Creating Evidence-Based Research in Adapted Physical Activity

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Professional practice guided by the best research evidence is usually referred to as evidence-based practice. The aim of the present paper is to describe five fundamental beliefs of adapted physical activity practices that should be considered in an 8-step research model to create evidence-based research in adapted physical activity. The five beliefs are individualization, critical thinking, self-determination, program effectiveness, and multifactor complexity. The research model includes conceptualize the problem, conduct research on the process of the problem, conceptualize and specify the intervention, evaluate intervention outcomes, evaluate intervention processes, determine person-by-treatment interactions, determine context-dependent limitations, and investigate factors related to intervention adoption maintenance. The eight steps are explained with reference to two research programs that used a randomized control group design.

Keywords: evidence-based research, evidence-based practice, empirically-supported practice, decision making

Adapted physical education emerged in North America in the 1950s and 60s and was viewed primarily as a special program where individuals with a disability were placed (Reid, 2003). Currently, the broader term adapted physical activity (APA) is used to denote a cross disciplinary body of knowledge, a field of professional study, a process of advocacy, acceptance of diversity, and a process of promoting self-determined physical activity (Hutzler & Sherrill, 2007; Reid, 2003). APA has become more than a physical activity program, but certainly programs remain part of APA, and their evaluation by intervention research is critical.

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For this paper we use *practice* as an umbrella term for programs, strategies, techniques, therapies, intervention, or treatments. Some examples of practice in APA that practitioners might use and wonder about the research support include large scale programs for those with intellectual disabilities such as *Smart Start* (Wessel, & Zittel, 1995), inclusion strategies developed in several jurisdictions such as Australia (Downs, 1995), peer-tutoring (e.g., Klavina & Block, 2008), and more focused programs such as treadmill stepping for infants with Down syndrome (Ulrich, Ulrich, Angulo-Kinzler, & Yun, 2001).

APA professionals often rely on “best practice” to guide interventions rather than research results. Davies (1999) proposed best practice involves integrating professional judgment and experience, and it occurs when actions are based on the way things have always been done, have the authority and legitimacy of highly-valued practitioners, or simply abide by common-sense. For a number of years, there have been calls for education to move beyond best practice to those practices based on best research evidence in addition to professional skills, expertise, and competence (Davies, 1999). For example, the No Child Left Behind Act in the U.S. (United States Government, n.d.) requires educational practitioners to use “scientifically based research” to guide decisions about which interventions to implement. Using scientific evidence to justify educational program decisions is often referred to as “evidence-based practice” (EBP, Bouffard & Reid, 2012); closely related terms include evidence-based education, empirically-supported treatment, and evidence-informed practice. Are the examples of practice in the preceding paragraph effective? Do they result in intended outcomes without negative consequences? Some have supporting and published research evidence (e.g., Klavina & Block, 2008; Ulrich et al., 2001), while others may be termed “best practices” (e.g., Downs, 1995). EBP is intuitively appealing and at first glance is a common sense idea positively viewed by researchers, grant agencies, practitioners, service users, and policy makers (Bouffard & Reid, 2012). Yet, as presented by Bouffard and Reid, this apparently simple idea has given rise to heated debate (e.g., Loughlin, 2007). Bouffard and Reid sketched ten fundamental questions about EBP for APA researchers and practitioners with regard to the knowledge creation dimension of EBP.

The 10 basic questions, summarized now, primarily addressed philosophical and political issues related to EBP and the authors hoped their comments would engender lively debate within APA. First, the production of hierarchies of evidence implies that proponents of EBP have engaged in epistemological work. Unfortunately, the rationales for the different hierarchies of evidence are not presented in detail and, hence, the possibility of unfettered debate, which is a central characteristic of academia, is not possible. Issues of power are lurking behind EBP. Second, by ranking double-masked randomized control trial (RCT), and meta-analysis of RTC, at the top of most hierarchies, proponents of EBP have adopted an empiricist view of causality. This view is fundamentally associated with the finding of relations among variables, so that one can make a statement such as “what” changes. A philosophy that limits scientific inquiry to *casual description* has some merits. However, it has little explanatory power and we should not abandon the search for *causal explanations*: “how” and “why” questions should also be posed by intervention researchers. Bouffard and Reid (2012) opposed the atheoretical stance taken by some proponents of EBP, arguing that the design of a study and its interpretation cannot be made in a theoretical vacuum. Third, APA should maintain a skeptical
attitude toward both RCT and theories as the only road to EBP. Some theories of the past have been misleading as they were operationalized into practice without supporting research evidence. Theory should be informed by data and data without theory is uninterpretable. It should also be recognized that results of RCT and meta-analysis, if obtained under tightly controlled conditions, are not always replicable (Ioannidis, 2005; LeLorier, Grégoire, Benhaddad, Lapierre, & Derderian, 1997). To alleviate this problem, it was argued that any intervention should be carefully monitored. When the researcher intends to estimate the average effect of a treatment, and make a causal description inference, the RCT is an excellent research design.

