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Peek, Kerry; Sanson-Fisher, Robert; Mackenzie, Lisa; Carey, Mariko "Patient adherence to physiotherapist prescribed self-management strategies: a critical review", Published in International Journal of Therapy and Rehabilitation Vol. 22, Issue 11, p. 535-543 (2015)

Available from: <http://dx.doi.org/10.12968/ijtr.2015.22.11.535>

Accessed from: <http://hdl.handle.net/1959.13/1330043>

Patient adherence to physiotherapist prescribed self-management strategies: A critical review.

Published 2015: International Journal of Therapy and Rehabilitation

Peek, K, Sanson-Fisher, R, Mackenzie, L. and Carey, M. "Patient adherence to physiotherapist prescribed self-management strategies: A critical review"; International Journal of Therapy and Rehabilitation. 22.11 (2015) 535-543.

Abstract

Aims: To examine the published literature on patient adherence to physiotherapist prescribed self-management strategies in order to describe changes in the proportion of publications over time; methodological quality of the non-intervention and intervention based studies; types of measures used to assess patient adherence and the reported accuracy of those measures.

Methods: A comprehensive search of eight electronic databases was conducted, covering the period from 1995 to November 2014. Data were extracted and coded for the number and proportion of papers that were 1) non-data based; reports 2) data-based, reviews and 3) data-based, new data (i) qualitative studies, (ii) non-intervention studies, and (iii) intervention studies. The methodological quality of non-intervention and intervention publications was assessed using Effective Public Health Practice Project quality assessment tool, and data were extracted regarding the type and accuracy of adherence measure/s reported in these publications.

Results: A total of 80 relevant papers were identified. Of these, 49 non-intervention and intervention quantitative study designs underwent methodological assessment; with only 14 studies (29%) assessed as being of at least moderate quality. Fifty-three different measures of patient adherence were recorded from the 49 included studies; with only five of the 49 included studies (10%) reporting statistical evidence to support accuracy of the adherence measure/s applied.

Conclusions: The results indicate that despite a trend towards intervention-based studies and reviews over the last 20 years, the methodological quality of studies on patient adherence could be improved. Accurate and standardised measures of patient adherence are needed for any future research involving patient adherence to physiotherapist prescribed self-management strategies.

Keywords: Physiotherapy, adherence, self-management, adherence measure, review

Introduction

Self-management refers to the handling of the day to day impact of a condition, which can be a life-long task (Cooper et al., 2009). Self-management strategies such as advice, home exercise, application of ice and prescribing braces are important physiotherapy treatment adjuncts (Hall et al., 2014). However, the efficacy of a self-management strategy can only be determined if the patient adheres to it in the first place (i.e. treatment fidelity). The World Health Organisation defines adherence as “the extent to which a person’s behaviour...corresponds with agreed recommendations from a healthcare provider” p.13 (WHO, 2003). It has been reported that approximately 60% of participants do not fully adhere to recommended home physiotherapy programs (Sluijs et al., 1993, Taylor and May, 1996, Bassett and Prapavessis, 2011). Poor physiotherapy treatment adherence can lead to poor treatment outcomes for the patient (Spetch and Kolt, 2001, Beinart et al., 2013).

Evidence-based practice (EBP) is a process whereby clinicians integrate best research evidence with clinical experience and patient preferences to produce the most appropriate and effective treatment plan (Scurlock-Evans et al., 2014). Part of the EBP process is to gather and synthesise the literature on any given topic in a systematic and critical way to inform future clinical decisions (Herbert et al., 2001). Given the importance of patient adherence in optimising physiotherapy treatment outcomes, it is timely to consider research activity in this area.

Both overall quantity as well as quality of specific types of studies, as measured by peer reviewed publications, can be used as metrics of research activity. Levels of evidence classify study designs according to their generally perceived capacity to minimise or eliminate bias in the effect being measured (NHMRC, 2000). Logically research should move through a progression from measurement research, descriptive research to intervention research (Sanson-Fisher et al., 2006). Consequentially, the type and proportion of publications on patient adherence should show a change over time. However, it is important that the *level* of evidence is not perceived to represent the *strength* of evidence on patient adherence, to which study design is only one of several contributors which also includes an assessment of methodological quality (NHMRC, 2000).

EBP implies the systematic use of best evidence in the form of high quality clinical research to solve clinical problems (Herbert et al., 2001). The *quality* of the evidence refers to the methods used by the investigators during the study to minimise bias and control confounding within a study type (i.e. how well the investigators conducted the study) (NHMRC, 2000). The homogeneity of the study sample, clinically appropriate interventions and valid, sensitive outcome measures are intrinsic to

the quality of any study irrespective of design, as without these elements in place, the study will not produce evidence that is relevant to, or adopted in, clinical practice (Grimmer et al., 2005).

