

Research on exercise programs—an approach of technological science

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The European Review on Aging and Physical Activity concentrates on reviews. Reviews are based on research papers. When compiling, reviewing, or just reading reviews on exercise programs, some difficulties arise. They will be discussed below:

- Original research more often aims at general laws than at technological rules to establish the assumptions under which these laws take effect.
- Authors omit important information on how interventions were executed.
- Definitions and background theory may lack clearness, or there are terminological differences in different scientific traditions.

In the present paper, the problem is sketched in the following paragraphs. Below, possible reasons and proposals are given. It closes with an appeal to emphasize the methods section in publications. The focus is on original research, which is the base of every review based on original research papers.

Reading reviews on physical activity programs, often no clear statement on the effects of certain procedures is given. Sometimes results of collected research seem to be or really are contradictory or no meta-analysis is possible, because the designs are too heterogeneous. Doing a Cochrane Review on home vs center-based exercise, Ashworth and colleagues expressed this experience [1].

This is valid independent of formal quality. Papers on interventional trials often are not comparable, because information on how the interventions were done is missing, or the interventions are too different to aggregate results. In addition, in physical activity interventions with the elderly, the growing heterogeneity of subjects exacerbates the problem: Interventions which show effects for one sample may fail with another sample, in which disorders, social status, motivation, and other aspects are distributed in a slightly different way. For illustration of the different aspects, three examples are sketched:

Example 1: specifications in strength training

Exercise prescriptions in strength training often comprise load magnitude, number of repetitions and sets, rest in-between sets, number of interventions per week, and training period. This was reported by Toigo and Boutellier [8]. The authors show, however, that these classical parameters are insufficient to precisely describe quantitative and/or qualitative effects on skeletal muscle. Therefore, it is not surprising that studies containing some sort of strength training lead to contradictory results or are not comparable. Toigo and Boutellier [8] identify new determinants and recommend to standardize the design and description of all future resistance exercise investigations by using a set of 13 mechanobiological determinants (classical and new ones), including fractional and temporal distribution of the contraction modes per repetition, duration of one repetition, rest in-between repetitions, time under tension, muscular failure, range of motion, recovery time, and anatomical definition.

Example 2: designing a new intervention

Missing information also aggravates the use of published research for the purpose of designing new

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programs. Reasons for choice and order of exercise, for example, are rarely reported. Other questions are: Does intensity increase over time? Which movement instruction is given? Is there any feedback or correction for the participants? These and more aspects are considered to be “action knowledge” or “experience.” Nevertheless, they influence training outcomes and thus contribute to quality of research. In order to overcome this difficulty and to learn from the experiences of colleagues, when designing an exercise program for seniors in residential care, personal contact to other authors was utilized, whose programs then served as references [2]. For this had been only a “work-around,” a proposal for improvement is given below.

Example 3: implementation and diffusion

Lack of information becomes even more obvious, if implementation in real life settings is considered.

In many research papers, ways to gain a maximum effect are studied. In opposite to that, a question of practical relevance could be: “I’ve got one hour per week for health oriented exercise, how should I do it?” or “The administration budgets 1.50 EUR per inhabitant for physical activity promotion, how should we spend it?” In addition to these resource aspects, implementation and dissemination of an exercise program depends on action on certain levels: Rather than motivating the individual subject to take up certain exercises, especially with the elderly certain institutions, professionals in the field and maybe attitudes within society determine the success or failure of the overall intervention.

Analysis and proposals

One reason for the problem may be poor research designs or papers. However, the examples above also include randomized controlled trials and other high-level research. More likely, different scientific approaches seem to conflict.

In biomedical and behavioral sciences, research targets on general laws to be discovered or studied, e.g., motor learning theory or muscle hypertrophy. In opposite to that, exercise or physical activity programs for the elderly are designed to change some feature, e.g., balance or strength. The focus is not on studying a general law, but to study and to establish preconditions, under which the law takes effect. Often this approach is called “applied research,” in opposite to pure or basic research. These terms, however, may be misleading. The “applied” approach of a certain science discipline not only is one part of this discipline, the pure being the

other. Instead it seems to be more technological, similar to engineering. Hansson [6] argued that technological sciences are neither branches nor applications of natural science, for they have certain characteristics (selective citation):

- human-made objects as their study objects
- include the practice of design
- use functional or normative concepts in definitions and evaluations

These features seem also valid, when exercise or other programs are studied. Below, there are two proposals, how research could take this into account:

1. Training parameters in original research should be described comprehensively and clearly. This will help to do reviews and to draw conclusions from multiple studies. This will also help to get an idea how to implement research results into real life settings. For strength training, the scheme of Toigo and Boutellier [8] is helpful. In general, emphasizing the methods section of a paper may enlarge it. Therefore, some journals accept separate study protocols as a special publication type [5]. The study protocol contains all the relevant information, which helps (a) authors of later reviews to include or exclude the trial and (b) program designers and implementers to learn from the experiences of colleagues.
2. Considering implementation, Chen [3, 4] goes even further and considers implementation a distinct “action model” of a program. The action model contains descriptions of (a) intervention and service delivery protocols, (b) implementing organizations, (c) program implementers, (d) associate organizations, (e) ecological context, and (f) the target population. In opposite to that, the change model [4] describes the general law which should be put in action. For example, considering a home-based exercise program [7], choice of exercises, wording of instructions, motivational material, and activities to reach the target group would fall to the action model. The change model could contain stimuli above threshold as cause of increased fiber recruitment and hypertrophy. According to Chen, action model and change model together form a “program theory”, which is defined as “a specification of what must be done to achieve the desirable goals, what other important impact may also be anticipated, and how these goals and impacts would be generated” [3, p. 43]. Unfortunately, a Medline search in early 2009 yielded no results of this promising approach utilized in exercise and physical activity.

Conclusion

The reader may or may not follow the theoretical proposals on program theory or the technological approach—everyone is invited to comment. Anyhow, emphasizing the methods section of original research papers would help a lot in compiling reviews.

Coming back to the European Review on Aging and Physical Activity: EURAPA started in 2004 with two annual issues, which were published by the Zinman College, Wingate Institute, Israel. Now, the journal has been published by Springer for 4 years: There are two issues per year, and the first impact factor is expected in 2010. In 2009, the citations of the 2007 and 2008 issues are tracked.

This gives occasion to thank the editors Michael Sagiv and Heinz Mechling for their initiative and endurance in implementing a new journal and establishing it. The journal also owes much to Springer and its staff in different departments—thank you for your support. Last but not least, thanks go to the scientific community—authors, reviewers, and readers—who contribute to the journal and thus contribute to develop the field we all are involved in. Please keep on submitting papers and reviewing them.

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