Participant identification, selection and recruitment - Chapter Preprint

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This is a preprint of a chapter forthcoming in the following edited textbook: Eimear Dolan & James Steele (Eds.). Research Methods in Sport and Exercise Science: An Open Access Primer. Society for Transparency, Openness, and Replication in Kinesiology.

Please cite as: McCrum C, Schneider C, Zenko Z. (2025). Chapter Preprint: Participant identification, selection and recruitment. In: Dolan E & Steele J (Eds.). Research Methods in Sport and Exercise Science: An Open Access Primer. Society for Transparency, Openness, and Replication in Kinesiology. Preprint DOI: 10.51224/SRXIV.509

Chapter Overview

Research in the sports and exercise sciences usually depends on participants volunteering their time and effort and taking on some element of risk. For researchers, it is key to recruit a sample of participants that is appropriate for the research question at hand and to ensure that the participants are suitably informed, comfortable, motivated, compensated and protected. Achieving the recruitment of a good sample of participants for any research question involves a number of theoretical, statistical, ethical and inter-personal factors. In this chapter, we discuss many of these factors from the early stages of designing a study and considering which population to study, through to sample size planning, sampling and recruitment, and communication with potential participants. We discuss current practice and evidence and provide recommendations and reference to other helpful resources with the aim to inform researchers of the many intricacies of these processes and the importance of considering them in the planning stages of any research project.

Considerations in determining the optimal population for your study

In this chapter, we will assume that a research question has been developed with appropriate specification of the population of interest. While it seems obvious to state, in order to answer the research question, the sample of participants in any research study should be sampled from the population of interest. In the sports and exercise sciences, this is often not precisely the case, with many studies using samples of healthy undergraduate (sports and exercise sciences) students, while aiming to investigate more generalizable effects, based on the reported research aim. These participants, while readily available, highly appreciated, and often highly motivated to participate in our research, neither represent the general public well (often being healthier, fitter, faster and stronger than much of the general population, not to mention generally possessing a higher affinity for sports and exercise) nor do they usually represent elite, professional or international athletes. Therefore, it is worth considering early on in the research process if the population of interest can reasonably be recruited and sampled.

If the research concerns an intervention, it is also helpful to consider at which point on the efficacy-effectiveness continuum we consider the research to sit (efficacy meaning that the intervention produces the expected result under ideal conditions and effectiveness meaning that the intervention produces the expected results in real-world conditions) (Godwin et al., 2003; Gartlehner et al., 2006; MacRae, 1989). In medical research, trials examining efficacy or effectiveness are often referred to as explanatory or pragmatic trials, respectively (Godwin et al., 2003). Explanatory trials may be particularly useful for research in which the potential mechanism of the effect is disputed or lacks evidence. In sports and exercise sciences, explanatory trials could, for example, test new interventions under optimal conditions with controlled, homogenous group of participants with high internal validity (Rothman et al., 2013). Explanatory trials have an additional advantage since they typically cost less, because fewer participants are needed compared to pragmatic trials with more heterogenous samples and higher external validity. If a mechanism of an effect is established, however, then a pragmatic trial in practice with a larger, heterogenous sample more closely representing the characteristics of the population might be warranted. In this case, the researcher must consider if the sample is likely to be representative with regards to sociodemographic, physiological and psychological characteristics.

Once a researcher has determined from which specific population they aim to sample, the next, related part of the process is to specify the appropriate eligibility criteria (the inclusion and exclusion

