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## LITERATURE REVIEW

# Health behaviour change and lifestyle-related condition prevalence: Comparison of two epochs based on systematic review of the physical therapy literature

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**KEYWORDS**

exercise;  
health promotion;  
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nutrition

**Abstract** Unhealthy lifestyle behaviours are primary contributors to the prevalence of lifestyle-related conditions this century. To examine the potential impact of the seminal World Health Organization-endorsed Ottawa Charter on health promotion in 1986 on physical therapy practice, we systematically reviewed articles that focused on physical activity for general health, smoking cessation, optimal nutrition, weight control, stress management, and sleep hygiene over two epochs. A search strategy was conducted in Cumulative Index to Nursing and Allied Health Literature to retrieve articles published between 1986 and 1989, and between 2006 and 2009 in five leading generalist physical therapy journals, and to compare numbers of relevant articles that focused on the lifestyle behaviours of interest. Articles were retrieved through title page searches of online and in print issues. Changes over time were evaluated with the Fisher exact test. Over 20 years, only the number of articles on physical activity and sleep hygiene increased. Although no benchmark exists, publication trends in physical therapy with respect to lifestyle-related conditions are somewhat consistent with epidemiological priorities, at least with respect to physical activity. Our findings could further sensitise the physical therapy community to health promotion and the prevention of lifestyle-related conditions to meet societal needs this century, specifically, the need to develop clinical competencies related to multiple health behaviour change. Copyright © 2012, Hong Kong Physiotherapy Association Ltd. Published by Elsevier (Singapore) Pte Ltd. All rights reserved.

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## Introduction

Lifestyle behaviours, namely, inactivity, tobacco use, poor nutrition, obesity, elevated stress, and suboptimal sleep, are major contributors to the pandemic of lifestyle-related conditions, morbidity, and premature death [1]. Preventable lifestyle-related conditions such as ischemic heart disease, chronic bronchitis, and emphysema (largely smoking related), hypertension, stroke, type 2 diabetes mellitus, and some cancers, are not only leading causes of disability and premature death in high-income countries, but increasingly in middle- and low-income countries. The social and economic burdens of these conditions are no longer tenable [2].

That more than 80% of coronary artery disease and 90% of type 2 diabetes mellitus, and their associated burdens on the healthcare system, could be avoided or minimised with healthier lifestyles warrants serious attention [3]. Knowledge about how health professionals including physical therapists are responding to this knowledge translation gap by integrating health promotion into practice is informative with respect to planning the directions of the profession long-term in a systematic, epidemiologically informed manner.

Over the past 60 years, the focus on health versus ill health has increased. In 1946, the World Health Organization (WHO) defined health as, “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” [4]. This definition underpins the International Classification of Functioning, Disability, and Health that is being increasingly adopted by member countries of the World Confederation of Physical Therapy [5,6]. In 1986, the First International Conference on Health Promotion was convened resulting in the adoption of the Ottawa Charter for Health Promotion by the World Health Organization [7,8]. Although this seminal charter has become the prototype for health promotion globally, concern has been raised that health promotion has severely lagged in terms of being integrated into healthcare, which remains largely reductionistic impairment-based care [9–11].

Physical therapy, a leading established healthcare profession, is committed to promoting health and wellness, and in some cases reversing, as well as managing lifestyle-related conditions with nonpharmacologic interventions. Furthermore, based on its practice pattern of prolonged visits over time and the opportunity for tailoring and targeting health education, and follow-up, the profession is well positioned to address lifestyle-related conditions through healthy lifestyle education [12]. Six lifestyle behaviours—physical activity and exercise, smoking cessation, nutrition optimisation, weight control, stress management, and sleep hygiene—have emerged as major contributors to health. When compromised, they can lead to lifestyle-related conditions and premature death (Appendix 1).

Of the six lifestyle behaviours, physical activity and exercise have traditionally been most related to physical therapy [13]. In addition to being primary interventions, they decrease risk of cardiovascular disease, hypertension, stroke, type 2 diabetes mellitus, obesity, and some cancers [14–19]. Given the sedentary lifestyles and the ageing of the population [20], contemporary physical therapists need

to address lifestyle-related conditions or their risk factors in almost every patient [1,12].

Of the remaining lifestyle behaviours, smoking remains a leading health priority and associated with considerable economic burden [21]. Although a leading contributor acute and chronic lung conditions, smoking is associated with delayed healing and repair, increased inflammation, impaired immunity, and complications following medical and surgical procedures [22,23], all of which are physical therapy priorities. Similarly, suboptimal nutrition contributes to primary and secondary pathologies, including obesity and type 2 diabetes mellitus, and compromises healing and repair [24]. Associated abnormal blood sugar levels can often be normalised with healthy nutrition [25]. Obesity contributes to or complicates several lifestyle-related conditions [26,27]. Stress has become an accepted part of contemporary living. Stress reactions contribute to or compound existing conditions and stress management can mitigate these effects [28]. Finally, sleep deprivation can be associated with stress, a primary physical diagnosis, or secondary problem [29,30]. Comparable to other lifestyle behaviours, sleep disturbance is associated with several lifestyle-related conditions [31], and independently impacts function and well-being, hence, physical therapy outcomes.

This study was designed to establish if the relative and absolute numbers, or both, of peer-reviewed articles published on each of the six lifestyle behaviours in physical therapy journals changed from 1986–1989 to 2006–2009. Sampling over 20 years (i.e., comparing two epochs: 1986–1989 and 2006–2009) was selected based on the emergence of the Ottawa Charter on health promotion to the present time. We examined changes in the relative as well as absolute numbers of articles published on these topics to adjust for any general increase in publication rate over time in the physical therapy literature.

As the prevalence of most lifestyle-related conditions has largely increased over the past 20 years, we hypothesised that the proportion of articles relating physical therapy and healthy living practices increased in number from 1986 to 1989 and 2006 to 2009, and increased proportionately, in the generalist physical therapy literature.

