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Trends and Changes in Research on the Psychology of Physical Activity across 20 Years: A Quantitative Analysis of 10 Journals

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Abstract

Objective: To investigate content of the psychology of physical activity research over the past 20 years. **Method:** Volumes of 10 journals, identified by impact factor and relevance to physical activity were audited every other year, during the period of 1990-2008. Inclusion criteria were studies that measured a physical activity outcome, and/or a psychological outcome as a result of physical activity. Data were extracted and coded based on 15 factors. **Results:** The review yielded 889 studies for analysis. Total volume of studies (from 127 in the 1990s to 762 in the 2000s), and the proportionate content space allotted to journals has increased significantly across 20 years (effect size $w = .24$) (Cohen, 1992). Many study characteristics (assessment of minority/high-risk groups, self-report measurement, cross-sectional designs) have not changed. There was evidence, however, of less growth in research among older adults and young children (effect size $w = 0.15$) compared to other age groups (effect size $w = 0.24$), a move from pure measurement studies (effect size $w = .21$) to descriptive research (effect size $w = 0.27$), and considerable growth in environmental correlates research across time (effect size $w = 0.41$) in the 10 journals sampled. **Conclusion:** The behavioural science of physical activity has clearly increased in prominence and volume among the 10 journals sampled, but methodological characteristics of research could be improved in the future.

Physical activity has been linked to improvements in over 25 chronic conditions and has a preventive effect on most major chronic diseases (Warburton et al., 2007; Warburton et al., 2006). Indeed, regular physical activity is likely the single best prescription that people of all ages could take for a collection of health benefits (Church and Blair, 2009). Despite this accrual of evidence, regular physical activity participation is very low in most industrialized nations with at least half of the populace failing to meet minimal guideline recommendations required for health benefits (Canadian Fitness and Lifestyle Research Institute, 2004; U.S. Department of Health and Human Services, 2003). Thus, the study of behavioural participation in physical activity is of grave importance.

The study of physical activity participation is relatively young, particularly when one considers the much longer history of exercise physiology (e.g., Astrand and Ryhming, 1954; Hill and Lupton, 1923; Krebs, 1935; founding of ACSM in 1954). It wasn't until Dishman's (1988; 1994) now seminal edited books on the topic, that the discipline began to gain attention. The evidence for the increase in behavioural research in physical activity is apparent with the introduction of dedicated journals, a much larger complement of researchers, course offerings at almost all major institutions of higher learning, and considerable research funding dedicated to the topic.

As the discipline moves into its third decade of intense attention, it seems fitting to step back and ascertain where the research has taken our body of knowledge. As Nigg and Jordan (2005) point out, the psychology of physical activity is a fledgling discipline that has its roots appropriately in the fields of other more established disciplines such as sport psychology, social psychology, epidemiology, and sociology. A descriptive

assessment of behavioural research over time is helpful to identify whether our methods have improved and whether the content of our research has changed. Therefore, the purpose of this paper was to review a collection of 10 "flagship" journals to appraise, theme, and investigate content in these journals over the past twenty years, similar to the analyses conducted in other disciplines (e.g., Robins et al., 1999; Sanson-Fisher et al., 2008; Sanson-Fisher et al., 2006; Shakeshaft et al., 1997).

While the basis of this approach is exploratory, we generated some hypotheses. These were based on the template created by Sallis, Owen, and Fotheringham (2000) for classifying the maturity of behavioural research, as well as on our readings and experience in the discipline. First, it was hypothesized that the volume and proportion of behavioural research would increase over time. Second, we hypothesized that, compared to studies published in the 1990's, those published in the 2000s would employ more direct methods of physical activity measurement and samples would comprise higher-risk specialty populations (e.g., cancer survivors, older adults). Third, in line with Sallis et al. (2000), we hypothesized that more intervention work and experimental designs (total volume and proportionality) would have been conducted since 2000 compared to the 1990s; and that measurement validation and correlational designs (linkage evidence) would have been more prevalent (proportionately) during the 1990s. Fourth, in terms of theoretical advances or trends, we hypothesized that environmental approaches to understanding physical activity would have been more prevalent in recent research.

