, but tend to favour low intensity aerobic exercise. After McDonald and Hodgdon's (1991) meta-analysis on exercise and mood it was concluded that aerobic fitness training can reduce feelings of tension, anger, depression, fatigue and confusion, while increasing vigour. Similarly, Arent et al.'s (2000) meta-analysis of 32 studies found that older adults may benefit particularly from low intensity exercise, but also when mixing elements of cardiovascular and resistance types of training. Such research has not dismissed the potential of affective benefits following higher intensity exercise, but noted that as intensity increases, so too does the risk that affective responses will cease to be pleasurable, and instead will turn to displeasure (Ekkekakis et al., 2005; Ekkekakis et al., 2011). Therefore, although high intensity exercises like High Intensity Interval Training (HIIT) are growing in popularity, their demanding nature means that they may be accompanied with less positive, and potentially negative feeling states during
and following participation (Ekkekakis and Dafermos, 2012; Ekkekakis, 2005). This is especially when the intensity is imposed, rather than self-selected (Ekkekakis et al., 2011).

In terms of longevity, research suggests that positive affective states occur following both a single session (acute) and sustained periods (chronic) of PA. Reed and One’s (2006) analysed 158 studies on the acute effects of aerobic exercise and found a moderate but meaningful effect immediately after exercise when the individual has been taking part for up to 35 minutes at a low intensity. This is also consistent across other meta analyses (e.g. Reed and Buck, 2009). However, it is worth noting that the effect is even stronger over a sustained period of time. For example, with a 30-35-minute duration, when completed for 3-5 days per week for 10-12 weeks.

Based on such findings it can be said that the relationship between PA and feeling states is mediated by various factors such as intensity, type of activity and length of participation (Emerson and Williams, 2015; Ekkekakis, 2003; Ekkekakis et al., 2011). Nonetheless, there is significant evidence that by engaging in targeted bouts of exercise, one may experience positive developments to their affective states. Interestingly, such an effect is larger when pre-activity affective states are low (Reed and Ones, 2006; Biddle et al., 2015). This provides credence to the idea that people may be able to ‘exercise themselves happy’.

**Depression**

Approximately 1 in 4 people in the UK experience a mental health problem such as depression and anxiety each year, and it is predicted that by 2030 depression will be the leading risk factor for life expectancy (McManus et al., 2009; Biddle et al., 2015). This is especially pertinent to nurses as Kalmbach et al. (2018) state that healthcare professionals often experience insalubrious environments for mental health created by long work hours, insufficient sleep, and
circadian challenging shift schedules. While there are various established forms of treatment (e.g. medication and cognitive behavioural therapy (CBT), PA has also been considered because of its potential to engender and facilitate positive affective states, social interaction, and to act as a relief/outlet for stress (Ekkekakis, 2013; Hamer et al., 2006).

Despite its importance, less research has been conducted on anxiety (exceptions include Wipfli et al., 2008; Ekkekakis et al., 2011), and that which has, suffers from issues of conceptual clarity (Biddle et al., 2015). Consequently, it is difficult to make many conclusions about the role of PA in improving anxiety. Evidence of a bi-directional relationship between PA and depression has been found by Da Silva et al., (2012). Their longitudinal study concluded that those who were not depressed but remained regularly active were less likely to be depressed after an eight-year follow-up than those who were not regularly active. Inversely, those who were depressed at baseline were less likely to be regularly active at the eight year follow up than those who were not depressed at baseline. Similarly, Mammen and Faulkner’s (2013) seminal systematic review of 30 longitudinal studies of high methodologic quality found a significant inverse relationship between PA and follow up depression. They concluded that, “There is promising evidence that any level of PA, including low levels (e.g., walking for less than 150 minutes/week), can prevent future depression...[and]... promoting PA may serve as a valuable mental health promotion strategy in reducing the risk of developing depression” (Mammen and Faulkner, 2013, p. 649).

Such findings offer support to the notion that PA may protect people from depression. However, considerations of the severity of the issue, the complex nature of mental illness, and its potential to be contributed to by a multitude of factors have meant that the role of PA remains disputed. This is understandable given that research in this area has for some time been harmed by
inconsistency of methodological rigour, differential approaches to defining mental health issues and it has been extremely difficult to account for confounding variables such as age, genetics, socio-economic status, the existence of other physical health issues and the use of drugs (e.g. antidepressant drugs) (Biddle et al., 2015). This is particularly problematic in terms of research considering PA as a treatment for depression, which presents more conflicting results.

For example, studies have found that aerobic exercise that meets the public health recommended dose can reduce symptoms of depression (e.g. Dunn et al., 2005), and almost two decades ago findings suggested that this may yield outcomes comparable to medication (Blumenthal et al., 1999; Babyak et al., 2000). Aside from developments in medicine which may impact the applicability of such findings today, more recent research has not consistently supported such claims. Rimmer et al. (2012) reviewed 30 studies on the potential relationship, only including randomised control trials, and comparing exercise to standard treatment, no treatment, placebo treatment, pharmacological treatment, psychological treatment (e.g. CBT) or other active treatment in adults (aged 18 and over) with depression. On one hand they found that exercise is moderately more effective than no or placebo interventions for reducing symptoms of depression, but compared to psychological or pharmacological therapies, exercise appears to be no more effective.