Fourth, questions about the compatibility of frequent understandings of EBP and typical tenets of APA were raised. Essentially, APA is recognized as a multidisciplinary field guided by a philosophy of individuality. Bouffard and Reid (2012) highlighted the tension between implicit ideas advanced by numerous hierarchies of evidence and basic tenets our field. Fifth, despite the concerns they expressed, we still think that the idea of using evidence to guide practice is valuable; however, we have to develop an EBP model that is congruent with fundamental ideas in APA. The main purpose of this manuscript it to outline some key tenets of our field and sketch a preliminary model about the creation of EBR in APA.

EBP began in medicine (Bouffard & Reid, 2012), as did much of disability research. APA will continue to be concerned with issues of health and function, but some have challenged the predominant focus of medicine in understanding disability and advocated a sociocultural understanding (e.g., DePauw, 2000; Grenier, 2007). If one embraces a sociocultural view with emphasis on pedagogical perspectives, there may be problems of applying the conceptualization of practice from medicine to APA (Standal, 2008). Although the 10 broad questions asked by Bouffard and Reid provide general challenges, specific guidelines for EBR in APA are needed.

Recently, Hutzler (2006) proposed that the International Classification of Functioning, Disability, and Health (IFC; World Health Organization, 2001), Adaptation Theory (Sherrill, 1995), and the Systematic Ecological Modification Approach (SEMA; Davis & Broadhead, 2007) were frames of reference to guide EBR in APA. In addition, Hutzler reported that only 16.5% of APAQ articles (from 1995 to 2004) entailed intervention research. EBP is a sensible idea about service providers using the best research evidence about intervention, and we agree that more quality intervention research is needed in APA. Jin and Yun (2010, p. 50) supported EBP for two primary reasons: to provide teachers with “effective teaching and problem solving skills” and to remain consistent with U.S. legislation, No Child Left Behind (United States Government, n.d.). Hutzler (2011) has also outlined important methodological issues for EBR within APA, particularly encouraging greater attention to quality indicators of the research. But, Bouffard and Reid, Hutzler, as well as Jin and Yun were all silent about how to create a program of research producing EBP. Creating evidence via research is the first step in EBP (Jin & Yun, 2010). What would such a program of research look like? We do not believe that EBP can be claimed from a single study (Cook, Tankersley, & Landrum, 2009), nor do we subscribe to the singular superiority of one method (La Caze, 2008, 2011; Odom, et al., 2005). How do researchers provide evidence for EBP? The purpose of this paper is to (a) describe some fundamental beliefs in APA and (b) outline research steps for those APA researchers seeking EBP that acknowledge these fundamental beliefs.
Fundamental Beliefs That Challenge Evidence-Based Research in Adapted Physical Activity

We contend that at least five fundamental beliefs related to practice in APA will influence our EBR programs, making them quite unique: individualization, critical thinking, self-determination, program effectiveness, and multifactor complexity. While we believe they enjoy wide acceptability, others might disagree with one or two, or wish to include other beliefs. They are used for illustrative purposes of how such beliefs provide challenges for EBR.

Intervention for individual people is a fundamental belief in APA. After all, the IEP is an individualized education program. APA is not limited to education, but scholars in APA have frequently endorsed a philosophy of individuality (e.g., Hutzler & Sherrill, 2007; Reid, 2003). That is, interventions should be individualized and congruent with the interests, needs, and aspirations of each participant. Well-prepared APA instructors adapt their practices with the individual in mind (Sherrill, 1995). From a research perspective, there is serious concern whether the outcome of groups, based on average performance, transfers to the individual case (Bouffard, 1993; Upshur, 2005). Huge interindividual differences in response to very similar physical activity treatments have been demonstrated (Bouchard & Rankinen, 2001; Roth, 2007) and we must remember the dangers of generalizing from aggregate to person.

