

1 **Title:** Ten research priorities related to youth sport, physical activity and health

2 **Running head:** YOUTH SPORT RESEARCH PRIORITIES

3

4 **Manuscript type:** Review

5

6 **Key Words:** children, public health, policy

7

8 **Date of submission:** March 17, 2020

9

10 **Abstract Word Count:** 200

11

12 **Manuscript Word Count** (all text excluding title page and abstract): 4,875

13

14 **Authors:**

15

16 Erin K. Howie*, University of Arkansas, Fayetteville, AR, USA, ekhowie@uark.edu

17 Justin M. Guagliano, University of Cambridge, Cambridge, England, UK,

18 jmg221@medschl.cam.ac.uk

19 Karen Milton, University of East Anglia, Norwich, England, UK, K.Milton@uea.ac.uk

20 Stewart A. Vella, University of Wollongong, NSW, Australia, stvella@uow.edu.au

21 Sjaan R. Gomersall, University of Queensland, Brisbane, QLD, Australia,

22 s.gomersall1@uq.edu.au

23 Tracy L. Kolbe-Alexander, University of Southern Queensland, Toowoomba, QLD, Australia,

24 Tracy.Kolbe-Alexander@usq.edu.au

25 Justin Richards, University of Sydney, Sydney, NSW, Australia, justin.richards@sydney.edu.au

26 Russell R. Pate, University of South Carolina, Columbia, SC, USA, rpate@mailbox.sc.edu

27 *corresponding author

28 **Abstract**

29 **Background:** Sport has been identified as one of the seven best investments for increasing
30 physical activity levels across the lifespan. Several questions remain on how to effectively utilize
31 youth sport as a strategy for increasing physical activity and improving health in youth. The
32 purpose of this paper is to identify the main research priorities in the area of youth sport and
33 physical activity for health. **Methods:** An international expert panel was convened, selected to
34 cover a wide-spectrum of topics related to youth sport. The group developed a draft set of
35 potential research priorities and relevant research was scoped. Through an iterative process, the
36 group reached consensus on the top ten research priorities. **Results:** The ten research priorities
37 identified related to sport participation rates, physical activity from sport, the contribution of
38 sport to health, and the overall return on investment from youth sport. For each research priority,
39 the current evidence is summarized, key research gaps are noted, and immediate research needs
40 are suggested. **Conclusions:** The identified research priorities are intended to guide researchers,
41 policymakers, and practitioners to increase the evidence base on which to base the design,
42 delivery and policies of youth sport programs to deliver health benefits.

43 **Background**

44 Physical activity is important for children's physical, mental and social development.^{1,2}
45 The Global Matrix report cards show that physical activity levels vary across countries, and
46 suggest that overall, particularly in western countries, physical activity levels are low and
47 physical inactivity is increasing.³ Physical inactivity during childhood not only affects childhood
48 health, but impacts health in adulthood through direct effects and tracking of inactivity behaviors
49 into adulthood.⁴⁻⁶ Thus, ways to increase physical activity among children around the world are a
50 public health priority.

51 Interventions to increase physical activity among children have predominantly been
52 implemented in the school setting.^{7,8} Sport is the most popular type of physical activity among
53 children,³ and youth sport exists in many cultures, in various forms, around the world.⁹ Yet sport
54 is not often used as an intervention strategy to increase physical activity. For the purposes of this
55 paper, youth sport is defined as formally arranged sport, governed by rules, and participated in
56 by individuals 18 years or younger and outside of school and physical education time.¹⁰ This
57 includes attending practices and games under supervision of one or more adults, who often
58 assume the role of team coach.^{10,11} Importantly, sport involvement includes rules, facilities,
59 equipment, normative beliefs and policies.¹²

60 Sport has been identified as one of the seven best investments for increasing physical
61 activity levels amongst all individuals¹³ and is particularly relevant to children due to existing
62 cultural norms and infrastructure that encourage sport participation among children and
63 adolescents, particularly in developed countries. This appears to be a global phenomenon as, for
64 example, the United States (US) National Physical Activity Plan identified sport as one of nine
65 sectors for implementing national physical activity guidelines¹⁴ and recently released a National

66 Youth Sport Strategy¹⁵, the International Olympic Committee has highlighted the importance of
67 sport in promoting physical activity,¹⁶ and Sport New Zealand has focused on achieving
68 wellbeing outcomes through sport in its National Strategy and 2020-2032 Outcomes
69 Framework.¹⁷ Therefore, sport is widely accepted as a potential avenue for promoting physical
70 activity participation and broader social and health outcomes if young people are exposed to
71 high-quality positive sporting experiences that increase the likelihood of continued participation
72 in sports and physical activity. However, several questions remain on how to most effectively
73 utilize youth sport as a strategy for increasing youth physical activity and improving health
74 worldwide, as youth sport, in its current form, may not be enough.

75 The purpose of this paper is to identify top research priorities in the area of youth sport
76 and physical activity for health. The overall purpose is to guide researchers, policymakers, and
77 practitioners to increase the evidence base on which to base the design, delivery and policies of
78 youth sport programs that will deliver health benefits.

79 **Methods**

80 An international expert panel (the authors) was convened following the 2016 International
81 Society for Physical Activity and Health (ISPAH) Congress in Bangkok, Thailand. The panel
82 was selected to cover a wide range of topics related to youth sport including youth sport
83 specifically, children's physical activity more broadly, measurement of physical activity, and
84 policy. Based on their knowledge and experience, the group developed a conceptual framework
85 of the contribution of youth sport to health (see Figure 1) and collectively drafted a set of
86 potential research priorities. Individuals were assigned to each priority area based on their
87 expertise to scope relevant literature, which was presented back to the group. The evidence was
88 discussed as a team, with additional research areas being added and scoped as necessary, to

89 further refine and reach consensus on the ten greatest priorities, which are presented in the paper.
90 For each research priority, the state of the evidence is summarized, key research gaps are noted,
91 and immediate research needs are suggested.

92

93 **Research Priorities**

94 **Research Priority 1: What is the participation rate in youth sports?**

95 Participating in sports is the first step to ensuring children benefit from sports. Youth
96 sport participation rates are assessed in many countries as part of existing large-scale surveys and
97 are included in the Global Matrix as a key indicator of youth physical activity.^{3,18,19} In the 2018
98 Global Matrix reports, grades for organized youth sport ranged from high, with Denmark
99 receiving an A- (with approximately 83% of 7 to 15 year-olds reporting regularly participating in
100 sport²⁰) to low, with Lebanon and Uruguay receiving F's (less than 20% participating), and
101 several countries reporting incomplete information and unable to assign a grade.¹⁹ However,
102 these metrics are based on different population surveys and questions making cross-country
103 comparisons difficult.