Methods

sampling

Volumes of ten English language flagship journals (American Journal of Preventive Medicine (Impact Factor from 2009 (IF) = 4.235), Annals of Behavioral Medicine (IF = 3.145), Health Psychology (IF = 3.462), International Journal of Behavioural Nutrition and Physical Activity (IF = 2.627), Journal of Physical Activity and Health (IF n/a), Journal of Sport and Exercise Psychology (IF = 2.951), Medicine and Science in Sport and Exercise (IF = 3.707), Preventive Medicine (IF = 3.172), Psychology of Sport and Exercise (IF = 2.152), and Research Quarterly in Exercise and Sport (IF = 1.103), were audited every other year, during the period of 1990-2008. Journals were identified by impact factor, relevance to the behavioural science of physical activity, and consensus between authors. These journals represent a sample of physical activity specific and general health outlets but all are generalist in terms of populations (e.g., older adults) and health conditions (e.g., cancer) so they represent an likely outlet for most behavioural physical activity research. The choice of journals was not intended to be comprehensive, and the results are considered limited to the journals chosen. All original research article titles and abstracts within these volumes were initially audited (n = 6108), and when necessary, full-texts were read.

inclusion and exclusion criteria

Reviews, meta-analyses, commentaries, letters, editorials, conference abstracts, book reviews, notes, and corrections were not evaluated nor included in the total number of audited publications. Studies on physical activity behaviour and psychological outcomes as a result of physical activity were evaluated (n = 889). From these, data were extracted and coded based on journal; country; participant number, gender, age, and ethnicity; physical activity measure used; type of research design; whether or not the

study was experimental, and if it was, duration, dose, number of arms, method of dissemination, and intervention content; and model or theory employed. When classification or coding appeared ambiguous, a decision was arrived at by discussion and consensus between the authors.

coding

Region was coded based on the country where the data were collected, and when this was not specified, coding was based on the country of employment of the primary investigator. Countries were then grouped by continent. If data were collected in more than one country, the article was coded as "multi". Participant gender was grouped as male only, female only; and mixed gender. Population age was divided into preschool (5 years and younger), child (6 to 12 years), teen (13 to 17 years), young adult (18 to 44 years), middle-aged adult (45 to 64 years), and older adult (65 years and older). If a study's participant age range overlapped coding categories, mean age was used. When mean age was not specified, median age was used. Ethnicity was divided into Mixed (≤75% Caucasian), white/Caucasian (>75% of the population), Black/African American/African (>75%), Asian (>75%), Hispanic/Mexican American/Latino (>75%), Native American/Aboriginal, and Other. When ethnicity was not specified, ethnicity was not coded.

Physical activity measure was coded as direct (accelerometer, pedometer, heart rate monitoring), direct observation (using validated or non-validated measures), validated self-report, or study-created self-report. If more than one measure was used, the study was coded based on the "highest quality" of measures utilized. If the validity of measures derived from a questionnaire was not reported, it was coded as study-created.

Research design was coded as cross-sectional (one-time measurement or longitudinal < one month), longitudinal (follow > month), pre-experimental (no control group), quasi-experimental (includes control group, no randomization), randomized controlled trial, qualitative, or measurement (creation, validation, or reliability of a measure). If the study was experimental, duration (weeks), number of arms, method of dissemination (face to face, phone, email or print without contact, or mass-media), and intervention content (persuasion; self-regulation; or experiential) were coded.

data analysis

Data analysis occurred in 2009 and included chi-square tests of proportions (of original research in behavioral medicine compared to all original research) across year (and decade) using cross tabs. Significant results ($p < .05$) were followed up by univariate chi-square analyses. Total volume estimates of original research were compared using univariate analyses of variance with Tukey post-hoc tests. Our specific analyses included basic descriptive breakdowns of behavioural research by journal, region, gender, age, ethnicity, research design, physical activity measure, theoretical frame, and intervention characteristics. This was followed by an analysis of the volume of studies across time (both absolute and relative to other original research within issues) and characteristics of participants, study design, behavior measurement, theory applied, and intervention characteristics. All analyses were conducted using SPSS 19 (IBM, 2010).

Results

study characteristics

Study characteristics for the 889 papers extracted over the last 20 years are presented in Table 1. Studies were primarily North American in origin (69%), mixed

gender (79%), and mixed ethnicity (52%). Age range of participant samples was well distributed across the population with the exception of children under 5 years of age (2%) and older adults (6%). Study designs were predominantly cross-sectional surveys of physical activity correlates (48%) followed by basic measurement validation studies (22%). Experimental designs represented 12% of the studies sampled and 65% of studies utilized self-reported behaviour.

