Sources of practice knowledge among Australian fitness trainers

Jason A. Bennie, PhD,¹ Glen H. Wiesner, PhD,¹ Jannique G. Z. van Uffelen, PhD,^{1,2} Jack T. Harvey, PhD,^{1,3} Stuart J. H. Biddle, PhD¹

¹Active Living and Public Health Program, Institute of Sport, Exercise and Active Living (ISEAL), Victoria University, PO Box 14428, Melbourne, VIC 8001, Australia

²Department of Kinesiology, Physical Activity, Sports and Health Research Group, KU Leuven—University of Leuven, B-3000, Leuven, Belgium

³Faculty of Health, Federation University Australia, Ballarat, VIC, Australia

Correspondence to: J Bennie
jason.bennie@vu.edu.au

Cite this as: *TBM* 2017;7:741–750
doi: 10.1007/s13142-017-0482-4

© Society of Behavioral Medicine 2017

Abstract

Few studies have examined the sources of practice knowledge fitness trainers use to inform their training methods and update knowledge. This study aims to describe sources of practice knowledge among Australian fitness trainers. In July 2014, 9100 Australian fitness trainers were invited to complete an online survey. Respondents reported the frequency of use of eight sources of practice knowledge (e.g. fitness magazines, academic texts). In a separate survey, exercise science experts ($n = 27$) ranked each source as either (1) ‘high-quality’ or (2) ‘low-quality’. Proportions of users of ‘high-quality’ sources were calculated across demographic (age, sex) and fitness industry-related characteristics (qualification, setting, role). A multivariate logistic regression analysis assessed the odds of being classified as a user of high-quality sources, adjusting for demographic and fitness industry-related factors. Out of 1185 fitness trainers (response rate = 13.0%), aged 17–72 years, 47.6% (95% CI, 44.7–50.4%) were classified as frequent users of high-quality sources of practice knowledge. In the adjusted analysis, compared to trainers aged 17–26 years, those aged ≥ 61 years (OR, 2.15; 95% CI, 1.05–4.38) and 40–50 years (OR, 1.54; 95% CI, 1.02–2.31) were more likely to be classified as a user of high-quality sources. When compared to trainers working in large centres, those working in outdoor settings (OR, 1.81; 95% CI, 1.23–2.65) and medium centres (OR, 1.59; 95% CI, 1.12–2.29) were more likely to be classified as users of high-quality sources. Our findings suggest that efforts should be made to improve the quality of knowledge acquisition among Australian fitness trainers.

Keywords

Knowledge translation, Evidence-based practice, Personal trainers, Group/gym instructors

Introduction

There is strong scientific evidence that physical inactivity increases the risk of poor cardiovascular, metabolic, respiratory, mental, musculoskeletal and functional health and also risk of breast and colon cancer [1, 2]. Furthermore, physical inactivity has a high economic burden, costing an estimated 67.5 billion USD in global healthcare expenditure and lost

Implications: ‘Sources of practice knowledge among Australian fitness trainers’

Practice: When acquiring new knowledge about their industry, fitness trainers (e.g. personal trainers, group/gym instructors) should ensure that sources align with proven principles of exercise science and exercise prescription.

Policy: To allow for standardization and quality control systems for exercise science, knowledge translation for fitness trainers should be centrally developed by the governing bodies of the fitness industry (such as Exercise & Sports Science Australia and the American College of Sports Medicine).

Research: Researchers should investigate the facilitators and barriers that fitness industry-related governing bodies encounter in developing knowledge translation systems, as well as the types of information fitness trainers perceive both interpretable and appropriate for implementation in their training practices.

productivity in 2013 [3]. For optimal health and well-being, The World Health Organisation’s (WHO) 2010 ‘Global Recommendations on Physical Activity for Health’ state that an adult should engage in (1) 150 min per week of moderate-intensity aerobic physical activity (MPA) or 75 min per week of vigorous-intensity aerobic physical activity (VPA) or an equivalent combination of MVPA, and (2) muscle strengthening activity (resistance/strength training) involving major muscle groups ≥ 2 days per week [2]. However, recent physical activity surveillance studies have estimated that 85% of Australian adults (18+ years) and 79% of U.S adults (18+ years) do not meet the combined MVPA and muscle strengthening activity guidelines [4, 5]. Given the low prevalence levels of those meeting the guidelines and the multiple health benefits associated with regular physical activity, there is an urgent need to devise sustainable methods to

promote and support population-level participation levels [6].

While physical inactivity is now recognised as a leading global public health challenge, comprehensive public health systems-based approaches to address this health risk are limited [7]. The accessibility of skilled and knowledgeable health professionals is a key aspect of public health-oriented approaches to improve population health [8]. Fitness trainers (e.g. personal trainers, group/gym instructors) are a group of health professionals that may have a key role in promoting and supporting physical activity adherence [9, 10]. In addition to being able to access equipment to perform a wide range of exercise modes, fitness trainers should be trained in aspects of exercise science, including goal setting, pre-exercise screening, safe program design and exercise instruction [11]. Highlighting a potential for great population reach, in 2011, it was estimated that ~30,000 adults were employed full time, part time or casually within the Australian fitness industry [12]. Moreover, although data on public fitness trainer utilisation are lacking or unreliable, in 2016, it was estimated that there are 3300 gyms/fitness centres in Australia—a 33% increase in 5 years—suggesting a substantial and growing public interest in fitness centres and trainers [13].