104 Importantly, many of these statistics are based on single- or limited-item questions, for
105 example the Youth Risk Behavior Surveillance System multiple-choice question in the United
106 States asks, "During the past 12 months, on how many sports teams did you play? (count any
107 teams run by your school or community groups)." This question gives little information on the
108 amount (duration and frequency) of participation or the level of involvement. Additionally, there
109 are inconsistent definitions of youth sport which lead to varying participation estimates, such as
110 not distinguishing between sport outside of school or sport that occurs during school or
111 inconsistencies in including other activities such as dance. Further, even less evidence exists on

112 youth participation in non-traditional sports such as mountain biking, ultimate Frisbee, or
113 competitive resistance training sports such as CrossFit, which are growing in popularity and may
114 represent novel sporting opportunities to engage previously unengaged youth. To accurately
115 understand participation in sport and the dose of exposure, more specific information about
116 frequency, duration, intensity, type of competition (i.e. recreational or elite sports league), type
117 of sport, and ultimately the quality of the sport participation are needed.

118 In addition to overall rates of participation, it is important to understand who is
119 participating and importantly, who is not participating. Minimal information is available on how
120 sport participation varies by gender, ethnicity, rural versus urban settings, and socioeconomic
121 status. Furthermore, little information is available on children with disabilities' including how
122 often they participate, in which sports, and who is not participating and why.²¹ This information
123 is critical to help identify target groups that may need additional support to increase
124 participation. Standardized measures are needed to regularly assess youth sport participation
125 rates regionally, nationally and internationally to capture which sports children are participating
126 in and how much, as well as who is participating and who is not. Ideally, these measures will
127 also provide an indication of how much sport participation contributes to total physical activity
128 levels so that we can understand how this varies in different population groups and changes
129 across the lifespan (see Research Priority 4 below).

130 **Research Priority 2: How can we best improve sport participation rates?**

131 Sport is one of the most popular forms of physical activity among children,²² with
132 participation rates typically increasing during childhood (e.g.,²³). While there is a growing
133 amount of literature on why children join sport,²⁴ research on how to utilize these reasons to
134 encourage and increase participation is limited. Capacity building, through the development of

135 knowledge, skills, infrastructure and systems, is one strategy that has been used to increase
136 sports participation successfully in adults in marginalized communities.²⁵ In youth sport,
137 building capacity could include improving the knowledge and skills of coaches and recreation
138 practitioners; providing infrastructure such as fields, equipment and sporting leagues; and
139 strengthening partnerships between youth sport organizations and government and other health
140 promoting organizations.

141 While many children are enrolled in sport at a young age,^{3,18,19} it is unknown whether
142 there is a “critical age” by which children need to start participating in sport or if they may join
143 at any point. Some longitudinal research suggests that there may be gender differences in the
144 probability of joining sports, with boys more likely to join at a later age.²⁶ Therefore, efforts to
145 get children to join sport should not just be targeted at young children but also include
146 adolescents who have not participated in sport or are trying a new sport.

147 For young children, initial participation may be instigated by their parents. While the role
148 of family is speculated to play a large role in sports participation,²⁷ more research is necessary on
149 its specific involvement and how to engage family to promote sport in a positive way. One
150 strategy may be encouraging parents to increase their levels of physical activity.²⁸ Some children
151 may need additional encouragement to participate in sport (as identified in Research Priority 1).
152 Overall, boys have higher sports participation rates than girls and men are more physically active
153 than women worldwide.²⁹ Populations least likely to participate may be from lower
154 socioeconomic groups that do not have the means to pay fees for participation, children in rural
155 areas where distance and transportation are large considerations,³⁰ children with disabilities who
156 do not have access to ability-appropriate sporting opportunities,³¹ or other minority groups such
157 as culturally and linguistically diverse and LGBTQ+ populations. Strategies need to be tested to

158 overcome barriers and perceived barriers, as parent perception of these barriers may be more
159 critical to participation than reality. Identified barriers should be targeted in youth sport policy
160 and programming. Furthermore, for some children or adolescents where youth sport may be
161 more negative than beneficial due to individual health concerns or negative social interactions,
162 alternative physical activities should be explored.

163 **Research Priority 3: How can we maintain sport participation?**

164 Once a child is participating in sport, they must maintain participation to continue to
165 receive benefits. However, participation rates decline steadily throughout adolescence,²³ and
166 there is evidence that children begin dropping out of sport and decreasing physical activity from
167 as young as eight years of age.^{26,32} While it is unclear what the exact rate of dropout from
168 organized youth sports is, best estimates place it at around 30% of all participants each year.³³
169 Two systematic reviews have concluded that there are a range of established intrapersonal,
170 interpersonal and environmental factors that predict dropout from organized sports.^{33,34} These
171 contributing factors include individual factors such as motor skills development, mental skills
172 such as mental toughness and grit, social climate from coaches, parents and peers,²⁷
173 organizational factors such as league scheduling, cost, and competition and policy factors
174 addressed in later priorities. The reasons are likely to be different for girls and boys, particularly
175 as they get older and physical and social development influences sporting decisions.³⁵ Given that
176 there is now sufficient information on the reasons for, and influences on, dropout from organized
177 sports, a solution-oriented approach is needed.³⁶ Solution-oriented research is forward-looking,
178 experimental in nature, and is capable of informing and changing policy and practice. This
179 information on factors that influence participation needs to be used to identify groups that may
180 be at high-risk of dropping out and manipulating some of these factors to reduce dropout.

181 Developmental models of sport participation and several position statements recommend that
182 children participate in a number of sports,³⁷⁻³⁹ however, there have been continued trends toward
183 early sport specialization.⁴⁰ Sampling a range of sports in childhood has been associated with
184 higher physical activity during adolescence,⁴¹ and evidence does not support sport specialization
185 increasing performance and sporting success.⁴² In addition, children who specialize in a single
186 sport early may be at an increased risk for a number of predictors of dropout from organized
187 sports, including injury, social isolation, and burnout.⁴³⁻⁴⁶ The reduction in rates of sport
188 specialization and parallel efforts to minimize and prevent injury and burnout among organized
189 youth sport participants are likely to be meaningful strategies in the reduction of dropout from
190 organized sports. Research on early specialization, with long-term follow-up of youth from a
191 developmental perspective, is needed to identify potential risks.

192 Lastly, it should be noted that there are circumstances where it is entirely appropriate for
193 children or adolescents to cease participation in a sport, including burnout, injury, or lack of
194 enjoyment. However, given the health and well-being detriments associated with dropout from
195 all sports,^{47,48} maintenance of participation via transfer to an alternate level of competition or
196 alternate sport may be beneficial. Little is known about the benefits or correlates of sports
197 transfer, or the switching between sports – in contrast to dropout. With the emergence of sports
198 such as skateboarding and mountain biking, there are alternatives for children who do not enjoy
199 traditional team and individual sports. It is also important to identify these children to improve
200 their current sporting participation or help them find an alternative sporting environment that
201 they can continue in.

202 **Research Priority 4: How much physical activity does sport provide participating youth?**

203 Sport (including dance) may represent one of the widest reaching out-of-school settings
204 for physical activity. In many countries around the world, the majority of youth participate in at
205 least one sport annually,⁴⁹ which could have substantial public health implications as youth sport
206 participation has been associated with an increased likelihood of meeting national physical
207 activity guidelines.⁵⁰⁻⁵² Still, the actual contribution of sport to children and adolescents' total
208 physical activity is still unclear. For instance, one study found that youth sport contributed 26
209 mins of participants' total moderate-to-vigorous physical activity (MVPA) for that day;⁵³
210 whereas, another found that youth participating in sport accumulated 7 min/day of MVPA more
211 than youth who did not participate in sport (with ~5 additional min/day of MVPA for each
212 additional sport they participated in).⁵⁴ These figures are likely to vary by measurement protocols
213 (e.g., accelerometer cut-points, self-report tool used), sports, cultures and population
214 socioeconomics. It is also possible that increasing physical activity through sport may displace
215 other physical activity, though limited experimental research does not support this.⁵⁵ It is,
216 therefore, critical to better understand the contribution of sport to overall physical activity.