## Methods

We examined the content of the generalist physical therapy related literature between 1986–1989 and 2006–2009 with respect to six lifestyle behaviours: physical activity and exercise, smoking cessation, nutrition optimisation, weight control, stress management, and sleep hygiene. We analyzed five leading generalist physical therapy journals: *Physiotherapy Canada*, *Physical Therapy*, *Physiotherapy*, *Australian Journal of Physiotherapy* (became the *Journal of Physiotherapy* in 2010), and *Physiotherapy Theory and Practice*. We selected these journals as they represented the five leading generalist journals accessible by the physical therapy community over the time frame of interest, and at the core of evidence-based practice [32]. For this preliminary study, we excluded specialty journals because our study was designed to examine whether the generalist physical therapy literature was placing increased attention

to the overall health benefits of lifestyle behaviours, rather than their effects on specific injuries or conditions. Based on preliminary review of specialty physical therapy journals, we made two observations germane to our purpose. First, specialty journals tend to be relatively recent compared with the generalist journals, and two, they are variable in terms of whether they are indexed and their degree of peer review. Given a systematic review of the literature in the way in which we proposed had not been done previously, we believed that an initial review of the generalist journals was reasonable. We also believed that the generalist literature would provide a better indicator of the degree to which the general practitioner was being exposed to the health promotion through the professional scientific literature.

The five physical therapy journals we selected were searched in the electronic database Cumulative Index to Nursing and Allied Health Literature (CINAHL). Two search strategies were developed, one for the epoch 1986–1989 and another for the epoch 2006–2009. Appropriate MeSH headings for each epoch were chosen for the six lifestyle behaviours. Relevant key words for each lifestyle behaviour were searched to identify source articles. A seventh category was searched using MeSH headings such as “health promotion”, and relevant key words. This seventh broad category was used to capture additional articles related to lifestyle behaviour change that did not focus sufficiently on a particular lifestyle behaviour, but was retrievable by one of the six specific searches (Appendix 2). The search findings were then limited to English and each epoch.

Full-text online records for *Physiotherapy*, *Physiotherapy Canada*, *Physiotherapy Theory and Practice*, and *Australian Journal of Physiotherapy* were not available in CINAHL for the 1986–1989 epoch. Relevant articles for *Physiotherapy* and *Physiotherapy Canada* published in 1986–1989 were retrieved using print issues. Relevant articles for the *Physiotherapy Theory and Practice* and *Australian Journal of Physiotherapy* were retrieved using online issues published on the journals’ websites between 1986 and 1989. For all journals, titles and abstracts were independently reviewed for inclusion by two reviewers.

Consensus between reviewers was required before a study was included. If agreement could not be obtained, a third reviewer arbitrated. Relevant articles were categorised by epoch, health behaviour, and journal, and summarised in a table. Each article was assigned to as many lifestyle behaviour categories as indicated by its content. Regardless of the number of lifestyle behaviours that were included in an article, each was counted as only one article towards the total number of articles in a journal.

The total number of articles published in each of the five journals in both epochs was determined through title page counts by the two reviewers. These data were used to calculate the proportion of articles on lifestyle behaviours relative to the total number of articles published in each epoch.

### Inclusion/exclusion criteria

We had two sets of inclusion/exclusion criteria, one for articles relating to lifestyle behaviours and another for the total count of all articles.

Lifestyle behaviour article inclusion criteria were as follows:

- (i) Peer reviewed
- (ii) Written in English
- (iii) Published in *Australian Journal of Physiotherapy*, *Physical Therapy*, *Physiotherapy*, *Physiotherapy Canada*, or *Physiotherapy Theory and Practice*
- (iv) Published in one of two epochs: 1986–1989 or 2006–2009
- (v) Focused on one or more of the key lifestyle behaviours: physical activity and exercise, smoking cessation, nutrition optimisation, weight control, stress management, and sleep hygiene
- (vi) Promoted health according to the WHO definition: “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”

Lifestyle behaviour article exclusion criteria were:

- (i) Articles discussing long-term lifestyle modification for any one condition, with the exception of: cardiovascular disease, smoking-related respiratory conditions including chronic obstructive pulmonary diseases such as emphysema and chronic bronchitis, hypertension, stroke and cerebrovascular disease, cancer, diabetes mellitus, and obesity
- (ii) Articles describing short-term treatments as opposed to ongoing interventions that address health behaviour changes

Total count inclusion criteria were:

- (i) Peer reviewed
- (ii) Written in English
- (iii) Published in *Australian Journal of Physiotherapy*, *Physical Therapy*, *Physiotherapy*, *Physiotherapy Canada*, or *Physiotherapy Theory and Practice*
- (iv) Published in one of two epochs, 1986–1989 or 2006–2009

Table 1 outlines specific inclusion and exclusion criteria for the various types of articles in each of the journals.

### Statistical analysis

Due to the low number of source studies, the Fisher exact test was chosen to determine the statistical significance of the change in the number of articles between the two epochs. The data were analyzed using computer software SPSS v.17. A *p* value was calculated for each lifestyle behaviour, and for the overall number of articles on the lifestyle behaviours combined. A change in the proportion of articles was considered significant if the *p* value for the two-tailed test was <0.05.