In terms of theoretical frameworks employed, the most common has been an environmental approach (13%) followed by Bandura's (2004) social cognitive theory (7%). Over half of the research conducted cited no explicit theory. In intervention research, 38% of research cited no explicit theory. Further, social cognitive (15%) and multi-theoretical (22%) approaches were predominant while environmental approaches were relatively scant (5%). Other intervention characteristics included an average duration of six months, the primary delivery being face to face (74%), the majority of trials featuring just the experimental and control arms (62%), and a primary focus on persuasive appeals.

volume of studies across time

The total volume of studies has increased significantly over 20 years ($\chi^2_{57} = 843.07$, $p < .01$; see Table 2). For example, 127 papers were published in the 1990s among the surveyed journals compared to 762 papers in the 2000s ($\chi^2 = 453.57$, $p < .01$). This trend is exaggerated by our sampling of journals because three of these were created after the 1990s. Correcting for this methodological bias, the same results were revealed when these three journals were removed from the analysis ($\chi^2_{54} = 151.37$, $p < .01$). When further examining the seven journals that have been around since the early 1990s, an

analysis by journal showed an increase in volume for all seven journals; most notably: American Journal of Preventive Medicine ($\chi^2_7 = 151.37$, $p < .01$), Medicine and Science in Sports and Exercise ($\chi^2_9 = 96.85$, $p < .01$), and Preventive Medicine ($\chi^2_9 = 187.95$, $p < .01$).

A more conservative test of volume across time concerns the relative contribution of original physical activity studies compared to all original research studies, within the ten journals. This helps determine the relative volume of studies in the field and overcomes the absolute volume bias that may be occurring from the simple addition of more journals, journal issues, or page space across time. For example, in 2008, Preventive Medicine published 171 original research articles; of those, 64 (thus 37.4%) were in the physical activity domain. Table 3 provides the relative contribution of studies per journal by year. Overall, the results show a significant increase in proportional volume within all journals across time ($F_{9, 45} = 4.45$, $p < .01$). An analysis by decade among journals that were present across the 20 years also showed a prominent increase from 7% in the 1990s to 16% since 2000 ($t_6 = 4.40$, $p < .05$).

study participants across time

Method variations in research across time are presented in Table 2. Overall, North America had significantly more research conducted on its population than other continents ($\chi^2_2 = 126.96$, $p < .01$) but there was no significant difference across time by specific continent. In terms of gender, female ($\chi^2_9 = 124.59$, $p < .01$) and mixed gender samples ($\chi^2_9 = 697.68$, $p < .01$) have increased over time. The mean number of participants per sample ($M = 3841$) did not differ across time ($F_{9,864} = 0.93$, $p > .05$), but the age of samples published across time was different ($\chi^2_{45} = 72.47$, $p < .01$) with an

increased volume of all age groups ($p < .01$) with the exception of 0-5 and 65+ years. Further, ethnic make-up showed that mixed-ethnicity ($\chi^2_9 = 320.43$, $p < .01$) and Caucasian ($\chi^2_9 = 104.32$, $p < .01$) samples increased over time.

study design and stage of research

Our analyses suggest that designs have not changed in proportion across the 20 years ($\chi^2_{54} = 70.20$, $p > .05$). A focused assessment, however, showed that the absolute value has increased for all types of designs across time ($p < .01$). Sallis et al. (2000) suggest a framework for understanding the stage of research and assessing the growth in a behavioural domain. This includes: measurement (stage 1), descriptive (stage 2), and intervention (stage 3). While all stages of research have shown growth over the last 20 years, descriptive research has had a far more accelerated trajectory (stage 1 = $\chi^2_9 = 117.67$, $p < .01$; stage 2 = $\chi^2_9 = 579.47$, $p < .01$; stage 3 = $\chi^2_9 = 212.64$, $p < .01$).

measures employed

Behavioural assessment methods showed no difference in proportions across time (see Table 2). This finding was present when methods were subdivided into observation, direct assessment, study created self-report, and validated self-report; and when categories of objective and subjective were used. An exploration by research stage also showed no difference in proportional prevalence across time.