If EBP is the judicious use of current research to guide decisions about individuals (after Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996), such research may be generated by nomothetic or idiographic approaches according to Spring (2007). The central concern of nomothetic research is to find what happens in general (Bouffard, 1993). A typical nomothetic research strategy is to conduct a group study (e.g., RCT). In this case, the average effect of treatment X is often a key concern. In addition, in a RCT study, the treatment is not likely adapted to particular personal or environmental circumstances. This research often leads to recommended practices or guidelines to practice and assumes a “one-size fits all” perspective (Spring, 2007). That is, the intervention assumes relatively homogeneous needs among different individuals who have similar perceived needs. Fundamentally, this is incongruent with APA practices, which reflect individualization and instructors should be wary of nomothetic research claiming to support evidence-based practice. Of course, we acknowledge that APA practitioners may start with group outcome research as the basis of practice and modify as individual responses dictate. An idiographic approach, more common today in health professions such as psychology (Spring, 2007), attempts to make decisions on careful assessment of an individual and the environment as occurs within ecological task analysis (Davis & Burton, 1991). APA might be better served by idiographic approaches to research because of its commitment to the individual. Spring (2007) proposed a three-factor model of EBP from an idiographic viewpoint. An informed program decision is the desired outcome (e.g., a particular student would benefit from teacher-directed applied behavior analysis, while another from opportunities for exploration and self-discovery). Such decisions receive input from three sources. The first is the best available research evidence, which some might consider to be the essence or only dimension of EBP. The second is practitioner input, which recognizes the experience of the practitioner.
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and is based upon competence delivering the intervention and nonspecific factors such as teacher warmth and enthusiasm (see Wampold, 2001). The third source of input for program decisions is the individual receiving the program, which reflects their personal goals and values.

In APA, practical experience should be related to our second fundamental belief, that practitioners should be engaged in critical thinking of selected practices for an individual (e.g., Bouffard & Strean, 2003). This includes monitoring of the individual’s progress under practice X and justifying continuing with X, modification to X, or change to another practice. The critically thinking instructor has developed the ability to justify why a particular practice has been selected, monitors its delivery, and modifies as necessary.

Including the person in the decision-making process is consistent with the third fundamental belief for APA, self-determination (e.g., Calzonetti, 2003; Reid, 2003; Sherrill 1995). What are the individual’s values, goals, and activity preferences? Is the person being empowered to make choices, become more independent, and to self-regulate personal learning and participation? While developmental factors such as age should be considered, an individual’s input into making intervention decisions is fundamentally important.

A fourth belief is that APA must be particularly concerned with program effectiveness, because our practices occur in real life and real educational, recreational, and sport environments. In intervention research, efficacy is similar to internal validity and addresses whether an intervention works, usually under tightly controlled conditions (Shadish, Cook, & Campbell, 2002). On the other hand, studies of effectiveness explore whether the practice works in a “real-world” situation that may be difficult to control in a true experimental sense. For example, effectiveness is the evidence of practice impact in a sport situation led by volunteer practitioners (e.g., Special Olympics) rather than efficacy of practice in learning physical skills in a university laboratory led by graduate students employed and supervised by their professor.

Our fifth principle, multifactor complexity builds on observations by Standal (2008), Odom et al. (2005), Davis and Broadhead (2007), Sherrill (1995), and ecological task analysis advocates (Davis & Burton, 1991). APA research includes numerous variables and interactions at several levels: complex contexts, diversity of student abilities and motivation, socioeconomic status, and curriculum. These many factors may lead to difficulty in determining what works. To underscore the multifactor nature of APA instruction we can add parent support, teacher commitment, attitude, and education, as well as cultural values. “What works” will be potentially constrained by many factors. It may be that peer-teaching is effective under only certain circumstances: for those individuals with a given disability, within this particular age range, with a specified degree of training for the instructors.

In a field such as APA, we agree with Standal (2008) that researchers face unique practical as well as philosophical issues in adopting EBP. With regard to special education, Cook et al. (2009) stated, “...we recognize the dangers of overemphasizing EBPs in a field premised on individualized instruction” (p. 381); however, we believe that researchers and practitioners should strive to prioritize practices shown by research to provide meaningful improvements in individual outcomes. As such, it is important to consider what APA researchers can do to establish evidence-based interventions while still acknowledging individualization, critical
thinking, self-determination, program effectiveness, and multifactor complexity. Below we sketch a potential EBR model that could alleviate some of the concerns expressed by Bouffard and Reid (2012) and is congruent with the key tenets of APA.