### Results

The combined online and hand searches of the five journals identified 999 articles published between 1986 and 1989,

**Table 1** Specific inclusion and exclusion criteria for total articles count

Included
Case Reports
Clinical Reports
Reprints from other journals
Technical Reports
Anatomy Reviews
"Discussions" ( <i>Physiotherapy</i> )
"Perspectives" ( <i>Physical Therapy</i> )
"Reading Tips" ( <i>Physical Therapy</i> )
"General Communications" ( <i>Physiotherapy Canada</i> )
"Brief Communications" ( <i>Physiotherapy Canada</i> )
"Education" ( <i>Physical Therapy</i> )
"Administration" ( <i>Physical Therapy</i> )
"Clinical Notes" ( <i>Physiotherapy Canada</i> )
"Special Communications" ( <i>Physical Therapy</i> )
Excluded
Editorials
Commentaries
Letters and Responses
Conference Proceedings
Congress Reports
Symposiums
Presidential Addresses
Supplements
Progress Reports
Corrections
Book/Manuscript/Multimedia Reviews
Equipment/Product Reviews
Scholarships, Fellowships, and Grants
News/Notices
Association Business
Rejoinders ( <i>Physical Therapy</i> )
"Mary McMillan Lectures" ( <i>Physical Therapy</i> )
"The Bottom Line" ( <i>Physical Therapy</i> )
"Suggestions From the Field" ( <i>Physical Therapy</i> )
"Enid Graham Memorial Lecture" ( <i>Physiotherapy Canada</i> )
"Equipment Notes" ( <i>Physiotherapy</i> )
"Treatment Notes" ( <i>Physiotherapy</i> )
"Founder's Lecture" ( <i>Physiotherapy</i> )

and 927 published between 2006 and 2009. The process of article exclusion for both epochs is detailed in Fig. 1A and B. The final numbers of articles retained on each lifestyle behaviour in each of the five journals for both epochs appear in Table 2 as well as the Fisher exact test results for the change in proportion over time. Some articles focused on multiple lifestyle behaviours; these were counted under two or more categories. Thus, the actual number of articles identified in each journal is reported as well, in order to account for duplicates when determining overall trends. Table 3 shows the percentage that each topic category represents of the total number of articles published and was calculated based on the data in Table 2. Appendix 3 shows the source articles, i.e., those that met the inclusion criteria.

With respect to our original hypothesis, articles promoting physical activity and sleep for health increased,

but not for promoting smoking cessation, nutrition optimisation, and stress reduction for health. Our detailed findings follow.

### Physical activity

Twelve articles were published on physical activity between 1986 and 1989 compared to 34 between 2006 and 2009. This threefold increase in volume over 20 years represents a change from 1.20% to 3.67% of all articles published. The Fisher exact test  $p$  value was  $<0.001$ , supporting increased literature on physical activity and exercise.

### Smoking cessation

Two articles were published on smoking cessation during 1986–1989 compared to four in 2006–2009. The doubling in volume between the two epochs represents an increase from 0.20% to 0.43% of all articles published. The Fisher exact test  $p$  value was 0.363, supporting no increase in articles on smoking cessation.

### Nutrition optimisation

Four articles were published on nutrition optimisation between 1986 and 1989 compared to five between 2006 and 2009. The increase in articles published over the 20-year period reflects a change from 0.40% to 0.54% of all articles published. The Fisher exact test  $p$  value was calculated at 0.655, supporting no increase in articles on nutrition optimisation.

### Weight control

Two articles were published on weight control between 1986 and 1989 compared to five between 2006 and 2009. This more than doubling in volume over 20 years represents an increase from 0.20% to 0.54% of all articles published. Based on the Fisher exact test  $p$  value of 0.216, literature on weight control did not increase.

### Stress management

Fifteen articles were published on stress management between 1986 and 1989, 12 of which were published in *Physiotherapy*, compared to 5 between 2006 and 2009. This apparent reduction in the trend of stress-related articles represents a decrease from 1.50% to 0.54% of all articles published. The Fisher's exact test  $p$  value was 0.018, reflecting a decrease (rather than expected increase) in the number of articles related to stress management.

### Sleep hygiene

No articles were published on sleep hygiene between 1986 and 1989, compared to three between 2006 and 2009. This finding reflects an increase from no articles to 0.32% of all articles published. The Fisher's exact test  $p$  value was