theories employed

The use of particular theories or theoretical frameworks has varied in their proportions across time ($\chi^2_{63} = 137.66$, $p < .01$); specifically, social cognitive theory ($\chi^2_9 = 35.43$, $p < .01$), the transtheoretical model ($\chi^2_9 = 27.49$, $p < .01$), theory of planned

behaviour ($\chi^2_9 = 30.00$, $p < .01$), environmental frameworks ($\chi^2_4 = 114.60$, $p < .01$), integrated/multiple theories ($\chi^2_9 = 102.61$, $p < .01$), and other theories collectively ($\chi^2_9 = 39.21$, $p < .01$) have all increased. Special note is taken for environmental frameworks, which shows the largest trajectory across time and was not even applied in the first 10 years surveyed. The use of no cited theoretical approach, however, also increased over time ($\chi^2_9 = 374.73$, $p < .01$). Still, there has been a significant shift over time ($\chi^2_9 = 31.23$, $p < .01$), with a gradual increase in the proportion of papers with a theoretical frame. For example, only 37% of studies in the 1990s cited using a particular frame, compared to 43% of all studies since 2000.

interventions

The mean number of participants per sample ranged from 10 to 76,710 (M = 1356, SD = 6732.5). A specific analysis of intervention characteristics across time is presented in Table 4. Duration of the interventions (M = 28 weeks, SD = 40.6 weeks, range = 1 to 312 weeks), number of experimental arms, and channel of intervention delivery were not significantly different across time. With regards to the content of the intervention, only the use of persuasive appeals has differed over time ($\chi^2_9 = 32.53$, $p < .01$).

Conclusion

The purpose of this paper was to review a collection of journals where behavioural physical activity research has had prominent submissions and to assess the methods and content in this research over the past 20 years. The study strengths include a long time-frame of assessment, a large sampling frame of journals and a quantitative analysis of the findings.

First, it was hypothesized that the total volume and proportion of behavioural physical activity research would be significantly higher across time. This had considerable support. The journals sampled that had continuity across 20 years demonstrated that the volume of studies has tripled between the 1990s and the 2000s; and the original article space allotted to this domain, in comparison to all original research articles, more than doubled over the two decades.

While these results clearly support a growth in research volume, a critical question for the evolution of the behavioural physical activity domain is whether the quality of the research has evolved over time. For this assessment, one can consider the methods employed, the stage of research, and the use of various theoretical approaches to guide interventions.

In terms of research methods, we hypothesized that participant samples would reflect the general population or high-risk populations requiring intervention, in comparison to convenience samples. The evidence provided some support for this hypothesis. There was evidence for mixed gender, age, and ethnicity sampling throughout the decades; this approach represented the bulk of research. The analysis of more targeted sampling procedures, however, showed limited change. The evidence suggests that considerable research has been conducted on females, but preschool children, older adults, and minority ethnic groups have seen scant research attention and this has not improved proportionately over the last 20 years. This finding should not be generalized beyond the journals sampled, because applied journals (e.g., older adult research published in gerontology journals) may be receiving articles on these more targeted/specific populations.

In line with the advancements in technology and the funding allotted to physical activity research, we hypothesized that recent studies would employ more direct methods of physical activity measurement compared to older research where we expected a greater prevalence of self-report. This hypothesis was not supported. There was no proportionate change in objective vs. subjective physical activity assessment. Clearly this is interesting given recent evidence on the validity concerns of self-report when compared to direct measures of physical activity (Prince et al., 2008). Indeed, when pure measurement studies were removed from our sampling, only 22% of studies included direct physical activity assessment. The inclusion of direct physical activity assessment (observation, accelerometry, pedometry) should be a goal of research in the next decade. The shift will undoubtedly improve the veracity of our research findings.

The other methodological enquiry concerned the designs employed in behavioural physical activity research. It was hypothesized that research would show a shift from passive designs to experimental/intervention methodology. This hypothesis was partially supported by the results. There was evidence that descriptive and intervention research has accelerated more proportionately to measurement research over time, but the bulk of research is in the descriptive phase. Indeed, half of all research employed cross-sectional designs and their proportionate use has not changed over the 20 year span. It seems prudent that research over the next 20 years should proceed to experimental/intervention methods when possible.