**An Adapted Physical Activity Model to Generate Evidence-Based Practice**

The best available research evidence can be identified in two ways: research synthesis and research generation (Spring 2007). There is a need for organizations to synthesize the existing literature, ascertain which practices are evidence-based, and disseminate the results to its members and the public. This is an important exercise. The following research model focuses on research generation rather than research synthesis. Logically, research generation must occur before research synthesis.

Research generation of EBP usually results from a program of research rather than a single study. For example, Levin, O’Donnell, and Kratochwill (2003) proposed four stages of an educational intervention research program and argued that a variety of research methodologies are potentially useful in EBR. At least four types of research have been identified in special education (Council of Exceptional Children, 2008) that may be useful in determining EBP for APA: experimental groups (Gersten et al., 2005), single-subject designs (Horner et al., 2005), correlational research (Thompson, Diamond, McWilliam, Snyder, & Snyder, 2005) and qualitative studies (Brantlinger, Jimenez, Klingner, Pugach, & Richardson, 2005).

On the basis of issues surrounding EBP (Bouffard & Reid, 2012) and our five fundamental beliefs, we propose a research model to identify EBP in APA. In several ways, it is similar to those previously presented (e.g., Kazdin, 1997; Levin et al., 2003). It is multistep, promotes numerous research methodologies, and focuses on efficacy and effectiveness research. The model is unique in that we combine aspects of knowing why practices work, with factors that influence their adoption in APA settings, and specifically address the fundamental beliefs we hold for APA. The APA model consists of eight steps, or stages. They should be viewed as guidelines rather than inflexible steps as specific interventions, and local circumstances may dictate that some steps become less important and perhaps others become more critical. Yet, the steps are areas “that ought to be covered so that the foundation of knowledge is systematic and builds in a unified way” (Kazdin, 1997, p. 117). We view all four types of research as viable: different questions being most effectively addressed by different methodologies. The stages are (a) conceptualize the problem, (b) conduct research on the process of the problem, (c) conceptualize and specify the intervention (d) evaluate intervention outcomes, (e) evaluate intervention processes, (f) determine person-by-treatment interactions, (g) determine context-dependent limitations, and (h) investigate factors related to intervention adoption and maintenance.

Two APA interventions will be used as examples in the eight steps so that readers can decide if the EBR supports the intervention being designated EBP. In general, it is likely that research evidence will vary from minimal to extensive. The treadmill stepping program for infants with Down syndrome by Ulrich et al. (2001) and the physical fitness program for adults with intellectual disabilities by Montgomery, Reid, and Seidl (1988) might lay claim to being EBR on the basis of their randomized trial designs; hence their selection for the present analysis.
Conceptualize the Problem

Two questions must be asked at this stage. First, which function needs to be improved? Different answers like cardiovascular fitness, throwing and catching skills, social interaction, or physical activity might result. Second, what theoretical understanding do we have about the factors affecting the function? Stated differently, “what processes are involved, and how [do] these processes emerge or operate” (Kazdin, 1997, p. 117). This can be achieved by a careful literature review as well as research in this initial stage of developing evidence. Qualitative, correlational, or descriptive research may be necessary. For example, Ulrich and colleagues (2001) created a treadmill intervention to facilitate walking in infants with Down syndrome because these infants usually walk at least a year later than their peers without a disability, and motor development is positively related to cognitive and social development. Walking was the function that required change. Guided by a dynamic systems theoretical perspective, they conceptualized walking as an outcome of interacting constraints rather than limited by maturation of the central nervous system. Had they viewed delayed walking as a function of slow maturation, no action would have been deemed appropriate since the passage of time would be sufficient to resolve the problem. To understand the processes involved in walking, the authors consulted existing research and argued that walking might be a hidden ability present during the latter part of the first year and with practice alternating stepping becomes more stable (Thelen & Ulrich, 1991). D. Ulrich and his team (Ulrich et al., 2001) hypothesized that a treadmill intervention might be useful in facilitating walking in infants with Down syndrome because it promotes many opportunities to practice stepping, leading to increased strength and balance necessary for independent walking long before the child can pull to a stand and walk.