criteria of a study) for participation in the study. Firstly, the inclusion criteria should be defined in order to ensure inclusion of a sample with characteristics in alignment with the pre-defined population. Exclusion criteria can then be defined in such a manner that they exclude potential participants that meet the inclusion criteria but may not be suitable for participation for some other reason (e.g., injury or medical condition or history puts them at increased risk during the study or certain characteristics make them unlikely to benefit or respond to the intervention). Researchers should also be mindful that they do not exclude potential participants from the population of interest simply for the sake of making the study recruitment easier or faster, or to simplify analysis or interpretation of the results. For example, women are underrepresented in sports and exercise research (Costello et al., 2014, Walton et al., 2024) partly due to studies excluding women to reduce (biological) heterogeneity in the sample, but in many cases, this argumentation is not well justified (Elliott-Sale et al., 2021). As implied above, pragmatic trials of interventions that are relevant for a population that includes men and women should recruit a sample that includes both men and women. Similarly, Brach et al. (2023) have recently highlighted that research with older adults often excludes certain potential participants directly due to unjustified exclusion criteria, such as upper age limits (Bayer and Tadd, 2000; Godlovitch, 2003), or indirectly due to recruitment strategies inappropriate for reaching a representative sample of the population (Witham and McMurdo, 2007). This is also important from an ethical perspective. Ensuring that the benefits (and burdens) of research participation are distributed fairly must be considered as a standard part of ethical research. These considerations should include individual justice (e.g., individual patients) and social justice (e.g., class, groups) (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979). These considerations (and others) are discussed later (see “Some Ethical Considerations”).

Once the eligibility criteria have been set, the researcher has firmly established who will be eligible to participate in the study. The next steps are to determine how many of such participants will be required to answer the research question.

Considerations for determining your sample size

Choosing the sample size for a study is a balancing act between a number of different factors, which can be practical or methodological. On the practical side, financial factors such as available budget, cost of measurements and participant compensation and logistical factors such as available

laboratory or project time, local potential participant pool and number of project team members may all affect what sample size is feasible to achieve. From the methodological perspective, factors such as measurement precision, desired statistical power and the effect size of interest can influence what sample size is required to meet related criteria.

Unfortunately, the sports and exercise sciences literature does not have a good track record in reporting and justifying how sample sizes have been determined (Table 1), with the vast majority of studies in the field not reporting any type of justification of their sample size, despite all of the above factors potentially having played a role in the decisions. It is also important to note that a justification being present does not guarantee that it is complete, valid, or correct (McCrum et al., 2022; Schulz et al., 2022; McKay et al., 2023). As a researcher, it is important to consider the multiple aspects discussed above prior to the start of data collection to ensure that a study will be both feasible within the given practical constraints and likely to be of scientific value. This decision process should be clearly communicated to readers in order to allow for critical methodological review and to ensure the quality of research in the long term. In addition to reading this section we recommend consulting the article "*Sample Size Justification*" (Lakens, 2022b) or the section "*Sample Size Justification*" in the open online textbook "*Improving Your Statistical Inferences*" (Lakens, 2022a) for an extensive guide to sample size justification and planning.

Effect Sizes

Among other factors, like the significance criterion (i.e., Type 1 error rate or alpha level) and reliability/precision of the results, the required sample size depends on the effect size, which is "*the degree to which the phenomenon exists*" (Cohen, 1988, p. 4). All other things being equal, the larger the effect size of interest, the smaller the required sample size. Unfortunately, in many areas of sports and exercise sciences, like research in elite athletes, we expect that small effects are important, while sample sizes are naturally limited and often small. This leads to a small effect—small sample size dilemma which possess substantial challenges to research design and analysis (for an introduction see Hecksteden et al. (2022).

Effect sizes are quantitative summaries of the study results and are often categorized with descriptors such as *trivial*, *small*, *medium* and *large* (Cohen, 1988; Hopkins et al., 2009). However, the use of default threshold values for such qualitative descriptors is largely criticized (Caldwell and Cheuvront, 2019; Hedges, 2008;Lakens, 2022a, Ch. 6.5; Mesquida et al., 2022; Mesquida and Lakens, 2024) and realistic and informative effect size thresholds need to be empirically determined

Table 1: Rate of Sample Size Justifications in Sports and Exercise Sciences Journals