217 While it is encouraging that many youth have access to sports and sports participation
218 increases the likelihood of being sufficiently active, it appears that there is still room for
219 improving physical activity in youth sport. Observational studies have consistently shown that
220 despite being in a sporting context, youth sport participants spend the majority of time inactive or
221 in light-intensity physical activity, regardless of setting context (e.g., practices, games), sport,
222 and sex.^{53,56-61} One of the primary factors influencing the quality of physical activity
223 participation in sporting contexts is the coach. Accordingly, there have been calls to investigate
224 and improve the current quality of coaching youth sports and particularly to determine efficient
225 ways of optimizing the dose of physical activity accumulated during youth sport.^{59,62,63} Other

226 contextual factors that may influence physical activity during sport may be the physical
227 environment, peer interactions (i.e. age-groupings and variations in skill level), or rules of the
228 game (i.e. modifications on player positioning and playing time). In particular, studies using
229 nuanced observation systems to capture these contextual data are needed. Further, for some
230 sports these data can then be paired with accelerometry and other data collection tools that use
231 novel sensory technology to assess patterns of variability during particular time segments. Few
232 studies to date have provided these contextual data in youth sport.^{56,64-67} Only two of these
233 studies paired contextual data with accelerometry to assess patterns of variability.^{64,65} Findings
234 showed that physical activity and inactivity were highly variable throughout the sporting event
235 and differed by task (e.g., warm-up, game play, management) and setting demand (i.e., whether
236 the practice setting fostered participation or exclusion).⁶⁴ This contextual information can be
237 used to inform interventions aiming to increase activity in youth sport; therefore, a more nuanced
238 examination of the structure and characteristics of youth sport settings is warranted.

239 **Research Priority 5: How can we develop effective and sustainable coaching interventions**
240 **to improve physical activity in sport?**

241 Coaches are in an ideal position to impact the health and wellbeing of youth sport
242 participants, as they are viewed as experts, have regular direct involvement, and carry
243 considerable influence over participants and the environment.^{68,69} Coaches are key figures in the
244 youth sport setting and play an important role in ensuring that youth have high-quality sporting
245 experiences.⁷⁰ Unfortunately, not all youth have positive experiences and their coach is one of
246 the most commonly cited reasons for dropping out of sport.⁷¹

247 Many youth sport organizations do not require coaches to receive any formal coaching
248 qualifications.⁶³ Further, the coach training programs (or accreditation courses) that are available,

249 generally do not provide coaches with direction on how to create structured environments that
250 promote physical activity.⁶³ Schlechter et al. found no difference in the percentage of time youth
251 playing American flag football spent in MVPA between coaches who completed a standard
252 coach training program compared to those with no training.⁵⁷ One of the factors contributing to
253 high percentages of inactivity and light intensity activity, may be that coaches spend little time
254 preparing for practices, relying on their experience in the sport to create impromptu practices.⁷²
255 While sport can include some beneficial activities of lower intensity, such as motor skill
256 development, team strategizing, and intentional observation, coaches have been observed
257 spending a considerable percentage of practice time in less effective management activities (e.g.,
258 setting up drills, transitioning between drills, instructions).⁵⁶ This lack of appropriate training and
259 planning negatively affects physical activity intensity, where MVPA is lower when coaches are
260 disengaged and in a management context.^{66,67}

261 Even when the coach is not specifically cited as the reason for youth drop out, the reasons
262 given are generally factors coaches control or affect, and thus can improve. For instance, lack of
263 excitement and fun, boredom, and not enough participation were some of the most common
264 reasons for withdrawing from sport in a study of over 500 youth athletes.⁷³ Since we know
265 coaches spend a considerable percentage of practice time in management ⁵⁶ and youth MVPA is
266 lower during this time ^{66,67}, it is possible that poor management practices contributes to youth
267 dropout from sport.

268 Research is needed to create and evaluate coaches' training programs aimed at improving
269 the quality of youth sport coaching. We are aware of only one experimental study that
270 investigated the efficacy of coach training on youth physical activity intensity in a small
271 convenience sample during sport practice.⁷⁴ This study showed that brief coach training can

272 significantly increase MVPA and decrease inactivity. Additionally, after coaches were trained to
273 implement efficient activity-promoting practices, attenuated differences in MVPA between youth
274 with high and low self-determined motivation were found.⁷⁵ However, this intervention was
275 short in duration (one week), highly controlled, and only focused on increasing physical activity
276 by modifying the structure of practices. Therefore, longer, fully-powered effectiveness trials of
277 interventions that are scalable are needed. In addition to increasing physical activity by
278 modifying the physical environment, future coach training programs could also incorporate
279 psychosocial (e.g., motivational climate, coach-athlete relationships) or developmental (e.g.,
280 interpersonal development, fundamental movement skills, physical literacy) elements. Future
281 interventions may also explore alternate training methods (e.g., online modules), incorporating
282 parents or families, maintain sport between sport seasons, and aim to influence physical activity
283 outside of the youth sport environment.

284 As discussed in the previous section, there is a dearth of interventions aiming to increase
285 physical activity during youth sport. While promising, the long-term effectiveness of training
286 coaches to implement activity-promoting practices is currently unknown and warrants further
287 investigation. However, interventions with long follow-ups in youth sports are difficult because
288 sport seasons are generally short, and there is high turnover amongst coaches and athletes. Future
289 interventions can continue to deliver interventions to coaches, but should conduct analyses at a
290 higher level (i.e., organization or club level). Therefore, organizational, club, or perhaps
291 governmental, buy-in is needed for interventions to be sustainable and to assess long-term
292 effectiveness.

293 **Research Priority 6: What policy-level actions on youth sport are most effective at**
294 **increasing physical activity?**

295 To achieve the required reach and scale of change in physical activity to benefit
296 population health, policy-level interventions are needed.⁷⁶ Several international and national
297 documents and initiatives highlight the roles of policy in promoting physical activity, and the
298 importance of sport policy within that. For example, the World Health Organization's Global
299 Action Plan on Physical Activity highlights policy actions across four objective areas that engage
300 and utilize sporting structures.⁷⁷ In the United States, the National Physical Activity Plan has 8
301 strategies with detailed tactics on how to use sport to promote physical activity¹⁴ and has recently
302 released a National Youth Sport Strategy;¹⁵ several of these strategies and tactics address policy-
303 level actions.¹⁴ The International Society for Physical Activity and Health's Bangkok
304 Declaration highlights sport policy actions to support the Sustainable Development Goals.⁷⁸
305 Whilst there is recognition of the potential role of sport in shifting population levels of physical
306 activity, the most effective strategies for increasing physical activity within this sector remain
307 unclear, and past efforts have been mostly unsuccessful.⁷⁹

308 While tools exist to evaluate physical activity policies,⁸⁰ there is a need for long-term
309 evaluations following sport-related policy changes with appropriate comparison groups to
310 determine long-term effectiveness. These can include natural experiments with matched control
311 communities. Evaluations of the effectiveness of policies should include cost-effectiveness
312 analyses by examining the return on investment for policy implementation. Cost-benefit analyses
313 should examine how a policy that increases sport participation increases physical activity and
314 decreases overall healthcare costs, in addition to other benefits to society. While policy change
315 can often be slow, research including a series of systematic reviews and modelling scenarios to
316 inform the development of a league table of the most effective and cost-effective policy level
317 actions on youth sport could help to enhance sport policies.