Conceptualizing the problem in Montgomery et al. (1988) was different. Earlier research evidence confirmed low levels of physical fitness in adults with an intellectual disability (Reid, Montgomery, & Seidl, 1985). The authors speculated these depressed levels were due to few opportunities to exercise and lack of knowledge by instructors of how to adapt fitness programs. They did not view the levels of fitness as unchangeable but wondered if community programs were accessible, or particularly motivational, for these adults. Thus, they developed a physical fitness intervention that would be led by employees in the supported work environments of the adults with intellectual disabilities. They argued that sustainability of the intervention would be enhanced by having employees who worked with the adults on a daily basis. Conceptualizing the mediators, moderators, and mechanisms of change (see distinctions in Kazdin, 2007, 2009) is an essential part of this stage and was included in question 2 of Bouffard and Reid (2012).

Conduct Research on the Process of the Problem

Research should test the processes hypothesized to be implicated in the problem; in other words, test the conceptual view (Kazdin, 1997). Whenever feasible, causal process theories should be inserted early in the development of evidence-based research. Although the word “theory” has numerous meanings, we use it to refer to a set of constructs and their interrelationships (Kerlinger, 1986). Given the numerous relationships present in most causal process theories, it is possible to identify moderators, mediators, and mechanisms of change. We submit that researchers
should test the processes hypothesized to be implicated in the problem. For example, if children with developmental coordination disorder are conceptualized, in part, as failing to employ self-regulation strategies as they practice movement skills, it behooves the researchers to test this claim, before a self-regulation intervention is created (e.g., Lloyd, Reid, & Bouffard, 2006). Research on the nature of the problem may identify multiple paths leading to the problems (Kazdin, 1997). These findings will influence the type of intervention and provide support that the major processes can change and such changes mediate the outcome. For example, B. and D. Ulrich and colleagues (Ulrich, Ulrich, & Collier, 1992; Ulrich, Ulrich, Collier, & Cole, 1995) conducted studies with infants with Down syndrome to demonstrate that a treadmill intervention elicits alternating stepping (Ulrich et al., 1992), which becomes more frequent over time before they walked independently (Ulrich et al., 1995). This research confirmed their speculation that supported treadmill stepping might be a beneficial intervention with these infants and hence a mediator of change (Kazdin, 2009).

Montgomery et al. (1988) did not conduct research to support their claim that low fitness was related to fewer opportunities to exercise and lack of knowledge by instructors of how to adapt for adults with an intellectual disability. In addition, this research did not possess a precise theoretical framework, and hence determining processes of change would be difficult.

**Conceptualize and Specify the Intervention**

Kazdin (1997) suggested operationalizing the outcomes that the intervention is designed to achieve and how changes to key processes occur. In this phase, researchers are concerned with how an intervention achieves change. In the Ulrich research example, researchers would pose questions such as “At what age should treadmill interventions begin in children with Down syndrome? What is the necessary frequency of the intervention? If the treadmill intervention reduces the delay in walking, what anthropometric changes might one expect?” Such specificity is important as it will provide direction for how the intervention outcomes are assessed and through which processes. Montgomery et al. (1988) focused on health-related physical fitness rather than performance-related fitness, but did not conceptualize their program as one which would have direct health benefits and hence did not include such measures as blood pressure or cholesterol changes that are more common today.

An issue in this phase of the research process is the specification of the intervention and whether to include an intervention manual. In the case of Ulrich et al. (2001), parents delivered the intervention 8 min per day for 5 days per week in their home until their child could walk independently. The researchers visited the parents and infants biweekly and required them to maintain a log book of such things as ongoing physical therapy, child illness, and specific time on treadmill. While not a manual per se, there were explicit intervention instructions. The biweekly visits served as an ongoing evaluation of the fidelity of the intervention protocol. Reid, Montgomery, and Seidl (1990) did create a manual of 48 physical fitness classes that was used by employees of the adults in the second year of the program. The specification of the physical fitness program involved 40 min lessons, three times per week for 6 months (Montgomery et al., 1988, study 1) and 4 months (Montgomery
et al., 1988, study 2). Some argue that a manual might reduce teacher spontaneity, creativity, and overall intervention flexibility. Others suggest that a manual will increase the probability that the intervention is performed as intended, which is fidelity (Horner et al., 2005) and will facilitate research replication. We support a flexible approach of intervention guidelines rather than “say this and play this game in the following situation . . .” since individualization and critical thinking by instructors trump a purely standardized approach; however, such adaptation challenges inferences feasible with traditional methodological designs (readers may wish to consult Murnane & Willett, 2011 for elaboration). Nonetheless, fidelity should be assessed and instructors might be interviewed to determine why they veered from the manual or guidelines.