Measurement accuracy has been defined as the “closeness of agreement between a measured quantity value and a true quantity value” p.21 (JCGM, 2012). For this review the accuracy of measures of patient adherence will focus on the included non-intervention and intervention studies which use more than one measure of patient adherence to a physiotherapist prescribed self-management strategy and in particular comparisons between an observational and self-report measure. When interpreting any research findings on adherence, consideration must be given to the accuracy of the measure used as this will affect the understanding of whether and how adherence can be influenced by an intervention and its impact on patient outcomes. This is particularly important for adherence research as there is currently no ‘gold standard’ for the measurement of patient adherence to physiotherapy self-management strategies.

Review aims:

The aims of this review were to examine the literature on patient adherence to physiotherapist prescribed self-management strategies published over the past 20 years (grouped into four equal time periods; 1995-1999; 2000-2004; 2005-2009; and 2010-2014) in order to describe:

1. Changes in the proportion of publications classified as a) non-data based, b) data-based, no new data, and c) data-based, new data. Data based, new data studies were further examined by the following categories i) qualitative studies, ii) non-intervention studies, and iii) intervention studies.
2. The proportion of non-intervention and intervention based study designs which met accepted methodological criteria for design quality.
3. Types of measures and the reported accuracy of those measures of patient adherence used in the non-intervention and intervention based study designs.

Methods

The PRISMA guidelines were used as a reference for the design and reporting of this review (Moher et al., 2009, Liberati et al., 2009).

Eligibility criteria

Inclusion criteria

Published studies describing adult patient adherence to physiotherapist-prescribed self-management strategies were included. Patient self-management strategies included any strategy that is prescribed by a physiotherapist for the client to perform independently, away from the physiotherapy clinic or other supervised environment. Only studies published in a peer reviewed journal in English were included.

Exclusion criteria

Studies were excluded if they reported adherence to preventative or pre-habilitation strategies. Studies using healthy participants or paediatric populations were also excluded.

Information Sources and search strategy

A comprehensive search of eight electronic databases included CINAHL, EMBASE, MEDLINE, PUBMED, PSYCINFO, SPORTS Discus, the Cochrane Central Register of Controlled Trials and PEDro. Databases were searched for full texts for a 20 year period from January 1995 to November 2014. Initial key words used were 'physiotherapy' 'adherence' 'self-management' and 'compliance'. Additional terms included 'physical therapy' 'exercise' 'tape' 'advice' 'brace' and 'splint'.

Reviewer one screened the titles, abstracts and full texts of potentially relevant publications. Hand searching of the reference list of all the included studies was then undertaken.

A search for unpublished studies or grey literature was not included due to the inaccessibility of these studies and their questionable ability to inform practice without having undergone peer review.

Eligibility assessment and coding was performed in a non-blinded standardised manner by reviewer one. The second reviewer independently assessed a random sample of 15% of the identified abstracts, classifying them as eligible or ineligible, and then coded the eligible abstracts as described below. A Kappa of 0.90 indicated a high level of inter-rater agreement of coding between the two reviewers.

Coding

Papers were coded under the following categories:

1. Non-data based, this includes commentaries and opinion based papers;

Papers which reported on patient adherence to physiotherapist prescribed self-management strategies but did not report on any new data

2. Data based, no new data (reviews):

Studies which were referred to as a review which did not contain any new data but rather collated data from previously published studies; this included systematic and critical review papers.

3. Data based, new data

Studies reporting new data or new analysis of data from existing sources but were not reviews using the following study designs:

i. Qualitative study designs

This included all qualitative study designs.

i. Non-intervention study designs

This included all studies using observational, descriptive or the quantitative component of a mixed methods study design.

ii. Intervention study designs

This included all RCTs or quasi-RCT; studies which involved an intervention and control group.

Data extraction from non-intervention and intervention based studies

Quantitative data were extracted from the non-intervention and intervention based studies using a standardised data extraction form developed specifically for this review. The form was pilot tested on ten randomly-selected included studies and refined accordingly. Data extracted included author, year, type of study, physiotherapist prescribed self-management strategy used, measure of patient adherence used and reported accuracy of this measure and results of methodological quality assessment using the quality assessment tool for quantitative studies developed by the Effective Public Health Practice Project (EPHPP).

Methodological quality assessment of non-intervention and intervention based studies

The EPHPP tool was used to assess the methodological quality of the non-intervention and intervention based studies included in this systematic review. This generic instrument was developed in 1998 for public health research regardless of study design ([Thomas et al., 2004](#), [Armijo-Olivo et al., 2012](#)) and has been used in a number physiotherapy reviews ([Scurlock-Evans et al., 2014](#), [Sugavanam et al., 2013](#)).