318 **Research Priority 7: How does youth sport contribute to physical health?**

319 Youth sport is a key opportunity for physical activity and the physical benefits of
320 physical activity are well documented.⁸¹⁻⁸³ As discussed in Research Priority 4, the total amount
321 of physical activity during sport needs to be assessed using direct observation or objectively
322 measured by devices. Sport, however, unique from other forms of physical activity, may provide
323 additional benefits such as improved motor skills and multiple fitness components, for example,
324 muscular strength, endurance, flexibility, cardiorespiratory fitness and body composition. Sport
325 participation, likely due to its physical activity with high intensity intervals, has been linked to
326 decreased risk of obesity⁸⁴ and other chronic diseases.^{85,86}

327 While cross-sectional studies provide evidence that participation in youth sport is
328 associated with improved physical health and fitness,^{50,87} there are few experimental studies
329 showing that joining sports increases physical health. A feasibility study randomized low-
330 income, overweight children to a soccer program and found improvements in body composition
331 after 3 months.⁸⁸ However, in typical sport settings, it is likely that children who have greater
332 physical health and fitness are more likely to participate, limiting any causal inferences. It is
333 unknown if joining sport, in its current form, is sufficient to improve physical health and which
334 sports in which settings improve which physical health outcomes. While some evidence suggests
335 answers to these questions,⁸⁸, such as reducing obesity, longitudinal studies that assess the
336 impact on overall physical health over time are needed to understand how the effects of youth
337 sport may translate into adulthood. Well-designed experimental studies are needed to assess the
338 physical effects of youth sport participation, and particularly how individuals with lower fitness
339 may benefit from joining and maintaining participation in appropriate sporting opportunities.

340 **Research Priority 8: How does youth sport contribute to mental health?**

341 Youth sport participation has been associated with improved mental health outcomes
342 including reduced mental illbeing (e.g. anxiety and depression), and increased mental wellbeing
343 (e.g. happiness).⁸⁹⁻⁹¹ In addition, sport and physical activity has been positively associated with
344 educational outcomes including improved cognitive performance and academic achievement.⁹²
345 Some of these benefits may be directly from the neurobiological effects of physical activity.
346 More research is needed on the specifics of these mechanisms, however, they may include acute
347 and chronic neuroelectric effects,⁹³ brain-derived neurotrophic factor, or cerebral blood flow
348 mechanisms.^{92,94} It is likely, however, that youth sport has an effect on mental health outcomes
349 independent of physical activity. Improved mental illbeing and wellbeing may be mediated
350 through psychosocial mechanisms that result from positive social interactions, outdoor activity,
351 or feelings of accomplishment.^{94,95} There may also be behavioral mechanisms linked to
352 improved auto-regulation or sleep patterns for those engaged regularly in sport that positively
353 influence mental health.⁽⁹⁴⁾ Similarly, improved cognitive performance may be a result of
354 complex problem solving and spatial reasoning needed during sport performance.

355 The majority of the evidence to support the relationship between physical activity and
356 mental health is either from tightly controlled laboratory experiments or cross-sectional data.^{92,96}
357 Broader effectiveness studies in real-world settings are indicated. These studies also need to
358 explore how sport is only part of the broader social phenomenon that surrounds it when delivered
359 as a mental health intervention.⁹⁷ Specifically, there may also be negative effects of sports on
360 mental health including eating disorders, increased anxiety or decreased self-esteem, particularly
361 in low quality sporting experiences.⁹⁸ It is likely that these mediators are variable between
362 individuals, sports, and sporting experiences.¹² Consequently, it may not be the traditional
363 components of physical activity dosage that are critical for achieving mental health outcomes

364 through sport.⁹⁹ For example, it may be that sport that is light-intensity and is performed in a
365 social and fun context for a short duration is effective at changing mental health outcomes,
366 despite have minimal impact on physical health. Well-designed, ecologically valid experiments
367 are needed to provide causal evidence on the benefits of sport on mental health. Additionally,
368 more research is needed on the mediators of these positive mental health benefits so that these
369 factors can be maximized during youth sport. Furthermore, longitudinal studies are needed to
370 determine how these changes in mental health may be sustained or dissipate.

371 **Research Priority 9: How does sport contribute to social health?**

372 There are several other developmental benefits of youth sport participation including the
373 social benefits of youth sport. Social identity is likely to contribute to positive youth
374 development.¹⁰⁰ Sport has been identified as a way to encourage and promote positive youth
375 development.¹⁰¹ Youth sport participation has also been shown to promote indicators of success
376 such as reduced school dropout, juvenile detention and crime rates.¹⁰² Youth sport may also
377 directly affect social capital through teamwork and social training. For example, children and
378 adolescents involved in youth sport may develop critical ‘21st century skills’ that increase their
379 employability such as communication and cooperation. High quality youth sport experience will
380 likely teach good social skills similar to other quality after school programs.¹⁰³ For youth who
381 have immigrated or are from international backgrounds, sport may also help with integration and
382 acculturation.¹⁰⁴

383 Youth sport also creates a setting for interactions with peers and family. Friends were
384 consistently reported as a predominant reason given by children and adolescents for participating
385 in sports, and good teammates are critical to a positive sport experience.¹⁰⁵ Siblings and parents
386 may encourage participation,²⁸ but are also involved in the entire sporting experience such as

387 attending games, helping with skill practice and providing transportation. Strategies to encourage
388 and maximize these positive social experiences need to be explored.

389 Through its inherent social interactions, sport can be used as a vehicle for positive
390 change, in addition to health promotion.¹⁰⁶ One sporting opportunity that has been used to effect
391 change in more than traditional physical health outcomes is Sport for Development.¹⁰⁷ However,
392 many of these programs have been implemented by health and non-profit agencies without
393 rigorous evaluation of effectiveness and evaluation has found mixed results on diverse
394 outcomes.^{97,108} Researchers can capitalize on the natural experiment opportunities that arise from
395 implementation of these programs as well as collaborating with existing sport for development
396 programs to strengthen implementation and evaluation design.¹⁰⁹

397 **Research Priority 10: What is the overall return on investment for youth sport**
398 **participation?**