**Evaluate Intervention Outcomes**

Table 1 presents guidelines to judge the research that purports to support a program practice. The guidelines deal with the amount and quality of research, essentially a research synthesis that is part of knowledge creation. Gersten et al. (2005) suggest that two group experimental studies are required to justify EBP if they possess high quality, but four are necessary if they have only acceptable quality. Horner et al. (2005) make the case for the legitimacy of single-subject designs in this phase of EBP research and propose that five or more studies with at least 20 participants across the studies are required to claim the practice as evidence-based. They also posit that the studies should be conducted by three different researchers in at least three different geographical locations. The notion of more than one research group contributing to EBP research is also part of the recommendations from Division 12, clinical psychology (Lonigan, Elbert, & Johnson, 1998) and Division 16, school psychology (Kratochwill et al., 2001) of the American Psychological Association. This could prove challenging to researchers since funding agencies may be reluctant to support research appearing to be only a replication. Research teams from different universities that are truly independent of each other may have to be constituted in original grant applications. The two American Psychological Association divisions explicitly assert that both single-subject research and group research can provide evidence of effective practice. The single-subject research models have additional benefits noted below, but they are recognized as viable designs to establish a causal functional relationship between independent and dependent variables.

Our purpose in presenting the 8-step model for APA is to provide guidelines rather than rigid requirements. We should adopt stringent requirements for APA only if they make sense in our field of study. There is little to be gained here in debating between nine single-subject studies as recommended by the American Psychological Association and the five suggested by Horner et al. (2005). Rather, there are similarities across the standards proposed in Table 1 to contemplate. First, group and single-subject designs are acceptable in EBR, one is not necessarily of lesser quality than the other. Second, more than one study is necessary. Third, findings should be corroborated by other research teams.

The issue of the research quality of individual studies is engrained within EBR, apart from our 8-step model of a research program. Quality research indicators is a topic in its own right (Cook et al. 2009; Gersten et al. 2005; Horner et al. 2005; Hutzler, 2011). We envision APA scholars will evaluate studies on relevant topics
such as peer-instruction from a quality indicator perspective, guided by quality indicator lists that exist for different research methodologies (e.g., Brantlinger et al. 2005; Gersten et al., 2005; Horner et al., 2005; Thompson et al. 2005). Such analyses will contribute to our quest of EBP in APA, but will not necessarily include all the steps in our model, for example conduct research on the process of the problem.

Both Ulrich et al. (2001) and Reid et al. (1990) used group designs with random assignment of participants to experimental and control conditions. As such, their research constitutes a high level of evidence according to some criteria (e.g., Cochrane, 1972). Ulrich et al. demonstrated that infants with Down syndrome exposed to regular treadmill stepping practice by their parents walk independently 101 days earlier than those who did not receive such an intervention. Reid and colleagues showed that adults with intellectual disabilities who participated in a planned and comprehensive fitness intervention led by physical education students (study 1) and work-place employees (study 2) improved fitness parameters to a greater extent than those who did not receive the intervention. Despite the positive results, the research has not been replicated by the respective authors nor by independent researchers.

Horner and colleagues (2005) and Watkinson and Wasson (1984) outlined reasons why single-subject research may be particularly useful to researchers concerned with APA. Populations examined in APA are often very heterogeneous, making information about means of groups less interesting to researchers. Single-subject designs may be particularly beneficial in initial theory development (Bouffard, 1993). These designs offer a rigorous method for analyzing individuals who do