If fitness trainers are to contribute to promoting community-level physical activity and other health-enhancing behaviours, it is important that their knowledge base and practices align with proven principles and current evidence. This approach is referred to as ‘evidence-based practice’, and is in alignment with the practices of other health professionals (physical therapists, occupational therapists, dieticians etc.) [14]. Indeed, with respect to the professional competency of fitness trainers, The American College of Sports Medicine’s (ACSM) ‘Resources for the Personal Trainer’ states that a trainer’s professional decisions should be based on ‘proven principles of exercise science/prescription’ as well as ‘current scientific evidence’ [11]. Hence, understanding the ways fitness trainers acquire practice knowledge is important.

In spite of the above, a recent review reported that little is known about the professional practices of fitness trainers [9]. In 2010, Stacey et al. [17] conducted a systematic review examining practice knowledge translation among fitness trainers. The review identified that only two studies had addressed this issue, comprising a cross-sectional survey of 325 U.S. fitness trainers [15] and a small qualitative study involving 10 fitness trainers from New Zealand [16]. The main finding from that review was that very little was known about the sources of information that fitness trainers use to obtain practice knowledge [17]. However, the limited data suggested that when compared to lower educated trainers (non-university educated), higher educated trainers (university educated) were more likely to report the use of ‘evidence-based’ information sources (e.g. scientific journals, academic text books) [17].

To our knowledge, since the review by Stacey et al. [17], there has been no research examining the common sources of practice knowledge among a large

representative sample of fitness trainers. Such research is important because it will provide an understanding into whether trainers use evidence-based sources. Moreover, these insights may identify areas where professional development and practices of trainers can be improved.

Assessing a large representative sample of Australian fitness trainers, the aims of this study were to, first, determine the common sources of practice knowledge and, second, to examine how these sources of practice knowledge differed across sociodemographic (age, sex, education level) and professional characteristics (fitness industry setting, length of time in the industry, method to obtain qualification).

Methods

Recruitment

The study protocol was approved by the Victoria University Ethics Committee (reference—HRE 14-070), and informed consent was obtained from each participant. The recruitment methods used in this study have been described in detail elsewhere [11]. In brief, a convenience sample of fitness trainers was recruited via a research collaboration with Fitness Australia (<https://fitness.org.au>). Fitness Australia is the peak health and fitness industry association in Australia. This organisation provides a range of support services and solutions to ~30,000 Registered Fitness Instructors, Registered Personal Trainers and fitness businesses. To be a registered fitness trainer in Australia, there is a minimum requirement to have at least a Certificate III in Fitness. More information on the Australian Fitness Industry qualifications can be found elsewhere (<https://fitness.org.au>).

In June 2014, an email invitation was sent to a database of currently registered Australian fitness trainers to participate in an online survey [11]. A total of 9100 emails were initially sent from the database. Of those who received the email, 1980 opened the online survey and 1185 completed the entire survey [response rate (RR) = 13.0%].

Survey format

The survey was delivered in an online format and asked participants to report general demographic (e.g. sex, age, region of residence) and specific fitness industry-related factors (e.g. time worked as a fitness trainer, time to obtain qualification, fitness industry role, fitness industry setting in which participants worked). Sociodemographic and fitness industry-related characteristic subcategories were created to be consistent with a previous study [11]. See Table 1 for a complete description of the response categories for each characteristic.

Sources of practice knowledge

Sources of practice knowledge were assessed by asking participants to respond to the following question: ‘When looking for new exercises, programs or training ideas

Table 1 | Percentage of selected sociodemographic and industry-related characteristics of Australian Fitness Professionals: overall and by sex