399 As highlighted, there are physical, mental and social health benefits of sport participation.
400 However, the benefits of positive sporting environments extend to economic and social benefits.
401 With limited resources, governments and agencies need to understand the relative return on their
402 investments, including the contribution of sport. Understanding the overall contribution of youth
403 sport to society may make decisions about resource allocation and sport-related policies more
404 obvious. It is impossible to capture all the benefits of youth sport. From a socioecological
405 perspective, studies on the benefits of youth sport typically focus on individual and interpersonal
406 benefits for the participating youth. However, expanding the research lens to macro-levels of
407 communities, policies, and environments may yield some unexpected outcomes from youth
408 sport. Some novel areas of research on outcomes can be applied to youth sport from other
409 disciplines. For example, one such area of exploration is the economic benefits of youth sport. In

410 the U.S. it is estimated that youth sports is a \$15 billion industry.¹¹⁰ This includes revenue from
411 participation, tourism, and advertising. Advertising through youth sporting events has been
412 controversial, but sports marketing has rarely been evaluated, either at the grassroots or national
413 level.¹¹¹ Organizations and investors will want to know the overall return on investment in youth
414 sport, including quantification of the benefits of advertising. Thus, social return on investment
415 analyses should consider these macro-level effects on community economies and environments
416 through partnerships with sustainability organizations that already exists. A series of different
417 methods to assess social return on investment have been trialed in various countries.¹¹² The
418 variation in the results of these analyses is thought to largely reflect the diversity of the methods
419 used rather than large differences in the value of sport across countries. Further research is
420 indicated to refine these methods and apply them to various sporting interventions, which include
421 strategies to directly influence the knowledge, skills and motivation of sport participants as well
422 as more indirect interventions like the creation or renovation of sporting facilities.

423

424 **Conclusion**

425 Researchers in physical activity and health, exercise science, sociology, youth
426 development and other disciplines should work collaboratively to answer the youth sport
427 research questions highlighted in the current paper and summarized in Table 1. Specific actions
428 by collaborative stakeholders to support the research questions and priorities in Table 1 could
429 include better alignment of comprehensive surveillance across countries; robust evaluations of
430 all sports initiatives; a shift in the focus of evaluation towards understanding the effects of
431 participation on physical, mental, and social health outcomes; and the integration of health
432 economics into the evaluation of sports initiatives to enhance understanding of their cost-

433 effectiveness. Investments are needed in initiatives to engage specific population groups such as
434 girls and minority groups as well as capacity building to increase knowledge and skills among
435 coaches, and. Specific activities for the research community that may support this
436 interdisciplinary research include data sharing, conference symposia calls, special issues in
437 journals, and funding opportunities that address youth sport topics. A truly convergent research
438 approach, involving international stakeholders, is needed to tackle the issue of youth sport
439 participation. Better understanding of these research priorities will assist in gaining funding
440 agencies' and stakeholders' recognition of the potential for youth sport to contribute to youth
441 health and development, which will lead to improved practice and in turn better health outcomes
442 for youth worldwide.

443

444 **References**

- 445 1. Janssen I, LeBlanc AG. Systematic review of the health benefits of physical activity and
446 fitness in school-aged children and youth. *Int J Behav Nutr Phys Act.* 2010;7(1):40.
- 447 2. Eime RM, Young JA, Harvey JT, Charity MJ, Payne WR. A systematic review of the
448 psychological and social benefits of participation in sport for children and adolescents:
449 Informing development of a conceptual model of health through sport. *Int J Behav Nutr*
450 *Phys Act.* 2013;10(1):98.
- 451 3. Aubert S, Barnes JD, Aguilar-Farias N, et al. Report card grades on the physical activity
452 of children and youth comparing 30 very high human development index countries. *J*
453 *Phys Act Health.* 2018;15(S2):S298-s314.
- 454 4. Debate RD, Pettee Gabriel K, Zwald M, Huberty J, Zhang Y. Changes in psychosocial
455 factors and physical activity frequency among third-to eighth-grade girls who participated
456 in a developmentally focused youth sport program: A preliminary study. *J Sch Health.*
457 2009;79(10):474-484.
- 458 5. Van der Horst K, Paw M, Twisk JW, Van Mechelen W. A brief review on correlates of
459 physical activity and sedentariness in youth. *Med Sci Sports Exerc.* 2007;39(8):1241-
460 1250.
- 461 6. Lounassalo I, Salin K, Kankaanpaa A, et al. Distinct trajectories of physical activity and
462 related factors during the life course in the general population: A systematic review. *BMC*
463 *Public Health.* 2019;19(1):271.
- 464 7. Dobbins M, DeCorby K, Robeson P, Husson H, Tirilis D. School-based physical activity
465 programs for promoting physical activity and fitness in children and adolescents aged 6-
466 18. *Cochrane Database Syst Rev.* 2009;21(1):CD007651.

- 467 8. Van Sluijs EM, McMinn AM, Griffin SJ. Effectiveness of interventions to promote
468 physical activity in children and adolescents: Systematic review of controlled trials. *BMJ*.
469 2007;335(7622):703.
- 470 9. Tremblay MS, Barnes JD, Gonzalez SA, et al. Global matrix 2.0: Report card grades on
471 the physical activity of children and youth comparing 38 countries. *J Phys Act Health*.
472 2016;13(11 Suppl 2):S343-s366.
- 473 10. Janssen I. Active play: An important physical activity strategy in the fight against
474 childhood obesity. *Can J Public Health*. 2014;105(1):e22-27.
- 475 11. Smoll FL, Smith RE. *Children and youth in sport: A biopsychosocial perspective*.
476 Kendall Hunt Publishing Company; 2002.
- 477 12. Evans MB, Allan V, Erickson K, Martin LJ, Budziszewski R, Cote J. Are all sport
478 activities equal? A systematic review of how youth psychosocial experiences vary across
479 differing sport activities. *Br J Sports Med*. 2017;51(3):169-176.
- 480 13. Global Advocacy for Physical Activity (GAPA) the Advocacy Council of the
481 International Society for Physical Activity and Health (ISPAH). Ncd prevention:
482 Investments that work for physical activity. *Health Promot*. 2010;17(2):5-15.
- 483 14. Pate RR. A national physical activity plan for the united states. *J Phys Act Health*. 2009;6
484 Suppl 2:S157-158.
- 485 15. U.S. Department of Health and Human Services. National youth sports strategy.
486 Washington, DC: U.S. Department of Health and Human Services; 2019.
- 487 16. Mountjoy M, Andersen LB, Armstrong N, et al. International olympic committee
488 consensus statement on the health and fitness of young people through physical activity
489 and sport. *Br J Sports Med*. 2011;45(11):839-848.