### Table 1 Criteria for Testing Intervention Outcomes

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<td>Gersten et al. (2005)</td>
<td>(a) at least four acceptable-quality studies, or two-high quality studies that support the practice; and (b) the weighted effect size is significantly greater than zero.</td>
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<td>Horner et al. (2005)</td>
<td>(a) at least five single-subject studies that meet minimally acceptable criteria and have been published in peer-reviewed journals; (b) the studies are conducted by at least three different researchers across three different geographical locations; and (c) the five or more studies have a total of at least 20 participants.</td>
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<td>Chambless et al. (1996) &amp; Task Force (1995)</td>
<td>(a) at least two well-conducted group-design studies, conducted by different investigation teams, showing the intervention to be either superior pill placebo or alternative intervention; OR equivalent to an already established intervention in studies with adequate statistical power. OR (b) a large series of single-case design studies (i.e., n &gt; 9) that both use good experimental design AND compare the intervention to another treatment, AND (c) treatment manuals used for the intervention preferred, AND (d) sample characteristics must be clearly specified.</td>
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not respond to an intervention, thereby acknowledging the existence of possible subgroups and/or potential changes to an intervention to make it more appealing to a wider audience. Finally, single-subject designs are valuable in determining effectiveness of an intervention, that is, outcomes in more naturalistic settings outside the research laboratory (De Los Reyes & Kazdin, 2006; Kazdin, 2004).

Qualitative designs can also be very informative regarding outcomes, and their use is consistent with our five fundamental beliefs. Grypdonck (2006) argues that qualitative research provides an understanding of why an intervention works, leads to intelligent application of the RCT by exploring the particular situation, and determines what an intervention means to individuals. Goodwin (2009) has recently reviewed insights from the voices of students with disabilities in inclusive settings to understand inclusion from their perspective. They certainly want to be physically active with their classmates and often report a sense of belonging, social acceptance, friendship, and physical competence, but also ridicule, embarrassment, and loss of independence. Such individual and rich perspectives would not have been possible without qualitative research. Finally, qualitative research has a long history in special education which has affected practice and policy (Brantlinger et al., 2005).

This section has focused primarily on issues pertaining to causal description: which methods and under what conditions enable an estimate of the size of an intervention effect and render plausible the causal description inference; however, their explanatory power is limited. Hence, we submit that studies focusing on an understanding of the processes linking hypothesized cause to effect be undertaken.

**Evaluate Intervention Processes**

This phase involves evaluating factors in the conceptualization of the intervention that were expected to produce or facilitate change, that is, the mechanisms of change. Evaluating such processes is essential to understand not only what works, but how and why an intervention works (see question 2 in Bouffard & Reid, 2012). Ulrich and associates (2001) expected a treadmill intervention would produce earlier independent walking in infants with Down syndrome when exposed to a treadmill stepping intervention. Strength and balance were the hypothesized mechanisms but were not assessed in the intervention study. However, anthropometric and motor development data from an earlier study was interpreted as consistent with a muscle strength mechanism for independent walking (Ulrich et al. 1995). Reid and colleagues (1990) did not hypothesize any mechanisms other than regular exercise.

**Determine Person-by-Treatment Interactions**

This step is important for researchers in APA as person-by-treatment interactions are likely to be observed (Bouffard, 1993). It is closely related to the question posed by Bouffard and Reid (2012). How do we generalize from aggregate to person? A person-by-treatment interaction (PTI) suggests a program has differential effects on individuals. In other words, each individual may not receive the same “boost” from the intervention (Bryk & Raudenbush, 1988). This concept is apparent to any insightful instructor; if a group of individuals begin a program at the same level of performance, change in each person is quite unique over time. Some will improve
tremendously, others very little. Yet, research evidence based on groups seldom considers PTIs. When a randomized group design is used, researchers typically compare average performance among groups and the possibility of heterogeneity of response to treatment is not evaluated. This makes inferences from aggregate to individuals tenuous (Bouffard, 1993). Recent data analysis strategies advanced by Tucker-Drob (2011) might be useful to evaluate the presence of person-by-treatment interaction and the study of covariates of change; however, this data analysis strategy relies on the use of structured equation modeling and may not work well with the small samples typically available in APA research.

Replicated single-subject designs illuminate PTIs as individuals who do not change will be apparent with the repeated assessment of the dependent variable. For example, one student of three in a study of peer tutors (Houston-Wilson, Dunn, van der Mars, & McCubbin, 1997) and self-monitoring (Todd & Reid, 2006) did not respond positively to the respective interventions. Qualitative interviews may also provide insights into PTIs. Because APA researchers often study the heterogeneity associated with disability, it is important to use the person as the basic unit of analysis and determine PTIs before generalizing results from aggregated data to individuals (Bouffard, 1993). Neither Ulrich et al. (2001) or Reid et al. (1990) discussed the issue of PTIs.