Publication	Journal	Rate	Notes
Abt et al. (2020)	Journal of Sports Science *n=120 randomly selected from the previous 3 years*	10.8%	12 *a priori* power calculations 1 precision-based calculation
Robinson et al. (2021)	Journal of Biomechanics *n=653 experimental articles published in 2018 or 2019*	4.4%	Of the 226 papers containing "power", 29 contained an *a priori* power analysis.
Twomey et al. (2021)	European Journal of Sports Science *(n=100)* Medicine and Science in Sports and Exercise *(n=100)* Journal of Science and Medicine in Sport *(n=100)*	19% 35% 14%	The author guidelines of Medicine and Science in Sports and Exercise requires sample size calculations. In this analysis, any sample size justification was considered.
McCrum et al. (2022)	Gait & Posture *The journal updated their author guidelines to require a justification of the sample size. 157 pre-guideline and 128 post-guideline articles were analysed*	16.6% pre 28.1% post	Any sample size justification was considered.
Borg et al. (2022)	American Journal of Sports Medicine *(n=2)* Archives of Physical Medicine and Rehabilitation *(n=9)* British Journal of Sports Medicine *(n=2)* International Journal of Sports Physiology and Performance *(n=42)* Journal of Neurologic Physical Therapy *(n=2)* Journal of Physiology *(n=2)* Journal of Science and Medicine in Sport *(n=16)* Medicine and Science in Sports and Exercise *(n=10)* Physical Therapy *(n=3)* Scandinavian Journal of Medicine and Science in Sports *(n=4)*	Overall: 8.7%	Focused on sample size calculations in 93 articles using intraclass correlation coefficient (ICC) for test-retest reliability based on a systematic search of leading exercise, sport and rehabilitation journals from 2016-2021
Schulz et al. (2022)	Clinical trials *(n=163)* from 27 journals in the top 25% of the orthopaedics and sports medicine category based on the Scimago Journal Rank Indicator	Overall: 60%	Only sample size calculations.
McKay et al. (2023)	Human Movement Science Journal of Motor Behavior Journal of Motor Learning and Development *(overall n=636)*	Overall: 13%	Only power analyses.
Preobrazenski et al. (2024)	The first 170 studies identified via a systematic search involving an exercise intervention published in each of 1995 and 2020 *(overall n=340)*	1995: 2.9% 2020: 31%	Only sample size calculations.

in each research discipline. There is no universal consensus for the optimal field-specific effect size, but for discussions and examples of field specific effect size thresholds in sports and exercise sciences see (Datson et al., 2022; Hopkins et al., 1999; Rhea, 2004; Swinton et al., 2023; Thomas et al., 1997)). In any case, it is not advisable to unreflectively use the empirically derived effect size threshold values for sample size planning and power analysis (Lakens, 2022a, Ch.8.19; Mesquida and Lakens, 2024), and the topic is generally still under-researched in our field.

In sports and exercise sciences, three commonly used types of effect sizes can be differentiated: mean differences, regression coefficients and differences in outcome proportions (Hedges, 2008) (see Table 2). Effect sizes can be expressed in absolute, and relative/standardized terms. Standardized effect sizes (i.e., scale free) are often used to summarize the effect of a treatment (e.g., exercise) on a construct measured with different scales (as is done in meta-analyses, for example), such as the effect of exercise on depression (Schuch et al., 2016). In general, researchers should always report enough detail about how the reported effect sizes were calculated as there are typically various options possible, and a suboptimal use of terminology (Caldwell and Vigotsky, 2020; Cumming, 2012; Hedges, 2008; Lakens, 2013).

Table 2. Overview of the types of effect sizes

Type	Description	Possible research questions	Examples
Mean difference	Mean differences describe the differences in average values between groups or time points.	How large is the performance difference between podium athletes at national championship versus world championships in the 100-m dash? How large is the average effect of a training intervention?	absolute difference, percentage difference (relative to mean, peak, reference value, etc.), standardization mean difference (relative to mean & standard deviation (i.e., Cohen's *d*) or median & interquartile range), percentage overlap/non-overlap.
Regression coefficients	Regression coefficients are typically used to measure the association or relationship between variables.	How strong is the relationship between lower-body strength and maximum jump height in female volleyball players? Can a simple jump test accurately track changes in sprint performance over time?	regression coefficients, correlation coefficients, variance explained
Outcome proportions	Outcome proportions are used to describe a comparison of proportions of individuals in dichotomous outcomes.	Is there is difference in ACL injury risk between female and male football players? How large is the effect of a preventive training program on the injury risk in youth gymnasts?	risk difference, risk ratio, odds ratio

Determining the effect size of interest

To define an appropriate sample size, researchers must determine which effect size they consider interesting (Lakens, 2022a, Ch. 8.2; Lakens, 2022b). There are various ways how the effect size of interest can be evaluated (Table 3).