Clearly, it is important that claims of the potential role of exercise to treat depression are not overstated, or promoted in place of other treatment forms (e.g. medication and CBT) without an impeccably high threshold for the evidence that would form the rationale for such suggestions. Though this does not mean that PA cannot have any role in treating depression. Even if not used as a replacement form of treatment, PA can be used to supplement existing forms of treatment
because, “the potential benefit of advocating the use of exercise as part of the treatment for depression far outweighs the potential risk that no effect will occur” (Biddle and Mutrie, 2001, p. 219).

**Sleep**

Good sleep quality improves daytime functioning, life satisfaction and mental health in general, while issues with sleep length and quality are associated with poorer quality of life, and a host of physical and mental issues (Kripke et al., 2002; Kredlow et al., 2015). Considering findings that nurses are susceptible to mental health issues because of the demanding nature of the job, its long work hours and circadian challenging shift schedules (Kalmbach et al., 2018), improvements in sleep may be another benefit of engaging in PA.

Physical activity has often been used as a self-help intervention for managing sleep issues (Kredlow et al., 2015). This is largely based on the ‘common-sense’ argument that PA will exhaust the individual and lead to a desirable level of fatigue at bedtime, which would in turn assist people to sleep longer and deeper (Biddle et al., 2015). This claim has become more sophisticated, and there are presently a host of claims about the mechanisms through which PA may exert an influence. For example, body temperature changes (McGinty and Szymusiak, 1990), increased energy consumption/metabolic rate (Morselli et al., 2012), changes in mood/anxiety symptoms (Buman and King, 2010; Uchida et al., 2012), changes in heart rate and heart rate variability (Sandercock et al., 2005), and body composition change (Uchida et al., 2012; Kredlow et al. 2015). Though there is a lack of agreement on its mechanisms, the notion that PA may improve sleep is supported by research evidence. For example, early meta-analyses in this area found that found that acute and regular exercise increases the proportion of deep sleep and total sleep time, while
also reducing the amount of time it takes to get to sleep (Kubitz, Landers, Petruzzello and Han, 1996; Youngstedt, O'Connor and Dishman, 1997; Yang et al., 2012). Kredlow et al., (2015) conducted a meta-analysis of 66 studies, with 2863 participants, on the effects of acute and chronic PA on sleep. They found strong evidence that acute exercise reduces sleep disturbance, has a small but significant effect on total sleep time, sleep latency and sleep efficiency and sleep quality. In relation to regular exercise, they found that it has a small but significant effect on total sleep time, sleep efficiency, sleep onset latency, and moderate beneficial effects on sleep quality. Such findings also showed no significant difference between aerobic vs anaerobic exercise. This suggests that nurses may experience these sleep benefits with a multitude of different types of PA.

A critical consideration is the time of the activity. Some studies have stated that exercising within a few hours of bedtime may be detrimental to sleep (Stepanski and Wyatt, 2003). Kredlow and colleagues (2015) stated that such findings were inconsistent and there remains no clear guidance on the ideal time for such activity to occur. For example, exercising less than 3h before bedtime was significantly associated with less disturbed sleep (lower wake time after sleep onset), whereas exercising 3–8h before bedtime was not. Exercising less than 3h before bedtime and greater than 8h before bedtime were significantly associated with less time spent in light sleep (stage 1 sleep), however, exercising between 3–8h before bedtime was not. Finally, acute exercise 3–8h before bedtime was significantly associated with a decrease in rapid eye movement sleep; however, less than 3h before bedtime and greater than 8h before bedtime were not. More recent evidence does not support the hypothesis that evening exercise negatively affects sleep, on the contrary, it can help sleep (Miller et al., 2019; Stutz et al., 2019). Though this is only when the exercise remains moderate and not vigorous, is not conducted less than 1 hour before bedtime.
and is relatively low impact (e.g. cycling) (Kredlow et al., 2015; Miller et al., 2019; Stutz et al., 2019).

**Conclusion**
There is a substantial amount of research evidence on the potential benefits of PA which can be applied to the nursing workforce and their patients as appropriate. Of those benefits, research suggests that PA can enhance the experience of positive affective states, serve as a protective mechanism against depression, contribute towards the treatment of depression and improve both the length and quality of sleep. There are a host of psychosocial factors and mediators that may impact the experience of these benefits. They are also influenced by the characteristics of the PA itself, e.g. the time, type and regularity of the activity being conducted. Nonetheless with evidence of extensive benefits which may be experiences from so many types, intensities and levels of consistency of PA, it can be said that nurses may enjoy these wellbeing related benefits by adhering to the WHO guidelines for PA which state that at least 150 minutes of moderate-intensity aerobic PA throughout any given week, or at least 75 minutes of vigorous-intensity aerobic PA, or an equivalent combination of moderate- and vigorous-intensity activity.
References


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