	All (<i>n</i> = 1185) Mean (SD)	Male (<i>n</i> = 343) Mean (SD)	Female (<i>n</i> = 842) Mean (SD)	<i>p</i> value ^a
Age (years)	39.3 (11.6)	38.3 (12.4)	39.7 (11.2)	0.590
Age (years)	% (<i>n</i>)	% (<i>n</i>)	% (<i>n</i>)	<i>p</i> value ^b
17–26	15.7 (186)	21.6 (74)	13.3 (112)	0.001*
27–39	35.8 (424)	35.6 (122)	35.9 (302)	
40–50	30.0 (356)	23.6 (81)	32.7 (275)	
51–60	14.7 (174)	14.3 (49)	14.8 (125)	
≥61	3.8 (45)	5.0 (17)	3.3 (28)	
Region				
Urban	66.3 (786)	72.0 (247)	64.0 (539)	0.010*
Regional	28.5 (338)	25.1 (86)	29.9 (252)	
Remote	5.1 (61)	2.9 (10)	6.1 (51)	
Time as a fitness industry professional				
<3 months	4.1 (49)	4.4 (15)	4.0 (34)	0.160
3–6 months	4.3 (51)	4.4 (15)	4.3 (36)	
6–12 months	7.3 (86)	7.6 (26)	7.1 (60)	
1–3 years	29.9 (354)	33.2 (114)	28.5 (240)	
4–9 years	28.9 (342)	30.3 (104)	28.3 (238)	
10 years or more	25.6 (303)	20.1 (69)	27.8 (234)	
Fitness industry employment status				
Full time	30.5 (361)	42.3 (145)	25.7 (216)	<0.001**
Part time	31.8 (377)	26.8 (92)	33.8 (285)	
Casual	34.2 (405)	26.8 (92)	37.2 (313)	
Unpaid/voluntary	3.5 (42)	4.1 (14)	3.3 (28)	
Fitness industry qualification				
Certificate III in Fitness	10.5 (124)	5.2 (18)	12.6 (106)	<0.001**
Certificate IV in Fitness	67.4 (799)	68.2 (234)	67.1 (565)	
Diploma of Fitness	7.8 (92)	8.5 (29)	7.5 (63)	
Undergraduate/Graduate Diploma degree in Exercise Sciences	8.7 (103)	12.8 (44)	7.0 (59)	
Other	5.7 (67)	5.2 (18)	5.8 (49)	
Time to obtain fitness industry qualification				
<6 weeks	3.8 (45)	4.1 (14)	3.7 (31)	0.756
Between 6 and 12 weeks	13.4 (159)	14.6 (50)	12.9 (109)	
Around 3–6 months	24.5 (290)	25.4 (87)	24.1 (203)	
6–12 months	29.5 (349)	26.8 (92)	30.5 (257)	
1 year or more	28.9 (342)	29.2 (100)	28.7 (242)	
Mode to obtain fitness industry qualification				
Face-to-face learning—attending classes or workshops	52.9 (627)	58.9 (202)	50.5 (424)	<0.001**
Online course—completed online modules	14.1 (167)	8.7 (30)	16.3 (137)	
A mix of face-to-face learning and online course	33.0 (391)	32.4 (111)	33.3 (280)	
Fitness industry role				
Personal trainer	29.6 (351)	38.8 (133)	25.9 (218)	<0.001**
Group instructor	36.5 (433)	25.9 (89)	40.9 (344)	
Gym instructor	4.4 (52)	2.9 (10)	5.0 (42)	
All three types of instructor	24.7 (293)	28.3 (97)	23.3 (196)	
Other (e.g. Yoga, Pilates, Aqua trainer)	4.7 (56)	4.1 (14)	5.0 (420)	
Fitness industry setting				
Large corporate gym or community health centre (>500 members)	32.9 (390)	34.4 (118)	32.3 (272)	0.153
Medium size gym or fitness centre (between 100 and 500 members)	17.6 (209)	15.5 (53)	18.5 (156)	
Small studio setting	13.4 (159)	13.7 (47)	13.3 (112)	
Outdoor setting	15.5 (184)	18.4 (63)	14.4 (121)	
Train clients from own home/visit clients home	11.4 (135)	11.7 (40)	11.3 (95)	
Other	9.1 (108)	6.4 (22)	10.2 (86)	

p* < 0.05, *p* < 0.001^a *t* test of significance between males and females^b χ^2 of significance between males and females

do you use any of the following resources?’ A total of eight items were provided as response choices, which were adapted from a previous systematic review of knowledge translation among fitness trainers [17] and consultation with several leading academics in the field of exercise science. A full list of practice knowledge items is shown in Table 2; examples included scientific journals (e.g. exercise/sports science-related), online fitness training-related forums and workshops/specialised courses. Response options were provided on a categorical 4-point scale: (1) ‘always’, (2) ‘sometimes’, (3) ‘rarely’ and (4) ‘never’.

Test–retest reliability of sources of practice knowledge items

To examine the reliability of the sources of practice knowledge items, a sub-sample of participants ($n = 211$, 73% female, mean age = 27.1 ± 10.8 years) were invited to repeat an abbreviated online version of the original survey with a minimum 14-day interim period.

Exercise science expert panel rating of quality of sources of practice knowledge

To examine the quality of the sources of practice knowledge items, we conducted a separate online survey with a convenience sample of exercise

prescription experts. The separate study protocol was sanctioned by the Victoria University Ethics Committee (reference—HRE 14-262), and informed consent was attained from each participant. For this sub-study, 65 university academics and fitness industry professionals working in the field of exercise prescription were invited to participate in a separate online survey. Experts were identified by consulting with a leading academic in the field of exercise science and key fitness industry professionals.

In brief, the expert panel survey included demographic questions (e.g. age, sex, region of residence, highest exercise prescription-related qualification, length of time in the field of exercise prescription, current role). A total of 27 experts participated in the study (RR = 41.5%). The final sample were mostly males (70.4%), had been working in the exercise prescription/science field for 19.9 years (± 7.1 years), 55.6% had a PhD in exercise-prescription related fields and most (87.6%) were currently working as either full-time academics teaching and lecturing undergraduate and post-graduate students or instructing in accredited Certificate III–IV and Diploma of Fitness courses (data available on request).

Experts were asked to rate their perception of importance of the individual sources of practice

Table 2 | Proportions reporting frequency of use of common sources of fitness industry practice knowledge, quality rating^a of each item and test–retest reliability^b of each item: overall

Sources of practice knowledge	Response (%)				Quality rating ^a Mean (SD)	Test–retest reliability ^b ICC (95% CI)
	Always	Sometimes	Rarely	Never		
High-quality						
Exercise/sports science-related academic text books	18.4	42.8	28.4	10.4	9.12 (±0.97)	0.61 (0.52–0.69)
Workshops or specialised courses	31.2	58.4	8.8	1.6	9.08 (±0.91)	0.57 (0.47–0.66)
Scientific journals: exercise/sports science-related	24.3	48.0	20.1	7.6	9.00 (±1.26)	0.71 (0.63–0.77)
Low-quality						
Get ideas from other trainers	31.2	56.0	9.3	3.5	6.52 (±2.40)	0.61 (0.52–0.69)
Generally develop my own ideas	25.0	62.5	9.3	3.3	6.36 (±1.85)	0.67 (0.59–0.74)
Online fitness training-related forums	15.6	47.7	26.0	10.6	6.28 (±2.19)	0.49 (0.38–0.59)
Online search for fitness training-related websites	37.0	51.3	7.9	3.8	5.84 (±2.75)	0.63 (0.54–0.71)
Popular fitness magazines	12.3	47.4	22.8	17.5	4.24 (±2.37)	0.75 (0.68–0.80)