- 490 17. Zealand SN. Every body active. 2019.
- 491 18. Manyanga T, Barnes JD, Abdeta C, et al. Indicators of physical activity among children
492 and youth in 9 countries with low to medium human development indices: A global
493 matrix 3.0 paper. *J Phys Act Health*. 2018;15(S2):S274-s283.
- 494 19. Gonzalez SA, Barnes JD, Abi Nader P, et al. Report card grades on the physical activity
495 of children and youth from 10 countries with high human development index: Global
496 matrix 3.0. *J Phys Act Health*. 2018;15(S2):S284-s297.
- 497 20. Norager Johansen DL, Neerfeldt Christensen BF, Fester M, et al. Results from denmark's
498 2018 report card on physical activity for children and youth. *J Phys Act Health*.
499 2018;15(S2):S341-s343.
- 500 21. Lee H, Causgrove Dunn J, Holt NL. Youth sport experiences of individuals with attention
501 deficit/hyperactivity disorder. *Adapt Phys Activ Q*. 2014;31(4):343-361.
- 502 22. Tremblay MS, Barnes JD, Gonzalez SA, et al. Global matrix 2.0: Report card grades on
503 the physical activity of children and youth comparing 38 countries. *J Phys Act Health*.
504 2016;13:S343-S366.
- 505 23. Australian Sports Commission. *Ausplay focus: Children's participation in organised*
506 *physical activity outside of school hours*. Canberra2018.
- 507 24. Allender S, Cowburn G, Foster C. Understanding participation in sport and physical
508 activity among children and adults: A review of qualitative studies. *Health Educ Res*.
509 2006;21(6):826-835.
- 510 25. Marlier M, Cardon G, De Bourdeaudhuij I, Willem A. A capacity building approach to
511 increase sports participation in disadvantaged urban communities: A multilevel analysis.
512 *J Urban Health*. 2014;91(6):1114-1128.

- 513 26. Howie EK, McVeigh JA, Smith AJ, Straker LM. Organized sport trajectories from
514 childhood to adolescence and health associations. *Med Sci Sports Exerc.*
515 2016;48(7):1331-1339.
- 516 27. Howie EK, Daniels BT, Guagliano JM. Promoting physical activity through youth sports
517 programs: It's social. *Am J Lifestyle Med.* 2018:1559827618754842.
- 518 28. Rodrigues D, Padez C, Machado-Rodrigues AM. Active parents, active children: The
519 importance of parental organized physical activity in children's extracurricular sport
520 participation. *J Child Health Care.* 2018;22(1):159-170.
- 521 29. Mielke GI, da Silva ICM, Kolbe-Alexander TL, Brown WJ. Shifting the physical
522 inactivity curve worldwide by closing the gender gap. *Sports Med.* 2018;48(2):481-489.
- 523 30. Hardy LL, Kelly B, Chapman K, King L, Farrell L. Parental perceptions of barriers to
524 children's participation in organised sport in australia. *J Paediatr Child Health.*
525 2010;46(4):197-203.
- 526 31. Jaarsma EA, Dijkstra PU, de Blecourt AC, Geertzen JH, Dekker R. Barriers and
527 facilitators of sports in children with physical disabilities: A mixed-method study. *Disabil*
528 *Rehabil.* 2015;37(18):1617-1623; quiz 1624-1615.
- 529 32. Farooq MA, Parkinson KN, Adamson AJ, et al. Timing of the decline in physical activity
530 in childhood and adolescence: Gateshead millennium cohort study. *Br J Sports Med.*
531 2017.
- 532 33. Balish SM, McLaren C, Rainhaim D, Blanchard C. Correlates of youth sport attrition: A
533 review and future directions. *Psychol Sport Exerc.* 2014;15:429-439.
- 534 34. Crane J, Temple V. A systematic review of dropout from organized sport among children
535 and youth. *Eur Phy Educ Rev.* 2015;21(1):114-131.

- 536 35. Scurr J, Brown N, Smith J, Brasher A, Risius D, Marczyk A. The influence of the breast
537 on sport and exercise participation in school girls in the united kingdom. *J Adolesc*
538 *Health*. 2016;58(2):167-173.
- 539 36. Robinson TN, Sirard JR. Preventing childhood obesity: A solution-oriented research
540 paradigm. *Am J Prev Med*. 2005;28(2S2):194-201.
- 541 37. Côté J, Lidor R, Hackfort D. Issp position stand: To sample or to specialize? Seven
542 postulates about youth sport activities that lead to continued participation and elite
543 performance. *Int J Sport Exerc Psychol*. 2009;7(1):7-17.
- 544 38. Bergeron MF, Mountjoy M, Armstrong N, et al. International olympic committee
545 consensus statement on youth athletic development. *Br J Sports Med*. 2015;49(13):843-
546 851.
- 547 39. LaPrade RF, Agel J, Baker J, et al. Aossm early sport specialization consensus statement.
548 *Orthop J Sports Med*. 2016;4(4):2325967116644241.
- 549 40. DiSanti JS, Erickson K. Youth sport specialization: A multidisciplinary scoping
550 systematic review. *J Sports Sci*. 2019;37(18):2094-2105.
- 551 41. Gallant F, O'Loughlin JL, Brunet J, Sabiston CM, Belanger M. Childhood sports
552 participation and adolescent sport profile. *Pediatrics*. 2017;140(6).
- 553 42. Post EG, Trigsted SM, Schaefer DA, et al. Knowledge, attitudes, and beliefs of youth
554 sports coaches regarding sport volume recommendations and sport specialization. *J*
555 *Strength Cond Res*. 2018.
- 556 43. Brenner JS. Overuse injuries, overtraining, and burnout in child and adolescent athletes.
557 *Pediatrics*. 2007;119(6):1242-1245.

- 558 44. Hecimovich M. Sport specialization in youth: A literature review. *Journal of the*
559 *American Chiropractic Association*. 2004;41(4):32-41.
- 560 45. Malina RM. Early sport specialization: Roots, effectiveness, risks. *Curr Sports Med Rep*.
561 2010;9(6):364-371.
- 562 46. Smucny M, Parikh SN, Pandya NK. Consequences of single sport specialization in the
563 pediatric and adolescent athlete. *Orthop Clin North Am*. 2015;46(2):249-258.
- 564 47. Vella SA, Cliff DP, Magee CA, Okely AD. Sports participation and parent-reported
565 health-related quality of life in children: Longitudinal associations. *J Pediatr*. 2014.
- 566 48. Vella SA, Cliff DP, Magee CA, Okely AD. Associations between sports participation and
567 psychological difficulties during childhood: A two-year follow up. *J Sci Med Sport*.
568 2014.
- 569 49. Tremblay MS, Barnes JD, González SA, et al. Global matrix 2.0: Report card grades on
570 the physical activity of children and youth comparing 38 countries. *J Phys Act Health*.
571 2016;13(Suppl. 2):S343-S366.
- 572 50. Vella SA, Cliff DP, Okely AD, Scully ML, Morley BC. Associations between sports
573 participation, adiposity and obesity-related health behaviors in Australian adolescents. *Int*
574 *J Behav Nutr Phys Act*. 2013;10:113.
- 575 51. Mooses K, Kull M. The participation in organised sport doubles the odds of meeting
576 physical activity recommendations in 7-12-year-old children. *Eur J Sport Sci*. 2019:1-7.
- 577 52. Sprengeler O, Buck C, Hebestreit A, Wirsik N, Ahrens W. Sports contribute to total
578 moderate to vigorous physical activity in school children. *Med Sci Sports Exerc*.
579 2019;51(8):1653-1661.