The EPHPP tool is a standardised tool which provides an overall methodological rating of strong, moderate or weak in eight sections: 1. Selection bias, 2. Study design, 3. Confounders, 4. Blinding, 5. Data collection methods, 6. Withdrawals and dropouts, 7. Intervention integrity 8. Analysis.

In accordance with recommendations of the authors of the EPHPP tool, overall study quality was classified based on the combination of the component ratings; strong (no weak ratings), moderate (less than one weak rating), weak (two or more weak ratings). Studies considered to have met accepted methodological criteria had a rating of strong or moderate. A reviewer's manual and dictionary was provided to assist the reviewers and maintain standardised results. Methodological quality for the included non-intervention and intervention based studies was conducted by one reviewer with a second reviewer who audited 10% of the included studies. Kappa was computed to determine inter-rater reliability of methodological quality assessment between the two reviewers. A Kappa of 0.72 indicated a substantial level of agreement.

Data analysis

Descriptive data and a narrative summary were used to report changes in the proportion of publications classified as a) non-data based, b) data-based, no new data, and c) data-based, new data: (i) qualitative studies, (ii) non-intervention studies, and (iii) intervention studies. The proportion of non-intervention and intervention based study designs which met accepted methodological criteria for design quality was described using percentages. A narrative summary was also used to describe the types of measures of patient adherence and the reported accuracy of those measures used in the non-intervention and intervention based studies due to study heterogeneity for patient population, type of self-management strategy, intervention and adherence measure used.

Results

The search provided a total of 144 unique records of which 80 were included for coding, leading to the identification of 28 non-intervention and 21 intervention based study designs, which then underwent methodological quality assessment. See Supplementary Appendix I for more detailed results of the study selection process.

Publication characteristics

1. Coding of papers:

Eighty papers were included for coding. Of these, 11 were coded as non-data based reports, 8 were coded as data-based reviews, 12 were coded as data-based qualitative studies, 28 were coded as data-based non-intervention studies and 21 were coded as data-based intervention studies.

The number of non-data based report papers has remained steady over the last 20 years with 1-4 papers published over each of the 4 time periods (1995-1999, 2000-2004, 2005-2009, 2010-2014). The number of review papers published was the greatest for the time period 2010-2014 with 6 papers. Data-based papers for non-intervention studies rose markedly between the time periods 2000-2004 and 2005-2009 and then declined for the next time period, 2010-14; whereas intervention based studies have shown a steady increase from 1995-1999 to 2010-2014 (Figure 1). Supplementary Appendix II provides a list of all included studies.

2. Methodological quality assessment

Results of the EPHPP assessment demonstrated that of the 49 non-intervention and intervention based studies, only 14 or 29% met the accepted methodological criteria for design quality. No studies were assessed as high quality. Thirty-five (71%) of the 50 included studies were assessed as weak quality. The main reason for a weak rating was related to data collection methods of patient adherence which affected the rating for the data collection methods. Lack of blinding in the RCTs was also a contributing factor to a weak rating as although a number of studies blinded the assessors, very few blinded the participants.

3. Types of measures used to assess patient adherence rates:

Forty-nine non-intervention and intervention based studies used some type of measure to assess patient adherence; of these 22 of the included studies used a patient self-report diary / log, 22 studies used a self-administered survey or questionnaire, four used a patient face to face or telephone interview, five used an observational measure such as activity monitor or video cassette counter. Some studies used more than one measure of adherence and where this was the case, both measures were recorded.

Figure 2 summarises the measures used to assess patient adherence to physiotherapist prescribed self-management strategies in the data based intervention and non-intervention based studies, with patient self-report diaries/logs and survey/ questionnaires being the most commonly used measure of adherence, used in 85% of the included studies.

a. Reported accuracy of the measures of patient adherence.

Of the 49 data based studies which measured patient adherence, 12 studies provided some evidence on the accuracy of the measure used with reporting of the degree of correlation across multiple measures. Table 1 provides a more detailed summary of results on the reported accuracy of the measures of patient adherence in these 12 studies. It can be seen that only five studies reported a statistically significant positive correlation between the multiple measures of patient adherence used in their studies to support the accuracy of their outcome measure.

Aside from these 12 studies, a number of other studies reported the use of adherence measures based on those developed by other research teams ([White et al., 2007](#)) or assessed correlations between adherence with other outcome measures such as intention to adhere ([Bassett and Prapavessis, 2011](#)). However, no adherence accuracy reporting was found for these measures in the included or referenced studies.

Discussion

A comprehensive search of the literature revealed that 80 papers have been published on patient adherence to physiotherapist prescribed self-management strategies since 1995. An assessment of patient adherence during physiotherapy research is imperative because unless research includes an assessment of patient adherence then an accurate evaluation of treatment outcomes cannot be reported.