Intervention research characteristics showed little difference across the 20 years. The average length of the interventions was 6 months, with relatively no growth despite the obvious need for long-term assessment. This may be a ceiling effect due to granting

agencies and their funding windows, more-so than an autonomous desire imposed by investigators. The growth of multi-arm trials proportionate to simple experimental/control studies was not significant. This seems an important future aim. There is enough evidence to suggest that modest improvements in short-term physical activity can be gained through behavioural intervention over nothing (Hillsdon et al., 2005), but the sensitivity and effectiveness of various intervention approaches is still poorly understood (Latimer et al., 2010).

Finally, the use of various theories of physical activity across time was of key interest in our analyses. Behavioural theories are considered extremely important to understanding, guiding, and evaluating physical activity interventions (Baranowski et al., 1998; Rhodes and Pfaeffli, 2010). We hypothesized that environmental approaches to understanding physical activity would be employed in more recent research compared to older research. This hypothesis was supported. Environmental approaches were absent in the 1990s but represented the largest prevalence in the 2000s. The challenge for this approach over the next decade will be to move this research from descriptive to intervention/experimental phases. Much (93%) of this research has been based on establishing a correlation between environmental characteristics and physical activity. The advancement of this line of research will pose a considerable challenge because of the obvious expense of making environmental changes.

Perhaps the most interesting finding when assessing theoretical approaches, however, was the number of research papers that did not use a theoretical frame whether descriptively or in intervention research. Even after removing pure measurement studies, 52% of research did not include an explicit theoretical frame. A similar result has been

identified previously in general health behavior research (Painter et al., 2008). This is concerning because it does not help advance our understanding of what "works" and what "doesn't work" as research progresses. Indeed, there was little evidence of any theory waning over time which would seem important to the advancement of the discipline (Painter et al., 2008). Research on the mediators of physical activity interventions has not seen considerable growth in the last 15 years, as reported in recent reviews (Lubans et al., 2008; Rhodes and Pfaeffli, 2010). This type of research should be a focus in the future in order to advance our state of theoretical knowledge.

This analysis of 10 journals has limitations that require consideration. First, the evidence is limited to the scope of the journals chosen. Indeed, it seems highly likely that behavioural physical activity research among specialized journals (e.g., Journal of Aging and Physical Activity, Pediatric Exercise Science) would be different based on their specialization. Still, it is the breadth of the 10 journals chosen that provides precisely the kind of assessments of overall physical activity trends and changes assessed in this review. Journals with restricted focus (e.g., cancer journals) would lack the variability for assessment over time. Similarly, the locations where research was conducted favored North America, but this may be a reflection of the journals included. Finally, our findings are limited to original research (i.e., not reviews, commentaries, editorials, etc.) and to our coding structure.

In summary, the total volume of behavioural physical activity research has increased significantly across 20 years as well as the proportionate content space allotted to journals. There was some evidence that the domain has shifted from measurement studies to descriptive research, but experimental intervention research is still relatively

scant. Further, methodological characteristics such as physical activity measurement, sampling, designs, and intervention characteristics have changed little in the last two decades. By contrast, there has been a major theoretical shift to environmental models of physical activity, but many studies still lack the inclusion of any theoretical frame.

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Table 1
Study Characteristics of the Journals Sampled from 1990 to 2008.

	Total n (%)
Journal	
American Journal of Preventive Medicine	66 (7)
Annals of Behavioural Medicine	46 (5)
Health Psychology	41 (5)
International Journal of Behavioural Nutrition and Physical Activity	76 (9)
Journal of Physical Activity and Health	120 (14)
Journal of Sport and Exercise Psychology	46 (5)
Medicine and Science in Sports and Exercise	203 (23)
Preventive Medicine	174 (20)
Psychology of Sport and Exercise	32 (4)
Research Quarterly in Exercise and Sport	85 (10)
Region	
North America	611 (69)
Australia/New Zealand	98 (11)
Europe	131 (15)
Mediterranean/Middle East	9 (1)
Asia	20 (2)
Africa	2 (0)
South America	4 (0)
Multi	14 (2)
Gender	
Male	23 (3)
Female	145 (16)
Mixed	703 (79)
Age	
preschool - 5 years old and under	20 (2)
child - 6-12 years old	129 (15)
teen - 13-17 years old	116 (13)
young adult - 18-44 years old	308 (35)
middle-aged adult - 45-64 years old	244 (27)
older adult - 65 years and older	52 (6)
Ethnicity	
Mix	233 (52)
white/Caucasian	155 (34)
black/African American/African	23 (3)
Asian	16 (2)
Hispanic/Mexican American/Latino	7 (1)
Native American/Aboriginal	6 (1)