- 580 53. Wickel EE, Eisenmann JC. Contribution of youth sport to total daily physical activity
581 among 6-to 12-yr-old boys. *Med Sci Sports Exerc.* 2007;39(9):1493-1500.
- 582 54. Koorts H, Timperio A, Arundell L, Parker K, Abbott G, Salmon J. Is sport enough?
583 Contribution of sport to overall moderate- to vigorous-intensity physical activity among
584 adolescents. *J Sci Med Sport.* 2019;22(10):1119-1124.
- 585 55. Gomersall SR, Maher C, English C, et al. Testing the activitystat hypothesis: A
586 randomised controlled trial. *BMC Public Health.* 2016;16:900.
- 587 56. Guagliano JM, Rosenkranz RR, Kolt GS. Girls' physical activity levels during organized
588 sports in australia. *Med Sci Sports Exerc.* 2013;45(1):116-122.
- 589 57. Schlechter CR, Rosenkranz RR, Milliken GA, Dzewaltowski DA. Physical activity levels
590 during youth sport practice: Does coach training or experience have an influence?
591 *Journal of Sports Science.* 2016.
- 592 58. Sacheck JM, Nelson T, Ficker L, Kafka T, Kuder J, Economos CD. Physical activity
593 during soccer and its contribution to physical activity recommendations in normal weight
594 and overweight children. *Pediatr Exerc Sci.* 2011;23(2):281-292.
- 595 59. Leek D, Carlson JA, Cain KL, et al. Physical activity during youth sports practices. *Arch*
596 *Pediatr Adolesc Med.* 2011;165(4):294-299.
- 597 60. van den Berg C, Kolen. Children in organized hockey: How much physical activity do
598 they really get? *Int J Exerc Sci.* 2015;8(2):184-191.
- 599 61. Ridley K, Zabeen S, Lunnay BK. Children's physical activity levels during organised
600 sports practices. *J Sci Med Sport.* 2018.
- 601 62. Pate RR, O'Neill JR. Youth sports programs: Contribution to physical activity. *Arch*
602 *Pediatr Adolesc Med.* 2011;165(4):369-370.

- 603 63. Vella SA, Schranz NK, Davern M, et al. The contribution of organised sports to physical
604 activity in australia: Results and directions from the active healthy kids australia 2014
605 report card on physical activity for children and young people. *J Sci Med Sport*.
606 2016;19(5):407-412.
- 607 64. Schlechter CR, Guagliano JM, Rosenkranz RR, Milliken GA, Dzewaltowski DA.
608 Physical activity patterns across time-segmented youth sport flag football practice. *BMC*
609 *Public Health*. 2018;18(1):226.
- 610 65. Schlechter CR, Guagliano JM, Rosenkranz RR, Dzewaltowski DA. Microsystem drivers
611 of inequality in physical activity during youth sport. under review.
- 612 66. Cohen A, McDonald S, McIver K, Pate R, Trost SG. Assessing physical activity during
613 youth sport: The observational system for recording activity in children: Youth sports.
614 *Pediatr Exerc Sci*. 2014;26(2):203-209.
- 615 67. Guagliano JM, Lonsdale C, Rosenkranz RR, Parker PD, Agho KE, Kolt GS. Mediators
616 effecting moderate-to-vigorous physical activity and inactivity for girls from an
617 intervention program delivered in an organised youth sports setting. *J Sci Med Sport*.
618 2015;18:678-683.
- 619 68. Conroy DE, Coatsworth JD. Coach training as a strategy for promoting youth social
620 development. *Sport Psychol*. 2006;20(2):128-144.
- 621 69. Smith RE, Smoll FL. Coaching the coaches: Youth sports as a scientific and applied
622 behavioral setting. *Curr Dir Psychol Sci*. 1997;6(1):16-21.
- 623 70. Bolter ND, Petranek LJ, Dorsch TE. Coach, parent, and administrator perspectives on
624 required coaching education in organized youth sport. *Int J Sports Sci Coach*.
625 2018;13(3):362-372.

- 626 71. Molinero O, Salguero A, Álvarez E, Márquez S. Reasons for dropout in youth soccer: A
 627 comparison with other team sports. *European Journal of Human Movement*. 2009;22:21-
 628 30.
- 629 72. Guagliano JM, Lonsdale C, Rosenkranz RR, Kolt GS, George ES. Do coaches perceive
 630 themselves as influential on physical activity for girls in organised youth sport? *PLoS*
 631 *One*. 2014;9(9):e105960.
- 632 73. Rottensteiner C, Laakso L, Pihlaja T, Kontinen N. Personal reasons for withdrawal from
 633 team sports and the influence of significant others among youth athletes. *Int J Sports Sci*
 634 *Coach*. 2013;8(1):19-32.
- 635 74. Guagliano JM, Lonsdale C, Rosenkranz RR, Kolt GS, George ES. Increasing girls'
 636 physical activity during an organized youth sport basketball camp: A randomized
 637 controlled trial. *J Sci Med Sport*. 2015;18:412-417.
- 638 75. Guagliano JM, Lonsdale C, Rosenkranz RR, Kolt GS, Dzewaltowski DA. Does self-
 639 determined motivation interact with environmental contexts to influence moderate-to-
 640 vigorous physical activity during a youth sport camp? *J Sports Sci*. 2019;37(23):2720-
 641 2725.
- 642 76. Pate RR, Dowda M. Raising an active and healthy generation: A comprehensive public
 643 health initiative. *Exerc Sport Sci Rev*. 2019;47(1):3-14.
- 644 77. World Health Organization. *Global action plan on physical activity 2018–2030: More*
 645 *active people for a healthier world*. Geneva2018.
- 646 78. Activity ISfP, Health. The bangkok declaration on physical activity for global health and
 647 sustainable development. *Br J Sports Med*. 2017;51(19):1389-1391.

- 648 79. Weed M. Should we privilege sport for health? The comparative effectiveness of uk
649 government investment in sport as a public health intervention. *Sport, physical activity*
650 *and public health*: Routledge; 2017:27-44.
- 651 80. Bull FC, Milton K, Kahlmeier S. National policy on physical activity: The development
652 of a policy audit tool. *J Phys Act Health*. 2014;11(2):233-240.
- 653 81. 2018 Physical Activity Guidelines Advisory Committee. *2018 physical activity*
654 *guidelines advisory committee report*. Washington, DC: U.S. Department of Health and
655 Human Services; 2018.
- 656 82. Milton K, Macniven R, Bauman A. Review of the epidemiological evidence for physical
657 activity and health from low- and middle-income countries. *Glob Public Health*.
658 2014;9(4):369-381.
- 659 83. Saunders TJ, Gray CE, Poitras VJ, et al. Combinations of physical activity, sedentary
660 behaviour and sleep: Relationships with health indicators in school-aged children and
661 youth. *Appl Physiol Nutr Metab*. 2016;41(6 Suppl 3):S283-293.
- 662 84. Lee JE, Pope Z, Gao Z. The role of youth sports in promoting children's physical activity
663 and preventing pediatric obesity: A systematic review. *Behav Med*. 2018;44(1):62-76.
- 664 85. Wannamethee SG, Shaper AG. Physical activity in the prevention of cardiovascular
665 disease. *Sports Med*. 2001;31(2):101-114.
- 666 86. Gill JM, Cooper AR. Physical activity and prevention of type 2 diabetes mellitus. *Sports*
667 *Med*. 2008;38(10):807-824.
- 668 87. Hebert JJ, Klakk H, Moller NC, Grontved A, Andersen LB, Wedderkopp N. The
669 prospective association of organized sports participation with cardiovascular disease risk
670 in children (the champs study-dk). *Mayo Clin Proc*. 2017;92(1):57-65.