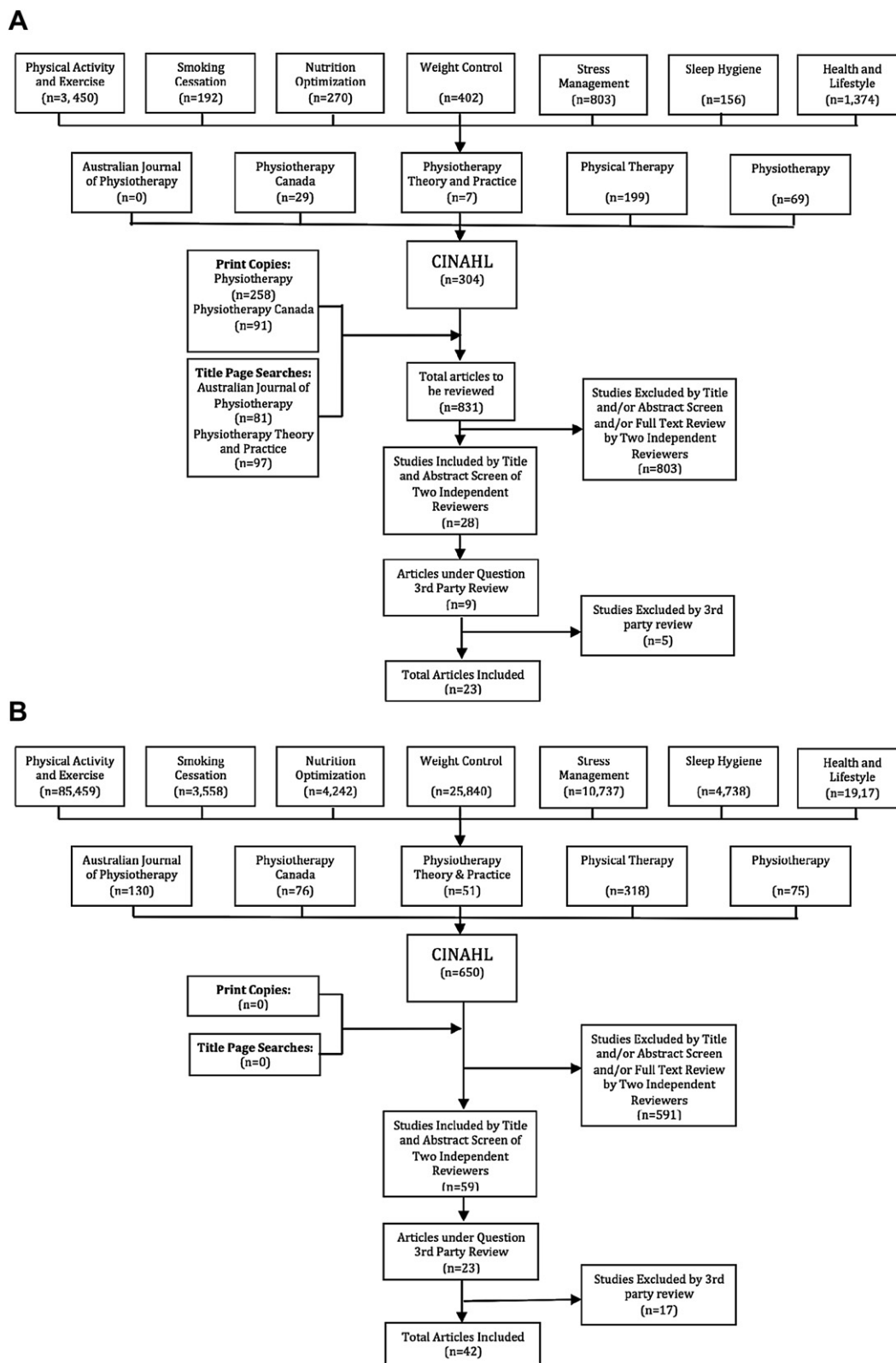


Figure 1 (A) Search strategy flowchart for 1986–1989. (B) Search strategy flowchart for 2006–2009.

**Table 2** Number of articles related to lifestyle behaviours in leading generalist physical therapy journals over two epochs

		<i>Australian Journal of Physiotherapy</i>	<i>Physical Therapy</i>	<i>Physiotherapy</i>	<i>Physiotherapy Canada</i>	<i>Physiotherapy Theory and Practice</i>	Total Articles	<i>p</i>
<b>1996–1989</b>	Physical Activity and Exercise	1	2	8	1	0	12	
	Smoking Cessation	0	0	2	0	0	2	
	Nutrition Optimisation	0	0	4	0	0	4	
	Weight Control	0	0	2	0	0	2	
	Stress Management	1	1	12	1	0	15	
	Sleep Hygiene	0	0	0	0	0	0	
	Total Articles on Lifestyle Behaviours	2	3	17	1	0	23	
	Total Articles	81	472	258	91	97	999	
<b>2006–2009</b>	Physical Activity and Exercise	6	13	6	6	3	34	>0.0001
	Smoking Cessation	0	0	0	1	3	4	0.363
	Nutrition Optimisation	1	1	0	0	3	5	0.655
	Weight Control	0	3	0	0	2	5	0.216
	Stress Management	1	0	1	0	3	5	0.018
	Sleep Hygiene	0	0	0	0	3	3	0.038
	Total Articles on Lifestyle Behaviours	7	15	7	6	7	42	0.007
	Total Articles	105	458	138	82	144	927	

0.038, supporting an increase over the 20-year time frame.

### Total

On comparison of the number of articles that focused on the six lifestyle behaviours in the five journals of interest, 23 articles were published during 1986–1989 compared to 42 between 2006 and 2009. Over 20 years, the number of articles addressing lifestyle behaviours doubled in the generalist physical therapy related literature, representing an increase from 2.30% to 4.53% of all articles published. The Fisher exact test *p* value was 0.007, supporting an increase in those articles published on the six lifestyle behaviours combined.

### Discussion

Of the six lifestyle behaviours of interest, articles related to the general health benefits of physical activity and exercise predictably increased in greater proportion between the two epochs, than other lifestyle behaviour topics. Thus, the physical therapy related literature

appears to have increased its focus on the role of physical activity and exercise in health promotion. Relative to the other lifestyle behaviours examined, the large number of articles on exercise and lifestyle-related conditions supports that physical therapists are placing greater attention to the health benefits of exercise than other lifestyle behaviours. This can be expected given that exercise is the lifestyle behaviour traditionally at the core of physical therapy, and that it is an important component of other healthy lifestyle behaviours as well, particularly weight control, stress management, and sleep hygiene. Despite the established benefits of exercise, inactivity and sedentary lifestyles that often accompany economic development have been flagged as serious health threats by the WHO [33]. Further investigation is needed on how best to close the gap between what is known in the literature and the lifestyle behaviours of the general public and, in turn, the prevalence of lifestyle-related conditions.

The number of articles published on the role of physical therapy in smoking cessation did not increase between the two epochs. Three of the four smoking cessation articles in the 2006–2009 epoch were from a special issue of *Physiotherapy Theory and Practice*. These results suggest that

**Table 3** Percentage of articles related to lifestyle behaviours in leading generalist physical therapy journals over two epochs

		<i>Australian Journal of Physiotherapy</i>	<i>Physical Therapy</i>	<i>Physiotherapy</i>	<i>Physiotherapy Canada</i>	<i>Physiotherapy Theory and Practice</i>	Total Articles
<b>1996–1989</b>	Physical Activity and Exercise	1.23	0.42	3.10	1.10	0	1.20
	Smoking Cessation	0	0	0.78	0	0	0.20
	Nutrition Optimisation	0	0	1.55	0	0	0.40
	Weight Control	0	0	0.78	0	0	0.20
	Stress Management	1.23	0.21	4.65	1.10	0	1.50
	Sleep Hygiene	0	0	0	0	0	0
	Total Percentage of Articles on Lifestyle Behaviours	2.47	0.64	6.59	1.10	0.00	2.30
	Total Articles	81	472	259	91	97	999
<b>2006–2009</b>	Physical Activity and Exercise	5.71	2.84	5.07	7.32	2.08	3.67
	Smoking Cessation	0	0	0	1.22	2.08	0.43
	Nutrition Optimisation	0.95	0.22	0	0	2.08	0.54
	Weight Control	0	0.66	0	0	1.39	0.54
	Stress Management	0.95	0	0.72	0	2.08	0.54
	Sleep Hygiene	0	0	0	0	2.08	0.32
	Total Percentage of Articles on Lifestyle Behaviours	6.67	3.28	5.07	7.32	4.86	4.53
	Total Articles	105	458	138	82	144	927