The concept of the smallest effect size of interest (SESOI) is a very important (but critically under-researched) concept, both for research and practice. What is the smallest effect size that can be considered theoretically or practically meaningful in the context of the research study? There are various terms being used in the literature which refer to the same, a similar or a related construct:

Table 3. Overview of possible ways to evaluate which effect sizes are interesting (Lakens (2022a) Table 8.2, used under CC-BY-NC-SA)

Type of evaluation	**Which question should a researcher ask?**
Smallest effect size of interest	What is the smallest effect size that is considered theoretically or practically interesting?
The minimal statistically detectable effect	Given the test and sample size, what is the critical effect size that can be statistically significant?
Expected effect size	Which effect size is expected based on theoretical predictions or previous research?
Width of confidence interval	Which effect sizes are excluded based on the expected width of the confidence interval around the effect size?
Sensitivity power analysis	Across a range of possible effect sizes, which effects does a design have sufficient power to detect when performing a hypothesis test?
Distribution of effect sizes in a research area	What is the empirical range of effect sizes in a specific research area and which effects are a priori unlikely to be observed?

minimum (practically/clinically) important difference (MID, MPID, MCID), smallest worthwhile change (SWC), minimum detectable change (MDC). In addition, there are various approaches how one can define the smallest effect size of interest:

- *Theory-based*: Is there solid theory or mechanism which defines the smallest possible effect size? For example, a minimum humanly possible reaction time based on known physiological limits.
- *Anchor-based*: Changes in a (surrogate) measure of interest are compared against an anchor or criterion measure. For example, changes in 'threshold' velocity that are needed to substantially increase the chances of making it to the podium and winning a medal; percentage of weight loss needed to substantially improve patients' health outcomes or overall quality of life; opinion-seeking among experts or practitioners to define meaningful effect sizes.
- *Distribution-based*: Cut-off values are derived from distributions of between-participant or within-participant data. For example, benchmarks for performance/selection levels; effect size threshold conventions like Cohen's d = 0.2 for '*small*'; typical day-to-day variability; reliability/measurement error at the individual level or minimal statistically detectable change at the group level.
- *Cost-benefit analysis*: For example, costs of the intervention versus its benefit; resources required for the investigation versus value of knowledge gain (see one method of sample size

calculation using a similar approach in Bader et al. (2018)). Or more directly in cases such as injury and medical care costs, a calculation can be made to estimate how many cases need to be prevented by an intervention (of which the costs are known) for the intervention to be cost-effective.

For a concise introduction on smallest effect size of interest concepts and approaches including additional reading recommendations see Lakens (2022a) Chapters 8.11 and 9.7–9.12 and for a discussion of some of the potential issues with the use, calculation and interpretation of some of these concepts, see section 2 of Tenan and Caldwell (2022).

Sampling and recruitment strategies

Once we have determined who we would like to include in our study and how many participants will be needed, we next must consider how we will sample and recruit these potential participants. Aside from determining the number of participants needed to achieve particular inferential aims, we must also consider how we can achieve a sample of participants that is representative of the population relevant to our research question. As described above, setting appropriate inclusion and exclusion criteria is an important part of this, but we must also consider how to most efficiently and effectively reach those potential participants (Liamputtong, 2017).

Many methods of recruitment are relevant for research in sports and exercise. Manohar et al. (2018) highlight the following methods often used in health research: a) Snowball sampling; b) Letters or postcards; c) Referral from healthcare provider; d) Flyers, pamphlets, brochures, posters (in public locations); e) Videos; f) Face-to-face recruitment (via healthcare provider settings or at community outreach activities); g) Phone calls, emails, internal mail in workplaces (i.e., from a known 3rd party); h) Newsletters, local newspapers, radio, television; i) Social media and websites; j) Research participant registries; k) Word of mouth; l) Recruitment through existing research studies. We recommend consulting their Table 1 for a summarized list of pros and cons of each method. For now, it is important to highlight that these vary greatly in their cost and time required, reliance on others, risk of bias or lack of representativeness in the potential sample and potential reach. Unfortunately, due to a general low quality of reporting in the sports and exercise literature, it is unclear whether specific methods of recruitment are significantly more effective (Cooke and Jones, 2017). A more recent analysis of the literature focusing on recruitment strategies for recruiting highly trained, elite

and world class athletes concluded that accessing athletes through a gatekeeper was the most common strategy, with others including convenient access to elite athletes at research facilities, recruiting and distributing study information on social media, relying on previously formed networks and attending training and competitions (Mitchell et al., 2024). These strategies broadly represent strategies of convenience sampling and again, while the most frequent, are not necessarily the most effective for obtaining representative samples of a population (the issue of whether or not this is an issue for world class athletes in a particular sport is a separate discussion). If we accept that, for now, there is not a strong evidence base to determine the most effective recruitment strategies in sports and exercise sciences, then we may instead consider practical restraints.