^a Quality rating derived from expert panel ($n = 27$) rating each source—‘10’ (*Extremely important*) to ‘1’ (*Not at all important*)

^b Reliability based on a sub-sample of participants ($n = 211$) who repeated their responses to these items after a minimum of 14 days

knowledge items/constructs on a 10-point scale; ‘*7*’ (*Extremely important*) to ‘*10*’ (*Not at all important*). These items were then reverse coded to ‘*10*’ (*Extremely important*) to ‘*7*’ (*Not at all important*). A mean quality rating (QR) was then calculated for each construct. As shown in Table 2, three sources stood out with clearly higher ratings than the remaining five: (1) ‘*Exercise/sports science-related academic text books*’ (QR = 9.12 ± 0.97), (2) ‘*Workshops or specialised courses*’ (QR = 9.08 ± 0.91) and (3) ‘*Scientific journals: exercise/sports science-related*’ (QR = 9.00 ± 1.26). The remaining five constructs had a QR range of 4.24–6.52. Therefore, we grouped the sources into two categories: (1) ‘*High-quality practice knowledge sources*’ (including the top three rated constructs) and (2) ‘*Low-quality practice knowledge sources*’ (the remaining five constructs). See Table 2 for a full description of the experts’ quality ratings.

Fitness trainers’ sources of practice knowledge quality rating

Our fitness trainer sample was dichotomised as either a (1) ‘*user of high-quality sources of practice knowledge*’ or a (2) ‘*user of low-quality sources of practice knowledge*’. To be classified as a ‘*user of high-quality sources of practice knowledge*’, respondents had to report ‘*always*’ or ‘*sometimes*’ using all three expert-rated ‘*high-quality practice knowledge sources*’ [i.e. (1) ‘*Exercise/sports science-related academic text books*’ AND (2) ‘*Workshops or specialised courses*’ AND (3) ‘*Scientific journals: exercise/sports science-related*’]. Respondents were classified as a ‘*user of low-quality sources of practice knowledge*’ if they did not meet the above criteria.

Statistical analysis

Data analyses were done using IBM SPSS Statistics 22 (SPSS Inc., an IBM Company, Chicago, IL, USA). Descriptive statistics were used to describe the characteristics of the overall sample and by sex. An independent *t* test was used to assess whether age in years differed by sex. A Pearson’s chi-squared test examined whether there were sex differences by age collapsed into five categories, region of residence, length of time as a fitness professional, fitness industry qualification, mode to obtain fitness industry qualification, fitness industry role and fitness industry setting (see Table 1). For all statistical tests, a *p* value of <0.05 was used to indicate significance.

Responses to the eight items assessing fitness professionals’ common sources of practice knowledge were reported for the total sample as percentages reporting (1) ‘*Always*’, (2) ‘*Sometimes*’, (3) ‘*Rarely*’ or (4) ‘*Never*’ using each source (Table 2). Intraclass correlation coefficients (ICC) were calculated to evaluate the relative agreement between test and retest for these items. Our analysis implemented a random two-way effect model and used tests for absolute agreement. This statistical approach is the equivalent of using quadratic weighted Cohen’s kappa coefficients of agreement [18]. For individual items, the ICC value and its 95% confidence interval (CI) are reported. An ICC value of 0.2–0.4 suggests poor agreement, 0.5–0.6 suggests moderate

agreement, 0.7–0.8 suggests strong agreement and >0.8 suggests almost perfect agreement [19].

The percentage and 95% CI of the sample classified as a ‘*user of high-quality sources of practice knowledge*’ were reported for the overall sample and by sociodemographic and fitness industry-related variables. A Pearson’s chi-squared test examined whether there were differences across categories.

A logistic regression analysis was used to assess the odds of being classified as a ‘*user of high-quality sources of practice knowledge*’. The dependent variable was dichotomous and items were transformed to indicate if a participant was classified as a (1) ‘*user of high-quality sources of practice knowledge*’ or (2) a ‘*user of low-quality sources of practice knowledge*’. The model included the following independent variables: sex (reference = ‘Male’), age (reference = ‘17–26 years’), time as fitness professional (reference = ‘ <3 months’), fitness industry qualification (reference = ‘Certificate III in Fitness’), time to obtain fitness industry qualification (reference = ‘ <6 weeks’), fitness industry employment status (reference = ‘Full-time’), mode to obtain fitness industry qualification (reference = ‘Face-to-face learning’), fitness industry role (reference = ‘Personal trainer’) and fitness industry setting [reference = ‘Large corporate gym or community health centre (>500 members)’]. The reference categories for the independent variables were created to be consistent with a previous study reporting on these data [11]. Adjusted odds ratios and their 95% CI were reported for this analysis.

Results

As shown in Table 1, a total of 1185 fitness professionals completed the online survey. The mean age of respondents was 39.3 years (± 11.5 , range 17–72 years), 71% were female and 66.4% were from urban settings. Over three quarters had worked in the fitness industry for 1 year or more. Over one third were employed on a casual basis, and 68.2% had a Certificate IV in Fitness qualification. To examine the representativeness of the sample, we made comparisons to previous descriptions of the demographic profile of Australian fitness trainers [10, 12]. Comparisons show that our sample had similar sex profile [10, 12] and similar proportions of trainers by fitness industry qualifications and educational levels and located across Australian States or Territories [12].