Although the majority of the 49 studies reporting new data had non-intervention study designs, it is encouraging to note that there was an increasing trend towards intervention studies and reviews published since 1995 given that the evidence hierarchy lists reviews and RCTs as the two highest levels of evidence ([NHMRC, 2000](#)). The increase in RCTs, in particular, suggests that progress is being made toward developing effective strategies to improve patient adherence ([NHMRC, 2000](#)). This finding is consistent with other studies which also found an improvement in the number of intervention studies being published in physiotherapy journals worldwide, even though non-intervention studies are still being published with the highest frequency ([Moseley et al., 2011](#), [Paci et al., 2009](#)).

Qualitative research represented about 15% of the published studies included in this review. Although the methodological quality of this research was not assessed, qualitative studies contribute to physiotherapy research in four key areas; as standalone research; to inform future quantitative studies; to augment concurrent quantitative research; and to inform the use or

development of outcome measures and their importance should not be overlooked (McPherson and Kayes, 2012).

The overall results of the quality assessment demonstrated that 71% of included studies were of weak quality. The quality of the studies was affected by the score for the data collection methods. This is consistent with a systematic review of measures of self-reported adherence to unsupervised home-exercise programs which found 58 studies reporting 61 different measures with only two measures scoring positively for content validity (Bollen et al., 2014). A further systematic review concluded that measurement of adherence to self-management recommendations for chronic musculoskeletal conditions is currently performed on an ad hoc basis with a lack of homogeneity in measurement (Hall et al., 2014). The results of this review support the findings of both reviews (Bollen et al., 2014, Hall et al., 2014) that there is a gap in the literature for well-developed measures that capture adherence to self-management strategies including prescribed but unsupervised home-based exercises.

For intervention studies the quality rating was also affected by their scores for blinding. A study which reported on the quality of RCTs of physiotherapy interventions over time found that the prevalence of blinding of participants was 9% compared to only 2% of therapists but a more encouraging 33% of assessors (Moseley et al., 2011). The authors do however report that the blinding of therapists and participants is not possible for most physiotherapy interventions involving engagement in exercise, education, rehabilitation and physical activity which is certainly supported by this review (Moseley et al., 2011).

There are different sources of error that clinicians need to be aware of when interpreting studies using various measures of adherence. In this review, self-report diaries or questionnaires were the most commonly used measure of adherence, however, they are subject to problems of reporting bias, reporting errors or intentional manipulation by the patient most commonly in the form of over-estimation of adherence (Kettler et al., 2002). Direct observation in the form of electronic recording devices, tally counters, and pedometers also have their own limitations, as the act of monitoring by external observers/devices may change adherence behaviour for the length of the monitoring process, but not long-term adherence attitudes and behaviours (Kettler et al., 2002). In addition, electronic recording devices do have the potential to be unreliable due to wear and tear or not being used correctly leading to incomplete data and in many cases the patient also has to adhere to wearing them (Bollen et al., 2014). In addition, objective measures may not always be possible or feasible in physiotherapy research. A multi-faceted approach to adherence assessment (a

combination of measures across the spectrum of objective, prospective, clinician assessed through to patient self-report) may provide the most reliable measure of patient adherence (Bollen et al., 2014).

The findings of this review suggest there is a large degree of heterogeneity in adherence measures applied in research studies, and there appears to be a gap in the research in measuring adherence in a rigorous and reproducible manner (Hall et al., 2014).

Strengths and limitations of this review.

The strength of this review is that it was inclusive of all physiotherapist prescribed self-management strategies, patient population and settings. This review was conducted in accordance with the PRISMA guidelines; however, it is possible that a number of factors may limit the findings.

Unpublished studies and grey literature were not included which may have influenced the results. The authors defend this exclusion as studies which are unpublished or without peer review and are not easily accessible to physiotherapists offer questionable ability to inform practice. However, the possibility of publication bias cannot be excluded particularly as only studies published in English were included.

In addition, data were not extracted from the qualitative studies. Qualitative research aims to enrich understanding of human experience and the meaning of actions taken within social and cultural contexts (Zitomer and Goodwin, 2014). Contrary to the quantitative research which reported the specific measures of patient adherence, the qualitative studies reported the adherence experience. It was decided that this was outside of the aims of this review and would be better expressed in a separate paper.

Implications for practice.

In summary, physiotherapists should consider the issue of adherence when prescribing self-management strategies to their patients. This is particularly important prior to modifying treatment approaches under the assumption that the strategy is not effective when adherence to it may in fact be the issue. However, physiotherapists need to exercise a degree of caution when interpreting intervention outcomes of studies which do not provide a report on patient adherence or evidence to support the accuracy of the measure used.

Implications for research.

It should be a research priority to establish adherence measurement in physiotherapy research which has good accuracy. In addition, researchers need to consider methodological quality criteria

when designing their research studies. Minimum standards for intervention studies should include random allocation, concealed allocation, blinding of assessors and use of intention to treat analysis (Moseley et al., 2011).