Other	11 (1)
Physical Activity Measure	
direct	242 (31)
direct observation	28 (4)
validated self-report	297 (38)
study created	207 (27)
Design	
cross-sectional	422 (48)
longitudinal	91 (10)
pre-experimental	41 (5)
quasi-experimental	16 (2)
randomized controlled trial	106 (12)
qualitative	17 (2)
measurement	195 (22)
Theoretical Frame	
Social Cognitive Theory	63 (7)
Transtheoretical Model	35 (4)
Theory of Planned Behaviour	30 (3)
Self-determination Theory	14 (2)
Environmental frameworks	117 (13)
Multi-Theory	77 (9)
Other	39 (4)
No theory explicitly stated	514 (58)
Intervention studies	162 (18)
Number of trial arms	
1	17 (11)
2	98 (62)
3	30 (19)
4+	14 (9)
Channel of dissemination	
face to face	115 (74)
phone	12 (8)
email or print	21 (14)
mass media	7 (5)
Type of intervention content	
persuasion	117 (72)
self-regulation	73 (45)
experiential	52 (32)

Theoretical Frame		
	Social Cognitive Theory	25 (15)
	Transtheoretical Model	15 (9)
	Theory of Planned Behaviour	7 (4)
	Self-determination Theory	2 (1)
	Environmental frameworks	8 (5)
	Multi-Theory	36 (22)
	Other	8(5)
	No theory	61 (38)
Length of intervention in weeks (M, SD)		28.7, 40.9

Table 2
Study Volume by Content and Methodological Characteristics of the Journals Sampled between 1990 and 2008

	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008		P-Value
Total	25	21	27	30	24	77	72	139	174	300		.00
Journal												.00
American Journal Preventive Medicine		1	0	1	0	1	6	10	8	15	24	
Annals of Behavioural Medicine		0	0	0	0	3	4	4	7	11	17	
Health Psychology	8	4	1	3	1	4	4	3	6	7		
International J of Behav Nutr & PA								9	18	49		
J of Physical Activity and Health									17	35	68	
J of Sport and Exercise Psychology	1	4	6	5	0	3	2	9	8	8		
Med & Sci in Sports & Exercise		4	3	5	13	14	27	22	39	43	33	
Preventive Medicine	3	3	10	5	2	21	13	31	22	64		
Psychology of Sport and Exercise						3	3	5	5	16		
Research Q. for Exercise and Sport	8	7	4	4	3	10	13	11	11	14		
Continent												.05
North America		25	19	22	23	20	55	47	96	123	181	
Australia/New Zealand		0	0	1	3	2	6	9	14	20	43	
Europe	0	2	2	4	1	14	11	21	22	54		
Gender												.58
Male	1	2	2	2	2	1	1	5	5	3		
Female	2	3	6	5	4	13	12	27	29	44		
Mixed	22	17	19	23	18	62	57	107	132	246		
Age												.00
0-5	3	1	0	1	0	2	0	0	4	9		
6-12	6	2	3	8	3	5	5	17	27	53		
13-17	3	1	4	4	2	7	10	25	36	24		
18-44	9	10	9	5	5	34	35	55	63	83		
45-64	3	7	7	11	12	23	17	34	40	90		
65+	1	0	4	1	2	5	3	8	7	21		
Ethnicity												.33
Mixed (representative)		1	3	2	6	6	16	18	36	58	87	
Caucasian	8	5	5	9	5	13	13	21	30	46		