The expert-panel ratings of individual sources of practice knowledge are shown in Table 2. The three highest quality items were ‘*Exercise/sports science-related academic text books*’ [mean quality rating (QR) = 9.12 ± 0.97], ‘*Workshops or specialised courses*’ (QR = 9.08 ± 0.91) and ‘*Scientific journals: exercise/sports science-related*’ (QR = 9.00 ± 1.26). In contrast, ‘*Popular fitness magazines*’ (QR = 4.24 ± 2.37) and ‘*Online search for fitness training-related websites*’ (QR = 5.8 ± 2.75) were rated the least important. The test–retest of items showed that most items displayed moderate-to-strong reliability (ICC range = 0.49–0.75) (Table 2).

Table 3 | Percentage and 95% CI of fitness trainers classified as using high-quality sources of practice knowledge^a about the fitness industry: overall and by demographic and fitness industry-related factors

	Use high-quality sources of practice knowledge ^a % (95% CI)
Total sample	47.6 (44.7–50.4)
Sex	
Male	46.1 (40.8–51.4)
Female	48.2 (44.9–51.6)
<i>p</i> value	0.501
Age (years)	
17–26	42.5 (35.6–49.7)
27–39	44.6 (39.9–49.3)
40–50	52.0 (46.8–57.1)
51–60	49.4 (42.1–56.8)
≥61	55.6 (41.1–69.1)
<i>p</i> value ^c	0.107
Region	
Urban	45.2 (41.7–48.7)
Regional	51.8 (47.9–58.7)
Remote	55.7 (43.3–67.5)
<i>p</i> value ^c	0.054
Time as a fitness industry professional	
Less than 3 months	53.1 (39.4–66.3)
3–6 months	47.1 (34.1–60.5)
6–12 months	45.3 (35.3–55.8)
1–3 years	51.1 (45.9–56.3)
4–9 years	49.1 (43.9–54.4)
10 years or more	41.6 (36.2–47.2)
<i>p</i> value ^c	0.203
Fitness industry qualification	
Certificate III in Fitness	43.5 (35.2–52.3)
Certificate IV in Fitness	50.9 (44.5–54.4)
Diploma of Fitness	50.0 (40.0–60.0)
Undergraduate degree/Graduate Diploma in Exercise Sciences	35.0 (26.4–44.6)
Other	31.3 (21.2–43.2)
<i>p</i> value ^c	0.001*
Time to obtain fitness industry qualification	
<6 weeks	42.2 (28.9–56.7)
Between 6 and 12 weeks	48.4 (40.8–56.1)
Around 3–6 months	45.5 (39.9–52.3)
6–12 months	52.4 (47.2–57.6)
1 year or more	44.7 (39.6–50.0)
<i>p</i> value ^c	0.243
Fitness industry employment status	
Full time	45.2 (40.0–50.3)
Part time	49.6 (44.6–54.6)
Casual	48.9 (44.1–53.8)
Unpaid/voluntary	38.1 (25.0–53.2)
<i>p</i> value ^c	0.353
Mode to obtain fitness industry qualification	
Face-to-face learning—attending classes or workshops	46.1 (42.2–50.0)
Online course—completed online modules	50.9 (43.4–58.4)
A mix of face-to-face learning and online course	48.6 (43.7–53.5)
<i>p</i> value ^c	0.483
Fitness industry role	
Personal trainer	47.3 (42.1–52.5)
Group instructor	50.1 (45.4–54.8)
Gym instructor	46.2 (33.3–59.5)
All three types of instructor	46.1 (40.5–51.8)
Other (e.g. Yoga, Pilates, Aqua trainer)	39.3 (27.6–52.4)

<i>p</i> value ^c	0.561
Fitness industry setting	
Large corporate gym or community health centre (>500 members)	39.7 (35.0–44.7)
Medium size gym or fitness centre (between 100 and 500 members)	52.6 (45.9–59.3)
Small studio setting	45.9 (38.4–53.7)
Outdoor setting	58.7 (51.5–65.6)
Train clients from own home/visit client's home	46.7 (38.5–55.1)
Other	50.9 (41.6–60.2)
<i>p</i> value ^c	0.001

^a To be classified as a user of high-quality sources of practice knowledge, respondents had to report 'always' or 'sometimes' using 'Exercise/sports science-related academic text books' AND 'Workshops or specialised courses' AND 'Scientific journals: exercise/sports science-related'

^b χ^2 test of significance

**p* < 0.05

The responses for the total sample for the frequency of use of common sources of practice knowledge are shown in Table 2. The knowledge sources most frequently reported as 'Always' used were 'Online search for fitness training-related websites' (37.0%), 'Get ideas from other trainers' (31.2%) and by 'Workshops or specialised courses' (31.2%). A total of 40.3 and 36.6% reported 'Rarely' or 'Never' using 'Popular fitness magazines' or 'Online fitness training-related forums', respectively (Table 2).

Overall, 47.6% (95% CI = 44.7–50.4%) of the sample were classified as users of high-quality sources of practice knowledge (Table 3). In the unadjusted analysis, significant differences were observed between proportions of the sample being classified as users of high-quality sources of practice knowledge depending on fitness industry qualification and also by fitness industry setting (*p* < 0.001 for both comparisons) (Table 3).

Table 4 shows the results of the adjusted analysis, assessing the odds of being classified as a user of high-quality sources of practice knowledge. No significant sex differences (OR, 1.04; 95% CI, 0.79–1.36) were observed. When compared to trainers aged 17–26 years, those aged ≥61 years (OR, 2.15; 95% CI, 1.05–4.38) and 40–50 years (OR, 1.54; 95% CI, 1.02–2.31) were more likely to be classified as a user of high-quality sources of practice knowledge.