the physical therapy community may be assuming a role in initiating or supporting smoking cessation in their patients who smoke. As a health profession which aspires to focus on health overall, physical therapy is poised to address smoking and the benefits of quitting [34]. Furthermore, exercise can be an effective component of smoking cessation programmes [35] and, as clinical exercise specialists, physical therapists can play a role [36]. Although physical therapists may recognise a responsibility to advise patients to quit smoking, many report being unprepared to counsel and report barriers, e.g., lack of resources and time [36]. Further investigation into how to better prepare physical therapists to provide counselling including smoking cessation and manage barriers is indicated.

The number of articles on optimal nutrition did not change between the two epochs. Of interest is that all articles in the earlier epoch were published in one journal, *Physiotherapy*, whereas in the later epoch the topic appeared in three journals. This may reflect greater acknowledgement of patient nutrition by physical therapists. Only one article considered nutrition independently of other lifestyle behaviours and gave specific practice guidelines, reflecting a possible lack of direct research on the role of nutrition in maximising physical therapy

outcomes. Given that nutrition is linked to energy systems and utilisation, tissue healing, and weight control, basic nutritional counseling or referral to a nutritionist could be a useful adjunct to physical therapy management. Strategies for effecting basic nutritional counselling, the indicators for referring a patient to a nutritionist, and mechanisms for such referral and follow-up need to be instituted and explored vis-a-vis, these being clinical competencies in contemporary physical therapy.

Weight control has been an increasing priority given not only its global prevalence but its myriad of associated comorbidities. Once considered a problem in high-income countries, the WHO reports an exponential increase in the prevalence of overweight and obesity in low- and middle-income countries [37]. Our findings failed to show a proportional increase in articles on weight control. The health concerns associated with obesity are of considerable importance to the contemporary physical therapist as basic nutrition not only affects energy levels, but low-grade inflammation and immunity, and healing and repair, all of which impact traditional physical therapy outcomes. Energy balance, the basis for weight control, is a function of physical activity and exercise, and optimal nutrition, thus, warrants being considered clinically as well as in related research. Of the articles published in

recent years, only two addressed weight control as an independent topic. Although physical therapists are known for their clinical expertise in exercise testing and prescription, they are not primarily engaged in weight control as an adjunct to improve physical activity and exercise outcomes. Thus, contemporary physical therapists need strategies and clinical competency in assessment of body composition, and normalising energy balance in people who are overweight or obese. Given the global trend toward people being overweight or obese, it can be argued that physical therapists have a responsibility to address this issue whether it is the patient's secondary or primary problem.

Of the six lifestyle behaviours studied, stress management is the only one for which the proportion of articles published unexpectedly decreased between epochs. During 1986–1989, this topic accounted for the most articles of any lifestyle behaviour, potentially reflecting the prominence of the issue in society at the time. During 2006–2009, attention to stress management was comparable to other lifestyle behaviours, except for physical activity and exercise. The WHO has identified stress as a health epidemic this century, with stress—manifested by depressive symptoms and anxiety—reported to underlie more than 70% of doctor visits [38]. It follows that physical therapists see a significant proportion of patients experiencing stress and whose management outcomes could be enhanced with stress reduction interventions. Stress plays a major role in motivation, performance, and perception of pain and disability [39]; hence, stress is an important factor in a patient's ability to participate effectively in physical therapy, e.g., attend visits and adhere to recommendations [40], and to participate in his or her life including being in the work force. Physical therapists need clinical competency to assess stress and initiate stress reduction strategies and evaluate their outcomes, as well as refer to other health professionals. Studies are needed to determine the related skills that effect the best practice outcomes particular to physical therapy practice.

Sleep hygiene appears to be an underexamined topic in the physical therapy literature. Although we observed an increase in the number of articles between the two epochs, only three articles were identified, all published in a 2009 special issue of *Physical Therapy Theory and Practice*. Only one of those articles focused on sleep hygiene independently from other lifestyle behaviours, examining its association with medical conditions and sleep hygiene management as a physical therapy clinical competency. Poor sleep hygiene is a risk factor for several lifestyle-related conditions and sleep hygiene augments healing and health [41]. Future research on the role physical therapists can play in sleep hygiene assessment and management is needed, in that if a patient is not sleeping well, their functional capacity is not optimal nor is their psychological wellbeing.

The change in the overall proportion of articles related to lifestyle-related behaviours in the five physical therapy journals of interest appeared to increase over the 20-year time frame. This finding supports that the physical therapy academic community is placing greater attention to lifestyle behaviours and their role in patient health

overall. However, this increase appeared to be influenced largely by the physical activity and exercise engagement, indicating it, above the others, is where the physical therapy community is focusing primarily. Although this reflects traditional physical therapy practice, contemporary practice values such as the International Classification of Function, Disability, and Health is based on the holistic definition of health of the World Health Organization [4,5].

Although the proportion of articles in the physical therapy related literature on healthy lifestyle behaviours appeared to double between 1986–1989 and 2006–2009, there is no established benchmark. That lifestyle-related conditions are largely the leading causes of premature death and prolonged morbidity supports that topics related to lifestyle-related conditions and health behaviour change warrant being priorities of practice as well as in research. The results of our review support the concern that the gap between knowledge and practice persists [11,42].