Black	0	0	2	0	0	2	1	6	3	9	
Asian	0	0	1	0	0	0	2	1	4	8	
Hispanic	0	0	0	0	0	1	0	0	2	4	
Aboriginal/Native	0	0	0	0	1	0	0	1	0	4	
Other	0	0	0	0	1	0	2	1	1	6	
Design											.07
Measurement	6	3	7	9	6	24	19	36	47	38	
Cross-Sectional		11	13	15	14	7	31	30	64	88	149
Qualitative	0	0	0	0	0	1	0	3	1	12	
Longitudinal	6	2	2	2	4	9	6	13	14	33	
Pre-Experimental	0	1	1	1	3	6	7	6	4	12	
Quasi-Experimental	0	0	0	0	1	0	1	3	3	8	
Experimental	2	2	2	4	3	6	9	14	17	47	
Research Stage											.01
Measurement	6	3	7	9	6	24	19	36	47	38	
Descriptive	17	15	17	16	11	41	36	80	103	194	
Intervention	2	3	3	5	7	12	17	23	24	67	
Behaviour Measurement											.10
Observation	2	1	2	0	0	3	1	2	5	12	
Direct (accelerometry, pedometry)	4	3	5	9	5	23	13	46	53	81	
Validated Self-Report	9	5	4	5	10	18	26	42	61	117	
Study Created Self-Report	6	6	12	7	6	22	18	33	41	56	
Theory Used											.00
Social Cognitive Theory		0	6	3	5	2	3	6	5	17	16
Transtheoretical Model		0	2	1	1	4	1	1	7	7	11
Theory of Planned Behavior	2	1	2	1	0	1	2	4	5	12	
Self-Determination Theory	0	0	0	0	0	1	2	4	5	12	
Environmental Frameworks	0	0	0	0	0	2	5	14	30	65	
Multi-Theory	2	1	1	3	1	10	11	4	13	31	

Other	4	1	3	1	2	2	2	5	4	15
No theory	17	10	17	19	15	57	43	97	95	145

Table 3
Percent Volume of Studies by Year for the Journals Sampled Between 1990 and 2008

	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	P-Value
Total	9	6	8	7	4	11	11	16	20	29	.00
Journal											
American Journal Preventive Medicine	4	0	4	0	1	7	14	8	11	18	
Annals of Behavioural Medicine	0	0	0	0	10	12	13	16	23	27	
Health Psychology	16	8	2	6	2	6	6	5	8	6	
International J of Behav Nutr & PA							82	55	79		
J of Physical Activity and Health								68	67	87	
J of Sport and Exercise Psychology	4	16	26	28	0	12	17	23	29	22	
Medicine & Sci in Sports & Exercise	5	2	4	8	6	9	8	15	16	13	
Preventive Medicine	6	5	14	7	2	15	11	12	16	37	
Psychology of Sport and Exercise					43	23	18	19	31		
Research Q. for Exercise and Sport	14	15	9	10	7	25	23	26	20	23	

Table 4
Study Characteristics of Behavioural Interventions of the Journals Sampled between 1990 and 2008.

	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	P-Level
Length in Weeks											.06
M	8.0	5.3	27.3	84.6	19.0	30.1	22.4	23.1	47.5	22.2	
SD	0.0	4.0	21.9	77.0	17.4	36.0	19.3	24.6	75.0	27.5	
# of arms											.28
1	0	1	1	1	1	2	0	2	1	9	
2	2	1	2	4	2	6	8	18	16	39	
3	0	1	0	0	4	1	4	2	6	12	
4+	0	0	0	0	0	2	5	0	1	6	
Intervention Delivery											.58
Face to Face	2	3	3	4	5	11	10	20	18	39	
Phone	0	0	0	0	0	0	4	2	3	3	
Print	0	0	0	0	1	1	2	1	2	14	
Media	0	0	0	0	0	0	1	0	1	5	
Content											
Persuasion	1	1	1	3	2	6	14	17	20	52	.03
Self-regulation	1	2	2	2	2	6	6	8	15	29	.67
Experiential	2	1	1	1	4	6	3	10	7	18	.18
Behaviour Measurement											.43
Observation	0	0	0	0	0	0	1	1	0	3	
Direct (accelerometry, pedometry)	0	0	0	2	0	3	2	11	5	20	
Validated Self-Report	0	0	1	0	3	5	8	4	12	27	
Study Created Self-Report	1	1	2	1	1	3	2	5	6	12	
Theory Used											.68
Social Cognitive Theory		0	2	1	2	0	1	3	3	6	7
Transtheoretical Model		0	0	0	1	2	1	1	3	2	5
Theory of Planned Behavior	0	0	0	0	0	0	0	1	0	6	
Self-Determination Theory	0	0	0	0	0	0	0	0	1	1	

Environmental frameworks	0	0	0	0	0	0	0	2	1	5
Multi-Theory	0	0	1	0	1	4	6	1	7	16
Other	0	0	0	0	0	1	0	2	0	5
No theory	2	1	1	2	4	5	7	11	7	21