Conclusion

There has been a trend towards intervention based studies and reviews over the last 20 years, however, the quality of this research still needs to improve based on the methodological assessment using the EPHPP tool. A range of different measures of patient adherence have been used in physiotherapy research, however accuracy of these measures is rarely reported. Accurate measurement of patient adherence is necessary for any research reporting on patient adherence and outcomes in relation to physiotherapist prescribed self-management strategies.

Key Points:

- There is an increasing trend towards publication of intervention studies and reviews focused on patient adherence to physiotherapist prescribed self-management strategies since 1995.
- Methodological quality criteria needs to be considered when designing studies of patient adherence to physiotherapist prescribed self-management strategies to improve research quality and therefore, its ability to inform clinical practice.
- Patient adherence can be measured in many different ways, with patient self-report being the most common method used.
- There currently exists paucity in the reported accuracy of the measures used to assess patient adherence to physiotherapist prescribed self-management strategies.

Conflicts of interest

The authors declare that there are no conflicts of interest.

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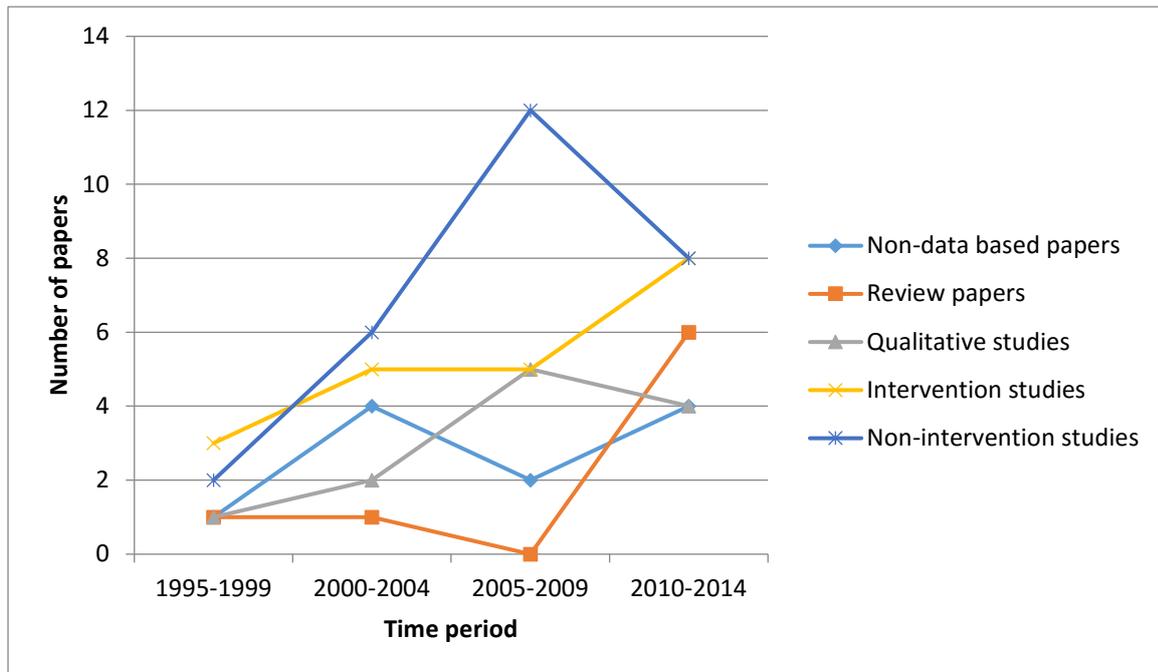
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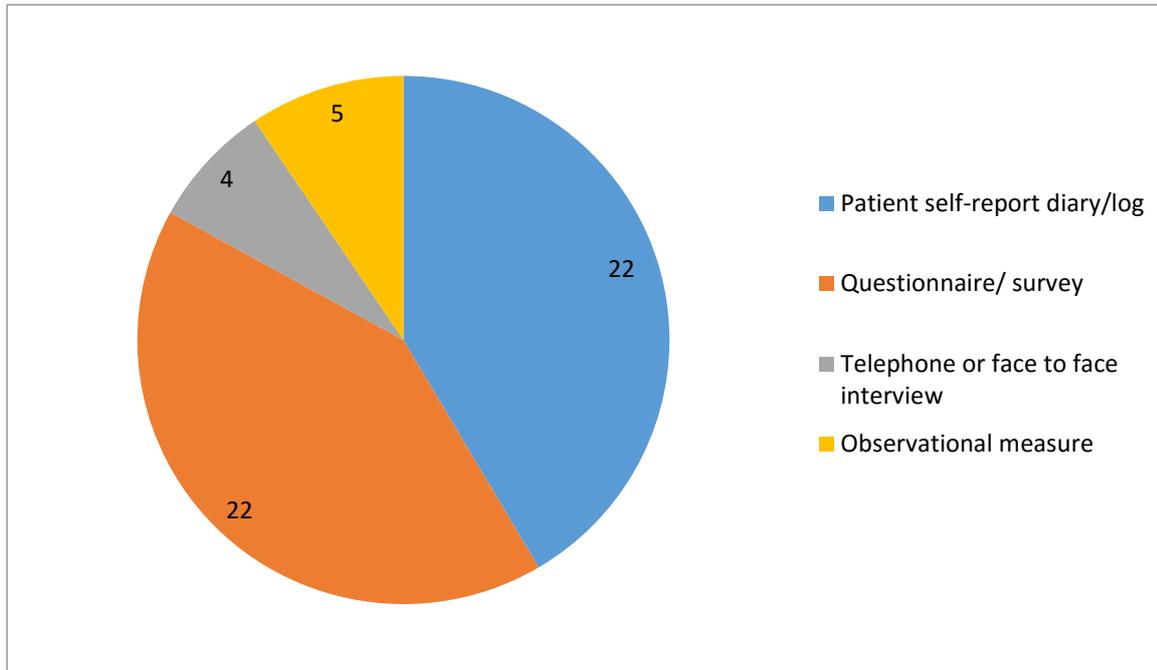
Attachment 1