Physical therapy as a profession is committed to evidence-based practice and generating evidence to support health priorities in our society. Reducing this knowledge translation gap would be a major advance within the profession. The power of healthy living in terms of effect size cannot be underestimated. In a study of more than 23,000 people between 35 and 65 years old, for example, Ford and his colleagues [43] showed that over an 8-year period, people who did not smoke, had a body mass index under 30, were physically active for at least 3.5 hours a week, and followed healthy nutritional principles, had a 78% lower risk for developing a chronic lifestyle-related condition. Specifically, the risk for type 2 diabetes mellitus was reduced by 93%, myocardial infarction by 81%, stroke by 50%, and cancer by 36%. Even if not all four of these health factors were present, the risk for developing one or more chronic lifestyle-related conditions decreased commensurate with an increase in the number of positive lifestyle factors.

It is noteworthy that even the proverbial wake-up cannot be relied upon to effect health behaviour change. Blanchard and colleagues [44] examined the health behaviours of more 9000 people with various cancer diagnoses. Although 83–92% of the cancer survivors were not smoking, only a minority were meeting the basic fruit and vegetable recommendation, i.e., 5-A-Day (15–19%) or the physical activity recommendation (30–47%). To further support healthy living in patients and clients, health-related quality of life increased commensurately with the number of positive health habits. Overall, these findings support the complexity of the determinants of lifestyle choices and, by extension, the complexity of effecting sustained health behaviour change.

Based on compelling literature, we argue that assessing health and health behaviour and implementing multiple health behaviour change are distinct clinical competencies that warrant being taught to entry-level students and in post-graduation courses. In a companion systematic review, we recently analysed health education strategies that have been selected and implemented by physical therapists in the literature [45]. A synthesis of those findings identified components of these commonly reported educational strategies were theories (e.g., transtheoretical



model and 5A's approach); timing (e.g., pre- and post-assessments and follow-up); session structure (e.g., brief advice, one-on-one, group, and telephone); technique (e.g., motivational prompts, individualised programmes, and goal setting); and delivery method (e.g., brochures, diaries, audiovisual or video, handouts, and skills demonstrations). We concluded that educational strategies may be maximally effective when targeted and tailored to the individual; however, group educational sessions do have a role.

Our study had limitations. First, as an exploration, this study did not evaluate the content of the literature or the quality of the source studies (other than they needed to be published in leading indexed generalist physical therapy journals that are peer reviewed). Second, our study did not differentiate between whether a lifestyle behaviour was a primary or secondary topic of an article, nor ranked the relative focus on each lifestyle behaviour when more than one was the focus. In addition, our findings provided an index of the responsiveness of the academic physical therapy community to the prevalence of lifestyle-related conditions; the degree to which this reflects responsiveness within the clinical community remains to be elucidated. Finally, although the adequacy of the time frame (20 years) may be questioned, we believed that 20 years should have been sufficient to have seen positive trends in the numbers of lifestyle and health topics in the physical therapy literature since the advent of the Ottawa Charter on public health in 1986. Globally, professional bodies and entry-level physical therapy educators need to consider sensitising the physical therapy community to health promotion practice in routine practice, in a systematic manner.

## Conclusion

The proportion of articles on one or more of six principal lifestyle behaviours increased over 20 years, i.e., from 1986–1989 to 2006–2009, with the greatest increase predictably related to physical activity and exercise based on traditional physical therapy practice. With respect to physical activity for health, the academic physical therapy community appears to have responded to the prevalence of lifestyle-related conditions over recent decades consistent with the thrust of major government reports and directions of the World Confederation of Physical Therapy. Despite this trend, with respect to physical exercise, however, trends were not apparent for other health behaviours (nutrition optimisation, weight reduction, and stress reduction) with the exception of sleep hygiene. The present study is the first of its kind as no benchmark exists to establish the degree to which this level of scholarly activity related to health behaviour change is sufficient or falls short of need. Our findings may help to increase the awareness of both academic and the clinical communities about the need for greater attention to lifestyle-related conditions and physical therapy's role in their prevention, in some cases reversal, as well as management, directions that are consistent with contemporary physical therapy.

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### Appendix 1 Operational definitions

Lifestyle-related Conditions	Multi-factorial health problems that can result from negative lifestyle behaviours (e.g., ischemic heart disease, chronic bronchitis and emphysema, hypertension, stroke, diabetes, and some cancers)
Lifestyle Behaviours	Modes of living that impact an individual's health status (e.g., physical activity and exercise, smoking cessation, weight control, nutrition optimisation, stress management, and sleep hygiene)
Physical Activity	A general term used for any activities that involve voluntary movement of the skeletal muscles resulting in increased energy expenditure (CINAHL)
Exercise	Physical activity which is usually regular and done with the intention of improving or maintaining physical fitness or health (CINAHL)
Smoking Cessation	Discontinuing the smoking habit (CINAHL)
Nutrition Optimisation	Obtaining the nutrition essential for healing and repair, immunity, maintaining an optimal body weight as well as providing energy for metabolism (Dean, 2009b)
Weight Control	The process by which individuals attempt to achieve and/or maintain a healthy body weight (CINAHL)
Stress Management	Strategies to minimise physical, psychological or emotional stressors of the body
Sleep Hygiene	The environmental factors, nightly habits or other practices that can influence sleep length and quality (ICSD 2001)
Responsiveness of the Professional Literature	Change over time in the proportion of peer reviewed articles on lifestyle-related conditions and lifestyle behaviours to reflect the changing prevalence in society of those issues