Since the majority of research in this field will not be funded, particularly in the case of student thesis projects, we may consult the recommendations of Joseph et al. (2016), who proposed some suggestions for successful recruitment for researchers with limited resources. These indeed overlap with some of the strategies mentioned above. The first is leverage existing social networks and personal contacts to aid in distribution and recruitment with both paper and electronic materials. In using this approach however, the researcher should be aware of the risk of contacts exerting undue influence in the recruitment process. The second recommendation is to identify and foster collaborations with community gatekeepers (Joseph et al., 2016), which in principle involves identifying and building a relationship with people in recognizable, trustworthy and/or responsible positions in the community from which you aim to recruit participants. We refer readers to Joseph et al. (2016) for more detailed discussion but one consideration to highlight is that this is much more likely to be successful if there is a) a longer standing relationship with the community gatekeepers, and b) that the gatekeeper believes the research to be relevant, important and helpful for the community they are part of. As you can imagine, this favorable set of circumstances might be more common in, for example, health-focused rather than sports-performance-focused research. The third recommendation of Joseph et al. (2016) is to develop a comprehensive list of potential recruitment platforms and venues, which seems obvious but is rarely done in any systematic manner. There are a number of advantages to actually taking the time to develop a list of platforms and venues, including identifying the places more likely to reach the intended population with least time or cost, as well as the ability to monitor which places participants hear about the study and feed this back to the list for the benefit of future projects. The final two recommendations are less related to the recruitment strategy itself and more about how the recruitment material and researcher communicate with potential participants: create recruitment materials that clearly describe the

purpose of the study; and build a respectful and trusting relationship with potential participants (Joseph et al., 2016). Again, we leave it to the reader to consult Joseph et al. (2016) for the details of each of these recommendations. We will however highlight a few key points. Material should be visually appealing, easy to read, and appear credible. It should also include a clear description of the study and ideally should also already indicate the inclusion requirements (i.e., clearly mention any criteria such as demographics, athlete status needed, any training history requirements, etc.) to help reduce unnecessary contact with potential participants that are ineligible. Finally, material should include various types of contact information so that potential participants can contact the researchers in the manner in which they are comfortable. Time and resource permitting, it is also recommended to pre-test recruitment material with members of the target population (Joseph et al., 2016). Regarding building respectful and trusting relationships with potential participants, Joseph et al. (2016) highlight three key points: respond promptly to potential participants (ideally on the same day); screen and enroll participants as quickly as possible; and communicate using the potential participants' desired form of communication. In general, these actions ensure that potential participants feel valued and respected and maintain their interest in the study. For these reasons, recruiting before the research is prepared to screen and enroll participants is not recommended (Joseph et al., 2016).

Communicating with participants

Researchers should be mindful of ethical principles when communicating with research participants (discussed next). Research participants make much, if not most, of research conducted in sports and exercise sciences possible. Responsible communication with research participants starts with research recruitment and persists until study completion and dissemination of the research findings.

Communication with participants begins with recruitment. It is often a requirement of Institutional Review Boards (IRB) and (Medical) Ethics Committees to have all talking points, flyers, study advertisements, and communication strategies approved prior to participant recruitment. That is, everything that the potential participant is exposed to about the research project may be subject to approval before being shared (and if this is not possible, then exceptions should be approved in advance). While local regulations and requirements can be highly variable, it is best practice (if not requirement) to obtain approval and permission in advance of all procedures involving human

participants. In working with human participants, it is always best to ask for permission rather than begging for forgiveness.