Figure 1: The number and type of studies published over the last 20 years over four time periods (1995-2014)



Attachment 2

Figure 2: The types of adherence measure used in the non-intervention and intervention based studies (n=53)



Attachment 3:

Table 1: Results on the reported accuracy of the measures of patient adherence used in the included non-intervention and intervention based studies.

| Author and year | Adherence measures used | Evidence to support accuracy of adherence measures | Results of accuracy of adherence measures |
|---|--|---|--|
| Alewijse et al., 2003a And Alewijse et al., 2003b | 7 day patient self-report diary; Patient self-report adherence questionnaire | Yes | These two studies based on the same measures reported the Spearman's rank correlation co-efficient between the self-report diary and an adherence questionnaire used in their studies on pelvic floor muscle exercise. |
| Brewer et al., 2004 | Patient self-report; and Video counter | No | The Spearman's rank correlation co-efficient was used to compare the number of times a video was played (as recorded by a hidden video tape counter) with the patient self-report of adherence which found that the self-report was significantly greater. |
| Chen et al., 1999 | Patient self-report of exercise adherence; and a) the patient recollection of the prescribed exercise program; and b) the physiotherapist's recorded exercise program prescription (patient chart) | No | The adherence rate for the patient self-report and patient recollection was 74% compared with 35% for patient self-report and physiotherapist recorded prescription. The correlation coefficient of these two adherence rates was 0.51. In general patients did not recall about 12% of the home exercises prescribed. |