When compared to trainers working in large corporate gym or community health centres, those working in outdoor settings (OR, 1.81; 1.23–2.65) and medium-sized fitness centres (OR, 1.59; 95% CI, 1.12–2.29) were more likely to be classified as users of high-quality sources of practice knowledge. There were no significant differences for being classified as a user of high-quality sources of practice knowledge when categorised by region, length of time as a fitness professional, qualification level, time to obtain qualification, employment status or industry role (Table 4).

Discussion

The key finding of the present study was that among a large sample of currently practicing Australian fitness trainers, less than half were classified as users of 'high-quality' sources of practice knowledge. Given that professional practices should be based on 'proven

principles of exercise science/prescription' and 'current scientific evidence' [9], these findings highlight the need for strategies to be implemented to increase the use of high-quality sources of practice knowledge among fitness trainers.

To our knowledge, this study is the first to comprehensively examine the sources of practice knowledge among a large representative sample of fitness trainers; therefore, comparisons to similar studies are limited. However, our finding that those classified as users of high-quality sources of practice knowledge did not follow an education gradient was unexpected. Based on data from a previous cross-sectional survey of 325 US fitness trainers [15] and a qualitative study among 10 New Zealand fitness trainers [16], there is some evidence to suggest that when compared to the non-university educated, the university educated were more likely to use evidence-based information sources (defined as academic text books and scientific journals). However, in our adjusted analysis, we showed no such education gradient. A potential explanation for these inconsistent findings may be the considerably larger sample size in the present study, which may mean our findings are more reflective of the industry. It is also possible these differences might be specific to trainers working within the Australian fitness industry. These inconsistent findings highlight the need for further studies using reliable assessment methods to examine the common sources of practice knowledge among fitness trainers across different settings and countries.

A further key finding was that we identified some potential sub-groups of trainers that may be targeted in future strategies to increase the quality of practice knowledge. For example, in the adjusted analysis, younger trainers (17–39 years) and those working in large fitness centres, small studios and those who train clients from own home/visit clients home, were identified as potential groups of trainers 'at risk' of not using high-quality sources.

Another important finding from the present study was that when considering eight possible sources of practice knowledge, experts ranked (1) exercise/sports science-related academic text books, (2) workshops/specialised courses and (3) exercise/sports science-related scientific journals as the highest quality sources with quality ratings markedly greater than the other five. This has practical implications because from an

Table 4 | Adjusted odds ratios^a (OR) and their 95% CI of being classified as a user of high-quality sources of practice knowledge^b about the fitness industry: by demographic and fitness industry-related factors

	Use high-quality sources of practice knowledge ^a OR (95% CI)
Sex (reference—male)	
Female	1.04 (0.79–1.36)
<i>p</i> value	0.802
Age (reference—7–16 years)	
27–39	1.10 (0.76–1.60)
40–50	1.54 (1.02–2.31)
51–60	1.59 (0.98–2.58)
≥61	2.15 (1.05–4.38)
<i>p</i> value	0.047*
Region (reference—urban)	
Regional	1.25 (0.95–1.64)
Remote	1.30 (0.74–2.27)
<i>p</i> value	0.223
Time as a fitness industry professional (reference—less than 3 months)	
3–6 months	0.80 (0.35–1.83)
6–12 months	0.74 (0.35–1.55)
1–3 years	0.86 (0.46–1.64)
4–9 years	0.77 (0.40–1.48)
10 years or more	0.55 (0.28–1.08)
<i>p</i> value	0.210
Fitness industry qualification (reference—Certificate III in Fitness)	
Certificate IV in Fitness	1.43 (0.91–2.24)
Diploma of Fitness	1.42 (0.75–2.65)
Undergraduate degree/Graduate Diploma in Exercise Sciences	0.93 (0.47–1.84)
Other	0.64 (0.33–1.25)
<i>p</i> value	0.320
Time to obtain fitness industry qualification (reference—<6 weeks)	
Between 6 and 12 weeks	0.94 (0.46–1.91)
Around 3–6 months	0.82 (0.42–1.61)
6–12 months	1.06 (0.54–2.07)
1 year or more	0.96 (0.48–1.90)
<i>p</i> value	0.653
Fitness industry employment status (reference—full time)	
Part time	1.00 (0.73–1.37)
Casual	1.13 (0.83–1.54)
Unpaid/voluntary	0.57 (0.28–1.17)
<i>p</i> value	0.272
Mode to obtain fitness industry qualification (reference—face-to-face learning)	
Online course—completed online modules	0.97 (0.67–1.40)
A mix of face-to-face learning and online course	0.99 (0.75–1.30)
<i>p</i> value	0.940
Fitness industry role (reference—personal trainer)	
Group instructor	1.13 (0.82–1.54)
Gym instructor	1.23 (0.64–2.38)
All three types of instructor	0.97 (0.69–1.36)
Other (e.g. Yoga, Pilates, Aqua trainer)	0.88 (0.47–1.65)
<i>p</i> value	0.818
Fitness industry setting [reference—large corporate gym or community health centre (>500 members)]	
Medium size gym or fitness centre (between 100 and 500 members)	1.59 (1.12–2.29)
Small studio setting	1.13 (0.77–1.67)
Outdoor setting	1.81 (1.23–2.65)
Train clients from own home/visit clients home	1.10 (0.72–1.69)
Other	1.41 (0.89–2.23)
<i>p</i> value	0.018*

^a Adjusted for all other explanatory variables in the table^b To be classified as a user of high-quality sources of practice knowledge, respondents had to report 'always' or 'sometimes' using 'Exercise/sports science-related academic text books' AND 'Workshops or specialised courses' AND 'Scientific journals: exercise/sports science-related'**p* < 0.05

access perspective, some trainers may find obtaining these sources problematic. For example, access to exercise science-related journal articles may require journal subscriptions with associated costs. Additionally, the purchase of academic text books and regular attendance at workshops/specialised courses may also be cost prohibitive. While many scientific journals now are open access and specialised text books can be obtained through university library subscriptions often available to the general public, many trainers might not be aware of such services. Moreover, even if there was increased awareness and access, the esoteric terminology used in scientific journals and academic text books may make it difficult for some trainers to interpret [20].