Communication with participants should continue throughout the data collection process. Participants may be interested in learning about study progress, updates, or ongoing developments. Augustine et al. (2016) found that telephone conferences about study progress during a clinical trial were received positively by the participants; 98% found the call useful, 91% indicated interest in receiving additional calls, and 88% indicated that the call enhanced willingness to continue participation. Augustine et al. (2016) suggested that the calls allowed for ongoing monitoring of safety and possible adverse events, and that the ongoing communication served as an "extension of the informed consent process" (p. 595). It is possible and even likely that communication strategies with participants may differ based on treatment groups. For example, in the context of a randomized controlled trial investigating the effects of exercise (vs. waitlist control) on health outcomes, an investigator may consider communicating adverse events with all participants in the treatment group and providing appropriate context (e.g., rarity of the event, other potential causes, options for continued participation or withdrawal without penalty, enhanced safety screening procedures, etc.). This information may be less relevant to participants in the control group because they are not exposed to the same risk. This information should be communicated clearly and promptly because it may influence a participant's wish to withdraw from a study (National Institutes of Health, 2016). Institutional Review Boards and Ethics Committees should be consulted for guidance on these issues (and reporting adverse events to these groups is likely a requirement). Our recommendation is to report and seek guidance from Institutional Review Boards and Ethics Committees whenever in doubt. If you find yourself asking whether you should report an issue or consult an Institutional Review Board or Ethics Committee, the answer is probably yes.

Research participants donate time, effort, and often expose themselves to more than minimal risk to allow projects to be completed. It is reasonable to expect results of research studies to be shared with the participants themselves. Research participants indicate interest in receiving information about study results, and respect for these interests should be maintained by researchers (Shalowitz and Miller, 2008). However, most research participants do not receive information about study results. In a survey of participants in health research studies, Long et al. (2016) found that only about 33% received study results, while most participants indicated that researchers should offer to share the results with study participants. Long et al. (2017) suggested enhanced collaboration to

communicate results of research more effectively. For example, researchers could work with participants, funders, patient advocacy groups, Institutional Review Boards, and Ethics Committees to create effective and ongoing dissemination strategies (Long et al., 2017). Hammond and Cooper (2011) suggested that video clips or "participant information clips" can be created using digital tools to share information. These clips can be used to meaningfully share information in understandable terms during recruitment, data collection, and dissemination.

Some Ethical Considerations

When collecting data with human participants (or animals), obtaining ethical approval prior to data collection is often a local and legal requirement. Many journals have policies that require author statements to indicate that ethical approval was obtained. Collecting data using animals requires consultation with an Institutional Animal Care and Use Committee (IACUC) or equivalent. This is a legal requirement in the United States, although policies vary internationally. Working with humans as participants in the research process is often known as "human subjects" research. In the United States, this research requires approval from an Institutional Review Board; names of Ethics Committees vary internationally. When in doubt or if unsure about how to obtain such approvals, we recommend asking an experienced research mentor or faculty supervisor for guidance and support.

According to the 2018 Common Rule from the United States Department of Health and Human Services (see 45 CFR Part 46), a *human subject* is a "living individual about whom an investigator (whether professional or student) conducting research: Obtains information or biospecimens through intervention or interaction with the individual, and uses, studies, or analyzes the information or biospecimens; or obtains, uses, studies, analyzes, or generates identifiable private information or identifiable biospecimens" (U.S. Department of Health and Human Services, 2018). Note that we prefer the term "participant" rather than "subject" because people participate in (and often consent to) the research process rather than being "subjected to research", which aligns with the preferred term "participants" used in the Declaration of Helsinki (World Medical Association, 2024). Researchers may also consider the terms "volunteers" or "patients" to be appropriate (Chalmers, 1999).

A full overview of the tragic history of human rights abuses in the name of research is beyond the scope of this chapter. Suffice to say that there are good reasons for the existence of Institutional Review Boards, Ethics Committees, and the legal requirements for research oversight. Students should familiarize themselves with the ethical issues and abuses of the U.S. Public Health Service

Syphilis Study at Tuskegee (see McCallum et al., 2006), Tearoom Trade Study (see Lenza, 2004), and the hepatitis studies at the Willowbrook State School (see Krugman, 1986), among others. A brief history of research with ethical issues is often part of required training for conducting research with human participants. Students should also familiarize themselves with the Declaration of Helsinki (World Medical Association, 2024) and the Belmont Report (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979). Here, we will focus on a few key ethical principles to consider, including respect for persons, beneficence, and justice; these are described more fully in the Belmont Report (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979).