Determine Context-Dependent Limitations

As suggested by Kazdin (1997) it is important to determine for whom and under what conditions an intervention is effective. At a broader level Bouffard and Reid (2012, question 5) suggested that researchers should consider the extent to which results of intervention are context specific. This grows from our belief of multifactor complexity in APA practices. In social sciences such as education, it is likely that outcomes are influenced by factors such as the enthusiasm and commitment portrayed by the instructor/teachers, level of development in the individual, or the existing supports for learning. The plausibility of contextualism was recognized over 40 years ago by Paul (1967, as cited by Gersham, Beebe-Frankenberger, & MacMillan, 1999, p. 561), who stated that it was important to know “What treatment, by whom, is most effective for this individual with that specific problem, under which set of circumstances.” All forms of research might contribute to this assessment. Brantlinger and colleagues (2005) made the point that qualitative research is usually not designed for widespread generalization but can be effective in exploring specific contexts and individuals.

Kazdin (1997) made the case for investigating the conditions of intervention effectiveness in the strongest terms; researchers have wrongly attempted to determine if an intervention is effective without investigating the conditions which lead to intervention effectiveness. In other words, understanding the contextual limitations of intervention is a crucial component of EBP. Ulrich and colleagues (2001) clearly state some of the conditions under which their treadmill intervention was effective:

Deliberate practice of alternating steps on a motorized treadmill before independent walking reduced the delay in the onset of this skill in infants with Down syndrome. A home-based training of 8 min. per day, 5 days per week on the treadmill, resulted in a significant positive effect on the development of standing, walking with assistance and walking independently. (p. 89)
But they did not consider other aspects of contextualization such as family structure or socioeconomic family status. Reid et al. (1990) also failed to investigate contextual factors such as level of intellectual disability, age, or type of leadership in the supported work environment.

Investigate Factors Related to Intervention Adoption and Maintenance

This phase builds on the distinction between research efficacy and effectiveness. Researchers should investigate factors related to adoption of a practice under naturally existing conditions, that is, factors that facilitate or impede use of an intervention. Numerous research methodologies are potentially useful (Odom et al., 2005). Factors related to adoption, which may be particularly pertinent to APA researchers, include (a) provider, supervisor, and administrator attitudes; (b) participant and parent satisfaction; and (c) cost.

Researchers might consider practitioner, supervisor, and administrative attitudes toward a given intervention as these individuals influence adoption of practices. By studying the appeal of a practice by various professionals, valuable feedback can be obtained that may be helpful in modifying the practice to encourage its use. If these individuals do not find a program appealing, then widespread implementation is unlikely, regardless of the outcomes of the intervention.

Participant and caregiver satisfaction are also important to program adoption, an essential part of a comprehensive evaluation and is consistent with our beliefs of individualization and self-determination. Because APA interventions are often optional, participants are likely to withdraw if they become dissatisfied. Interventions for some individuals (e.g., severe disabilities) might be limited because they depend upon considerable time and effort from already busy families. Finally, cost will be considered in adopting an intervention. When implementing programs for participants with minimal discretionary funds, it is important to consider the economic feasibility of an intervention.

If EBP uses the best research evidence to guide program decisions, the factors which influence adoption should be part of the overall research evidence. This research base, in concert with practitioner skills and experience, as well as input from the individual (Spring, 2007), will move APA forward in a rigorous and thoughtful manner.

Summary and Conclusions

Creating EBP in adapted physical activity is a laudable goal; however, EBP is fraught with philosophical and political issues, such as those raised by Bouffard and Reid (2012). From an explicit statement of five fundamental beliefs about APA practice, an eight-step research model was presented. It was designed as a set of guidelines for inquiry that should lead to EBP in adapted physical activity. The first five steps produce empirical research of what works and why. These questions can be addressed by group, single-subject, correlational, and qualitative research methods, used in appropriate places within the collection of studies that constitute EBR. EBR should also evaluate factors that constrain the efficacy of interventions such as PTIs and contextual factors (steps 6 and 7). Finally, the eighth step concerns
questions of effectiveness in real world settings. We expect that many APA colleagues agree with program decisions involving experienced instructor input and the views and values of the participant. The eight research guidelines should assist those contemplating EBP research and extends the evaluation of individual studies by quality indicators, an important element in EBR (Hutzler, 2011). We anticipate that EBP will remain on the adapted physical activity research agenda. Hopefully, this paper contributes to the conversation about EBP in APA.

End Note

1Terry Rizzo was the editor for this manuscript.

References