Appendix 2 Search strategy				
Lifestyle Behaviour	MeSH Heading		Keywords	Limiters
	1986–1989	2006–2009		
Physical Activity and Exercise	Exercise+, Exertion+, Physical Fitness	Exercise+, Physical Activity	activ*, exercis*, walk*, run*, jog*, swim*, bik*, cycl*, skat*, row*, climb*, yoga, tai chi, tai-ji, pilates (stop*, quit*) w3 (cigar*, tobacco, smok*)	<i>Australian Journal of Physiotherapy, Physical Therapy, Physiotherapy Canada, Physiotherapy Theory and Practice, English</i>
Smoking Cessation	Smoking Cessation Programs, Smoking/PC	Smoking Cessation, Smoking Cessation Programs	(diet*, nutrition*) w3 (educat*, counsel*, assess*, interven*, consult*)	<i>Physiotherapy Theory and Practice, English</i>
Nutrition Optimisation	Nutrition Education	Nutrition Education	(diet*, nutrition*) w3 (educat*, counsel*, assess*, interven*, consult*)	<i>Physiotherapy Theory and Practice, English</i>
Weight Control	Body Weight, Obesity, Weight Gain, Weight Loss, Thinness, Diet, Reducing, Weight Reduction Programs, Weights and Measures	Body Weight, Thinness, Weight Gain, Obesity, Weight Loss, Weight Control, BMI, body mass index	weight w3 (control*, manag*, reduc*, gain*, optim*)	<i>Physiotherapy Theory and Practice, English</i>
Stress Management	Stress/PC; Stress, Occupational/PC; Stress, Psychological	Stress, Psychological+, Stress Management	(stress*, anxiety) w3 (reduc*, manag*, counsel*, control*)	<i>Physiotherapy Theory and Practice, English</i>
Sleep Hygiene	Sleep Disorders+	Sleep Disorders+	sleep* w3 (hygiene, optim*, manag*, counsel*, qualit*)	<i>Physiotherapy Theory and Practice, English</i>
Overall Lifestyle Behaviour Change	Health Promotion, Life Style Changes, Behaviour, Health, Life Style	Health Promotion, Life Style Changes, Health Behaviour, Life Style, Life Style Sedentary	lifestyle modif*, life style modif*, lifestyle chang*, life style chang*, health* behav*, health* promot*	<i>Physiotherapy Theory and Practice, English</i>

Appendix 3 Source articles (journal, year, author, title, and health behaviour category)			
Journal	Year	Source Articles (Author, Title)	Category
Aus Journal	1987	Rissel, C.; <i>Water exercises for the frail elderly: a pilot programme</i>	PA&E
	1989	Ritchie, J.E., <i>Keeping Australians healthy: the challenge to physiotherapy practice posed by the concept of new public health</i>	Stress
	2006	Teo, J.S.H., et al., <i>Do sleep problems or urinary incontinence predict falls in elderly women?</i>	Sleep
	2006	Rosendahl, E., et al., <i>High-intensity functional exercise program and protein-energy supplement for older persons dependent in activities of daily living: a randomized controlled trial</i>	PA&E, Nutrition
	2007	Taylor, N.F., et al., <i>Therapeutic exercise in physiotherapy practice is beneficial: a summary of systematic reviews 2002–2005</i>	PA&E
	2008	Chien, C., et al., <i>Home-based exercise increases exercise capacity but not quality of life in people with chronic heart failure: a systematic review</i>	PA&E
	2008	Guerin, M., et al., <i>Exercise class participation among residents in low-level residential aged care could be enhanced: a qualitative study</i>	PA&E
	2009	Tamari, K., <i>Diabetes predicts decreased quality of life among community-dwelling seniors undertaking progressive resistance exercise: an observational study</i>	PA&E
	2009	Irvine, C., Taylor N.F., <i>Progressive resistance exercise improves glycaemic control in people with type 2 diabetes mellitus: a systematic review</i>	PA&E

(continued on next page)

Appendix 3 (continued)				
Journal	Year	Source Articles (Author, Title)	Category	
Phys Ther	1988	Busch A.J., McClements, J.C., <i>Effects of a supervised home exercise program on patients with severe chronic obstructive pulmonary disease</i>	PA&E	
	1988	Ramsden, E.L., Taylor, L.J., <i>Stress and anxiety in the disabled patient</i>	Stress	
	1989	Amundsen, L.R., et al., <i>Evaluation of a group exercise program for elderly women</i>	PA&E	
	2006	Forkan, R., et al., <i>Exercise adherence following physical therapy intervention in older adults with impaired balance.</i>	PA&E	
	2006	Littbrand, H., et al., <i>A high-intensity functional weight-bearing exercise program for older people dependent in activities of daily living and living in residential care facilities: evaluation of the applicability with focus on cognitive function</i>	PA&E	
	2006	Asikainen, T.M., et al., <i>Effect of brisk walking in 1 or 2 daily bouts and moderate resistance training on lower-extremity muscle strength, balance, and walking performance in women who recently went through menopause: a randomized, controlled trial</i>	PA&E	
	2006	Lin, M.R., et al., <i>Community-based tai chi and its effect on injurious falls, balance, gait, and fear of falling in older people</i>	PA&E	
	2007	Greenspan, A.L., et al., <i>Tai Chi and perceived health status in older adults who are transitionally frail: a randomized controlled trial</i>	PA&E	
	2007	Puthoff, M.L., Nielsen, D.H., <i>Relationships among impairment in lower-extremity strength and power, functional limitation, and disability in older adults</i>	PA&E	
	2007	Bohannon, R.W., <i>Number of pedometer-assessed steps taken per day by adults: a descriptive meta-analysis</i>	PA&E	
	2008	Marcus, R.L., et al., <i>Comparison of combined aerobic and high-force eccentric resistance exercise with aerobic exercise only for people with type 2 diabetes mellitus</i>	PA&E	
	2008	Chen, C., et al., <i>Clinical measures of physical fitness predict insulin resistance in people at risk for diabetes</i>	PA&E , Weight	
	2008	Gulve, EA., <i>Exercise and glycemic control in diabetes: benefits, challenges, and adjustments to pharmacotherapy</i>	PA&E, Nutrition	
	2008	Stehno-Bittel, L., <i>Intricacies of fat</i>	Weight	
	2008	Deshpande, A.D., et al., <i>Physical activity and diabetes: opportunities for prevention through policy</i>	PA&E	
	2009	Sack, S., et al., <i>Physical therapists' attitudes, knowledge, and practice approaches regarding people who are obese</i>	Weight	
	2009	Taylor, J.D., et al., <i>Impact of physical therapist-directed exercise counseling combined with fitness center-based exercise training on muscular strength and exercise capacity in people with type 2 diabetes: a randomized clinical trial</i>	PA&E	
	2009	Haga, M., <i>Physical fitness in children with high motor competence is different from that in children with low motor competence</i>	PA&E	
	Physiother	1986	Burkitt, A., <i>Health, health education and the physiotherapist</i>	PA&E, Nutrition
		1986	Lyne, P.A., <i>The professions allied to medicine — their potential contribution to health education</i>	PA&E, Nutrition, Weight, Stress
1986		Shore, M., <i>The health education council 'Look After Yourself' Programme</i>	PA&E, Stress, Nutrition, Smoking	
1986		Maclarty, J., <i>The fitness programme at Marks and Spencer Head Office</i>	PA&E	
1986		Payne, R., <i>Health education for small groups</i>	PA&E, Stress, Smoking, Weight, Nutrition	
1986		Price, C.C., <i>Confusion, depression, dementia</i>	Stress	
1986		Nixon, P.G.F., <i>Exhaustion: cardiac rehabilitation's starting point</i>	Stress	
1986		Turner, S.C., <i>Exercise training in a community sports centre</i>	PA&E	
1986		Cox, T., <i>Coronary heart disease and stress: psychosocial and behavioural factors in rehabilitation</i>	Stress	
1987		Garrett, R., <i>Back strength and fitness programme using Norsk and sequence training</i>	PA&E	