- 671 88. Weintraub DL, Tirumalai EC, Haydel KF, Fujimoto M, Fulton JE, Robinson TN. Team
672 sports for overweight children: The stanford sports to prevent obesity randomized trial
673 (sport). *Arch Pediatr Adolesc Med.* 2008;162(3):232-237.
- 674 89. Biddle SJ, Asare M. Physical activity and mental health in children and adolescents: A
675 review of reviews. *Br J Sports Med.* 2011;bjsports90185.
- 676 90. Balish SM, Conacher D, Dithurbide L. Sport and recreation are associated with happiness
677 across countries. *Res Q Exerc Sport.* 2016;87(4):382-388.
- 678 91. Vella SA, Swann C, Allen MS, Schweickle MJ, Magee CA. Bidirectional associations
679 between sport involvement and mental health in adolescence. *Med Sci Sports Exerc.*
680 2017;49(4):687-694.
- 681 92. Donnelly JE, Hillman CH, Castelli D, et al. Physical activity, fitness, cognitive function,
682 and academic achievement in children: A systematic review. *Med Sci Sports Exerc.*
683 2016;48(6):1223-1224.
- 684 93. Hillman CH, Kamijo K, Scudder M. A review of chronic and acute physical activity
685 participation on neuroelectric measures of brain health and cognition during childhood.
686 *Prev Med.* 2011;52 Suppl 1:S21-28.
- 687 94. Lubans D, Richards J, Hillman C, et al. Physical activity for cognitive and mental health
688 in youth: A systematic review of mechanisms. *Pediatrics.* 2016;138(3).
- 689 95. Sims-Gould J, Vazirian S, Li N, Remick R, Khan K. Jump step - a community based
690 participatory approach to physical activity & mental wellness. *BMC Psychiatry.*
691 2017;17(1):319.
- 692 96. Vella SA, Swann C, Batterham M, et al. Ahead of the game protocol: A multi-
693 component, community sport-based program targeting prevention, promotion and early

- 694 intervention for mental health among adolescent males. *BMC Public Health*.
695 2018;18(1):390.
- 696 97. Richards J, Foster C, Townsend N, Bauman A. Physical fitness and mental health impact
697 of a sport-for-development intervention in a post-conflict setting: Randomised controlled
698 trial nested within an observational study of adolescents in gulu, uganda. *BMC Public*
699 *Health*. 2014;14:619.
- 700 98. Strohle A. Sports psychiatry: Mental health and mental disorders in athletes and exercise
701 treatment of mental disorders. *Eur Arch Psychiatry Clin Neurosci*. 2018.
- 702 99. Teychenne M, White R, Richards J, Schuch F, Rosenbaum S, Bennie J. Do we need
703 physical activity guidelines for mental health: What does the evidence tell us? . *Ment*
704 *Health Phys Act*. 2020;18:100315.
- 705 100. Bruner MW, Balish SM, Forrest C, et al. Ties that bond: Youth sport as a vehicle for
706 social identity and positive youth development. *Res Q Exerc Sport*. 2017;88(2):209-214.
- 707 101. Fraser-Thomas JL, Côté J, Deakin J. Youth sport programs: An avenue to foster positive
708 youth development. *Phys Educ Sport Pedagogy*. 2005;10(1):19-40.
- 709 102. Caruso R. Crime and sport participation: Evidence from italian regions over the period
710 1997–2003. *J Socio Econ*. 2011;40(5):455-463.
- 711 103. Durlak JA, Weissberg RP, Pachan M. A meta-analysis of after-school programs that seek
712 to promote personal and social skills in children and adolescents. *Am J Community*
713 *Psychol*. 2010;45(3-4):294-309.
- 714 104. Kim J, Kim M, Henderson KA, Han A, Park SH. Serious engagement in sport and health
715 benefits among korean immigrants in the USA. *Int J Qual Stud Health Well-being*.
716 2016;11:31340.

- 717 105. Howie EK, Daniels BT, Guagliano JM. Promoting physical activity through youth sports
718 programs: It's social. *Am J Lifestyle Med.*0(0):1559827618754842.
- 719 106. Kokko S. Sports clubs as settings for health promotion: Fundamentals and an overview to
720 research. *Scand J Public Health.* 2014;42(15 Suppl):60-65.
- 721 107. Beutler I. Sport serving development and peace: Achieving the goals of the united nations
722 through sport. *Sport in society.* 2008;11(4):359-369.
- 723 108. Woodcock A, Cronin O, Forde S. Quantitative evidence for the benefits of moving the
724 goalposts, a sport for development project in rural kenya. *Eval Program Plann.*
725 2012;35(3):370-381.
- 726 109. Richards J, Kaufman Z, Schulenkorf N, et al. Advancing the evidence base of sport for
727 development: A new open-access, peer-reviewed journal. *J Sport Dev.* 2013;1(1):1-3.
- 728 110. Gregory S. How kids' sports became a \$15 billion industry. *TIME*2017.
- 729 111. Meenaghan T, O'Sullivan P. Metrics in sponsorship research—is credibility an issue?
730 *Psychol Mark.* 2013;30(5):408-416.
- 731 112. Keane L, Hoare E, Richards J, Bauman A, Bellew W. Methods for quantifying the social
732 and economic value of sport and active recreation: A critical review. *Sport in Society.*
733 2019;22(12):2203-2223.

734

735

Table 1: Suggestions for future research directions

Research Question	Research Priority
1. What is the participation rate in youth sports?	Research using standardized and more in-depth assessment of sport participation including the frequency, duration, intensity and type of sport participation are needed and these should include special populations and alternative sports
2. How can we best improve sport participation rates?	Research on the barriers to participation and strategies to overcome these barriers, particularly among underserved populations (i.e. girls, low SES families, rural areas, and other minority populations)
3. How can we maintain sport participation?	Research using a solutions-oriented approach to prevent dropout from sports Research on multi-level factors and strategies to target these factors Research with a developmental focus on sport specialization and strategies for sport transfer
4. How much physical activity does sport provide participating youth?	Research on the examination of sporting structure context and its influence on physical activity including using devices like accelerometers and contextual data.
5. How can we develop effective and sustainable coaching interventions to improve physical activity in sport?	Research using longer, fully-powered effectiveness trials that are scalable are needed on effective training and planning for coaches
6. What policy-level actions on youth sport are most effective at increasing physical activity?	Research to determine the most effective policy actions to improve youth sport
7. How does youth sport contribute to physical health?	Well-designed experimental studies are needed to assess the physical effects of youth sport participation, particularly how individuals with lower fitness may benefit from joining appropriate sporting opportunities
8. How does youth sport contribute to mental health?	Research supporting causal evidence on the benefits of sport on mental health Research examining mediators of these positive mental health benefits so that these factors can be maximized during youth sport
9. How does sport contribute to social health?	Research testing strategies to maximize positive social experiences Research on the implementation and evaluation of benefits of sport for development
10. What is the overall return on investment for youth sport participation?	Analyses considering macro-level effects on community economies and environments through partnerships with sustainability organizations

738 **Figure 1.** A conceptual framework of the contribution of youth sport to health
739