A possible opportunity to increase the quality of knowledge practice translation among fitness trainers may be the development of a specific online platform where trainers can freely, or at a low cost, access the latest and relevant peer-reviewed fitness industry information [21]. Importantly, such information would need to be delivered in a format in which most trainers can understand and provide practical information useful for their professional practices [20]. To allow for standardisation and quality control, such systems should be centrally developed by the governing bodies of the fitness industry (e.g. Exercise & Sports Science Australia, American College of Sports Medicine). Further research is now needed to facilitate the development of these avenues for increasing the quality of knowledge translation among trainers. This may include researching the facilitators and barriers that key stakeholders encounter in developing complex knowledge translation systems. A further research area vital to inform the successful development of a knowledge translation platform is the investigation of the types of information fitness trainers perceive both interpretable and appropriate for implementation in their training practices.

Although not the focus of this study, we acknowledge that there are several public health-related limitations with respect of the utilisation and uptake of fitness trainers at a population level. First, engaging a fitness trainer is unlikely to be suitable for all community members because of, for example, personal interest, logistical or financial reasons. Second, since engagement of a fitness trainer is contingent upon the ability to afford this service, there are obvious barriers for the most physically inactive, such as those who experience socioeconomic disadvantage [22], to use their services. However, despite such limitations, the use of fitness trainers as a service to improve population physical activity adherence has been largely overlooked [6, 21, 23]. Given the considerable health, social and economic benefits associated with increasing population physical activity levels, effort should be made to examine more effective ways of integrating fitness trainers into public health physical activity promotion strategies, particularly working in areas and with populations in which, from a public health perspective, appropriately trained fitness trainers' skills and

support are most likely to be needed. Key populations include those from culturally and linguistically diverse backgrounds, those with low income/education levels and those living in rural and remote regions.

Strengths of this study include the recruitment of a large and generally representative sample of currently practising fitness trainers [6]. This enabled examination of differences in the sources of practice knowledge across numerous fitness industry-related and sociodemographic characteristics. A further strength was that we assessed the level of importance of each source of information as perceived by exercise science experts. This process facilitated a development of a proxy assessment of discriminant validity [24], from which we developed a quasi-ranking system (e.g. high-quality vs. low-quality). An additional strength was the examination of the test-retest reliability survey of the sources of practice knowledge items, which showed acceptable reliability [19].

This study has some limitations which should be acknowledged. A key limitation was that we did not determine the validity of the main outcome variable: 'a user of high-quality sources of practice knowledge'. While we did test for reliability, we are unable to exclude the possibility that trainers may have either misinterpreted or misreported the frequency of use of the sources we assessed. Moreover, the issues of recall bias and social desirability may have further impeded the validity of our findings [24, 25]. Consequently, until the methods used in the present study are tested for validity, caution should be taken when interpreting our main findings. A further limitation was that we made an assumption that when compared to the knowledge obtained from 'high-quality' sources, information accrued from 'low-quality' sources (i.e. ideas from other trainers, popular fitness magazines, online fitness training-related forums) was less valid. It might be possible that practice knowledge gained from low-quality sources may be equally as valid as what is presented in 'high-quality' sources. However, a justification for our dichotomisation of sources (high vs. low) was the insights gained from the experts' ranking of sources. Importantly, while not assessed, a reasonable explanation for the experts' ranking of each source is the fact that it is highly unlikely that many of the 'low-quality' sources have been subjected to a scientific peer-review process.

Conclusion

Among a large sample of registered Australian fitness trainers, less than half were classified as frequent users of high-quality sources of practice knowledge. Our findings call for strategies to be implemented ensuring that fitness trainers can readily access high-quality sources of practice knowledge about their industry. A potential strategy may be the development and dissemination of a standardised platform that it delivered to fitness trainers that is affordable and provides easy access to high-quality sources of fitness industry practice knowledge. Promoting and increasing utilisation

of high-quality information sources will hopefully lead to better trainer knowledge and evidence-based practices translating into improved client satisfaction and health outcomes.

Acknowledgements: Thanks to all study participants for their contribution to this paper and staff at Fitness Australia for the invaluable support with recruiting fitness professionals. We also thank Dr. Zeljko Pedisic for his initial statistical advice on this paper. J.A.B. wishes to thank Fitness Australia for part funding his research fellowship.

Compliance with ethical standards

Statements: The authors declare that the findings reported in this paper have not been previously published and that the manuscript is not being simultaneously submitted elsewhere.

The authors confirm that they have full control of all primary data and that they agree to allow the journal to review their data if requested.

Study funding sources: J.A.B. declares he has a research fellowship part-funded by Fitness Australia. S.J.H.B. declares that he received funding from Fitness First, Nuffield Health and Unilever. None currently active. Funding received in 2016 for work for Halpern Ltd. Provision of a sit-to-stand desk from Ergotron, 2012–2014. J.A.B. and S.J.H.B. confirm that these funders had no role in study design, data collection and analysis, decision to publish or preparation of the manuscript.