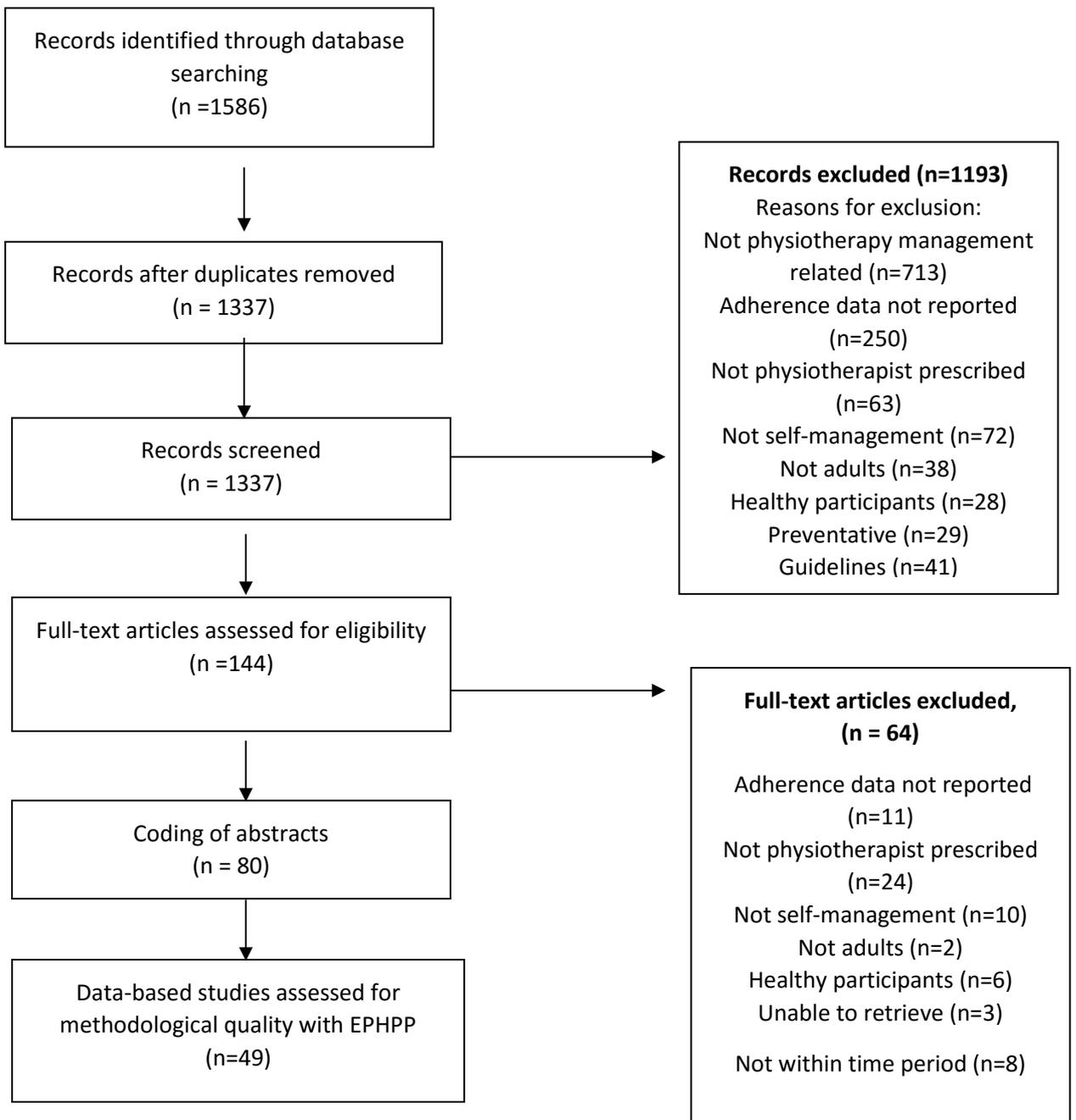
| | | | |
|-----------------------|--|-----|---|
| Evans and Hardy, 2002 | Patient self-report exercise diary; and physiotherapist estimate of adherence | No | No statistical correlation between the measures of adherence. Results suggested that physiotherapist estimate of patient adherence was an inappropriate measure of patient adherence to exercise. |
| Goto et al., 2014 | Activity monitor; and Physiotherapist prescription | No | Comparison data between measures not reported. Although the authors used an activity monitor, the monitor only collected data for physical activity; adherence to exercise was recorded using the number of times the patient inputted data into the monitor and it did not record any other objective data to compare this with. |
| Huang et al, 2014 | iPod tracking system which directly recorded the number of times it was used for the prescribed exercises: and Physiotherapist prescription | Yes | The authors validated the sensor measurement of an iPod tracking system which recorded the number of exercises sessions completed by the patient and compared this to the physiotherapist prescription to provide a level of adherence. |
| Hunter et al., 2006 | Patient self-report diary; and Activity monitor | No | The authors report that patients doing more than the prescribed amount of activity as adherent which leads to difficulty when interpreting the results for patient adherence. |

| | | | |
|-----------------------|--|-------------------------------------|--|
| Kolt and McEvoy, 2003 | Home exercise compliance assessment (patient self-report); and Sports Injury Rehabilitation Scale (SIRAS) (physiotherapist rates the patient's adherence during rehabilitation sessions using a 5-point Likert-type scale) | Yes | Authors report a significant correlation between a home exercise compliance assessment (using patient self-report) and SIRAS for patients with low back pain. |
| Schoo et al., 2005 | Patient self-report log; and Physiotherapist report using correctness of exercise performance assessment | No | Comparison data between measures not reported. The authors collected data for correctness of exercise performance during assessment and self-report home exercise logs although no statistical correlation was reported between these two data sets. |
| Steele et al., 2008 | Patient self-report measure; and an accelerometer | No | The authors suggest that patient self-report was subject to over-reporting in the intervention compared with accelerometer data although the study did have measurement issues with the accelerometer. |
| Taylor and May, 1996 | Two compliance sheets as estimates of patient adherence to different facets of a home program for injured athletes: one completed by the physiotherapist; and | Yes, but only for rest prescription | On analysis the only significant correlations were physiotherapist and patient estimates of patient adherence to rest and not to the other facets of the program such as exercise. |

| | | | |
|--|------------------------------|--|--|
| | one completed by the patient | | |
|--|------------------------------|--|--|

Attachment 4:

Supplementary Appendix I: Flow chart of the literature search



Attachment 5:

Supplementary Appendix II

Included Studies:

1. Non-data based, this includes commentaries and opinion –based papers;

1. Bassett S. The assessment of patient adherence to physiotherapy rehabilitation. *NZ J physiother.* 2003; 31(2):60-6.
2. Crandall S, Howlett S, Keysor J. Exercise adherence interventions for adults with chronic musculoskeletal pain. *Phys Ther.* 2013; 93(1):17-21.
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6. Liddle SD. Compliance with Exercise in Low Back Pain: Aspiration or Achievable Goal? *Phys Ther Rev.* 2004; 9(4):181-2.
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8. O'Brien L. The evidence on ways to improve patient's adherence in hand therapy. *J Hand Ther.* 2012; 3:247-50.
9. Page CJ, Hinman RS, Bennell KL. Physiotherapy management of knee osteoarthritis. *Int J Rheum Dis.* 2011; 14(2):145-51.
10. Spetch LA, Kolt GS. Adherence to sport injury rehabilitation: implications for sports medicine providers and researchers. *Phys Ther Sport.* 2001; 2(2):80-90.
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2. Data based, no new data: Reviews

1. Beinart NA, Goodchild CE, Weinman JA, Ayis S, Godfrey EL. Individual and intervention-related factors associated with adherence to home exercise in chronic low back pain: a systematic review. *Spine J.* 2013; 13(12):1940-50.
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5. Jordan JL HM, Mason EEJ, Foster NE. Interventions to improve adherence to exercise for chronic musculoskeletal pain in adults (review). *Cochrane Database of systematic Reviews* 2010, issue 1. 2010.
6. Kingston G, Gray MA, Williams G. A critical review of the evidence on the use of videotapes or DVD to promote patient compliance with home programmes. *Disabil Rehabil: Assist Tech.* 2010; 5(3):153-63.
7. McLean SM, Burton M, Bradley L, Littlewood C. Interventions for enhancing adherence with physiotherapy: a systematic review. *Man Ther.* 2010; 15(6):514-21.
8. Middleton A. Chronic Low Back Pain: Patient Compliance with Physiotherapy Advice and Exercise, Perceived Barriers and Motivation. *Phys Ther Rev.* 2004; 9(3):153-60.

3. Data based, new data

i. Qualitative study designs

1. Campbell R, Evans M, Tucker M, Quilty B, Dieppe P, Donovan JL. Why don't patients do their exercises? Understanding non-compliance with physiotherapy in patients with osteoarthritis of the knee. *Journal of Epidemiology & Community Health.* 2001; 55(2):132-8.
2. Carr L, Smith RE, Pryor JA, Partridge C. Cystic fibrosis patients' views and beliefs about chest clearance and exercise -- a pilot study. *Physiother.* 1996; 82(11):621-7.

3. Dean SG, Smith JA, Payne S, Weinman J. Managing time: An interpretative phenomenological analysis of patients' and physiotherapists' perceptions of adherence to therapeutic exercise for low back pain. *Disability & Rehabilitation*. 2005; 27(11):625-36.
4. Emtner M, Hedin A. Adherence to and effects of physical activity on health in adults with asthma. *Advances in Physiotherapy*. 2005; 7(3):123-34.
5. Escolar-Reina P, Medina-Mirapeix F, Gascon-Canovas JJ, Montilla-Herrador J, Jimeno-Serrano FJ, de Oliveira Sousa SL, et al. How do care-provider and home exercise program characteristics affect patient adherence in chronic neck and back pain: a qualitative study. *BMC Health Serv Res*. 2010; 10:60.
6. Kåringen I, Dysvik E, Furnes B. The elderly stroke patient's long-term adherence to physiotherapy home exercises. *Advances in Physiotherapy*. 2011; 13(4):145-52.
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9. Myers LB, Horn SA. Adherence to chest physiotherapy in adults with cystic fibrosis. *J Health Psychol*. 2006; 11(6):915-26.
10. Pizzari T, McBurney H, Taylor NF, Feller JA. Adherence to Anterior Cruciate Ligament Rehabilitation: A Qualitative Analysis. *Journal of Sport Rehabilitation*. 2002; 11(2):90-102.
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ii. Non-intervention study designs

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2. Alewijnse D, Mesters I, Metsemakers J, van den Borne B. Predictors of long-term adherence to pelvic floor muscle exercise therapy among women with urinary incontinence. *Health Educ Res.* 2003; 18(5):511-24.
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5. Burns A, BurrIDGE J, Pickering R, Turk R. Does the use of a constraint mitten to encourage use of the hemiplegic upper limb improve arm function in adults with subacute stroke? *Clin Rehabil.* 2007; 21(10):895-904.
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iii. Intervention study designs

1. Alewijnse D, Metsemakers JFM, Mesters IEPE, van den Borne B. Effectiveness of pelvic floor muscle exercise therapy supplemented with a health education program to promote long-term adherence among women with urinary incontinence. *Neurourol Urodyn*. 2003; 22(4):284-95.
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