Respect for persons includes the respect for people's autonomy, and added protection for people with diminished autonomy, less ability to consent, or the inability to consent. This includes respecting a participant's right to informed consent to participation in a research study and respect for their right to change their mind and withdraw from participation without penalty (National Institutes of Health, 2016). This also recognizes that some people (e.g., children, incarcerated persons) may not be able to freely consent. Respecting autonomy means avoiding coercion. As an example, some Institutional Review Boards may add protections and procedures to ensure that students are protected from coerced participation in their professor's studies because of the inherent power differential between professors and students (i.e., supervisory capacity). For example, if a professor wishes to recruit students enrolled in her course, she may need another investigator to communicate with students and explicitly communicate that participation in the research study will have no impact on the course grade. In other cases, Institutional Review Boards may require that a different informed consent document is created which does not list the professor's name (to avoid creating a sense of obligation or pressure to participate). Respecting autonomy and avoiding coercion involves other considerations, like compensation or participant incentive. For example, a professor offering a large amount of extra credit or a researcher offering a large amount of money for participant compensation may feel like they are being generous. However, they may unintentionally create a pressure to participate because the amount of extra credit or financial compensation is difficult to turn down.

Beneficence refers to making efforts to protect the wellbeing of participants by doing no harm and maximizing benefits while minimizing harms. One practical but sometimes overlooked implication of this is with sample size determination (discussed earlier). If a research study has too few

participants, it may be underpowered and have an unacceptably high probability of resulting in a Type II error (not detecting a statistically significant effect even when it exists in reality). In this case, participants are exposed to the research process, often with its inherent risks, without realistic chance of benefit that outweighs the risks (a situation that is unfortunately quite common in the sports and exercise sciences since many studies may not be adequately powered to detect meaningful effects (Mesquida et al., 2022; Twomey et al., 2021). On the other hand, if a researcher samples too many people using highly invasive procedures or methods with elevated risk (e.g., supramaximal exercise with a clinical population), then the researcher is exposing participants to increased risk unnecessarily. In these examples, ethical considerations are part of the sample size determination process. A practical, real-life example of trying to maximize benefit and minimize harm might be as simple as offering water bottles to exercisers. A researcher studying the effects of exercise on psychological responses may want to increase internal validity by standardizing laboratory procedures, methods, and participant conditions. On one hand, it is reasonable to expect that access to water or fluids may impact psychological responses to exercise (Backhouse et al., 2007) and add a confounding variable. Therefore, the researcher may wish to avoid access to water bottles during exercise. On the other hand, researchers must consider participant safety and wellbeing. Therefore, the researcher may feel compelled to offer water bottles to help participants avoid dehydration and to enhance wellbeing, even if it may slightly interfere with study results.

Finally, justice is about ensuring that participants are recruited and part of the research process in a fair and just way. Institutional Review Boards recognize certain populations as vulnerable, including pregnant women, incarcerated persons, and children (Gordon, 2020). Arguably, a researcher conducting an exercise intervention with children just because they have convenient access to a sample of children (e.g., in a school setting) would not be adhering to the principle. On the other hand, not allowing children to participate in exercise interventions would prevent children from benefitting from the knowledge gained as a result of the research process.

Practically, Gyure et al. (2014) describe several recommendations for applying these principles to the recruitment process. These include being polite, respectful, and culturally sensitive with participants; being aware of the recruiting environment and issues relates to confidentiality; listening and responding to participants who are distressed or anxious, and recognizing that participants are free to participate or decline to participate in research studies. An effective Institutional Review Board or Ethics Committee will help ensure that each of these principles are

followed and offer guidance or advice when needed. Although the process of obtaining ethical approval can feel intimidating, in our experience these Ethics Committees genuinely want to help researchers conduct meaningful research while protecting the rights and welfare of the participants. Rather than viewing the process as an inconvenient obstacle, or viewing the Ethics Committee as adversaries, they should be viewed as collaborators. As mentioned previously, when in doubt, we recommend seeking guidance from an experienced faculty mentor to help navigate this process at your institution.

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