Any actual or potential conflicts of interest: J.A.B. declares he has a research fellowship part-funded by Fitness Australia. S.J.H.B. received funding since 2012 for consultancy work from Fitness First, Nuffield Health, Unilever and Weight Watchers, and for travel from The Coca Cola Foundation. None of these are currently active. Funding was received in 2016 for consultancy work for Halpern Limited. In-kind support through the provision of a sit-to-stand desk was provided by Ergotron from 2012 to 2014. Advice has been requested by and offered to Active Working, Get Britain Standing and Blueearth, none with funding. All other authors declare no actual or potential conflicts of interest.

Ethical disclosures regarding treatment of human and animal experimental subjects and informed consent: The study protocol was approved by the Victoria University Ethics Committee (reference—HRE 14-070), and informed consent was obtained from each participant.

1. Lee, I. M., Shiroma, E. J., Lobelo, F., Puska, P., Blair, S. N., & Katzmarzyk, P. T. (2012). Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet*, 380(9838), 219–229.
2. World Health Organization. *Global Recommendations on Physical Activity for Health*. Geneva, 2010.
3. Ding, D., Lawson, K. D., Kolbe-Alexander, T. L., et al. (2016). The economic burden of physical inactivity: a global analysis of major non-communicable diseases. *Lancet*, 388(10051), 1311–1324.
4. Bennie, J. A., Pedisic, Z., van Uffelen, J. G., et al. (2016a). The descriptive epidemiology of total physical activity, muscle-strengthening exercises and sedentary behaviour among Australian adults—results from the National Nutrition and physical activity survey. *BMC Public Health*, 16(1), 73.
5. Centers for Disease Control and Prevention. (2013). Adult participation in aerobic and muscle-strengthening physical activities—United States, 2011. *MMWR. Morbidity and Mortality Weekly Report*, 62(17), 326–330.
6. Hallal, P. C., Bauman, A. E., Heath, G. W., Kohl, H. W., Lee, I., & Pratt, M. (2012). Physical activity: more of the same is not enough. *The Lancet*, 380(9838), 190–191.
7. Matheson, G. O., Klug, M., Engebretsen, L., et al. (2013). Prevention and management of noncommunicable disease: the IOC consensus statement, Lausanne 2013. *Clinical Journal of Sport Medicine*, 23.
8. Frenk, J., Chen, L., Bhutta, Z. A., et al. (2010). Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. *Lancet*, 376(9756), 1923–1958.
9. De Lyon, A., Neville, R., & Armour, K. (2016). The role of fitness professionals in public health: a review of the literature. *Quest*, 1–18.
10. Oprescu, F., McKean, M., & Burkett, B. (2012). Exercise professionals—could they be the forgotten public health resource in the war against obesity? *Journal of Sports Medicine & Doping Studies*, 2012.
11. American College of Sports Medicine. *ACSM's Resources for the Personal Trainer*. Lippincott Williams & Wilkins; 2013.
12. Australian Bureau of Statistics. 4148.0 Employment in Sport and Recreation, Australia. Available at: <http://www.abs.gov.au/ausstats/abs@.nsf/mf/4148.0>. Accessed 12 January 2017.
13. Bennie, J. A., Thornton, L. E., van Uffelen, J. G. Z., Banting, L. K., & Biddle, S. J. H. (2016b). Variations in area-level disadvantage of Australian registered fitness trainers usual training locations. *BMC Public Health*, 16(1), 1–7.
14. Fitness Australia. Fitness Industry Workforce Report. Available at: <https://fitness.org.au/visageimages/Reports/Full%20Report%20April%202012.pdf>. 2012. Accessed 12 January 2017.
15. IBIS World Industry Report. Gyms and Fitness Centres in Australia. 2016. Available at: <http://clients1.ibisworld.com.au/reports/au/industry/default.aspx?entid=658>. Accessed 12 January 2017.
16. Melnyk BM, Fineout-Overholt E. *Evidence-based practice in nursing & healthcare: a guide to best practice*. Lippincott Williams & Wilkins; 2011.
17. Stacey, D., Hopkins, M., Adamo, K. B., Shorr, R., & Prud'homme, D. (2010). Knowledge translation to fitness trainers: a systematic review. *Implementation science* : IS., 5, 28.
18. Hare, S. W., Price, J. H., Flynn, M. G., & King, K. A. (2000). Attitudes and perceptions of fitness professionals regarding obesity. *Journal of Community Health*, 25(1), 5–21.
19. Forsyth, G., Handcock, P., Rose, E., & Jenkins, C. (2005). Fitness instructors: how does their knowledge on weight loss measure up? *Health Education Journal*, 64(2), 154–167.
20. Dormer, A., & Zou, G. (2002). Interval estimation for a difference between intraclass kappa statistics. *Biometrics*, 58(1), 209–215.
21. Landis, R., & Koch, G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, 159–174.
22. Stableford, S., & Mettger, W. (2007). Plain language: a strategic response to the health literacy challenge. *Journal of Public Health Policy*, 28(1), 71–93.
23. Bauman, A. E., Reis, R. S., Sallis, J. F., Wells, J. C., Loos, R. J., & Martin, B. W. (2012). Correlates of physical activity: why are some people physically active and others not? *Lancet*, 380(9838), 258–271.
24. Rosenthal R, Rosnow RL. *Essentials of behavioral research: methods and data analysis*. McGraw-Hill Humanities Social; 1991.
25. Fisher, R. J. (1993). Social desirability bias and the validity of indirect questioning. *Journal of consumer research*, 20(2), 303–315.