## Appendix 3 (continued)

Journal	Year	Source Articles (Author, Title)	Category
	1988	Kerr, K.M., <i>Exercise and health-related fitness</i>	PA&E
	1988	O'neill, E., <i>Change is the key to stress</i>	Stress
	1988	Saunders, C., Maxwell, M., <i>The case for counseling in physiotherapy</i>	Stress
	1989	Payne, R., <i>Glad to be yourself: a course of practical relaxation and health education talks</i>	Stress
	1989	McAteer, M.F., <i>Some aspects of grief in physiotherapy</i>	Stress
	1989	Swann, P., <i>Stress management for pain control</i>	Stress
	1989	Williams, E., <i>Stress management</i>	Stress
	2008	Egwu, M.O., Nwuga, V.C.B., <i>Relationship between low back pain and life-stressing events among Nigerian and Caucasian patients</i>	Stress
	2008	Haga, M., <i>Physical fitness in children with movement difficulties</i>	PA&E
	2008	Thow, M., Rafferty D., Kelly H., <i>Exercise motives of long-term phase IV cardiac rehabilitation participants</i>	PA&E
	2009	Houchen, L., Steiner, M.C., Singh, S.J., <i>How sustainable is strength training in chronic obstructive pulmonary disease?</i>	PA&E
	2009	Miller, J.S., et al., <i>Motivating patients with shoulder and back pain to self-care: can a videotape of exercise support physiotherapy?</i>	PA&E
	2009	Buttery, A.K., Martin, F.C., <i>Knowledge, attitudes and intentions about participation in physical activity of older post-acute hospital inpatients</i>	PA&E
	2009	Morris, J.H., Williams, B., <i>Optimising long-term participation in physical activities after stroke: exploring new ways of working for physiotherapists</i>	PA&E
Phys Canada	1988	Hannah, T.E., et al., <i>Psychological benefits of a lifestyles modification program for Workers' Compensation recipients</i>	PA&E, Stress
	2006	Mandic, S., et al., <i>Exercise training for individuals with coronary artery disease or heart failure</i>	PA&E
	2006	MacKay-Lyons, M.J., et al., <i>Cardiovascular fitness and adaptations to aerobic training after stroke</i>	PA&E
	2006	Gupta, R., Brooks, D., <i>Aerobic exercise for individuals with chronic obstructive pulmonary disease</i>	PA&E
	2006	Darrah, J., Kelly, M., <i>Aerobic exercise for children</i>	PA&E
	2007	Reid, W.D., et al., <i>The Canadian Thoracic Society recommendations for management of chronic obstructive pulmonary disease: implications for physiotherapists</i>	PA&E, Smoking
	2009	Beaton, R., et al., <i>Effects of exercise intervention on persons with metastatic cancer: a systematic review</i>	PA&E
PTT&P	2009	Dean, E., <i>Physical therapy in the 21<sup>st</sup> century (Part I): Toward practice informed by epidemiology and the crisis of lifestyle conditions</i>	All
	2009	Dean, E., <i>Physical therapy in the 21<sup>st</sup> century (Part II): Evidence-based practice within the context of evidence-informed practice</i>	All
	2009	Bodner, M., Dean, E., <i>Advice as a smoking cessation strategy: A systematic review and implications for physical therapists</i>	Smoking
	2009	Mottid, D.M., et al., <i>Strategies for optimizing nutrition and weight reduction in physical therapy practice: the evidence</i>	Nutrition
	2009	Coren, S., <i>Sleep health and its assessment and management in physical therapy practice: the evidence</i>	Sleep
	2009	Lemyre, L., Lalonde-Markon, M.P., <i>Psychological Stress measure (PSM-9): integration of an evidence-based approach to assessment, monitoring, and evaluation of stress in physical therapy practice</i>	Stress
	2009	Rhodes, R., Fiala, B., <i>Building motivation and sustainability into the prescription and recommendations for physical activity and exercise therapy: the evidence</i>	PA&E

Aus Journal = *Australian Journal*; PA&E = physical activity and exercise; Phys Can = *Physiotherapy Canada*; Phys Ther = *Physical Therapy*; Physiother = *Physiotherapy*; PTT&P = *Physiotherapy Theory and Practice*.

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